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Troubleshooting cBR-8/CCAP Based Services

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BRKSPG-2501

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Agenda

- CCAP Introduction
- Troubleshooting cBR-8 High Speed Data Services
- Troubleshooting cBR-8 Video and Voice Services
- cBR-8 Operational Maintenance
- Summary
- Q & A

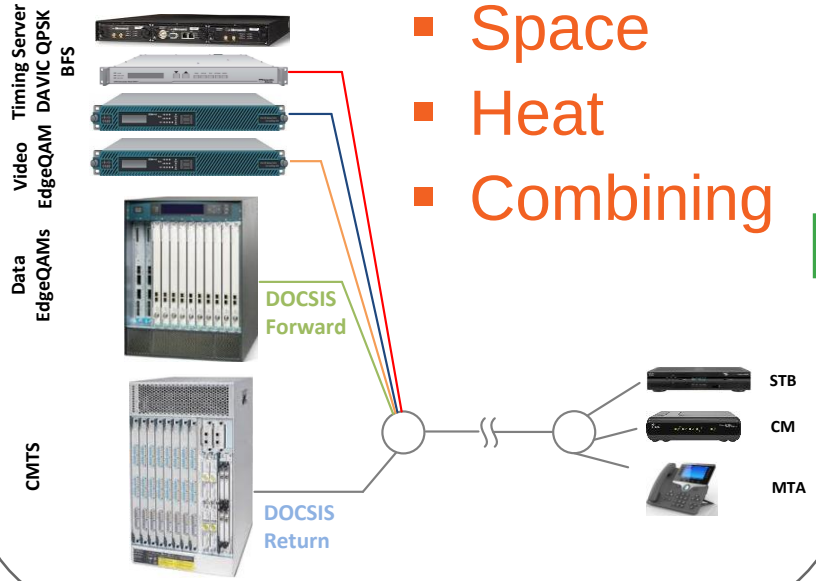
CCAP Introduction

Converged Cable Access Platform- CCAP

Converged Platform !!

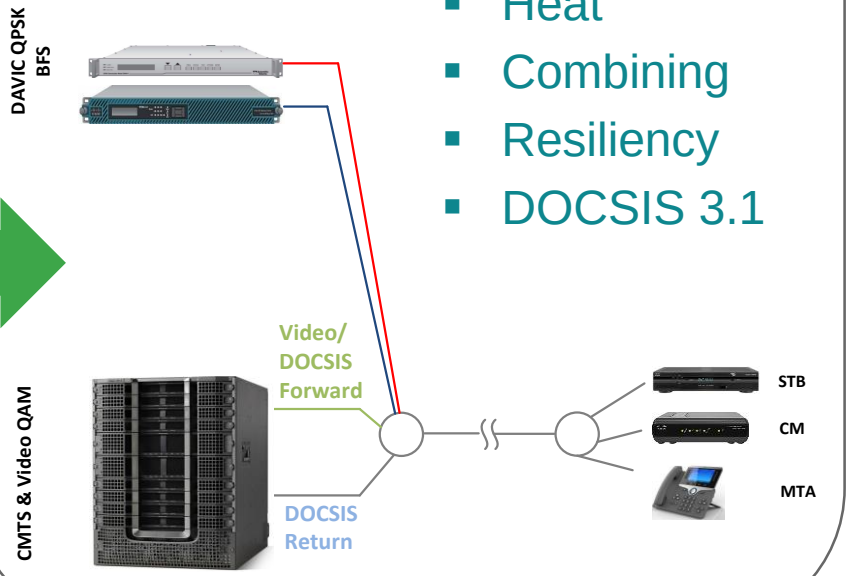
Multiple Devices

- Power
- Space
- Heat
- Combining



GAINS

- Power
- Space
- Heat
- Combining
- Resiliency
- DOCSIS 3.1



Converged Cable Access Platform

Cisco CCAP/cBR-8 Highlights

- **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
- **Path to DOCSIS 3.1**
  Enables FTTx comparable speeds, no DOCSIS 3.1 roadmap for uBR100012
- **CCAP video convergence**
  CapEx/OpEx savings; potential for PICs with integration optics
- **Path to Remote PHY**
  SG scaling & hub consolidation; full advantages of DOCSIS 3.1
- **Service & Feature Velocity with SDN**
  Faster feature implementation; customization

Check out BRKSPG-2505 !

cBR-8 High Speed Data Services

DOCSIS 3.1 Primer

What's New

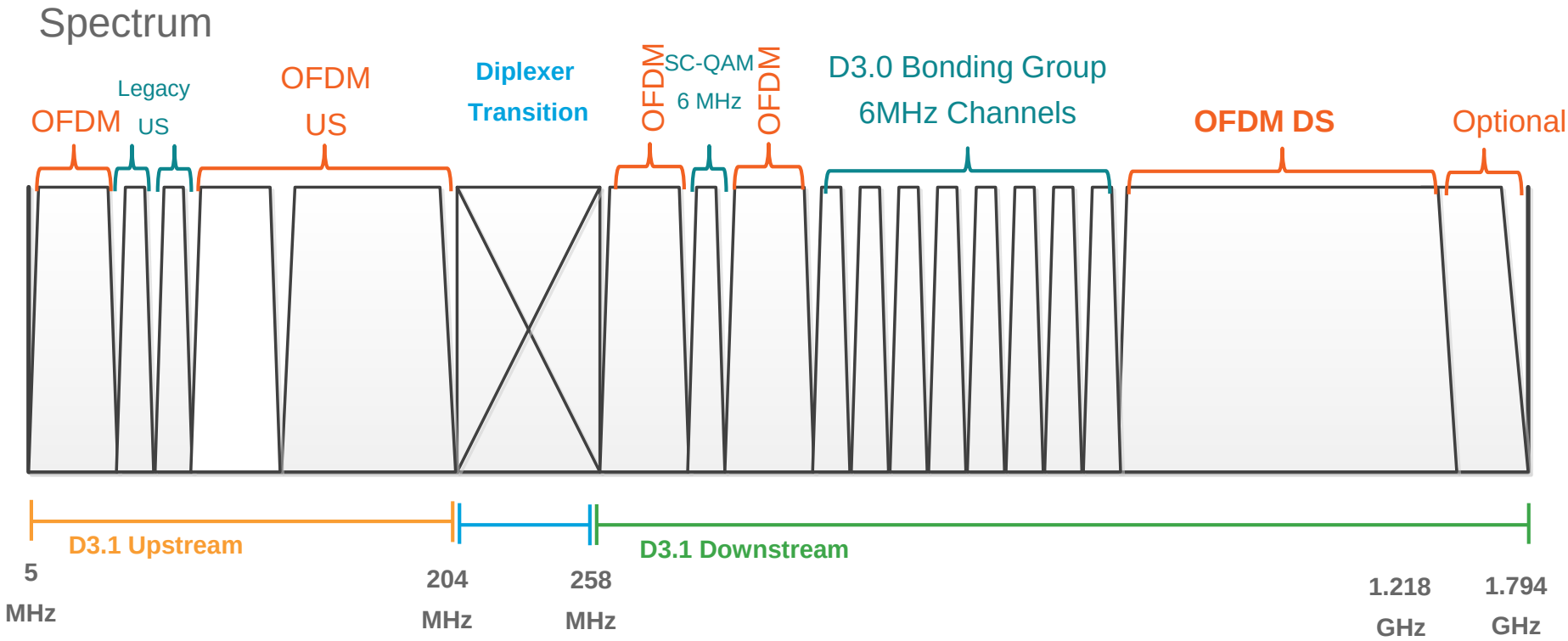
- OFDM (Orthogonal Frequency Division Multiplexing)
- OFDMA (Upstream)
- LDPC (Low Density Parity Check)
- Sub Carriers
  - Individual Profiles
- Profile Management
  - CM reports MER/SNR and receive power of each subcarrier
  - CM can test its ability to received unused profiles and report to CMTS

Check out BRKSPG-2505 !

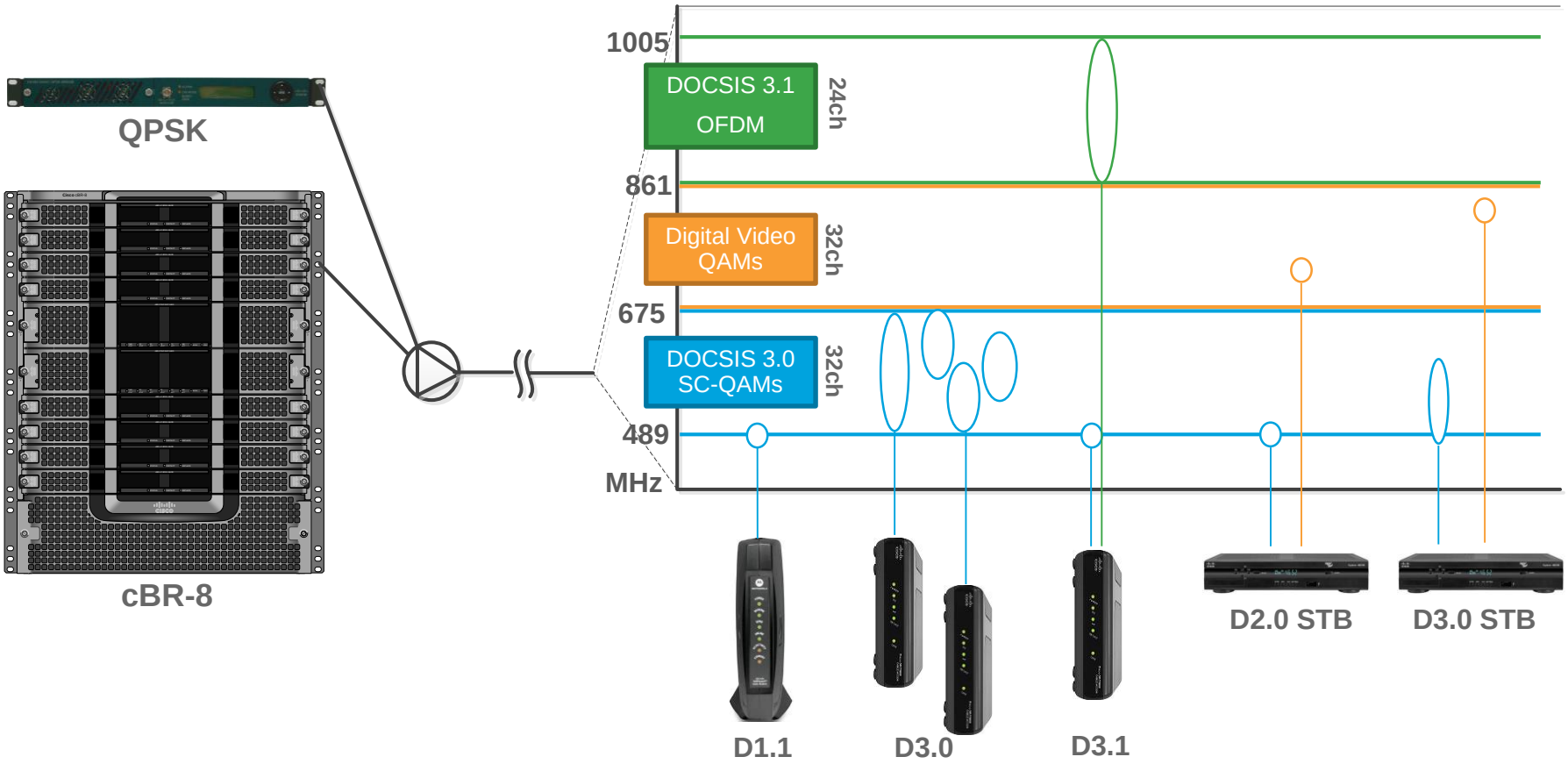
	DOCSIS 3.0	DOCSIS 3.1
Throughput	1 Gbps Down	10Gbps Down
	250 Mbps Up	1 Gbps
Channels	Annex B / 6MHz Channel	OFDM CH up to 192 MHz
Multiplex	Time Division	Frequency Division
Modulation	QAM 64/256 DS	QAM 256 / 1024 / 4096
Error Correction	Reed Solomon	Low Density Parity Check
Profiles	One Profile per QAM	Multiple Profiles per CM
Spectrum	204 to 1008 MHz	258 MHz to 1.218 GHz / Optional 1.794 GHz

