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# cBR-8 & CCAP

Leveraging Operational Best Practices

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BRK-SPG2515

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Barcelona | January 27-31, 2020



# Cisco Webex Teams

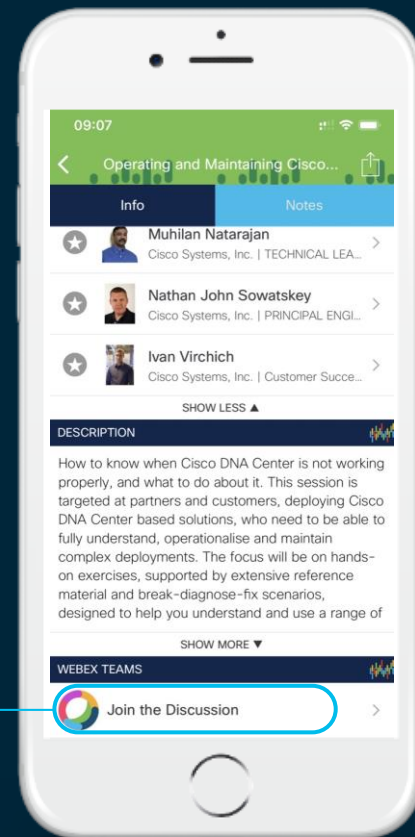
## Questions?

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

## How

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

Webex Teams will be moderated by the speaker until June 16, 2020.



# Agenda

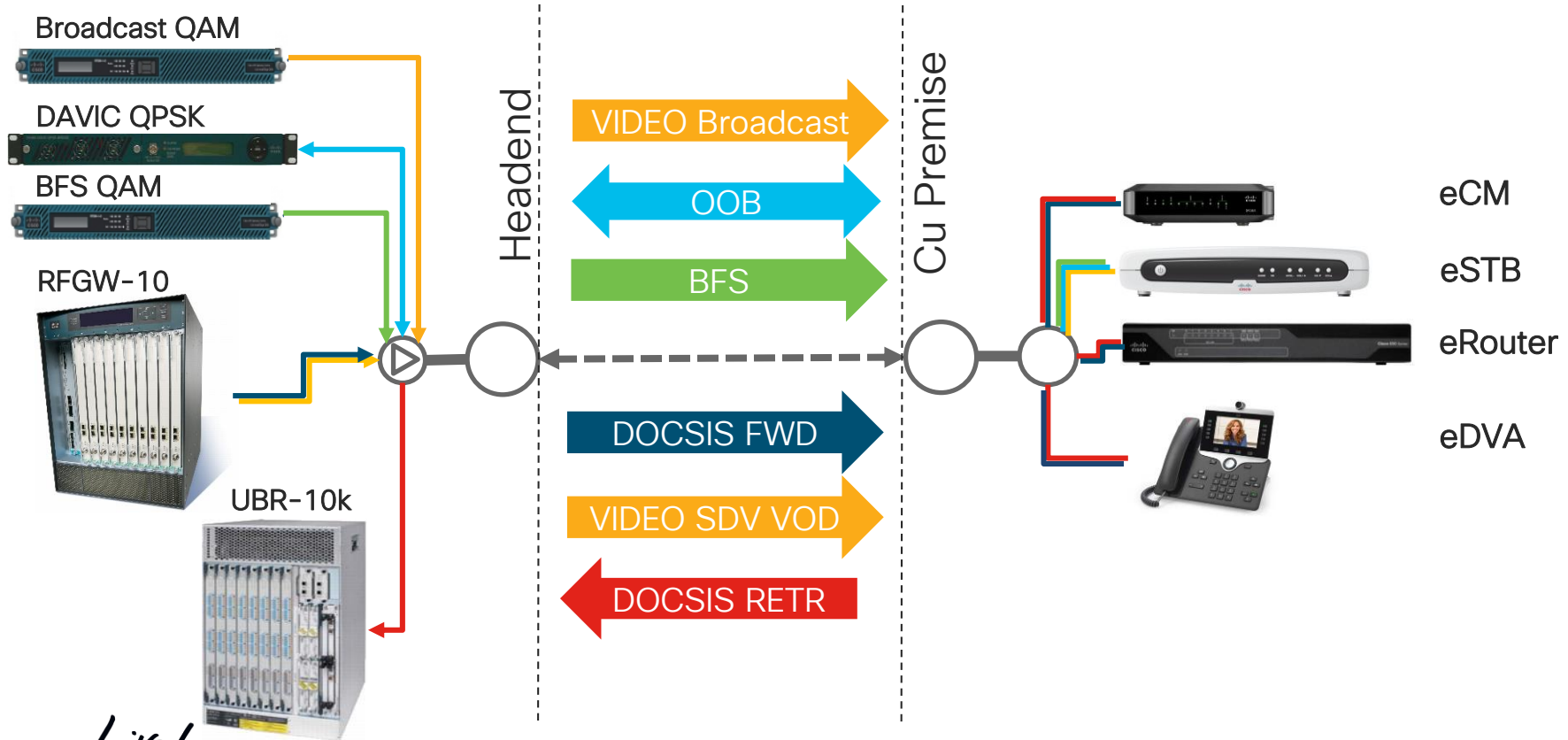
- CCAP Introduction
- Operational Best Practices for cBR-8 Features & Tools
- Troubleshooting Techniques for CCAP Services
- cBR-8 Optimizations and Automation
- Summary
- Q & A



# CCAP Introduction

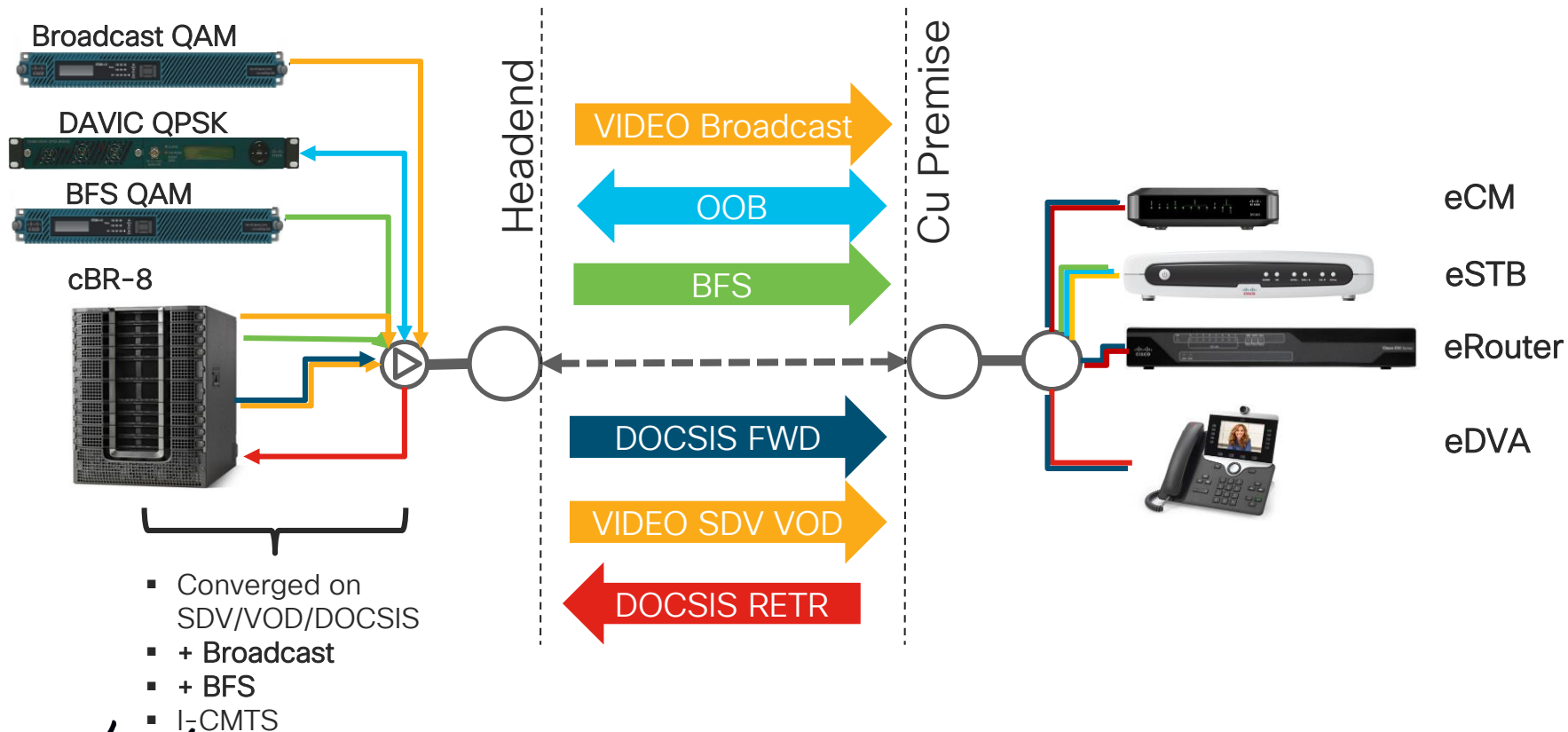
# Early CCAP

- Legacy uBR10k and RFGW-10



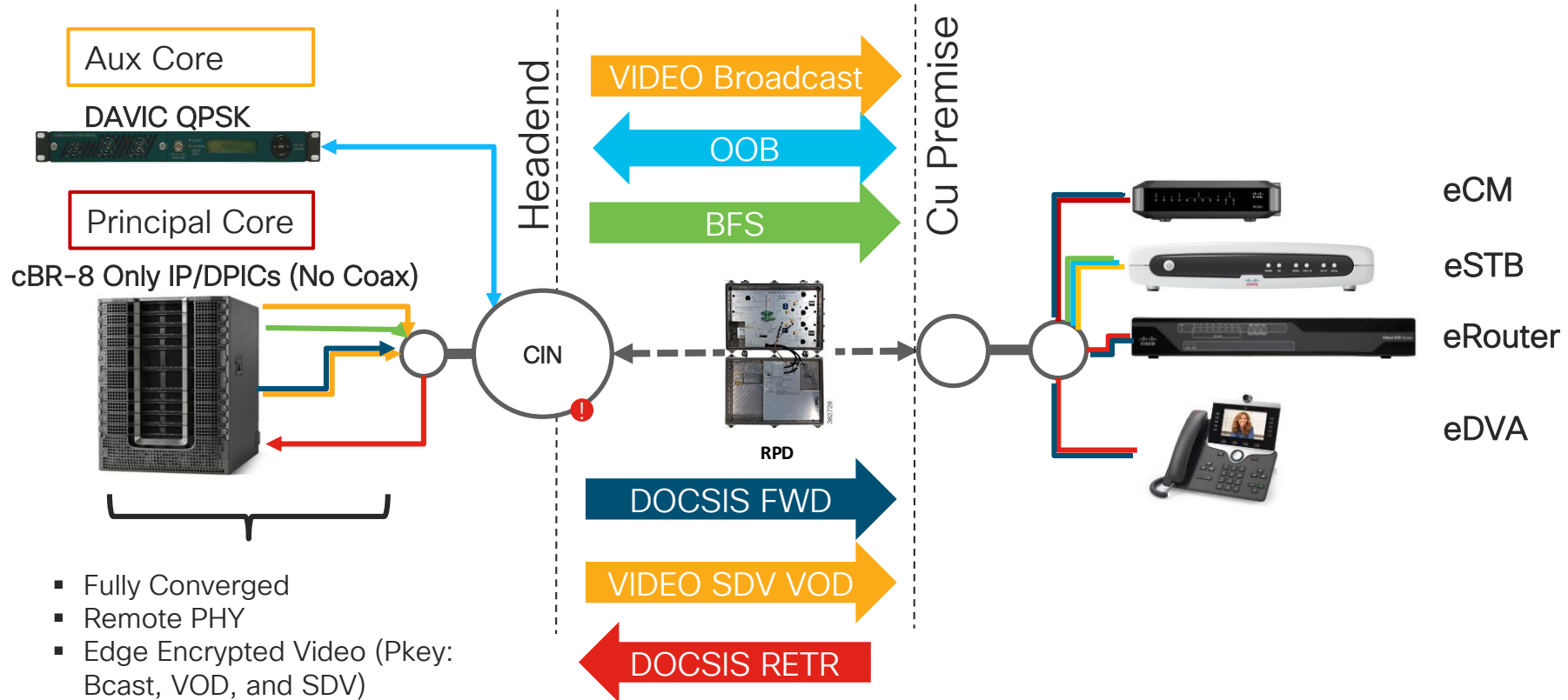
# CCAP Progression

- Video OOB / BFS / Broadcast not yet converged



# CCAP Progression and DAA (Distributed Access Architecture)

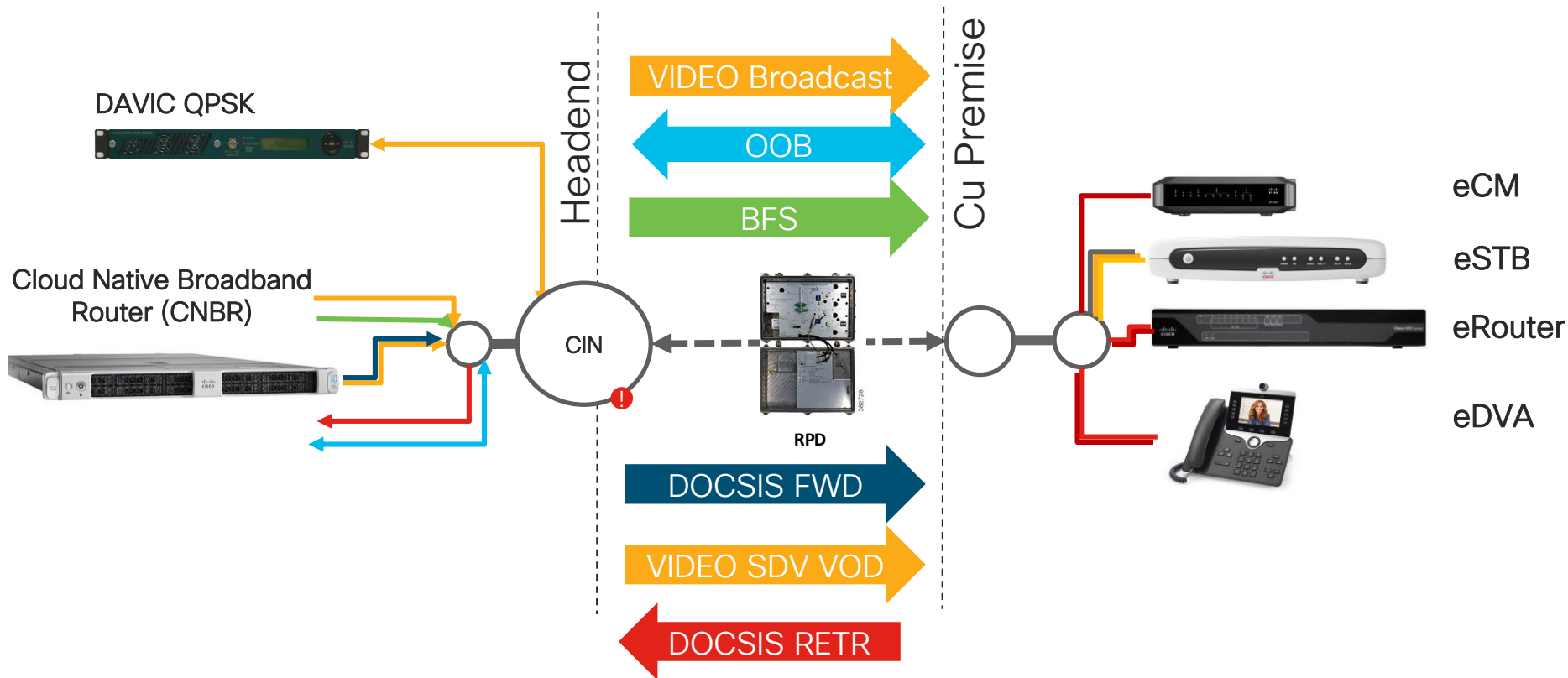
- Transition to DAA with support for Video OOB, BFS, and Encryption



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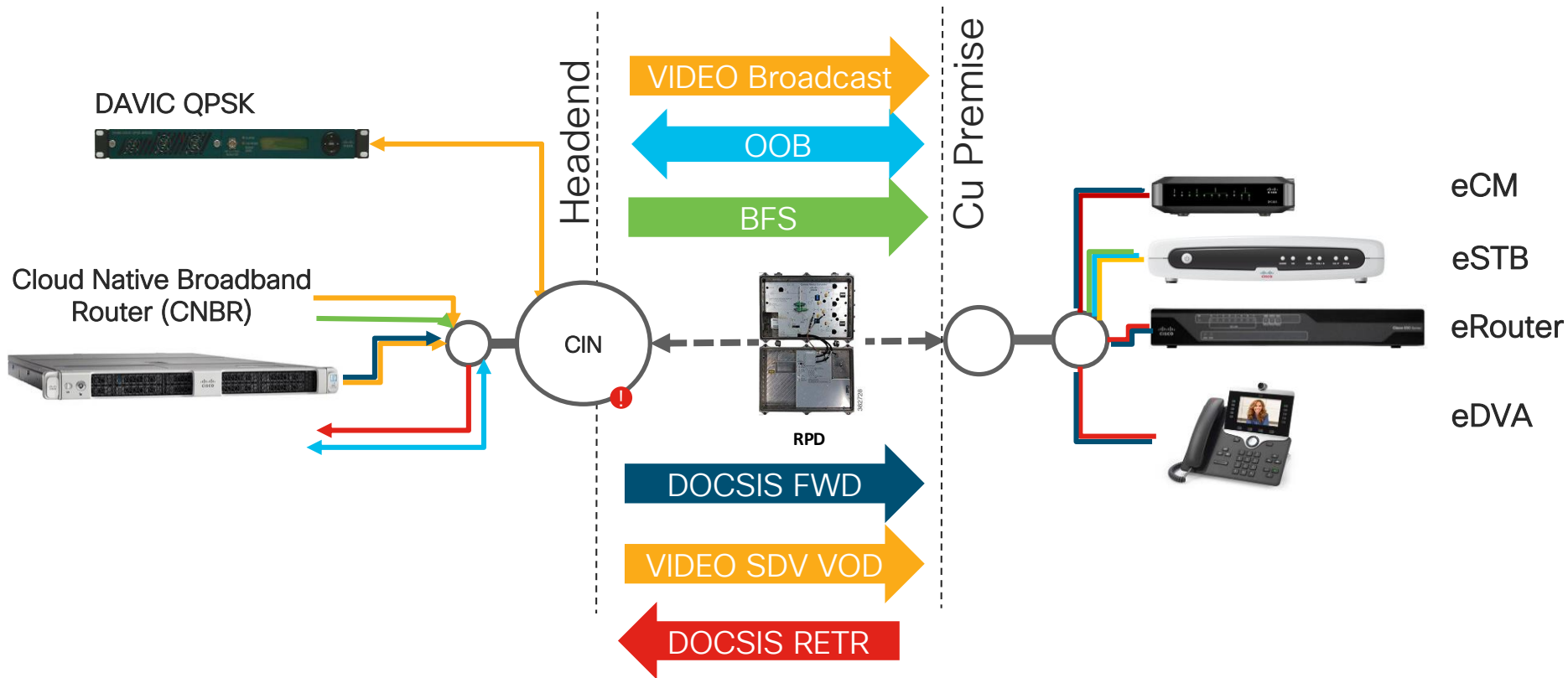
# Cloud Native

- Virtualize the CMTS



# Cloud Native

- Virtualize the CMTS



# Challenges

- Staying productive with day-to-day management
- Achieving effective troubleshooting in the face of increasing complexity
- Deploying, Managing, and Monitoring with ever increasing density and scale

- Operational Best Practices for cBR-8 Features & Tools
- Troubleshooting Techniques for CCAP Services
- cBR-8 Optimizations and Automation

# Operational Best Practices for cBR-8 Features & Tools



# Agenda

- Features & Tools
  - Operational Simplification with Service Groups, Load-Balancing, and DSG
  - Dynamic Bonding Group
  - Load Balancing with Dynamic Bonding Groups
  - Upstream Resiliency
  - Linear Power Tilt
  - D3.1 – Time and Frequency Division Multiplexing
  - Timing Considerations for R-PHY and CIN
  - DOCSIS Predictive Scheduler
  - PTP Considerations
  - IOS Guest Shell

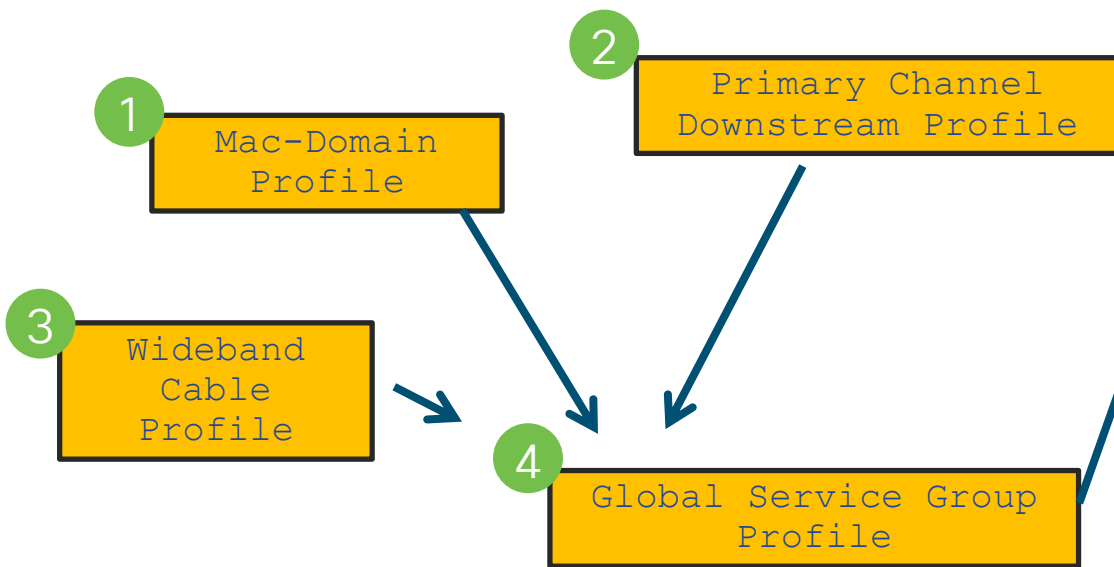
# Operational Simplification

- Service-Groups
- Load-Balancing
- DSG

- Simplified and Shortened configuration(s)
- Per-Fiber Node instantiation
- Model similar to future Cisco offerings (cloud native)
- Cannot adjust on-the-fly for individual SGs

# Operational Simplification

## Profile Configuration(s)



## Application

- Cable Fiber Node
- Downstream controller
  - Upstream controller
  - DS SG-Channel
  - US SG-Channel
  - Service-Group Profile

IOS-XE 16.10 and later:

- Load-Balancing OpSimp
- R-PHY OpSimp
- DSG OpSimp

# Operational Simplification

```

cable wideband auto-reset
#(rphy)# cable wideband rphy-auto-reset

```

## **cable profile mac-domain MD-1-PROFILE**

```

cable shared-secret 7 secret
cable privacy mandatory

```

## **cable profile downstream DS-1-PROFILE**

```

cable rf-bandwidth-percent 1

```

## **cable profile wideband-interface WB-1-PROFILE**

```

cable downstream attribute-mask 0x80000000

```

## **cable profile service-group RPHY-1-PROFILE**

```


cable bundle 1
mac-domain 0 profile MD-1-PROFILE
  downstream sg-channel 0-31 profile DS-1-PROFILE
  upstream 0 sg-channel 0
  upstream 1 sg-channel 1
  upstream 2 sg-channel 2
  upstream 3 sg-channel 3
  us-bonding-group 1
    upstream 0
    upstream 1
  #...
wideband-interface 1 profile WB-1-PROFILE
  downstream sg-channel 0-3 rf-bandwidth-percent 1
#...
  downstream sg-channel 0-31 rf-bandwidth-percent 1
wideband-interface 33 profile WB-1-PROFILE
  downstream sg-channel 0-31 158 rf-bandwidth-percent 1

```

```

interface Cable1/0/0
  downstream Integrated-Cable 1/0/0 rf-channel 0-31 158
  upstream 0 Upstream-Cable 1/0/0 us-channel 0
  upstream 1 Upstream-Cable 1/0/0 us-channel 1
  upstream 2 Upstream-Cable 1/0/0 us-channel 2
  upstream 3 Upstream-Cable 1/0/0 us-channel 3
  cable upstream 0 power-adjust continue 6
  cable upstream 1 power-adjust continue 6
  cable upstream 2 power-adjust continue 6
  cable upstream 3 power-adjust continue 6
  cable upstream balance-scheduling
  cable upstream bonding-group 1
    upstream 0
    upstream 1
    upstream 2
    upstream 3
    attributes 80000000
  ...
  cable bundle 1


```



```

interface Cable1/0/0
  cable mac-domain-profile MD-1-PROFILE
  ...
  cable bundle 1
  cable managed fiber-node 1
!

```



```

cable fiber-node 1
  downstream Downstream-Cable 1/0/0
  upstream Upstream-Cable 1/0/0
  downstream sg-channel 0 31 downstream-Cable 1/0/0 rf-channel 0 31
  downstream sg-channel 158 downstream-Cable 1/0/0 rf-channel 158
  upstream sg-channel 0 3 Upstream-Cable 1/0/0 us-channel 0 3
  service-group profile RPHY-1-PROFILE

```

# Operational Simplification with Load-Balancing

- Create a Profile Load-Balance and apply it within the Profile Service-Group

```
cable profile load-balance LB_1_Profile
  method utilization primary-distributed us-method
utilization
  threshold load 2
  policy pcmm
  interval 1
```

```
cable profile service-group RPHY-1-PROFILE
  cable bundle 1
  load-balance docsis-group 0 profile LB_1_Profile
  mac-domain 0 profile MD-1-PROFILE
  downstream sg-channel 0-31 profile DS-1-PROFILE
  upstream 0 sg-channel 0
  upstream 1 sg-channel 1
  upstream 2 sg-channel 2
  upstream 3 sg-channel 3
  us-bonding-group 1
    upstream 0
    upstream 1
  #...
```

```
cable fiber-node 1
  downstream Downstream-Cable 1/0/0
  upstream Upstream-Cable 1/0/0
  downstream sg-channel 0 31 downstream-Cable 1/0/0 rf-channel 0 31
  downstream sg-channel 158 downstream-Cable 1/0/0 rf-channel 158
  upstream sg-channel 0 3 Upstream-Cable 1/0/0 us-channel 0 3
  service-group profile RPHY-1-PROFILE
```

```
cBR8-01#show cable load-balance docsis-group fn 1 md c1/0/0
```

```
DOCSIS LB Enabled: Yes
DOCSIS 2.0 LB Enabled: Yes
DOCSIS 3.0 LB Enabled: No
DOCSIS 3.0 Static LB Enabled: Yes
DOCSIS 3.0 Dynamic Downstream LB Enabled: No
DOCSIS 3.0 Dynamic Upstream LB Enabled: No
```

```
DOCSIS 3.0 General LB
MD      FN  Group ID  S Intv DCC mask  Policy      Mtd MD-CM-SG  Thre
                               /UCC
Ca1/0/0 1    2147508224 E 30    0xF8(0)/N 0      m/m 0x300601 ...
```

# Operational Simplification with DSG

- In your Profile Service-Group add DSG Configurations

```
...  
  
cable profile service-group RPHY-1-PROFILE  
  cable bundle 1  
  mac-domain 0 profile MD-1-PROFILE  
  downstream sg-channel 0-31 profile DS-1-PROFILE  
  upstream 0 sg-channel 0  
  upstream 1 sg-channel 1  
  upstream 2 sg-channel 2  
  upstream 3 sg-channel 3  
  cable downstream dsg chan-list 111  
  cable downstream dsg timer 1  
  cable downstream dsg vendor-param 2  
  cable downstream dsg tg 4500  
  cable downstream dsg tg 4500 priority 2  
  cable downstream dsg tg 4500 vendor-param 2  
  cable downstream dsg tg 4500 ucid 1 2  
...
```

What about *DSG TG Channel* ?  
It is auto-generated upon instantiation

```
interface Cable1/0/0  
  cable mac-domain-profile MD-1-PROFILE  
  ...  
  cable bundle 1  
  cable managed fiber-node 1  
!
```

```
cable fiber-node 1  
  downstream Downstream-Cable 1/0/0  
  upstream Upstream-Cable 1/0/0  
  downstream sg-channel 0 31 downstream-Cable 1/0/0 rf-channel 0 31  
  downstream sg-channel 158 downstream-Cable 1/0/0 rf-channel 158  
  upstream sg-channel 0 3 Upstream-Cable 1/0/0 us-channel 0 3  
  service-group profile RPHY-1-PROFILE
```

Use “show derived-configs” to see individual instantiations

```
cBR8-01# Show derived-config interface Cable1/0/0  
  
interface Cable1/0/0  
#...  
  cable downstream dsg chan-list 111  
  cable downstream dsg timer 2  
  cable downstream dsg vendor-param 2  
  cable downstream dsg tg 4500 channel 1  
end
```

# Dynamic Bonding Groups

- Optimization of utilization by creation of as-needed Bonding Group(s)
- Optimization against CM bonding capabilities
- Compatible with LB, RBG(s), and Static BG(s)
- Relatively new
- Hard to completely backout

# Dynamic Bonding Groups

- To enable configure “**cable dynamic-bonding-group**”
- IOS-XE will attempt to create bonding groups to accommodate CM capabilities and distributions
- DBG feature complies with standard RCP profiles
- Interoperable with Resiliency Bonding Groups and Load-balancing
- Unused dynamic bonding groups can be reclaimed by system
- Only way to cleanly back out is to reload



# Dynamic Bonding Groups

- Feature will attempt to match CM RCP and create new Bonding Group

```
cBR8-1# show cable mac-domain cable1/0/0 rcc
```

RCC-ID	RCP	RCs	MD-DS-SG	CMs	WB/RCC-TMPL	D3.0	D3.1
1	00 00 00 00 00	32	0	0	WB (Wi1/0/0:0)	Y	Y
2	00 00 00 00 00	8	0	1	WB (Wi1/0/0:1)	Y	Y
3	00 00 00 00 00	16	0	1	WB (Wi1/0/0:2)	Y	Y
<b>4</b>	<b>00 00 00 00 00</b>	<b>24</b>	<b>0</b>	<b>1</b>	<b>WB (Wi1/0/0:3)</b>	<b>Y</b>	<b>Y</b>

```
cBR8-1# show cable dynamic-bonding-group summary
```

Dynamic bonding group: Enable

BG ID	BG Name	BG Size	CMs	ServFlows	Create Time	Create Client	BG State	RFid list
8194	Wi1/0/0:3	24	8	16	Apr 7 09:12:47.190	<b>MODEM_ONLINE</b>	<b>OPERATIONAL</b>	8200-8223
...								

