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January 29 – February 2, 2018 · Barcelona

BRKSPG-2501

Troubleshooting DOCSIS 3.1, Converged Services, and R-PHY on cBR-8 CCAP Platform

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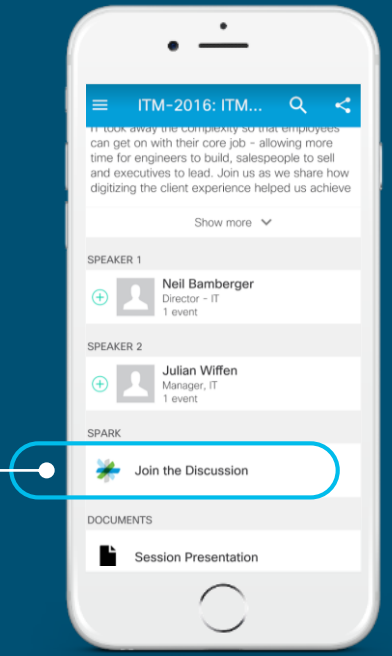

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Agenda

- CCAP Introduction
- Troubleshooting cBR-8 DOCSIS 3.x Services
- Troubleshooting cBR-8 Remote PHY Services
- Troubleshooting cBR-8 Converged Video Services
- Summary
- Q & A

CCAP Introduction

Converged Cable Access Platform

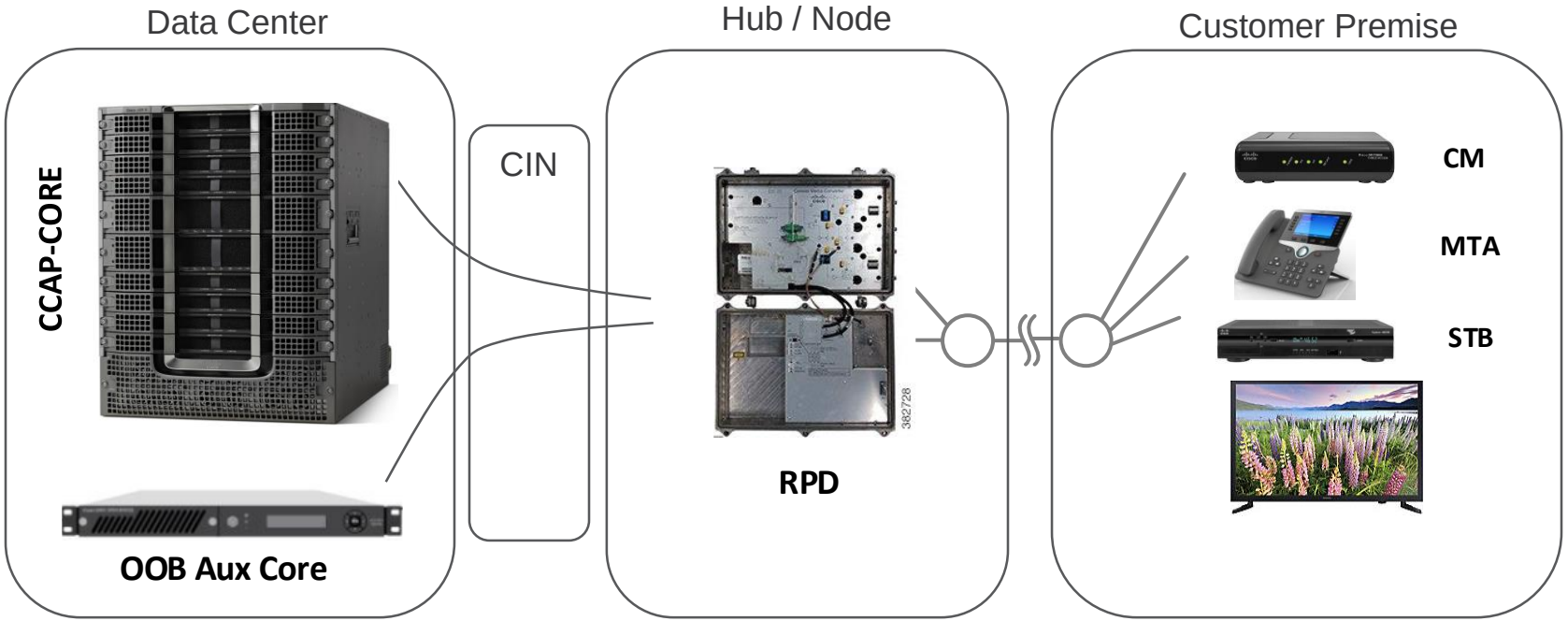
Cisco CCAP/cBR-8 Highlights

- **Path to DOCSIS 3.1**
  Enables FTTx Speeds – **2017 adds DOCSIS 3.1 Upstream**
- **Remote PHY**
  SG scaling & hub consolidation; full advantages of DOCSIS 3.1
- **CCAP video convergence**
  CapEx/OpEx savings; potential for PICs with integration optics
- **CCAP Scaling**
  200 Gbps of switching capacity, 6,144 DS channels and 768 US channels in 13 RU I-CCAP chassis with built-in HA
- **Service & Feature Velocity with SDN**
  Faster feature implementation; customization

Reference Architecture

CCAP with Remote PHY

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



Troubleshooting cBR-8 DOCSIS 3.x Services

Troubleshooting cBR-8 DOCSIS 3.x HSD Services

DOCSIS 3.1 Review

- OFDM (Orthogonal Frequency Division Multiplexing)
- OFDMA (Upstream – OFDMA)
- LDPC (Low Density Parity Check)
- Sub Carriers
  - Individual Profiles
- Profile Management
  - CM reports MER/SNR and receive power of each subcarrier
  - CM can test its ability to received unused profiles and report to CMTS

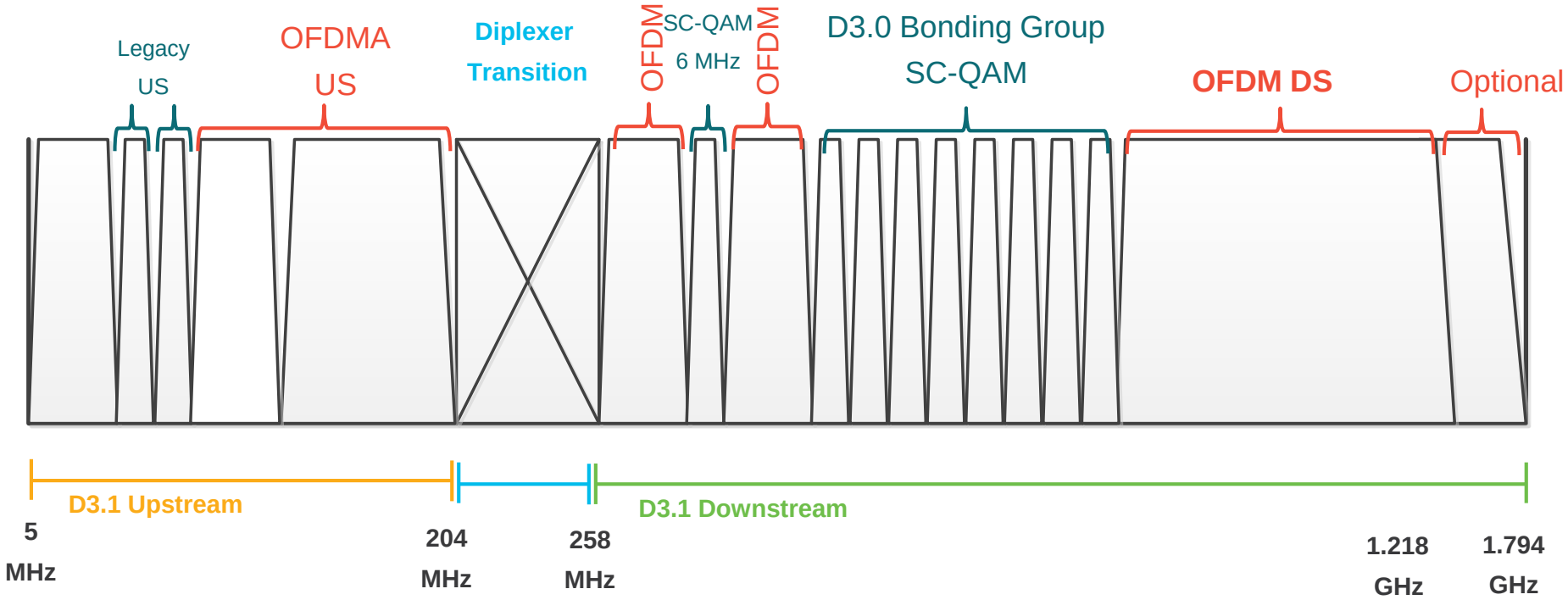
	DOCSIS 3.0	DOCSIS 3.1
Throughput	1 Gbps Down	10Gbps Down
	250 Mbps Up	1 Gbps
Channels	Annex B / 6MHz Channel	OFDM CH 192 MHz OFDMA CH 96 MHz
Multiplex	Time Division	Frequency Division
Modulation	QAM 64/256 DS	QAM 512 - 4096 / **16384**
Error Correction	Reed Solomon	Low Density Parity Check
Profiles	One Profile per QAM	Multiple Profiles per CM
Spectrum	204 to 1008 MHz	DS 258 MHz to 1.218 GHz / Opt 1.794 GHz
		US 5 – 204 MHz

DOCSIS 3.1 Spectrum

Spectrum

D3.1 Spec reports: Docsis 3.1 CM/CMTS support at least 8 US SC-QAM and 2 OFDMA in TCS, 24 DS SC-QAMs and 2 OFDM in RCS

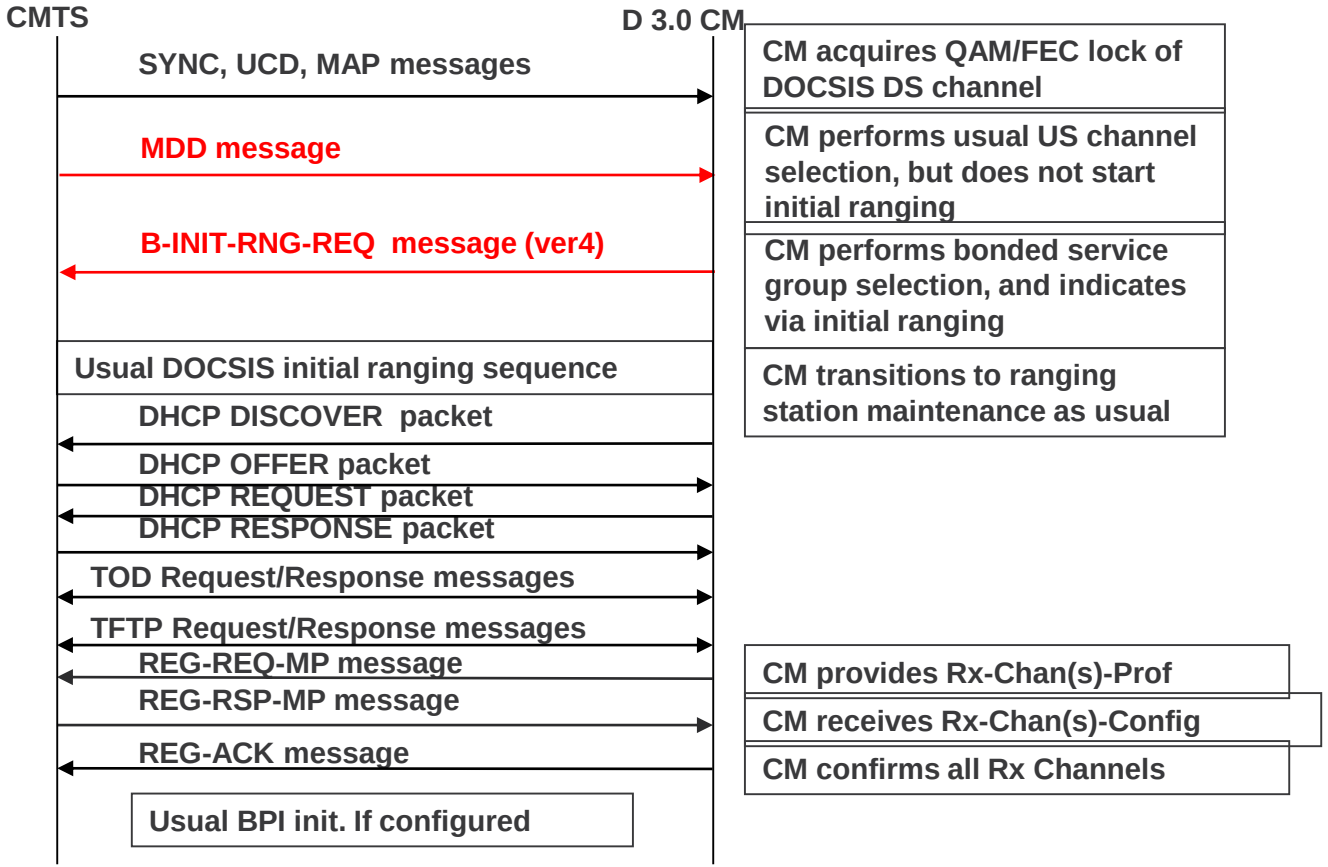
TaFDM: Allows D2.0 and D3.0 US to interop without exclusion bands!



DOCSIS 3.0 Registration

Comparison

- **D3.0 Registration**
- D3.1 Registration

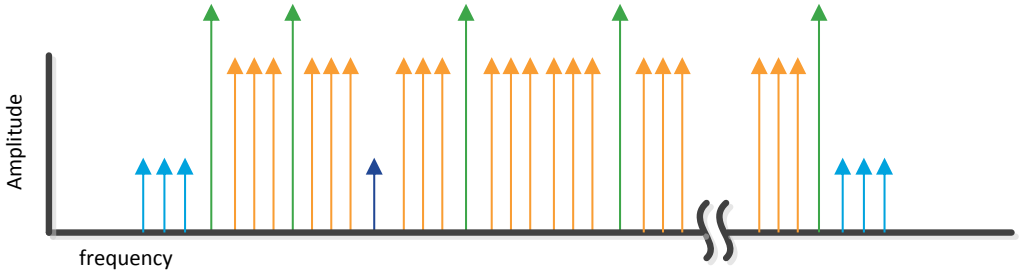


DOCSIS 3.1 Registration

CM Boot Procedure

	Step
1	Scan for OFDM DS upon cold boot
2	CM finds PLC via Pilot pattern and preamble
3	PLC contains OCD and DPD
4	CM connects to Profile
5	O-INIT-RNG-REQ sent in Initial Maintenance Region
6	CM declares sync complete
7	CM gets promoted to a working profile
	If no OFDM channel is deemed useable, scan for SC-QAM

Pilots, PLC, DPD, and OCD in the OFDM Channel

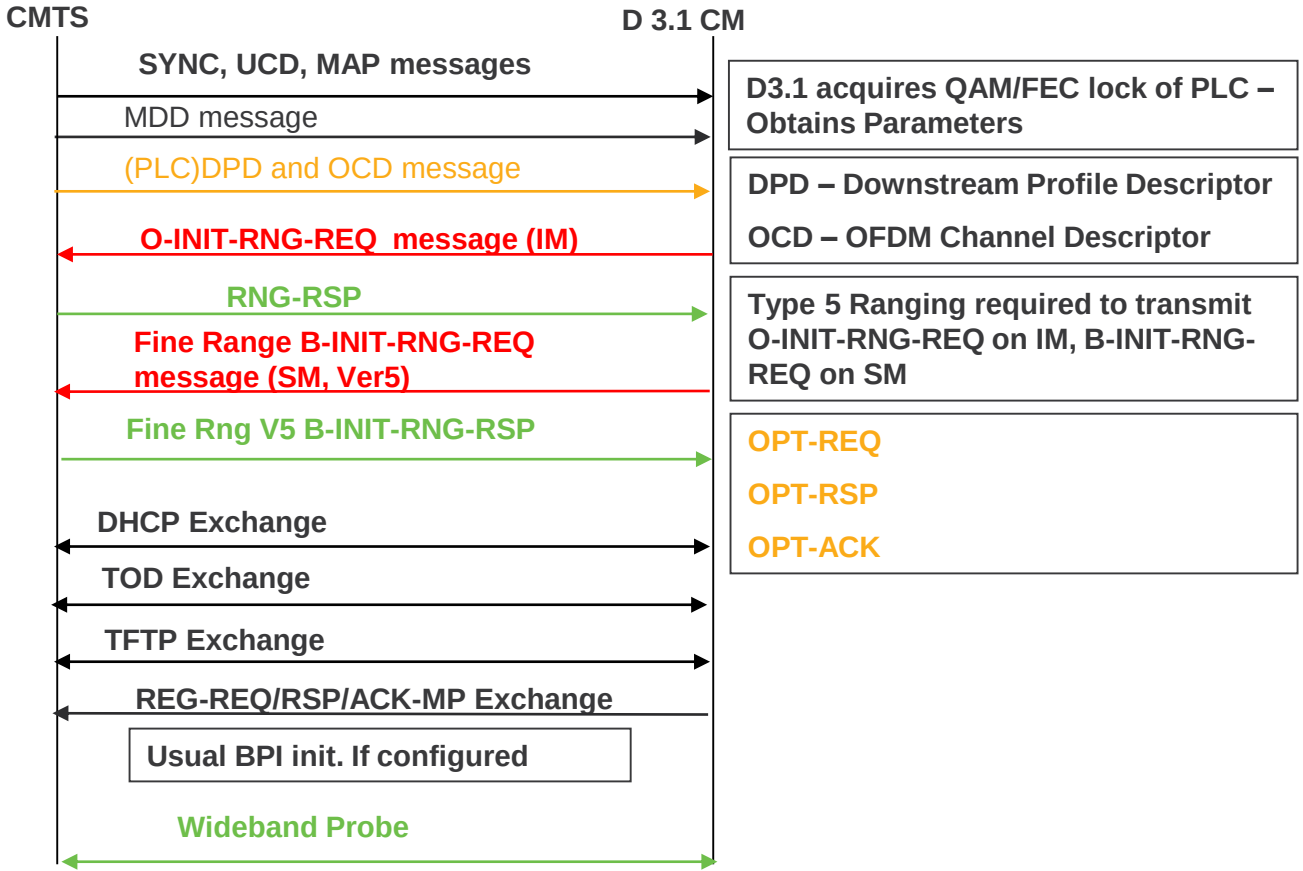


- Guard Sub Carriers
- Pilot Sub Carriers (For Channel Aqui, Adaptive Eq..etc)
- Data Sub Carriers
- PLC (Physical Link Channel)Start

DOCSIS 3.1 Registration

Comparison

- D3.0 Registration
- **D3.1 Registration**



US DOCSIS 3.1 Ranging Debugs

*Truncated

- debug cable mac-add *mac-address* verbose
- debug cable range [protocol]

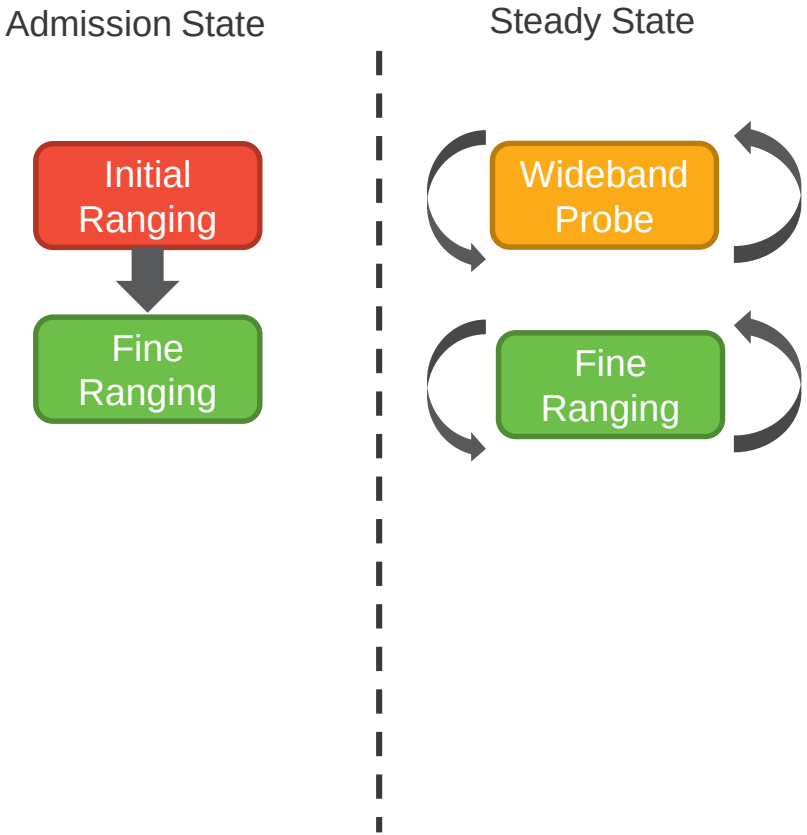
Stage	What to look for
Initial Ranging	Received, Msg Type, Incoming Interface
Ranging Response	Type 5, Correct Upstream Channel ID. Timing, Frequency, and Power adjust
Bonding –Init Ranging Req	Station Maintenance B-INIT-RNG-REQ
CDMAN Ranging Success	Cable DOCSIS Manager Ranging Success and Station Maintenance

```
CLC 2/0: INIT-RNG [info] : RCV initialization RNG attempt for CM 14b7.f80e.3d94: Msg-Type 252, DCID-9, RFID-8456, Interface Cable2/0/1/U4
CLC 2/0: Ranging request (252) from 14b7.f80e.3d94, SID 0 [0/9/8456] on Interface Cable2/0/1/U4 msg-ver 5

CLC 2/0: CM 14b7.f80e.3d94, RNG-RSP status CONTINUE (1)
CLC 2/0: CM 14b7.f80e.3d94 RNG-RSP version: 5 UCID 5
CLC 2/0: cmts_ranging_send_range_response_message: timing adj:  44352 / power adj:  5 / freq adj:  0

CLC 2/0: Ca2/0/1/U4: Send RNG-RSP (1) for 14b7.f80e.3d94, SID 3893, Ca2/0/1 DS RFID 8456
CLC 2/0: SM B-INIT from 14b7.f80e.3d94, SID 3893 [0xF35] on Interface Cable2/0/1/U4: MD-DS-SG-ID 9, Cap flags 207
CLC 2/0: CM 14b7.f80e.3d94 RX rng-event from CDM: us 5 CM state 6 event 1 chan state 4
CLC 2/0: 14b7.f80e.3d94 is D3.1, SM P1.6r 0 IM P1.6r 0

CLC 2/0: CDMAN chan state (4) Ranging Success, Station Maintenance
CLC 2/0: CM 14b7.f80e.3d94 us 5 RX rng-status from CDM: t_off/t_adj/f_adj/p_adj/rxpwr/rpt_pwr
44352/0/0/0/0/139

CLC 2/0: 14b7.f80e.3d94 is D3.1, SM P1.6r 3475 IM P1.6r 0
CLC 2/0: IPC P1.6c 139, P1.6low 1700, P1.6load 1611
CLC 2/0: IPC Pmax 6500, P1.6hi 5086, Neq 26, P1.6load_min_set 64, P1.6low_multi 91

CLC 2/0: CDMAN chan state (4) Ranging Success, Station Maintenance
CLC 2/0: OFDMA-US: CM 14b7.f80e.3d94 chid 5 pwr_min_level 1700 phy_peak_level 5086 pwr_peak_level 5086 pwr_load 64
CLC 2/0: 14b7.f80e.3d94: Power ref 139 rx-ed 0 extra 0 offset 76 peak 203 mode 2
CLC 2/0: OFDMA-US: CM 14b7.f80e.3d94 chid 5 pwr_min_level 1700 phy_peak_level 5086 pwr_peak_level 5086 pwr_load 64
CLC 2/0: 14b7.f80e.3d94: max 64 min 64 new load 40
CLC 2/0: CM 14b7.f80e.3d94 ucid 5, OFDMA b/w: 42000000
```