DOCSIS 3.1 Primer

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



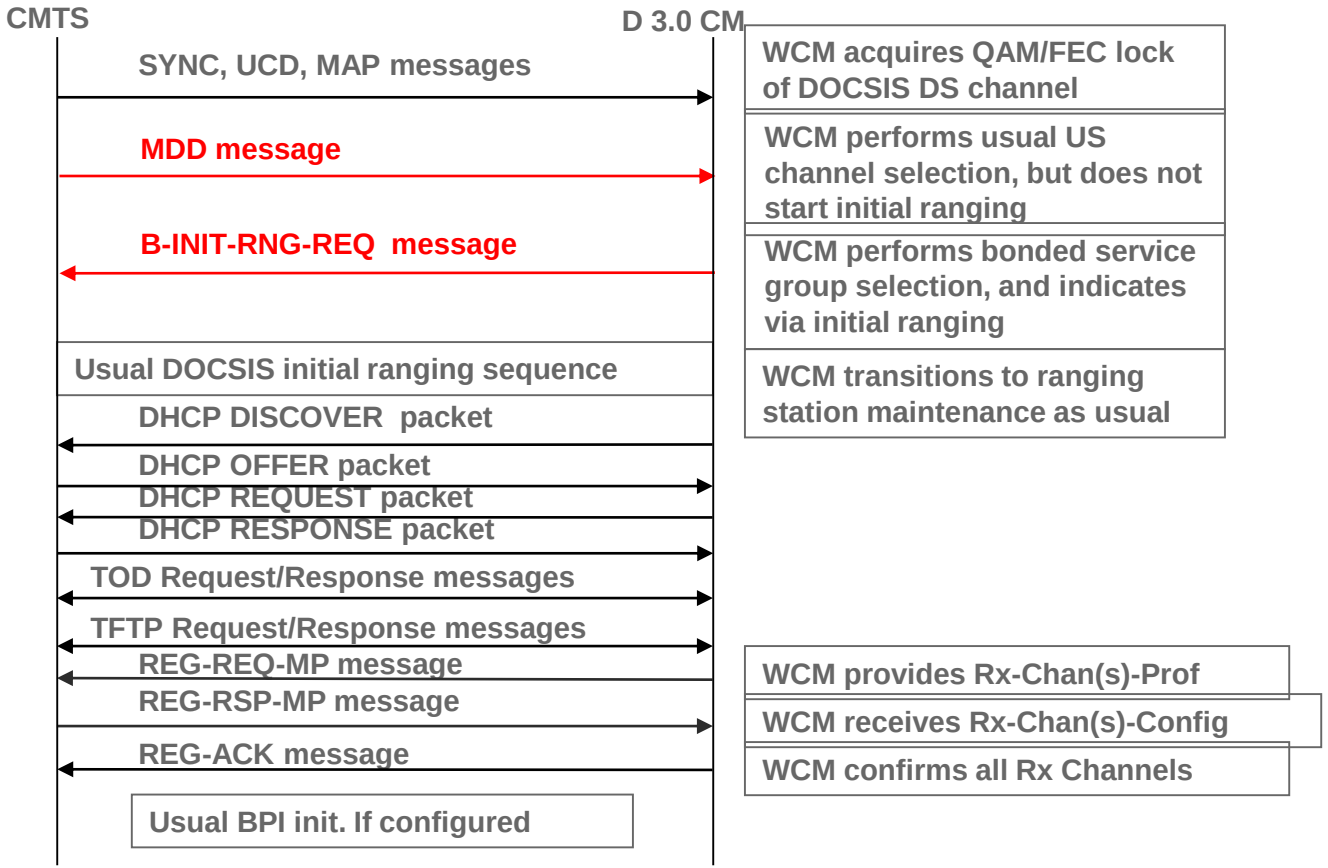
Spectrum Overview



DOCSIS 3.0 Registration

Comparison

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

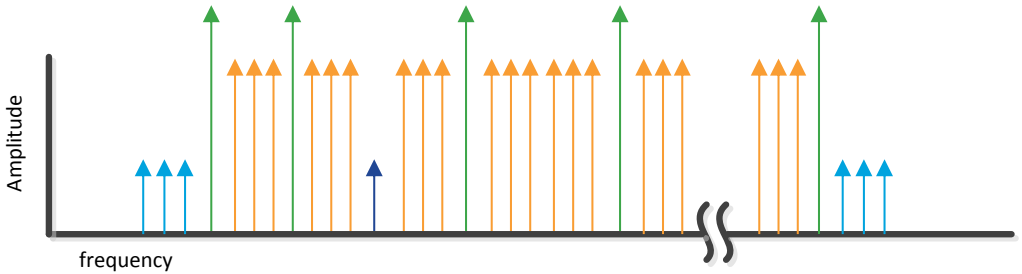


DOCSIS 3.1 Registration

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

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

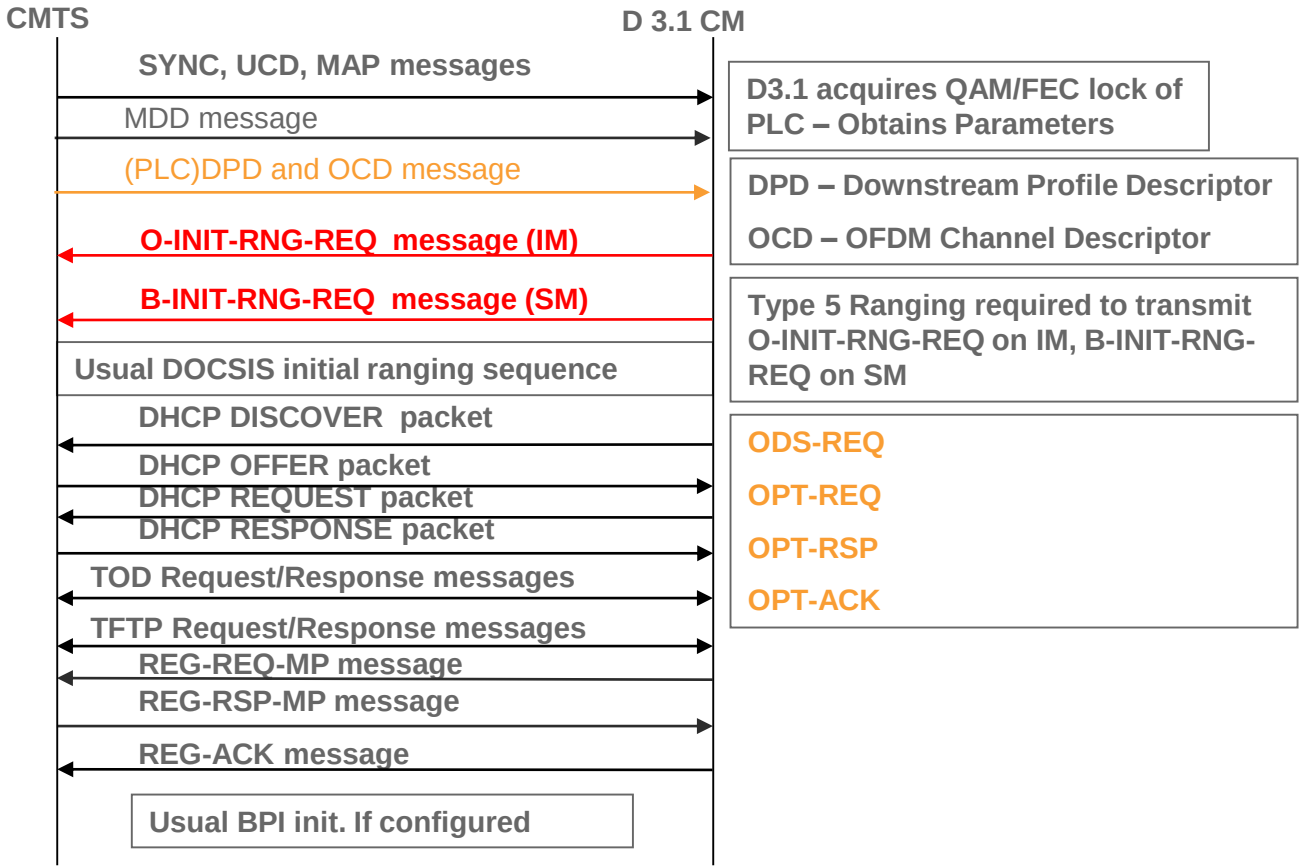


- Guard Sub Carriers
- Pilot Sub Carriers (For Channel Aqui, Adaptive Eq..etc)
- Data Sub Carriers
- PLC (Physical Link Channel)Start

DOCSIS 3.1 Registration

Comparison

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



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

Software and Hardware Support

- IOS-XE 3.18.0SP & Newer
- DOCSIS 3.1 Downstream Module
  - Gemini 2
  - PID CBR-D31-DS-MOD
- DOCSIS 3.0 Upstream Module
  - Leoben 3
  - PID CBR-D31-US-MOD

Check Chassis Compatibility

```
cBR8-01# show cable cal-cc chassis
  Chassis Capabilities
 Capability                    Supported        Value
------------------------------x----------------x--------
DOCSIS 3.1                        YES
Number of Fibernodes                              256
Number of Bundles                                 40
```

Should say "yes"

Check Hardware

PID should have "D31"

```
cBR8-01# show inventory
NAME: "CLC Downstream PHY Module 0/1", DESCR: "Cable PHY
Module"
PID: CBR-D31-DS-MOD    , VID: V01 , SN: CAT1915E0E1
NAME: "CLC Upstream PHY Module 0/2", DESCR: "Cable PHY
Module"
PID: CBR-D31-US-MOD    , VID: V01, SN: CAT1951E0A7
```

Check Firmware

```
cBR8-01# show cable card 3/0 ds-phy display | i ver
img info: section 2, running ver 30013, bundled 1000c G2 2000c G2-D31 0(micro)
img info: section 2, running ver 44141, bundled 2000f G2 30103 G2-D31 0(apollo)
micro ver 30013, sector(1 base) 2, apollo ver 44141, sector(0 base) 2
cpld ver 7, sector(1 base) 1, psoc ver 40004, sector(1 base) 1
img info: section 2, running ver 30013, bundled 1000c G2 2000c G2-D31 0(micro)
img info: section 2, running ver 44141, bundled 2000f G2 30103 G2-D31 0(apollo)
micro ver 30013, sector(1 base) 2, apollo ver 44141, sector(0 base) 2
cpld ver 7, sector(1 base) 1, psoc ver 40004, sector(1 base) 1
```

30013 for "Micro"
44141 for "Apollo" (DS-PHY)

1.b - Configuration

Controller Configuration

```
controller Integrated-Cable 3/0/0
 max-ofdm-spectrum 96000000
 max-carrier 32
 base-channel-power 40
 rf-chan 0 31
  type DOCSIS
  frequency 561000000
  rf-output NORMAL
  power-adjust 0
  qam-profile 1
  docsis-channel-id 1
```

32 SC RF Channels grouped

US BG Configuration

CGD Interface Cable configuration

```
interface Cable3/0/0
 load-interval 30
 downstream Integrated-Cable 3/0/0 rf-channel 8
 downstream Integrated-Cable 3/0/0 rf-channel 16
 downstream Integrated-Cable 3/0/0 rf-channel 20
 downstream Integrated-Cable 3/0/0 rf-channel 23
 upstream 0 Upstream-Cable 3/0/0 us-channel 0
 upstream 1 Upstream-Cable 3/0/0 us-channel 1
 upstream 2 Upstream-Cable 3/0/0 us-channel 2
 upstream 3 Upstream-Cable 3/0/0 us-channel 3
 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 50
 downstream Integrated-Cable 3/0/0
 upstream Upstream-Cable 3/0/0

Cbr8-01#Show cable fiber-node 50
Fiber-Node 50
Channel(s)    :  downstream Integrated-Cable 3/0/0:  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  32 158
Upstream-Cable 3/0/0
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

Group of RF channels and ACFE Adaptive CIR and Fair EIR - allows for dynamic bandwidth allocation

Wideband Interface Configuration

```
interface Wideband-Cable3/0/0:14
 load-interval 30
 cable bundle 1
 cable rf-channels channel-list 0-31
bandwidth-percent 1
```

1.b - D3.1 Configuration

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

Control profile for MMM

```
cable downstream ofdm-chan-profile 100
  cyclic-prefix 1024
  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
4096-QAM
```

Profile ID	100	1
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
		D512

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

Diff data mod profile for range of sub-carriers

```
controller Integrated-Cable 3/0/0
 max-ofdm-spectrum 96000000
 max-carrier 32
 base-channel-power 40
 rf-chan 0 31
  type DOCSIS
  frequency 561000000
  rf-output NORMAL
  power-adjust 0
  qam-profile 1
  docsis-channel-id 1
 rf-chan 158
  power-adjust 0
  docsis-channel-id 159
  ofdm channel-profile 100 start-
frequency 777000000 width 96000000 plc
826000000
```

Define OFDM Channel Separately- starts at 158

```
interface Wideband-Cable3/0/0:14
 cable bundle 1
 cable rf-channels channel-list 0-31 158
 bandwidth percent 1
```

Include OFDM Channel 158

1.b - Controller verification

Configuration Verification

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

- Channel State
- Frequency
- Type
- Annex
- Modulation
- Symbol Rate
- Interleaver
- DCID
- Power
- Output

Single Carrier QAM Parameters

OFDM Parameters