## Create Client

## Meaning

**MODEM\_ONLINE**

Modem Need (RCP)

**STATIC\_LOAD\_BALANCE**

Static (Mdm Count) Based LB

**DYNAMIC\_LOAD\_BALANCE**

Dynamic (Utilization) Based LB

# Load-balancing with Dynamic Bonding Groups

- Creates bonding groups for DOCSIS 3.1/3.0 modems to leverage based on utilization

```
cable acfe enable
cable dynamic-bonding-group
cable dynamic-bonding-group reclaim-threshold percent 5 modems 6
...
cable load-balance docsis-enable
cable load-balance docsis30-enable
cable load-balance docsis30-enable dynamic downstream
cable load-balance method-utilization min-threshold 20
..
cable load-balance docsis-group FN 1 MD Cable1/0/0
method utilization
policy pure-ds-load
interval 60
...
```

# Load-balancing with Dynamic Bonding Groups

- Utilization based load-balancing seeks to fill-in underutilized BW

```
cBR8-1# show cable load-balance docsis-group fn 1 md c1/0/0 rfch-util
```

Interface	Pstate	Pending-In	Pending-Out	Throughput (Kbps)	Util	NBCM	WBCM
In1/0/0:0	up	No	No	36784	98%	4	27
In1/0/0:1	NA	No	No	37935	100%	0	27
...							
In1/0/0:22	NA	No	No	28415	75%	0	5
In1/0/0:23	NA	No	No	28415	75%	0	5
In1/0/0:24	initial	No	No	2146	5%	0	2
In1/0/0:25	NA	No	No	0	0%	0	2
In1/0/0:26	NA	No	No	0	0%	0	2
In1/0/0:27	NA	No	No	0	0%	0	2
In1/0/0:28	initial	No	No	2146	5%	0	2
In1/0/0:29	NA	No	No	0	0%	0	2
In1/0/0:30	NA	No	No	0	0%	0	2
In1/0/0:31	NA	No	No	0	0%	0	2
In1/0/0:158	up	No	No	18743	49%	0	3

Average: 68.30. Variance: 1583.544

Underutilized  
RF-Channels

# Load-balancing with Dynamic Bonding Groups

- Utilization based load-balancing fills-in underutilized BW by creating BG to leverage RF-channel(s)

```
cBR8-1# show cable dynamic-bonding-group summary
```

```
Dynamic bonding group: Enable
```

BG ID	BG Name	BG Size	CMs	ServFlows	Create Time	Create Client	BG State	RFid
list								
8194	Wi1/0/0:1	16	7	7	Apr 10 15:38:44.720	MODEM_ONLINE	OPERATIONAL	8208-8223
...								
8200	Wi1/0/0:7	8	2	4	Apr 10 16:00:18.447	STATIC_LOAD_BALANCE	OPERATIONAL	8199-8205,8208
8201	Wi1/0/0:8	16	5	8	Apr 10 16:01:18.738	DYNAMIC_LOAD_BALANCE	OPERATIONAL	8192-8207

# Load-balancing with Dynamic Bonding Groups

- For example – after LB with DBG we see utilization across all RF-ch

```
cBR8-1# show cable load-balance docsis-group fn 1 md c1/0/0 rfch-util
```

Interface	Pstate	Pending-In	Pending-Out	Throughput (Kbps)	Util	NBCM	WBCM
In1/0/0:0	up	No	No	36787	98%	3	7
In1/0/0:1	NA	No	No	22567	60%	0	7
In1/0/0:2	NA	No	No	22568	60%	0	7
In1/0/0:3	NA	No	No	22567	60%	0	7
In1/0/0:4	up	No	No	21524	57%	0	7
In1/0/0:5	NA	No	No	22567	60%	0	7
In1/0/0:6	NA	No	No	22567	60%	0	7
In1/0/0:7	NA	No	No	22568	60%	0	8
...							
In1/0/0:25	NA	No	No	37938	100%	0	18
In1/0/0:26	NA	No	No	37938	100%	0	18
In1/0/0:27	NA	No	No	37938	100%	0	18
In1/0/0:28	up	No	No	36788	98%	9	22
In1/0/0:29	NA	No	No	37938	100%	0	18
In1/0/0:30	NA	No	No	37938	100%	0	18
In1/0/0:31	NA	No	No	37938	100%	0	18
In1/0/0:158	up	No	No	18581	49%	0	3
Average:	85.757						
Variance:	284.62						

# Upstream Resiliency

## Data-Burst Resiliency for D3.0 MTC-Mode

- Improvement on classic US Partial Mode transitions

US Resiliency Mode	Detection Method	Pros & Cons
Traditional	Missed Station Maintenance (SM) results in partial state	<ul style="list-style-type: none"><li>Disparities when SM/IM is QPSK vs QAM16 (“Break points”)</li></ul>
Data-Burst	Threshold based on user-configured CM MER and FEC	<ul style="list-style-type: none"><li>Better real-world detection</li><li>No SM bursts or Fast Polling</li></ul>

```
cable upstream resiliency data-burst polling-interval 60
```

```
interface Cable1/0/0
```

```
 cable upstream resiliency sf-move UGS
```

```
 cable upstream resiliency sf-move RTPS
```

```
 cable upstream resiliency sf-move NRTPS
```

```
 cable upstream resiliency data-burst snr 24 ufec 3 cfec 0 hys 4
```

```
...
```

SNR Threshold: 24, Fec/Cfec 3/0%, hysteresis 4dB

Logic Test: Data SNR AND (corr FEC OR uncorr FEC)

# Upstream Resiliency

## US Resiliency Service-Flow

- Moves UGS (active voice) off impaired upstream of CM
- Service flows preserved

```
cable upstream resiliency data-burst polling-interval 60

interface Cable1/0/0
  cable upstream resiliency sf-move UGS
  cable upstream resiliency sf-move RTPS
  cable upstream resiliency sf-move NRTPS
  cable upstream resiliency data-burst snr 24 ufec 3 cfec 0 hys 4
  ...
```

# Linear Power Tilt

Automatically configure controller to tilt the output power (linearly)

Set with “**power-tilt linear db max-frequency Hz**” under controller

```
controller integrated-cable 1/0/0
max-carrier 96
base-channel-power 36
power-tilt linear 4.0 max-frequency 1218000000
```

```
rf-chan 0 31
type DOCSIS
frequency 603000000
rf-output NORMAL
power-adjust 0.0
gam-profile 1
docsis-channel-1
...
```

```
cBR8-01#show controller integrated-Cable 1/0/0 rf-ch 0-162
```

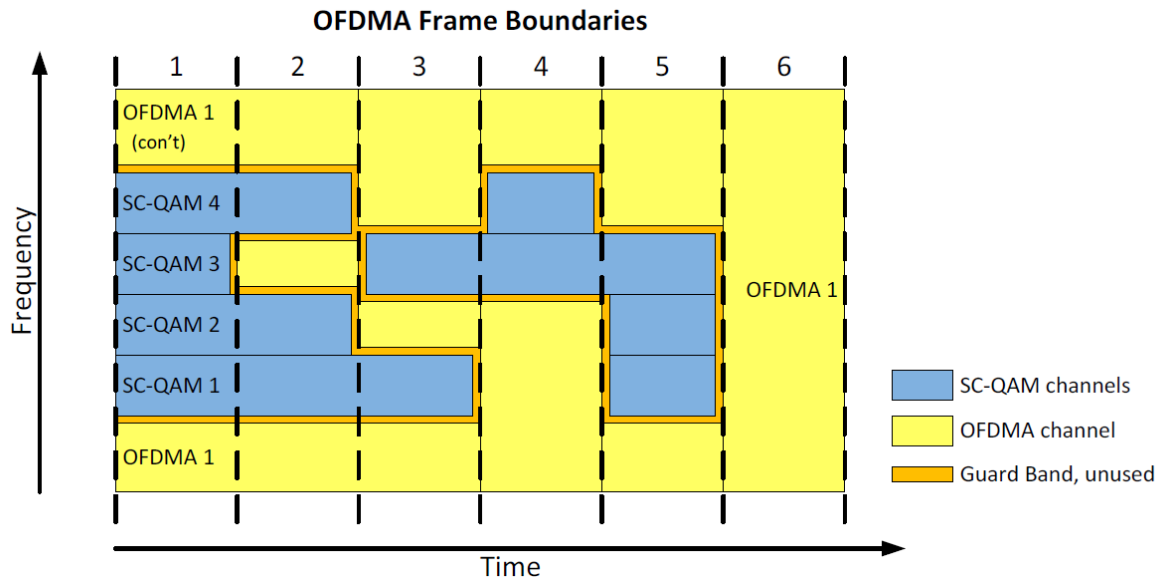
Chan	State	Admin	Frequency	Type	Annex	Mod	srates	Interleaver	dcid	power	output
0	UP	UP	603000000	DOCSIS	B	256	5361	I32-J4	1	35.1	NORMAL
2	UP	UP	615000000	DOCSIS	B	256	5361	I32-J4	3	35.1	NORMAL
3	UP	UP	621000000	DOCSIS	B	256	5361	I32-J4	4	35.2	NORMAL
4	UP	UP	627000000	DOCSIS	B	256	5361	I32-J4	5	35.2	NORMAL
5	UP	UP	633000000	DOCSIS	B	256	5361	I32-J4	6	35.2	NORMAL
6	UP	UP	639000000	DOCSIS	B	256	5361	I32-J4	7	35.3	NORMAL
7	UP	UP	645000000	DOCSIS	B	256	5361	I32-J4	8	35.3	NORMAL
8	UP	UP	651000000	DOCSIS	B	256	5361	I32-J4	9	35.3	NORMAL
9	UP	UP	657000000	DOCSIS	B	256	5361	I32-J4	10	35.4	NORMAL
10	UP	UP	663000000	DOCSIS	B	256	5361	I32-J4	11	35.4	NORMAL
11	UP	UP	669000000	DOCSIS	B	256	5361	I32-J4	12	35.4	NORMAL
...											



# Time and Frequency Division Multiplexing

DOCSIS 3.1 OFDMA and D3.0 SCQAM Over the same spectrum

- Optimize upstream for D and D3.0 environment
- Division against time-axis
- Caveats: **Bandwidth considerations from cross-bonding (D3.1 vs D3.0 dev)**



# TaFDM Configuration Sample

- Overlap the OFDMA Frequency Range with SC-QAM
- Configure the Initial Ranging Frequency
- IOS-XE will automatically implement TaFDM
- Ensure you are running 16.7 and later IOS-XE
- Caveats – Possible bandwidth limitations with D3.0 only modems

```
cable mod-profile-ofdma 470
subcarrier-spacing 50KHz
initial-rng-subcarrier 64
fine-rng-subcarrier 192
data-iuc 9 modulation 1024-QAM pilot-pattern 1
data-iuc 10 modulation 512-QAM pilot-pattern 1
data-iuc 11 modulation 256-QAM pilot-pattern 1
data-iuc 12 modulation 128-QAM pilot-pattern 1
data-iuc 13 modulation 64-QAM pilot-pattern 1
```

```
controller Upstream-Cable 7/0/0
...
us-channel 12 docsis-mode ofdma
us-channel 12 subcarrier-spacing 50
us-channel 12 modulation-profile 470
us-channel 12 frequency-range 10000000 85000000
us-channel 12 initial-rng-frequency-start 50000000
us-channel 12 cyclic-prefix 96 rol
us-channel 12 symbols-per-frame 8
no us-channel 12 shutdown
```

Overlaps with SCQAM

Specify the IM Freq

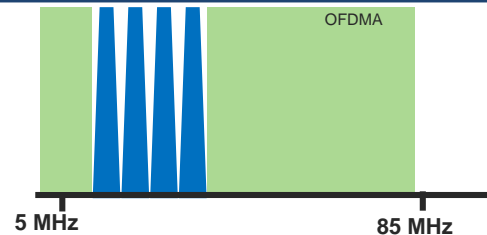
# TaFDM Considerations

## Should you implement TaFDM?

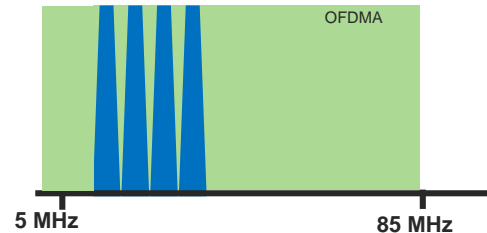
- **Faster D3.1 Speeds Possible with TaFDM than with Cross-Bonded**
- **... Possibly at the cost of D3.0 Traffic rates!**
- Current scheduler only reserves up to 20% for SC-QAM traffic
- TaFDM does provide higher D3.1 modem speeds but at the expense of limiting D3.0 traffic
- Cross bonding between OFDMA channel and SC-QAM provides almost the same D3.1 speeds without as much impact to D3.0 traffic

Parameters	Throughput
OFDMA < 16 MHz + Four ATDMA + OFDMA 42-85 MHz	~445 MBps
OFDMA: 5-16 MHz @64-QAM + 16-85 MHz @256-QAM	~515 MBps

### Cross Bonded



### TaFDM

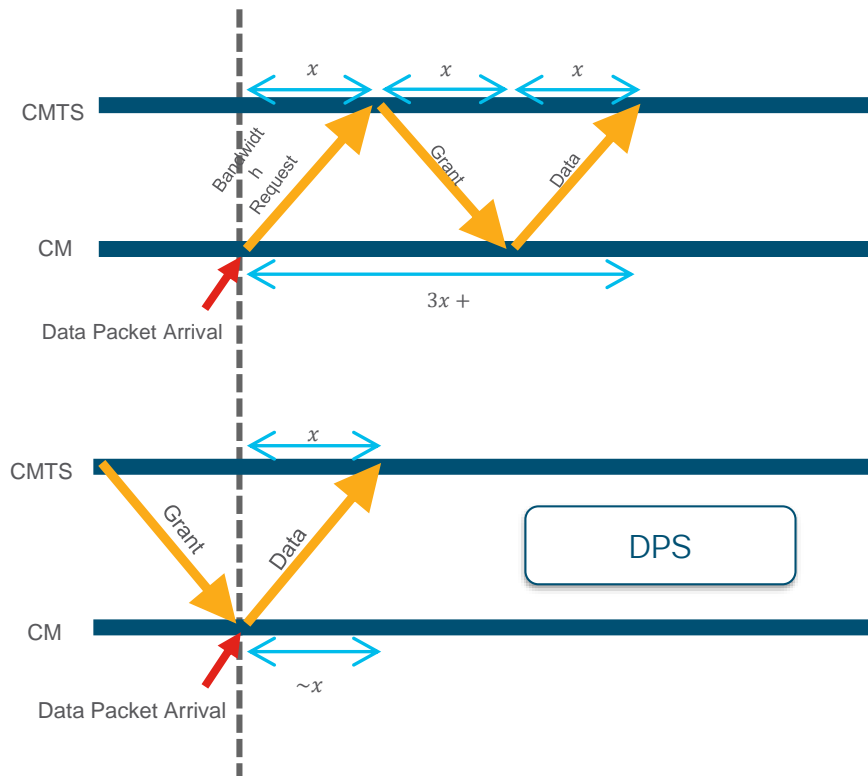


# DOCSIS Timing Considerations for R-PHY & CIN

- DOCSIS requires timing elements to schedule upstream
- PTP is used to achieve common timing for CCAP core and RPD
- DLM can be use so MAP advance time adjust to changes in CIN
- DLM does not reduce request-grant delay in CIN with large delay times or address high CIN delay variance
- DOCSIS Predictive Scheduling (DPS) can reduce ~~/eliminate~~ request-grant delay by proactively giving upstream grants to modems based on historic traffic patterns

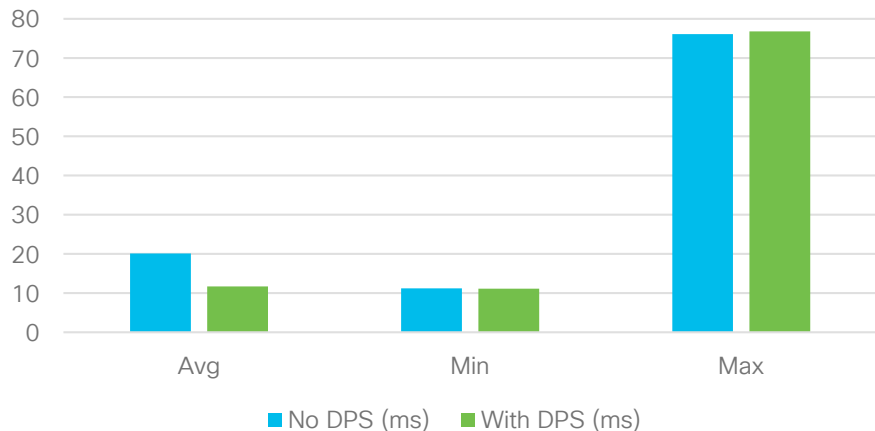
# DOCSIS Predictive Scheduler

- Possible Increased delay with DAA
- Account for this with DOCSIS Predictive scheduler
- Result is generally higher throughput potential

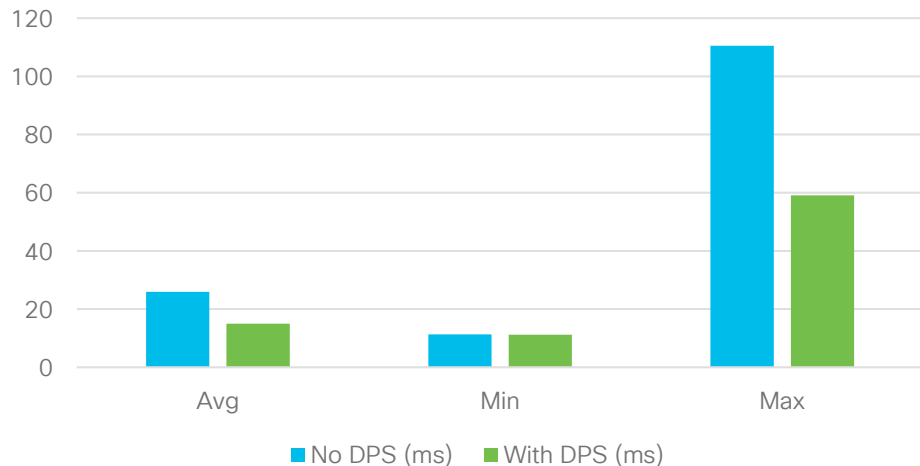


# DOCSIS Predictive Scheduler-Latency Graph

## Single Service Flow



## Multiple Service Flows



- Tests use UDP, 40 Mbps with mixed packet size, BE SFs
- 10 ms of latency in the CIN
- Significant improvement in average latency in both cases, but outliers still exist

# DOCSIS Predictive Scheduler

- Configure under the MAC-Domain with “**cable upstream dps**”

```
cBR8-01#show interface cable 1/0/0 mac-scheduler 0

DOCSIS 1.1 MAC scheduler for Cable1/0/0/U0 : rate 15360000
wfq:None
us_balance:OFF
dps:ON
dpon_mode:OFF
fairness:OFF
Queue[Rng Polls] flows 0
Queue[CIR Grants] flows 0
...
```

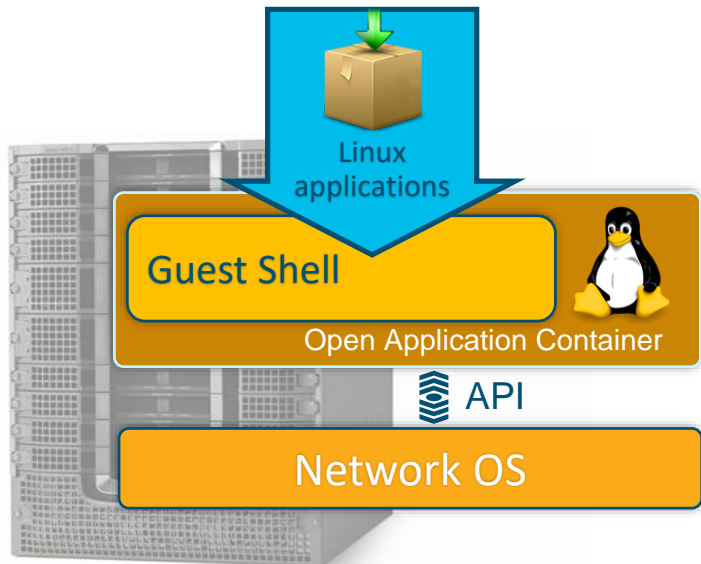
# Timing Servers and Placement

- PTP Boundary and Master Support for cBR-8 starting in 16.12
  - Master Clock have scale limitations
  - Placement affects Latency and Jitter
  - Path Delay Variance must be  $\leq 10\text{ms}$
  - Core and associated RPDs should have common master, be in common domain
- Allows increased sessions by making cBR8 PTP Master or Boundary
  - Consider placing ASR or NCS Master along CIN Spine
  - Symmetric path between Master and Slave important



# IOS Guest Shell

- Decoupled execution space within a Linux container
- IOS-XE 16.10.1d and later



- Access to the network over Linux network interfaces
- Access to bootflash
- Access to IOS CLI
- Ability to install and run python scripts
- Ability to install and run Linux applications

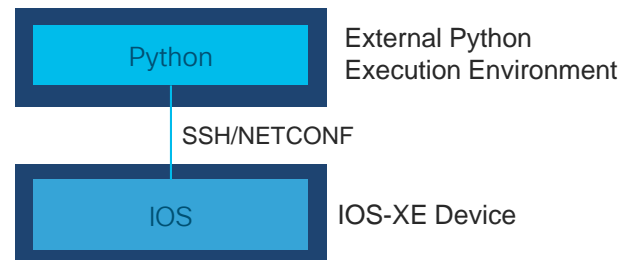
# Guestshell and Python

## IOS-XE “On-Box” Python



- **Scripts executed locally on cBR-8**
- Ideal for:
  - Provisioning automation (ZTP)
  - Automating Embedded Event Manager responses
  - Application development
  - Internet of things (IOT)
  - Complex Troubleshooting Tooling

## IOS-XE “Off-Box” Python



- Scripts executed externally
- Ideal for:
  - Configuration management automation
  - Telemetry & Operational data
  - Controller use cases including APIC-EM / Cisco Network PNP

# IOS Guest Shell

- Configure “iox”, Interface VirtualPortGroup, and app-hosting

```
cBR8-01#show iox-service
```

```
IOx Infrastructure Summary:
```

```
-----
```

```
IOx service (CAF)      : Running
IOx service (HA)       : Not Running
IOx service (IOxman)   : Running
Libvirt                : Running
```

```
interface VirtualPortGroup31
description For-Guest-shell
ip address 13.50.0.1 255.255.255.0
no mop enabled
no mop sysid
```

```
app-hosting appid guestshell
app-vnic gateway0 virtualportgroup 31 guest-interface 0
guest-ipaddress 13.50.0.2 netmask 255.255.255.0
app-default-gateway 13.50.0.1 guest-interface 0
```

Command	Description
guestshell enable	Starts the guestshell microservice
guestshell disable	Stops the guestshell microservice
guestshell destroy	Destroys (clears) the microservice
show iox-services	Displays the IOX services running and resource utilization
show app-hosting list	Displays the containers running

```
cBR8-01# guestshell enable
Interface will be selected if configured in app-hosting
Please wait for completion
guestshell installed successfully
Current state is: DEPLOYED
guestshell activated successfully
Current state is: ACTIVATED
guestshell started successfully
Current state is: RUNNING
Guestshell enabled successfully
```

```
cBR8-01#show app-hosting list
```

App id	State
-----	-----
guestshell	RUNNING

# IOS Guest Shell

Command	Description
guestshell run bash	Runs bash process
guestshell run python	Runs python process (default v2.7.5)

```
cBR8-01# guestshell run bash
[guestshell@guestshell etc]$ cat /etc/os-release
NAME="CentOS Linux"
VERSION="7 (Core)"
ID="centos"
ID_LIKE="rhel fedora"
VERSION_ID="7"
PRETTY_NAME="CentOS Linux 7 (Core)"
ANSI_COLOR="0;31"
CPE_NAME="cpe:/o:centos:centos:7"
HOME_URL="https://www.centos.org/"
BUG_REPORT_URL="https://bugs.centos.org/"
...
```

For **dohost** or Python CLI APIs please ensure you have **ip http server** configured

\* CSCvn43093 fixed in 17.1 and later means you have to toggle **“ip http server”** off and back on while your guestshell is enabled

```
F241-36-04-cBR8-01#guestshell run python
Python 2.7.5 (default, Apr 11 2018, 07:36:10)
[GCC 4.8.5 20150623 (Red Hat 4.8.5-28)] on linux2
Type "help", "copyright", "credits" or "license" for more
information.
>>> from cli import *
>>> executep("show ver")
Load for five secs: 5%/0%; one minute: 7%; five minutes:
7%
Time source is NTP, 11:22:59.010 edt Tue May 14 2020
Cisco IOS XE Software, Version 16.10.01d
Cisco IOS Software [Gibraltar], cBR Software
(X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 16.10.1d,
RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
...
```



# IOS-XE Guestshell Demo

# IOS Guest Shell Example

- Resiliency Bonding Group Customization

- You can configure an arbitrary number of Resiliency BGs per Mac-Domain
- More RBGs means better resiliency but also higher CPU and less for DBGs and Static BGs
- Less means possibly suboptimal protections
- Chassis-wide static RBG configurations may be suboptimal

**Idea:** Why not customize/optimize to each MAC-Domain the number of Resiliency BGs?

**Algorithm:**

- Assume Dynamic BG with Dynamic LB

**Max(  $\sum s [ (s * i) / t ]$  , MAX\_NUM\_RBG )**

- s is the size of this bonding group (4-ch is s=4)
- i is the reoccurrence of this bg size
- t is total SC-QAM channels in MD (for 32 SC-QAMs, t=32)
- MAX\_NUM\_RBG for 16.10 is 16

Example: Say you have Eight 4-ch, four 16-ch, three 24-ch, and one 32-ch:

$$(4*8)/32 + (4*16)/32 + (3*24)/32 + 32/32 = 1 + 2 + 2 + 1 = 6 \text{ RBGs}$$

# IOS Guest Shell Example

*Play Demo*





# IOS Guest Resource Utilization

- By default allocates 256 MB of memory and 1% of CPU

Command	Description
show app-hosting utilization appid guestshell	Current utilization
show app-hosting detail appid guestshell	Allocated resources

```
cBR8-01#show app-hosting utilization appid guestshell
```

```
Application: guestshell
```

```
CPU Utilization:
```

```
  CPU Allocation: 800 units
```

```
  CPU Used:      0.02 %
```

```
Memory Utilization:
```

```
  Memory Allocation: 256 MB
```

```
  Memory Used:      52124 KB
```

```
Disk Utilization:
```

```
  Disk Allocation: 1 MB
```

```
  Disk Used:       0.00 MB
```

```
cBR8-01# show app-hosting detail appid guestshell
```

```
App id           : guestshell
```

```
Owner            : iox
```

```
State            : RUNNING
```

```
...
```

```
Resource reservation
```

```
  Memory         : 256 MB
```

```
  Disk           : 1 MB
```

```
  CPU            : 800 units
```

```
...
```

```
Network interfaces
```

```
-----
```

```
...
```

# IOS Guest Resource Resizing

- To resize configure under app  
“**resource profile custom** *cpu value*  
*memory memory-size*”
- Destroy & re-enable guestshell to take effect

```
app-hosting appid guestshell
app-vnic gateway0 virtualportgroup 31 guest-interface 0
guest-ipaddress 13.50.0.2 netmask 255.255.255.0
app-default-gateway 13.50.0.1 guest-interface 0
app-resource profile custom
  cpu 1000
  memory 1028
```

```
cBR8-01#show app-hosting detail appid guestshell

App id           : guestshell
Owner            : iox
State            : ACTIVATED
Application
  Type           : lxc
  Name           : GuestShell
  Version        : 2.5.1
  Description    : Cisco Systems Guest Shell XE for x86_64
  Path           : /guestshell:/guestshell.tar
Activated profile name : custom
...
Resource reservation
  Memory        : 1028 MB
  Disk          : 1 MB
  CPU           : 1000 units
```

# Troubleshooting Techniques for CCAP Services

# Agenda

## Troubleshooting cBR-8 and R-Phy Features

- IOS Shell
- D3.1 CM Throughput And Bonding Validation
- CCAP Video Troubleshooting
- Advanced Voice Troubleshooting Techniques
- DTrack
- SmartPHY



# IOS Shell

# IOS Shell

Not the same as IOS Guest Shell

- Basic shell on IOS-XE CLI
- Configuration and Exec both possible
- Enable with configuration “**shell processing full**”
- Disable with configuration “**no shell processing**”
- Enable on exec with “**terminal shell**” (term shell trace)
- Terminating the VTY terminals the process
- Be aware of security considerations

- Speeds up simple and repetitive tasks
- Missing variable substitution

```
cBR8-01#terminal shell trace
cBR8-01#for i in 1 2 3 4 5 6 ; do
do..done>echo $i
do..done>done
1
...
6
cBR8-01#show log | tail
006067: May 15 08:38:28.909: %PARSER-6-LOG:
CLI_command: show cable rpd name
006068: May 15 08:38:28.931: %PARSER-6-LOG:
CLI_command: show license all
<snip>
...
```

# IOS Shell Sample

## Iterative LCHA Failover for every LC

```
term shell

for slot in 1 2 3 6 7 8 9; do

echo "Targeting Slot $slot for LCHA Failover to Slot 0"
echo "Check if LCHA available"

# Warm loop
for i in 1 2 3 4 5 6 ; do
    warm=0;
    for xx in `show redund line all`; do
        if [[ "Warm" == $xx ]]; then
            #echo 'Warm Found'
            warm=1;
            fi
        ; done
        if [[ $warm == 1 ]]; then
            echo " Warm Found - ready to failover from $slot"
            break
        else
            echo " Not warm - wait 3 minutes and try again"
            if [[ $i == 6 ]]; then
                echo " Timeout waiting warm, $slot, aborting..."
                exit $slot
            fi
            sleep 180
        fi
    ;done

redundancy linecard switchover from slot $slot
echo "Failover initiated - wait 5 minutes"
sleep 300
```

```
# Continued ...

# Find hot for revertive
# Hot loop

for j in 1 2 3 4 5 6 ; do
    hot=0;
    for xx in `show redund line all`; do
        if [[ "Hot" == $xx ]]; then
            hot=1;
            fi
        ; done
        if [[ $hot == 1 ]]; then
            echo " Hot Found - ready to failback"
            break
        else
            echo " No hot - wait 3 minutes and try again"
            if [[ $i == 6 ]]; then
                echo " Timeout waiting hot, $slot, aborting..."
                exit $slot
            fi
            sleep 180
        fi
    ;done

    redund linecard switchover from slot 0
    echo "Failback initiated to $slot - wait 5 minutes"
    sleep 300

;done
```



## D3.1 CM Throughput And Bonding Validation



# D3.1 CM Throughput And Bonding Validations

- D3.1 OFDM and OFDMA Configuration Verification
- Bonded CM Operational Verification
- Overall Throughput Numbers On cBR-8
- Per CM DS and US Performance Verification

# D3.1 DS Configuration

- OFDM Channel Profile(s)
- OFDM Modulation Profile(s)
- Controller Integrated-Cable
- Interface Wideband

## controller Integrated-Cable 2/0/1

```
max-ofdm-spectrum 384000000
max-carrier 64
base-channel-power 35
rf-chan 0 31
type DOCSIS
frequency 591000000
rf-output NORMAL
power-adjust 0
qam-profile 1
docsis-channel-id 1
```

## rf-chan 158

```
power-adjust 0.0
docsis-channel-id 159
ofdm channel-profile 100 start-frequency
780000000 width 192000000 plc 873000000
```