D3.1 OFDMA Initial Ranging

Initial, Fine, and Probing Ranging

Ranging Type	Ranging Purpose
Initial Ranging	Modem Registration
Fine Ranging	Precise power and timing adjustments Only a part of the spectrum
Probing	Pre-Equalization configuration Periodic MER Measurement Spans entire channel (default every 60 minutes)



DOCSIS 3.0/3.1 CMs Reporting DS/US Performance Issues

Possible Reasons

- 1. Improper configuration
  - 1.a - Docsis 3.1 support on cBR-8
  - 1.b - Verify Integrated controller and interface, WB interface, CGD and Fiber-node configuration and verification for D3.0 and D3.1
  - 1.c – MDD, DPD, OCD and Debugs verification
  - 1.d - Real time operational maintenance and show commands verification
- 2. CMs Throughput Troubleshooting
  - 2.a – DS Performance verification
    - Requirement of DS Bonding Resiliency
  - 2.b – US Performance verification

1.a - DOCSIS 3.1 Support

Hardware And Software Requirements

Hardware	Firmware
CBR-CCAP-LC-40G *"Cylon"*	
CBR-D31-DS-MOD *"Gemini 2"*	
CBR-D31-US-MOD *"Leoben 3"*	
Cable Linecard ROMMON	
SUP ROMMON	

IOS-XE Software	Feature
16.6 Polaris	D3.1 Upstream OFDMA

PID should have "D31"

```
cBR8-01# show inventory
NAME: "clc 0", DESCR: "Cisco cBR        Line Card"
PID: CBR-CCAP-LC-40G    , VID:     , SN: CAT1919E1RR
NAME: "CLC Downstream PHY Module 0/0", DESCR: "Cable PHY Module"
PID: CBR-D31-DS-MOD     , VID: V01  , SN: CAT2025E0NK
NAME: "CLC Upstream PHY Module 0/2", DESCR: "Cable PHY Module"
PID: CBR-D31-US-MOD     , VID: V01  , SN: CAT2024E13J
```

```
cBR8-01# show cable card 1/0 ds-phy display | i ver
img info: section 2, running ver 30019 (micro)
img info: section 1, running ver 4814b (fpga)
micro ver 30019, sector(1 base) 2, apollo ver 4814b,
sector(0 base) 1
cpld ver 7, sector(1 base) 1, psoc ver 40004, sector(1 base) 1
img info: section 2, running ver 30019 (micro)
img info: section 1, running ver 4814b (fpga)
micro ver 30019, sector(1 base) 2, apollo ver 4814b, sector(0 base) 1
cpld ver 7, sector(1 base) 1, psoc ver 40004, sector(1 base) 1
```

30019 for "Micro" 4814b for "Apollo" (DS-PHY)

```
cBR8-01# show platform
Chassis type: CBR-8-CCAP-CHASS
1          CBR-CCAP-LC-40G      ok                    3w1d
1/1        CBR-RF-PIC           ok                    3w1d

Slot       CPLD Version         Rommon Version
---------  -------------------  ------------------------------------
0          00000025             2011.03.18
1          00000025             2011.03.18
SUP0       16052011             16.5(1r)S
SUP1       16052011             16.5(1r)S
```

1.b – D3.0 Configuration

Controller Configuration

```
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 0.0
  qam-profile 1
  docsis-channel-id 1
```

DS Primary OFDM

32 SC RF Channels grouped

US BG Configuration

Interface Cable configuration

```
interface Cable2/0/1
 downstream Integrated-Cable 2/0/1 rf-channel 8
 downstream Integrated-Cable 2/0/1 rf-channel 158
 upstream 0 Upstream-Cable 2/0/2 us-channel 0
 <SNIP>
 upstream 4 Upstream-Cable 2/0/2 us-channel 12
 cable upstream balance-scheduling
 cable upstream bonding-group 1
  upstream 0
  upstream 1
  upstream 2
  upstream 3
attributes 80000000
cable bundle 1
```

Fiber-node configuration verification

```
cable fiber-node 40
 downstream Integrated-Cable 2/0/1
 upstream Upstream-Cable 2/0/2

Cbr8-01#Show cable fiber-node 40
Fiber-Node 40
Channel(s)    :  downstream Integrated-Cable 2/0/1:  0-31, 158
Channel ID(s):   1   2   3   4   5   6   7   8   9  10  11  12  13  14
                15  16  17  18  19  20  21  22  23  24  25  26  27  28
                29  30  31  32 159
Upstream-Cable 2/0/2
FN Config Status: Configured (status flags = 0x01)
MDD Status: Valid
```

Fiber Node with RF channels
(DS Does not have to be unique)

US Controller 3/0 port 0 (connector)

MDD has to be valid

Wideband Interface Configuration

```
interface Wideband-Cable2/0/1:13
 load-interval 30
 cable bundle 1
 cable rf-channels channel-list 0-31
bandwidth-percent 1
```

1.b - D3.1 DS Configuration

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

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

```
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

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
```

1.b - D3.1 US Configuration

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

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>
```

US-CH 12-15 OFDMA

OFDMA channel with profile

```
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-chan
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
```

```
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

1.b – Downstream Controller verification

Configuration Verification

show controller integrated-cable *slot/subslot/port* **rf-channel** *cr-ap-list*

Single Carrier QAM Parameters

```
cBR8-01#show controller integrated-Cable 2/0/1 rf-channel 0-158

Chan State Admin Frequency  Type   Annex Mod  srate Interleaver  dcid  power  output
 0     UP    UP   591000000  DOCSIS  B    256   5361  I32-J4       1    35.0   NORMAL
 1     UP    UP   597000000  DOCSIS  B    256   5361  I32-J4       2    35.0   NORMAL
 2     UP    UP   603000000  DOCSIS  B    256   5361  I32-J4       3    35.0   NORMAL
 <SNIP>
 31    UP    UP   777000000  DOCSIS  B    256   5361  I32-J4       32   35.0   NORMAL
 32    UP    UP   495000000  VIDEO   B    256   5361  I128-J1      -    35.0   NORMAL
 63    UP    UP   489000000  VIDEO   B    256   5361  I128-J1      -    35.0   NORMAL

Chan State Admin Mod-Type  Start       Width     PLC         Profile-ID   dcid  power  output
                           Frequency
 158   UP    UP   OFDM      780000000   192000000 873000000       100      159   35.0   NORMAL
```

OFDM Parameters

Parameter	Desired	What to look at
State and Admin	UP & UP	show controllers & urm / configuration
Frequency/Annex/Mod/Interleave	As configured	admin shut / controller IC configuration
Type	DOCSIS or VIDEO	controller IC configuration
Power	Linear or Tilted	controller IC configuration
Start Freq / PLC / Profile ID	As configured	DS OFDM Profile configuration & ctrl IC

1.b – Upstream Controller verification

show controller upstream-cable *slot/subslot/port* **us-channel** {**12 – 15**}

Parameter	What to look for
OFDMA Support	FULL
AdminState & OpState	UP & UP
SC QAM Frequency List	Single-Carrier QAMs as appropriate for your spectrum
OFDMA Frequency List & Range	Range matches D3.1 US
Minislot “Size”	Positive Integer
Modulation Profile and IUCs	As configured, variations to account for modulation profiles

```
cBR8-01# show controller upstream-cable 2/0/2 us-channel 12
USPHY OFDMA support: FULL
Controller SCQAM Freq List:
   17.600 MHz( 13.900,  20.799),  24.000 MHz(
20.800,  27.699),  31.000 MHz( 27.700,  34.299),
   37.500 MHz( 34.300,  41.199),
Controller OFDMA Freq List:
  ( 42.500 MHz,  84.500 MHz),
Controller 2/0/2 upstream 12  AdminState:UP OpState: UP
  ofdma mode enabled
  Channel Freq Range 42.500 MHz to 84.500 MHz
  Channel Subcarrier Index Range Cfg: 148, 1827 Op: 148, 1827
  Channel SC0 Freq Cfg: 38.800 MHz Op: 38.800 MHz
  #Excl bands: 2
  (   0,  147), (1828, 4095),
  #Unused bands: 0
  Cyclic Prefix Size 96,  Rolloff Period Size 0
  Subcarrier Spacing 25KHz,  Symbols Per Frame 9 Subcarrier Per
Minislot: 16
  Modulation Profile (ID 423, Subcarrier Spacing 25KHz)
    IUC type    Cfg   Act  Preamble Bit       Pilot
                subc  subc Symbols  Loading   Pattern
    3  (IR)     64    64     4       -         -
    4  (FR)     128   128    1       -         -
    13 (data)   -     -      -     1024-QAM    8
  Calculated Data burst profile:
  IUC  Group   Bit       Pilot   Start  Consec
               Loading   Pattern Mslot  Mslot
  13   0       1024-QAM  8       0       104
```

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1.b - DOCSIS 3.1 Chan-Profile Verification

Configuration Verification

OFDM Profile

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	D1024	D1024
	D4096	D2048
		D4096

Show Cable OFDM-chan-profile

```
cBR8-01# show cable ofdm-chan-profile 1

**** OFDM Channel Profile Configuration ****

Description: System Profile 1

Prof  Cycl  Roll  FFT  Intr   Pilot  Modulation (D-Default, P-Profile)
ID    Prfx  Off   KHz  Depth  Scale  Cntrl   NCP     Data Profiles (count = 2)
                                                     1       2       3       4       5
1   1024  128   50   16     48     D:256   D:16    D:1024  D:4096    NA      NA      NA

cBR8-01# show cable ofdm-chan-profile 100

**** OFDM Channel Profile Configuration ****

Prof  Cycl  Roll  FFT  Intr   Pilot  Modulation (D-Default, P-Profile)
ID    Prfx  Off   KHz  Depth  Scale  Cntrl   NCP     Data Profiles (count = 2)
                                                     1       2       3       4       5
100 1024  128   50   16     48     D:256   D:16    D:1024  D:2048    D:4096  NA      NA
   **** OFDM Channel Profile Assigned Channels ****


Prof  Admin  Controller:channels
ID
100   Up     2/0/1:158              3/0/1:158              3/0/2:158              3/0/3:158
             3/0/4:158              3/0/5:158              3/0/6:158              3/0/7:158
```

Where this channel profile is active

1.c - DOCSIS MDD Verification

show cable mac-domain cable *slot/subslot/port* **mdd**

Debug interface cable *slot/subslot/port*

debug cable mdd

Parameter	What to look for
MDD Message	MDD Headers: DA, SA, Config change count
Downstream Channel List	Entries match configured
Channel ID	Match DSID – Typically contiguous and unique
Frequency	Match configured
Modulation & Annex	256 QAM & Annex B
Primary Capable	Match configured

```
cBR8-01# show cable mac-domain cable 2/0/1 mdd
MDD:  Mac-Domain(1) DCID(1)
MDD Header:
    Configuration Change Count: 0x19
    Number Of Fragments: 0x01
    Fragment Sequence Number: 0x01
    Current Channel DCID: 0x01
Frame Header:
    Frame Control:  0xc2
    MAC Parm:       0x00
    Length:         0x0456
MAC Management Message Header:
    Destination Address:     01e0.2f00.0001
    Source Address:          54a2.740d.e95b
    Length:                  0x0444
    DSAP, SSAP:              0, 0
    control, version, type:  0x03, 0x04, 0x21
      Downstream Active Channel List
        Channel ID:              1
        Frequency:               591000000Hz
        Modulation Order/Annex: 256 QAM/Annex B
        Primary Capable:         Primary-Capable
        CM-STATUS Event Bitmask:0x36
                                 MDD Timeout
                                 QAM FEC failure
                                 MDD Recovery
                                 QAM FEC recovery
        MAP/UCD Transport Indicator:  Can carry MAPs
and UCDs
```

1.c - DOCSIS MDD Verification

show cable mac-domain cable *slot/subslot/port* **mdd**

Parameter	What to look for
MD Downstream Service Group	Channels match
DS Ambiguity Resolution	Populated as needed
IP Initialization Parameters	IPv4 and/or IPv6
DOCSIS Version	Major 3 and Minor 1

```
MAC Domain Upstream active chan list
     MD-US Chan ID/CM-STATUS:  1/0x0000
     MD-US Chan ID/CM-STATUS:  5/0x0000
   Upstream Ambiguity Resolution Channel List
     MD-US Chan ID:           1 2 3 4 5
   Upstream Frequency Range  1
   Upstream Transmit Power Reporting: On
   CM-STATUS non-channel-specific events
                            Seq out of range
   Upstream Extended Transmit Power On
```

```
MAC Domain Downstream Service Group
     MD-DS-SG ID:              9
     Channel IDs:                1,   2,   3,   4,   5
                       <snip>    31,  32, 159
   Downstream Ambiguity Resolution Frequency List
     Frequencies:              591000000Hz
                               615000000Hz
                               639000000Hz
   IP Initialization Parameters
     IP Provisioning Mode:   IPv4
   Receive Channel Profile Reporting Control
     Center Freq spacing:    6 MHz
     Verbose Reporting:      No
     Fragmented RCP accept:  Yes
   Early Authentication and Encryption (EAE)
     Early Authentication:   Disabled
   Symbol Clock Locking Indicator
     Locked to Master:       Locked

CMTS DOCSIS Version
     DOCSIS Major Version:  3
     DOCSIS Minor Version:  1
   CM Periodic Maintenance Timeout Indicator:
     UNICAST_RANGING
   DOCSIS v3.1 CM-STATUS non-channel-specific events
            Downstream OFDM Profile Failure
                        NCP Profile Failure
                   Loss of FEC lock on PLC
                      NCP Profile Recovery
                       FEC Recovery on PLC
              FEC Recovery on OFDM Profile
```

1.c - DOCSIS MDD Verification

show cable mac-domain cable *slot/subslot/port* **mdd count**

Parameters	What to look for
OFDM Channel	Contains OFDM PLC Parameters
MDD Transmit Count	Incrementing between shows
Last Timestamd	Incrementing between shows

```
cBR8-01# show cable mac-domain cable 2/0/1 mdd counts
Mac-Domain 1 MDD Counts:
  DCID:     MDD Tx Count:     MDD Update Count:     Last Update:
    1          29321                  15          19:08:09
    2          29320                  10          19:08:06
    3          29320                  10          19:08:06
    4          29319                  9           19:08:06
    5          29319                  13          19:08:09
    6          29318                  7           19:08:06
    7          29318                  6           19:08:06
    8          29318                  6           19:08:06
    32         29316                  2           19:08:06
    159        29313                  2           19:08:09
```

OFDM DS as Primary Capable

```
cBR8-01# show cable mac-domain cable 2/0/1 mdd
MDD:  Mac-Domain(1) DCID(1)

Downstream Active Channel List
        Channel ID:             159
        Frequency:              873000000Hz
        Primary Capable:        Primary-Capable
        CM-STATUS Event Bitmask:0x36
                                MDD Timeout
                                QAM FEC failure
                                MDD Recovery
                                QAM FEC recovery
        MAP/UCD Transport Indicator:  Can carry MAPs and
UCDs
        OFDM PLC Params Bitmask:
              Tukey raised cosine window: 0.625
              Cyclic Prefix: 0.9375
              Sub carrier spacing: 50
```

MDD count is increasing

1.c - DOCSIS 3.1 OCD Verification

Configuration Verification

OFDM Channel Descriptor

show cable mac-domain cable *slot/subslot/port* **ocd**

- DCID
- Spacing
- Rolloff
- Spectrum
- Interleave Depth
- Subcarrier Assignment for Pilots
- Exclude subcarriers
- PLC Subcarriers

```
cBR8-01# show cable mac-domain cable 2/0/1 ocd
DCID: 159  OFDM Controller:channel 2/0/1:158
OCD Message
  MAC Header
    Frame Control                    : 0xC2    (MAC specific, MAC msg, EHDR Off)
    MAC Parameters                   : 0x0
    Length                           : 135
    Header Check Sequence            : 0xC60E (50702)
  MAC Management Header
    Destination MAC ADDR             : 01e0.2f00.0001
    Source MAC ADDR                  : 54a2.740d.e9cb
    Length                           : 117
    Control                          : 3
OCD fields
    DCID                             : 159
    CCC                              : 1
    TLV 0 Spacing                    : 50 KHz
    TLV 1 Cyclic Prefix              : 1024 samples
    TLV 2 Rolloff                    : 128 samples
    TLV 3 Spectrum Location          : 722600000 Hz
    TLV 4 Interleave Depth           : 16
    TLV 5 Subcarrier Assignment      : Continuous Pilots (list)
      1162  1234  1306  1378  1450  1522  1594  1666  1738  1810
      1882  1954  2026  2077  2089  2100  2109  2146  2155  2166
      2178  2218  2290  2362  2434  2506  2578  2650  2722  2794
      2866  2938
    TLV 5 Subcarrier Assignment      : Excluded Subcarriers (range)
                                     : 0000 - 1125
    TLV 5 Subcarrier Assignment      : Excluded Subcarriers (range)
                                     : 2970 - 4095
    TLV 5 Subcarrier Assignment      : PLC Subcarriers (range)
                                     : 2124 - 2131
    TLV 6 Primary Capable            : 0 (No)
```

DCID for OFDM Channel

Confirm as per config

1.c - DOCSIS 3.1 DPD Verification

Configuration Verification

OFDM Profile

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	D1024	D1024
	D4096	D2048
		D4096

Downstream Profile Descriptor

```
cBR8-01# show cable mac-domain cable 2/0/1 dpd
DPD Message
  MAC Header
    Frame Control                    : 0xC2    (MAC specific, MAC msg, EHDR Off)
    MAC Parameters                   : 0x0
    Length                           : 34
    Header Check Sequence            : 0x61FC (25084)
  MAC Management Header
    Destination MAC ADDR             : 01e0.2f00.0001
    Source MAC ADDR                  : 54a2.740d.e9cb
    Length                           : 16
    Destination SAP                  : 0
    Source SAP                       : 0
    Control                          : 3
    Version                          : 5
    Type                             : 50
    Multipart                        : 0     (Sequence number 0, Fragments 0)
  DPD fields
    DCID                             : 159
    Profile ID                       : 3
    CCC                              : 1
    TLV 5 Subcarrier Range/List      : Range (continuous)
      Modulation                     : 4096 (default value)
                                     : 0000 - 4095

DPD Message
  DPD fields
    DCID                             : 159
    Profile ID                       : 255
    CCC                              : 1
    TLV 5 Subcarrier Range/List      : Range (continuous)
      Modulation                     : 16 (default value)
                                     : 0000 - 4095
```

Each MD will have several DPDs

This is the same as the Data Profile configured (either default OFDM Modulation or custom)

OFDM Modulation

1.c – Debugs Verification

- Debugs to verify MDD generation on CMTS
  - debug cable interface cable {slot/subslot/port} [verbose]
  - debug cable mdd
- Debugs needed for ranging and registration—For DSCB/USCB modem
  - debug cable mac-address {cable-modem-mac-address} verbose
  - debug cable mdd
  - debug cable ranging [initial | protocol]
  - debug cable registration
  - debug cable tlv
  - debug cable ipv6 dhcp
  - debug cable service-ds-selection
  - debug cable rcc
  - debug cable wbcmts
  - debug cable md-sg
  - debug cable ubg

1.d - DOCSIS 3.1 Operational Maintenance

Identifying D3.1 Modems

- show cable modem docsis version d31 [operational|not-operational]

```
cBR8-01# show cable modem docsis version d31-capable
MAC Address     I/F              MAC              Reg  Oper  DSxUS  DS    PSC   US
                                 State            Ver  Ver         OFDM  ID    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

Number of OFDMA Chans

Show Cable Modem Docsis Version Summary Total

Total D3.1 modems per MD

Total D3.1 modems per chassis

```
CBR8-01# show cable modem docsis verion 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              v1.1: 118    UB  : 116    WB:  116
                     v3.0: 95                           UP  : 0      WP:  0
                     v2.0: 2               v1.0: 0      ofdm: 7      NB:  2
                     v1.1: 0                            atdm: 111
                     v1.0: 0                            tdma: 0
-------------------------------------------------------------------------------------
```

1.d - Modem Verification

Show Cable Modem Verbose

Parameters	What to look for …
Modem Status	w-online(pt) Security=assign(tek)
Primary Channel(s)	SC-QAM + OFMDA
OFDM Profiles	In-use
	Downgrade
	Recommended
DOCSIS Versions	MAC Version 3.1
	Operational Version 3.1
	QoS Provisioned 1.1