```
CBR8-01# show controller integrated 3/0/0 rf-ch 0-31 158
Chan State Admin Frequency  Type   Annex Mod  srate Interleaver  dcid  power  output
0    UP    UP    561000000  DOCSIS  B    256   5361  I32-J4       1    40     NORMAL
1    UP    UP    567000000  DOCSIS  B    256   5361  I32-J4       2    40     NORMAL
2    UP    UP    573000000  DOCSIS  B    256   5361  I32-J4       3    40     NORMAL
3    UP    UP    579000000  DOCSIS  B    256   5361  I32-J4       4    40     NORMAL
4    UP    UP    585000000  DOCSIS  B    256   5361  I32-J4       5    40     NORMAL
5    UP    UP    591000000  DOCSIS  B    256   5361  I32-J4       6    40     NORMAL
6    UP    UP    597000000  DOCSIS  B    256   5361  I32-J4       7    40     NORMAL
7    UP    UP    603000000  DOCSIS  B    256   5361  I32-J4       8    40     NORMAL
8    UP    UP    609000000  DOCSIS  B    256   5361  I32-J4       9    40     NORMAL
9    UP    UP    615000000  DOCSIS  B    256   5361  I32-J4       10   40     NORMAL
10   UP    UP    621000000  DOCSIS  B    256   5361  I32-J4       11   40     NORMAL
11   UP    UP    627000000  DOCSIS  B    256   5361  I32-J4       12   40     NORMAL
12   UP    UP    633000000  DOCSIS  B    256   5361  I32-J4       13   40     NORMAL
13   UP    UP    639000000  DOCSIS  B    256   5361  I32-J4       14   40     NORMAL
14   UP    UP    645000000  DOCSIS  B    256   5361  I32-J4       15   40     NORMAL
15   UP    UP    651000000  DOCSIS  B    256   5361  I32-J4       16   40     NORMAL
16   UP    UP    657000000  DOCSIS  B    256   5361  I32-J4       17   40     NORMAL
17   UP    UP    663000000  DOCSIS  B    256   5361  I32-J4       18   40     NORMAL
18   UP    UP    669000000  DOCSIS  B    256   5361  I32-J4       19   40     NORMAL
19   UP    UP    675000000  DOCSIS  B    256   5361  I32-J4       20   40     NORMAL
20   UP    UP    681000000  DOCSIS  B    256   5361  I32-J4       21   40     NORMAL
21   UP    UP    687000000  DOCSIS  B    256   5361  I32-J4       22   40     NORMAL
22   UP    UP    693000000  DOCSIS  B    256   5361  I32-J4       23   40     NORMAL
23   UP    UP    699000000  DOCSIS  B    256   5361  I32-J4       24   40     NORMAL
24   UP    UP    705000000  DOCSIS  B    256   5361  I32-J4       25   40     NORMAL
25   UP    UP    711000000  DOCSIS  B    256   5361  I32-J4       26   40     NORMAL
26   UP    UP    717000000  DOCSIS  B    256   5361  I32-J4       27   40     NORMAL
27   UP    UP    723000000  DOCSIS  B    256   5361  I32-J4       28   40     NORMAL
28   UP    UP    729000000  DOCSIS  B    256   5361  I32-J4       29   40     NORMAL
29   UP    UP    735000000  DOCSIS  B    256   5361  I32-J4       30   40     NORMAL
30   UP    UP    741000000  DOCSIS  B    256   5361  I32-J4       31   40     NORMAL
31   UP    UP    747000000  DOCSIS  B    256   5361  I32-J4       32   40     NORMAL
Chan State Admin Mod-Type  Start Frequency  Width      PLC         Profile-ID  dcid  power  output
158  UP    UP    OFDM      777000000        96000000   826000000   100         159   40     NORMAL
```

1.c - DOCSIS MDD Verification

Debug Cable MDD

```
Cable8/1/1: size 592 mdd_tlv_size 562 num_frag 1 seq_num 1
test_mdd_tlv_length 0
 Cable8/1/1 MDD datagramsize 592, msg len 590, ehdr type_or_len 572,
tlv_size 562 max_pak_size 1518
 MDD MESSAGE
   FRAME HEADER
     FC, MAC_PARM, LEN       - 0xC2, 0x00, 0x024E
   MAC MANAGEMENT MESSAGE HEADER
     DA, SA                  - 01E0.2F00.0001, 0012.001A.689B
     msg LEN                 - 0x023C
     DSAP, SSAP              - 0, 0
     control, version, type  - 0x03, 0x04, 0x21
     change_count            - 0x9F
     num_fraqment, seq_num   - 0x01, 0x01
     dcid                    - 203
     MDD TLV, Total TLV size - 562
     MDD TLV
       Downstream Active Channel List
         Channel ID:             200
         Frequency:              615000000Hz
         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
       Downstream Active Channel List
         Channel ID:             201
         Frequency:              621000000Hz
         Modulation Order/Annex: 256 QAM/Annex B
         Primary Capable:        Not Primary-Capable
<SNIP>
```

```
MAC Domain Downstream Service Group
 MD-DS-SG ID: 1
  Channel IDs: 200
               201
               202
               203
               204
               205
               <SNIP>
               211
               212
               213
               214
               215
  Downstream Ambiguity Resolution Frequency List
   Frequencies: 615000000Hz
                621000000Hz
                627000000Hz
                633000000Hz
                <SNIP>
                687000000Hz
                693000000Hz
                699000000Hz
                705000000Hz
 IP Initialization Parameters
 IP Provisioning Mode:   IPv6
 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
```

1.c - DOCSIS 3.1 OCD Verification

OFDM Channel Descriptor

Configuration Verification

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 3/0/0 ocd
DCID: 159  OFDM Controller:channel 3/0/0:158
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	100	1
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
		D512

Downstream Profile Descriptor

```
cBR8-01# show cable mac-domain cable 3/0/0 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     (Seq        Number 0, Fragments 0)
  DPD fields
    DCID                           : 159
    Profile ID                     : 2
    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
  - debug cable registration
  - debug cable tlv
  - debug cable ipv6 dhcp
  - debug cable service-ds-selection
  - debug cable rcc
  - debug cable wbcmts
  - debug cable range initial
  - 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   RCC
                                State               Ver  Ver       OFDM ID
fc52.8d5e.869a C3/0/0/UB        w-online(pt)        3.1  3.1  33x4  1    81
fc52.8d5e.83dc C3/0/0/UB        w-online(pt)        3.1  3.1  33x4  1    80
```

Operational Version 3.1

33 Channels – 32 SC-QAM + 1 OFDM

Number of OFDM 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 version sum total
Cable Modem DOCSIS Version Summary
                  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 scdm atdm tdma UP   WB   WP   NB
C3/0/0/UB     6    3    3    0    0    0    6    0    0    0    0    0    6    0    0
C3/0/0/U0     2    0    1    1    0    0    2    0    0    2    0    0    0    0    2
              ------------------------------------------------------------------------
Total:        81   v3.1: 30                 v1.1: 81     UB  : 76     WB: 76
                   v3.0: 74                              UP  : 0      WP: 0
                   v2.0: 4                  v1.0: 0      scdm: 0      NB: 5
                   v1.1: 0                               atdm: 10
                   v1.0: 0                               tdma: 0
------------------------------------------------------------------------------
```

1.d - Modem verification

- Primary Channel
- Bonding Group
- OFDM Channel(s) / Profile(s)
- MAC and Operational Version
- Tuner Capability

Show Cable Modem Verbose

```
F241-36-03-cBR8-01# show cable modem fc52.8d5e.869a verbose
MAC Address                          : fc52.8d5e.869a
IP Address                           : 13.41.0.34
IPv6 Address                         : ---
Dual IP                              : N
Prim Sid                             : 1
Host Interface                       : C3/0/0/UB
MD-DS-SG / MD-US-SG                  : 7 / 1
MD-CM-SG                             : 0x900701
Primary Wideband Channel ID          : 12303 (Wi3/0/0:14)
Primary Downstream                   : In3/0/0:8 (RfId : 12296, SC-QAM)
Wideband Capable                     : Y
DS Tuner Capability                  : 32
Downstream Channel DCID RF Channel : 9     3/0/0:8 (SC-QAM)
Downstream Channel DCID RF Channel : 1     3/0/0:0 (SC-QAM)
Downstream Channel DCID RF Channel : 2     3/0/0:1 (SC-QAM)
<SNIP>
Downstream Channel DCID RF Channel : 159   3/0/0:158 (OFDM)
Downstream OFDM DCID                 : 159
Downstream OFDM Profile (in-use)     : 2
Downstream OFDM Profile (dwngrd)     : 1
Downstream OFDM Profile (recomm)     : 2
Downstream OFDM Profile (unfit)      : N/A
<SNIP>
sysDescr                             : Technicolor DOCSIS 3.1 advanced cable
modem <<HW_REV: 1.4; VENDOR: Technicolor; BOOTR: 5.0.0; SW_REV:
01.F3.08.16.00; MODEL: TC4400-XM6>>
Downstream Power                     : -0.30 dBmV (SNR = 47.60 dB)
MAC Version                          : DOC3.1
Operational Version                  : DOC3.1
QoS Provisioned Mode                 : DOC1.1
```

Primary DS and Bonding Group

Types of QAM

Types of QAM

Various OFDM Profiles

1.d - Modem verification..contd

- Modem Status
- OFDM MRC Support
- OFDM MTC Support
- DS OFDM Profile Support
- DS OFDM QAM Modulation Support
- US OFDM QAM Modulation Support
- DS Lower and Upper Band Ranges

Show Cable Modem Verbose

```
Modem Status                          : {Modem= w-online(pt),
Security=assign(tek)}
Capabilities                          : {Frag=N, Concat=N, PHS=N}
Security Capabilities                 : {Priv=BPI+, EAE=Y,
Key_len=56,128}
L2VPN Capabilities                    : {L2VPN=N, eSAFE=N}
L2VPN type                            : {CLI=N, DOCSIS=N}
Sid/Said Limit                        : {Max US Sids=16, Ma
Optional Filtering Support            : {802.1P=N, 802.1Q=N
Transmit Equalizer Support            : {Taps/Symbol= 1, Num      aps= 24}
Extended Pkt Len Capability           : Max len of PDU = 2000 bytes, CMTS
sent 2000
OFDM MRC Support                      : Max num of DS OFDM channels = 2
OFDM MTC Support                      : Max num of US OFDM channels = 2
DS OFDM Profile Support               : Max num of DS OFDM profile per
channel = 5
DS OFDM QAM Modulation Support        :
0x1FD4{|QPSK|16|64|128|256|512|1024|2048|4096 QAM}
US OFDM QAM Modulation Support        :
0x1FFC{|QPSK|8|16|32|64|128|256|512|1024|2048|4096 QAM}
DS Lower Band Edge                    : 0x2{258 MHz}
DS Upper Band Edge                    : 0x1{1218 MHz}
Diplex Upper Band Edge                : 1081(-)
DTP mode                              : 0(DTP Op not supported)
DTP performance                       : 0(DTP mode not supported)
CM Capability Reject                  : {1,3,15,22,23,35,36,38,44,46,47}
Flaps                                 : 10(Jun 13 18:08:16)
Errors                                : 0 CRCs, 0 HCSes
```

Supported number of OFDM Channels

OFDM Spectrum Range

OFDM Modulation Supported

1.d - D3.1 Verification

D3.1 All-Together

Modem Profile

```
CBR8-01# show cable modem fc52.8d5e.869a verbose | inc OFDM
Downstream Channel DCID RF Channel : 159   3/0/0:158 (OFDM)
Downstream OFDM DCID               : 159
Downstream OFDM Profile (in-use)   : 2
Downstream OFDM Profile (dwngrd)   : 1
Downstream OFDM Profile (recomm)   : 2
Downstream OFDM Profile (unfit)    : N/A
```

OFDM Profile

Profile ID	100	1
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 D4096	D1024 D2048 D512