OFDM Starts @ 158

Profile ID	1	100
Cyclic Prefix	1024	192
Roll Off	128	128
FFT Khz	50	50
Intl Depth	16	16
Pilot Scale	48	48
Modulation Control	D:256	D:256
NCP	D:16	D:16
Data Profile 1-2-3-4-5	2048	1024
	1024	2048
		4096

## cable downstream ofdm-chan-profile 100

```
cyclic-prefix 192
interleaver-depth 16
pilot-scaling 48
roll-off 128
subcarrier-spacing 50KHZ
profile-control modulation-default 256-QAM
profile-ncp modulation-default 16-QAM
profile-data 1 modulation-default 1024-QAM
profile-data 2 modulation-default 2048-QAM
profile-data 3 modulation-default 4096-QAM
```

## interface Wideband-Cable2/0/1:13

```
cable bundle 1
cable rf-channels channel-list 0-31 158
bandwidth-percent 1
```

OFDM ch 158 added

Diff data mod profile for  
range of sub-carriers

## cable downstream ofdm-modulation-profile 1

```
subcarrier-spacing 50KHZ
width 192000000
start-freq 642000000
assign modulation-default 1024-QAM
assign modulation 512-QAM range-subcarriers freq-abs 824000000 width
10000000
assign modulation 2048-QAM range-subcarriers freq-abs 644000000 width
16000000
assign modulation 2048-QAM range-subcarriers freq-abs 660000000 width
32000000
assign modulation 4096-QAM range-subcarriers freq-abs 692000000 width
30000000
```

# D3.1 US Configuration

- OFDMA Channel Profile(s)
- OFDMA Modulation Profile(s)
- Controller Upstream-Cable
- Interface Cable

## US-CH 12-15 OFDMA

```
controller Upstream-Cable 2/0/2
us-channel 0 frequency 17600000
us-channel 0 channel-width 1600000 1600
us-channel 0 docsis-mode atdma us-channel 0
minislot-size 4
us-channel 0 modulation-profile 221
us-channel 0 equalization-coefficient
<snip>
us-channel 12 docsis-mode ofdma
us-channel 12 subcarrier-spacing 25KHz
us-channel 12 modulation-profile 424
us-channel 12 frequency-range 42000000 85000000
us-channel 12 cyclic-prefix 96 roll-off-period 0
us-channel 12 symbols-per-frame 9
no us-channel 12 shutdown
```

OFDMA channel with profile

Expanded to 7 IUCs (9 to 13)

```
cable mod-profile-ofdma 424
subcarrier-spacing 25KHz
initial-rng-subcarrier 64
fine-rng-subcarrier 128
data-iuc 12 modulation 1024-QAM pilot-pattern 8
data-iuc 13 modulation 256-QAM pilot-pattern 8
<snip>
```

```
interface Cable 2/0/1
load-interval 30
downstream Integrated-Cable 2/0/1 rf-channel 0
downstream Integrated-Cable 2/0/1 rf-channel 4
downstream Integrated-Cable 2/0/1 rf-channel 8
downstream Integrated-Cable 2/0/1 rf-channel 12
downstream Integrated-Cable 2/0/1 rf-channel 158
upstream 0 Upstream-Cable 2/0/2 us-channel 0
upstream 1 Upstream-Cable 2/0/2 us-channel 1
upstream 2 Upstream-Cable 2/0/2 us-channel 2
upstream 3 Upstream-Cable 2/0/2 us-channel 3
upstream 4 Upstream-Cable 2/0/2 us-channel 12
cable upstream bonding-group 1
upstream 0
upstream 1
upstream 2
upstream 3
upstream 4
attributes 80000000
cable bundle 1
```

OFDMA channel as a part of USBG

# DOCSIS 3.1 Operational Maintenance

## Identifying D3.1 Modems

```
cBR8-01# show cable modem docsis version d31-capable
```

MAC Address	I/F	MAC State	Reg Ver	Oper Ver	DSxUS	DS OFDM	PC ID	US OFDMA
14b7.f80e.3ee4	C3/0/1/UB	w-online (pt)	3.1	3.1	33x5	1	69	1
14b7.f80e.3ffc	C3/0/1/UB	w-online (pt)	3.1	3.1	33x5	1	69	1

Operational  
Version 3.1

33 Channels - 32 SC-  
QAM + 1 OFDM

Number of  
OFDM Chans

## Show Cable Modem Docsis Version Summary Total

```
CBR8-01# show cable modem docsis version summary total
```

		DOCSIS Registered					US QoS		US Phy Mode			DOCSIS Mode				
	On-															
Interface	line	v3.1	v3.0	v2.0	v1.1	v1.0	v1.1	v1.0	ofdm	atdm	tdma	UP	WB	WP	NB	
C2/0/1/UB	32	7	25	0	0	0	32	0	7	25	0	0	32	0	0	
C2/0/0/UB	4	1	3	0	0	0	4	0	0	4	0	0	4	0	0	
C3/0/0/UB	38	8	30	0	0	0	38	0	0	38	0	0	38	0	0	
C3/0/1/UB	5	3	2	0	0	0	5	0	0	5	0	0	5	0	0	
Total:	118	v3.1: 21 v3.0: 95					v1.1: 118		UB : 116			WB: 116				
							v1.0: 0		UP : 0			WP: 0				
									ofdm: 7			NB: 2				
									atdm: 111							
									tdma: 0							

Total D3.1  
modems per  
MD

Total D3.1  
modems per  
chassis

Number of  
OFDMA Chans

# D3.1 Bonding Validations CM

- **Show cable modem {mac-address | ipaddress} wideband rcs-status**
  - Make sure CM is not in “Partial Service”
    - MAC state will be “p-online(pt)” for DS partial service

## Chan status for a CM

```
cBR8-01#show cable modem 14b7.f80e.3ee4 wideband
```

CM	DS-CTRL	RF	CH	ID	STATUS	TYPE	PRIM-CHAN
-----	-----	---	----	----	-----	-----	-----
14b7.f80e.3ee4	2/0/1	0	1		UP	SC-QAM	NO
		1	2		UP	SC-QAM	NO
		2	3		UP	SC-QAM	NO
		7	8		UP	SC-QAM	NO
		8	9		UP	SC-QAM	YES
		30	31		UP	SC-QAM	NO
		31	32		UP	SC-QAM	NO
		158	159		UP	OFDM	NO

# Overall Throughput Numbers On cBR-8

show controllers { downstream-cable | integrated-cable } slot/sub/port counter rf-channel 0-162

```
cBR8-01# show controllers integrated-Cable 2/0/1 counter ofdm-channel
```

Controller	Chan#	Profile/PLC	Packets	Bytes	MaxRate (Mbps)	Rate (Mbps)	Utilization (%)
2/0/1	158	Total	21215976761	20531535357096	-	1216.056926	100.0
2/0/1	158	0	178625333	254776976190	496	0.004952	0.0
2/0/1	158	1	5290363	214635993	616	0.001600	0.0
2/0/1	158	2	21015238174	20274362725057	1216	1216.005271	100.0
2/0/1	158	PLC-MMM	15771114	1161805398		0.008840	
2/0/1	158	PLC-EM	0	0		0.000000	
2/0/1	158	PLC-TR	0	0		0.000000	

```
cBR8-01# show controllers downstream-cable 7/0/0 counter rf-channel
```

Controller	RF Chan	MPEG Packets Tx	MPEG bps	MPEG Mbps	Sync Packets Tx	MAP/UCD Packets Tx	User Mbps	QAM Util Percentage
7/0/0	0	0	0	00.00	0	0	00.00	000.00
7/0/0	1	0	0	00.00	0	0	00.00	000.00
7/0/0	2	8239954	2475952	02.47	0	0	02.39	006.60
7/0/0	3	85927382	25769779	25.76	0	0	24.94	068.71
7/0/0	4	85927608	25769027	25.76	0	0	24.94	068.71
7/0/0	5	8239088	2474599	02.47	0	0	02.39	006.59
7/0/0	6	8210840	2463770	02.46	0	0	02.38	006.57
7/0/0	7	50103	15040	00.01	0	0	00.01	000.04

Field	Meaning
MPEG BPS	Raw throughput (MPEG)
User BPS	Payload throughput
QAM Util Percentage	(New) Percentage utilized based on 37.5 MBP pipe

# DS Performance Verification

- Show cable modem <mac/ip-add> service-flow

No P-online(pt) or partial-service in Up mode

```
cBR8-01#show cable modem 14b7.f80e.3ee4 service-flow
```

MAC	Address	IP Address	Host	MAC	Prim	Num	Primary	DS	
			Interface	State	Sid	CPE	Downstream	RfId	
14b7.f80e.3ee4	13.41.0.34		C2/0/1/UB	w-online(pt)	7	8	In2/0/1:8	12296	
Sfid	Dir	Curr	Sid	Sched	Prio	MaxSusRate	MaxBrst	MinRsvRate	Throughput
		State		Type					

11	US	act	7	BE	0	0	3044	0	19930223
12	DS	act	N/A	N/A	0	0	3044	0	1899996040

## DOWNSTREAM SERVICE FLOW DETAIL:

SFID	Flg	Policer	Scheduler		
		Xmits	Drops	Xmits	Drops
12		0	0	1726	0

FrwdIF

Wi2/0/1:13

Current DS throughput

## UPSTREAM SERVICE FLOW DETAIL:

SFID	SID	Requests	Polls	Grants	Packets
11	7	15569323	0	15569045	1565745

Wideband intf is for forwarding.  
Modular intf. Or Dynamic  
WC Intf For WB CM in partial  
service mode

US Requests for  
Grants US BW

# Upstream Performance Verification

US Not in Partial-Service

```
cBR8-01#show cable modem 14b7.f80e.3ee4
```

MAC Address	IP Address	I/F	MAC State	Prim Sid	RxPwr (dBmV)	Timing Offset	Num CPE	I P
14b7.f80e.3ee4	13.41.0.34	C2/0/1/UB	w-online (pt)	7	0.00	2095	0	N

Only see this info if modem in Partial Service on US side

Parameter	What to look for
Partial-Mode Information	Failed TCS Bitmap LSB is highest US
Ranging Status	cnt = continue dr = down recovery sta = station maint (good)
Codewords	Good CW incrementing Corrected and Uncorr not
Tjming offset	Not changing much

```
cBR8-01#show cable modem 14b7.f80e.3ee4 verbose
```

**Partial-Mode Information : reason 0x1 failed-tcs 0x2**

Parameter	US0	US1	US2	US3
MAC Address	14b7.f80e.3ee4			
IP Address	13.41.0.34			
IPv6 Address	---			
Dual IP	N			
Prim Sid	7			
Host Interface	C2/0/1/UB			
<b>Upstream Channel</b>	<b>US0</b>	<b>US1</b>	<b>US2</b>	<b>US3</b>
<b>Ranging Status</b>	<b>sta</b>	<b>sta</b>	<b>sta</b>	<b>sta</b>
Upstream SNR (dB)	42.4	42.4	39.8	38.12
Upstream Data SNR (dB)	40.0	39.8	39.8	35.56
Received Power (dBmV)	0.00	0.00	0.00	0.00
Data Burst resiliency suspended	N	N	N	N
Reported Transmit Power (dBmV)	30.00	30.00	30.00	30.50
Commanded Transmit Power (dBmV)	30.00	30.00	30.00	30.50
<b>Good Codewords rx</b>	<b>888920</b>	<b>852219</b>	<b>882345</b>	<b>855338</b>
Corrected Codewords rx	0	0	0	0
Uncorrectable Codewords rx	7	0	0	0
Phy Operating Mode	atdma*	atdma*	atdma*	atdma*

Good Codewords received..

All US in "sta" Station Maint. Mode with good SNR

For throughput  $\geq 40M$

2 sid clusters with 2 max request per sid

For fairly balanced utilization on US channels under one USBG per MD

Configure "**cable upstream balance-scheduling**" globally



# Upstream Performance Verification

```
cBR8-01#sho cable modem 14b7.f80e.3ee4 service-flow 11
Sfid      : 11
Hfid      : 285
Mac Address : 14b7.f80e.3ee4
Type      : Primary
Direction : Upstream
Current State : Active
Rate Limit Delayed Grants : 0
Rate Limit Dropped Grants : 0
Current Throughput : 16017517 bits/sec,2010 packets/sec
US Bonded : YES
Upstream Bonding Group : UBG-1
Sid Cluster : SC-0, Sid [ 7 7 7 7 ]
Sid Cluster : SC-1, Sid [ 11 11 11 11 ]
Upstream PCH : 12 13 14 15
Segments Valid : 10926917
Segments Discarded : 0
Segments Lost : 0
<snip>
Sid : 7
Request polls issued : 0
BWReqs {Cont,Pigg,RPoll,Other} : 189704, 10753203, 0, 0
Grants issued : 301850
Packets received : 137439110
Bytes received : 67873270485
Queue-indicator bit statistics : 0 set, 0 granted
Good Codewords rx : 30964862
```

UGS flow numbers

```
cBR8-01#sh cable admission-control int c2/0/1
Interface Cable2/0/1
Upstream # 0
```

```
Upstream Bit Rate (bits per second) = 30720000
Sched Table Rsv-state: Grants 0, Reqpolls 0
Sched Table Adm-state: Grants 0, Reqpolls 19, U
0%
```

UGS : 11 SIDs, Reservation-level in bps 959365

UGS-AD : 0 SIDs, Reservation-level in bps 0

RTPS : 0 SIDs, Reservation-level in bps 0

NRTPS : 19 SIDs, Reservation-level in bps 318155

BE : 72 SIDs, Reservation-level in bps 0

Maximum AC reservable bandwidth is not configured

Two US SID Clusters

Per US sid numbers

NRTPS flow (Voice Signaling) numbers



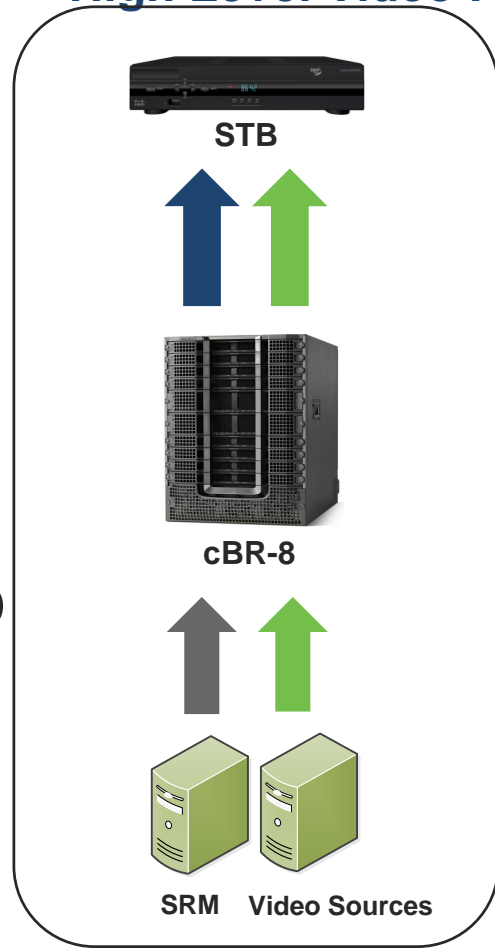
# CCAP Video Troubleshooting

# Video Services Troubleshooting

## Common Problems

- 1. No Video
  - Video Configurations
  - Session Validations
  - AD SG Validations
- 2. Macro-blocking or Impaired Video
  - Throughput Rates
  - Dropped Packets
  - Reserved Session Rates

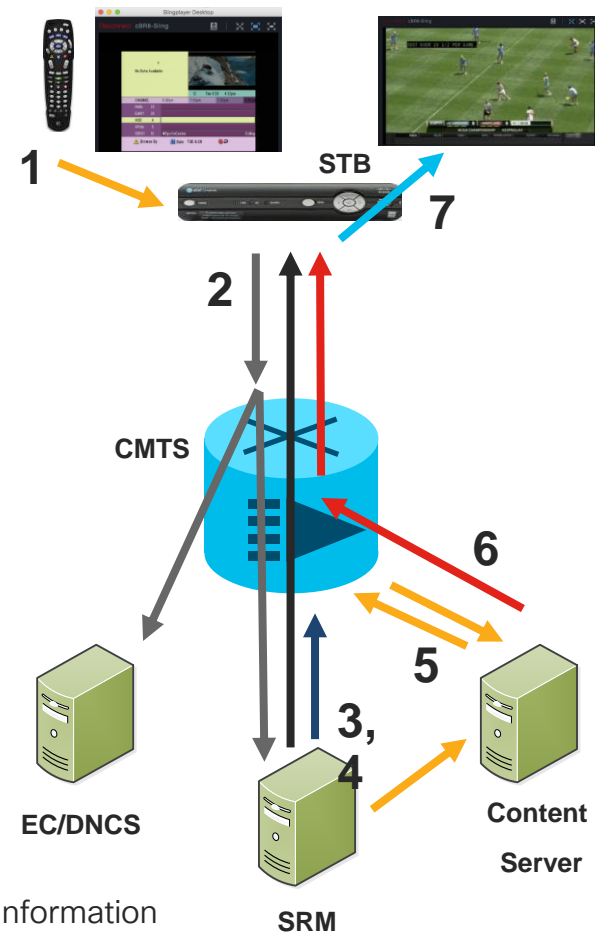
## High Level Video Flow



# Video Services

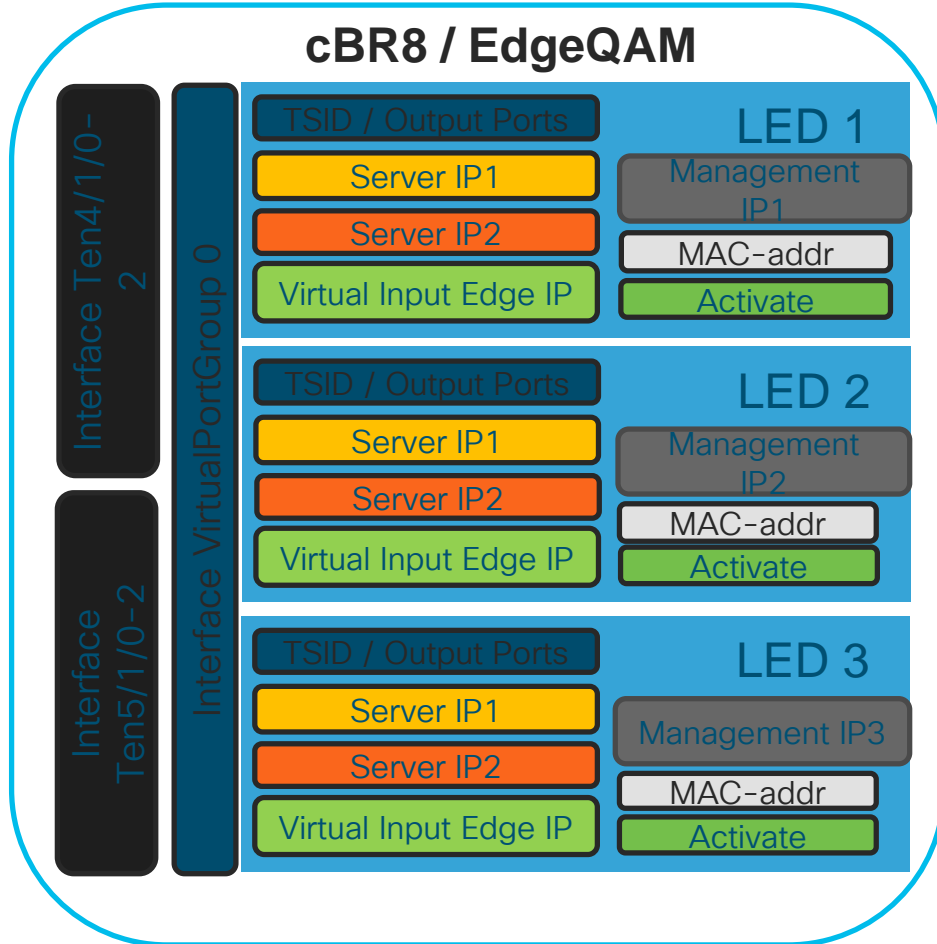
## Video Session Setup

- 1 **Customer STB selects programming**
- 2 STB communicates to EC/SRM to request content
- 3 **SRM requests session creation to cBR-8**
  - Source Specific Multicast or Unicast (VOD)
- 4 SRM transmits to STB the session information
- 5 **cBR-8 obtains content from Content Server**
  - Add Encryption if cBR-8 doing edge Encryption
  - cBR-8 initiates the SSM / SRM instructs source to start
- 6 **cBR-8 forwards content on the appropriate SG**
- 7 **Set Top tunes to appropriate QAM Carrier**
  - Decodes program with the provided encryption keys and program information



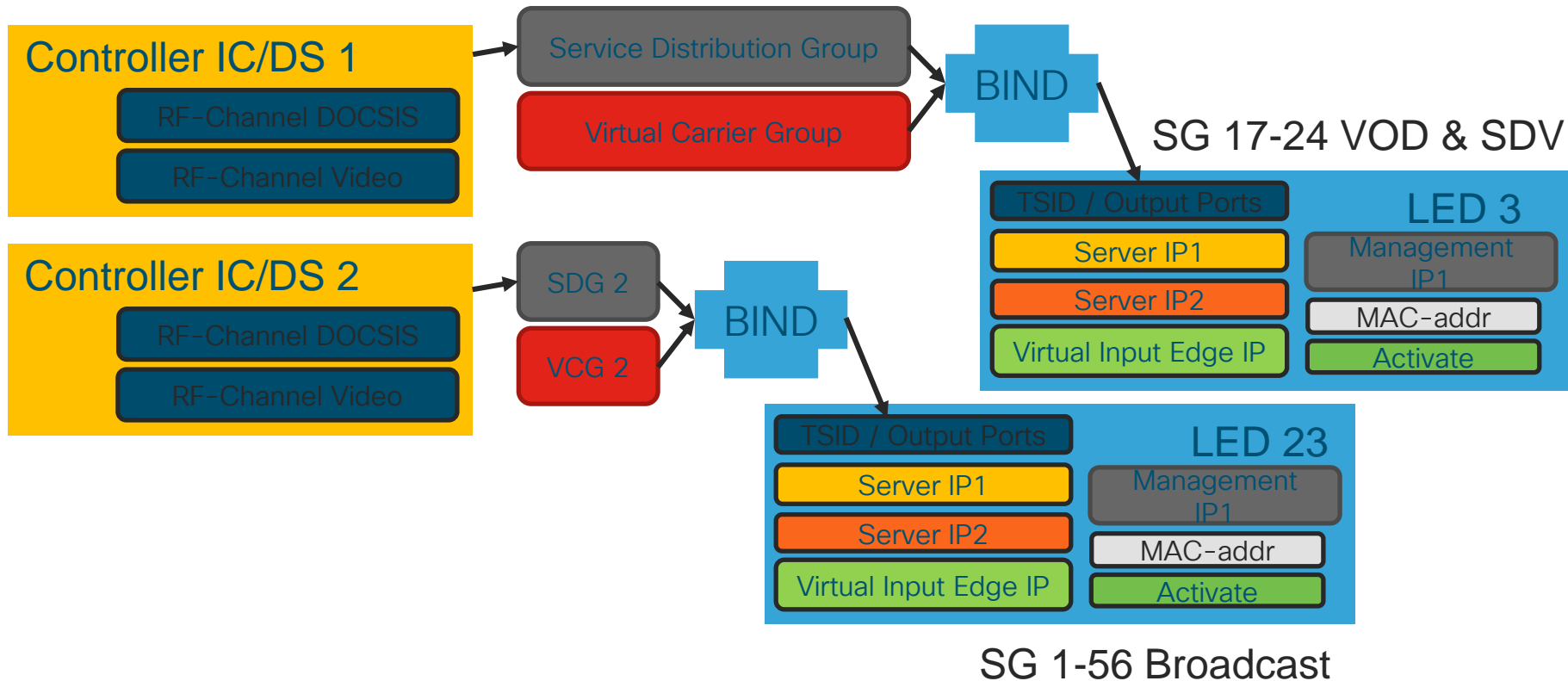
# Cable Video Components

- LED – Logical Edge Device
  - “QP” QAM Partition in RFGW-10
  - LED can be thought of as “Virtual RFGW-1”
- Management IP
  - IP of the LED
- **Server IP 1 and IP 2**
  - IP Address of VSRM Primary and Standby
- **Virtual Edge Input**
  - Destination IP for VOD
- Interface Virtual Port Group 0
  - Loopback/Virtual
  - Subnet where Mgmt Ips are
  - Redistribute Connected in IGP
- Encryption
- **Multicast Uplink and ACL**



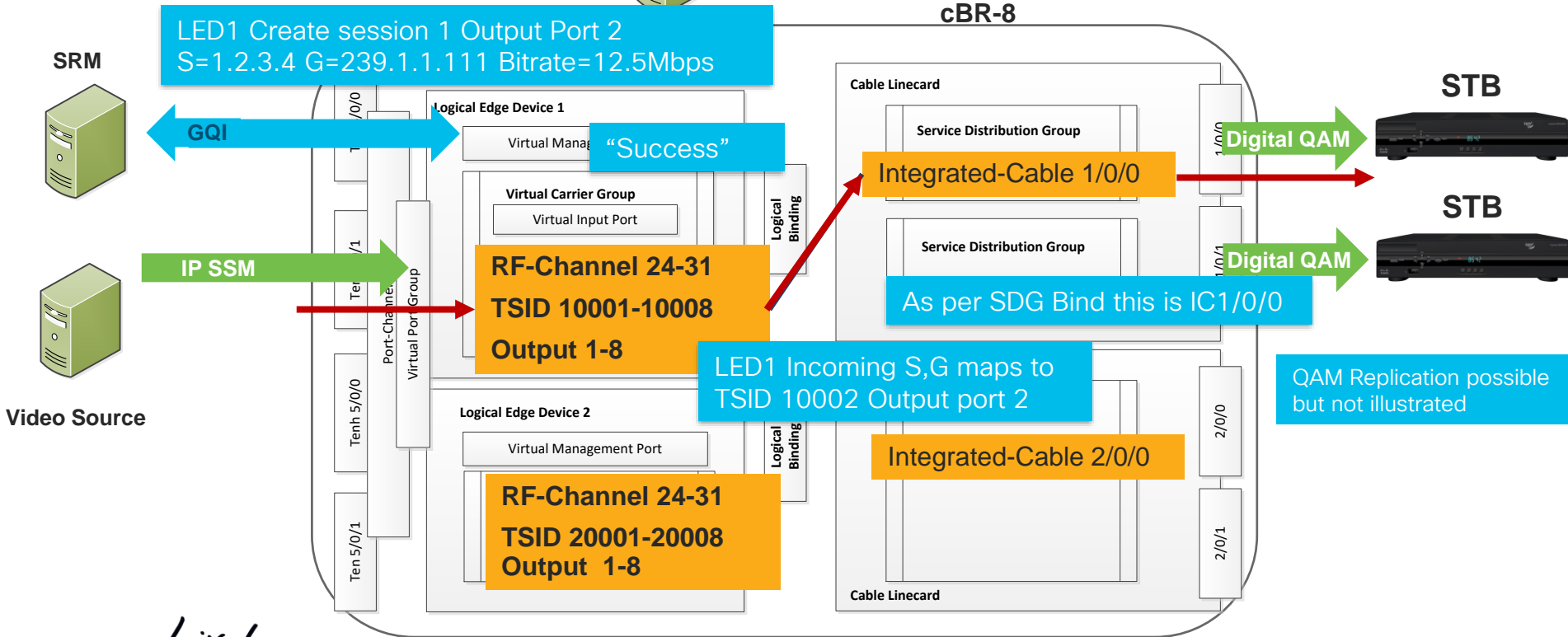
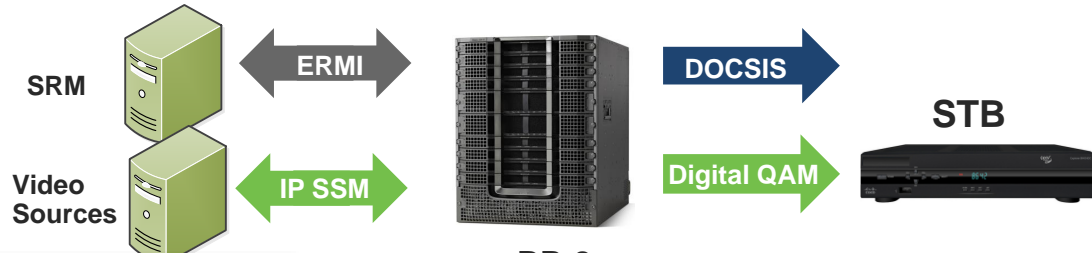
# Configuration Example

Various services for each LED to SG



# Video Services

How it should work



cisco *Live!*

# CCAP Video Troubleshooting

## Video Sessions Deep-Dive

### Command

show cable video sessions logical id *id*

show cable video sessions all [summary]

show cable video session logical id *id* session-id *sess-id*

### Insight

Per-LED Sessions : Look for statistics, trends, general health

Per-Chassis Sessions : Statics, trends, session states

Per-Session Details: Input/Output, Packet counts, and MPEG Stats

```
CBR8-01# show cable video sessions logical id 1
```

LED Session Id	Session Id	Output Port	Streaming Type	Sess Type	Session Ucast	Source Dest IP/Mcast IP (S,G)	UDP Port	Output Program	Input State	Output State	Input Bitrate	Output Bitrate	Encrypt Type	Encrypt Status	Low Lat	PMV NUM	Session Name
1	1107156	26	Passthru	SSM	10.225.139.11	239.203.49.50	0	-	ACTIVE-PSI	ON	21961	16573	CLEAR	-	N	-	0x545200F04...
1	1191769	26	Remap	SSM	10.225.139.11	239.202.2.253	0	1050	ACTIVE-PSI	ON	8955242	8927587	Pre-encrypted	Encrypted	N	-	...9B066E9C6C
1	1197288	26	Remap	SSM	10.225.139.11	239.202.11.9	0	1104	ACTIVE-PSI	ON	8565688	8597610	Pre-encrypted	Encrypted	N	-	...9B067041B5
1	1197362	104	Remap	UDP	13.136.70.223		23902	2001	ACTIVE-PSI	ON	14846535	14833575	PowerKey	Encrypted	N	-	...5A00000F09

```
cBR8-01#show cable video session all summary
```

Video Session Summary For Chassis:

```
Active      : 2105      Init       : 0      Idle       : 0
Off         : 0        Blocked    : 0      PSI-Ready  : 2105
UDP         : 36        ASM        : 0      SSM        : 2069
Remap       : 730       Data       : 0      Passthru   : 1375
Pending     : 0         Encrypted  : 36     Low Latency: 0
```

```
Total Sessions      : 2105
Total Input Bitrate  : 6237924818 BPS
Total Output Bitrate : 6190313200 BPS
Total LEDs          : 7
```