```
cBR8-01# show cable modem 14b7.f80e.3ee4 verbose
Modem Status                          : {Modem= w-online(pt),
Security=assign(tek)}

MAC Address                           : 14b7.f80e.3ee4
IP Address                            : 13.41.0.41
IPv6 Address                          : ---

Dual IP                               : N
Prim Sid                              : 23
Host Interface                        : C2/0/1/UB
MD-DS-SG / MD-US-SG                   : 9 / 61
MD-CM-SG                              : 0x31093D
Primary Wideband Channel ID           : 8459 (Wi2/0/1:13)
Primary Downstream                    : In2/0/1:0 (RfId : 8448, SC-QAM)
Wideband Capable                      : Y
DS Tuner Capability                   : 32
Downstream Channel DCID RF Channel : 1     2/0/1:0 (SC-QAM)
Downstream Channel DCID RF Channel : 159   2/0/1:158 (OFDM)
Downstream OFDM DCID                  : 159
  Downstream OFDM Profile (config)      : 0 1 2 3
  Downstream OFDM Profile (REG-RSP-MP) : 0 1 2 3
  Downstream OFDM Profile (DBC-REQ)     : N/A
  Downstream OFDM Profile (in-use)      : 3  [4096-QAM]
  Downstream OFDM Profile (dwngrd)      : 2
  Downstream OFDM Profile (recomm)      : 3
  Downstream OFDM Profile (unfit)       : N/A
sysDescr                              : xxxx
Downstream Power                      : -0.30 dBmV (SNR = 47.60 dB)
MAC Version                           : DOC3.1
Operational Version                   : DOC3.1
QoS Provisioned Mode                  : DOC1.1
OFDM MRC Support                      : Max num of DS OFDM channels = 2
OFDMA MTC Support                     : Max num of US OFDMA channels = 2
```

1.d - D3.1 Verification

D3.1 All-Together

Modem Profile

```
cBR8-01# show cable modem 14b7.f80e.3ee4 verbose | inc OFDM
Downstream Channel DCID RF Channel : 159   2/0/1:158 (OFDM)
Downstream OFDM DCID               : 159
Downstream OFDM Profile (in-use)   : 3
Downstream OFDM Profile (dwngrd)   : 1
Downstream OFDM Profile (recomm)   : 3
Downstream OFDM Profile (unfit)    : N/A
OFDMA Profile in Use               : 13
```

OFDMA Profile and support

OFDM Profile

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	D1024	D1024
	D4096	D2048
		D4096

Controller

```
cBR8-01# show controller integrated-Cable 3/0/0 rf-ch 158
Chan State Admin Mod-Type  Start        Width      PLC          Profile-ID   dcid  power  output
                           Frequency
158   UP    UP   OFDM      777000000    96000000   826000000    100          159   40     NORMAL
```

Look for Up/Up

Described by ProfileID=100

Frequency, Width, Pilot

Modem Service Flow

```
cBR8-01# show cable modem 14b7.f80e.3ee4 service-flow ds
BPI DS Index: 33
Jib4DS Show BPI: [Bufsz 8000]: idx:33 [0x21] seq no: 0
AES
Said   :              1
Seq_No :              1
Key    : 254f9b4b511df36a dab7d52caf07fe80
SFID: 12  DS HW Flow Index: 2871 DSID: 393246
Valid          : TRUE
DSID           :       131102 [   0x2001e]
Priority       :            0
Bonding Group:           513 [     0x201]
Channel        :        65535 [    0xffff]
DS-EH          :            3 [       0x3]
Profile 1      :            3 [       0x3]
Profile 2      :            0 [         0]
```

1.d - Show Modem “select” Information

show cable modem select *sql-query*

```
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

show cable modem *[mac]* phy | include ofdma

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

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

2 - CMs Throughput Troubleshooting

Best Way To Troubleshoot Is

- 1. Look at overall interface numbers on cBR-8
  - rf-channel bandwidth sharing, DBS Vs Static
- 2. Per CM DS and US throughput verification

  2.a – Identify the subscriber's CM having a problem on DS/US (or in both direction)

  Perform throughput test

  Look at the real DS numbers on cBR-8

  Install a test CM at headend on same US/DS interface, if possible

  Perform FTP test from server behind cBR-8

  2.b – Verify US Throughput issues

  SID tracker verification for US throughput issues (In Appendix)

  Look at the real numbers on cBR-8
- 3. Configure DS Bonding Resiliency (In Appendix)
  - DS Bonding resiliency configuration and debugs

2.a - Per CM DS and US Throughput Verification

Show Commands to be Used

- **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
```

All SC-QAMs are up

OFDM is up too !!

2.a - DS Performance Verification

Wideband interface stats

```
cBR8-01#show int wideband-Cable 2/0/1:13
Wideband-Cable3/0/0:14 is up, line protocol is up
  Hardware is CMTS WB interface, address is 54a2.740d.e9cb (bia
54a2.740d.e9cb)
  MTU 1500 bytes, BW 1336000 Kbit/sec, DLY 1000 usec,
     reliability 255/255, txload 77/255, rxload 1/255
  Encapsulation MCNS, loopback not set
  Keepalive set (10 sec)
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output never, output hang neve
  Last clearing of "show interface" counters n
  Input queue: 0/375/0/0 (size/max/drops/fl      es); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 2262000 kilobits/sec
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 406891000 bits/sec, 50011 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignor
     11671790713 packets output, 113701867294 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Total BW and current load of WB interface
32+1 channels

No output drops

Current output rate

No Output Errors

2.a - D3.0 And D3.1 Channel Utilization

Primary channel SYNC and MAP verification

```
cBR8-01#show controllers integrated-Cable 2/0/1 counter ofdm-channel
Controller Chan# Profile/PLC              Packets                Bytes MaxRate     Rate       Utilization
                                                                        (Mbps)      (Mbps)     (%)
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
```

OFDM –Max and Current load on each channel

MAP/UCD/SYNC Generated by Cable line card

Packet Counter

Throughput Rate (~37.5 Max)

```
cBR8-01# show controllers integrated-Cable 2/0/1 counter rf-channel
Controller   RF     MPEG        MPEG         MPEG    Sync       MAP/UCD     User
             Chan   Packets     bps          Mbps    Packets    Packets     Mbps
                    Tx                               Tx         Tx
2/0/1        0      987308931   6931203      06.93   0          525995      06.20
2/0/1        1      900979271   6345766      06.34   0          525995      05.68
2/0/1        2      914382688   6443522      06.44   0          525995      05.76
2/0/1        3      984291945   6913607      06.91   0          525995      06.21
2/0/1        4      998100101   7010812      07.01   0          525995      06.30
2/0/1        5      913935967   6447382      06.44   0          525995      05.76
2/0/1        6      914746053   6436955      06.43   0          525995      05.78
2/0/1        7      981493724   6896462      06.89   0          525995      06.18
2/0/1        8      5928219913  34048422     34.04   105198435  2093325397  29.61
2/0/1        9      3751509182  31973723     31.97   0          525995      28.64
```

Current load on each SC-channel

2.a - DS Performance Verification

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

```
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           399996040

DOWNSTREAM SERVICE FLOW DETAIL:
SFID  Flg Policer              Scheduler            FrwdIF
          Xmits      Drops      Xmits      Drops
12        0          0          726        0         Wi2/0/1:13
UPSTREAM SERVICE FLOW DETAIL:
SFID  SID  Requests   Polls      Grants     Packets
11    1    1568323    0          1569045    1565745
```

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

Current DS throughput

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

US Requests for Grants US BW

2.b - Upstream Performance Verification

```
cBR8-01#show cable modem 14b7.f80e.3ee4
MAC Address     IP Address      I/F            MAC                Prim  RxPwr   Timing Num I
                                               State              Sid   (dBmv)  Offset CPE P
14b7.f80e.3ee4 13.41.0.34      C2/0/1/UB      w-online(pt)       7     0.00    2095   0   N
```

US Not in Partial-Service

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

For throughput >= 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

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

```
cBR8-01#show cable modem 14b7.f80e.3ee4 verbose
Partial-Mode Information            : reason 0x1  failed-tcs 0x2
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
Upstream Channel                    : US0         US1         US2         US3
Ranging Status                      : sta         sta         sta         sta
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
Good Codewords rx                   : 888920      852219      882345      855338
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

2.b - OFDMA Upstream D3.1 Modem Verification

OFDMA Verification per Modem

show cable modem *mac-address* **verbose**

Parameter	What to look for
Upstream Channel	**Sta** – for Ranging Status of OFDMA Channel
OFDMA Timing Offset	Stable
Phy Operating Mode	OFDMA
OFDMA Profile in Use	Valid OFDMA defined IUC

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

US Frequency Range Capability      : Extended (5-85 MHz)
Extended Upstream Transmit Power   : 0dB
Max CM Transmit Power (dBmV)       : 65.00
Neq 1.6MHz Transmit Channels       : 26
US Power Display Bandwidth Units   : 1.6 MHz
Max Transmit Channel Power (dBmV)  : 50.86
Multi-Transmit Channel Mode        : Y
Max US SC-QAMs Supported           : 8
Number of US in UBG                : 1
Minimum power load in DRW (dB)     : 16.25
Max Dynamic ranging window (dBmV)  : 34.50
Min Dynamic ranging window (dBmV)  : 22.50
Upstream Channel                   : US4
Ranging Status                     : sta
Upstream SNR (dB)                  : -----
Upstream Data SNR (dB)             : 42.04
Received Power (dBmV)              : 0.00
Data Burst resiliency suspended    : N
Reported Transmit Power (dBmV)     : 34.50
Commanded Transmit Power (dBmV)    : 34.50
Minimum Transmit Power (dBmV)      : 17.00
Power Load (dB)                    : 16.36
Timing Offset            (97.6 ns): 2207
OFDMA Timing Offset      (4.88 ns): 44144
Initial Timing Offset              : 2207
Phy Operating Mode                 : ofdma
OFDMA Profile in Use               : 13
```

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

2.b - 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
```

```
cBR8-01#sh cable admission-control int c2/0/1 up
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, Util 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 configure
```

UGS flow numbers

Two US SID Clusters

Per US sid numbers

NRTPS flow (Voice Signaling)numbers

2.b - Upstream Performance Verification

```
cBR8-01#sh int cable 2/0/1 mac-scheduler 1
DOCSIS 1.1 MAC scheduler for Cable2/0/1/U1 : rate 130720000
wfq:None
us_balance:ON
dpon_mode:OFF
fairness:OFF
Queue[Rng Polls] flows 0
Queue[CIR Grants] flows 0
Queue[BE(07) Grants] flows 0
Queue[BE(06) Grants] flows 0
<snip>
Queue[BE(00) Grants] flows 0
Req Slots 2056707696, Req/Data Slots 3567181
Init Mtn Slots 30204447, Stn Mtn Slots 68256
Short Grant Slots 0, Long Grant Slots 0
Adv Phy Short Grant Slots 159, Adv Phy Long Grant Slots 206682
Adv Phy UGS Grant Slots 220
Avg upstream channel utilization : 25%
Avg percent contention slots : 73%
Avg percent initial ranging slots : 1%
Avg percent minislots lost on late MAPs : 0%
MAP TSS: lch_state 10, init_retries 0
         late_initial_maps 0, late_ucd_maps 0
         mac-phy tss errors 0, missed ccc 0
```

```
cBR8-01#sh int cable 2/0/1 up bonding-
group
Cable2/0/1: Upstream Bonding Group 1
243836 packets input, 88930550 octets
input
Segments: 237793 valid, 0 discarded, 0
lost
Reserved Bandwidth Max : 0 bits/sec
Reserved Bandwidth     : 0 bits/sec
Available Bandwidth    : 122880000
bits/sec
     Total Service Flows On This Bondir
Group: 116
```

Bonding Group BW Stats

No Lost Segments

US channel utilization

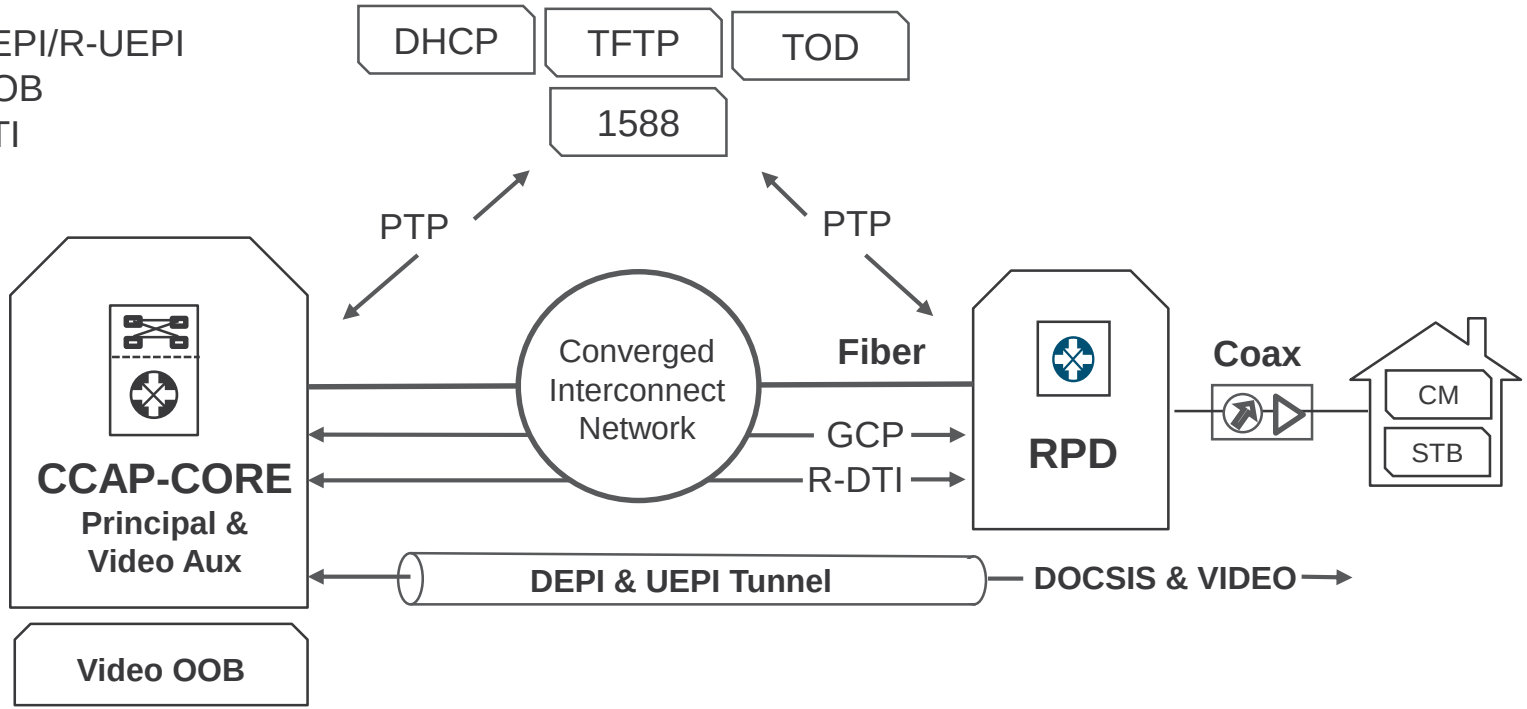
Troubleshooting cBR-8 Remote PHY Services

Remote PHY Troubleshooting Agenda

- Architecture
- Configuration
- Remote PHY Device
- PTP / Precision Timing Protocol
- GCP / Generic Control Protocol
- L2TP / DEPI and UEPI
- Video

Architecture Overview

- Complies with CableLabs' MHAv2 standards:
  - GCP
  - R-DEPI/R-UEPI
  - R-OOB
  - R-DTI



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

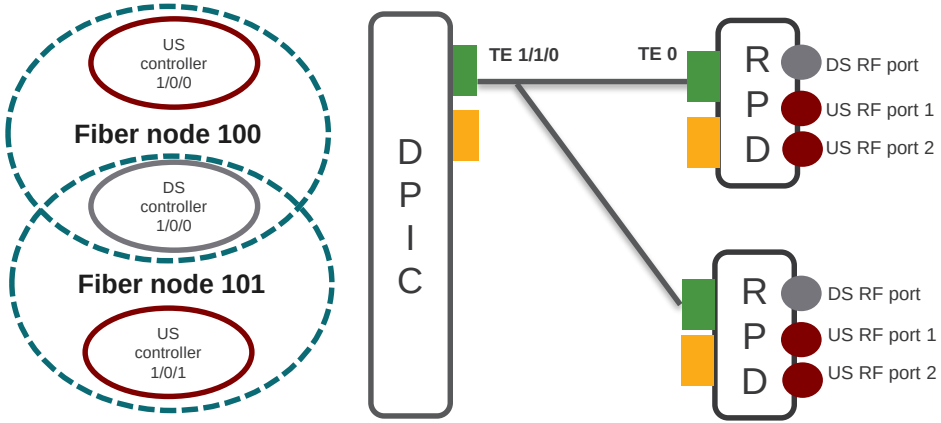
IOS-XE Software	Feature
16.5 Everest & Later	R-PHY Support
16.5(1r)S	SUP ROMMON
2011.03.18	Cable Linecard ROMMON

```
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
```

2 Configuration Reference




```
cable rpd NODE1-RTP
 identifier aaaa.aaaa.aa01
 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

cable rpd NODE2-RTP
 identifier aaaa.aaaa.aa02
 core-interface Te1/1/0
  principal
  rpd-ds 0 downstream-cable 1/0/0 profile 30
  rpd-us 0 upstream-cable 1/0/1 profile 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
```

```
cable downstream controller-profile 30
rf-chan 0 31
  type DOCSIS
  frequency 405000000
  rf-output NORMAL
  qam-profile 1
  docsis-channel-id 1
rf-chan 32 39
  type VIDEO SYNC
  frequency 603000000
  rf-output NORMAL
  qam-profile 5
```

```
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 modulation-profile 224
 no us-channel 3 shutdown
```

```
interface Wideband-Cable1/0/0:0
  cable bundle 1
 cable rf-channels channel-list 0-31 bandwidth-percent 1
```

3a DS and US Controllers

- **cable downstream controller-profile** *number*
- **cable upstream controller-profile** *number*

Downstream Profile
Multicast Pool (Optional)
RF Channel Range
Type
Frequency
RF-Output
QAM Profile
Shutdown
Cable DEPI Multicast pool *id*
Power Profile (future release)

```
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 (recommend leave default)
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
```

3d Downstream Controller Profiles

- **show cable downstream controller-profile** *number*

Parameter	What to look for …
Being Used By	**Expected Controllers**
Admin State	**UP**
OFDM Spectrum	1 or more if doing OFDM D3.1
Max Carrier	AS expected / Affects power
DS Splitting	Yes: if Overlay & Mcast
Multicast Pool ID	ID: if Overlay & Mcast
OFDM Exclusion Band	As configured
Configured Channels	As configured
Admin	**UP**
Frequency	As configured
Type	DOCSIS
	VIDEO SYNC or ASYNC
Annex/Mod/Profile	B / 256

```
cBR8-01# show cable downstream controller-profile 30
Downstream controller-profile 30 is being used by controller Downstream-Cable:
  1/0/0, 1/0/5, 2/0/0, 2/0/5
  Admin:  UP
  MaxOfdmSpectrum: 0
  MaxCarrier: 158
  Mode: normal
  Frequency profile: unconfigured
  DS Splitting: Yes
  Multicast Pool ID: 1
  OFDM frequency exclusion bands: None

Configured RF Channels:
Chan Admin Frequency  Type       Annex Mod  srate Qam-profile  dcid  output
 0    UP   405000000  DOCSIS      B    256   5361  1           1     NORMAL
 1    UP   411000000  DOCSIS      B    256   5361  1           2     NORMAL
…
 31   UP   591000000  DOCSIS      B    256   5361  1           32    NORMAL
…
 39   UP   639000000  VIDEO-SYNC  B    256   5361  5           -     NORMAL
```

3d Upstream Controller Profiles

- **show cable upstream controller-profile** *number*

Parameter	What to look for …
Being Used By	**Expected range of controllers**
OFDMA Exclusion Unused	Exclusion = No D3.1 Carrier
	Unused = Still send pilots
Upstream Channel	For each upstream channel
Channel Width	As configured
DOCSIS Mode	As configured, (Mix-Mode, ATDMA, or OFDMA)
Frequency	As configured
Modulation Profile	As configured
Shutdown	**False**