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 fc52.8d5e.869a 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     :            2 [       0x2]
Profile 2     :            0 [         0]
No Sniff Enabled.
```

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 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 – SID tracker verification for US throughput issues

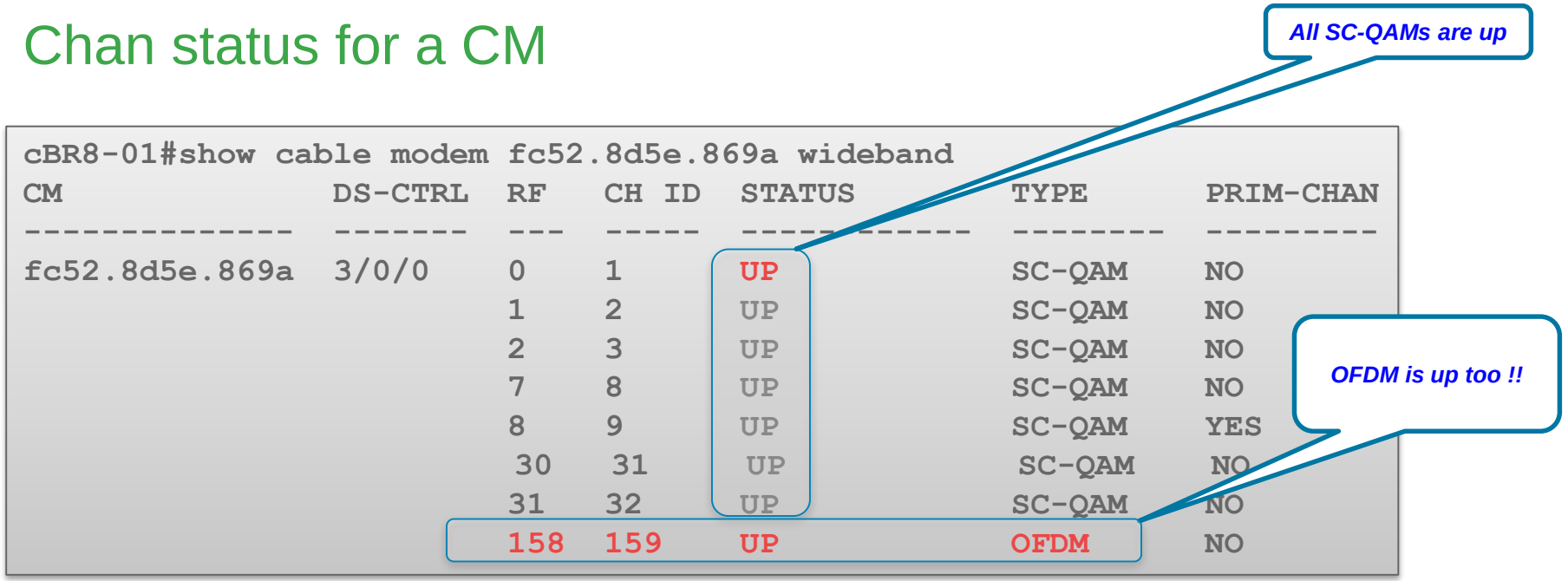
  Look at the real numbers on cBR-8

- 3. Configure DS Bonding Resiliency
  - 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



2.a - DS Performance Verification

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

```
cBR8-01#show cable modem fc52.8d5e.869a service-flow
MAC Address    IP Address      Host          MAC                Prim  Num Primary    DS
                               Interface     State              Sid   CPE Downstream RfId
fc52.8d5e.869a 13.41.0.34      C3/0/0/UB     w-online(pt)       1     8   In3/0/0:8  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         Wi3/0/0:14
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.a - DS Performance Verification

Wideband interface stats

```
cBR8-01#show int wideband-Cable 3/0/0:14
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/m x total/threshold/drops)
     Conversations  0/0/256 (a tive/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 2 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 3/0/0 counter ofdm-channel
Controller Chan# Profile/PLC              Packets                Bytes MaxRate     Rate       Utilization
                                                                        (Mbps)     (Mbps)     (%)
3/0/0      158   Total                 21215976761       20531535357096       -    1216.056926  100.0
3/0/0      158   0                       178625333         254776976190     496      0.004952   0.0
3/0/0      158   1                         5290363           214635993     616      0.001600   0.0
3/0/0      158   2                     21015238174       20274362725057    1216   1216.005271  100.0
3/0/0      158   PLC-MMM                  15771114           1161805398               0.008840
3/0/0      158   PLC-EM                          0                    0               0.000000
3/0/0      158   PLC-TR                          0                    0               0.000000
```

OFDM –Max and Current load on each channel

MAP/UCD/SYNC Generated by Cable line card

```
cBR8-01# show controllers integrated-Cable 3/0/0 counter rf-channel
Controller  RF    MPEG        MPEG        MPEG    Sync       MAP/UCD     User
            Chan  Packets     bps         Mbps    Packets    Packets     Mbps
                  Tx                              Tx         Tx
3/0/0       0     987308931   6931203     06.93   0          525995      06.20
3/0/0       1     900979271   6345766     06.34   0          525995      05.68
3/0/0       2     914382688   6443522     06.44   0          525995      05.76
3/0/0       3     984291945   6913607     06.91   0          525995      06.21
3/0/0       4     998100101   7010812     07.01   0          525995      06.30
3/0/0       5     913935967   6447382     06.44   0          525995      05.76
3/0/0       6     914746053   6436955     06.43   0          525995      05.78
3/0/0       7     981493724   6896462     06.89   0          525995      06.18
3/0/0       8     5928219913  34048422    34.04   105198435  2093325397  29.61
3/0/0       9     3751509182  31973723    31.97   0          525995      28.64
3/0/0       10    3704864095  31878272    31.87   0          525995      28.58
```

Packet Counter

Throughput Rate (~37.5 Max)

Current load on each SC-channel

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

```
cable rf-change-trigger percent 75 count 10
!
cable resiliency ds-bonding
```

Rf-change-trigger % and count of CM

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
```

2.b - Upstream Performance Verification

```
cBR8-01#show cable modem fc52.8d5e.869a
MAC Address    IP Address      I/F            MAC                Prim  RxPwr   Timing Num I
                                              State              Sid   (dBmv)  Offset CPE P
fc52.8d5e.869a 13.41.0.34      C3/0/0/UB      w-online(pt)       1     0.00    2095   0   N
```

US Not in Partial-Service

```
cBR8-01#show cable modem fc52.8d5e.869a verbose

MAC Address                     : fc52.8d5e.869a
IP Address                      : 13.41.0.34
IPv6 Address                    : ---
Dual IP                         : N
Prim Sid                        : 1
Host Interface                  : C3/0/0/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*
```

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

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

Good Codewords received..

2.b - Upstream Performance Verification

```
cBR8-01#sho cable modem fc52.8d5e.869a service-flow 11
Sfid                          : 11
Hfid                          : 285
Mac Address                   : fc52.8d5e.869a
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 c3/0/0 up
Interface  Cable3/0/0
Upstream # 0

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

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 3/0/0 mac-scheduler 1
DOCSIS 1.1 MAC scheduler for Cable3/0/0/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 : 98%
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 3/0/0 up bonding-
group
Cable3/0/0: 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 Bondin
Group: 116
```

Bonding Group BW Stats

No Lost Segments

US channel utilization

cBR-8 Video and Voice Services

Converged Cable Access Platform- CCAP

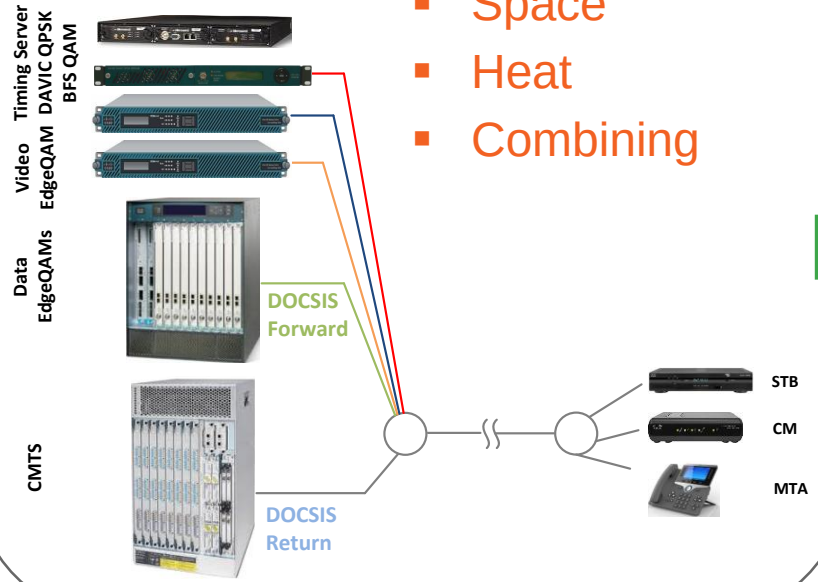
Recap

Converged Platform !!

Traditional

Multiple Devices

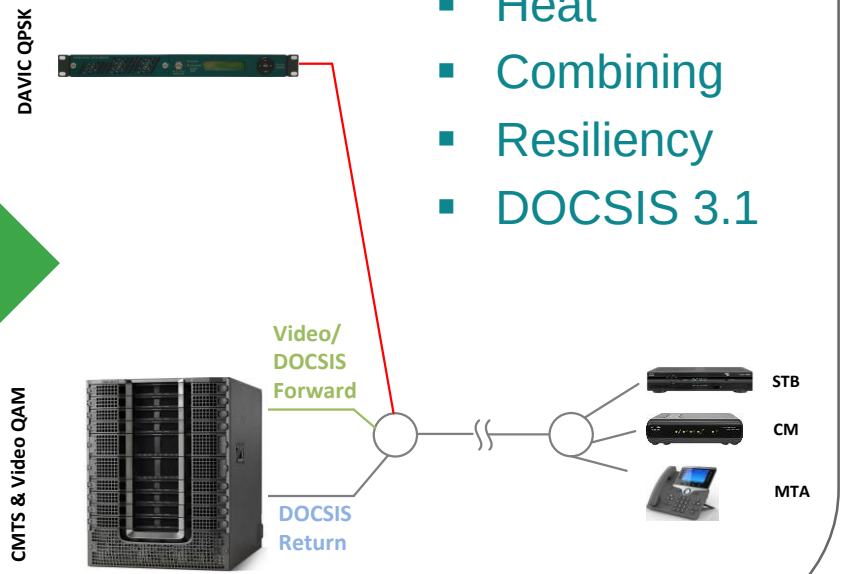
- Power
- Space
- Heat
- Combining



CCAP

GAINS

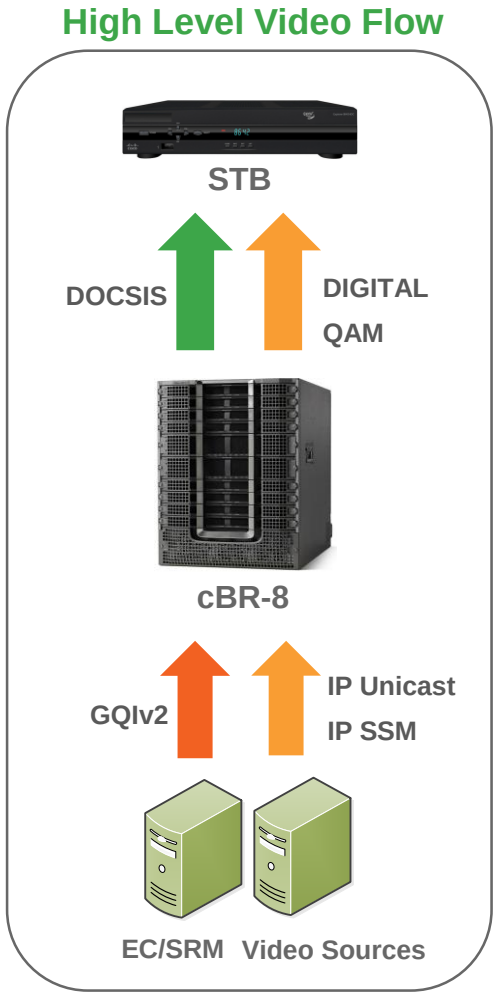
- Power
- Space
- Heat
- Combining
- Resiliency
- DOCSIS 3.1



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 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

More in BRKSPG-2505 !

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)

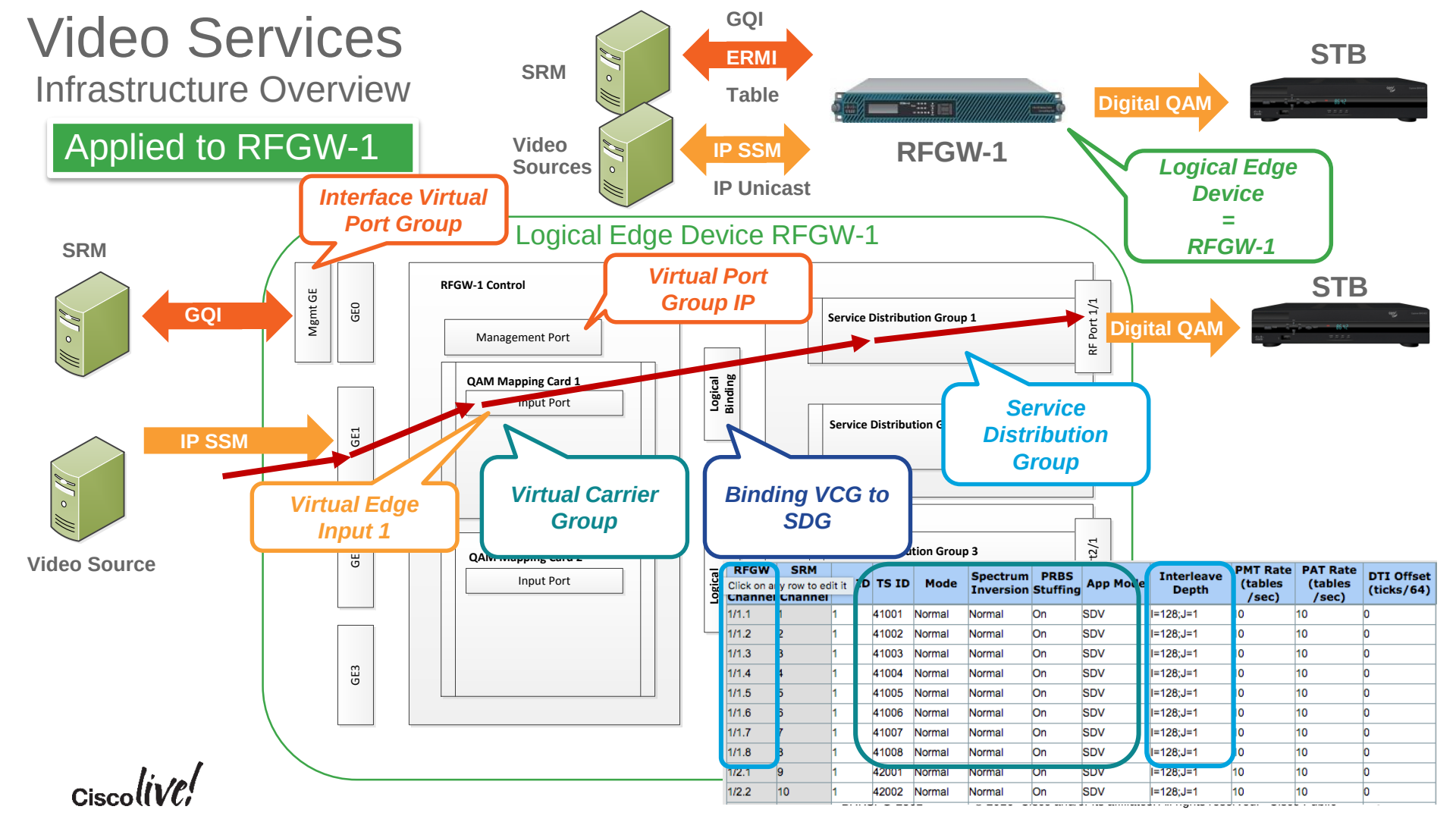
Access Lists Required

- Multicast Uplink ACL allowed

Video Services

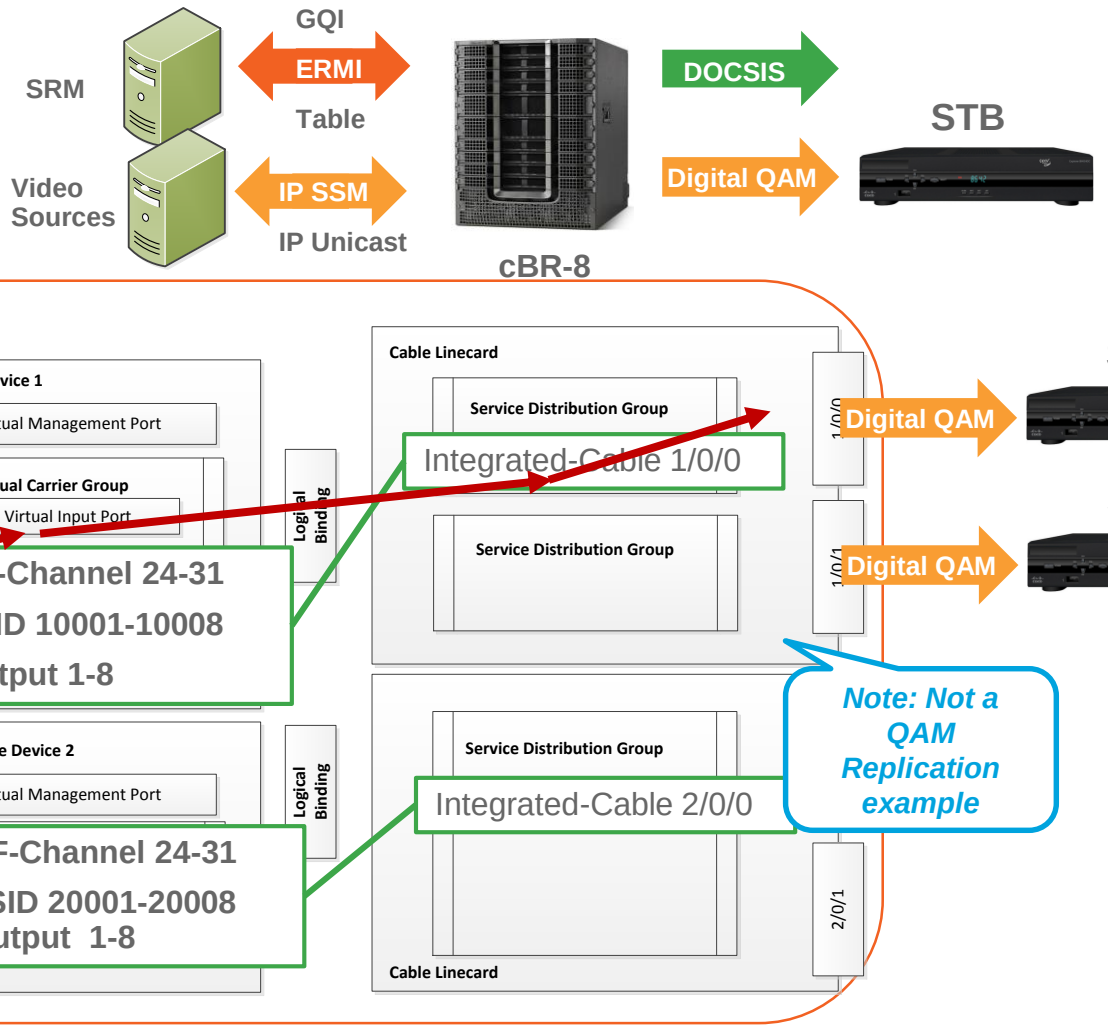
Infrastructure Overview

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)
Click on any row to edit it											
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

Video Services
Infrastructure Overview



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 Service Configuration

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

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

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

Edge Encryption per LC

Specify the forwarding port(s)

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

Bind these to output port(s)

LED

GQI or Table Based

Mgmt-IP is IP covered by the Intf VPGSubnet

VSRM or EC Server IP

Associate to VCG

"active" activates

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
```