### State

### Meaning

Pre-Encrypted

Bulk Encrypted

Active-PSI

Active and PSI Info

Init

Session pinned up

Idle

Waiting for incoming traffic

Off

Timed out waiting



# CCAP Video Troubleshooting

## Video Sessions Deep-Dive

```
cBR8-01# show cable video sess logical id 1 session-id 1197362
```

```
Session Name      : 0x4C83DE17F1A500000F09
Session Id       : 1197362
Creation Time    : Wed May 15 10:53:52 2020
```

```
Output Port      : 104
TSID             : 7599
ONID             : 0
Number of Sources : 1
  Destination IP  : 13.136.70.223
  UDP Port       : 23902
Config Bitrate   : 14957724
```

```
...
Off Timeout      : 300 sec
Encryption Type  : PowerKey
Encryption Status : Encrypted
```

### Input Session Stats:

```
=====
State: ACTIVE-PSI, Uptime: 0 days 00:19:32
IP Packets: In 1613285, RTP 0, Drop 0
TP Packets: In 11166215, PCR 50656, PSI 19111, Null 126780
             Unreference 0, Discontinuity 17
Errors: Sync loss 0, CC error 65, PCR Jump 0,
        Underflow 1, Overflow 1, Block 0
Bitrate: Measured 14863277 bps, PCR 14891916 bps
```

### Output Session Stats:

```
=====
State: ON, Uptime: 0 days 00:19:32
TP Packets: In 11174905, PCR 50652, PSI 19110,
             Drop 9554, Forward 11146241, Insert 11723
Errors: Info Overrun 0, Info Error 0, Block 0, Overdue 0,
        Invalid Rate 0, Underflow 0, Overflow 0
Bitrate: Measured 14853156 bps
```

### MPEG Counters

### Meaning

CC Error

Continuity Check error – Incoming stream inconsistent

PCR Jump

Clock/Timing Inconsistency

Under/Overflow

Jitter and latency buffers

### PAT Info:

```
=====
Version 0, TSID 1, len 16, section 0/0
Program 1: PMT 480
```

### Input PMT Info:

```
=====
Program 1, Version 0, PCR 481, Info len 0
PID 481: Type 2, Info len 0
PID 482: Type 129, Info len 24, (desc 5 len 4), (lang eng), (desc 129 len 10)
```

### Output PMT Info:

```
=====
Program 2001, Version 7, PCR 2129, Info len 0
PID 2129: Type 2, Info len 9, (CA SYS-ID 3584, PID 2159, Private data: 01010b)
PID 2130: Type 129, Info len 33, (desc 5 len 4), (lang eng), (desc 129 len 10), (CA SYS-ID 3584, PID 2159, Private data: 01010c)
```

### Output PID Map:

```
=====
PID 480 -> 2128
PID 481 -> 2129
PID 482 -> 2130
```

# CCAP Video Troubleshooting

## Debugs and Tracing

Command	Insight
<code>debug cable video gqi</code>	Enables GQI Debugs
<code>set platform software trace {led-01} RP active { vgqi-mgmt   vgqi-msg } noise</code>	Sets additional tracing for Debugs to be meaningful
<code>show platform software trace message {led-01} RP active</code>	Displays the resulting debug/trace logs

```
[vgqi-mgmt]:vgqi_msg_encode_query_sessions_response_v2 - Session ID Count on requested QAM: 1
[vgqi-mgmt]:vgqi_msg_encode_query_sessions_response_v2 - GQI Output Port 1 maps to physical QAM -> slot 1 port 0
channel 24
[vgqi-mgmt]:vgqi_allocate_response, Allocating GQI Response: GQI Server IP 10.225.198.88, LED Mgmt IP 13.135.69.2
[vgqi-msg]:vgqi_rpc_print_session_list_query_params -> Received GQI Query Sessions Request:
  Transaction Header:
    Transaction ID: 00D30000
    Response Program Number: 30000082
    Output Port Number: 1
[vgqi-mgmt]:get_gqi_rpc_message_remote_local_ip, Received GQI Query Sessions V2 Request from 10.225.198.88 to
13.135.69.2
```

# RPHY - RPD Video Troubleshooting Deep-Dive

show downstream channel counter { dps | tpmi | dpmi }

	What is it	What does it tell us
DPS	Transmitted Packets	What packets are tx on the carrier
TPMI	Rx Match Destination MAC, IP, and L2TPv3 Session ID	If incrementing : valid tuple received for channel
DPMI	Rx Match L2TPv3 Session ID and Sequence Number Checking	If incrementing : valid sequencing received If SeqErr-Pkt : Out of sequence packets received

```
R-PHY# show downstream channel counter dps
Chan Tx-packets Tx-octets Drop-pkts Tx-sum-pkts Tx-sum-octs Drop-sum-pkts
46 1412715444 3597499732 0 1412715444 3597499732 0
47 1412733756 3600941072 0 1412733756 3600941072 0
158 719767 47391972 0 719767 47391972 0
...
```

```
R-PHY# show downstream channel counter tpmi
```

```
Level Rx-pkts Rx-sum-pkts
Node Rcv 182177630 182177630
Deps Pkt 2382390178 2382390178
```

```
Port Chan Rx-pkts Rx-sum-pkts
DS_0 39 778328859 778328859
...
DS_0 44 460223051 460223051
DS_0 45 460211632 460211632
DS_0 46 460221125 460221125
DS_0 47 460344092 460344092
```

```
Port Rx-pkts Rx-sum-pkts Drop-pkts Drop-sum-pkts
DS_0 3863639261 3863639261 0 0
US_0 485970657 485970657 0 0
US_1 2244 2244 0 0
```

```
R-PHY# show downstream channel count dpmi
```

```
Field Pkts Sum-pkts
Dpmi Ingress 2203906685 2203906685
Pkt Delete 0 0
Data Len Err 0 0
Chan Flow_id Octs Sum-octs SeqErr-pkts SeqErr-sum-pkts
47 0 3887236816 3887236816 5 5
47 1 0 0 0 0
47 2 0 0 0 0
47 3 0 0 0 0
```



# Advanced Voice Troubleshooting Techniques

# Advanced Voice Troubleshooting

- Vacancy Tables and the MAC-Scheduler
- Voice Show and Debug
- Service Flow Troubleshooting
- SID Tracker

# Vacancy Tables and MAC-Scheduler

## Command

```
show interface cable slot/sub/port mac-scheduler upstream
```

```
show interface cable slot/sub/port mac-scheduler upstream map-stats
```

## Purpose & Validation

Utilization % and Number of Service Flows

Mini-Slot Vacancy Tables are correct

```
cBR8-01#show interface cable 1/0/0 mac-sch 0 map-stat
```

```
UBR MAP Proxy U0 for Cable1/0/0/U0:
```

```
UBR MAP Proxy U0 for Cable1/0/0/U0:
```

```
mslots_per_frame: 1 frame_in_nsecs: 12500
```

```
Bktwidth:(2000 usecs, 20480 tstamps, 160 mslots) numbkts:150
```

```
Tblwidth:(300000 usecs, 3072000 tstamps, 24000 mslots)
```

```
Vacant bkt interval: 4800 mslots
```

```
Bucket vacancy table (slot_count, used_ms, vacancy_ms)
```

```
( 1,160, 0) ( 0, 3,157) ( 0, 3,157) ( 0, 3,157) ( 0,
```

```
( 0, 3,157) ( 0, 3,157) ( 0, 3,157) ( 0, 3,157) ( 0,
```

```
( 0, 3,157) ( 0, 3,157) ( 0, 3,157) ( 0, 3,157) ( 0,
```

```
...
```

```
cBR8-01#show interface cable 1/0/0 mac-sch 0
```

```
DOCSIS 1.1 MAC scheduler for Cable1/0/0/U0 : rate 15360000
```

```
wfq:None
```

```
us_balance:OFF
```

```
dps:ON
```

```
dpon_mode:OFF
```

```
fairness:OFF
```

```
Queue[Rng Polls] flows 0
```

```
Queue[CIR Grants] flows 0
```

```
...
```

```
Avg upstream channel utilization(%data grants) : 65%
```

```
Avg upstream channel utilization in 30 sec : 66%
```

```
Avg percent contention slots : 30%
```

```
Avg percent initial ranging slots : 2%
```

```
Avg percent minislots lost on late MAPs : 0%
```

```
Avg percent guardband slots : 0%
```

# Voice Services

## Commands

- show cable upstream service-flow summary
- show cable modem voice
- show cable modem *mac-address* service-flow [verbose]
- show interface cable *slot/subslot/port* service-flow qos us | include UGS
- show interface cable *slot/subslot/port* service-flow *sflow-id* verbose
- show interface cable *slot/subslot/port* dynamic-service statistics
- show cable admission-control interface *slot/subslot/port* {bonding-group all | upstream *us-number*}
- debug cable dynsrv
- debug cable qos

# Voice Services Flow Debugs

## Dynamic Service Flow

### Debug cable dynsrv & Debug cable tlvs

```
Mar 9 19:28:49.792: DSA-REQ-RECD: OrgMac->0013.1050.3801 OrgId->89
Mar 9 19:28:49.792: DSA-STATE-CREATED: OrgMac->0013.1050.3801 OrgId->89
Mar 9 19:28:49.796: Found Upstream Service Flow TLV
Mar 9 19:28:49.796:   Service Flow Reference : 1
Mar 9 19:28:49.796:   QoS Parameter Set Type : 0x2
Mar 9 19:28:49.796:   Scheduling Type : 6
Mar 9 19:28:49.796:   Request/Transmission Policy : 0x17F
Mar 9 19:28:49.796:   Unsolicited Grant Size : 232
Mar 9 19:28:49.796:   Nominal Grant Interval : 20000
Mar 9 19:28:49.796:   Tolerated Grant Jitter : 800
Mar 9 19:28:49.796:   Grants Per Interval : 1
Mar 9 19:28:49.796: Found Upstream Packet Classifier TLV
Mar 9 19:28:49.796:   Classifier Reference : 1
Mar 9 19:28:49.796:   Service-Flow Reference : 1
Mar 9 19:28:49.796:   Rule Priority : 128
Mar 9 19:28:49.796:   Activation State : 0
Mar 9 19:28:49.796: Found IP Packet Classifier Sub-TLV
Mar 9 19:28:49.796:   Protocol : 17
Mar 9 19:28:49.796:   Source Address : 24.34.240.235
Mar 9 19:28:49.796:   Destination Address : 24.34.240.247
Mar 9 19:28:49.796:   Source Port Start : 53456
Mar 9 19:28:49.796:   Source Port End : 53456
Mar 9 19:28:49.796:   Destination Port Start : 53456
Mar 9 19:28:49.796:   Destination Port End : 53456
```

Mac-add of CM

DSA REQ Received

Admit Service Flow only

US Scheduling type UGS

Std. UGS size for G.711/20ms

20 ms grant interval

Classifier not active yet

RTP port numbers



# Voice Service Flow Debugs

## Debug cable dynsrv & Debug cable tlvs

```
Mar 9 19:28:49.796: Found Downstream Service Flow TLV
Mar 9 19:28:49.796:   Service Flow Reference : 2
Mar 9 19:28:49.796:   QoS Parameter Set Type : 0x2
Mar 9 19:28:49.796:   Traffic Priority : 5
Mar 9 19:28:49.796:   Maximum Sustained Traffic Rate : 87200
Mar 9 19:28:49.796:   Maximum Traffic Burst : 1522
Mar 9 19:28:49.796:   Minimum Reserved Traffic Rate : 87200
Mar 9 19:28:49.796:   Minimum Reserved Rate Packet Size : 218
Mar 9 19:28:49.796: Found Downstream Packet Classifier TLV
Mar 9 19:28:49.796:   Classifier Reference : 2
Mar 9 19:28:49.796:   Service-Flow Reference : 2
Mar 9 19:28:49.796:   Rule Priority : 128
Mar 9 19:28:49.796:   Activation State : 0
Mar 9 19:28:49.796: Found IP Packet Classifier Sub-TLV
Mar 9 19:28:49.796:   Protocol : 17
Mar 9 19:28:49.796:   Source Address : 24.34.240.247
Mar 9 19:28:49.796:   Destination Address : 24.34.240.235
Mar 9 19:28:49.796: Auth Block:
Mar 9 19:28:49.796: 0x0000: 01 06 01 04 00 00 14 3E
Mar 9 19:28:49.796: Sfref = 1, SFID = 103 <- Service Flow IDs assigned by CMTS
Mar 9 19:28:49.796: Sfref = 2, SFID = 104
Mar 9 19:28:49.796: Cfr-ref = 1, CFID = 33, SF-ref 1, SFID 103
Mar 9 19:28:49.796: Cfr-ref = 2, CFID = 34, SF-ref 2, SFID 104
Mar 9 19:28:49.796: DSA-RSP-SENT: CM->0013.1050.3801 TranscId->89 ConfCode->0
Mar 9 19:28:49.896: DSA-ACK-RECD: OrgMac->0013.1050.3801 OrgId->89 ConfCode->0
Mar 9 19:28:50.196: DSA-REQ End : Transaction over-T8 timer expired. OrgMac->0013.1050.3801 OrgId->89
Mar 9 19:28:50.196: DYN-SRV-STATE-DESTROYED : OrgMac->0013.1050.3801 OrgId->89
```

*Admit Service Flow only*

*DS service flow with high priority*

*DQOS Gate ID contained here*

*SFID assigned for US and DS*

*DSA Response sent and ACK received*

# Voice Service Flow

## Service Flow Verification

### Dynamic Service Flow

```
CBR8-01# show cable modem 0000.cad6.eeb6 service-flow verbose
```

```
Sfid : 143
Mac Address : 0000.cad6.eeb6
Type : Secondary(Dynamic)
Direction : Downstream
Current State : Active
Current QoS Indexes [Prov, Adm, Act] : [0, 11, 11]
Active Time : 24:02
Sid : N/A
Traffic Priority : 5
Minimum Reserved Rate : 87200 bits/sec
Admitted QoS Timeout : 200 seconds
Current Throughput : 87254 bits/sec, 50 packets/sec
Application Priority : 3
Classifiers:
Classifier Id : 79
Service Flow Id : 143
CM Mac Address : 0000.cad6.eeb6
Direction : downstream
Activation State : active
Classifier Matching Priority : 128
PHSI : 0
Number of matches : 72112
IP Classification Parameters:
IP Source Address : 14.80.82.7
Source IP Address Mask : 255.255.255.255
Destination IP Address : 14.80.82.141
Destination IP Address Mask : 255.255.255.255
```

Alternative: Show interface cable slot/subslot/port  
service-flow sfid verbose

DS dynamic service flow

DS Service Flow

High Priority for DS flow

Min Reserve rate

Current throughput

Source IP of DS flow

Destination IP of DS flow

# SID Tracker

- From the LC console:
- Enable SID Tracker:
  - `debug cable interface cx/y/z serv <sfid> track`
  - `test cable mod-sched show-sf-track <md> <sfid> <start-idx> <num_entries>`
- Clear SFID tracker:
  - `test cable mod-sched clear-sf-track <us-channel> <sfid>`



# DTrack

- To track control plane packets—packets transitioning RP—both ways
- For Example..DDoS attacks, IF debugs showing DHCP Discover and Request only (e.g. ingress only), CM config file, Routing updates

Where	Debug	What it does
SUP	<code>show platform hardware qfp active feature docsis dtrack statistics clear</code>	Clear Dtrack stats so you have clean start
SUP	<code>test platform hardware qfp active feature docsis dtrack mac <i>mac</i></code>	Enable dtrack against a mac-address
SUP	<code>test platform hardware qfp active feature docsis dtrack packet-copy</code>	Enable dtrack packet-copy
SUP	<code>clear cable modem <i>mac</i> reset</code>	Reset CM
SUP	<code>show platform hardware qfp active feature docsis dtrack statistic</code>	Display Dtrack Stats
SUP	<code>show platform hardware qfp active feature docsis dtrack statistic verbose</code>	(Optional) Deep dive stats, packet header etc..
SUP	<code>test platform hardware qfp active feature docsis dtrack disable</code>	Turn off Dtrack

# DTrack

```
F241-36-04-cBR8-01#show platform hardware qfp active feature docsis dtrack statistics clear
dtrack not enabled
```

```
F241-36-04-cBR8-01#test plat hard qfp act feat doc dtrack mac 848d.c7eb.16
```

```
F241-36-04-cBR8-01#test plat hard qfp act feat doc dtrack packet-copy
```

```
F241-36-04-cBR8-01#clear cable modem 848d.c7eb.16cc reset
```

```
F241-36-04-cBR8-01#show plat hard qfp act feat doc dtrack stat
```

```
DTRACK # mac-addr 848d.c7eb.16cc # flags 0x0000001F
```

```
CABLE:upstream
```

```
8          match
```

```
0          transmit
```

```
Punt
```

```
count      ID  punt-cause
```

```
2          007 ARP request or response
```

```
4          103 cable modem pre reg
```

```
2          107 Cable DHCP
```

```
Drop
```

```
no drops
```

```
CABLE:downstream
```

```
3          match
```

```
3          transmit
```

```
CABLE:inject-ds
```

```
count      ID  inj-cause
```

```
3          040 Cable L2 unicast inject
```

```
all transmitted
```

```
CABLE:bundle-flood
```

```
not enabled
```

```
WAN:dhcp6-to-server
```

```
no matches
```

```
WAN:dhcp6-from-server
```

```
no matches
```

```
WAN:dhcp4-to-server
```

```
4          match
```

```
4          transmit
```

```
WAN:dhcp4-from-server
```

```
2          match
```

```
Punt
```

```
count      ID  punt-cause
```

```
2          107 Cable DHCP
```

```
Drop
```

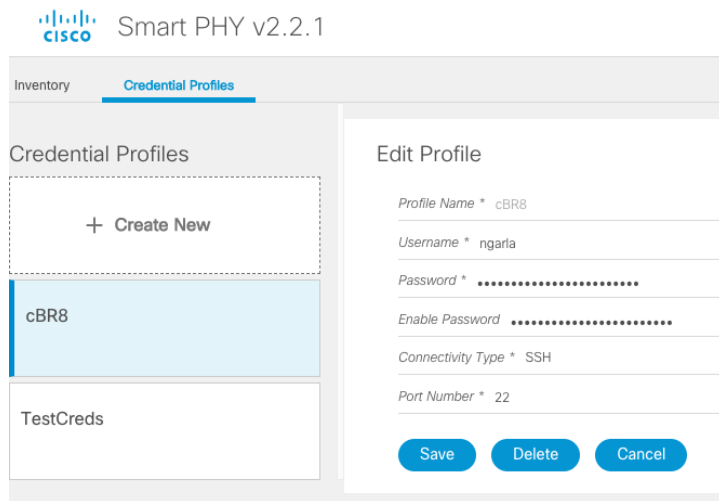
```
no drops
```

# SmartPHY

## Checking configuration from cBR-8

- Used to track RPD related config changes via any tool on cBR-8
- Ensure you have archive logging enabled
- show archive log config user *username 0*
- Monitoring logging changes for “any” automation tool (SmartPhy/BPA/NSO)

```
cBR8-01#sh run | sec archive
archive
  log config
    logging enable
    logging size 1000
  notify syslog contenttype plaintext
  hidekeys
```



# SmartPHY

## Validating RPD Transition States

- From Dashboard -> Overview
- Or Dashboard -> RPD Assignment -> Select RPD -> Details -> Under “RPD State History”

State	Meaning
Online	Online
NotProvisioned	SmartPhy not provisioned for this RPD and GCP messages discarded
GcpRedirectStarted	RPD provisioned on cBR-8
GcpRedirectError	RPD unable to redirect
GcpRedirected	RPD ACK redirect
Offline	Not online on the cBR-8

Dashboard

▲ Core

F241-36-05-cBR8-01.ascable.ci

Search...

RPD MAC

a0f8.496f.ad7e

### GS7KviaAPI-02

⬇ ⌵

▼ RPD Summary

RPD MAC: a0f8.496f.ad7e

▼ RPD State History

2019-05-16 17:49:42 : Online

2019-05-16 17:46:03 : GcpRedirectStarted

2019-05-16 17:46:03 : GcpUp

2019-05-16 17:45:54 : GcpRedirected

Total 2 ↻		
PDs Online		RPDs Errored
1		2
Longitude	RPD State	Provisioned
	Online	✓

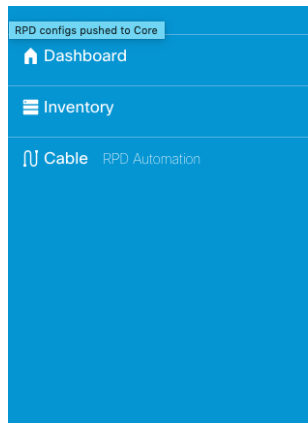
cisco *Live!*



# SmartPHY

## Checking configuration for RPD or cBR-8

- RPD: Go to RPD Assignment Page -> Select RPD



Smart PHY v2.2.1

Overview **RPD Assignment** Service Definitions Global Settings

Assign Service Definitions

Associate RPDs

+ ✎ ✕ ⬇ ⬆ Assign Clear Details

Search...

	Status	Provisioned	RPD Name	RPD MAC	Service Definition	CCAP Core	CCAP Core Inter...	Downstream Data S...
<input checked="" type="checkbox"/>		✓	GS7KviaAPI-02	a0f8.496f.ad7e	24x4SG-IPv4-API	F241-36-05-cBR8-...	TenGigabitEthernet2/1/0	DS
<input type="checkbox"/>		—	RPD	acbe.1234.2345	Test-96x4_192OFDM	F241-36-05-cBR8-...	TenGigabitEthernet2/1/4	asas
<input type="checkbox"/>		—	FindOne	0909.1212.2121	Test-96x4_192OFDM	F241-36-05-cBR8-...	TenGigabitEthernet2/1/0	fgvbhj

```
RPD CLI

cable rpd GS7KviaAPI-02
description Test
identifier a0f8.496f.ad7e
core-interface Te2/1/0
principal
  rpd-ds 0 downstream-cable 2/0/0 profile 50
  rpd-us 0 upstream-cable 2/0/0 profile 60
r-dti 1
rpd-event profile 5
cable fiber-node 1
  downstream Downstream-Cable 2/0/0
  downstream sg-channel 0 23 downstream-Cable 2/0/0 rf-channel 0 23
  upstream Upstream-Cable 2/0/0
  upstream sg-channel 0 3 upstream-Cable 2/0/0 us-channel 0 3
service-group profile 24x4
```

# cBR-8 Optimizations and Automation

# Agenda

## Optimization and Automation

BRKSPG-2505

- SmartPHY
- Evolved Programmable Network Manager
- Business Process Automation (+Demo cBR-8 IOS-XE Upgrade)
- Automated Fault Manager

# SmartPHY



## Deployment Simplified

- Resource Selection
- DOCSIS & Video
- cBR-8 and RPD orchestration



## Unified Provisioning

- Common DHCP Policy
- Flexible RPD to SG mapping without managing one-offs

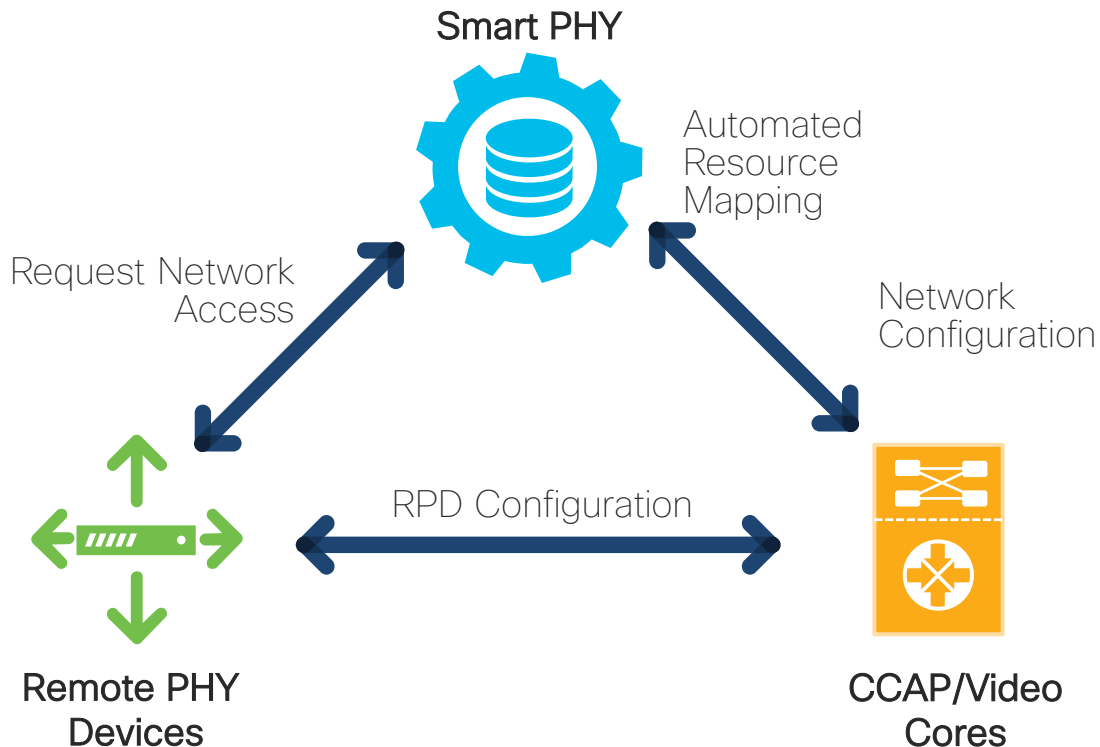


## Cisco Crosswork Platform

- Common Infrastructure
- API-Centric Design

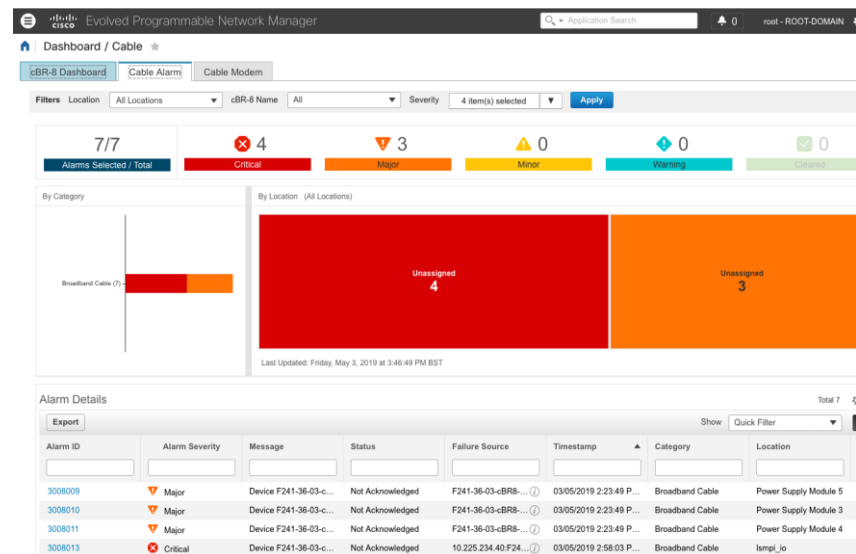
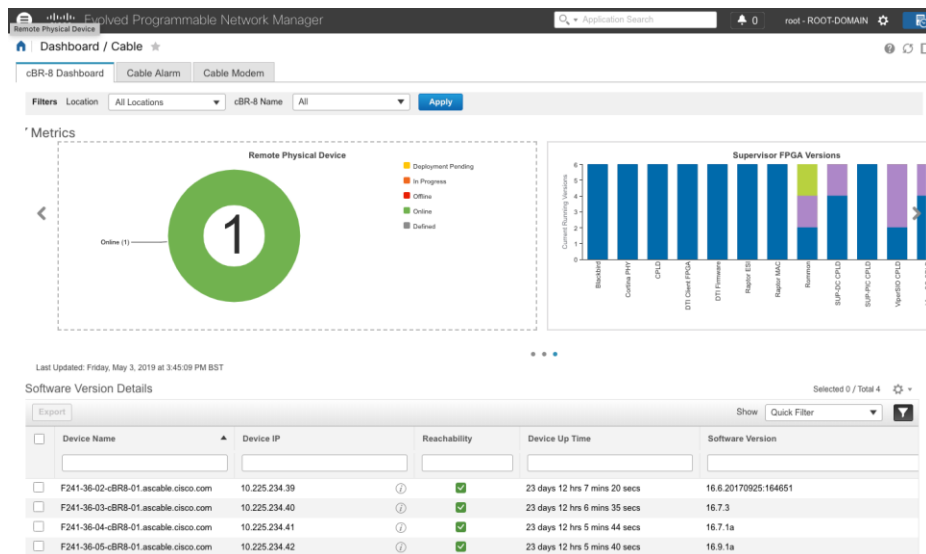


## Advanced Monitoring & Troubleshooting



# Evolved Programmable Network Manager

- Version 3.0 supports cBR-8 Specific Features and Dashboard



# Evolved Programmable Network Manager

- Device Specific View

Evolved Programmable Network Manager

Chassis View Logical View Device Details Utilization

F241-36-04-cBR8-01.ascable.cisco.com

Alarms Configuration Inventory Interfaces Performance Circuits

1 Critical 0 Major 0 Minor 0 Warning

Export Show Quick

Severity Condition Timestamp Affected Object

TV\_MEMORY\_U... 2019-May-03, 15:00:00 Impact: low

Evolved Programmable Network Manager

Chassis View Logical View Device Details Utilization

F241-36-04-cBR8-01.ascable.cisco.com

Fiber Node Utilization

Downstream Upstream

76-100% 51-75% 26-50% 0-25% 76-100% 51-75% 26-50% 0-25%

0% 0% 0% 100% 0% 0% 0% 100%

Total 14

Show Quick Filter

Fiber...	Fiber Node Descri...	Downstream Details	Upstream Details	Service Group Profile	MAC Domain	RPD Count	Modem Count
		DOCSIS Utilization	# Channels	DOCSIS Utilization	# Channels		
1	FN1-36-04	0%	31	0%	4	0	0
2	Jay2-dummy-valid...	0%	31	0%	0	0	0
20	FN20-36-04	0%	24	0%	4	0	0
21	FN21-36-04	0%	24	0%	4	0	0
22	FN22-36-04	0%	25	0%	4	0	0
30	FN30-36-04	0%	24	0%	4	0	0
31	FN31-36-04	0%	24	0%	4	0	0
40	FN40-36-04	0%	24	0%	4	0	0
41	FN41-36-04	0%	34	0%	4	0	0
42	FN42-36-04	0%	0	0%	4	0	0
43	FN43-36-04	0%	0	0%	4	0	0
44	FN44-36-04	0%	34	0%	5	0	0
500	FN500-36-04	0%	32	0%	6	0	0
501	FN501-36-04	0%	32	0%	6	0	0