```
cBR8-01# show cable upstream controller-profile 1
Upstream controller-profile 1 is being used by controller Upstream-
Cable:
1/0/5,  1/0/0,  1/0/1
  Controller Upstream-Cable
    def-phy-burst                  : 0
    ofdma-frequency-exclusion-band :
    ofdma-frequency-unused-band    :
    spectrum-group                 :
  Upstream-channel 0
    chan-class-id                  : 0x0
    channel-width                  : 6400000 6400000
    docsis-mode                    : atdma
    equalization-coefficient       : TRUE
    frequency                      : 17500000
    hop-priority                   : frequency modulation channel-wide
    maintain-psd                   : OFF
    max-logical-chans              : 1
    minislot-size                  : 2
    modulation-profile             : 224
    power-level                    : 0
    rng-holdoff                    : 0x0
    shutdown                       : FALSE
    specsvl error-adaptive-profile : 1
    spectrum-group                 :
    threshold cnr-profiles         : 25 13
```

Remote PHY Device

1. RPD State Validation from cBR-8
2. RPD Provisioning Process
3. RPD Event Logging from cBR-8
4. RPD Validation
   a. Access
   b. TOD, Dot1x, DHCP on RPD
5. RPD CM and MAC-Domain associations from cBR-8
   a. MD Association
   b. Cable Modem Association

1 RPD State Validation from cBR-8

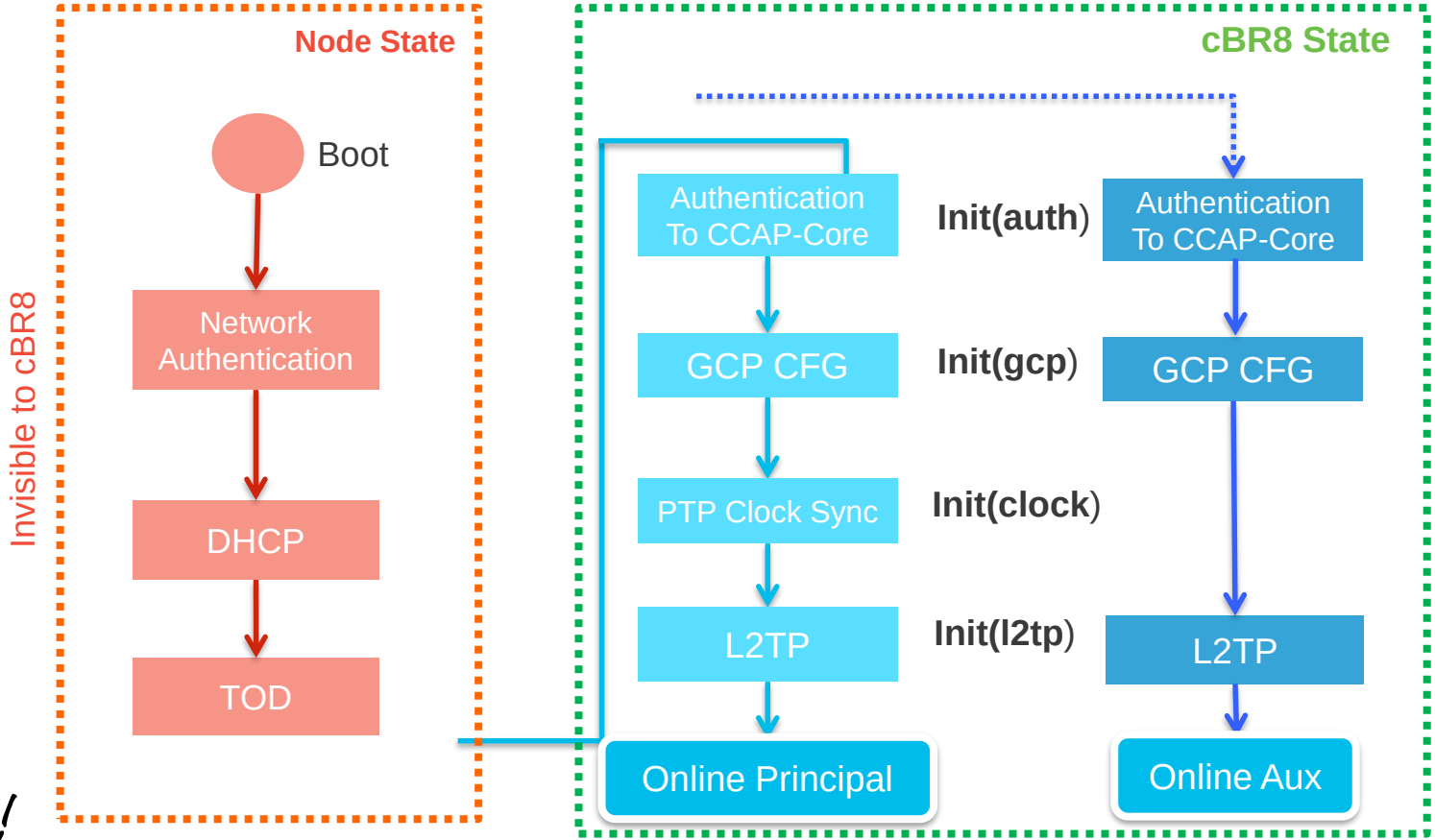
- **show cable rpd**

Parameter	What to look for…
RPD even present?	*Check RPD: DHCP, Dot1x, TOD*
MAC Address	**RPD's MAC Address**
IP Address	RPD's DHCP Assigned IP
Interface	DPIC Tengig link
State	**Online**
	Init (Auth, GCP, Clock, L2TP)
	Offline
Role	**Pri – Principal / One per RPD**
	Aux – Auxiliary: Video, DS Split, OOB
High Availability	Act – Active
	Sby – Standby (lcha-cores)
Name	Configured name

```
cBR8-01# show cable rpd
MAC Address     IP Address       I/F       State   Role HA  Name
0004.9f33.0449  13.52.0.3        Te1/1/0   online  Pri  Act P2Shelf_RTP
0004.9f33.0449  13.52.0.3        Te1/1/6   online  Aux  Act P2Shelf_RTP
badb.ad13.1452  13.52.0.19       Te1/1/0   online  Pri  Act GS7K_RTP
badb.ad13.1452  13.52.0.19       Te1/1/6   online  Aux  Act GS7K_RTP
badb.ad13.1476  10.90.148.232    Te1/1/2   online  Pri  Act GS7K-LWR
```

```
cBR8-01# show cable rpd lcha-cores
MAC Address     IP Address       I/F       State  Role HA  Name
0004.9f33.0449  13.52.0.3        Te0/1/0   online NA   Sby P2Shelf_RTP
0004.9f33.0449  13.52.0.3        Te1/1/0   online Pri  Act P2Shelf_RTP
0004.9f33.0449  13.52.0.3        Te0/1/6   online NA   Sby P2Shelf_RTP
0004.9f33.0449  13.52.0.3        Te1/1/6   online Aux  Act P2Shelf_RTP
badb.ad13.1452  13.52.0.19       Te0/1/0   online NA   Sby GS7K_RTP
badb.ad13.1452  13.52.0.19       Te1/1/0   online Pri  Act GS7K_RTP
badb.ad13.1452  13.52.0.19       Te0/1/6   online NA   Sby GS7K_RTP
badb.ad13.1452  13.52.0.19       Te1/1/6   online Aux  Act GS7K_RTP
badb.ad13.1476  10.90.148.232    Te0/1/2   online NA   Sby GS7K-LWR
badb.ad13.1476  10.90.148.232    Te1/1/2   online Pri  Act GS7K-LWR
```

2 RPD Provisioning Process



3 RPD Event Logging from cBR-8

- **show cable rpd** *mac-address* **tengig** *slot/subslot/0* **log**
- **show cable rpd** *mac-address* **event**

	RPD States
1	Offline
2	Init(auth)
3	Init(gcp)
4	Init(clksync)
5	Init(l2tp)
6	Online

```
cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 log
RPD ID           I/F        Severity  Time                    LOG INFORMATION
---------------- ---------- -------- ----------------------  ----------------------------------------
badb.ad13.1452   Te1/1/0    DEBUG    13:04:43.869  RPD badb.ad13.1452 CoreTe 1/1/0 change MASTER STATE from offline to init(auth)
badb.ad13.1452   Te1/1/0    DEBUG    13:04:43.869  RPD badb.ad13.1452 CoreTe 1/1/0 change MASTER STATE from init(auth) to init(gcp)
badb.ad13.1452   Te1/1/0    DEBUG    13:04:43.869  RPD badb.ad13.1452 CoreTe 1/1/0 change GCP STATE from offline to init
badb.ad13.1452   Te1/1/0    DEBUG    13:04:43.950  RPD badb.ad13.1452 CoreTe 1/1/0 change GCP STATE from init to nego
badb.ad13.1452   Te1/1/0    DEBUG    13:04:43.972  RPD badb.ad13.1452 CoreTe 1/1/0 change GCP STATE from nego to nego
badb.ad13.1452   Te1/1/0    DEBUG    13:04:43.973  RPD badb.ad13.1452 CoreTe 1/1/0 change GCP STATE from nego to bulksync_cfg
badb.ad13.1452   Te1/1/0    DEBUG    13:04:45.159  RPD badb.ad13.1452 CoreTe 1/1/0 change GCP STATE from bulksync_cfg to ready
badb.ad13.1452   Te1/1/0    DEBUG    13:04:45.159  RPD badb.ad13.1452 CoreTe 1/1/0 change MASTER STATE from init(gcp) to init(clksync)
badb.ad13.1452   Te1/1/0    DEBUG    13:08:14.329  RPD badb.ad13.1452 CoreTe 1/1/0 change MASTER STATE from init(clksync) to
init(l2tp)
badb.ad13.1452   Te1/1/0    DEBUG    13:08:15.810  RPD badb.ad13.1452 CoreTe 1/1/0 change MASTER STATE from init(l2tp) to online
```

```
cBR8-01# show cable rpd badb.ad13.1452 event
RPD              EventId Level Count LastTime       Message
badb.ad13.1452   66070204 Error  1 May17 15:35:47 GCP Connection Failure CCAP-IP=13.13.0.218;RPD-ID=badb.ad13.1452;
badb.ad13.1452 2148074241 Error  1 May17 15:35:48 Session failed:closed by core side, @SLAVE: 13.52.0.19:None --> 13.13.0.218:8190;RPD-
ID=badb.ad13.1452;
badb.ad13.1452   66070204 Error  1 May17 15:35:49 GCP Connection Failure CCAP-IP=13.13.0.218;RPD-ID=badb.ad13.1452;
```

4a RPD Mac-Domain Association

- **show cable rpd** *mac-address* **md-association**
- **show controller downstream-cable** *slot/sub/port* **rf-channel** *group-list*
- **show cable modem** *mac* **verbose | inc RP**

```
cBR8-01# show cable rpd badb.ad13.1452 md-association
RPD ID: badb.ad13.1452
RPD Principal Core Te1/1/0:
  DS 0 controller: 1/0/0  (profile 30, DOCSIS + VIDEO)
  US 0 controller: 1/0/0  (profile 1, DOCSIS)
  US 1 controller: NA
  Mac Domain: Ca1/0/0
RPD Auxiliary Core Te1/1/6:
  DS 0 controller: 1/0/31 (profile 40, VIDEO)
  US 0 controller: NA
  US 1 controller: NA
  Mac Domain: NA
```

Parameter	What to look for…
Principal Core	Correct TenGig
DS Controller	Expected controller
	Expected profile ID
	Type(s)
US Controller	(same)
MAC Domain	Expected Cable Intf
Auxiliary Core	US : NA, MAC-Domain: NA

```
cBR8-01# show controller downstream-Cable 1/0/0 rf-channel 0-63
Chan State Admin Frequency  Type        Annex Mod  srate Interleaver  dcid  output
 0    UP    UP   405000000  DOCSIS       B    256   5361  I32-J4       1    NORMAL
 30   UP    UP   585000000  DOCSIS       B    256   5361  I32-J4       31   NORMAL
 31   UP    UP   591000000  DOCSIS       B    256   5361  I32-J4       32   NORMAL
 32   UP    UP   603000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
 39   UP    UP   645000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
```

```
cBR8-01# show controller downstream-Cable 1/0/31 rf-channel 0-63
Chan State Admin Frequency  Type        Annex Mod  srate Interleaver  dcid  output
 40   UP    UP   597000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
 41   UP    UP   651000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
 47   UP    UP   687000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
```

```
cBR8-01# scm 1457.ab13.fbbe verbose | i RP
RPD ID                                : badb.ad13.1452
```

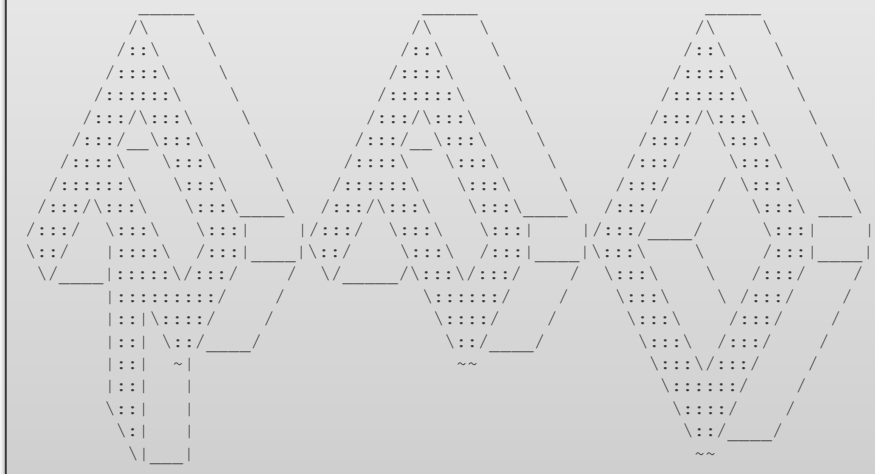
5a RPD Access

- 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	616161

```
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**

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

```
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
```

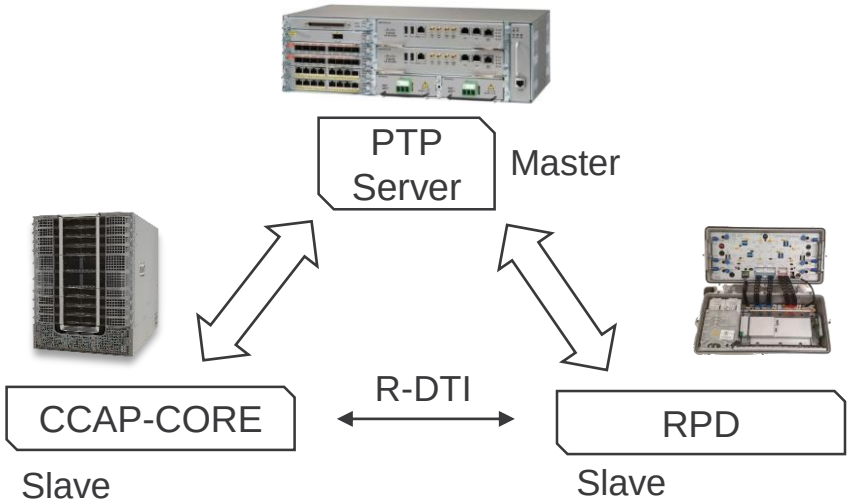
Precision Timing Protocol & GCP

1. Overview PTP
2. Configuration of PTP
3. PTP Validation on cBR-8
4. PTP Validation on RPD
5. Overview GCP
6. GCP Validation on cBR-8

1 Precision Timing Protocol Overview

- Provides timing sync between CCAP-CORE and RPD
- PTP implements IEEE1588
- No need for DTI server next to device

Checklist	What to look for …
IP Connectivity	PTP Master to CCAP-CORE
	PTP Master to RPD
	RPD and CCAP-CORE
Configuration	R-DTI Configurations on cBR8
	RPD should obtain PTP parameters from cBR8
	Only one Ordinary Domain



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
```

3 Validate Clock on cBR-8

- **show ptp clock running [domain 0]**

Parameter	What to look for …
Clock State	PHASE_ALIGNED
Role	Slave
Port State	Listening
PTP Master	As configured (not alternate)
Packets In & Out	Incrementing
Errors In & Out	Stable or 0

```
cBR8-01# show ptp clock running domain 0

                    PTP Ordinary Clock [Domain 0]
        State          Ports          Pkts sent      Pkts rcvd      Redundancy Mode
        PHASE_ALIGNED  1              35884823       108757275      Hot standby

PORT SUMMARY

                                                                    PTP Master
Name           Tx Mode      Role     Transport    State          Sessions  Port Addr
slave-from-903 unicast      slave    Lo0          Listening      1         10.225.197.254

                              SESSION INFORMATION
slave-from-903 [Lo0] [Sessions 1]
 Peer addr          Pkts in     Pkts out    In Errs     Out Errs
 10.225.197.254     108760134   35885432    0           0
```

```
...
                              SESSION INFORMATION
slave-from-903 [Lo0] [Sessions 1]
 Peer addr          Pkts in     Pkts out    In Errs     Out Errs
 10.225.197.254     1087601855  35885783    0           0
```

	Clock States
1	Free Run
2	Acquiring
3	Frequency Lock
4	**Phase Aligned**

Network Issues → Holdover

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

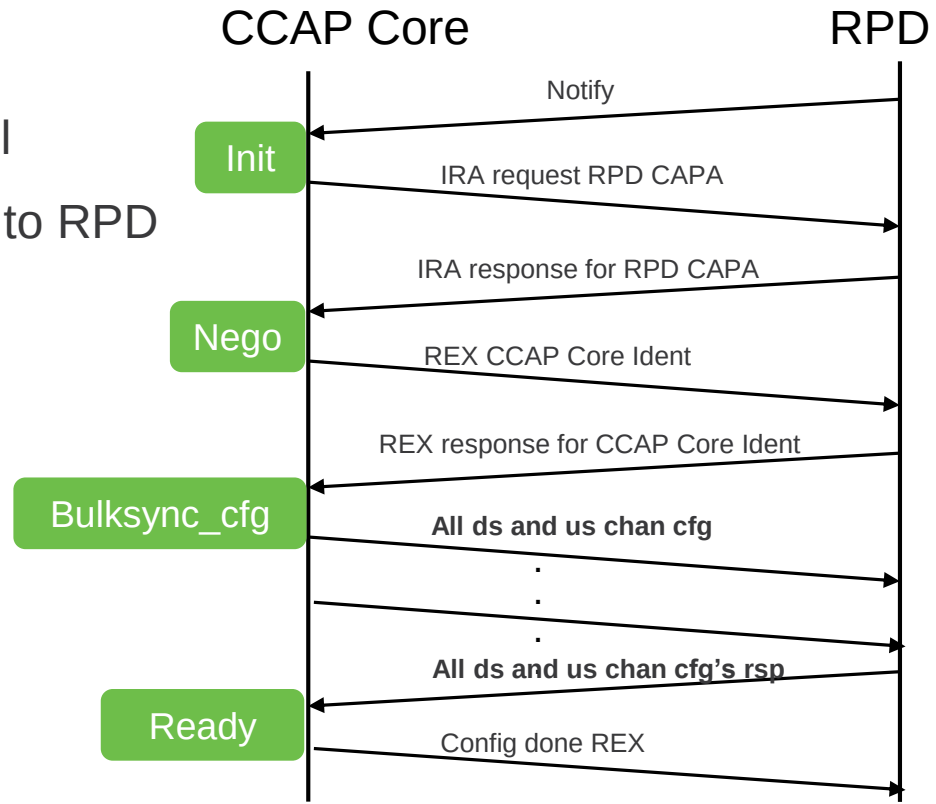
```
R-PHY# show ptp clock 0 state
apr state        : PHASE_LOCK
clock state      : SUB_SYNC
current tod      : 3595870       Wed Feb 11 14:51:10 1970
active stream    : 0
==stream    0    :
  port id        :                  0
  master ip      :    10.225.197.254
  stream state   :        PHASE_LOCK
  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
```

5 GCP Overview

- Generic Control Plane Protocol
- RCP Remote PHY Control Protocol
- Used to send/update configuration to RPD
- Used to report events from RPD

	GCP Negotiation Kickoff
1	cBR-8 configured with RPD Identifier
2	RPD knows CCAP-CORE IP from DHCP
3	cBR8 Receives Notify Msg from RPD

	Conditions to trigger GCP Message
1	DS/US Controller Profile Change
2	Add DS/US Controller
3	Delete DS/US Controller
4	clear cable rpd mac reset
5	Remove RPD – “no cable rpd”



6 Validate GCP Sessions on cBR-8

- **show cable rpd** *mac-address* **tengig** *slot/subslot/0* **{ gcp-state | gcp-session | gcp-transaction }**

Parameter	What to look for…
State	Ready
	Init / Nego / bulkcfg_sync
RPD Address	RPD IP
Session State	Active
Packet Statistics	RX and TX incrementing
	RX and TX dropped holding
Message Statistics	RX and TX incrementing

	State
1	Init
2	Nego
3	Bulk_sync
4	**Ready**

```
cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 gcp-state
MAC Address     IP Address       I/F       State        Role HA  Name
badb.ad13.1452  13.52.0.19       Te1/1/0   ready        Pri  Act GS7K_RTP
```

```
cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 gcp-session
GCP Session ID : 12
Core Address   : 13.13.0.226:8190
RPD Address    : 13.52.0.19:56322
Next Hop MAC   : 008A.962F.C028
Session State  : Active
Packet Statistics:
========================
Rx          : 37666
Tx          : 37275
Rx Dropped : 0
Tx Dropped : 0
Message Statistics:
========================
Rx          : 43468
Tx          : 43088
```

```
cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 gcp-transaction
RPD ID           I/F        TRANS ID   GCP MSG TYPE             RCP MSG TYPE   TIMESTAMP
---------------- ---------- ---------- ------------------------ -------------- ------------------------
badb.ad13.1452   Te1/1/0    25586      GCP_MSG_ID_EDS_RSP       TYPE_REX       2017-05-30 17:01:55.327
badb.ad13.1452   Te1/1/0    25586      GCP_MSG_ID_EDS           TYPE_REX       2017-05-30 17:01:55.305
badb.ad13.1452   Te1/1/0    25585      GCP_MSG_ID_EDS_RSP       TYPE_REX       2017-05-30 17:01:54.926
badb.ad13.1452   Te1/1/0    25585      GCP_MSG_ID_EDS           TYPE_REX       2017-05-30 17:01:54.905
…
```

L2TP DEPI and UEPI

- Validate DEPI & UEPI on cBR-8
- Validate DEPI & UEPI on RPD

57 = 40 DS SC-QAM + 1 OFDM + (4 x 4 US SC-QAM)

Validating DEPI and UEPI on cBR-8

- **show cable rpd** *mac-address* **tengig** *slot/subslot/0* **depi [tunnel | session]**

Parameter	What to look for …
State	**Est - Established**
	Error State Tunnel – wscc(rp/rq)
Remote	Device - Matches MAC of RPD
	IP – Matches IP of RPD
Session Count	Sum DS Channels
	Sum USx4 Channels
Pseudowire	Downstream or Upstream + Ctrlr + Ch
	M - MAP / **D**- DATA / **R** – RngReq / **S** - SpecMgmt
Last Change	Not recent
Type	P – Primary
Mode	PSP for DOCSIS
	MPT for Video
Remote State	UP