Cisco live!

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

Refers to D6

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
    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
  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

- Show cable video gqi connection

VSRM Log Tail

```
RaGqiSrmResourceInit,RID=13.135.69.2,RPCVersion=2
UQFlush,queue=cBR8
RmResourceStartup,RID=13.135.69.2
RmResourceStartupQam,RID=13.135.69.2
RmGetSessionList,RID=13.135.69.2,chan=1
RmCmdExec,Cmd=SessionListQuery,RID=13.135.69.2,Device=cBR8
RmCmdSuccess,Cmd=SessionListQuery,RID=13.135.69.2,RName=cBR8,CmdTime=0ms
```

Not cBR-8 Outputs

Show Cable Video GQI Connection

```
CBR8-01# show cable video gqi connection
LED   Management     Server          Connection      Version   Event          Reset
ID    IP             IP              Status                    Pending        Indication
1     13.135.69.2    10.225.198.88   Connected       2         0              ACKED
2     13.135.69.3    10.225.198.87   Not Connected   0         0              Not Sent
```

cBR8.Chassis

AdminState	InService
OperationalState	InService
ProvisionedStatus	Operational
State	Init
InterfaceStatus	Alarm

What if not connected?

- 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

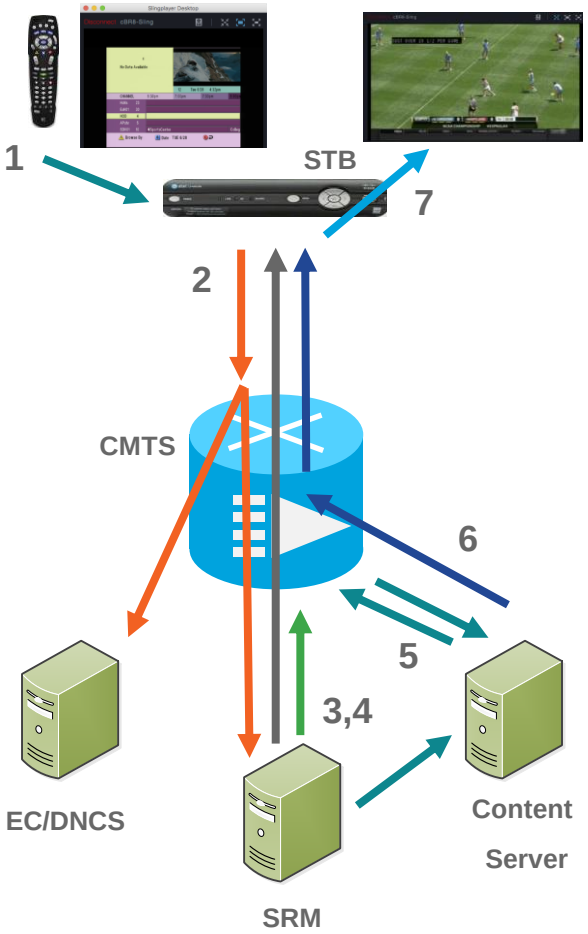
```
[vgqi-mgmt]:vgqi_msg_encode_query_sessions_response_v2 - Session ID Count on requested QAM: 1
[vgqi-mgmt]:vgqi_msg_encode_query_sessions_response_v2 - GQI Output Port 1 maps to physical QAM -> slot 1 port 0 channel 24
[vgqi-mgmt]:vgqi_allocate_response, Allocating GQI Response: GQI Server IP 10.225.198.88, 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
```

Most recent at top

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*

Show Cable Video Session Logical-Edge-Device id

Recommend Alias “scvs 1”

```
CBR8-01# show cable video sessions logical id 1
Total Sessions = 6
Session     Output      Strea                                          UDP    Output  Input      Output  Input     Output
Id          Port        Type                 cast IP (S,G)             Port   Progran                    Bitr
-------------------------------------------------------------------------------------------------------------------
1048624     1           Passthru   SSM    10.225.198.88,239.255.205.2   0      -       ACTIVE-PSI ON      18290     11990     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     11985     CLEAR
1048627     4           Passthru   SSM    10.225.198.88,239.255.205.2   0      -       ACTIVE-PSI ON      18290     11990     CLEAR
1048628     5           Passthru   SSM    10.225.198.88,239.255.205.2   0      -       ACTIVE-PSI ON      18290     11789     CLEAR
```

Passthru/Remap/Datapipe

Program Number

Encryption

Output Port

Unicast or SSM

Multicast / I

Output: On

Bitrate

Session ID

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

Led-xx where xx is same as the ID number

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                state = 0x03,
new_state = 0x02;
vgqi_msg_encode_create_session_response_v2_internal, Sending GQI Create Se                m 13.135.69.2 to
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
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 suc
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
```

ACTIVE and Prgm Stream info

Source active

Mapping GQI Session to internal session

SSM PIM Join Sent

SSM PIM Join Pending

Internal mapping and Sessions Created

SRM Instructs cBR-8 To create Session

Most recent at top

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* S

```
CBR8-01# show cable video session logical id 1 session-id 104863
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     : -
```

Multiple Sources Supported

Adequate reserved bit rate

Input State: Active-PSI prgm specific informatio

Input Incrementing & No incrementing Drops

Output State: On

Errors Not Incrementing