# Business Process Automation

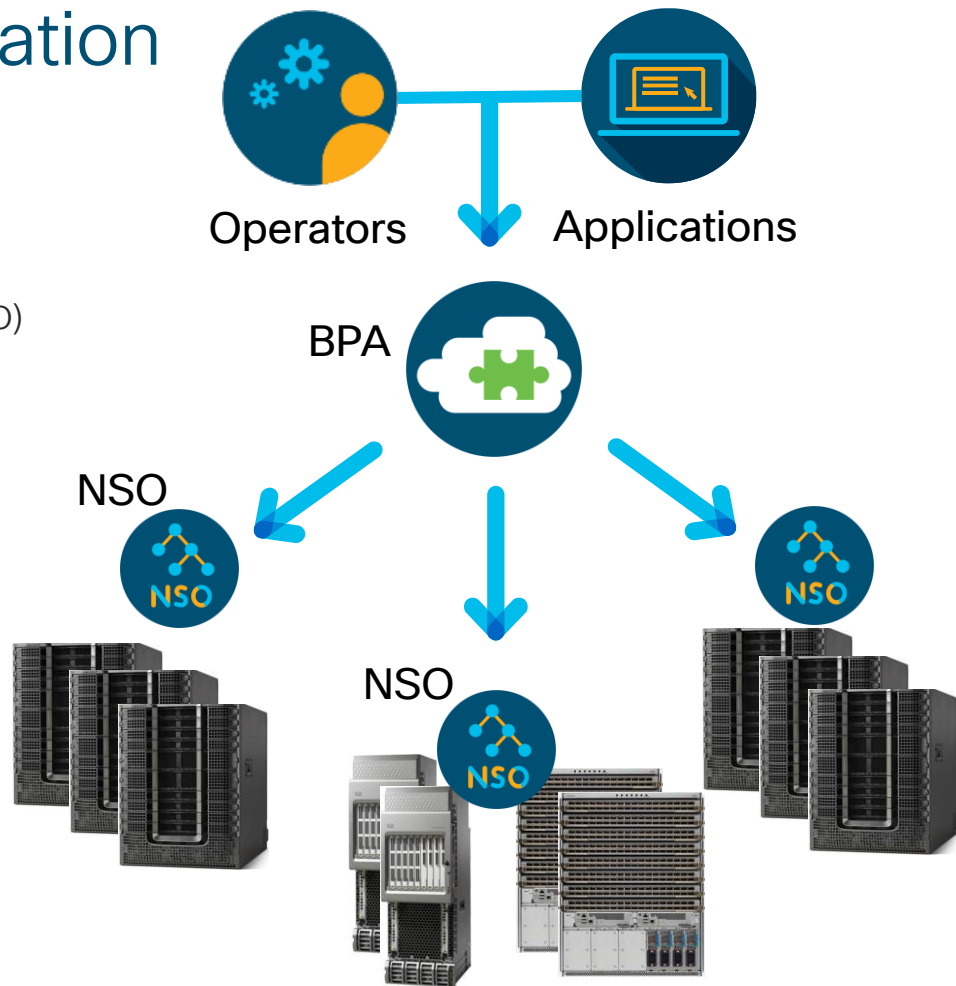
- A software workflow engine
  - Leverages Cisco Network Services Orchestrator (NSO)
  - Leverages BP workflows

## Real-World Use Cases

ASR9k to NCS Migration

cBR-8 IOS-XE Upgrade

RPD and CIN Onboarding



# BPA Workflow Example – cBR-8 IOS-XE Upgrade

## Defined Workflows

Overview Tasks Defined Workflows Workflow Instances

Create

Import

↓ CSV

Import Process Definition

1 rows selected







✕ Clear Selection

🔍 device

✕

🔍

🔍

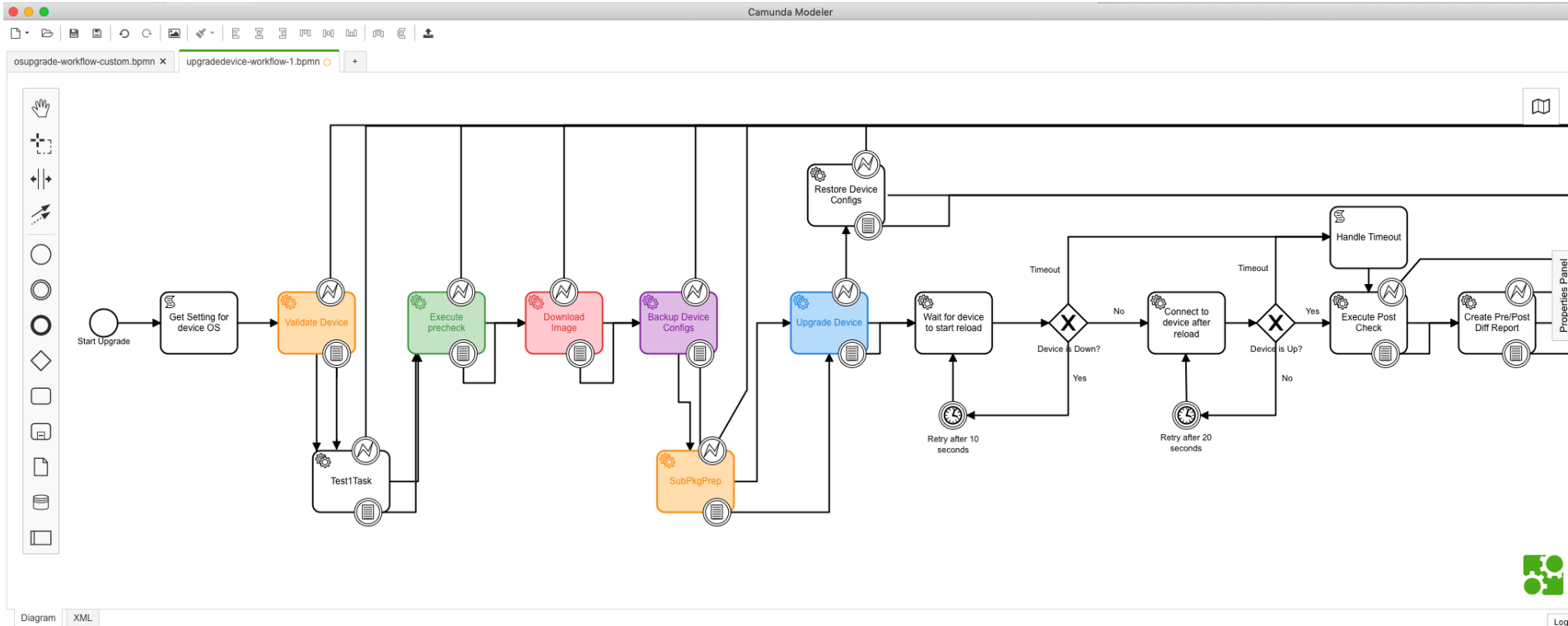
<input type="checkbox"/>	Key	Name	Version	Resource	Status	Last M...	Actions
<input type="checkbox"/>	device_activation	Device Activation	1	device_activation-workflow.bpmn	Deployed		  
<input checked="" type="checkbox"/>	upgradedevice	IOS Software Upgrade Sub WF	1	upgradedevice-workflow.bpmn	Deployed		  

1 to 2 of 2

⏪ < Page 1 of 1 > ⏩



# BPA Workflow Example – cBR-8 IOS-XE Upgrade



# BPA Process Template Sample



[Home](#) / Process Templates

Business Process Automation

admin admin



## Process Templates

[Process Templates](#) [Executions](#) [Analytics](#) [Diff](#) [Scripts](#)

Add

Upload

Upload Zip

Download

Download Zip

Delete

From Date



To Date

↓ CSV

↓ Excel



<input type="checkbox"/>	Template	⋮	Commands	⋮	Description	⋮	Created At	⋮	Updated At	⋮	Actions
<input type="checkbox"/>	cBR8-Test		1		Dummy		05/21/19, 05:42 PM		05/21/19, 05:42 PM		
<input type="checkbox"/>	cBR8-Subpackage-Preparati...		9				05/21/19, 02:56 PM		05/21/19, 05:31 PM		
<input type="checkbox"/>	cBR8-Validation-Checks		5		Firmware Chks + Rommon		05/21/19, 02:35 PM		05/21/19, 10:13 PM		
<input type="checkbox"/>	cBR8-Download-Images		4				05/21/19, 02:32 PM		05/21/19, 05:56 PM		
<input type="checkbox"/>	cBR8-Upgrade-SubPkg-Mode		5		Subpkg Mode Upgrade		05/21/19, 12:46 PM		05/21/19, 06:06 PM		
<input type="checkbox"/>	cBR8-Rewind-16101d		3		Del backupcfg, pkg files, sub...		05/21/19, 12:41 PM		05/21/19, 12:44 PM		
<input type="checkbox"/>	cBR8-Backup-Run-Cfg		2		Backup Running		05/21/19, 12:38 PM		05/21/19, 05:23 PM		



## Process Templates

[Process Templates](#) [Executions](#) [Analytics](#) [Diff](#) [Scripts](#)

Name	Description	Pass Criteria
cBR8-Subpackage-Preparator		1&&3&&8

Select NED



Test

1	verify /sha512 bootflash:cbrsup-universalk9.16.10.01d.SPA.bin	
2	verify /sha512 stby-bootflash:cbrsup-universalk9.16.10.01d.SPA.bin	
3	verify /sha512 bootflash:/cbrsup-programmable_firmware.16.10.01d.SPA.pkg	
4	copy bootflash:cbrsup-programmable_firmware.16.10.01d.SPA.pkg stby-bootflash:   prompts ENTER	
5	copy bootflash:cbrsup-universalk9.16.10.01d.SPA.bin stby-bootflash:   prompts ENTER	
6	dir stby-bootflash:   prompts ENTER	
7	verify /sha512 stby-bootflash:/cbrsup-programmable_firmware.16.10.01d.SPA.pkg	
8	request platform software package expand file bootflash:cbrsup-universalk9.16.10.01d.SPA.bin to bootflash:/IOSXE/ wipe	
9	request platform software package expand file stby-bootflash:cbrsup-universalk9.16.10.01d.SPA.bin to stby-bootflash:/IOSXE/ wipe	



# Demo – Business Process Automation cBR-8 IOS-XE Upgrade



# Automated Fault Management

## What

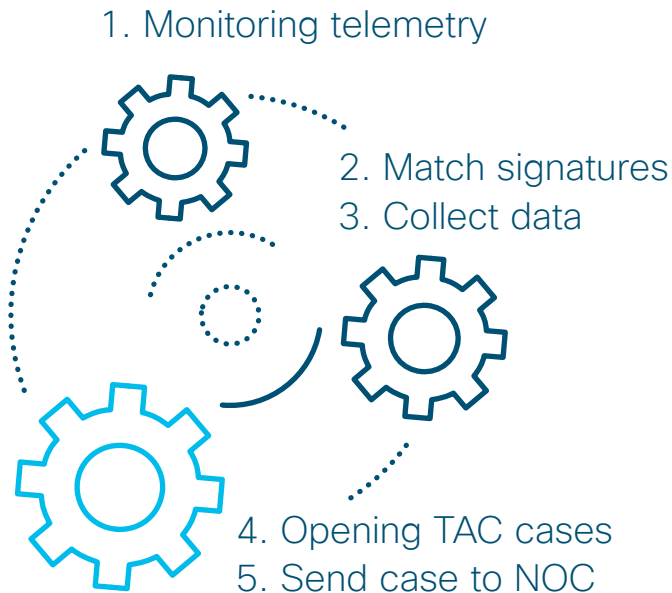
Near-real time, accurate fault detection.

## How

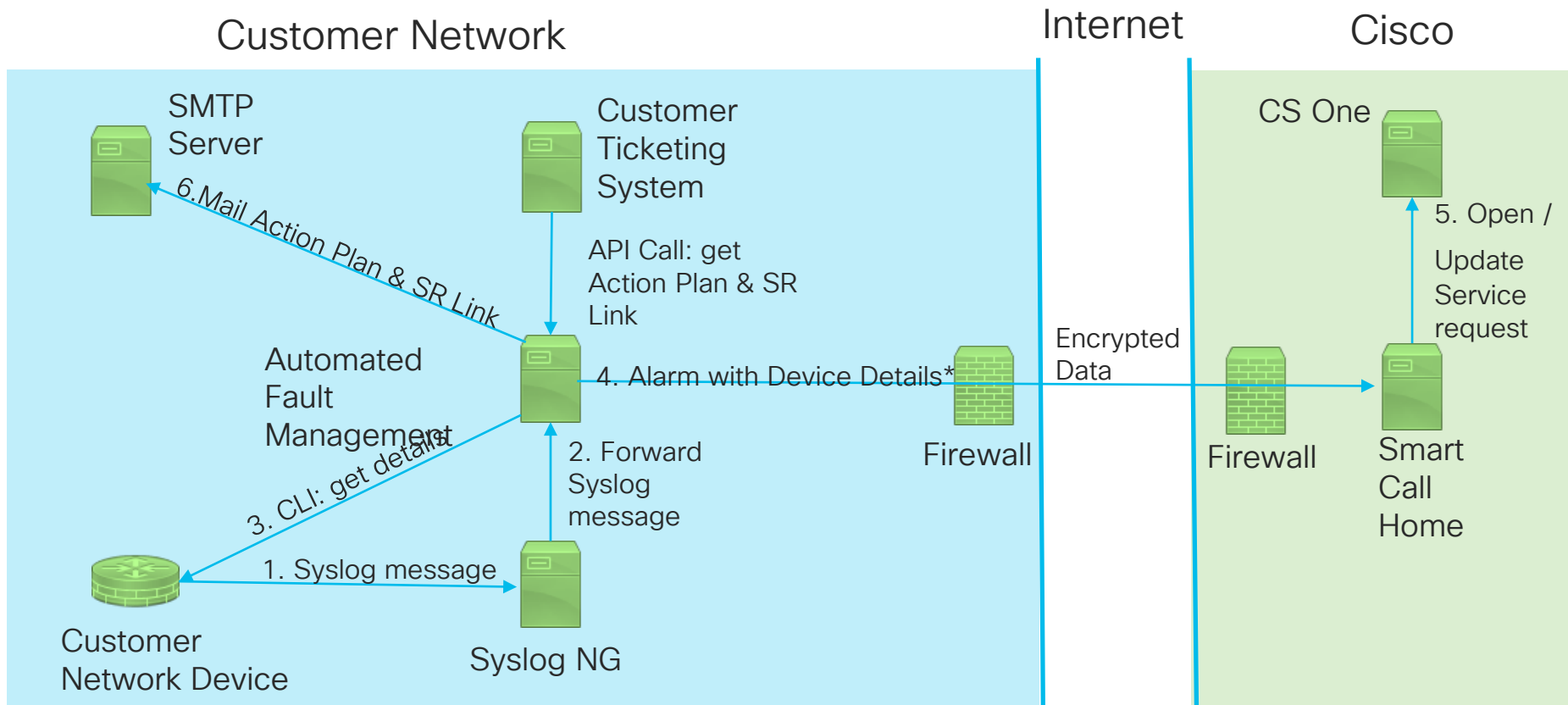
World-class event collection, identification and correlation functionality combined with Cisco proprietary intellectual capital.

## Why

Speed issue resolution and increase staff utilization.

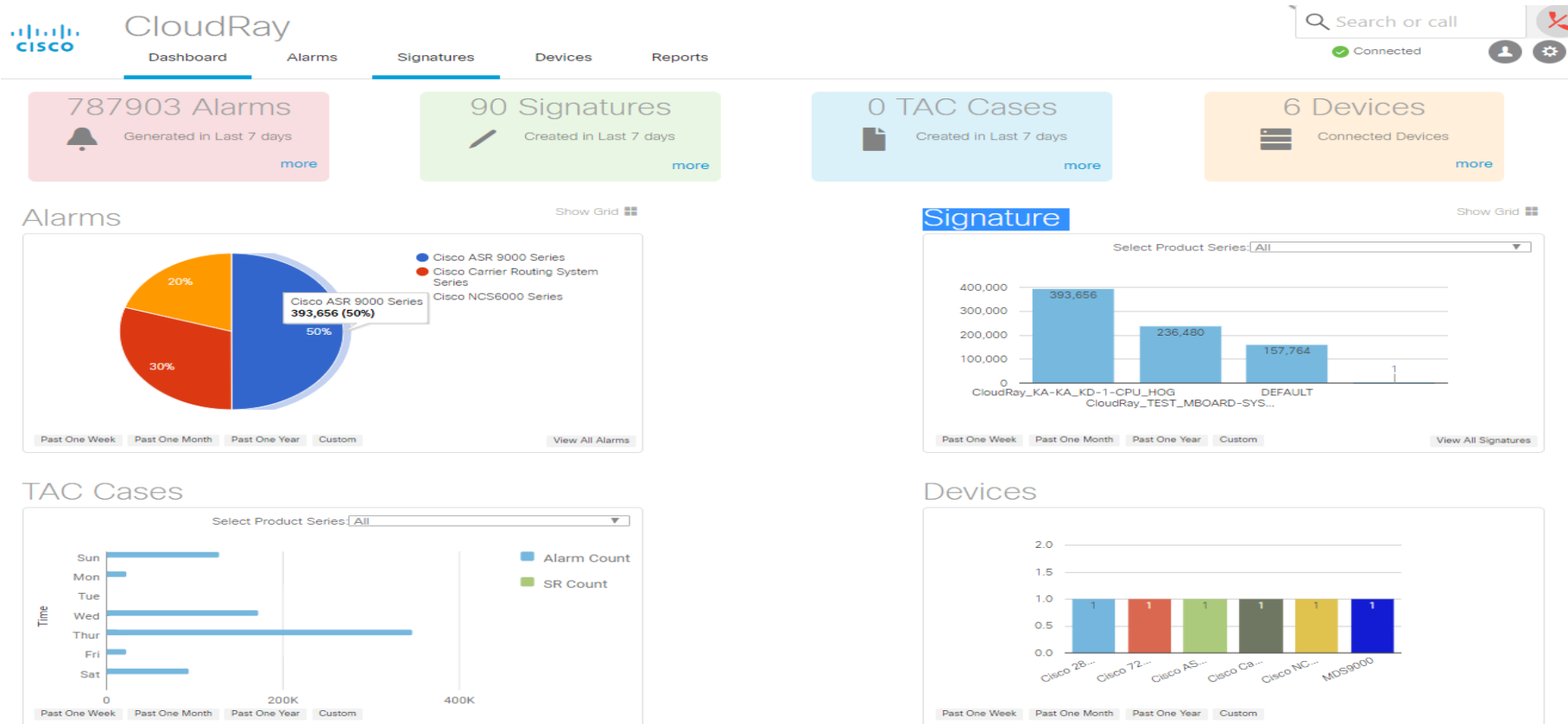


# Automated Fault Management Architecture



\*Some alarms are notification only and don't need to generate a Cisco Service Request, but this is modifiable.

# Summary Tab





# Summary

# Summary

- CCAP Journey
- Deployment And Operational Best Practices for cBR-8 Features
- Troubleshooting Techniques for CCAP Services
- Tools Review For cBR-8 Optimizations and Automation
- Detailed Troubleshooting cBR-8 Voice services (In appendix)
- Downstream Bonding Resiliency (in appendix)

# Complete your online session survey



- Please complete your session survey after each session. Your feedback is very important.
- Complete a minimum of 4 session surveys and the Overall Conference survey (starting on Thursday) to receive your Cisco Live t-shirt.
- All surveys can be taken in the Cisco Events Mobile App or by logging in to the Content Catalog on [ciscolive.com/emea](https://ciscolive.com/emea).

Cisco Live sessions will be available for viewing on demand after the event at [ciscolive.com](https://ciscolive.com).

# Continue your education



Demos in the  
Cisco Showcase



Walk-In Labs



Meet the Engineer  
1:1 meetings



Related sessions



Thank you





You make **possible**

# Appendix





# cBR-8 Quick Reference Sheet

a	Max- <i>ofdm</i> -spectrum <i>mbz</i> + max carrier + base-power
b	<i>rf</i> -channel 158 (to 162)
c	<i>ofdm</i> channel-profile <i>num</i> start-frequency <i>freq</i> width <i>width</i> plc <i>plc-freq</i>
3	cable downstream <i>ofdm</i> -chan-profile <i>num</i>
A	Subcarrier-spacing (25/50)
B	Profile- <i>ncp</i> , Profile-data 1,2,3
4	Interface Wideband-cable <i>xyz:n</i>
A	Cable bundle + <i>rf</i> -bandwidth-percent
5	Interface cable <i>xyz</i>
A	(primary DS) downstream integrated-cable <i>xyz</i> <i>rf</i> -channel (158-162)
6	Interface wideband-cable <i>xyz:nnn</i>
cable	cable <i>rf</i> -channels channel-list <i>list+ofdm</i> <i>ch</i> bandwidth-percent 1

show cable mac-domain cable *xyz* ocd  
show cable mac-domain cable *xyz* dpd  
show cable ofdm-channel-profile *prof-num*  
show cable ofdm-modulation-profile *prof-num*  
show cable ofdm-modulation-profile configuration  
show interface cable *xz* controller | | \OCDC  
show controllers Integrated-Cable *xyz* *rf*-channel (158-162) [verbose]  
show controllers Integrated-Cable *xyz* *rf*-channel 158 prof-order  
show controllers integrated-Cable *xyz* counter ofdm-channel

**Upstream OFDMA**  
show controllers upstream-cable *x/y/z* us-channel (12-15) [cdm-ump]  
show cable card *x/y* us-phy ofdma-channel cw-error  
show cable card *x/y* us-phy ofdma-channel (iuc-stat | map-stats) | phy-dev-instance ofdma-ch-num  
show cable modulation-profile ofdma profile-number

Configuration Checklist US OFDMA	
1	check diplexer ranges
2	check modem capabilities & fw
1	Configure OFDMA Downstream
2	Define Fiber Node
3	US OFDMA Profile (or default)
4	Controller Upstream-Cable <i>xyz</i>
a	Us-channel (12-15) docsis-mode ofdma
b	Us-channel (12-15) docsis-mode frequency-start <i>start-freq</i> end-freq
c	no us-channel (12-15) shutdown
5	Interface cable <i>xyz</i>
a	Upstream 4 us-channel (12-15)
b	Upstream bonding-group number
c	Upstream 4 + desired

**CM Profile Management**  
show cable modem mac phy ofdm-profile { downstream | upstream }  
show cable modem mac prof-mgmt

Remote PHY	
RPD	
show cable rpd	
Int State	Meaning
Auth	Dot1x Auth
DHCP	Obtain IP for vbh0
ToD	Obtain Time of Day
cBR8 State	Meaning
offline	RPD offline, no comm
Init(auth)	CORE and RPD Auth
Init(gcp)	Control Protocol exch
Init(dksync)	Timing sync, Skip if Aux Cor
Init(l2tp)	DEPI/UEPI
Online	RPD fwding / recv

show cable rpd  
show cable rpd *rf-id*  
show cable rpd slot *slot*  
show cable rpd tengig *x/y/0*  
show cable rpd { *p* | *mac* } [teng *x/y/0*]  
show cable rpd id *id*  
show cable rpd name *name*  
show cable rpd *mac-add* | principal | aux |  
show cable rpd *mac-add* lcha-cores [ active | standby ]  
show cable rpd [slot *slot* | ten *x/y/0*] summary

show cable downstream controller-profile  
show cable upstream controller-profile

(rpd) show dot1x detail  
(rpd) show dhcp  
(rpd) show tod

clear cable rpd { all | id | *ip-add* | slot *slot* | ten *asp* } [ reset | delete ]  
clear cable rpd { same-above } modem { reset | delete }  
clear cable rpd { same-above } powercycle

**Logging & Event**  
show cable rpd mac tengig *x/y/0* log  
show cable rpd mac event  
(rpd) logging provision-archive scp server-*ip* user-id *dst\_loc*  
(rpd) show env sensor [sensor-id]  
(rpd) show env table sensor-id

**Generic Control Protocol**  
Purpose: CCAP-Core to control RPD configuration, event report, & query  
show cable rpd mac ten *xyz* gcp-transaction [verbose]

show cable rpd mac ten <i>xyz</i> { gcp-session   gcp-state }	
State	Meaning
init	Recv RPD Notify
negot	Sent req RPD Capab
negot	Recv RPD Capability
BulkSync	Sent CCAPCore Ident
Ready	DS/US Ch cfg & rpd Configs done

(rpd) show provision { all | history }  
(rpd) show gcp session  
debug cable rpd  
(r) set platform trace *phyman* *rp*  
*rp* *phy* *gcp* *infra* noise  
(r) set platform trace *phyman* *rp*  
*rp* *phy* *gcp* *tv* noise

PTP Timing	
Purpose: Timing sync for MAC Mgmt	
cBR8 State	Ref Failed
Free Run	Ref Failed
Acquiring	Acquiring
Freq Lock	Freq lock
Phase Aligned	Phase Lock
Holdover	Holdover

show ptp clock running  
show platform software ptp stat stream (0/1)  
(rpd) show ptp clock 0 config  
(rpd) show ptp clock 0 state

**DEPI & UEPI**  
Purpose: Encap DOCSIS or Video DS and US traffic to RPD

show controllers downstream-cable *xyz* counter *rf-channel* [verbose]

Field	Meaning
High	UCDs, MAPs
Medium	MMM, High QoS Data
Low	Low QoS Data
MPEG	MPEG Increment for video
DEPI	DEPI Incr: MMM, Data, Overhd
MAP UCD	Increment for DEPI Primary DS
SYNC	0 - RPD handles SYNC

show cable rpd mac depi   tunnel   session	
M. MAP	D. Data   R. RngRt   S. SpcM
MPT	MPEG Transport
PSP	Pkt Stream Proto : DOCSIS

C R	Message	Meaning
→	SCCRQ	Start Ctrl Ch Request
←	SCCRP	Start Ctrl Ch Response
→	SCCCN	Start Ctrl Ch Connected
→	StopCCN	Initiate teardown
→	ICRQ	Incoming Call Request
←	ICRP	Incoming Call Reply
→	ICCN	Incoming Call Connected
		Initiate session teardown
	CDN	

show cable depi multicast pool  
show cable depi multicast ip all  
(rpd) show downstream depi config  
(rpd) show upstream uepi config  
(rpd) show downstream channel config  
(rpd) show upstream channel config  
(rpd) show l2tp { tunnel | session }  
debug cable rpd r-depi  
debug l2tp all

**Access & Security**  
Default is SSH admin/admin  
Remove Admin conf: ssh password off  
Add SSH Pubkey: conf: ssh pubkey add  
Disable auto reboot - set reboot hold

Enable auto reboot - clear reboot hold  
(rpd) show ssh session  
(rpd) show ssh nms-pubkey

Video RPD	
(rpd) show downstream channel counter [tpmi   dpmi   dps]	
Type	Meaning
DPS	Transmitted Packets
DPMI	Rx Matching L2TPv3 Session ID and Sequence Number Checking
TPMI	Rx Match Destination MAC, IP, and L2TPv3 Session ID

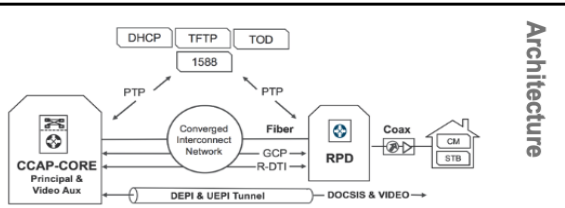
(rpd) show fpga video statistics start-*rf-ch* end-*rf-ch*  
(rpd) show fpga video interrupt

Slot 0 (RF L linecard)	
Slot 1 (RF L linecard)	
Slot2 (RF L linecard)	
Slot 3 (RF L linecard)	
Slot 4 (SUP)	
Slot 5 (SUP)	
Slot 6 (RF L linecard)	
Slot 7 (RF L linecard)	
Slot 8 (RF L linecard)	
Slot 9 (RF L linecard)	

PEM0	PEM1	PEM2
PEM3	PEM4	PEM5

Slot 0 (PIC)	FAN0
Slot 1 (PI C)	
Slot 2 (PI C)	FAN1
Slot 3 (PI C)	
Slot 4 (SUPPIC)	FAN2
Slot 5 (SUPPIC)	FAN3
Slot 6 (PI C)	
Slot 7 (PI C)	FAN4
Slot 8 (PI C)	
Slot 9 (PI C)	

Power Shelf  
(Power Switch, Power Plugs)



**cable rpd** *RPD\_NAME*  
description *sample\_RPD\_1*  
identifier 0000.aaaa.bbbb  
core-interface Te *x/1/z*  
principal  
rpd-ds 0 downstream-cable *xyz* profile 30  
rpd-us 0 upstream-cable *abc* profile 1  
network-delay dlm 10  
core-interface Te *x/1/z*  
rpd-ds 0 downstream-cable *x/y1z1* profile 40  
r-dti 1  
rpd-event profile 5

**cable downstream controller-profile 30**  
multicast-pool *pool\_id*  
rf-chan 0 31  
**type DOCSIS**  
frequency *rf-frequency\_start\_1*  
rf-output NORMAL  
qam-profile 1  
docsis-channel-id 1  
rf-chan 33 39  
**type VIDEO SYNC**  
frequency *rf-frequency\_start\_2*  
rf-output NORMAL  
qam-profile 5

**cable upstream controller-profile 1**  
...  
us-channel *n* channel-width 6400000 6400000  
us-channel *n* docsis-mode atdma  
us-channel *n* equalization-coefficient  
us-channel *n* frequency *freq\_center*  
us-channel *n* minislot-size 2  
us-channel *n* modulation-profile 224  
no us-channel *n* shutdown

**cable depi multicast pool** *pool\_id*  
ip address 225.225.225.0 255.255.255.0

**Interface Cable xyz**  
downstream Downstream-Cable *xyz* *rf*-channel *n*  
upstream *m* Upstream-Cable *abc* us-channel *p*  
cable bundle *bundle\_id*

**ptp clock ordinary domain 0**  
servo tracking-type R-DTI  
clock-portname-of-server slave  
delay-reg interval-4  
sync interval-5  
sync one-slep  
transport ip v4 unicast interface Lo0  
negotiation  
clock source master-ptp-server-IP

**ptp r-dti 1**  
ptp-domain 0  
clock-port 1  
clock source ip master-ptp-server-IP

Notes

# Bonus Slides

# Remote PHY

# Configuration Overview

1. Hardware & Software Requirements
2. Configuration Reference
3. Configuration Validation
  - a. Downstream and Upstream Controller(s)
  - b. RPD
  - c. Interface Cable & Fiber Node(s)
  - d. Controller Profile(s)

# 1 Hardware & Software Requirements

## Remote PHY Support

Part ID	Component
CBR-CCAP-LC-40G-R	CCAP-CORE, Cable LC
CBR-DPIC-8X10G	CCAP-CORE, DPIC
RPD-1x2	RPD
IOS-XE Software	Feature
16.5 Polaris & Later	R-PHY Support
16.5(1r)S	SUP ROMMON
2011.03.18	Cable Linecard ROMMON

```
cBR-8# show run | include card
card 0/0 cBR-CCAP-LC-40G r-phy
card 2/0 cBR-CCAP-LC-40G r-phy
```

```
cBR8-01# show inventory
NAME: "clc 0", DESCR: "Cisco cBR CCAP Line Card"
PID: CBR-CCAP-LC-40G , VID: V01 , SN: CAT1919E1RR
NAME: "CLC Downstream PHY Module 0/0", DESCR: "Cable PHY Module"
NAME: "ATO clc 2", DESCR: "Cisco cBR CCAP Line Card"
PID: CBR-CCAP-LC-40G-R , VID: V01 , SN: CAT2040E03T
NAME: "clc 2", DESCR: "Cisco cBR CCAP Line Card"
PID: CBR-CCAP-LC-40G-R , VID: V01 , SN: CAT2040E03T
NAME: "digi-pic 2/1", DESCR: "Cisco cBR CCAP Line Card Digital PIC"
PID: CBR-DPIC-8X10G , VID: V01 , SN: CAT2113E003
```

```
cBR8-01# show platform
Chassis type: CBR-8-CCAP-CHASS
Slot      Type                State                Insert time (ago)
-----
0          CBR-CCAP-LC-40G        ok                   2w4d
0/1        CBR-DPIC-8X10G         ok                   2w4d
2          CBR-CCAP-LC-40G-R      ok                   2w4d
2/1        CBR-DPIC-8X10G         ok                   1w0d
SUP0      CBR-CCAP-SUP-160G      inserted            2w4d

Slot      CPLD Version          Rommon Version
-----
0          00000025              2011.03.18
2          00000025              2011.03.18
SUP0      16052011              16.5(1r)S
```