```
cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 depi tunnel
LocTunID   RemTunID   Remote Device  State  Remote Address  Sessn L2TP Class
                                                           Count
338004174  4141291000 badb.ad13.1452 est    13.52.0.19      57    rphy-l2tp-gl...


cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 depi session
LocID      RemID      Pseudowire      State  Last Chg Uniq ID    Type Mode RemSt
0x00012027 0x80002028 DS1/0/0:38      est    04:46:15 698         P    MPT  UP
0x0001200B 0x8000200C DS1/0/0:10      est    04:46:15 944         P    PSP  UP
0x00012008 0x80002009 DS1/0/0:7       est    04:46:15 692         P    PSP  UP
0x41040014 0x00000B01 US1/0/0:1(R)    est    04:46:15 977         P    PSP  UP
0x00012002 0x80002003 DS1/0/0:1       est    04:46:15 738         P    PSP  UP
0x41040010 0x00000B00 US1/0/0:0(R)    est    04:46:15 703         P    PSP  UP
0x41000014 0x00000D01 US1/0/0:1(M)    est    04:46:15 705         P    PSP  UP
0x00012021 0x80002022 DS1/0/0:32      est    04:46:15 966         P    MPT  UP
0x0001201F 0x80002020 DS1/0/0:30      est    04:46:15 964         P    PSP  UP
```

Type	
MPT	DOCSIS MPEG Transport for Video
PSP	Multichannel Packet Stream Protocol for Downstream
	Legacy Packet Stream Protocol for Upstream

Validating DEPI and UEPI on cBR-8

- **show controller downstream-cable** *slot/sub/port* **counter rf-channel**

Parameter	What to look for…
User Mbps	Non-zero
MAP/UCD	Incrementing on Primary DS
Packets TX	Incrementing between caps

Sync = 0

RPD generates SYNC

```
cBR8-01# show controller downstream-Cable 1/0/0 count rf-channel

Controller  RF    RF          MPEG/DEPI     MPEG/DEPI     MPEG/DEPI      MPEG/DEPI    MPEG/DEPI   Sync       MAP/UCD    User
            Chan  chan        Packets       pps           bytes          bps          Mbps        Packets    Packets    Mbps
                  type        Tx                                                                  Tx         Tx
1/0/0       0     DOCSIS      391416788     3943          30514019112    2528233      02.52       0          391451923  00.00
1/0/0       1     DOCSIS      391410058     3942          30513032210    2528870      02.52       0          391123398  00.00
1/0/0       2     DOCSIS      74635         0             3121762        152          00.00       0          4          00.00
1/0/0       3     DOCSIS      75272         0             3192293        182          00.00       0          4          00.00
1/0/0       4                                             30514290014    2527130      02.52       0          391349092  00.00
1/0/0       5                                             30511172180    2529344      02.52       0          391123369  00.00
1/0/0       6     DOCSIS      74771         0             3135486        213          00.00       0          4          00.00
1/0/0       7     DOCSIS      75234         0             3186646        182          00.00       0          4          00.00
1/0/0       8     DOCSIS      398144928     3943          30511174512    2524532      02.52       0          381771208  00.00
1/0/0       9     DOCSIS      391343421     3942          30504926256    2529289      02.52       0          391121339  00.00
1/0/0       10    DOCSIS      76681         0             3352010        243          00.00       0          4          00.00
...
1/0/0       31    DOCSIS      72761         0             2902421        152          00.00       0          4          00.00
1/0/0       32    VIDEO-SYNC  1772740011    12182         333275122068   18323090     18.32       0          0          17.73
1/0/0       33    VIDEO-SYNC  2601958       18            489168104      27072        00.02       0          0          00.02
1/0/0       34    VIDEO-SYNC  26            18            489168104      27072        00.02       0          0          00.02
```

Primary DS C1/0/0 & C1/0/1

Video QAMs

Validating DEPI and UEPI on cBR-8

- **show controller downstream-cable** *slot/sub/port* **counter rf-channel verbose**

High	Medium	Low
MAPs and UCDs	MDD, high QoS Data	Low / BE QoS Data

Parameter	What to look for…
PPS (Pkt Per Sec)	Non-zero
Bytes	Incrementing, multiple
BPS (Bits per Sec)	Non-zero

```
cBR8-01# show controller downstream-Cable 1/0/0 counter rf-channel verbose

RF   High         High       High         High       Medium     Medium     Medium     Medium     Low        Low        Low          Low
chan Packets      pps        bytes        bps        Packets    pps        bytes      bps        Packets    pps        bytes        bps
0    1682045979   1971       128491847339 1257896    892038     1          489543751  4681       625604     0          124797012    1410
1    1699535710   1971       130525002317 1258805    1737176    1          623996566  5519       845811     0          160094847    1430
2    38           0          1292         0          852472     1          28984048   272        74026      0          8731859      0
3    38           0          1292         0          852472     1          28984048   272        83298      0          9893055      0
4    1682045492   1971       128490463417 1257938    877206     1          487481301  4560       616505     0          123892697    1410
5    1699571182   1971       130522511074 1258833    1338986    1          560960898  5052       685610     0          133211246    1503
6    38           0          1292         0          852472     1          28984048   272        74207      0          8751277      0
7    38           0          1292         0          852472     1          28984048   272        84024      0          9893302      0
8    1682025474   1971       128491265095 1257938    885800     1          488508395  4560       591732     0          120329224    1410
9    1699506654   1971       130521059945 1258846    1185741    1          540746066  4912       609931     0          125831865    1410
10   38           0          1292         0          852472     1          28984048   272        17310      0          1980114      0
...

31   38           0          1292         0          852686     1          28991324   272        5449       0          614312       0
32   0            0          0            0          0          0          0          0          9889083384 12312      1859147675440 18518482
33   0            0          0            0          0          0          0          0          14866437   18         2794890156   27073
34   0            0          0            0          0          0          0          0          14866437   18         2794890156   27073
...
```

Validating DEPI & UEPI on RPD

- **show l2tp tunnel**
- **show l2tp session**

Parameter	What to look for…
Remote Name	cBR-8 Hostname
State	Est - Established
Local Address	RPD IP
Session Count	1x per DS, 4x per US

	Did you know…
DEPI	One PW for all MMM, Data, etc
UEPI	Every MAP Duplicated
	Four PW per US

CR	Msg	What does it mean…
→	SCCRQ	Start Control Channel Request
←	SCCRP	Start Control Channel Response
→	SCCCN	Start Control Channel Connected
	StopCCN	Used to initiate tunnel teardown
→	ICRQ	Incoming Call Request
←	ICRP	Incoming Call Reply
→	ICCN	Incoming Call Connected
	CDN	Used to initiate tunnel teardown

```
R-PHY# show l2tp tunnel
L2TP Tunnel Information Total tunnels 4 sessions 130
LocTunID   RemTunID   Remote Name State Remote Address   Local Address    Sessn
                                                                          Count
2884801b   56219e89   F241-36-05-cBR8-01 est   13.13.0.222      13.52.0.19       8
f6d715f8   142588ce   F241-36-05-cBR8-01 est   13.13.0.226      13.52.0.19       57
cb0f343e   961d6029   F241-36-05-cBR8-01 est   13.13.0.218      13.52.0.19       8
653234e3   409793d1   F241-36-05-cBR8-01 est   13.13.0.198      13.52.0.19       57
```

```
R-PHY# show l2tp session
L2TP Tunnel Information Total tunnels 4 sessions 130
LocSessID RemSessID LocTunID  RemTunID  State Type       Last Chg
80002029  20012028  653234e3  409793d1  est   MPT_LEGACY 12:59:21 2017-05-17
00000d01  61000014  653234e3  409793d1  est   MAP_SCQ    12:59:23 2017-05-17
80002002  20012001  653234e3  409793d1  est   PSP_DEPI   12:59:23 2017-05-17
00000800  61020000  653234e3  409793d1  est   BW_SCQAM   12:59:21 2017-05-17
00000d03  6100001c  653234e3  409793d1  est   MAP_SCQ    12:59:21 2017-05-17
00000603  6101001c  653234e3  409793d1  est   UEPI_SCQAM 12:59:19 2017-05-17
80002005  20012004  653234e3  409793d1  est   PSP_DEPI   12:59:23 2017-05-17
00000b01  61040014  653234e3  409793d1  est   RNG_SCQ    12:59:23 2017-05-17
00000f00  61080010  653234e3  409793d1  est   SPECMAN    12:59:23 2017-05-17
```

Video Auxiliary Core

1. Video Validation in RPHY
   a. Validate Video channel status
   b. Validate Video throughput in RPD

1a Validating video status

- **show controller downstream-cable** *slot/sub/port* **rf-channel** *range*
- **show cable rpd** *rpd-mac* **tengig** *slot/sub/port* **depi session**
- **(RPD) show l2tp session**

Parameter	What to look for…
State Admin State	UP UP
Type	VIDEO-SYNC
Phy Parameters	Annex, Mod, Interleave as expected
Tunnel / Session State	Est - Established
DEPI Mode	MPT MPT_Legacy

```
cBR8-01# show controller downstream-Cable 1/0/0 rf-channel 0-63
Chan State Admin Frequency  Type        Annex Mod  srate Interleaver  dcid  output
...
 32    UP   UP   603000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
 39    UP   UP   645000000  VIDEO-SYNC   B    256   5361  I128-J1      -    NORMAL
```

```
cBR8-01# show cable rpd badb.ad13.1452 ten1/1/0 depi session
LocID      RemID      Pseudowire      State  Last Chg Uniq ID    Type Mode RemSt
0x00012027 0x80002028 DS1/0/0:38      est    04:46:15 698        P    MPT  UP
0x00012021 0x80002022 DS1/0/0:32      est    04:46:15 966        P    MPT  UP
...
```

```
R-PHY# show l2tp sess
L2TP Tunnel Information Total tunnels 4 sessions 132
LocSessID RemSessID LocTunID  RemTunID  State Type       Last Chg
80003f2a  20013f29  98e249ee  38450fe8  est   MPT_LEGACY 13:00:03 2017-05-17
80003f2b  20013f2a  98e249ee  38450fe8  est   MPT_LEGACY 13:00:03 2017-05-17
...
```

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
```

Tx Rx clears on multiple show

```
R-PHY# show downstream channel counter tpmi
Level     Rx-pkts    Rx-sum-pkts
Node Rcv  182177630  182177630
Depi 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
```

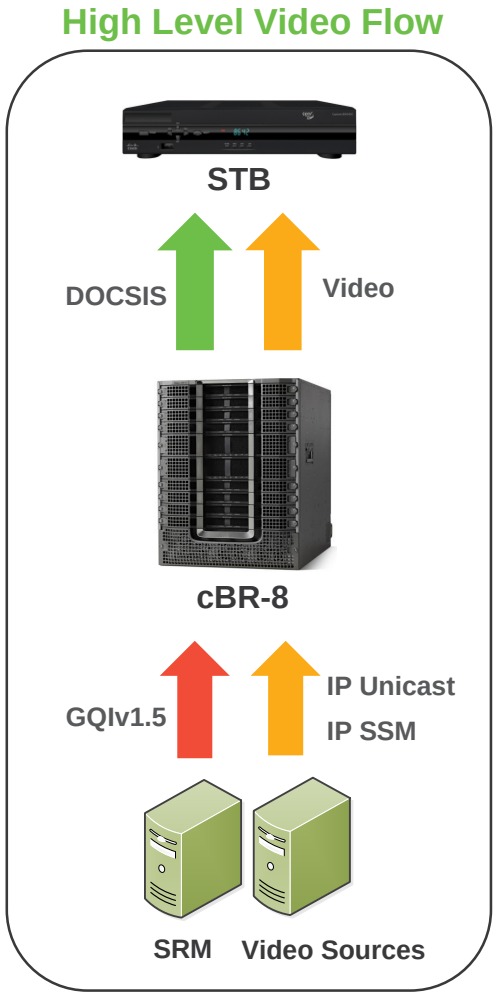
```
R-PHY# show downstream channel count dpmi
Field        Pkts       Sum-pkts
Dpmi Ingress 2203906685 2203906685
Pkt Delete   0          0
Data Len Err 0          0
Chan Flow_id Octs       Sum-octs   SeqErr-pkts SeqErr-sum-
pkts
47   0       3887236816 3887236816 5           5
47   1       0          0          0           0
47   2       0          0          0           0
47   3       0          0          0           0
```

Troubleshooting cBR-8 Converged Video Services

Video Services Troubleshooting

Common Problems

- 1. No Video
  - Video Configurations
  - Session Verifications
  - ADSG Configurations (reference)
- 2. Macro-blocking or Impaired Video
  - Throughput Rates
  - Dropped Packets
  - Reserved Session Rates



Video Services Configuration

cBR-8 Configuration Overview

- Logical Edge Device **LED**
- Virtual Carrier Group **VCG**
- Service Distribution Group **SDG**
- Binding VCG and SDG
- Interface Virtual Port Group **VPG**
- Subnet for Virtual Edge Input **VEI**
- Controller for Video QAMs
- IP Subnets for VPG and VEI(s)
- Chassis MAC Address
- Access-list(s) and Route-Map(s)

Checklist

Best Practices
- One LED Per Cable Line Card
- Unique Output Port Numbers for each LEDs and VCGs
- Uniform binding of VCGs and SDGs
- Uniform naming conventions
- Loopback for Management Interface(s)
- Separate Subnets of Virtual-Port Group and VEI

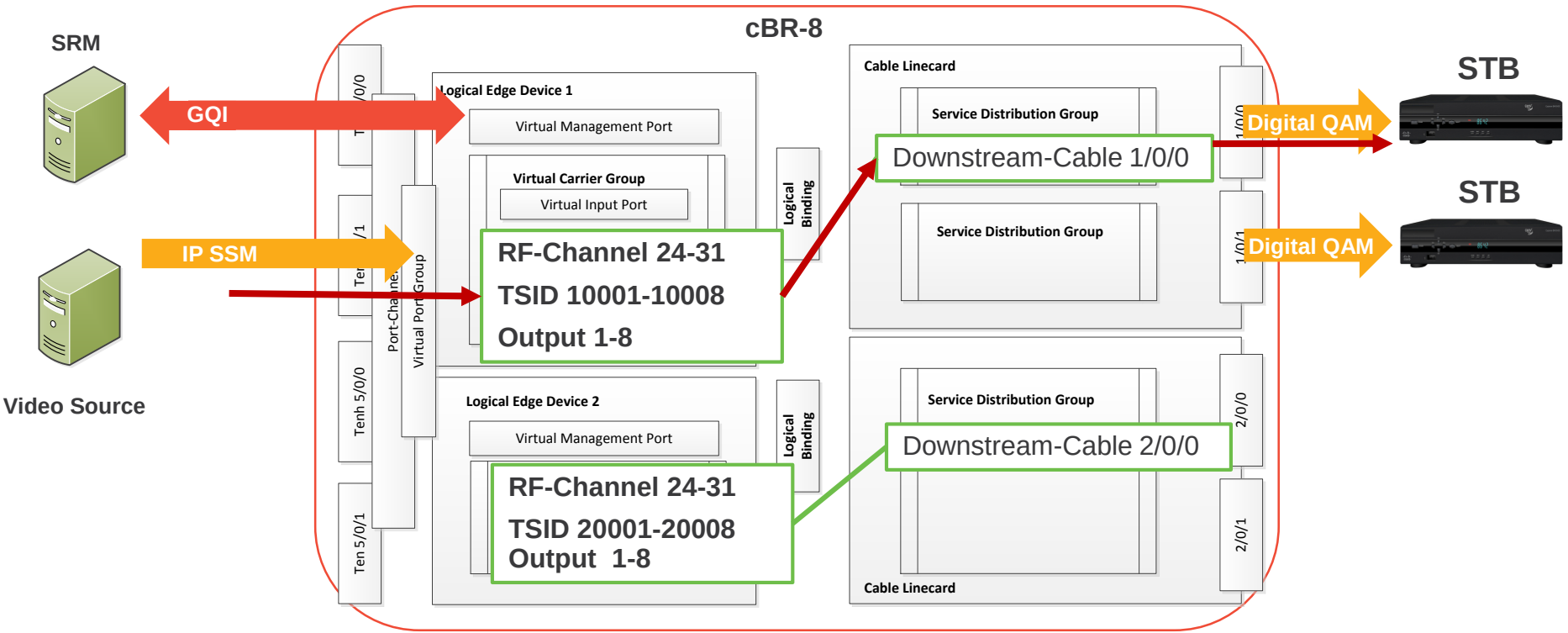
IP Subnets Required
- Bundle – CPE / STB subnets
- Virtual Port Group 0 – Management Subnet
- Virtual Edge Interface - /32 Static Subnet

IGP Routing Required
- Redistribute Connected Virtual Port Group
- Redistribute Static Virtual Edge Device IP(s)

Access Lists Required
- Multicast Uplink ACL allowed

Video Services

Infrastructure Overview



Video Services

Configuration Verification and Status

- Show cable video logical-edge-device id *id-number*

```
CBR8-01# sh cable video logical-edge-device id 1
Logical Edge Device: led-1
Id: 1
Protocol: GQI
Service State: Active
Discovery State: Disable
Management IP: 13.135.69.2
MAC Address: a46c.2ab0.2c01
Number of Servers: 1
   Server 1: 10.225.198.88
Keepalive Interval: 10    Retry Co
Number of Virtual Carrier Groups:
Number of Share Virtual Edge Input: 1
Number of Physical Qams: 5
Number of Sessions: 8
Reserve PID Range: 256
Virtual Edge Input:
Input Port    VEI                Bay     Bundle       Gateway
ID            IP
1             13.135.70.1        1/0
Virtual Carrier Group:
ID    Name                       Total   Total        Service-Distribution-Group      Service-Distribution-Group
                                 VEI     RF-channel   Name                            ID
1     VCG_SDV_10                 0       5            SDG_SDV_10                      1
Integrated    Physical   Admin     Operational  TSID        ONID        Output     VCG        SDG        Encrypt
Cable         QAM ID     State     State                                Port       ID         ID         Capable
1/0/0:24      288        ON        UP           33001       0           1          1          1          clear
1/0/0:25      289        ON        UP           33002       0           2          1          1          clear
```

GQI or Table Based

Active or No Active

cBR-8 Source IP for Management

cBR-8 Destination IP for Management (to EC or VSRM)

Virtual Edge Input Address

VCG and SDG Binding

Cable Video Configuration

```
cable video
  reserve-pid-range 256
  multicast-uplink Port-channel2 access-list
  mgmt-intf VirtualPortGroup 0
  service-distribution-group SDG_SDV_10 id 1
    rpd downstream-cable 1/0/0
  virtual-carrier-group VCG_SDV_10 id 1
    service-type narrowcast
    rf-channel 24-28 tsid 33001-33005
output-port-number 1-5
  bind-vcg
    vcg VCG_SDV_10 sdg SDG_SDV_10
  logical-edge-device led-1 id 1
    protocol gqi
    mgmt-ip 13.135.69.2
    mac-address a46c.2ab0.2c01
    server 10.225.198.88
    keepalive retry 3 interval 10
    reset interval 8
    virtual-edge-input-ip 13.135.70.1
input-port-number 1
    vcg VCG_SDV_10
    active
```

Video Services

Connection to the SRM/EC

Parameter	What to look for…
Mgmt IP	VirtualPortGroup 0 Range
Service IP	SRM IP
Connection Status	Connected

- **show cable video gqi connection**

Show Cable Video GQI Connection

```
CBR8-01# show cable video gqi connection
LED   Management      Server          Connection      Protocol   Event      Event       Reset        Encryption
ID    IP              IP              Status          Version    Version    Pending     Indication   Discovery
-------------------------------------------------------------------------------------------------------------
10    13.135.69.2     10.225.198.88   Connected       2          2          0           ACKED        ACKED
```

- debug cable video **gqi**
- set platform software trace {led-01} RP active { **vgqi-mgmt | vgqi-msg** } noise
- show platform software trace message {led-01} RP active

Show Platform Software Trace

```
[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
```

Video Services

Dynamic Session Creation and Deletion

show cable video sessions logical-edge-device id *id-number*

Show Cable Video Session Logical-Edge-Device id

```
CBR8-01# show cable video sessions logical id 1
Total Sessions = 6
Session    Output     Streaming   Session Session Source                  UDP   Output  Input      Output Input    Output
Id         Port       Type        Type    Ucast Dest IP/Mcast IP (S,G)    Port  Program State      State  Bitrate  Bitrate  Type
-------------------------------------------------------------------------------------------------------------------------
1048624    1          Passthru    SSM     10.225.198.88,239.255.205.2     0     -       ACTIVE-PSI ON     18290    11996    CLEAR
1048629    1          Remap       SSM     13.135.10.29,239.255.105.23     0     60002   ACTIVE-PSI ON     1036760  1023290  CLEAR
1048625    2          Passthru    SSM     10.225.198.88,239.255.205.2     0     -       ACTIVE-PSI ON     18290    11984    CLEAR
1048626    3          Passthru    SSM     10.225.198.88,239.255.205.2     0     -       ACTIVE-PSI ON     18290    11855    CLEAR
1048627    4          Passthru    SSM     10.225.198.88,239.255.205.2     0     -       ACTIVE-PSI ON     18290    11850    CLEAR
1048628    5          Passthru    SSM     10.225.198.88,239.255.205.2     0     -       ACTIVE-PSI ON     18290    11789    CLEAR
```

- debug cable video **{ session | gqi | qam }**
- set platform software trace { led-*id* } RP active **{ vsess-mgmt | vsess-msg }** noise
- show platform software trace message {led-01} RP active

Reference Sheet

Ciscolive!