```
Input Session S
==================
  State: ACTIVE-PSI, Uptime: 0 days 16:03
  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 25          1685460 bps

utput Session Stats:
====================
  State: ON, Uptime: 0 d      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
```

Make sure you aren't oversubscribed!

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

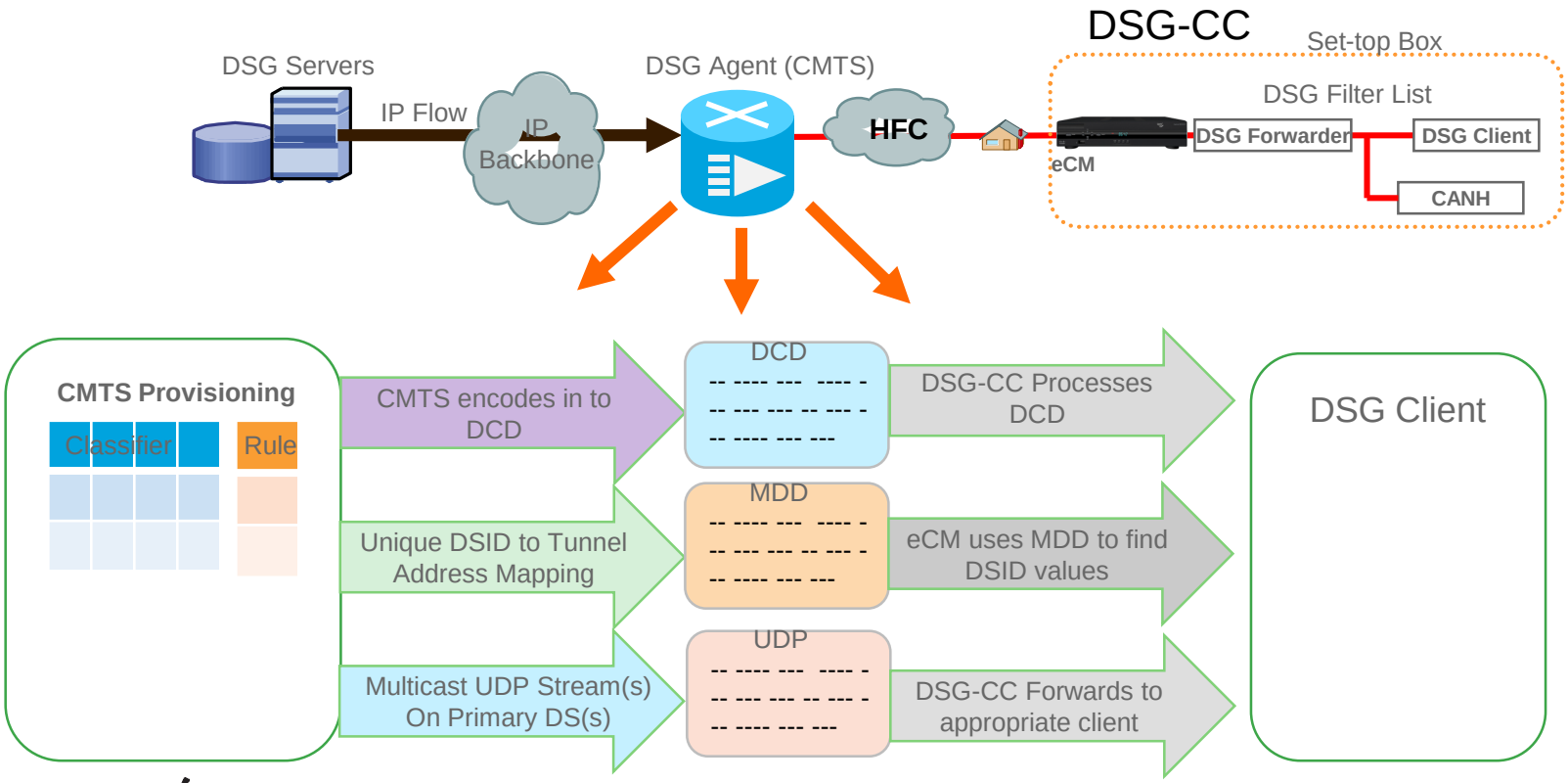
- Provides tunnel data to Set Top Boxes through the DOCSIS Forward
- Includes SI, CAS, OOB, etc.

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

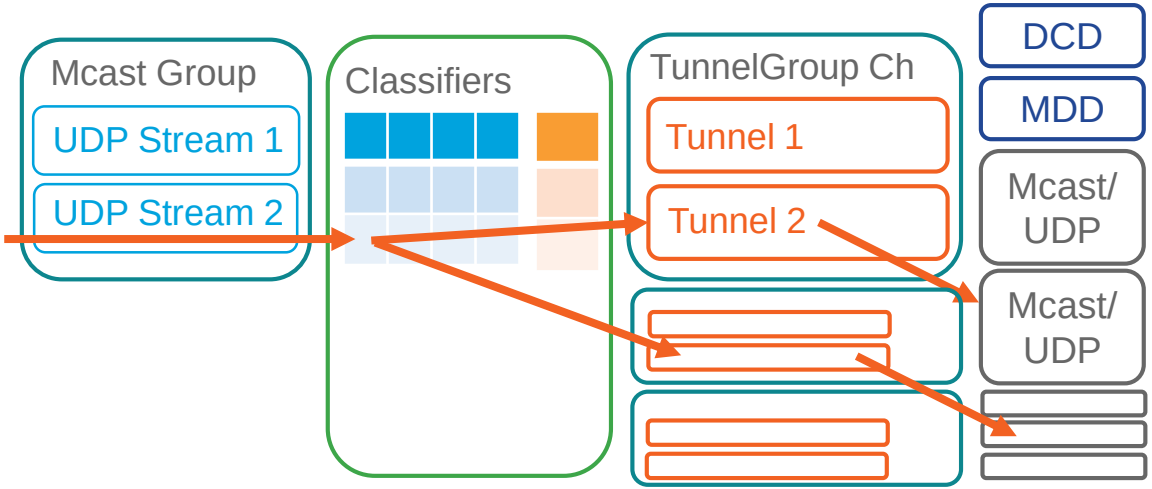
Multicast Routing and ACL configuration

```
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
```

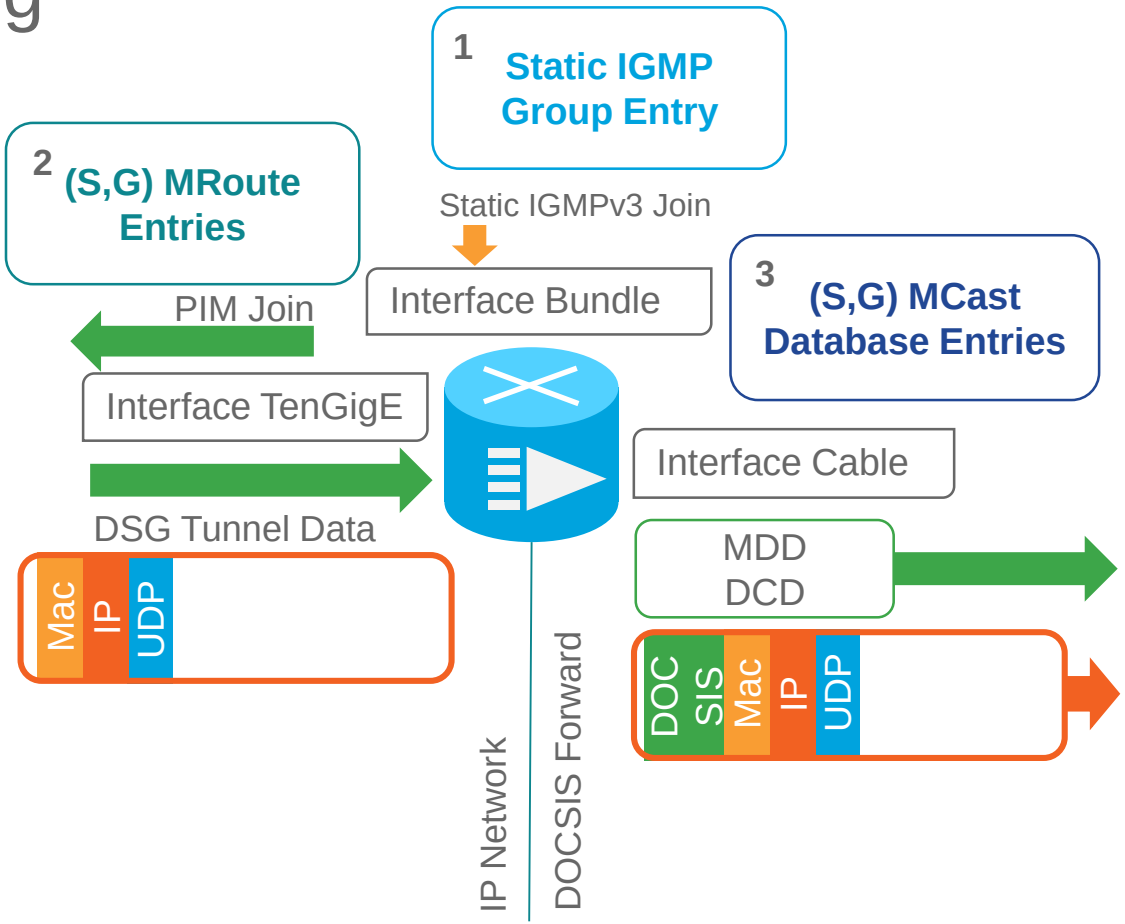
Primary DS Disable - Optional

```
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"

"Others" should not be incrementing

Make sure Received and Forwarded incrementing

```
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
```

ADSG Troubleshooting

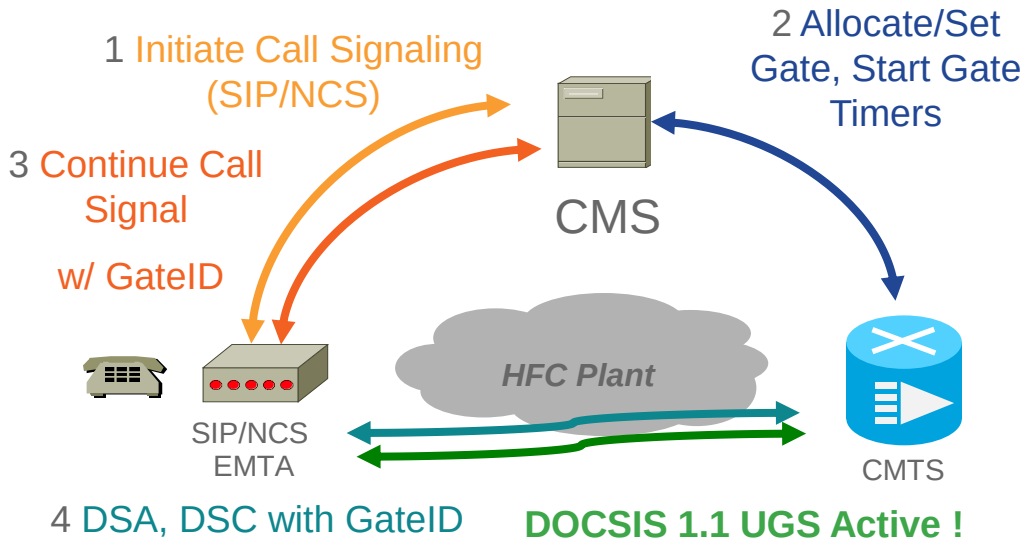
Commands Reference

- 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]}

Voice Services

Common Problems

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



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 *u*

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

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

cBR-8 Operational Maintenance

cBR-8 Exec and Filesystem

Navigating and Tools

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

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

Summary

Summary

Troubleshooting HSD with DOCSIS 3.0 and 3.1

Troubleshooting Voice and Video on cBR-8

cBR-8 Operational Maintenance

“Effective Troubleshooting Will Decrease Downtime and Increase Customer Satisfaction”

Q & A

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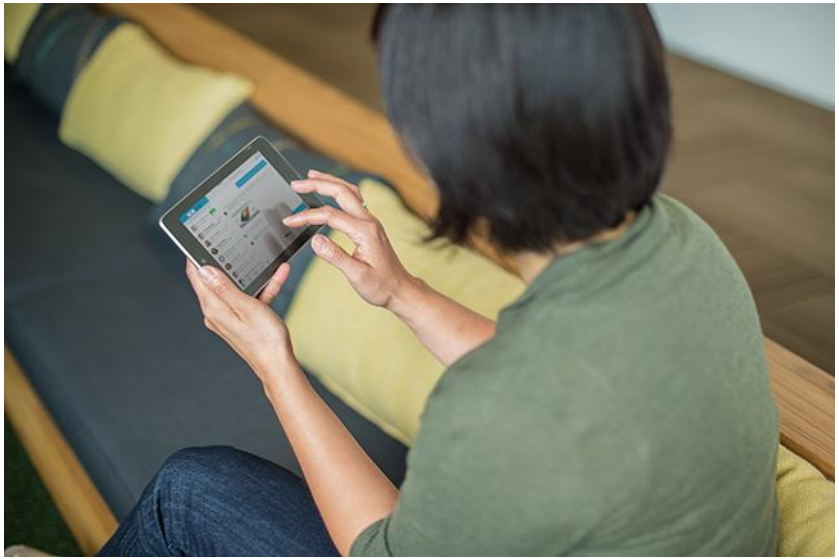