# 3a DS and US Controllers

- cable downstream controller-profile *number*

Downstream Profile
Multicast Pool (Optional)
RF Channel Range
Type
Frequency
RF-Output
QAM Profile
Shutdown
Cable DEPI Multicast pool <i>id</i>
Power Profile

```
cable downstream controller-profile 30
multicast-pool 1
rf-chan 0 31
type DOCSIS
frequency 405000000
rf-output NORMAL
qam-profile 1
docsis-channel-id 1
rf-chan 33 39
type VIDEO SYNC
frequency 603000000
rf-output NORMAL
qam-profile 5
```

```
cable depi multicast pool 1
ip address 225.225.225.0 255.255.255.0
```

**\*Base channel power and  
adjust moved to cable rpd  
configuration**

## Upstream Profile

US-channel(s) / US Channel Width

DOCSIS Mode

Pre-Equalization

Frequency

Modulation Profile

Minislot Size

Shutdown

### **cable upstream controller-profile 1**

```
us-channel 0 channel-width 6400000 6400000
us-channel 0 docsis-mode atdma
us-channel 0 equalization-coefficient
us-channel 0 frequency 17500000
us-channel 0 minislot-size 2
us-channel 0 modulation-profile 224
no us-channel 0 shutdown
...
us-channel 3 channel-width 6400000 6400000
us-channel 3 docsis-mode atdma
us-channel 3 equalization-coefficient
us-channel 3 frequency 37500000
us-channel 3 minislot-size 2
us-channel 3 modulation-profile 224
no us-channel 3 shutdown
```

# 3b Remote PHY Device

## cable rpd *name*

Parameter	Purpose
Identifier	Mac-address of the RPD
Core interface	Interface of the DPIC TenGig
Principal & Auxiliary	Each RPD must have exactly one Principal
RPD-DS	Downstream-Cable Controller + Profile
RPD-US	Upstream-Cable Controller + Profile
RPD Base Power	Set the base power
DLM	DEPI Latency Management
R-DTI	Timing
RPD Event Profile	GCP Event Reporting

```

cable rpd P2Shelf_RTP
description P2 1RU in AS Lab RTP
identifier 0004.9f33.0449
core-interface Te1/1/0
principal
  rpd-ds 0 downstream-cable 1/0/0 profile 30
  rpd-us 0 upstream-cable 1/0/0 profile 1
network-delay dlm 10
core-interface Te1/1/6
  rpd-ds 0 downstream-cable 1/0/31 profile 40
r-dti 1
rpd-event profile 5
  
```

### Pitfalls

controller profile(s)	Cannot change an specific instantiation of the profile without entire editing profile
	Removing last downstream-cable controller from RPD requires removing all in-use channel(s) - .e.g Video Binding

# 3c Interface Cable & downstream-Cable, Fiber Node

- `interface cable slot/subslot/port`
- `interface downstream-cable slot/subslot/port:channel`
- `cable fiber node number`

Parameter	Purpose
Primary interface DS Cable	For each Primary RF -> Interface DC
	Downstream-Cable for RPHY
Downstream-Cable Controller	Forwarding controller
Upstream-Cable Controller	Return controller
Upstream Bonding Group(s)	Define USBG(s)

Parameter	Purpose
Bundle	(Inherited) Associates Primary RF to L3
RF-Bandwidth Percent	ACFE – Default 1%

```
interface Cable1/0/0
  downstream Downstream-Cable 1/0/0 rf-channel 0
  downstream Downstream-Cable 1/0/0 rf-channel 4
  downstream Downstream-Cable 1/0/0 rf-channel 8
  downstream Downstream-Cable 1/0/0 rf-channel 12
  downstream Downstream-Cable 1/0/0 rf-channel 16
  downstream Downstream-Cable 1/0/0 rf-channel 24
  upstream 0 Upstream-Cable 1/0/0 us-channel 0
  upstream 1 Upstream-Cable 1/0/0 us-channel 1
  upstream 2 Upstream-Cable 1/0/0 us-channel 2
  upstream 3 Upstream-Cable 1/0/0 us-channel 3
  cable bundle 1
```

```
interface Downstream-Cable1/0/0:0
  cable bundle 1
  rf-bandwidth-percent 1
```

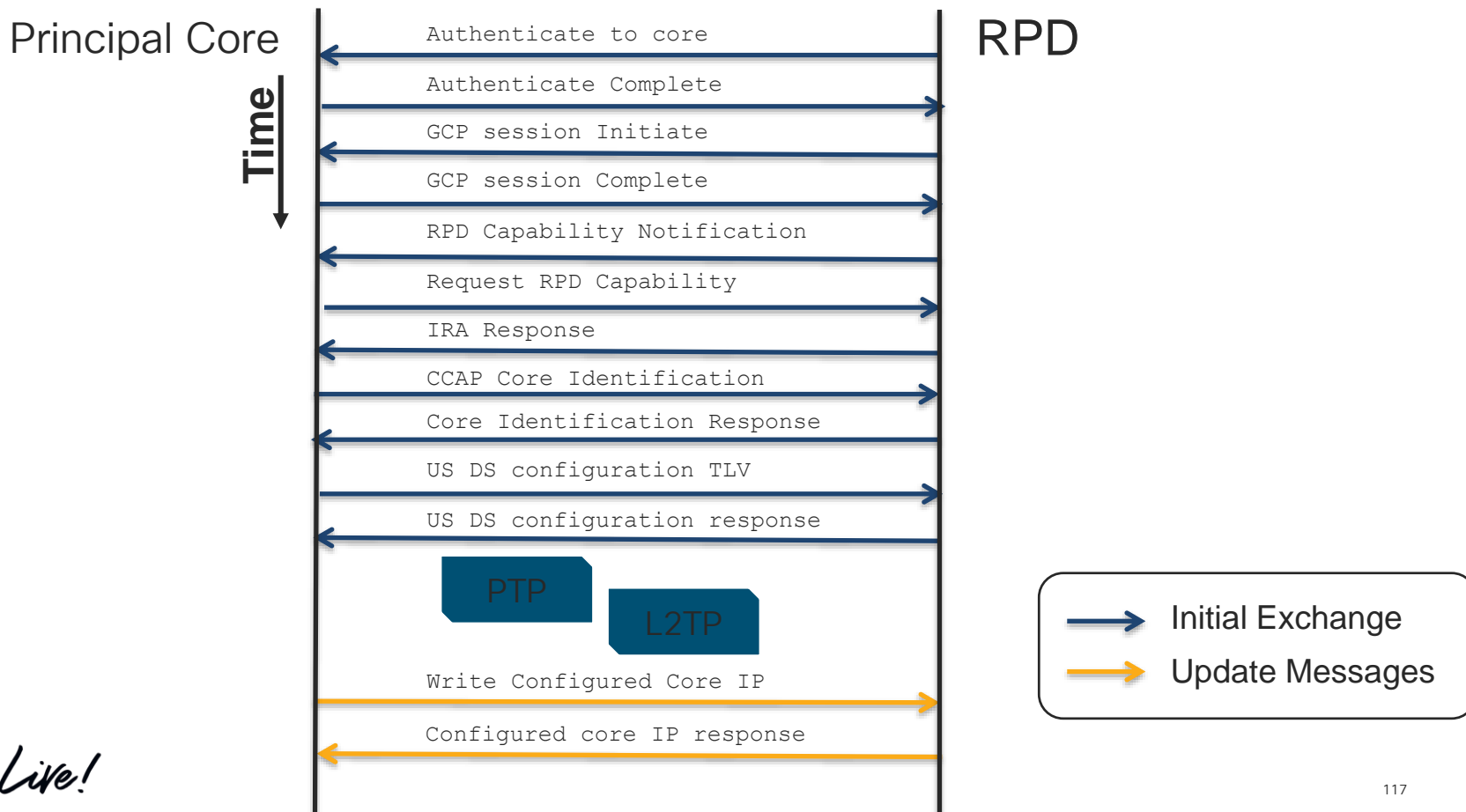
```
interface Downstream-Cable1/0/0:3
  cable bundle 1
  rf-bandwidth-percent 1
```

```
cable fiber-node 100
  downstream Downstream-Cable 1/0/0
  upstream Upstream-Cable 1/0/0
```

```
cable fiber-node 101
  downstream Downstream-Cable 1/0/0
  upstream Upstream-Cable 1/0/1
```



## 2 RPD and CCAP-CORE Exchange



# 2 Validate Configuration

## Precision Timing Protocol

Parameter	Purpose
IP reachability	cBR8 must be able to reach clock source IP
PTP Clock Domain	Define your PTP parameters use by R-DTI
Clock-Port	Slave clock, transport, source
Transport	Specify IPv4 / Unicast / Source Intf
Clock source	Match to master 1588 interface
PTP R-DTI {0-64}	Defines the R-DTI for RPD
PTP Domain {0-127}	Associates R-DTI to domain parameters

Pitfalls	
Transport	IPv4 only , no Port-Channel(s), support coming
R-DTI Config	Requires reboot of RPD to take effect
PTP Source	Can only use SUP-PIC TE 4/1/x and 5/1/x

```
interface Loopback0
 ip address 13.10.0.207 255.255.255.255
```

```
ip route 10.225.197.254 255.255.255.255
TenGigabitEthernet4/1/7 13.13.0.210
```

```
ptp clock ordinary domain 0
 servo tracking-type R-DTI
 clock-port slave-from-903 slave
 delay-req interval -4
 sync interval -5
 sync one-step
 transport ipv4 unicast interface Lo0 negotiation
 clock source 10.225.197.254
```

```
ptp r-dti 1
 ptp-domain 0
 clock-port 1
 clock source ip 10.225.197.254
```

# 5a RPD Access

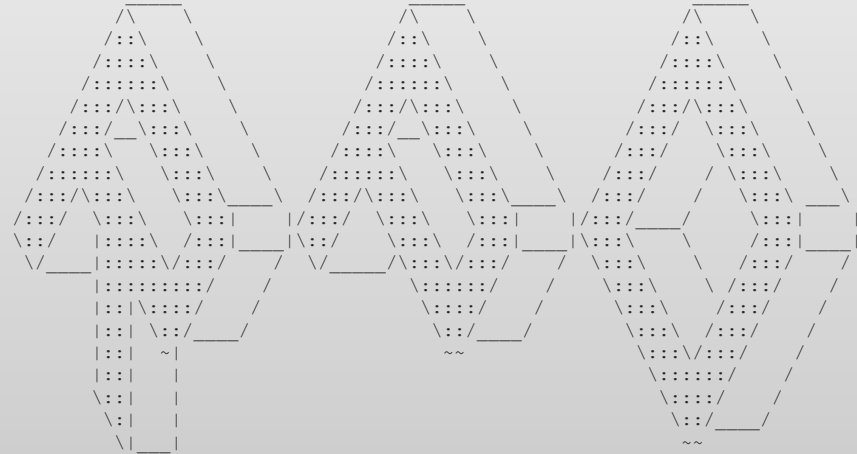
- SSH to RPD
- admin/admin default

No external console exists

Considerations	Best Practice ...
Security - Access	Disable admin/admin Disable password login
	Install SSH Public Key for non-password access
Security - L2	Use 802.1x authentication
DHCP	Provision DHCP Server to assign unique IP
Reachability	IP Layer through the CIN

```
cBR8-01# show cable rpd
MAC Address      IP Address      I/F      State      Role HA Name
badb.ad13.1452   13.52.0.19      Te1/1/0   online     Pri  Act GS7K_RTP
```

```
cBR8-01# ssh -l admin 13.52.0.19
Password:
BusyBox v1.23.2 (2017-04-16 02:15:01 CST) built-in shell (ash)
# Copyright (c) 2016 Cisco and/or its affiliates, and
# Cable Television Laboratories, Inc. ("CableLabs")
```



```
Already started.waiting
Starting OpenRPD CLI
rpd dependencies software is up
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
SECURITY WARNING: ssh password login is accessible!
Please use pubkey login and set password login off!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Welcome to Cisco R-PHY
R-PHY>enable
R-PHY#
```

# 5b RPD DHCP, TOD, and Dot1x

- show dhcp
- show tod
- show dot1x detail

```
R-PHY# show dhcp
```

Interface	IP-Address	Subnet-Mask
vbh0	13.52.0.19	255.255.255.240

```
Details:
```

```
-----  
Interface:                vbh0  
TimeServers:              172.18.98.116, 172.18.98.117  
TimeOffset:               -18000  
LogServers:               172.18.98.57, 172.18.98.59  
CCAPCores:                13.13.0.226, 13.13.0.198
```

```
R-PHY# show tod
```

Server	TimeOffset	Time	Status
172.18.98.116, 172.18.98.117	-18000	2017 May 18 06:57:01	OK

```
R-PHY# show dot1x detail
```

Interface	Core-id	EAP_Received	Status
vbh0	CORE-586853802	False	UP

```
bssid=01:80:c2:00:00:03  
freq=0  
ssid=  
id=0  
mode=station  
pairwise_cipher=NONE  
group_cipher=NONE  
key_mgmt=IEEE 802.1X (no WPA)  
wpa_state=ASSOCIATED  
ip_address=13.52.0.19  
address=ba:db:ad:13:14:52  
Supplicant PAE state=HELD  
suppPortStatus=Unauthorized  
EAP_state=FAILURE  
uuid=e9432baa-15c6-5a12-8976-d505ba50cd25
```

Parameter	What to look for...
Interface	vbh0
IP Address	As expected
Mask	As expected
Time Servers	As expected
CCAPCores	cBR8 DPIC IP
Time Servers	As expected

## 4 Validate Clock on RPD

- show ptp clock 0 config
- show ptp clock 0 state

Parameter	What to look for ...
APR State	PHASE_LOCK
Domain/Mode	Slave
Master IP	Server IP
Stream State	PHASE_LOCK

Clock States	
1	Ref Failed
2	Acquiring
3	Frequency Lock
4	Phase Lock

Network Issues



Holdover

```
R-PHY# show ptp clock 0 state
apr state      : PHASE_LOCK
clock state    : SUB_SYNC
current tod    : 3595870      Wed Feb 11 14:51:10 1970
active stream  : 0
==stream 0    :
  port id      : 0
  master ip    : 10.225.197.254
  stream state : PHASE_LOCK
  Master offset : 659
  Path delay   : -4022
  Forward delay : -3919
  Reverse delay : -4125
  Freq offset   : -82699
  1Hz offset   : 389

R-PHY# show ptp clock 0 config
Domain/Mode    : 0/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile        : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 1, Enet Port 1 ----
  Port local Address :13.52.0.19
  Unicast Duration :300 Sync Interval : -4
  Announce Interval : 0 Timeout : 11
  Delay-Req Intreval : -4 Pdelay-req : -4
  Priority local :128 COS: 6 DSCP: 47
  ==Stream 0 : Port 1 Master IP: 10.225.197.254
```

# 1b Validating video throughput on RPD

show downstream channel counter { dps | tpmi | dpmi }

What is it		What does it tell us
DPS	Transmitted Packets	What packets are tx on the carrier
TPMI	Rx Match Destination MAC, IP, and L2TPv3 Session ID	If incrementing : valid tuple received for channel
DPMI	Rx Match L2TPv3 Session ID and Sequence Number Checking	If incrementing : valid sequencing received If SeqErr-Pkt : Out of sequence packets received

```
R-PHY# show downstream channel counter dps
Chan Tx-packets Tx-octets Drop-pkts Tx-sum-pkts Tx-sum-octs Drop-sum-pkts
```

```
46 1412715444 3597499732 0 1412715444 3597499732 0
47 1412733756 3600941072 0 1412733756 3600941072 0
158 719767 47391972 0 719767 47391972 0
```

```
R-PHY# show downstream channel counter dps
Chan Tx-packets Tx-octets Drop-pkts Tx-sum-pkts Tx-sum-octs Drop-sum-pkts
```

```
46 55300 10396400 0 1412770744 3607896132 0
47 55293 10396400 0 1412789049 3611337472 0
158 31 1979 0 719798 47393951 0
```

```
R-PHY# show downstream channel counter tpmi
```

```
Level Rx-pkts Rx-sum-pkts
Node Rcv 182177630 182177630
Deps Pkt 2382390178 2382390178
```

```
Port Chan Rx-pkts Rx-sum-pkts
DS_0 39 778328859 778328859
...
DS_0 44 460223051 460223051
DS_0 45 460211632 460211632
DS_0 46 460221125 460221125
DS_0 47 460344092 460344092
```

```
Port Rx-pkts Rx-sum-pkts Drop-pkts Drop-sum-pkts
DS_0 3863639261 3863639261 0 0
US_0 485970657 485970657 0 0
US_1 2244 2244 0 0
```

```
R-PHY# show downstream channel count dpmi
```

```
Field Pkts Sum-pkts
Dpmi Ingress 2203906685 2203906685
Pkt Delete 0 0
Data Len Err 0 0
Chan Flow_id Octs Sum-octs SeqErr-pkts SeqErr-sum-pkts
47 0 3887236816 3887236816 5 5
47 1 0 0 0 0
47 2 0 0 0 0
47 3 0 0 0 0
```

# RxMER to Bit Loading Mapping

DOCSIS 3.1 PHY Spec – Table 7-41

RxMER (in ¼ dB)	RxMER (in dB)	QAM	Bit Loading
60	15	16	4
84	21	64	6
96	24	128	7
108	27	256	8
122	30.5	512	9
136	34	1024	10
148	37	2048	11
164	41	4096	12
184	46	8192	13
208	51	16384	14

Note: On cBR-8 use the CLI: **show cable ofdm-rxmer-qam-bl-table**

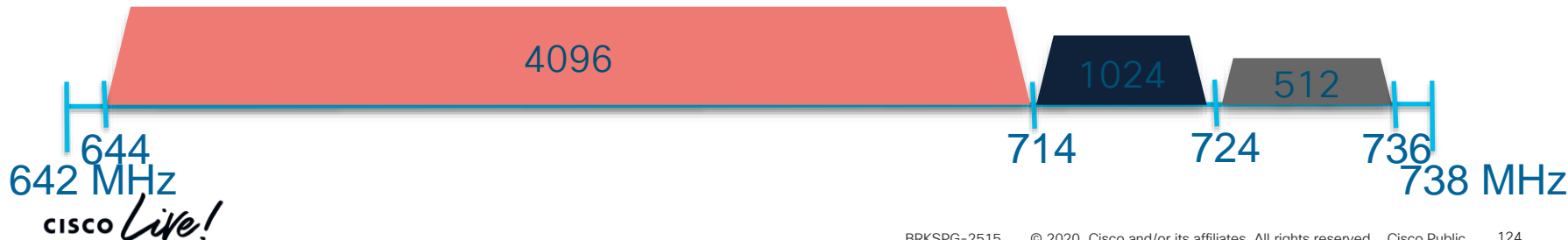
1

# OFDM Mixed Modulation Profiles

- Can be used for control or data profiles
- Each supports up to 5 ranges
- Define absolute or relative frequencies

```
cable downstream ofdm-chan-profile 100
<snip>
profile-data 1 modulation-profile 96
```

```
cable downstream ofdm-modulation-profile 96
  subcarrier-spacing 50KHZ
  width 96000000
  start-freq 642000000
  assign modulation-default 1024-QAM
  assign modulation 512-QAM range-subcarriers freq-abs 724050000 width 12000000
  assign modulation 4096-QAM range-subcarriers freq-abs 644000000 width 70000000
```





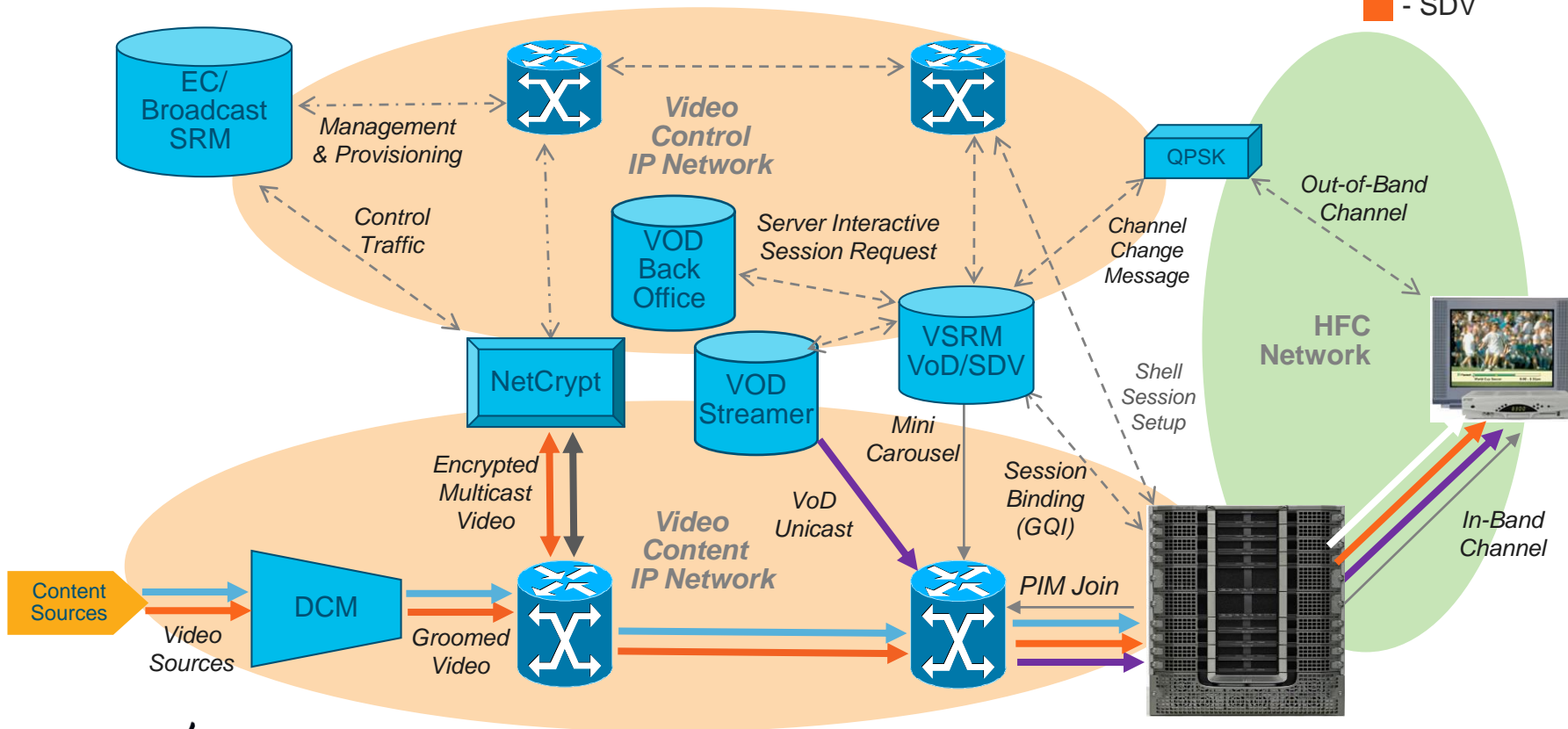


# Video

# Video Architecture

Source: 2017  
BRKSPG-2505

- Broadcast
- VoD
- SDV



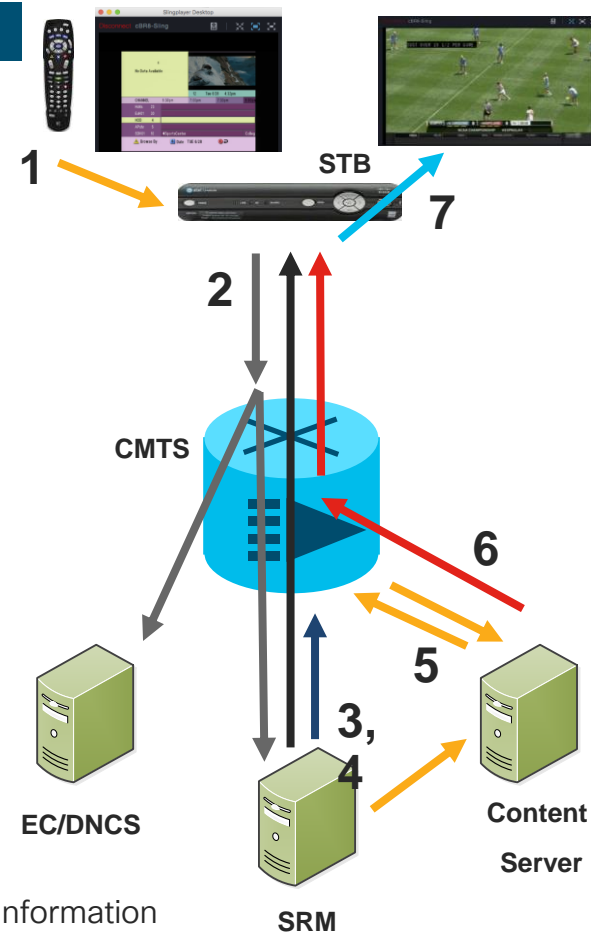
cisco *Live!*

# Video Services

Not Video Over DOCSIS

## Video Session Setup (Cisco/SA)

- 1 **Customer STB selects programming**
- 2 STB communicates to EC/SRM to request content
- 3 **SRM requests session creation to RFGW-10**
  - Source Specific Multicast (SDV) or Unicast (VOD)
- 4 SRM transmits to STB the session information
- 5 **RFGW-10 obtains content from Content Server**
  - Add Encryption if RFGW-10 assigned edge encryption (VOD)
  - RFGW-10 initiates the SSM / SRM instructs source to start
- 6 **RFGW-10 forwards content on the appropriate SG**
- 7 **Set Top tunes to appropriate QAM Carrier**
  - Decodes program with the provided encryption keys and program information



# Video Services

## Session states

- Disconnect/Connect and interactions with SRM

	LED “Active”	LED “No Active”	LED De-Configured
SRM Functional and “In Service” State	Normal operations	LED continues to pin up existing sessions. No new sessions.	All sessions destroyed.
SRM Unresponsive	LED continues to pin up existing sessions. No new sessions.	LED continues to pin up existing sessions. No new sessions.	All sessions destroyed
SRM “Release” or “Out Of Service” and then “In Service”	LED instructed to remove all sessions and rebuild	LED never gets the order and continues sessions.	All sessions destroyed

# How does cBR8 fit in your Video architecture?

Mid level by Function

A bit more details now...