BRKSPG-2501 v2.09

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Sheet is in color – careful about b&w copy

Impacting(!) *italicized- name,* [] – optional, () – required, | - "or" (cd) – conditional debug (tr) – trace debug (clc) – cable linec ard console (rpd) – on RPD command

debug (orange) note/instruction special-LC con/trace

Key

PART IDs

Chassis	CBR-8-CCAP-CHASS
Cable LC	CBR-CCAP-LC-40G
Prot PIC	CBR-RF-PROT-PIC
Supervisor	CBR-CCAP-SUP-160G
Optics	SFP+ 10GBASE-SR/-LR
Fan	CBR-FAN-ASSEMBLY
Pwr Shelf	CBR-DC-PS, -AC-PS
Pwr Modul	CBR-PEM-DC-6M
Rphy CLC	CBR-CCAP-LC-40G-R
Rphy PIC	CBR-DPIC-8X10G

Unix/Linux

(create) tar –cvf *name.tar src-path*
(extract) tar –xvf *name.tar*
gzip *filename.zip source-files*

Core, Console, & Shell

request plat software con attach *lc-num*
request plat software system shell [rp|r0|r1|0-3,4-9]
dir harddisk:/core/
dir stby-harddisk:/core/
archive tar /create *name.tar path-src*
request platform software trace slot rp active archive target harddisk:all-traces
Send msg to all TTY: send *, *msg* , ctrl+z

Images and Copying

Pushing from server: scp *local-filename username@cbr8-hostname:path*
copy scp: *target-path*
copy ftp:user:passwd@loc/dir/filename
verify *path* /md5 *md5-hash*
request platform software package expand file *path* to *path* [force | wipe]

IOS Upgrades ISSU and Consolidate

conf t + no boot sys + boot sys *path* + exit + write mem + show bootvar
request platform software package install node file bootflash:/318SP/*image-name*
reload cancel
reload [at *hh:mm* reason *text-reason*]
reload in *m-minute*

Firmware

upgrade rom-monitor filename *path* {R0|R1}
upgrade hw-programmable cable *slot* rommon pkg_name *pkg-path*
upgrade hw-programmable cable *slot* dsphy auto pkg_name *pkg-path*

Administration

Hardware & Facility

show platform [diag]
show env power
show facility-alarm status
show cable card *slot/subslot* ds-phy disp
hw-module {slot|subslot} *slot* {reload|start|stop}
hw-module slot r{0|1} {reload|start|stop}

Versions & Firmware

show platform software patch info
show platform & show platform diag
show version
show redundancy
show bootvar
show cable card *slot*/0 ds-phy display

Redundancy & Failover

show redundancy
show redundancy linecard all
show redundancy switchover history
redundancy force-switchover
redundancy linecard switchover from *origin-slot* to *target-slot*
test lcha toggle config_protect_mode
Linecard Health
show platform diag
show logging onboard slot *slot* message reverse
show logging onboard slot *slot* uptime
show logging onboard slot *slot* temp
test lcha toggle config_protect_mode

Licensing

show license all
license smart dereg
license smart reg idtoken *token*

SNMP

show snmp mib ifmib ifindex
snmp set v2c *ip community* oid {integer|ip-add|string}

Plant Health

show cable flap-list
show cable flap-list [wb-rf|sort-time|sort-interface|sort-flap]
show cable resiliency
show cable resil-rf-status
show cable modem resiliency

Service Flows

show interface cable *x/y/z* service-flow qos [ds|us]
show interface cable *x/y/z* service-flow *flow-id* [counters | qos | verbose]
show cable modem *mac* service-flow [verbose]
(cd) debug cable dyns / debug cable tlvs

MAC-Domain RCC/UCC/MDD/CGD

show cable mac-domain cable *x/y/z* rcc [timeline]
show cable mac-domain cable *x/y/z* mdd
show controller cable *x/y/x* downstream
show controller cable *x/y/x* upstream [*upstream-id*]
show controller integrated-cable *x/y/z* rf-channel 0-63 158-162
show controller integrated-cable *x/y/z* counter rf-channel
show controller integrated-cable *x/y/z* counter wb-channel

Operational

ADSG / PIM / IGMP / Video Mcast

show ip mroute & show ip mroute count
show ip mfib & show ip mfib count
show ip mroute *group* [count]
show cable video routing multicast
show cable dsg cfr
show cable dsg static-group bundle *bundleID*
show interface cable *x/y/z* dsg
downstream dcd
show cable modem docsis-device | inc STB

ARP & IP Routing

show ip interface brief
show ip pim neighbor
show ip ospf neighbor
show arp & sh int cx/y/z modem
show ip bgp neighbor
show ipv6 interface brief
show ipv6 ospf neighbor
show isis neighbors

Bandwidth

show interface tengig *x/y/z*
show controller integrated-cable *x/y/z* counter rf-channel
show controller integrated-cable *x/y/z* counter wb-channel
show cable modem *mac* {qos|service-flow}
show interface cable *x/y/z*
show interface cable x/y/z upstream bonding-group

Modem States

show cable modem [*mac* [timeline | verb]]

	Init-State
R1,2	1: init Rng recv, 2: Rng adjust
RC	Ranging Complete
D,	DHCP Discover Recv
IO	DHCP Offer Recv
O	First TFTP Packet OR Bad Config File
S A R I O	IPv6 S-Solicit, A-Advert, R-Request, I-Reply First TFTP Packet OR Bad Config File

	Symbol
*	Pre - Bpi-policy not satisfied
#	Online - CM /out TFTP dwnld
!	State – Dyn Secret violation Time – Exceeded Max Delay Rx Power – Max transmit
(PT)	BPI - TEK assigned
(PK)	BPI - KEK (Key exch) assigned
(d)	Network access CPE disallowd
(na)	Reject – CM no REG-ACK
(c)	Reject – Class of service issue
w-online/p	Upstream Partial
p-online/UB	Downstream Partial
w-online/UB	DS/US Bonded

	Scm verbose Ranging
IM/SM	Waiting Intial/Station, Maint
CNT	Continuous Rng: Miss Rng or Rng Adjustment occurring
DR	Down Recovery: Down, CMTS send IM rng oppor
DT	Down Timeout: No recovery
DI	Down Interface: intf shutdwn
STA	Station Maint: Good State

Modem Timeout Codes

T4	Rcv Rsp to Bcast Mnt Req, but no Ucast Mnt Opp recv
T3	Rng Req retries exhausted
T2	No mnt Bcast for Rng
T1	No UCDs

Partial & Impaired States

show cable mac-domain cable *x/y/z* us-impairment

Reset & Delete

clear cable modem *mac-address* delete
clear cable modem *mac-address* reset
clear cable modem interface cable *x/y/z* {all|offline|wideband}
clear cable modem device-class {STB|MTA|PS|RTR}
clear cable modem offline delete

Status

show cable modem [*mac|IP*]
show cable modem *mac* verbose
show cable modem *mac* cpe
show cable modem *mac* sysDescr

PHY, RF, Ranging

show cable modem *mac* flap
show cable modem *mac* phy
show cable modem *mac* rng-cdman
show cable modem *mac* partial-service
show cable modem *mac* verbose | inc Code
(cd) debug cable range [protocol]
set platform software trace cdman *slot*/0 cdman_docsis_rng debug
(clc) test cable rng unsolict-rng-rsp *mdm-mac us-ch timingoffset poweradj*

IP & IPv6

show cable modem *mac* ipv6
show cable modem *mac* dhcp-status
show cable modem *mac* dhcpv6-status

Privacy & Encryption

Show cable modem *mac* privacy [verbose]
(cd) debug cable privacy

DOCSIS 3.0 General

show cable modem wideband
show cable modem *mac* wideband
show cable modem *mac* wideband channel
show cable modem *mac* wideband rcs-status
show cable modem *mac* wideband primary-ch

DOCSIS 3.1 Downstream

Cable Modem

show cable modem docsis version d31-capable
show cable modem select * where macver like "DOC3.1%"

Batch

show cable modem sql *sql-query*
show cable modem summary total
show cable modem primary summary total
show cable modem docsis device-class
show cable modem docsis device-class summary [total]
show cable modem docsis device-class withip

SQL Show Cable Modem

show cable modem sql *sql-query*

SQL Generic format:
select * where * [opt]
select *set* where *condition*
condition: is, like, "", %

Traditional	SQL
scm doc ver d31	select ip,mac where macver like "DOC3.1"
scm cable xyz summary	select intf as hostinterface, count(mac) as number group by intf

Debug – Modem Registration

Term mon
show logging
debug cable mac-address *mac* verbose
debug cable range
debug cable reg
debug cable dhcp
debug cable tlvs
debug cable priv
debug cable dyns
debug cable video gqi
debug cable video sessions
debug cable video qam
debug cable video led

Debug – Tracing Setup & Remove

set platform software trace *led-name* RP active *trace-name* debug
show platform software trace level cdman *linecard*
show platform software trace level *led-name* RP active
show platform software trace message cdman *linecard*
show platform software trace message *led-name* RP active
(reset) set platform software trace level *trace-id* RP active all-modules notice
show debugging
(reset) undebug all

Trace & Debug

Converged Video

show cable video session logical-edge-device id *led-id*

Input State	Meaning
Init	Pinned up, waiting traffic
Idle	No incoming traffic
Active(-PSI)	Traffic started
Off	If traffic does not resume
Blocked	Error parsing PAT/PMT
Output State	
Off	QAM shut or non-Operat
On	QAM operat and fwding
Conflict	PgmPID conflict PMT/PAT
Pending	PMT withheld, missing CA

show cable video gqi connections
show cable video logical-edge-device id *led-id* [statistics]
show cable video session logical-edge id *led-id* [session-id]
clear cable video session logical-edge-device id *id-number* session-id *session-id*
set platform software trace led-*id* rp active {vgqi-mgmt|vgqi-err} noise
(cd) debug cable video gqi
(cd) debug cable video led

QFP Tracking:

Use QFP when tracing CM packet flow
test platform hardware qfp active feature docsis dtrack mac-address *mac-address*
test platform hardware qfp active feature docsis dtrack packet-copy
"reload the modem to reproduce the issue
show platform hardware qfp active feature docsis dtrack statistics clear
test platform hardware qfp active feature docsis dtrack disable

QFP Rate-Limiting:

show platform hardware qfp active infrastructure punt sbrl
show platform hardware qfp active infrastructure punt policer

SID Tracker:

Use SID Tracker for Mac mgmt. grants and MAPs per modem
show cable modem *mac* service-flow
(clc) debug cable interface cable *xyz* sid *nnn* track
(clc) show int cable *xyz* up debug sid-tracking *nnn* clear
(clc) show int cable *xyz* up debug sid-tracking *nnn* 0 40000

DOCSIS 3.1

	Registration Process
1	Scan for OFDM DS
2	CM find PLC via Pilot & Preamble
3	PLC contains OCD & DPD
4	CM uses learned profile
5	O-INIT-RNG-REQ sent by CM RNG-RSP v5 sent by CMTS B-INIT-RNG-REQ v5 Fine Rng
6	CM declares sync complete
7	CM promoted to working profile
	If no ODFM: Scan SC-QAM

Downstream OFDM

Configuration Checklist DS OFDM	
	check diplexer ranges check modem capabilities & fw
1	Define Fiber Node
2	Controller Integrated-Cable *xyz*

	Max-ofdm-spectrum *mhz* + max carrier + base-power
	rf-channel 158 (to 162)
	ofdm channel-profile *num* start-frequency *freq* width *width* plc *plc-freq*

3	cable downstream ofdm-chan-profile *num*
A	Subcarrier-spacing {25|50}
B	Profile-ncp, Profile-data 1,2,3
4	Interface Wideband-cable xyz:*n*
A	Cable bundle + rf-bandwidth-percent
5	Interface cable *xyz*
A	(primary DS) downstream integrated-cable *xyz* rf-channel {158-162}
6	Interface wideband-cable *xyz:nnn*
	cable rf-channels channel-list *list+ofdm_ch* bandwidth-percent 1

show cable mac-domain cable *xyz* ocd
show cable mac-domain cable *xyz* dpd
show cable ofdm-chan-profile *prof-num*
show cable ofdm-modulation-profile *prof-num*
show cable ofdm-modulation-profile configuration
show interface cable *xz* controller | i \[OCD
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/0 us-phy ofdma-channel cw-error
show cable card x/0 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

	check diplexer ranges check modem capabilities & fw
1	Configure OFDM Downstream
2	Define Fiber Node
3	US OFDMA Profile (or default)
4	Controller Upstream-Cable *xyz*
a	Us-channel {12-15} docsis-mode ofdma
b	Us-channel {12-15} docsis-mode frequency-start *start-freq end-freq*
c	no us-channel {12-15} shutdown
5	Interface cable *xyz*
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(clksync)	Timing sync, Skip if Aux Cor
Init(l2tp)	DEPI/UEPI
Online	RPD fwding / recv

show cable rpd
show cable rpd *rpd-id*
show cable rpd slot *slot*
show cable rpd tengig *x/y/0*
show cable rpd { *ip* | *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 *ssp*} [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 *xyz* { gcp-session | gcp-state }	
State	**Meaning**
init	Recv RPD Notify Sent req RPD Capab
nego	Recv RPD Capability Sent CCAPCore Ident
Bulksync	DS/US Ch cfg & rsp
Ready	Configs done

(rpd) show provision { all | history }
(rpd) show gcp session
debug cable rpd
(tr) set platform trace rphyman rp rphy_gcp_infra noise
(tr) set platform trace rphyman rp rphy_gcp_tlv noise

PTP Timing

Purpose: Timing sync for MAC Mgmt

cBR8 State	RPD State
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 DEPI	MPEG increment for video 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: RngRq	S:SpcM
MPT	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
	CDN	Initiate session teardown

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

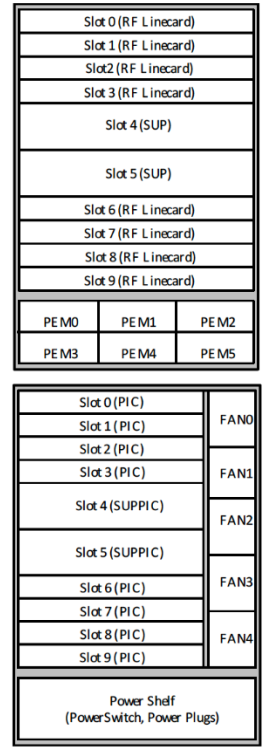
Access & Security

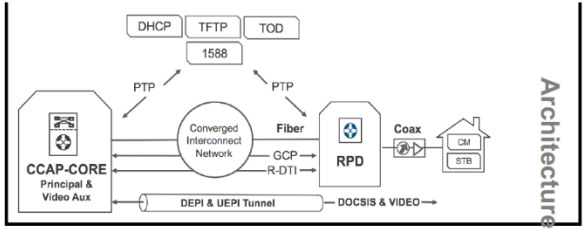
Default is SSH admin/admin
Remove Admin conf: ssh password off
Add SSH Pubkey: conf: ssh pubkey add
Disable auto reboot - set reboot hold
Enable auto reboot - clear reboot hold
(rpd) show ssh session
(rpd) show ssh nms-pubkey

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-r-chf*
(rpd) show fpga video interrupt





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 *x1y1z1* profile 40
r-dti 1
rpd-event profile 5

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-port *name-of-server* slave
delay-req interval -4
sync interval -5
sync one-step
transport ipv4 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-serverIP*

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

cable fiber-node *node_number*
downstream Downstream-Cable *xyz*
upstream Upstream-Cable *xyz*

Sample RPHY Configuration

Notes

Summary

Summary

- Troubleshooting cBR-8 DOCSIS 3.x Services
- Troubleshooting cBR-8 Remote PHY Services
- Troubleshooting cBR-8 Converged Video Service
- Troubleshooting cBR-8 Voice services (In appendix)
- cBR-8 Operational Maintenance (In appendix)

“Effective Troubleshooting Will Decrease Downtime and Increase Customer Satisfaction”

Q & A

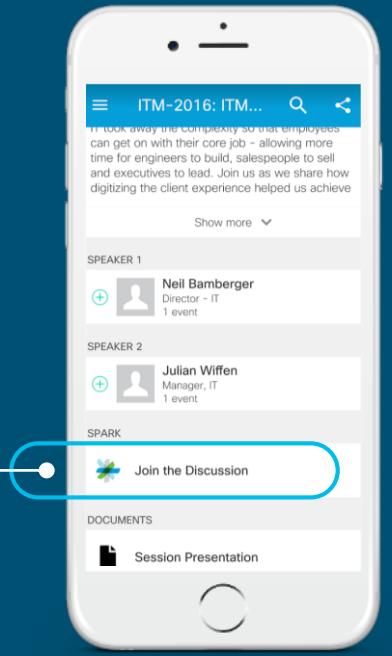
Cisco Spark

Questions?

Use Cisco Spark to communicate with the speaker after the session

How

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



cs.co/ciscolivebot#BRKSPG-2501

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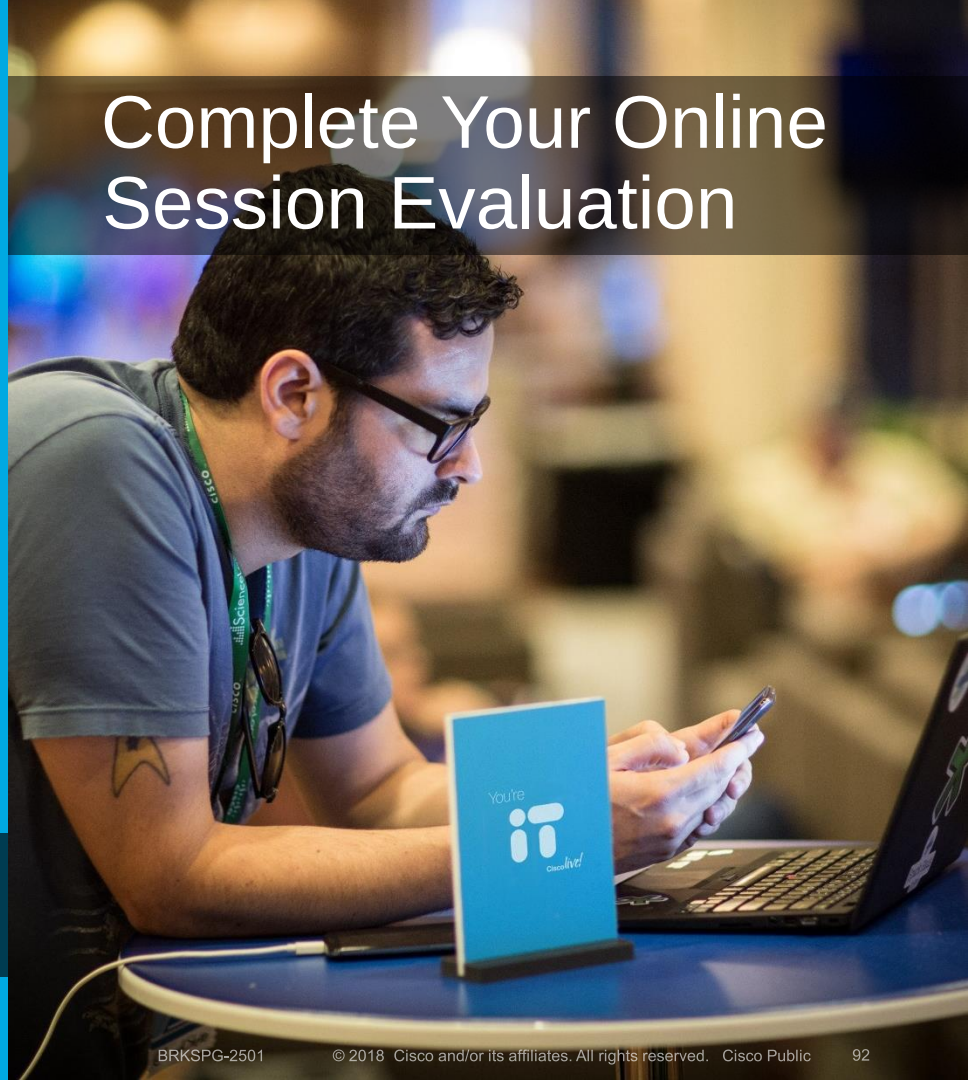

Continue Your Education

- Demos in the Cisco campus
- Walk-in Self-Paced Labs
- Tech Circle
- Meet the Engineer 1:1 meetings
- Related sessions

Thank you


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Bonus Slides

cBR-8 Operational Maintenance

OFDMA Recommendations (June 2017)

- 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

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

Also mkdir / rmdir

```
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# 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#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
```

```
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
```

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  Current  Switchover              Switchover
       active    active   reason                  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
                LC      My          Peer        Peer      Peer
Slot Subslot    Group   State       State       Slot      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

                LC      My          Peer        Peer      Peer
Slot Subslot    Group   State       State       Slot      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                       Cable Modem
Description
                Total Reg   Oper  Unreg Offline Wideband initRC initD initIO
initO
C0/0/0/UB       5     5     5     0     0       5        0      0     0      0
C0/0/0/U1       1     1     1     0     0       0        0      0     0      0
C0/0/1/UB       29    29    29    0     0       29       0      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 acec1f32a0b8898eceea0f7f31ee5797

.....Done!

Verified (bootflash:cbrsup-universalk9.03.18.00a.S.156-2.S0a-ext.SPA.bin) = acec1f32a0b8898eceea0f7f31ee5797
```

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
```

Recommended Method !