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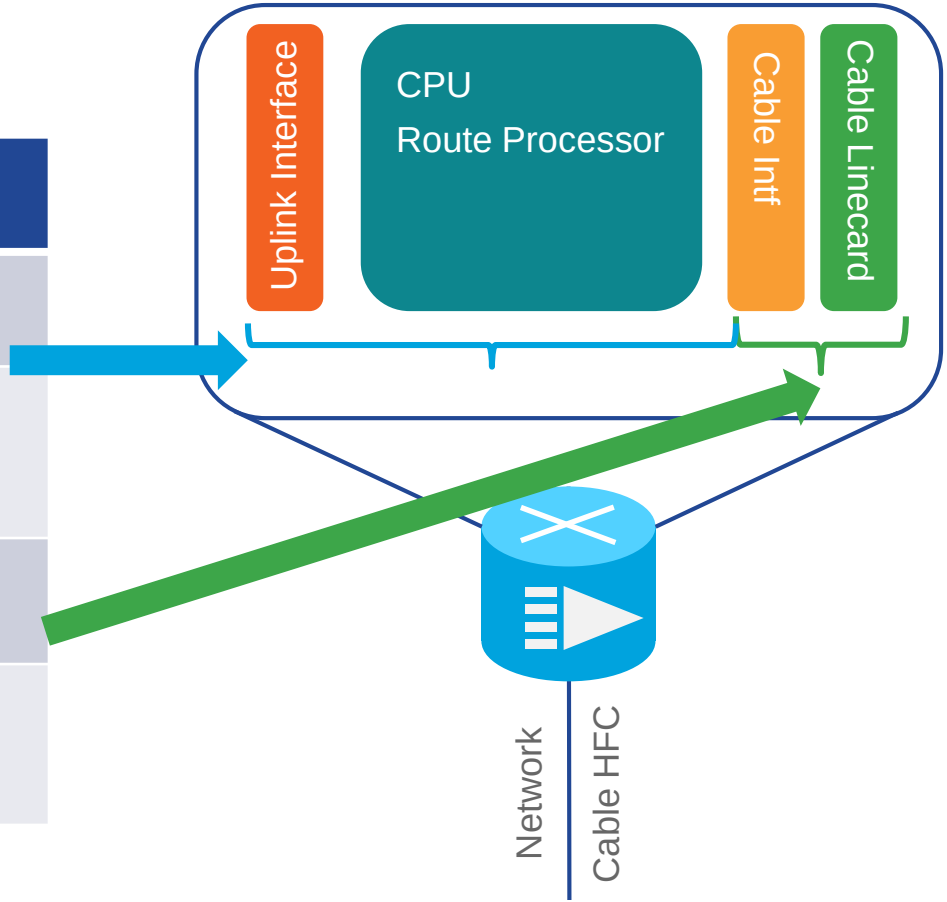
Thank you

Bonus Slides

Packet Tracing

Overview

Type	When to Use
Command Line	Fast-moving Dynamic Troubleshooting
IOS Embedded Packet Capture	Lightweight PCAP Capture for Network Traffic
Cable Monitor	DOCSIS Packet Sniffer
SID-Tracking	Voice or Throughput Issues with DOCSIS Modems



Packet Tracing

CBR8 QFP Tracing

When to Use: When you want to quickly trace traffic from/to a MAC-address

Set It Up

```
test platform hardware qfp active feature docsis dtrack
mac-address mac-address
```

- Passively Capturing
- Examples: Ping / DHCP / Unknown activity

Show your capture output

```
show platform hardware qfp active feature docsis dtrack
statistics
```

Resetting the Capture

```
test platform hardware qfp active feature docsis dtrack
packet-copy

show platform hardware qfp active feature docsis dtrack
statistics clear
```

Cleanup

```
test platform hardware qfp active feature docsis dtrack
disable
```

Example Ping re 3

```
F241-36-04-cBR8-01# show platform hardware qfp active feature
docsis dtrack statistics
DTRACK # mac-addr 105f.491c.cc1c # flags 0x0000000F
SRC tracking
  3           match
  0           transmit
  Punt
  count       ID  punt-cause
  3           011 For-us data
  Drop
   no drops
DST tracking
  no matches
INJ tracking
  count       ID  inj-cause
  3           002 QFP destination lookup
  all transmitted

Packet-Copy # mask DROP PUNT XMIT # packets 6
Packet 0 # match INJ: 002 QFP destination lookup # pkt-len 114 #
xmit: DS
 DTR  00000000 2002640f 00000000 00000072 00000000 00000000
0000338f 630eac85
 CBL  0003dc1f 0003dbe6 05f00000 0003dc64 ffffffff 01010029
00000000 00ff0000
 JIB  00000000 00000000 00000000 00000002 00000001 002f1c00
00042000 00000000
```

Packet Tracing

IOS XE Command Line Tracing

Available in 3.16.0S and later
Primary benefit is simplicity in set up and capture right on CLI

Set It Up

```
debug platform packet-trace enable
debug platform packet-trace packet 8192  circular fia-trace  data-size  2048
debug platform packet-trace copy packet both size 2048 L2
debug platform condition ipv4 232.10.10.2/32 both
```

Buffer Size

IPv4, IPv6 | Unicast, Multicast, MAC | Ingress, Egress, Both

★Use **Ingress**

Start & Stop the Capture

```
debug platform condition start
<Initiate your testing>
debug platform condition stop
```

Capture Activity – Whether passive, or active (ping)

Show your capture output

```
show platform packet-trace statistics
show platform packet-trace summary
show platform packet-trace packet all
show platform packet-trace packet {pkt-number}
```

Cleanup

```
clear platform condition all
```

Packet Tracing

Example

```
F241-36-04-cBR8-01#show platform packet-trace pack 0
Packet: 0          CBUG ID: 295534
Summary
  Input     : INJ.2
  Output    : Bundle1
  State     : FWD
  Timestamp
    Start   : 530714247289439 ns (04/14/2016 18:32:29.522277 UTC)
    Stop    : 530714247382194 ns (04/14/2016 18:32:29.522370 UTC)
Path Trace
  Feature: IPV4
    Input       : internal1/0/rp:1
    Output      : Bundle1
    Source      : 13.42.0.1
    Destination : 13.42.0.6
    Protocol    : 1 (ICMP)
<SNIP>
Packet Copy In
  45000064 009d0000 ff01a0a1 0d2a0001 0d2a0006 08009ffb 00210000 00000000
  1fa7be86 abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd
  abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd
  abcdabcd
Packet Copy Out
  503955f9 9afba46c 2ab02c19 08004500 0064009d 0000ff01 a0a10d2a 00010d2a
  00060800 9ffb0021 00000000 00001fa7 be86abcd abcdabcd abcdabcd abcdabcd
  abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd abcdabcd
  abcdabcd abcdabcd abcdabcd abcdabcd abcd
```

Ingress and Egress Interfaces

Layer 3 & Layer 4 Information

Packet Hex Dump

```
F241-36-04-cBR8-01#show platform packet-trace summary
Pkt   Input          Output         State  Reason
0     INJ.2          Bu1            FWD
1     Bu1            internal1/0/rp:0  PUNT   11  (For-us data)
2     INJ.2          Bu1            FWD
3     Bu1            internal1/0/rp:0  PUNT   11  (For-us data)
4     INJ.2          Bu1            FWD
5     Bu1            internal1/0/rp:0  PUNT   11  (For-us data)
6     INJ.2          Bu1            FWD
7     Bu1            internal1/0/rp:0  PUNT   11  (For-us data)
8     INJ.2          Bu1            FWD
9     Bu1            internal1/0/rp:0  PUNT   11  (For-us data)
```

```
F241-36-04-cBR8-01#show platform packet-trace statistics
Packets Summary
  Matched  10
  Traced   10
Packets Received
  Ingress  5
  Inject   5
    Count      Code  Cause
    5          2     QFP destination lookup
Packets Processed
  Forward  5
  Punt     5
    Count      Code  Cause
    5          11    For-us data
  Drop     0
  Consume  0
```

Packet Tracing

Cable Monitor

Available in 3.18.0S and later
Capture by tunnel by GRE to Capture Point
Capture by saving to Hard-Disk

Create Tunnel to Capture Point

```
interface CMON-tunnel number
 tunnel source ip-address
 tunnel destination ip-address
 [mode buffer]
 [remove-jib]
```

```
interface CMON-Tunnel0
 tunnel source 13.42.0.1
 tunnel destination 172.18.227.18
 remove-jib
```

```
cable monitor
 sniff card 1 outbound docsis Integrated-Cable
1/0/0:0 dest cmon-tunnel 0
```

Forward	Description	Order
Depi	Between PHY and MAC	3rd
Docsis	After adding DOCSIS Header	2nd
Mpeg	Split MPEG before sending out RF	4th
Pre-Docsis	Before JIB adds DOCSIS Header	1st

Define your Cable Monitor Capture

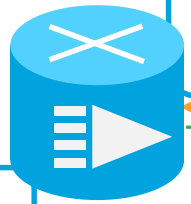
```
cable monitor
 sniff card slot-number outbound {docsis|pre-docsis|mpeg|depi} {mac-address mac-address|integrated-cable intCable} dest
cmon-tunnel tunnel-id
 sniff card slot-number incoming docsis cable mac-domain {sid sid|upstream upstream-ch} dest cmon-tunnel tunnel-id
 sniff card slot-number incoming docsis mac-address mac-address dest cmon-tunnel tunnel-id
 sniff card slot-number incoming docsis upstream-controller upstream-controller us-channel us-ch dest cmon-tunnel tunnel-id
```

Packet Tracing

Cable Monitor

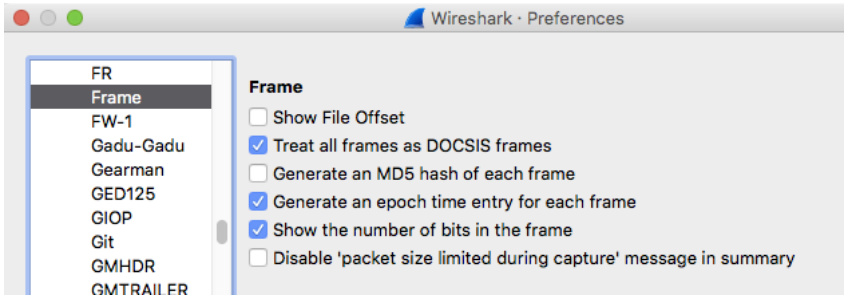
Available in 3.18.0S and later
Instead of SPAN to Physical GigE – Tunnel by UDP/IP to Capture Point

```
cable monitor
 sniff card 1 outbound docsis Integrated-Cable
1/0/0:0 dest cmon-tunnel 0
```




```
interface CMON-Tunnel0
 tunnel source 13.42.0.1
 tunnel destination 172.18.227.18
 remove-jib
```

Set your Wireshark preference for Frame to DOCSIS



Verify

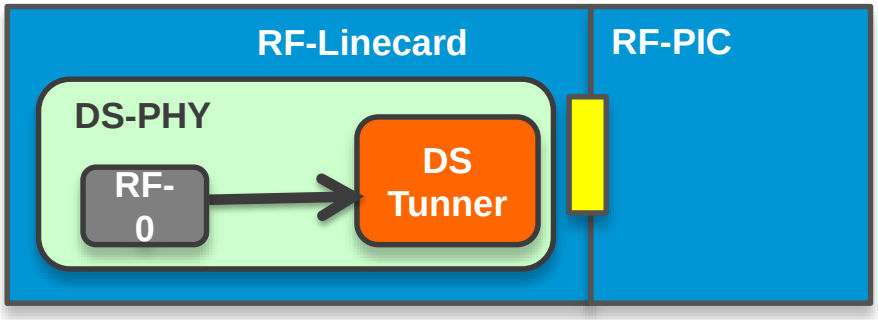
```
F241-36-04-cBR8-01#sh cable monitor setting

DS WB/NB setting:
CARD  DIR       SNIFF-      INTERFACE      DEST-
                POINT                      CMON
1     OUTBOUND  DOCSIS      IC1/0/0:0      0
```

LC On Board Tuner

Using the Gemini On-Board Tuner

- Cable Line Card hardware (Gemini) contains built in tuner
- Use is non-destructive



Access the Line Card Console

```
Request platform software console attach slot/0
```

Set It Up

```
test cable dcm qam-resource rftuner module port frequency
```

Collect Data from Tuner

```
test cable dcm qam-resource rftuner module port 1
```

Reset the Tuner

```
test cable dcm qam-resource rftuner module port 0
```

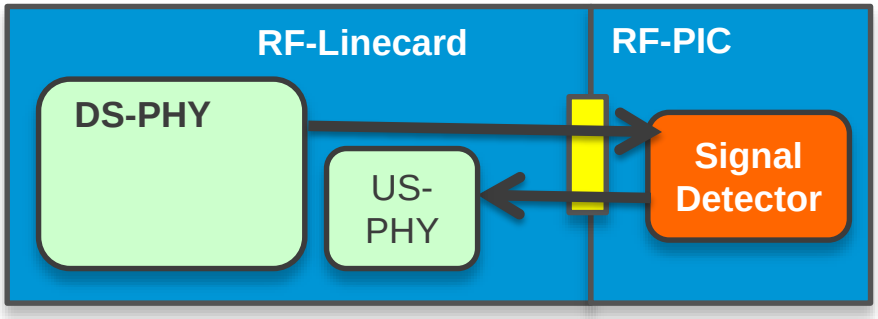
Example

```
Slot-1-0#test cable dcm qam-resource rftuner 0 0 591000000
------------------------------------------------------------
Module  0 RF tuner set to monitor port  0 freq 591000000 HZ:
------------------------------------------------------------
Slot-1-0#test cable dcm qam-resource rftuner 0 0 1
------------------------------------------------------------
Module of the read  0: addr   4724c0 words    9
       0        0     92fe      14a 38500000
      1e   200004        0        0
QAM is Locked, Power dBMv 33
RFMHex: BERPST=0,BERPRE=0,SNRMER=92fe,Power=14a
,OST=38500000, Locks=1e
LOCK Status, Nonzero means lock. Freq  2, SYM 4, MPEG 8, FEC 10
<SNIP>
```