## Application/Servers

## Access Edge

## Customer Premise

Session Manager

Edge Resource Manager

Netcrypt / DCM

SDV Sources

VOD Pump

CCAP

QPSK

BFS

Set-Top-Boxes

Core

RF Plant

Recall, BFS, QPSK, all can be converge

- ← AD SG Tunnels IB(SI, EAS, CA, APP)
- ← AD SG Tunnels Multicast SSM
- ← STB Return IP (2-way)
- ← STB Return DAVIC & OOB
- ← DAVIC RPC and BOOTP
- ← Mini-Carousel
- ← SDV Multicast SSM
- ← VOD Unicast
- ← ERM GQI Messages

# How does cBR8 fit in your Video architecture?

High level by Function

## Application/Servers

Session Manager

Edge Resource Manager

VOD Session Manager

CA Manager

RCAS

SDV Sources

VOD Back Office

VOD Pump

## Access Edge

**CCAP**

QPSK

BFS

## Customer Premise

Set-Top-Boxes

Core

RF Plant

← Control

← Data / Content

# What is the cBR8 Responsible for?

Not Video Over DOCSIS

Check out BRKSPV-2303

- For VIDEO services:
  - **Advanced DOCSIS Set-Top Gateway (ADSG)**
    - cBR8 forwards DSG tunnel traffic from your controller to each Video SG
    - DSG tunnel data is used for STB control: System Information (SI), Emergency Messaging (EAS), Conditional Access (CA), and additional In-Band data such as BFS carousel and application data
  - **Set-Top-Box Return Path (part of 2-way)**
    - DOCSIS STB signals the VSRM over IP and the first “hop” is the cBR8 Bundle
    - *DAVIC STB signals the QPSK (MOD/DEMOD)*
  - **Switch Digital Video (SDV)**
    - Responsible for pinning up and tearing down sessions as required by the VSRM
    - Multicast PIM Join towards the multicast source and then forwards it out the Video QAM(s)
  - **Video on Demand (VOD)**
    - Similar to SDV but with unicast sources
    - **Edge Encryption** with PME or PowerKey

# What is the cBR8 Responsible for?


- Continued
  - **Broadcast Video / Linear Content**
    - Table Based Sessions
    - Can be done by RFGW-1s
  - **Broadcast File System (BFS)**
    - Table Based
    - If EC is Version 8 or later – GQI sessions for BFS
    - IOS-XE 16.7.1 and later



# cBR8 Configuration and VSRM

- Each cBR8 Logical Edge Device associates to an VSRM “QAM”
  - TSID and Output port range - Virtual Carrier Groups
  - Source Mac-address of the LED
  - Server IP of ERM - Two standard, three possible
  - Management IP - cBR8 LED’s IP
  - Virtual Edge Input - Destination IP for VOD
  - Activate or no activate

```
jayu2 — jayu2@Jayu2-VM-Ubuntu: ~ — ssh 10
logical-edge-device LED_6 id 6
logical-edge-device LED_1_GQI id 10
protocol gqi
  mgmt-ip 13.135.69.4
  mac-address a46c.2ab0.2c02
  server 10.225.198.88
  keepalive retry 3 interval 10
  virtual-edge-input-ip 13.135.70.10 input-port-number 1
  vcg vcg_gqi_1-0
  active
```



# VSRM

Videoscape Session & Resource Manager

Page 1

### Navigation Tree

- VSRM1
  - Platform
  - PlatformAdaptors
  - Applications
  - ProtocolAdaptors
  - QAMs
    - Software
      - QAM RFGW10\_C6
      - QAM F241-36-04-LC01
      - QAM F241-36-05-LC01
      - QAM F241-36-04-LC02-202
      - QAM F241-36-04-LC01-cBR8
    - CA Support
      - Chassis
      - Configuration
      - Edge Inputs
      - Logging Config
      - Output Ports
      - QAM Channels
      - Queue
      - Queue Tasks
      - Sessions
      - Software
      - Table Configuration

## F241-36-04-LC01-cBR8.Chassis

ProductType	cBR8
Name	F241-36-04-LC01-cBR8
EdgeDeviceName	F241-36-04-cBR8-01
EdgeDeviceNameStatus	Ok
NumOutputPorts	8
NumChansPerPort	100
AlarmThreshold	1
FailThreshold	1
Protection	Manual
CtrlIpAddress	13.135.69.4
Cost	0
AdminState	InService
State	OK
OperationalState	InService
InterfaceStatus	OK
TransactionTimeout	5000 ms
Commands	149
CommandFailures	33
MaxCmdResponseTime	69.0 milliseconds
MaxCmdTimestamp	2018/03/15 14:17:01
AllocatedBandwidth	0.875
ActiveSessions	7

# ADSG Troubleshooting

## Check Client-id and tunnel association

```
CBR8-01# show cable dsg tunnel 2200 client
tunnel client client client      client      vendor
id      listId id      id type      address      group
-----
2200    22      1      CA System ID 0x0E00
          2      MAC Addr  000a.000a.000a
```

## Check cable intf. Tunnel association

```
CBR8-01# show cable dsg tunnel 2200
tunnel      TG      cfr      tunnel      rule      client service
id state mac-addr id      id state I/F      id state listId class
-----
2200 en 0100.0000.0022 60      2200 en C1/0/0 3      en 22
          C2/0/0 3      en
          C3/0/0 3      en
```

## Check tunnel cfrs configuration for all tunnels

```
CBR8-01# show cable dsg tunnel 2200 cfrs
tunnel cfr      cfr      cfr destination ip      source ip      srcPre d_port d_port
id      id      state pri address      address      length start end
-----
2200    2200    en      1      232.10.10.1      13.135.8.104      32      2200 13821
```

*Check your interface is listed*

## Check DSG tunnel counters for all tunnels

```
CBR8-01# show cable dsg tunnel 2200 statistics
tunnel cfr      cfr      destination ip      source ip      total      total
id      id      state address      address      forwarded received
-----
2200    2200    en      232.10.10.1      13.135.8.104      120355774 120355774
```

*Make sure incrementing*

*Multicast Group is correct*

# ADSG Troubleshooting

## Verifications

- Tunnel Groups
- Classifiers
- Client List
- MDD
- DCD
- Timers
- IP Multicast

### Show interface cable *slot/subslot/port* dsg downstream

```
CBR8-01#show interface cable 1/0/0 dsg downstream
chan  chan  chan timer init      oper      twoWay oneWay num  num    num  num    num
list  index freq index timeout timeout timer   timer rule tunnel cfr  client vsp
-----
                1      2      150      10      150      3      3      3      3      0
```

### Show interface cable *slot/subslot/port* dsg downstream tunnel

```
CBR8-01#show interface cable 1/0/0 dsg downstream tunnel
tunnel      TG      cfr      rule      client service
id  state mac-addr      id  id  state id state listId class
-----
200   en 0100.0000.0002 20   200   en 1      en 2
1200  en 0100.0000.0012 40   1200  en 2      en 12
2200  en 0100.0000.0022 60   2200  en 3      en 22
```

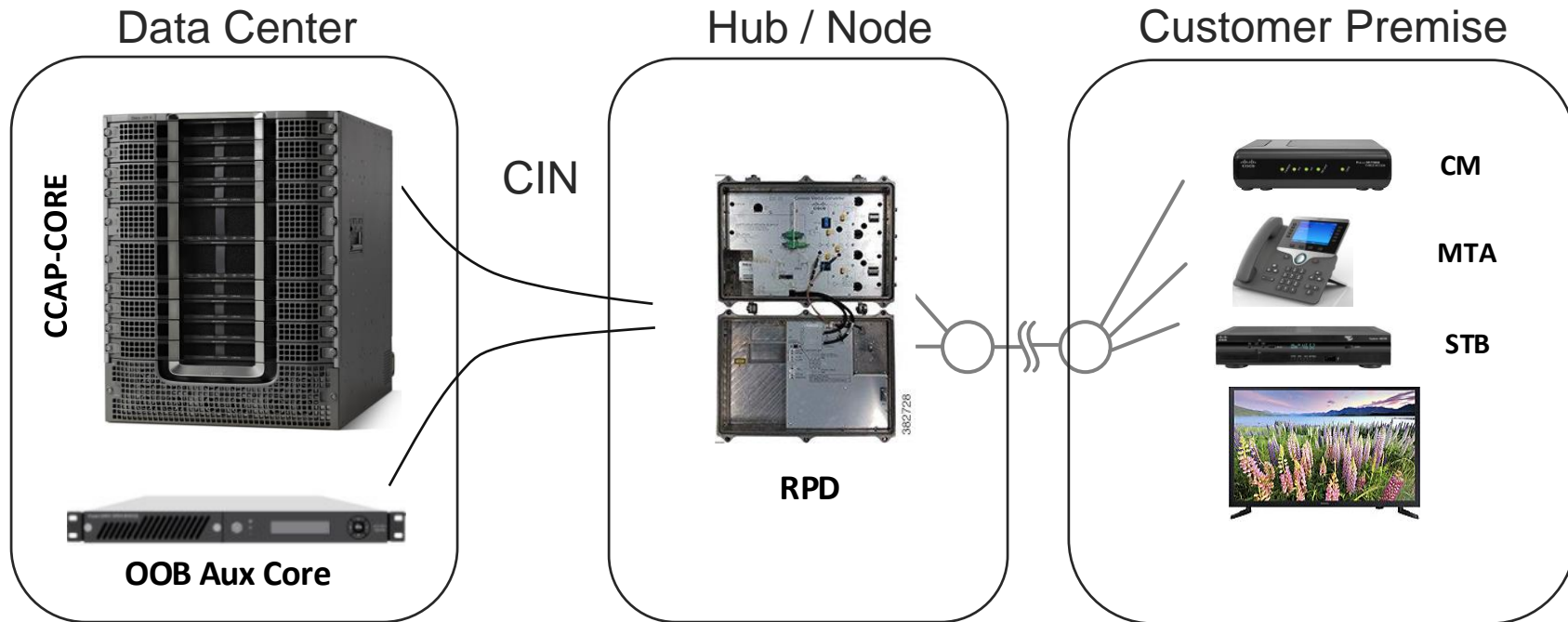
### Show interface cable *slot/subslot/port* dsg downstream tg

```
CBR8-01#show interface cable 1/0/0 dsg downstream tg
TG: 20   Chan: 100   State: en  Pri: 0   Vendor:      UCID:
rule      tunnel      cfr      In  clients
id state id  state mac-addr      id state dest-ip      DCD listId
-----
1      en 200   en 0100.0000.0002 200   en 232.10.10.2   yes 2
TG: 40   Chan: 100   State: en  Pri: 0   Vendor:      UCID:
2      en 1200  en 0100.0000.0012 1200  en 232.10.10.3   yes 12
TG: 60   Chan: 100   State: en  Pri: 0   Vendor:      UCID:
3      en 2200  en 0100.0000.0022 2200  en 232.10.10.1   yes 22
```

# Reference Architecture

## CCAP with Remote PHY

- DOCSIS 3.1 High Speed Data
- Video Aux Core
- Video OOB for DAVIC



# Video Services with RPHY

## Considerations

- Controller(s) are now “Downstream-Cable”
- Controllers instantiate profile(s): “cable downstream controller-profile”
- Controller RF-channel Type “Video” are now “Video Sync” or “Video Async”
- Video RF-Channels are either part of an Auxiliary core or part of the Principal core
- cBR8 IOS-XE must be 16.8 and later / RPD version must be 4.1 and later
- Cable Video largely unchanged – Only SDG controllers need to be updated to “rpd downstream-cable”

# Video Services with RPHY

## Auxiliary Core and Principal Core

- Option 1 – Set up Video within the Principal Core:

### Controller Configuration

```
cable downstream controller-profile 36
```

```
multicast-pool 2  
max-ofdm-spectrum 192000000  
rf-chan 0 31  
  type DOCSIS  
  qam-profile 1  
  frequency 405000000  
  rf-output NORMAL  
  docsis-channel-id 1
```

```
rf-chan 32 39
```

```
  type VIDEO SYNC  
  qam-profile 5  
  frequency 111000000  
  rf-output NORMAL
```

```
rf-chan 158  
  docsis-channel-id 159  
  ofdm channel-profile 7  
  start-frequency 690000000 width 192000000 plc 783000000
```

```
cable depi multicast pool 2 ip address 225.225.225.0 255.255.255.0
```

Controller-Profile

Instantiation now  
automatic  
depending on RPD  
assignment

Type Video Sync / Async

### RPD Configuration

```
cable rpd RPD_1  
description LAB-RPD  
identifier 0000.aabb.cdd  
core-interface Tel1/1/0
```

```
principal
```

```
rpd-ds 0 downstream-cable 1/0/0 profile 36  
rpd-us 0 upstream-cable 1/0/0 profile 1  
rpd-us 1 upstream-cable 1/0/1 profile 1  
network-delay dlm 10  
core-interface Tel1/1/6  
  rpd-ds 0 downstream-cable 1/0/31 profile 41  
r-dti 6  
rpd-event profile 5
```

Controller Profile  
36 under Principal

Aux-Core here –  
not our profile

Multicast Pool – DEPI-UEPI

# Video Services with RPHY

## Auxiliary Core and Principal Core

- Option 2 – Set up Video in an Auxiliary Core

### Controller Configuration

```
cable downstream controller-profile 20  
multicast-pool 1  
rf-chan 32 39  
  type VIDEO SYNC  
  qam-profile 5  
  frequency 111000000  
  rf-output NORMAL
```

### RPD Configuration

```
cable rpd RPD_1  
  identifier 0000.abcd.1234  
  core-interface Te1/1/0  
    principal  
    rpd-ds 0 downstream-cable 1/0/0 profile 10  
    rpd-us 0 upstream-cable 1/0/0 profile 1  
  core-interface Te9/1/6  
    rpd-ds 0 downstream-cable 9/0/31 profile 20  
  r-dti 1  
  rpd-event profile 5
```

Notice here the Profile 20 is under the non-principal (Aux) core

# Automation – Ansible for LCHA Failovers

## Walkthrough

- Objective: Leverage Ansible to incrementally LCHA failover defined Cable Line Cards one-by-one and fail back
- Use-Case: DDTS which may require Linecard reinitialization unavailable by LCPR. For example, FPGA DDTS requiring FPGA reinitialization.
- Value: Typically an operator doing this manually will spend 12-15 minutes per CLC and is extremely tedious.

**We will take Cisco.com's Firmware upgrade Ansible script for 16.7.1 and hack it to fit our needs !**



# Automation – Ansible for LCHA Failovers

## Walkthrough

- **Step 1:** Obtain the container for 16.7.1a Firmware Package upgrade on Cisco.com
- **Step 2:** Start the docker container
  - Example: `docker run -it ansible1671 /bin/bash`
- **Step 3:** Edit the necessary control files within `/opt/cbr-8_upgrade_ansible_16.5_or_16.6_to_16.7.1`
  - **hosts** : Define the chassis IP you wish to perform this on
  - **secrets.yaml** : Define authentication credentials – keep secure
  - **upgrade\_vars.yaml** : Set parameters for upgrade – set your `src_dir` to harddisk and define your `slot_to_upgrade` parameters (range of CLCs to do this on)
- **Step 4:** Copy the `mop_upgrade.yaml` to a different filename `automate-LCHA-Failovers.yaml`

# Automation – Ansible for LCHA Failovers

## Walkthrough

- **Step 5:** Edit your new `automate-LCHA-Failovers.yaml`

- **Comment out the following sections:**

- # - include: tasks/get\_target\_file.yaml
- # - include: tasks/check\_md5.yaml
- # - set\_fact: script\_start\_time
- # - debug: var=script\_start\_time
- # - include: tasks/no\_secondary\_lc.yaml
- # - include: tasks/sup\_cpld\_upgrade.yaml
- # - include: tasks/wait\_slot\_ok.yaml
- # - name: wait slot {{slot\_standby}} status ok
- # - include: tasks/change\_global\_var.yaml
- # - include: tasks/lc\_cpld\_upgrade\_inter.yaml
- # - include: tasks/gemini\_upgrade\_auto\_inter\_sub.yaml

# Automation – Ansible for LCHA

## Walkthrough

- **Step 6:** Edit your new `automate-LCHA-Failovers.yaml`
  - Immediately after the comment out of the Gemini upgrade, add
    - `# - include: tasks/gemini_upgrade_auto_inter_sub.yaml`
    - `- debug: msg="Start LCHA Failover Tasks"`
    - `- include: tasks/lc_failover_reload_inter.yaml when: "{{slot_standby}} >= 0"`
    - `- debug: msg="LCHA Failover complete"`
    - `- include: tasks/wait_slot_ok.yaml slot_num={{item}} with_items: "{{slot_list}}" when: "{{slot_standby}} < 0"`
  - Continue then to comment out the following sections
    - `# - include: tasks/recover_secondary_lc.yaml`
    - `# - include: tasks/save_config.yaml`
    - `# - include: tasks/check_result.yaml`
    - `# - debug: msg="slot{{item}} state is wrong, didn't perform upgrade, please fix it and try again!"`

# Automation – Ansible for LCHA

## Walkthrough

- **Step 7:** Change your working directory to `tasks/`
- **Step 8:** Copy `wait_slot_to_stdbby_warm.yaml` to `wait_slot_to_stdbby_hot.yaml`
- **Step 9:** Edit `wait_slot_to_stdbby_hot.yaml`
  - Change the **register** to `register: platform_status_end2`
  - Change `platform_status_end` to `platform_status_end2`
  - Change the `find` to **“Stdbby Hot”** `platform_status_end2.stdout[0].find("Stdbby Hot") != -1)`
- **Step 10:** Create file `lc_failover_reload_inter.yaml`
  - Edit it to contain
    - `- include: tasks/lc_failover_reload_inter_step1.yaml slot_num={{item}} with_items: "{{slot_list}}"`

# Automation – Ansible for LCHA

## Step 11: Create file lc\_failover\_reload\_inter\_step1.yaml

```
- debug: msg="Debug in LC reload Step1 , slot number is {{ slot_num }}, slot_list is {{ slot_list }}"
- include: tasks/wait_slot_to_stdbym_warm.yaml
  with_items: "{{slot_list}}"
  when: "{{slot_standby}} >= 0"
- debug: msg="Debug in LC 0 is ready, proceed to failover"
- name: switchover to slot {{slot_num}}
  ios_command:
    provider: "{{ provider }}"
    timeout: 300
    commands:
      - redundancy linecard switchover from slot {{slot_num}}
- name: wait 60s
  command: sleep 60
- debug: msg="Debug Post failover, wait for original working to come back ready, proceed to failover"
- include: tasks/wait_slot_to_stdbym_hot.yaml
  with_items: "{{slot_num}}"
  when: "{{slot_standby}} >= 0"
- debug: msg="Debug Post failback, proceeding"
- name: switchover back to slot {{slot_num}}
  ios_command:
    provider: "{{ provider }}"
    timeout: 300
    commands:
      - redundancy linecard switchover from slot 0
- debug: msg="Debug Failedback"
- name: wait 300s
  command: sleep 300
```

# Automation – Ansible for LCHA

## Walkthrough

- **Step 12:** Return to the parent directory `/opt/cbr-8_upgrade_ansible_16.5_or_16.6_to_16.7.1`
- **Step 13:** Execute the ansible playbook when desired
  - `ansible-playbook -i hosts automate-LCHA-Failovers.yaml`

# 1.d – Show Modem “select” Information

```
cBR8-01#scm select ipv6 where dsxus is "33x4"
```

```
ipv6
```

```
=====
2001:DB8:FFFF:C:21D:D4FF:FED3:31D2
2001:DB8:FFFF:C:21D:D4FF:FED3:3122
2001:DB8:FFFF:C:2273:55FF:FEC6:35BB
```

```
cBR8-01#show cable modem select ip where dsxus is "33x5"
```

```
ip
```

```
=====
13.42.0.64
13.42.0.25
13.42.1.119
13.42.0.24
```

```
cBR8-01#show cable modem select mac where dsxus is "33x5"
```

```
mac
```

```
=====
14b7.f80e.3ffc
14b7.f80e.3ee4
6477.7d90.43f2
14b7.f80e.3d2c
```

Show Cable Modem	SQL
show cable modem	select *
scm docsis version d31-capable	select mac where macver like "DOC3.1%"
scm wideband	show cable modem select mac,ip,intf where st is "w-online(pt)"
scm primary	Show cable modem select mac,ip,intf,primds order by primds desc

```
cBR8-01#scm 14b7.f80e.3f10 phy
```

MAC Address	I/F	Sid	USPwr (dBmV)	USMER (SNR) (dB)	Timing Offset	DSPwr (dBmV)	DSMER (SNR) (dB)	Mode	DOCSIS Prov
14b7.f80e.3f10	C2/0/1/U4	345	52.75	-----	2391	- 9.20	41.60	ofdma	1.1

# cBR-8 Operational Maintenance



# cBR-8 Exec and Filesystem

## Navigating and Tools

- IOS-D has some Unix-like Commands
- pwd/cd/dir (but no ls)
- **Regex Arguments**
- Pipe ( | ) options

```
CBR8-01# cd XE318
CBR8-01# dir
Directory of bootflash:/XE318/
```

```
177761 -rw-          28685264 Mar 30 2016
13:24:57 -04:00  cbrsup-
cciomdsup.03.18.00.S.156-2.S-std.SPA.pkg
7804653568 bytes total (2629476352 bytes free)
```

```
CBR8-01#show cable modem docsis de | count RTR|MTA
Number of lines which match regexp = 82
CBR8-01#show cable modem docsis de | count MTA
Number of lines which match regexp = 31
CBR8-01#show cable modem docsis de | count RTR
Number of lines which match regexp = 81
```

```
CBR8-01# pwd
bootflash:/
F241-36-04-cBR8-01# del *
Delete filename [*]?
Delete bootflash:/lost+found?
[confirm]n
Delete of bootflash:/lost+found
aborted!
```

```
CBR8-01#sh run | section controller
Integrated-Cable 1/0/0
controller Integrated-Cable 1/0/0
max-carrier 96
rf-chan 0 15
type DOCSIS
rf-chan 16 31
type VIDEO
```

Char	Meaning
.	Matches any single character, including white space
*	Matchers 0 or more sequences of the pattern
+	Matches 1 or more sequences of the pattern
?	Matches 0 or 1 occurrences of the pattern
^	Matches the beginning of the string
\$	Matches the end of the string
-	Matches , { } ( ), the beginning of the string, the end of the string, or a space.
\	Delimiter above characters
Argument	Use Case
section	Section indented after match
count	Regex count
begin	Show line and all lines after match
Include	Show only matching line
redirect path	Redirect to output file

# cBR-8 High Availability Route Processor

- When and How to use it
- What to expect
  - Time may take up to 30 seconds
  - Modems should not drop offline
  - Uplinks on both SUPs remain functional

## Redundancy Switchover History

```
CBR8-01# show redundancy switchover history
```

Index	Previous active	Current active	Switchover reason	Switchover time
1	48	49	active unit removed	10:30:07 edt Mon
2	49	48	user forced	15:35:42 edt Wed

## Initiating a SUP Failover

```
CBR8-01# redundancy force-switchover
```

```
Proceed with switchover to standby RP? [confirm]
```

```
Manual Swact = enabled
```

```
Connection to 13.42.0.1 closed by remote host.
```

```
Connection to 13.42.0.1 closed.
```

## Show Redundancy

```
CBR8-01# show redundancy
```

```
Redundant System Information :
```

```
-----  
Available system uptime = 1 week, 4 days, 21 hours, 44  
minutes
```

```
Switchovers system experienced = 2
```

```
Standby failures = 0
```

```
Last switchover reason = user forced
```

```
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 = 7 minutes
```

```
Image Version = Cisco IOS Software, cBR  
Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version  
15.6(2)S0a, RELEASE SOFTWARE (fc1)
```

```
BOOT = bootflash:/XE318/packages.conf,12;
```

```
CONFIG_FILE =
```

```
Configuration register = 0x2102
```

```
Peer Processor Information :
```

```
Standby Location = slot 5
```

```
Current Software state = STANDBY HOT
```

```
Uptime in current state = 0 minutes
```

```
Image Version = Cisco IOS Software, cBR  
Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version  
15.6(2)S0a, RELEASE SOFTWARE (fc1)
```

```
BOOT = bootflash:/XE318/packages.conf,12;
```

```
CONFIG_FILE =
```

```
Configuration register = 0x2102
```

# cBR-8 High Availability Cable Linecard

- When and How to use it
- Revertive Timer
  - Default is 120 seconds
- What to expect
  - Time may take up to 30 seconds
  - Modems should not drop offline
  - Modems now reporting on Slot 0

## Basic Configuration

```
CBR8-01#sh run | sec redund
redundancy
mode sso
linecard-group 0 internal-switch
class 1:N
member slot 1 primary
member slot 2 primary
member slot 0 secondary
revertive 120
```

## Check Redundancy State

```
CBR8-01#show redundancy linecard all
```

Slot	Subslot	LC Group	My State	Peer State	Peer Slot	Peer Subslot	Role	Mode
1	-	0	Active	Stdby Warm	0	-	Active	Primary
2	-	0	Active	Stdby Warm	0	-	Active	Primary
0	-	0	-	-	Multiple None		Standby	Secondary

## Initiate a Failover

```
CBR8-01# redundancy linecard-group switchover from slot 1
Bringing 1:N Secondary slot (0) to Hot Standby for manual switchover.
```

## Check Redundancy State Post Failover

```
CBR8-01#sh redundancy line all
Load for five secs: 19%/2%; one minute: 12%; five minutes: 16%
Time source is NTP, 15:43:57.635 edt Wed May 4 2016
```

Slot	Subslot	LC Group	My State	Peer State	Peer Slot	Peer Subslot	Role	Mode
1	-	0	Init	Active	0	-	None	Primary
2	-	0	Active	Unavail	0	-	Active	Primary
0	-	0	Active	Init	1	-	Active	Secondary

## Post-Failover Mac-Domains

```
CBR8-01#show cable modem summary total
```

Interface Description	Total	Reg	Oper	Unreg	Offline	Wideband	initRC	initD	initIO
initIO									
C0/0/0/UB	5	5	5	0	0	5	0	0	0
C0/0/0/U1	1	1	1	0	0	0	0	0	0
C0/0/1/UB	29	29	29	0	0	29	0	0	0

# cBR-8 Linecard Health Platform

Command	When to Use
show platform [diag]	Monitoring card states
show env power	Monitoring power budgets
show facility-alarm status	Monitoring critical alarms
show cable card slot/subslot ds-phy display   inc ver	Monitoring correct firmware versions
hw-module slot {0-9,R0,R1} {reload start stop}	Resetting hardware

## Show Platform Diag

```

CBR8-01# show platform diag
Chassis type: CBR-8-CCAP-CHASS
Slot: 0, CBR-CCAP-LC-40G
    Running state           : ok
    Internal state          : online
    Internal operational state : ok
    Physical insert detect time : 00:01:18 (2d05h ago)
    Software declared up time  : 00:38:48 (2d04h ago)
    CPLD version             : 00000021
    Rommon version           : 2011.03.13
    PSOC 0 version           : v4.6
Pic: 0/1, CBR-RF-PROT-PIC
    Internal state          : inserted
    Physical insert detect time : 00:02:43 (2d05h ago)
    Firmware version:       : 0000071E
  
```

## Show Platform

```

CBR8-01# show platform
Chassis type: CBR-8-CCAP-CHASS
Slot      Type                State                Insert
time (ago)
-----
0         CBR-CCAP-LC-40G        ok                  2d05h
0/1       CBR-RF-PROT-PIC        ok                  2d05h
1       CBR-CCAP-LC-40G         booting           2d05h
1/1       CBR-RF-PIC                  ok                  2d05h
2         CBR-CCAP-LC-40G        ok                  2d05h
2/1       CBR-RF-PIC                  ok                  2d05h
SUP0      CBR-CCAP-SUP-160G       inserted          2d05h
  R0      ok, standby
  F0      ok, standby
  4        ok, standby
  4/1     CBR-SUP-8X10G-PIC    ok                  2d05h
SUP1      CBR-CCAP-SUP-160G      inserted           2d05h
  R1      ok, active
  F1      ok, active
  5        ok, active
  5/1     CBR-SUP-8X10G-PIC    ok                  2d05h
P0        CBR-AC-PS            ok                  2d05h
<SNIP>
P14       CBR-FAN-ASSEMBLY     ok                  2d05h

Slot      CPLD Version          Rommon Version
-----
0         00000021              2011.03.13
1         00000021              2011.03.13
2         00000021              2011.03.13
SUP0    15091511              15.5 (3r) S
SUP1    15091511              15.5 (3r) S
  
```

# IOS-XE Upgrade and Installation

## Consolidated Mode

- Traditional Model
- Mimics Traditional IOS
- IOS-XE automatically extracts and links appropriate packages
- One-Shot Upgrade

### Verify MD5

```
CBR8-01#verify /md5 bootflash:cbrsup-universalk9.03.18.00a.S.156-2.S0a-ext.SPA.bin aceclf32a0b8898ecee0f7f31ee5797

.....Done!

Verified (bootflash:cbrsup-universalk9.03.18.00a.S.156-2.S0a-ext.SPA.bin) =
aceclf32a0b8898ecee0f7f31ee5797
```

### Point Bootvar to Image

```
CBR8-01(config)# no boot system
CBR8-01(config)# boot system bootflash:cbrsup-universalk9.03.18.00a.S.156-2.S0a-ext.SPA.bin
CBR8-01# copy run start
```

### Verify Bootvar

```
CBR8-01#show bootvar

BOOT variable = bootflash:cbrsup-universalk9.03.18.00a.S.156-2.S0a-ext.SPA.bin,12;

Standby BOOT variable = cbrsup-universalk9.03.18.00a.S.156-2.S0a-ext.SPA.bin,12;
```

### Reload

```
CBR8-01# reload
```

# IOS-XE Upgrade and Installation

## Sub-Package Mode

- IOS-XE loads individual packages
- Activate and Install only the Packages you want
- Allows ISSU Patch Application

### Make Directory (Optional)

```
CBR8-01#mkdir bootflash:/XE318
Create directory filename [XE318]?
Created dir bootflash:/XE318
CBR8-01#cd XE318
CBR8-01#pwd
bootflash:/XE318/
```

### Extract Image Packages to directory

Do this for Stby-bootflash too

```
CBR8-01# request platform software package expand file
bootflash:16.32_johuynh.SSA.bin to bootflash:/XE318SP_ECE1 force
Thu May 5 16:35:11 edt 2016 Verifying parameters
Thu May 5 16:35:11 edt 2016 Validating package type
Thu May 5 16:36:00 edt 2016 Copying package files
Thu May 5 16:37:37 edt 2016 SUCCESS: Finished expanding all-in-one software
package.
```

### Verify

```
CBR8-01#dir bootflash:/XE318/
Directory of bootflash:/XE318/
565602  -rw-          12856   May 5 2016 16:42:13 -04:00  cbrsup-packages-universalk9.2016-04-
22_16.32_johuynh.conf
565603  -rw-        35972052   May 5 2016 16:42:17 -04:00  cbrsup-rp-firmware.2016-04-22_16.32_johuynh.SSA.pkg
129284  -rw-          13697   May 5 2016 16:43:24 -04:00  packages.conf
```

You can use the <image-name>.conf as well!