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

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

```
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
```

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

- Call-home destination address and Protocol
- 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
 destinati
https://10
tHandler
  no desti
https://to
snmp-serve
```

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/DeviceReques
tHandler
```

Smart Software Licensing

Common Issues

- 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

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

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

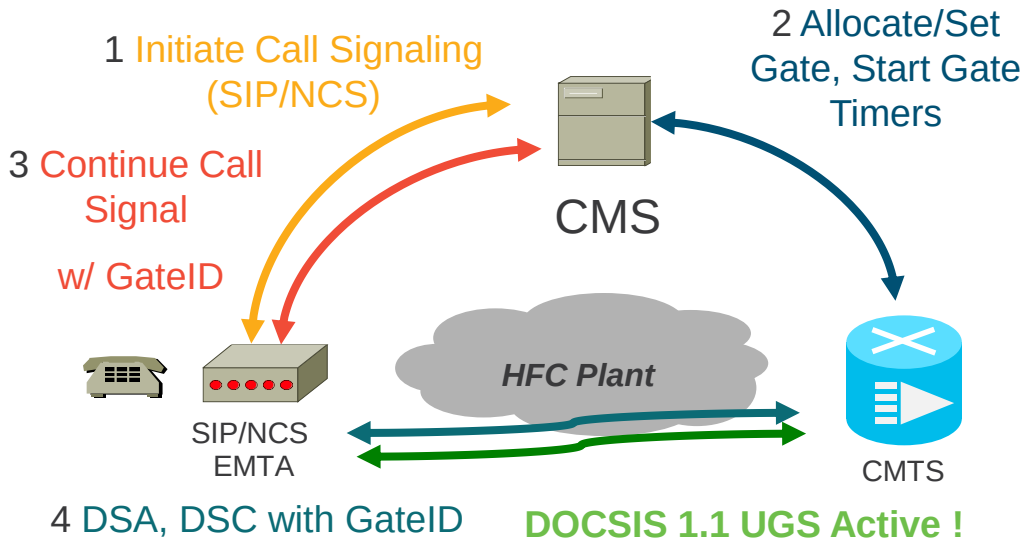
```
CBR8-01# sh run | sec crypto pki trustpoint SLA-TrustPoint
crypto pki trustpoint SLA-TrustPoint
 enrollment terminal
 revocation-check crl
```

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

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

```
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
```

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*

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
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
```

REQ and RES should be similar (pairing)

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
```

Can specify bonding-group too

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:    r 0 state UP[11] rfid 5208
SLOT 8/1: Mar 26 16:40:06.183 EDT:    r 1 state UP[11] rfid 5209
SLOT 8/1: Mar 26 16:40:06.183 EDT:    r 2 state UP[11] rfid 5210
<SNIP>
SLOT 8/1: Mar 26 16:40:06.183 EDT:    r 14 state UP[11] rfid 5223
SLOT 8/1: Mar 26 16:40:06.183 EDT:    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>
Original active RF members: 24-39
Needed RF members: 25-39
Down RF members: 24
Avail RF members: 25-39
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/
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>
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
```

Modem Resiliency move necessary

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

Dynamic WB intf. Created for RBG

WB RBG with remaining chans. Comes up

DS Bonding Resiliency Show Commands

Show cable rf-status

```
 Logical   Suspend   Suspend   Flap   Flap
RF         Status    Status    Fails  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
```

1st Channel went down

Flap Fail and Count

Show cable resiliency

```
F241-38-05-uBR10K-01#show cable resiliency
                BG    Resil BG                                    RF
Resil BG I/F    ID    State          Count Time                Ctrl  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
                                                                  15
```

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

Show cable modem resiliency

```
F241-38-05-uBR10K-01#show cable modem resiliency
                                Orig BG                  Curr BG
I/F      MAC Address     ID     I/F            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

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
```

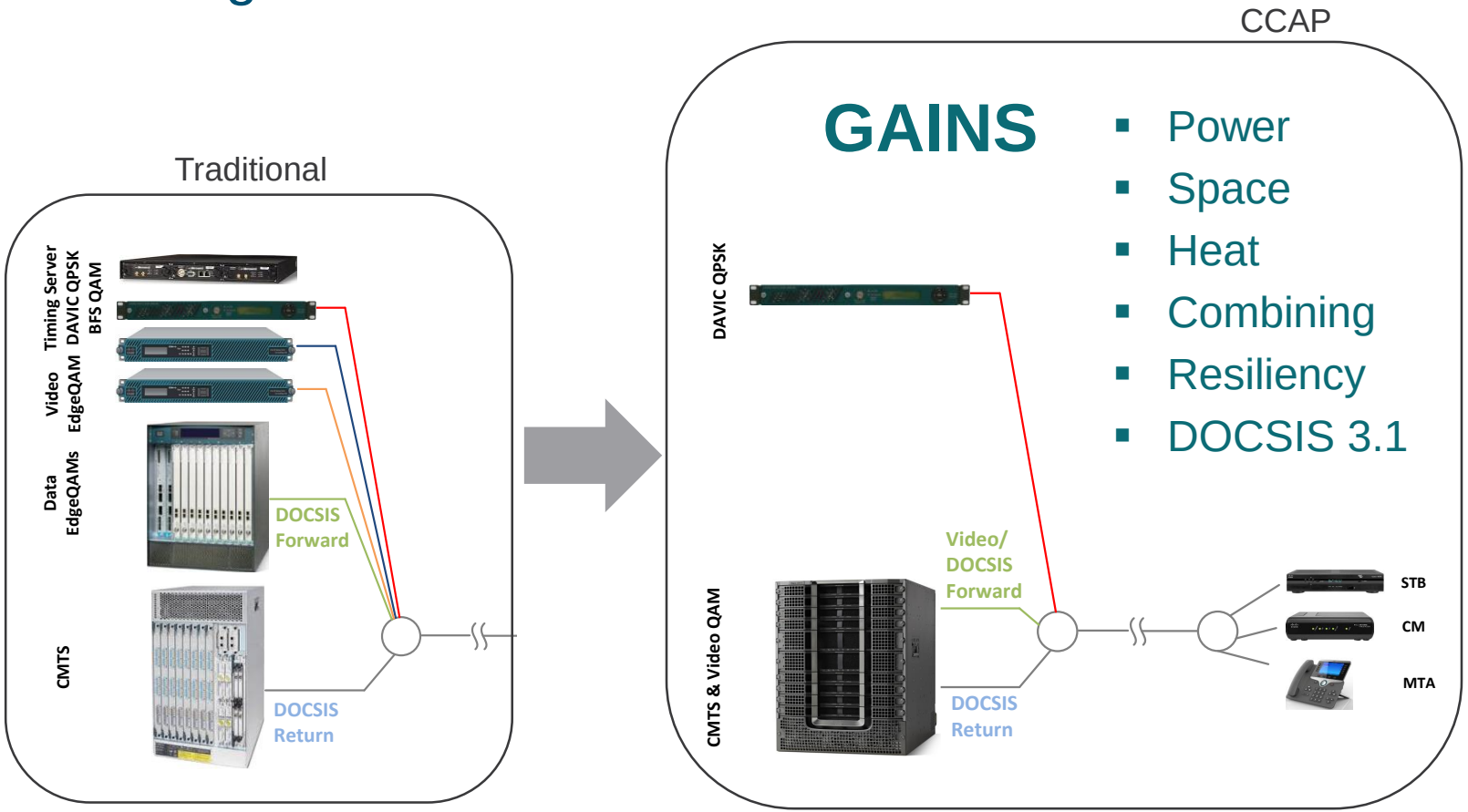
```
interface Wideband-Cable8/1/1:9
cable bundle 1
cable ds-resiliency
cable rf-channel 0 bandwidth-percent 1
cable rf-channel 2 bandwidth-percent 1
<SNIP>
cable rf-channel 15 banddith-percent 1
```

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
```

Converged Video

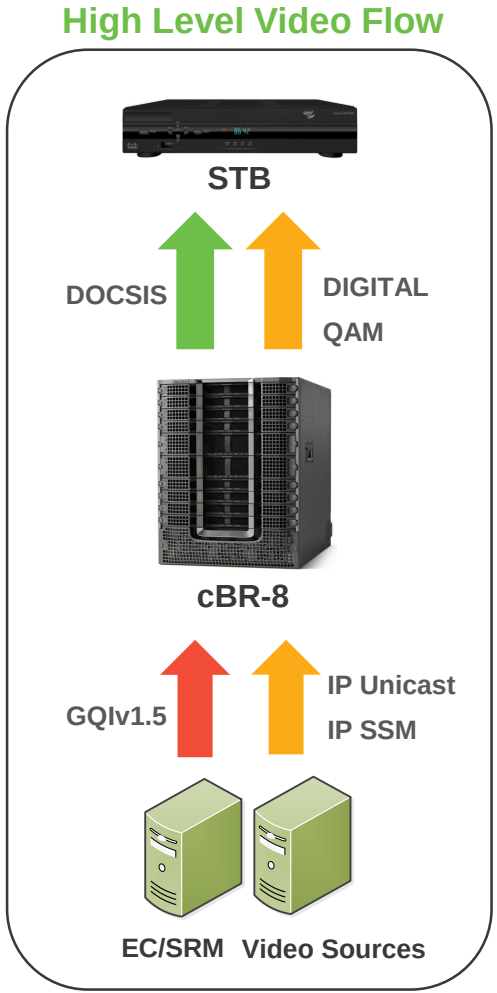
Converged Cable Access Platform- CCAP



Video Services Troubleshooting

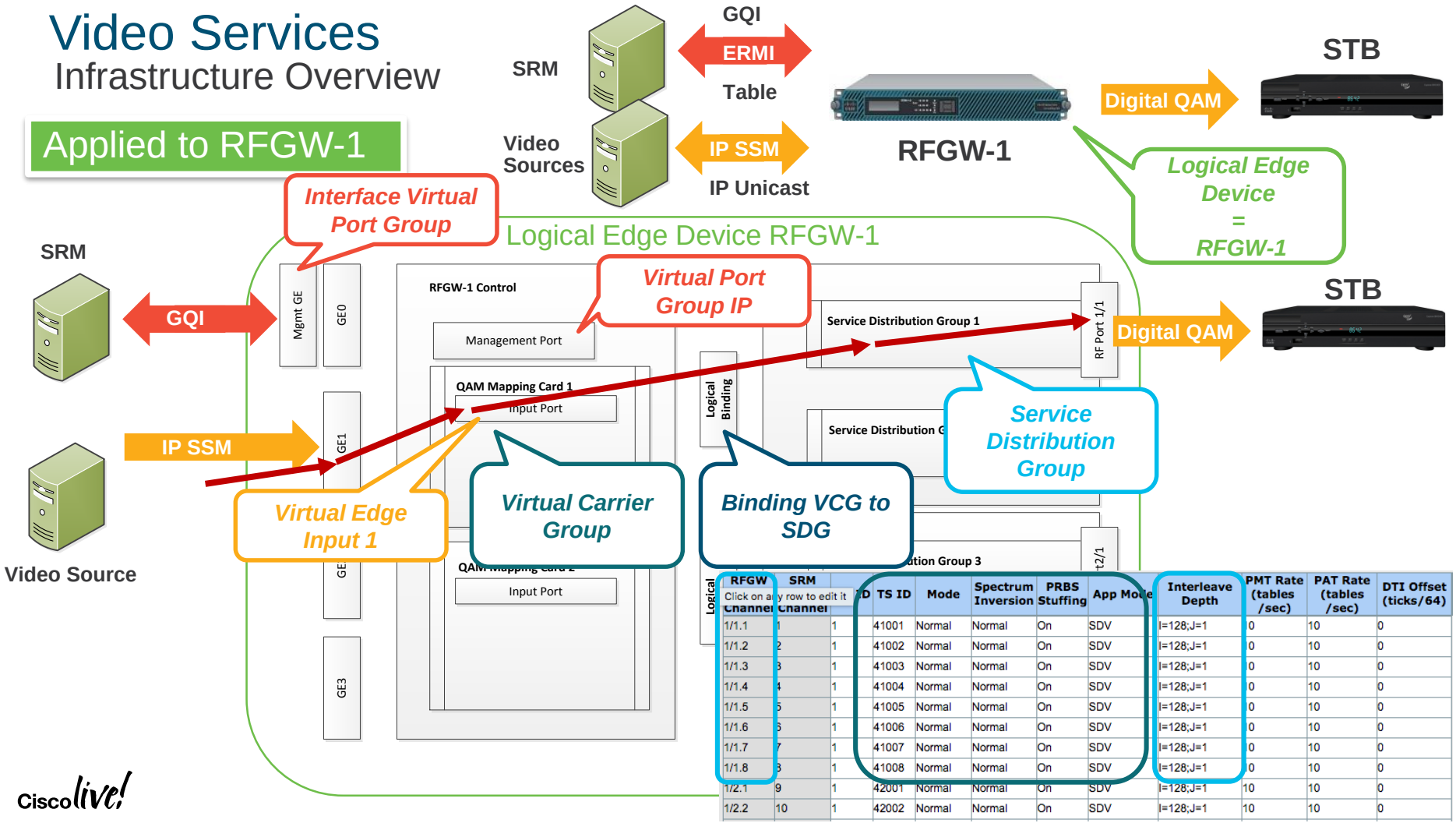
Common Problems

- 1. No Video
  - Video Configurations
  - Session Verifications
  - ADSG Configurations
- 2. Macro-blocking or Impaired Video
  - Throughput Rates
  - Dropped Packets
  - Reserved Session Rates
- 3. Cannot Tune / Order Programming
  - ADSG Status
  - IP PIM and IGMP Multicast Verifications



Video Services
Infrastructure Overview

Applied to RFGW-1



RFGW Channel	SRM Channel		TS ID	Mode	Spectrum Inversion	PRBS Stuffing	App Mode	Interleave Depth	PMT Rate (tables /sec)	PAT Rate (tables /sec)	DTI Offset (ticks/64)
1/1.1	1	1	41001	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.2	2	1	41002	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.3	3	1	41003	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.4	4	1	41004	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.5	5	1	41005	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.6	6	1	41006	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.7	7	1	41007	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/1.8	8	1	41008	Normal	Normal	On	SDV	I=128;J=1	0	10	0
1/2.1	9	1	42001	Normal	Normal	On	SDV	I=128;J=1	10	10	0
1/2.2	10	1	42002	Normal	Normal	On	SDV	I=128;J=1	10	10	0

Click on any row to edit it

Service Distribution Group

Ciscolive!

Video Services

Configuration

- Controller Integrated-Cable Video QAMs
- Video QAM Profile
- Interface VirtualPortGroup
- IGP Routing Configuration
- IP Access-list(s)

Virtual Port Group Configuration

```
interface VirtualPortGroup0
 description VPG
 ip address 13.135.69.1 255.255.255.0
```

Access-list Configuration

```
ip access-list standard all-multicasts
 permit 232.0.0.0 0.255.255.255
 permit 233.0.0.0 0.255.255.255
 <SNIP>
 permit 239.0.0.0 0.255.255.255
```

Controller Configuration

```
controller Integrated-Cable 1/0/0
 max-carrier 96
 base-channel-power 36
 freq-profile 1
 rf-chan 0 23
  type DOCSIS
  frequency 603000000
  rf-output NORMAL
  power-adjust 0
  qam-profile 1
  docsis-channel-id 1
 rf-chan 24 31
  type VIDEO
  frequency 747000000
  rf-output NORMAL
  power-adjust 0
  qam-profile 4
```

Type Video

Start Freq

Output Type

QAM Profile

```
cable downstream qam-profile 4
  annex B
  modulation 256
  interleaver-depth I128-J1
  symbol-rate 5361
  spectrum-inversion off
  description Video-AnnexB-256
```

RF-Output
Normal
Alt
PRBS
CW

IGP Configuration

```
router ospf 100
 router-id 13.10.0.204
 nsf cisco
 area 8 nssa
 redistribute connected subnets route-map
block_internal_video
 redistribute static subnets route-map
video_vei
 passive-interface default
 no passive-interface Port-channel1
 no passive-interface Port-channel2
 network 13.13.0.142 0.0.0.0 area 8
 network 13.13.0.146 0.0.0.0 area 8
```

Redistribute Subnet for Virtual Port Group

Optional Route-Map

Redistribute Subnet for Virtual Edge Input(s)

Video Services

Configuration

- Management Interface
- Encryption
- Service Distribution Group **SDG**
- Virtual Carrier Group **VCG**
- Define Bind between VCG a
- Logical Edge Device **LED**
- Virtual Edge Inputs

"Cable Video" section encapsulates all LED/VCG/SDG configuration

Edge Encryption per LC

LED

GQI or Table Based

VSRM or EC Server IP

Associate to VCG

"active" activates

Cable Video Configuration

```
cable video
  reserve-pid-range 256
  multicast-uplink Port-channel2 access-list 99
  mgmt-intf VirtualPortGroup 0
  encryption
    linecard 1/0 ca-system powerkey scrambler des
  service-distribution-group SDG_SDV_10 id 1
    rf-port integrated-cable 1/0/0
  service-distribution-group SDG_BCA
    rf-port integrated-cable 1/0/0
  virtual-carrier-group VCG_SDV_10 id 1
    service-type narrowcast
    rf-channel 24-28 tsid 33001-33005 output-port-number 1-5
  virtual-carrier-group VCG_BCAST_10 id 2
    service-type broadcast
    rf-channel 29 tsid 33006 ou
  bind-vcg
    vcg VCG_SDV_10 sdg SDG_SDV_10
    vcg VCG_BCAST_10 sdg SDG_BCA
  logical-edge-device led-1 id 1
    protocol gqi
      mgmt-ip 13.135.69.2
      mac-address a46c.2ab0.2c01
      server 10.225.198.88
      keepalive retry 3 interval 10
      reset interval 8
      virtual-edge-input-ip 13.135.70.1 input-port-number 1
      vcg VCG_SDV_10
      active
  logical-edge-device led-1-bca
    protocol table-based
      virtual-edge-input-ip 13.135.70.3 input-port-number 3
      vcg VCG_BCAST_10
      active
```

Specify the uplink port and ACL

Define the Management Interface

Specify the forwarding port(s)

VCG to include RF-Ch, TSIDs, and Output Port Numbers

Bind these to output port(s)

Mgmt-IP is IP covered by the Intf VPGSubnet

Virtual Edge Input IP

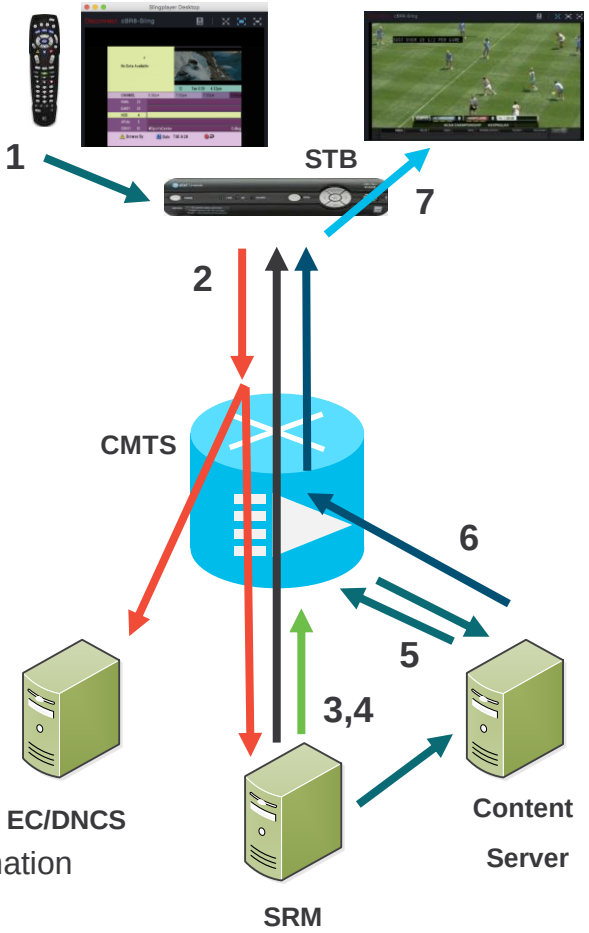
Chassis MAC Address

```
CBR8-01# show diag all eeprom detail | include MAC
        Chassis MAC Address      : a46c.2ab0.2c00
        MAC Address block size   : 1024
```

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



Video Services

Dynamic Session Creation and Deletion

- Show cable video sessions logical-edge-device id id-number sesson-id sess-id

Show Cable Video Session Logical-Edge-Device *id* Session-id *id*

```
CBR8-01# show cable video session logical id 1 session-id 1048630
Session Name          : 0x005056B2504A0000015F
Session Id:           : 1048630
Creation Time:        : Tue Jun 28 18:44:04 2016

Output Port           : 1
TSID                  : 33001
ONID                  : 0
Number of Sources     : 1
  Source IP           : 13.135.10.29
  Group IP            : 239.255.115.26
  UDP Port            : 0
Config Bitrate        : 18000000
Jitter                : 200 ms
Processing Type       : Remap
Stream Rate           : VBR
Program Number        : 60003
Idle Timeout          : 2000 msec
Init Timeout          : 2000 msec
Off Timeout           : 60 sec
Encryption Type       : CLEAR
Encryption Status     : -
```

```
Input Session Stats:
====================
  State: ACTIVE-PSI, Uptime: 0 days 16:03:05
  IP Packets: In 14259628, RTP 0, Drop 0
  TP Packets: In 98784050, PCR 1559389, PSI 1630026, Null 1033346
              Unreference 0, Discontinuity 20
  Errors: Sync loss 0, CC error 3148, PCR Jump 0,
          Underflow 0, Overflow 0, Block 0
  Bitrate: Measured 2551366 bps, PCR 1685460 bps

Output Session Stats:
=====================
  State: ON, Uptime: 0 days 16:03:05
  TP Packets: In 99598918, PCR 1559387, PSI 1630024,
              Drop 815058, Forward 97153836, Insert 842042
  Errors: Info Overrun 0, Info Error 0, Block 0, Overdue 0,
          Invalid Rate 0, Underflow 0, Overflow 0
  Bitrate: Measured 2523604 bps

PAT Info:
=====================
Version 1, TSID 1, len 16, section 0/0
  Program 14: PMT 480
```

Video Services

Dynamic Session Creation and Deletion

- show cable video output-port *port*
- show cable video integrated-cable *slot/subslot/port* rf-channel *rf-ch*

Show Cable Video Output-Port

```
CBR8-01# show cable video output-port 1
Integrated TSID  ONID  Output  Physical Admin Operational Virtual-Car-Grp Service-Dist-Grp Logical-Edge-Device Enc     Tot
Cable                  Port    QAM ID   State State       Name            Name             Name                Capable Sess
-------------------------------------------------------------------------------------------------------------------------
1/0/0:24   33001 0     1       24       ON    UP          VCG_SDV_10      SDG_SDV_10       led-1               clear     3
2/0/0:24   20024 0     1       88       ON    UP          VCG_SDV_20      SDG_SDV_20       led-2               clear     1
```