### Update Bootvar

```
CBR8-01(config)#boot sys bootflash:/XE318/packages.conf
```

# In Service Software Upgrade (ISSU)

## Hitless IOS-XE Upgrade

- request platform software package install node file *path*
- Requires SUP Switchover
- If LC Firmware Upgrade – Requires CLC reset

### Requirements

Dual SUP  
Standby SUP is Standby HOT  
Auto-boot Enabled  
At least 700MB free on Bootflash  
Only between same IOS Trains  
IOS-XE 3.18.0S and later

## Copy Target IOS-XE Bin to the packages directory

```
CBR8-01# copy ftp:<image> bootflash:XE318/<image>
```

## Initiate Upgrade

```
CBR8-01# request platform software package install node file
bootflash:XE318/cbrsup-universalk9.2016-03-28_08.17_johuynh.SSA.bin
--- Starting initial file path checking ---
--- Starting config-register verification ---
--- Starting image file expansion ---
STAGE 1: Installing software on standby RP =====
--- Starting local lock acquisition on R0 ---
--- Starting installation state synchronization ---
--- Starting ISSU compatibility verification ---
--- Starting commit of software changes ---
SUCCESS: Software provisioned. New software will load on reboot.
STAGE 2: Restarting standby RP =====
--- Starting standby reload ---
--- Starting wait for Standby RP to reach terminal redundancy state ---
STAGE 3: Installing software on active RP =====
--- Starting local lock acquisition on R0 ---
--- Starting installation state synchronization ---
--- Starting list of software package changes ---
--- Starting commit of software changes ---
SUCCESS: Software provisioned. New software will load on reboot.
Write failed: Broken pipe
```

Due to SUP Failover – Re-login here

# Smart Software Licensing

## Registering the cBR-8

### Configuration

- 
- license smart register idtoken  
*IDToken*

### Verification and Debugging

- show license status [all]
- show license show-tech
- debug smart\_lic {all|error|info}
- debug crypto pki {validation|trans}

### Register

```
CBR8-01#license smart deregister
CBR8-01# license smart register idtoken
YzUyOTIzZWYtOTA2OS00ZjQ1LWFhNzMtMGMxZWQxNmI0MTdhLTE0NjYwMTA$
Registration process is in progress. Use the 'show license
status' command to check the progress and result
```

### Configuration

```
CBR8-01# sh run | sec call-home
call-home
  profile "CiscoTAC-1"
    reporting smart-licensing-data
  destination
    https://10.225.198.29:443/Transportgateway/services/DeviceRequestHandler
  no destination
  https://10.225.198.29:443/Transportgateway/services/DeviceRequestHandler
  snmp-server
```

### Status

```
CBR8-01# show call-home profile CiscoTAC-1
Profile Name: CiscoTAC-1
Profile status: ACTIVE
Profile mode: Full Reporting
Reporting Data: Smart Licensing
Preferred Message Format: xml
Message Size Limit: 3145728 Bytes
Transport Method: http
Email address(es): callhome@cisco.com
HTTP address(es):
https://10.225.198.29:443/Transportgateway/services/DeviceRequestHandler
```



# Smart Software Licensing

## Common Issues

**TIP:** You can force a re-reg on-demand by license smart register idToken command

- **cBR-8 Registration Failure**
  - ip http client source-interface *interface*
  - ip domain-name {lookup|source-int *intf*}
  - ip domain-name *name*
  - crypto pki trustpoint SLA-TrustPoint
  - revocation {crl|none}
  - aaa-authorization username "callhome"
- **Operating Models**
  - Direct connect to Cisco cloud
  - Satellite
  - Offline Mode
- **Call-Home Best Practices**

## Registration Status

```
CBR8-01# show license status
Smart Licensing is ENABLED
Registration:
  Status: REGISTERING - REGISTRATION IN PROGRESS
  Export-Controlled Functionality: Not Allowed
  Initial Registration: FAILED on May 16 18:30:07 2016 edt
  Next Registration Attempt: May 16 19:34:41 2016 edt
License Authorization:
  Status: EVAL MODE
  Evaluation Period Remaining: 37 days, 11 hours, 54 minutes, 37 seconds
```

## Source and Domain Name

```
CBR8-01# sh run | i ip http client source|ip domain-name
ip domain-name cisco
ip http client source-interface Loopback0
```

## Crypto

```
CBR8-01# sh run | sec crypto pki trustpoint SLA-TrustPoint
crypto pki trustpoint SLA-TrustPoint
  enrollment terminal
  revocation-check crl
```

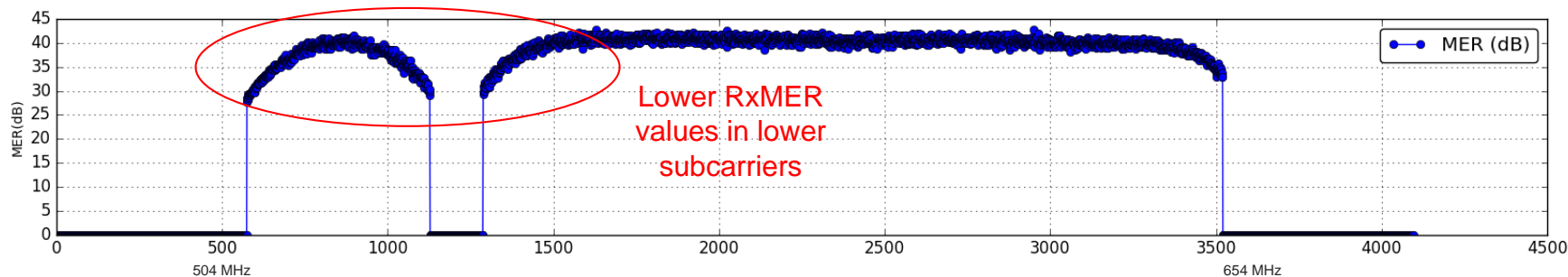
# OFDM and OFDMA Optimization

# Max Carrier/OFDM to Base Channel Power

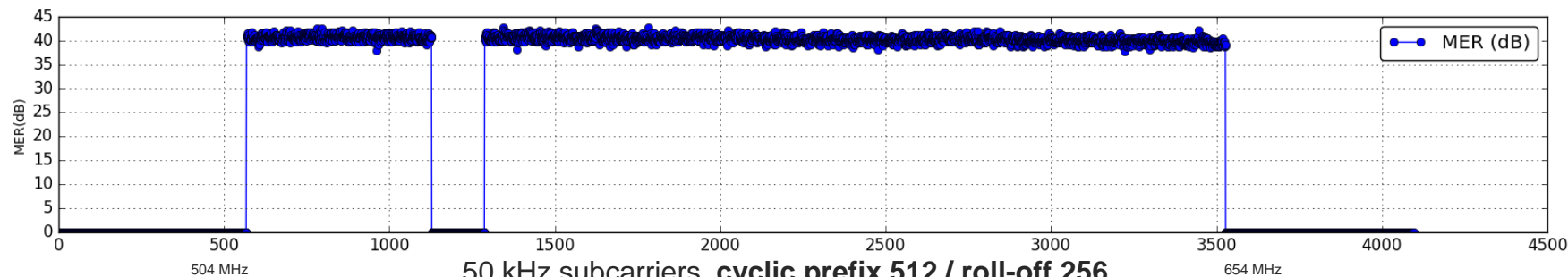
Example Supported Ranges in dBmV

Max Carrier	No OFDM	24 MHz OFDM	48 MHz OFDM	96 MHz OFDM	144 MHz OFDM	192 MHz OFDM	384 MHz OFDM
8	41 – 50	39 – 48	37 – 46	35 – 44	34 – 43	32 – 41	29 – 38
16	37 – 46	36 – 45	35 – 44	34 – 43	32 – 41	31 – 40	29 – 38
24	35 – 44	34 – 43	34 – 43	32 – 41	31 – 40	31 – 40	28 – 37
32	34 – 43	33 – 42	32 – 41	31 – 40	31 – 40	30 – 39	28 – 37
48	31 – 40	31 – 40	31 – 40	30 – 39	29 – 38	29 – 38	27 – 36
64	30 – 39	30 – 39	29 – 38	29 – 38	28 – 37	28 – 37	26 – 35
96	28 – 37	28 – 37	27 – 36	27 – 36	27 – 36	26 – 35	25 – 34
128	26 – 35	26 – 35	26 – 35	26 – 35	25 – 34	25 – 34	24 – 33
158	25 – 34	25 – 34	25 – 34	25 – 34	24 – 33	24 – 33	– NA –

150 MHz OFDM channel 504 MHz – 654 MHz with node plus 5 amplifiers

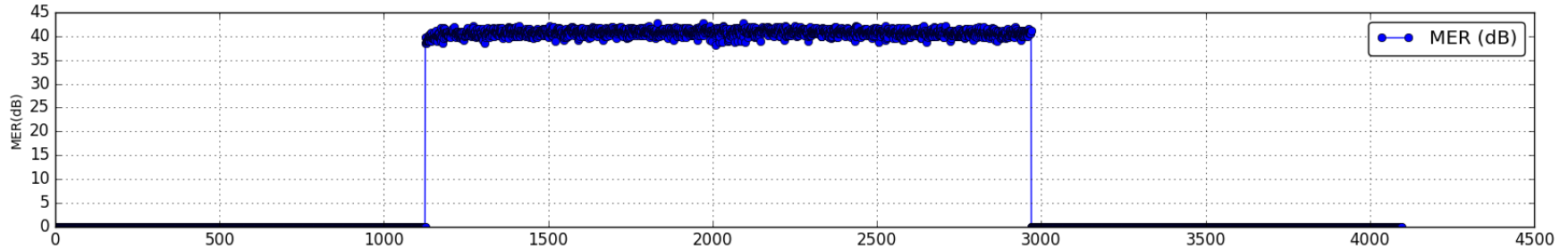


50 kHz subcarriers, **cyclic prefix 192 / roll-off 128**  
Channel speed 1342 Mbps @ 4096-QAM (1230 Mbps @ 2048-QAM)

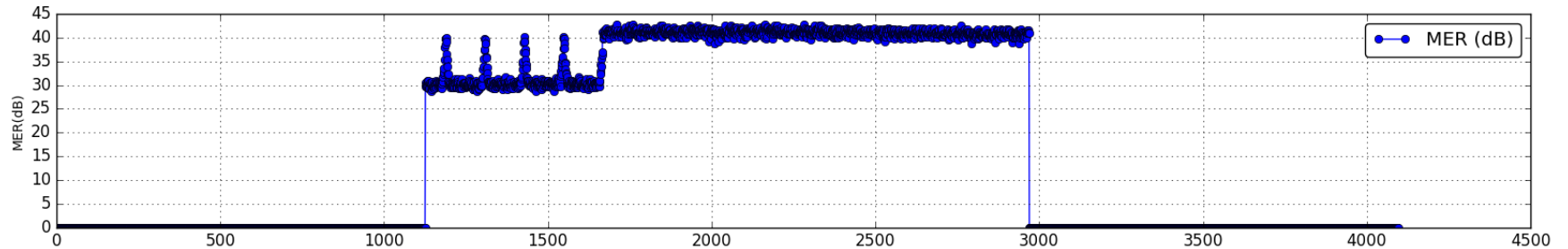


50 kHz subcarriers, **cyclic prefix 512 / roll-off 256**  
Channel speed 1265 Mbps @ 4096-QAM

LDPC and frequency interleaving in D3.1 makes channel very robust to impairments



96 MHz OFDM channel running 4096-QAM no uncorrectable FEC codewords  
(cBR8 would recommend 2048-QAM profile by default)



Same 96 MHz OFDM channel (now with 30 MHz interference) still running 4096-QAM no uncorrectable FEC codewords  
(cBR8 would recommend 256-QAM profile by default)

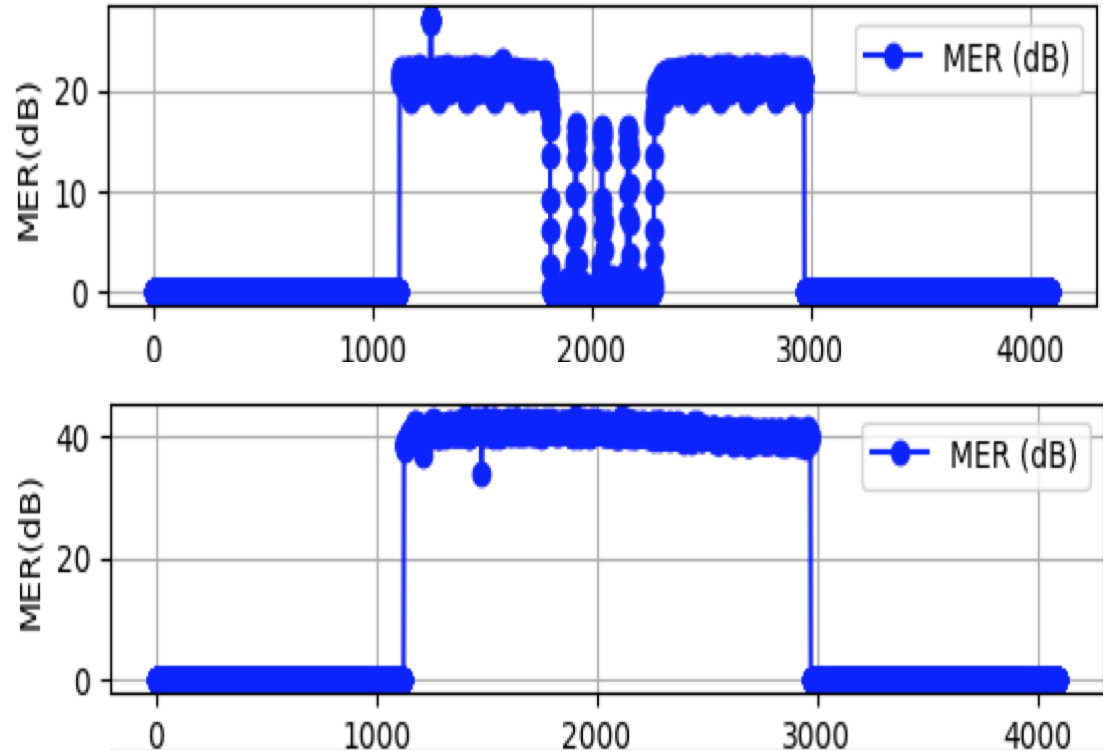
**cisco** *Live!*

# Usefulness of RxMER data

RxMER data collection can be very useful in pinpointing plant problems

In this example it was found that some equipment was running tests from over a year ago across 4 channels and was never disabled

In the top diagram you can see the MER for the entire OFDM spectrum is degraded; the bottom diagram shows the spectrum after removing the interfering carriers



# OFDM Settings To Maximize Speeds

- **cyclic-prefix 192**
  - For larger channels ( $\geq 96$  MHz(50),  $\geq 144$  (25)) use lowest value (192)
  - For smaller channels ( $< 96$  MHz(50),  $< 144$  (25)) use 256 to allow larger roll-off
- **pilot-scaling 48**
  - Keep at lowest setting – default is 48
- **roll-off 128**
  - Make as large as possible but must be less than cyclic prefix value
- **subcarrier-spacing 25KHZ**
  - Less overhead for 25 kHz
- **profile-data 1 modulation-default 1024-QAM**
  - Make data profile as high as HFC plant will support
- **profile-ncp modulation-default 64-QAM**
  - Make NCP as high as plant will support

# OFDM Profile Management Settings

- **cable downstream ofdm-prof-mgmt prof-dwngrd-auto**
  - Allow automatic profile downgrades after a profile declared unfit (default on)
- **cable downstream ofdm-prof-mgmt rxmer-poll-interval**
  - Period of RxMER polling (default 60 mins)
- **cable downstream ofdm-prof-mgmt exempt-sc-pct**
  - Percentage of sub-carriers allowed to be below the MER margin (default 2%)
- **cable downstream ofdm-prof-mgmt recommend-profile-age**
  - How long to cache recommended profile (default 120 mins)
- **cable downstream ofdm-prof-mgmt unfit-profile-age**
  - How long to cache unfit profile (default 60 mins)
- **cable downstream ofdm-prof-mgmt mer-margin-qdb**
  - Offset in 1/4 dB for MER margin determination



# OFDMA Profile Management Settings

- **cable upstream ofdma-prof-mgmt prof-upgrade-auto**
  - Allow automatic profile upgrade (default off\*) – default to change in later code
- **cable upstream ofdma-prof-mgmt rxmer-poll-interval**
  - Period of RxMER polling (default 60 mins)
- **cable upstream ofdma-prof-mgmt exempt-mslot-pct**
  - Percentage of minislots allowed to be below the MER margin (default 2%) )
- **cable upstream ofdma-prof-mgmt mer-margin-qdb**
  - Offset in 1/4 dB for MER margin determination
- **cable upstream ofdma-prof-mgmt active-scs-threshold-pct**
  - Percentage of active subcarriers allowed to be below the MER margin (default 2%) )

# OFDMA Recommendations (June 2018)

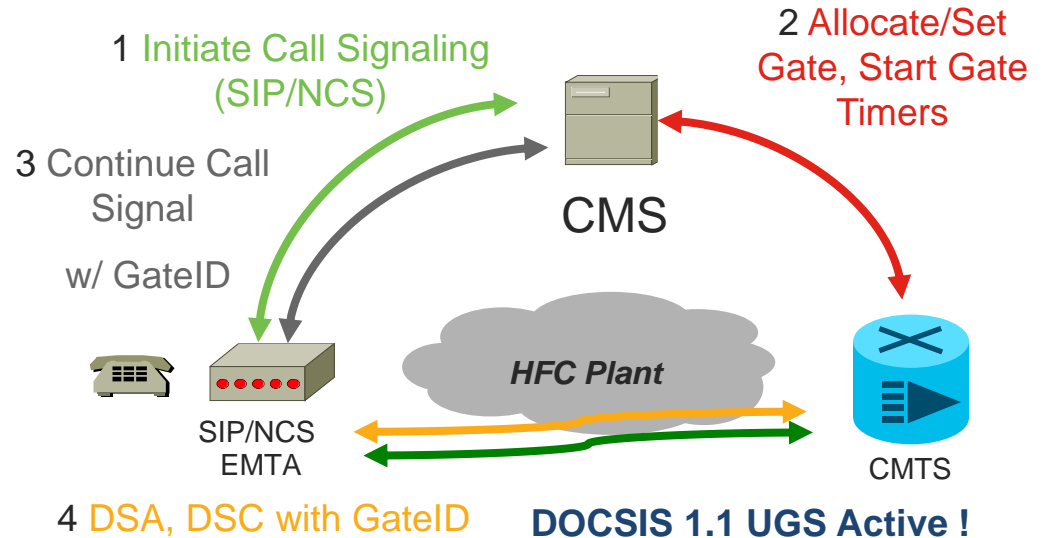
- Use range **40-85 MHz**
- Avoid exclusion bands if possible
  - modem interop because of **dynamic modulation change on SC-QAM**, throughput issues
- When creating USBGs –create at least one SC-QAM (UGS scheduled flow) in USBG **and no more than 4 SC-QAMs in the USBG (4+1)**
- Interface Cable, being with Upstream 6 for the OFDMA upstream
  - Reserve 4 and 5 for D2.0 US later
- Use 25 Khz subcarrier
- Use 64.5 MHz Initial Ranging and subcarrier 256 fine-ranging
- Avoid using more than 45 Mhz spectrum because of current linecard USPHY rate limit settings.
- Modulations 4096 and 2048 QAM Removed
  - Can re-enable for demo purposes
- Go with larger cyclic prefix rollout, testing works better with modem interop issues
- Use LCHA and not LCPR in general

# Troubleshooting cBR-8 Voice Services

# Voice Services

## Common Problems

- 1. No Voice
- 2. Voice Quality
  - Choppy / Jittery / Robotic
- 3. Unable to Make a Call



# Voice Services

## Commands

- show cable upstream service-flow summary
- show cable modem voice
- show cable modem *mac-address* service-flow [verbose]
- show interface cable *slot/subslot/port* service-flow qos us | include UGS
- show interface cable *slot/subslot/port* service-flow *sflow-id* verbose
- show interface cable *slot/subslot/port* dynamic-service statistics
- show cable admission-control interface *slot/subslot/port* {bonding-group all | upstream *us-number*}
- debug cable dynsrv
- debug cable qos

# Voice Services

## Dynamic Service Flow

### Debug cable dynsrv & Debug cable tlvs

```
Mar 9 19:28:49.792: DSA-REQ-RECD: OrgMac->0013.1050.3801 OrgId->89
Mar 9 19:28:49.792: DSA-STATE-CREATED: OrgMac->0013.1050.3801 OrgId->89
Mar 9 19:28:49.796: Found Upstream Service Flow TLV
Mar 9 19:28:49.796:   Service Flow Reference : 1
Mar 9 19:28:49.796:   QoS Parameter Set Type : 0x2
Mar 9 19:28:49.796:   Scheduling Type : 6
Mar 9 19:28:49.796:   Request/Transmission Policy : 0x17F
Mar 9 19:28:49.796:   Unsolicited Grant Size : 232
Mar 9 19:28:49.796:   Nominal Grant Interval : 20000
Mar 9 19:28:49.796:   Tolerated Grant Jitter : 800
Mar 9 19:28:49.796:   Grants Per Interval : 1
Mar 9 19:28:49.796: Found Upstream Packet Classifier TLV
Mar 9 19:28:49.796:   Classifier Reference : 1
Mar 9 19:28:49.796:   Service-Flow Reference : 1
Mar 9 19:28:49.796:   Rule Priority : 128
Mar 9 19:28:49.796:   Activation State : 0
Mar 9 19:28:49.796: Found IP Packet Classifier Sub-TLV
Mar 9 19:28:49.796:   Protocol : 17
Mar 9 19:28:49.796:   Source Address : 24.34.240.235
Mar 9 19:28:49.796:   Destination Address : 24.34.240.247
Mar 9 19:28:49.796:   Source Port Start : 53456
Mar 9 19:28:49.796:   Source Port End : 53456
Mar 9 19:28:49.796:   Destination Port Start : 53456
Mar 9 19:28:49.796:   Destination Port End : 53456
```

Mac-add of CM

DSA REQ Received

Admit Service Flow only

US Scheduling type UGS

Std. UGS size for G.711/20ms

20 ms grant interval

Classifier not active yet

RTP port numbers

# Voice Services

## Debug cable dynsrv & Debug cable tlvs

```
Mar 9 19:28:49.796: Found Downstream Service Flow TLV
Mar 9 19:28:49.796:   Service Flow Reference : 2
Mar 9 19:28:49.796:   QoS Parameter Set Type : 0x2
Mar 9 19:28:49.796:   Traffic Priority : 5
Mar 9 19:28:49.796:   Maximum Sustained Traffic Rate : 87200
Mar 9 19:28:49.796:   Maximum Traffic Burst : 1522
Mar 9 19:28:49.796:   Minimum Reserved Traffic Rate : 87200
Mar 9 19:28:49.796:   Minimum Reserved Rate Packet Size : 218
Mar 9 19:28:49.796: Found Downstream Packet Classifier TLV
Mar 9 19:28:49.796:   Classifier Reference : 2
Mar 9 19:28:49.796:   Service-Flow Reference : 2
Mar 9 19:28:49.796:   Rule Priority : 128
Mar 9 19:28:49.796:   Activation State : 0
Mar 9 19:28:49.796: Found IP Packet Classifier Sub-TLV
Mar 9 19:28:49.796:   Protocol : 17
Mar 9 19:28:49.796:   Source Address : 24.34.240.247
Mar 9 19:28:49.796:   Destination Address : 24.34.240.235
Mar 9 19:28:49.796: Auth Block:
Mar 9 19:28:49.796: 0x0000: 01 06 01 04 00 00 14 3E
Mar 9 19:28:49.796: Sfref = 1, SFID = 103 <- Service Flow IDs assigned by CMTS
Mar 9 19:28:49.796: Sfref = 2, SFID = 104
Mar 9 19:28:49.796: Cfr-ref = 1, CFID = 33, SF-ref 1, SFID 103
Mar 9 19:28:49.796: Cfr-ref = 2, CFID = 34, SF-ref 2, SFID 104
Mar 9 19:28:49.796: DSA-RSP-SENT: CM->0013.1050.3801 TranscId->89 ConfCode->0
Mar 9 19:28:49.896: DSA-ACK-RECD: OrgMac->0013.1050.3801 OrgId->89 ConfCode->0
Mar 9 19:28:50.196: DSA-REQ End : Transaction over-T8 timer expired. OrgMac->0013.1050.3801 OrgId->89
Mar 9 19:28:50.196: DYN-SRV-STATE-DESTROYED : OrgMac->0013.1050.3801 OrgId->89
```

*Admit Service Flow only*

*DS service flow with high priority*

*DQOS Gate ID contained here*

*SFID assigned for US and DS*

*DSA Response sent and ACK received*

# Voice Services

## Service Flow Verification

### Dynamic Service Flow

```
CBR8-01# show cable modem 0000.cad6.eeb6 service-flow verbose
```

```
Sfid : 143
Mac Address : 0000.cad6.eeb6
Type : Secondary(Dynamic)
Direction : Downstream
Current State : Active
Current QoS Indexes [Prov, Adm, Act] : [0, 11, 11]
Active Time : 24:02
Sid : N/A
Traffic Priority : 5
Minimum Reserved Rate : 87200 bits/sec
Admitted QoS Timeout : 200 seconds
Current Throughput : 87254 bits/sec, 50 packets/sec
Application Priority : 3
Classifiers:
Classifier Id : 79
Service Flow Id : 143
CM Mac Address : 0000.cad6.eeb6
Direction : downstream
Activation State : active
Classifier Matching Priority : 128
PHSI : 0
Number of matches : 72112
IP Classification Parameters:
IP Source Address : 14.80.82.7
Source IP Address Mask : 255.255.255.255
Destination IP Address : 14.80.82.141
Destination IP Address Mask : 255.255.255.255
```

Alternative: Show interface cable slot/subslot/port service-flow sfid verbose

DS dynamic service flow

DS Service Flow

High Priority for DS flow

Min Reserve rate

Current throughput

Source IP of DS flow

Destination IP of DS flow



# Voice Troubleshooting

## Dynamic Service Flow

- show interfaces c1/0/0 dynamic-service statistics
- show cable admission-control interface cable *slot/sub/port* upstream *up-number*

Can specify  
bonding-group  
too

### Dynamic Service Flow Statistics

```
CBR8-01# show interfaces c1/0/0 dynamic-service statistics
```

	Upstream	Downstream
DSA REQ	6647	0
DSA RSP	0	6865
DSA ACK	6823	0
DSC REQ	12014	0
DSC RSP	0	12028
DSC ACK	12025	0
DSD REQ	6627	37
DSD RSP	20	6627

REQ and RES  
should be similar  
(pairing)

Retransmission counts

	Upstream	Downstream
DSA REQ	9	0
DSA RSP	0	227
DSA ACK	154	0
DSC REQ	0	0
DSC RSP	0	14
DSC ACK	10	0
DSD REQ	6	23
DSD RSP	2	6

Retransmissions  
are normal, but  
make sure it's  
not excessive

### Service Flow Reservations and Statistics

```
CBR8-01# show cable admission-control int c1/0/0 up 0
```

Interface Cable1/0/0  
Upstream # 0

Upstream Bit Rate (bits per second) = 30720000  
Sched Table Rsv-state: Grants 0, Reqpolls 0  
Sched Table Adm-state: Grants 0, Reqpolls 18, Util 0%  
**UGS : 12 SIDs, Reservation-level in bps 0**  
UGS-AD : 0 SIDs, Reservation-level in bps 0  
RTPS : 0 SIDs, Reservation-level in bps 0  
**NRTPS : 18 SIDs, Reservation-level in bps 301410**  
**BE : 70 SIDs, Reservation-level in bps 0**  
Maximum AC reservable bandwidth is not configured

Use this to check  
number of  
Sflows

# DS Bonding Resiliency

# DS Bonding Resiliency

- Bonded CM operation without resiliency
- DOCSIS 3.0 allows CMTS to transmit on Primary and NP RF channels
- If CM lose connectivity to Primary RF, CM goes offline
- If CM lose connectivity to NP RF, there will be data loss
- CM informs NP RF failure/recovery via CM-STATUS message
- CMTS/CM behavior with DS Bonding Resiliency
- RBG contains all RFs of original BG except the failed RFs
- Move primary DS Service Flow for CM to its dynamic RBG with 2 or more RFs
- Secondary SFs to dynamic RBG if configured with “Cable rf-change-trigger secondary” command
- CM remains in p-online state for tracking

# Config and Debugs for DS-Bonding Resiliency

## DS Resiliency Configuration

*Rf-change-trigger % and count of CM*

```
cable rf-change-trigger percent 75 count 10
```

```
! cable resiliency ds bonding
```

*Global Configuration  
Required*

```
interface Wideband-Cable8/1/1:0
```

```
cable bundle 1
```

```
cable rf-channel 0 bandwidth-percent 1
```

```
cable rf-channel 1 bandwidth-percent 1
```

```
cable rf-channel 2 bandwidth-percent 1
```

```
cable rf-channel 3 bandwidth-percent 1
```

```
<SNIP>
```

```
cable rf-channel 15 bandwidth-percent 1
```

*Static Bonding Group  
(Not the DS Bonding  
Resiliency BG)*

```
interface Wideband-Cable8/1/1:8
```

```
cable ds-resiliency
```

```
!
```

```
interface Wideband-Cable8/1/1:9
```

```
cable ds-resiliency
```

```
!
```

```
interface Wideband-Cable8/1/1:10
```

```
cable ds-resiliency
```

*DS Bonding resiliency  
enabled under BG*

## Debugs Used

*Debugs for wideband resiliency*

```
debug cable wbcmts resiliency
```

```
debug cable interface c8/1/1 mac-address 001d.d4d3.3122
```

## All channels are up in BG

```
SLOT 8/1: Mar 26 16:40:06.183 EDT: CM 001d.d4d3.3122 n_rfch 15 CM_RFID 5215
```

```
SLOT 8/1: Mar 26 16:40:06.183 EDT:
```

```
SLOT 8/1: Mar 26 16:40:06.183 EDT:
```

```
SLOT 8/1: Mar 26 16:40:06.183 EDT:
```

```
<SNIP>
```

```
SLOT 8/1: Mar 26 16:40:06.183 EDT:
```

```
SLOT 8/1: Mar 26 16:40:06.183 EDT:
```

```
  r 0 state UP[11] rfid 5208
```

```
  r 1 state UP[11] rfid 5209
```

```
  r 2 state UP[11] rfid 5210
```

```
  r 14 state UP[11] rfid 5223
```

```
  r 15 state UP[11] rfid 5224
```

*Debug shows all RF-Channels are UP at the  
moment*

# DS Bonding Resiliency Debugs

## One DS Channel down

```
SLOT 8/1: Mar 26 16:40:13.203 EDT: handle_wb_rf_resil_event: 001d.d4d3.3122 n_rfch 15, event 2 n_ds_chid 1
SLOT 8/1: Mar 26 16:40:13.203 EDT: ds_chid 200 mc_info channel_id 200
SLOT 8/1: Mar 26 16:40:13.203 EDT: send_docsis_resil_event_trap: now sending docsis_resil event trap.
SLOT 8/1: Mar 26 16:40:13.203 EDT: no permit, bit=80, bitmap=0
SLOT 8/1: Mar 26 16:40:16.191 EDT: CM 001d.d4d3.3122 n_rfch 15 CM RFID 5215
SLOT 8/1: Mar 26 16:40:16.191 EDT: r 0 state DOWN_PENDING[41] rfid 5208
<SNIP>
SLOT 8/1: Mar 26 16:40:16.191 EDT: r 14 state UP[11] rfid 5223
SLOT 8/1: Mar 26 16:40:16.191 EDT: r 15 state UP[11] rfid 5224
```

*Channel went down for CM  
because of impairments*

## RBG comes up with remaining channels

```
018110: Mar 26 16:41:26.343 EDT: RESIL-IPC-RP: 001d.d4d3.3122, receiving 757 bytes
018111: Mar 26 16:41:26.343 EDT: RESIL-RP: message type 1
018112: Mar 26 16:41:26.343 EDT: RESIL-RP: tlv_len 740, RESIL-RP: bitmask down: 24
018113: Mar 26 16:41:26.343 EDT: RESIL-RP: current_interface 6952
018114: Mar 26 16:41:26.343 EDT: RP GOT REQUEST TO MOVE CM
<SNIP>
```

*Modem Resiliency move  
necessary*

```
Original active RF members: 24-39
Needed RF members: 25-39
Down RF members: 24
Avail RF members: 25-39
```

*RP to look for RBG for  
Wi 8/1/1:0*

```
018139: Mar 26 16:41:26.347 EDT: Find Best DBG: for 8/1/1:0 needed RF member: 25-39
018140: Mar 26 16:41:26.347 EDT: cmts_rf_resil_rp_dbg_get_unused(): WB Index checking match 8/1/1:8
018141: Mar 26 16:41:26.347 EDT: cmts_rf_resil_rp_dbg_get_unused(): WB Index was found to be free 8/1/1:8
Found free DBG to use,requesting create RF member: 25-39
018142: Mar 26 16:41:26.347 EDT: Creating Dyn WB interface 8/1/1:8 with bundle 1
Needed RF: 25-39
<SNIP>
```

*Dynamic WB intf. Created for  
RBG*

```
018157: Mar 26 16:41:26.351 EDT: WB msg type 169 sent to LC 8/1
018158: Mar 26 16:41:26.351 EDT: %SNMP-5-LINK_UP: LinkUp:Interface Wideband-Cable8/1/1:8 changed state to up
```

*WB RBG with  
remaining chans.  
Comes up*

# DS Bonding Resiliency Show Commands

## Show cable rf-status

Logical RF	Suspend Status	Suspend Status	Flap Fails	Flap Count	Time
8/1/1 0	DOWN	N/A	0	22	Mar 24 19:15:57
1	UP	N/A	0	3	Mar 24 19:15:57
2	UP	N/A	0	0	
<SNIP>					
15	UP	N/A	0	0	

1<sup>st</sup> Channel went down

Flap Fail and Count

## Resiliency WB running config

```
interface Wideband-Cable8/1/1:8
cable bundle 1
cable ds-resiliency
cable rf-channel 1 bandwidth-percent 1
cable rf-channel 2 bandwidth-percent 1
<SNIP>
cable rf-channel 15 bandwidth-percent 1
```

## Show cable resiliency

F241-38-05-uBR10K-01#show cable resiliency

Resil BG I/F	BG ID	Resil State	Count	Time	Ctrl	RF Num
Wi8/1/1:8	6953	Assigned	3	Mar 26 16:41:26	1	1 2 15
...						
Wi8/1/1:9	6954	Assigned	1	Mar 26 17:11:32	1	0

Current chans in a RBG, 15 channel (no rf-ch 0)

```
interface Wideband-Cable8/1/1:9
cable bundle 1
cable ds-resiliency
cable rf-channel 0 bandwidth-percent 1
cable rf-channel 2 bandwidth-percent 1
<SNIP>
cable rf-channel 15 bandwidth-percent 1
```

## Show cable modem partial-service

F241-38-05-uBR10K-01#show cable modem partial-service

MAC Address	IP Address	I/F	MAC	DSxUS
Impaired	Impaired	State	State	DS US
001d.d4d3.3122	---	C8/1/1/UB	p-online (pt)	15x4
001d.d4d3.31d2	---	C8/1/1/UB	p-online (pt)	15x4

## Show cable modem resiliency

F241-38-05-uBR10K-01#show cable modem resiliency

I/F	MAC Address	Orig BG ID	I/F	Curr BG RFs ID	I/F	RFs
C8/1/1	001d.d4d3.3122	6952	Wi8/1/1:0	16	6953	Wi8/1/1:8 15
C8/1/1	001d.d4d3.31d2	6952	Wi8/1/1:1	16	6954	Wi8/1/1:9 15

Channels in old and new BG for a CM

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