Show Cable Video integrated-cable 1/0/0 rf-ch 24

```
CBR8-01# show cable video integrated-cable 1/0/0 rf-channel 24
Integrated-Cable: 1/0/0
RF Channel: 24
TSID: 33001
Physical QAM ID: 24
Admin State: ON
Operational State: UP
Virtual Carrier Group Name: VCG_SDV_10
Service Distribution Group Name: SDG_SDV_10
Logical Edge Device Name: led-1
Total Bandwidth: 38810700 bps
Available Bandwidth: 2746700 bps
Oversubscribed Bandwidth: 0 bps
Total Sessions: 3
```

Video Services

Show Cable Video Session Logical-Edge-Device id

```
CBR8-01# show cable video sessions logical id 1
Total Sessions = 6
Session     Output      Streaming   Session Session Source                  UDP    Output   Input       Output Input    Output
Id          Port        Type        Type    Ucast Dest IP/Mcast IP (S,G)    Port   Program  State       State  Bitrate  Bitrate  Type
-------------------------------------------------------------------------------------------------------------------------------
1048629     1           Remap       SSM     13.135.10.29,239.255.105.23     0      60002    ACTIVE-PSI  ON     3071569  3041989  CLEAR
1048630     1           Remap       SSM     13.135.10.29,239.255.115.26     0      60003    IDLE        OFF    0        0        CLEAR
… <repeat command> … <Omitted Session Names> …
1048629     1           Remap       SSM     13.135.10.29,239.255.105.23     0      60002    ACTIVE-PSI  ON     3196502  3161899  CLEAR
1048630     1           Remap       SSM     13.135.10.29,239.255.115.26     0      60003    ACTIVE-PSI  ON     333577   307086   CLEAR
```

Show Platform Software Trace Message Led-01 RP Active

```
vsess_events_source_state_change_handler -> Received Source State Change Event: src = 13.135.10.29:0, dest = 239.255.115.26:0 old_state = 0x03,
new_state = 0x02;
vgqi_msg_encode_create_session_response_v2_internal, Sending GQI Create Session v2 Response from 13.135.69.2 to 10.225.198.88
vgqi_allocate_response, Allocating GQI Response: GQI Server IP 10.225.198.88, LED Mgmt IP 13.135.69.2
Converting vgqi_rc_e (0) to GQI Reponse Status code
vgqi_code_create_session_v2_internal - GQI Session ID 0x005056B2504A0000015F is mapped to Internal Session ID 1048630, encryped 0 QAM 1/0/0:24
vsess_ipc_send_session_join_to_iosd -> Sending mcast join to iosd for session 1048630 on source 13.135.10.29:239.255.115.26:0
vsess_ipc_send_session_join_to_iosd -> Adding Video Session routing to DMP/CPP in IOSd for session_id = 1048630
vsess_create_session -> Create new session ID 1048630, map ID 1048598
vsess_dbms_session_tx_add_oper, session id 0x100036, num_sources 1, active_src_indx 0, ca_data_total_len 0, state 2, create_time 1467153844,
encrption type 0
vsess_create_session, Session 1048630 Multicast Join is pending
vsess_dbms_session_create_and_copy -> A new session 100036 (1048630) LC session id 1048630, rfid = 24 successfully created.
vgqi_code_create_session_v2_internal - GQI Input Port 1 is mapped to LEI IP Address 13.135.70.1
vgqi_msg_decode_create_session_v2 - GQI Output Port 1 maps to physical QAM -> slot 1 port 0 channel 24
vgqi_rpc_print_session_create_params_2 -> Received GQI Create Session Request:
  Transaction Header:
    Transaction ID: 00D90000
get_gqi_rpc_message_remote_local_ip, Received GQI Create Session V2 Request from 10.225.198.88 to 13.135.69.2
```

Video Services

Show & Debug Command Summary

- show cable video logical-edge-device id *id-number*
- show cable video gqi connection
- show cable video sessions logical-edge-device id *id-number*
- show cable video sessions logical-edge-device id *id-number* session-id *session-id*
- show ip mroute [count | active]
- show ip igmp group
- set platform software trace *led-name* RP active *trace-name* noise
- set platform software trace *led-name* RP active all-module notice
- debug cable video gqi
- debug cable video sessions
- debug cable video qam
- debug cable video led
- show platform software trace level *led-name* RP active
- show platform software trace message *led-name* RP active
- request platform software system shell RP active
- clear cable video session logical-edge-device id *id-number* session-id *session-id*

Trace Name	Description
Vsess-mgmt	Session Control
Vsess-msg	Session Messages
Vsess-ha	Session HA
Vsess-dbms	Session Database
Vgqi-mgmt	GQI Control
Vgqi-msg	GQI Messages
V6-mgmt	D6 Control
V6-msg	D6 Messages
Vtbl-msg	Table-Based Messages
Vtbl-session	Table-Based Session

LED Name	Description
Led-01	First Configured LED
Led-02	Second Configured LED

Video Debug	Description
D6	Ramsden D6
GQI	GQI
LED	Logical Edge Device
QAM	Forwarding QAM
Routing	Video Routing
TBB	Table Based

ADSG Troubleshooting

Advanced DOCSIS Set Top Gateway Introduction

Purpose: Use the CMTS to send control data to Set-Top-Box

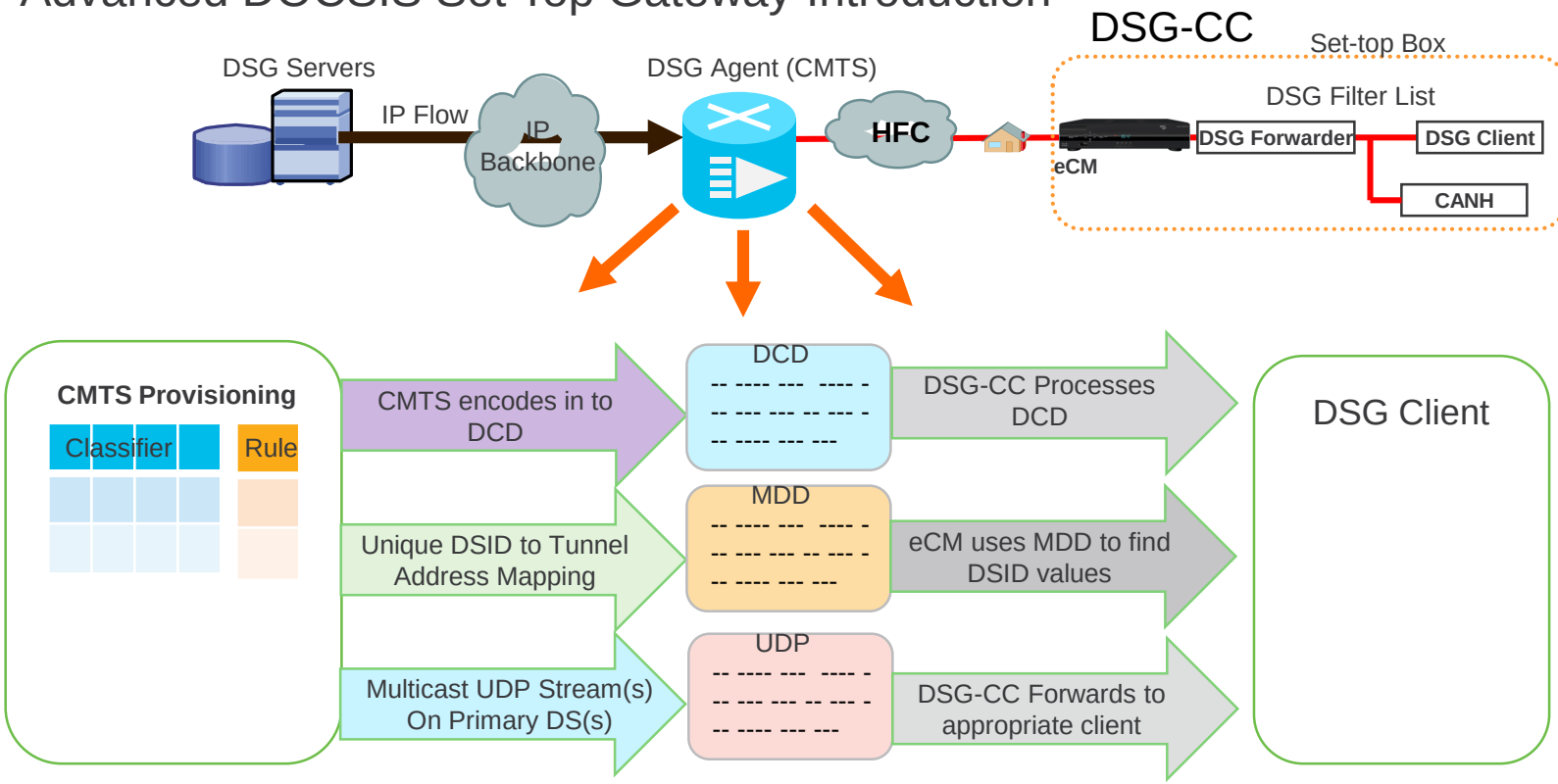
- Provides tunnel data to Set Top Boxes through the DOCSIS Forward
- Includes SI, CAS, OOB, etc.

DSG Issues:

- DOCSIS STB not coming online
  - Stuck in one-way mode
- DOCSIS STB not able to get control data
  - System Information (SI) / CA Information / Emergency Alert System / Out-of-band
  - Interactive Programming Guide Data
  - Encryption Keys (EMMs)

ADSG Troubleshooting

Advanced DOCSIS Set Top Gateway Introduction



ADSG Configuration

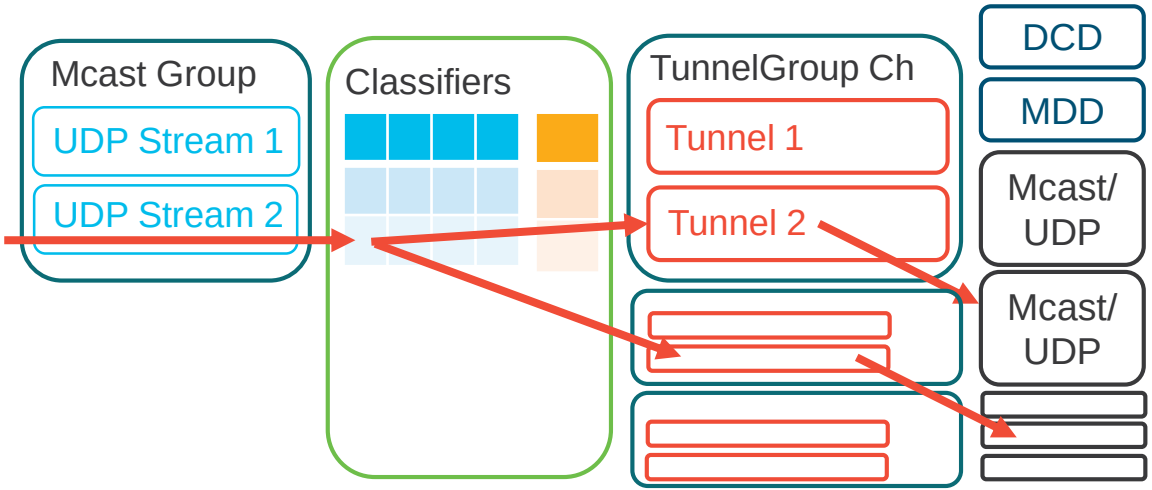
Multicast Routing and ACL configuration

```
ip multicast-routing
!
ip access-list standard SSM-ALLOW
permit 232.0.0.0 0.255.255.255
!
ip pim ssm range SSM-ALLOW
!
interface Bundle1
 ip pim sparse-mode
!
interface TenGigabitEthernet4/1/0
 ip pim sparse-mode
```

Enable Multicast routing

ACL to allow 232/8

Enable PIM on Interface(s)



Cable side ACL configuration

```
access-list 150 permit udp any eq rip any eq rip
access-list 150 deny igmp any any
access-list 150 deny icmp any 224.0.0.0 15.255.255.255
access-list 150 deny tcp any 224.0.0.0 15.255.255.255
access-list 150 deny udp any 224.0.0.0 15.255.255.255
access-list 150 deny pim any any
access-list 150 deny udp any 10.0.0.0 0.255.255.255 eq snmp
access-list 150 permit ip any any
!
interface Bundle 1
 ip access-group 150 in
```

ACL to protect rouge multicast source from HSD

ADSG Configuration

DSG Classifiers configuration

```
cable dsg cfr 2200 dest-ip 232.10.10.1 tunnel 2200 dest-port 2200 13821 priority 1 src-ip 13.135.8.104 in-dcd yes
cable dsg cfr 200  dest-ip 232.10.10.2 tunnel 200 dest-port 2200 13821 priority 1 src-ip 13.135.8.104 in-dcd yes
cable dsg cfr 1200 dest-ip 232.10.10.3 tunnel 1200 priority 1 src-ip 13.135.8.104 in-dcd yes
```

DSG tunnel configuration with multicast mac add

```
cable dsg tunnel 2200 mac-addr 0100.0000.0022 tg 60 clients 22
cable dsg tunnel 200 mac-addr 0100.0000.0002 tg 20 clients 2
cable dsg tunnel 1200 mac-addr 0100.0000.0012 tg 40 clients 12
```

DSG Client-list configuration

```
cable dsg client-list 22 id-index 1 ca-system-id E00
cable dsg client-list 22 id-index 2 mac-addr 000a.000a.000a
cable dsg client-list 2 id-index 1 broadcast 1
cable dsg client-list 12 id-index 1 broadcast 2
```

DSG Timers - Optional

```
cable dsg timer 1 Tdsg1 2 Tdsg2 150 Tdsg3 10 Tdsg4 150
```

DSG Interface configuration

```
interface Cable1/0/0
 cable downstream dsg timer 1
 cable downstream dsg tg 20 channel 100
 cable downstream dsg tg 40 channel 100
 cable downstream dsg tg 60 channel 100
```

Tunnel Group and Channels

```
cable dsg tg 20
cable dsg tg 20 channel 1
cable dsg tg 20 channel 100
cable dsg tg 20 channel 101
cable dsg tg 20 channel 102
cable dsg tg 20 channel 103
cable dsg tg 40
cable dsg tg 40 channel 1
cable dsg tg 40 channel 100
cable dsg tg 40 channel 101
cable dsg tg 40 channel 102
cable dsg tg 40 channel 103
cable dsg tg 60
cable dsg tg 60 channel 100
cable dsg tg 60 channel 101
cable dsg tg 60 channel 102
cable dsg tg 60 channel 103
```

Define the Tunnel Group Channel (SG)

D3.0 Disable - Optional

```
cable dsg dseh disable
cable multicast mdf-disable DSG
```

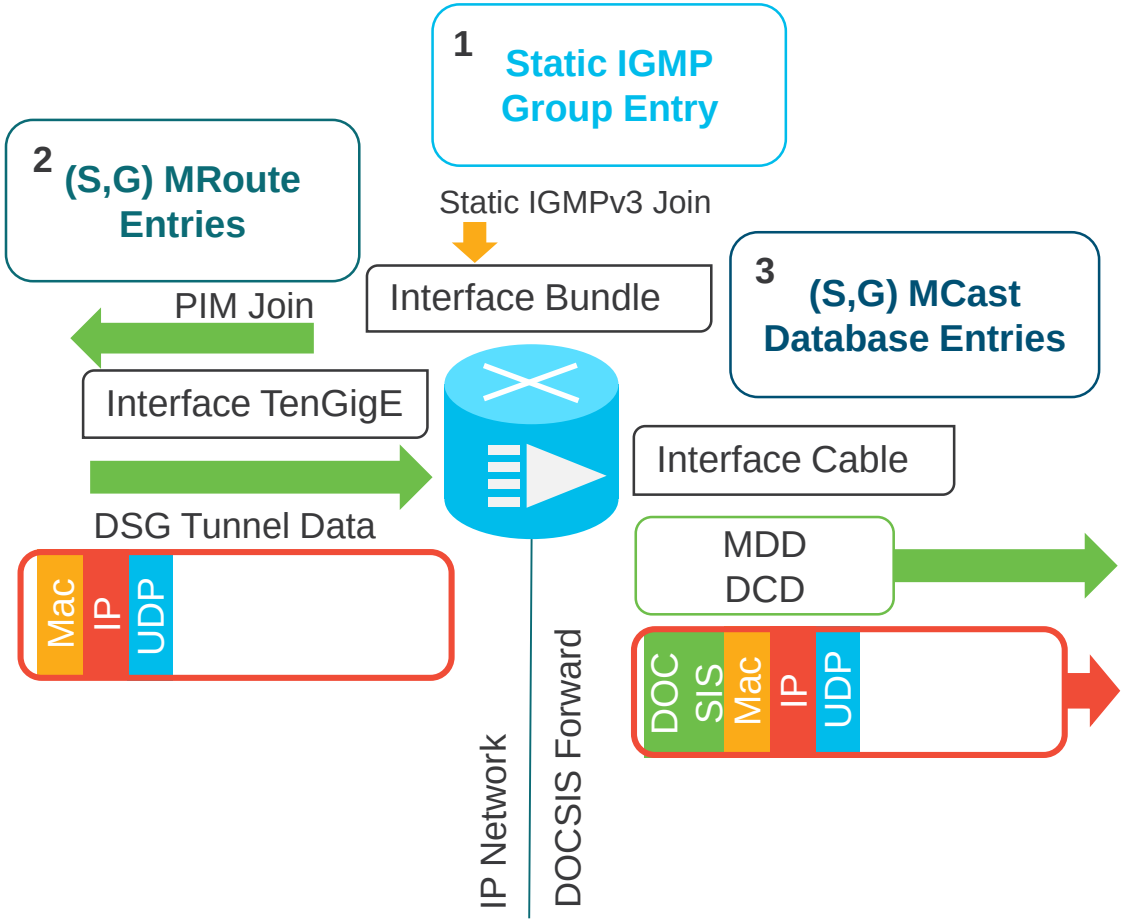
Primary DS Disable - Optional

```
interface Integrated-Cable1/0/0:0
cable downstream dsg disable
```

ADSG Troubleshooting

Operational Verification

- 1 Configuration triggers IGMP Group Join for Tunnel Data
- 2 Multicast Route set up and Tunnel Data flows
- 3 CMTS takes ingress Multicast and based on classifiers forwards out DOCSIS Forward



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
```

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 your interface is listed

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 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

Verification – MDD and DCD

Do this multiple times

Show cable mac-domain cable *slot/sub/port* mdd

```
CBR8-01# show cable mac-domain cable 1/0/0 mdd
MDD:  Mac-Domain(0) DCID(1)
Configuration Change Count: 0x1c
Number Of Fragments: 0x01
Fragment Sequence Number: 0x01
Current Channel DCID: 0x01
<SNIP>
 Upstream Frequency Range  1
      Upstream Transmit Power Reporting: On
      DSG DA-to-DSID Association Entry
                        MAC DA:  0x010000000002
                          DSID:  244087
      DSG DA-to-DSID Association Entry
                        MAC DA:  0x010000000012
                          DSID:  244095
      DSG DA-to-DSID Association Entry
                        MAC DA:  0x010000000022
                          DSID:  244103
      CM-STATUS non-channel-specific events
<SNIP>
```

Map to Multicast MAC to a DSID (Some eCMs have problems with this!)

Show interface cable *slot/sub/port* dsg downstream dcd

```
CBR8-01# show interface cable 1/0/0 dsg downstream dcd
IF          dcd   dcd   dsg   num of dcd      num of dcd     num of dcd  numof
Name        state Tx    fwd   sent           fail           change cnt  frag
----------- ----- ----- ----  -------------- -------------- ----------- -----
In1/0/0:0   en    on    en    2004081        0              3           1
In1/0/0:4   en    on    en    2004081        0              3           1
In1/0/0:8   en    on    en    2004081        0              3           1
In1/0/0:12  en    on    en    2004081        0              3           1
In1/0/0:16  en    on    en    1375044        0              3           1
In1/0/0:20  en    on    en    1375042        0              3           1
```

Each Primary DS Listed here

Make sure incrementing

Timer change, classifier change, etc.

ADSG Troubleshooting

Verification - Multicast

Verify DSG is triggering IGMP Group Report

```
CBR8-01# show cable dsg static-group bundle 1
Bundle Interface      Group            Source
Bundle1               232.10.10.2      13.135.8.104
Bundle1               232.10.10.3      13.135.8.104
Bundle1               232.10.10.1      13.135.8.104
```

No Static group – no PIM Join

Multicast Group Activity

```
cBR8-01#show ip mroute active
Active IP Multicast Sources - sending >= 4 kbps
Group: 232.10.10.1, (?)
   Source: 13.135.8.104 (?)
     Rate: 157 pps/253 kbps(1sec), 253 kbps(last 10 secs), 253 kbps(life avg)
```

Some Groups are very low bit-rate and will not show

Multicast Group Counters

Do this multiple times / Can use "mfib"

```
cBR8-01# show ip mroute count
IP Multicast Statistics
11 routes using 11960 bytes of memory
11 groups, 0.90 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-li
Group: 232.10.10.2, Source count: 1, Packets forwarded: 2449
  Source: 13.135.8.104/32, Forwarding: 244993/0/112/0, Other
Group: 232.10.10.3, Source count: 1, Packets forwarded: 57, Packe      ived: 57
  Source: 13.135.8.104/32, Forwarding: 57/0/291/0, Other: 57/0/0
Group: 232.10.10.1, Source count: 1, Packets forwarded: 110127155, Packets received: 110127155
  Source: 13.135.8.104/32, Forwarding: 110127155/157/201/252, Other: 110127155/0/0
```

"Others" should not be incrementing

Make sure Received and Forwarded incrementing

ADSG Troubleshooting

Commands Reference

- Show cable mac-domain cable ***slot***/subslot/port mdd
- Show ip igmp groups
- Show cable dsg static-group bundle *bundle*
- Show ip mroute [count | active]
- Show ip mfib [count | active]
- Show cable dsg tg
- Show cable dsg tunnel [tunnel-id [verbose]]
- Show cable multicast db {summary | detail}
- Show interface cable *slot/subslot/port* dsg downstream [tg | tunnel | dcd]
- Show cable dsg tunnel *tunneid* statistcs
- Show cable modem *mac-address* verbose
- Show cable modem docsis device-class {summary [total]}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