Bullet Forward Detector

Signal Path from Cable LC to PHY

- CLC sends signal to PIC
- Must be consoled into the RP
- Use is **impacting**
- Downstream or Upstream PHY



Set It Up

```
test bfd thru ds slot port rf-channel [verbose]
test bfd thru us slot port rf-channel [verbose]
```

Example

```
acdc-cbr8-2#test bfd thru ds 3 0 1
acdc-cbr8-2#
 ***** port 0 FAIL
acdc-cbr8-2#
acdc-cbr8-2#test bfd thru ds 3 0 5
acdc-cbr8-2#
 ***** port 0 FAIL
acdc-cbr8-2#
acdc-cbr8-2#test bfd thru ds 3 0 0
acdc-cbr8-2#
 ***** port 0 FAIL
acdc-cbr8-2#
```

Cable Linecard

Low Level Verifications

- Jib Commands
  - (CLC) test cable ump cdman j4us-show-health
  - (CLC) test cable ump cdman j4us-seu-status
- show cable card slot/subslot us-phy error
- show cable card slot/subslot ds-phy {state|display}
- show cable card slot/subslot us-phy channel fec-summary

Test Cable UMP CDMAN j4us-show-health

```
Slot-1-0# test cable ump cdman j4us-show-health
Slot-1-0#Jib4US Health

-----------------------
Jib4US Ver: 17 [0x00000011], 21 [0x00000015]
RLD[0] Cal: Good
RLD[1] Cal: Good
RLD[2] Cal: Good
RLD[3] Cal: Good
RLD[4] Cal: Good
RLD[5] Cal: Good
RLD[6] Cal: Good
RLD[7] Cal: Good
ILK0: Good
ILK1: Good
SGMII0: Good
SGMII1: Good
SGMII2: Good
SGMII3: Good
SGMII4: Good
SGMII5: Good
SGMII6: Good
SGMII7: Good

<Additional omitted>
```

CBR8 Supervisor

QFP Troubleshooting

- show platform software object-manager fp {active|standby} statistics
- show platform hardware qfp {active|standby} system fault stats
- show platform hardware qfp {active|standby} infrastructure bqs status | i Drain
- show platform hardware qfp {active|standby} statistic drop [detail]

QFP Drops

```
F241-36-04-cBR8-01# sh platform hardware qfp act stat drop detail
ID  Global Drop Stats                          Packets              Octets
  369  ArpRequstFilterDrop                        98341             5900226
   10  BadIpChecksum                              26856             5735917
    2  BadUidbIdx                                 25708             6131862
  382  CablePreRegNotFromCM                         116                6366
  330  CablemcInvalidReplicaR...                    236              221274
  137  Disabled                                      10                 670
   59  Icmp                                      199973           288469466
    5  InvL2Hdr                                  117762            10743970
  218  InvSpaHdr                                 116066           153072129
   12  IpBadOptions                                   1                  54
```

QFP Drains

```
F241-36-04-cBR8-01# show platform hardware qfp active infrastructure bqs status
| i Drain
  Queue ID Pending Drain:          0xffffade3
  Queue ID Pending Drain:          0xffffffff
  Queue ID Pending Drain:          0xffffffff
  Queue ID Pending Drain:          0xffffffff
F241-36-04-cBR8-01# show platform hardware qfp standby infrastructure bqs status
| i Drain
  Queue ID Pending Drain:          0xffffd01a
  Queue ID Pending Drain:          0xffffffff
  Queue ID Pending Drain:          0xffffffff
  Queue ID Pending Drain:          0xffffffff
```

If “draining” should be 0xffffffff

CBR8 Supervisor

QFP Troubleshooting

- show platform hardware qfp active infrastructure punt summary

```
F241-36-04-cBR8-01 #show platform hardware qfp active infrastructure punt summary
Punt Path Rate-Limiting summary statistics
Subscriber-side
ID   punt cause                          CPP punt       CoPP drop       SBRL drop       per-cause          global
105  Cable DHCP                         12495463         1249411            9327             302                0
101  cable modem pre reg                  987495               0             131               0                0
100  Source Verify inconclusive          6479942               0         1818098          937235                0
060  IP subnet or broadcast packet       1474811             290          537105               0                0
055  For-us control                      7126306               0               0               0                0
029  RP handled ICMP                     1471084               0               0               0                0
026  QFP ICMP generated packet           3842135               0            4258               0                0
024  Glean adjacency                       54402               0               0           44525                0
```

DOCSIS Registration

Debugs

- Debugs to verify MDD generation on CMTS
  - **debug cable interface cable** {*slot*|*subslot*|*port*} [**verbose**]
  - **debug cable mdd**
- Debugs needed for ranging and registration
  - **debug cable mac-address** {*cable-modem-mac-address*} **verbose**
  - **debug cable mdd**
  - **debug cable ranging**
  - **debug cable registration**
  - **debug cable tlv**
  - **debug cable dhcp**
  - **debug cable service-ds-selection**

DOCSIS Wideband Troubleshooting

Verifications

Wideband interface verification

```
interface Wideband-Cable3/0/0:14
 load-interval 30
 cable bundle 1
 cable rf-channels channel-list 0-31 158-159 bandwidth-percent 1
```

Bundle ID that should match under modular/IC interface

Cisco ACFE - Adaptive CIR and Fair EIR - allows for dynamic bandwidth allocation

Fiber-node configuration verification

```
cable fiber-node 50
 downstream Integrated-Cable 3/0/0
 upstream Upstream-Cable 3/0/0

Cbr8-01#Show cable fiber-node 50

Fiber-Node 50  Channel(s)   :  downstream Integrated-Cable 3/0/0:  0-31, 158                5    6    7
8    9   10   11   12   13   14                                 9   20   21   22   23                    29
30   31   32  159   Upstream-C                                  nfigured (status flags = 0x01)    MDD Status: Valid
```

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

US Connectors Defined (Unique per FN)

MDD has to be valid

CGD association verification

```
show cable cgd-associations
CGD Host   Resource   DS Channels             Upstreams (AllUS)   Active DS
Ca3/0/0    3/0/0      8                       0-3          Yes         8
                      16                      0-3          Yes         16
                      20                      0-3          Yes         20
                      23                      0-3          Yes         23
```

Active DSs

Configured DS

DOCSIS Initial Ranging & Response

Initial Ranging

```
CLC 3/0: Jun 14 20:55:34.436 edt: INIT-RNG [info] : RCV initialization RNG attempt for CM fc52.8d5e.83dc: Msg-Type 34, DCID-9, RFID-12296, Interface Cable3/0/0/U3
CLC 3/0: Jun 14 20:55:34.436 edt: Bonding Initial Ranging request from fc52.8d5e.83dc, SID 0 [16383] on Interface Cable3/0/0/U3: MD-DS-SG-ID 7, Cap flags 192 SSAP 122, msg version 5
CLC 3/0: Jun 14 20:55:34.436 edt: Initial Ranging: Downstream channel ID is 9 (CGD host DS chan Id 0)CLC 3/0: Jun 14 20:55:34.436 edt: cmts_tcc_uschan_add: CM fc52.8d5e.83dc tcs 0 chan 3 tech 2 ref 0
CLC 3/0: Jun 14 20:55:34.437 edt: cmts_ranging_parse_rng_request: rng_req_version 5
CLC 3/0: Jun 14 20:55:34.438 edt: RNG-REQ: cmdpwr: ucid 4 type-5 dsap 0 ssap 122 p16r_n 3050
CLC 3/0: Jun 14 20:55:34.438 edt: BINIT-RNG-REQ fc52.8d5e.83dc: chid 4 dsap x00 ssap x7A reported_pwr 122
CLC 3/0: Jun 14 20:55:34.438 edt: BINIT-RNG-REQ fc52.8d5e.83dc: dyn pwr status C000 reported_pwr 122 ch load 255 min load 0
CLC 3/0: Jun 14 20:55:34.438 edt: Modem fc52.8d5e.83dc: Host Ca3/0/0/U3: ds_channel_id 9, rfid 12296 prepend[0] 7CLC 3/0: Jun 14 20:55:34.438 edt: CM fc52.8d5e.83dc Ambiguity Resolution Done US_SG_ID=1
```


CLC 3/0: Jun 14 20:55:34.436 edt: INIT-RNG [info] : RCV initialization RNG attempt for CM fc52.8d5e.83dc: Msg-Type 34, DCID-9, RFID-12296, Interface Cable3/0/0/U3
CLC 3/0: Jun 14 20:55:34.436 edt: Bonding Initial Ranging request from fc52.8d5e.83dc, SID 0 [16383] on Interface Cable3/0/0/U3: MD-DS-SG-ID 7, Cap flags 192 SSAP 122, msg version 5
CLC 3/0: Jun 14 20:55:34.436 edt: Initial Ranging: Downstream channel ID is 9 (CGD host DS chan Id 0)
CLC 3/0: Jun 14 20:55:34.436 edt: cmts_tcc_uschan_add: CM fc52.8d5e.83dc tcs 0 chan 3 tech 2 ref 0

IPv6 Neighbor Discover & DAD Initial

```
Mar 24 13:30:25.404 EDT: Proxy DAD: Initiating DAD for FE80::21D:D4FF:FED3:31D2 for sid 3 prim_sid 3 in Cable8/1/1
Mar 24 13:30:25.408 EDT: Proxy DAD: Learnt new LL address FE80::21D:D4FF:FED3:31D2 for 001d.d4d3.31d2
Mar 24 13:30:25.408 EDT: CMTS IPV6DB: cmts_ipv6_lookup_entry_by_v6addr: FE80::21D:D4FF:FED3:31D2 not found in Cable8/1/1
Mar 24 13:30:25.408 EDT: IPV6 ND: IPv6 addr FE80::21D:D4FF:FED3:31D2 added to new host 001d.d4d3.31d2, SID 3, Mar 24 13:30:25.408 EDT: Proxy DAD : Succeeded manual ND cache add for CPE FE80::21D:D4FF:FED3:31D2 001d.d4d3.31d2
Mar 24 13:30:25.408 EDT: Proxy DAD: << Proxy DAD FINAL exit for FE80::21D:D4FF:FED3:31D2 for prim_sid 3 in Cable8/1/1
```

DOCSIS IPv6 Registration

IPv6 DHCPv6 Addressing Assignment

```
Mar 24 13:30:31.034 EDT: IPv6 UDP Packet from FE80::21D:D4FF:FED3:31D2 to dport 547
Mar 24 13:30:31.034 EDT: CMTS DHCPV6: Incoming DHCPv6 SOLICIT from 001d.d4d3.31d2 (sid 3 prim_sid 3) in Cable8/1/1.
Mar 24 13:30:31.034 EDT: CMTS IPV6DB: cmts_ipv6_lookup_entry_by_v6addr: bucket = 449 FOUND for FE80::21D:D4FF:FED3:31D2 Flag 0x4200
in Cable8/1/1
Mar 24 13:30:31.034 EDT: IPv6 DHCP: detailed packet contents
Mar 24 13:30:31.034 EDT:   src FE80::21D:D4FF:FED3:31D2 (Bundle99)
Mar 24 13:30:31.034 EDT:   dst FF02::1:2
Mar 24 13:30:31.034 EDT:   type SOLICIT(1), xid 6374736
Mar 24 13:30:31.034 EDT:   option CLIENTID(1), len 10
Mar 24 13:30:31.034 EDT:     00030001001DD4D331D2
Mar 24 13:30:31.034 EDT:   option IA-NA(3), len 40
Mar 24 13:30:31.034 EDT:     IAID 0xD4D331D2, T1 0, T2 0
Mar 24 13:30:31.034 EDT:     option IAADDR(5), len 24
Mar 24 13:30:31.034 EDT:       IPv6 address ::
Mar 24 13:30:31.034 EDT:       preferred 0, valid 0
Mar 24 13:30:31.034 EDT:   option RAPID-COMMIT(14), len 0
Mar 24 13:30:31.034 EDT:   option ELAPSED-TIME(8), len 2
Mar 24 13:30:31.034 EDT:     elapsed-time 0
Mar 24 13:30:31.034 EDT:   option ORO(6), len 4
Mar 24 13:30:31.034 EDT:     VENDOR-OPTS,DNS-SERVERS
Mar 24 13:30:31.034 EDT:   option RECONF-ACCEPT(20), len 0
Mar 24 13:30:31.034 EDT:   option VENDOR-CLASS(16), len 15
Mar 24 13:30:31.034 EDT:   option VENDOR-OPTS(17), len 300
Mar 24 13:30:31.034 EDT: Removing dhcpv6 GUA addrs from host 001d.d4d3.31d2
Mar 24 13:30:31.034 EDT: cmts_dhcpv6_cm_set_device_class_list: Setting device_class_list CM-mac_addr 001d.d4d3.31d2, esafe option
ECM:EROUTER, device_class_list in hex = 41
Mar 24 13:30:31.034 EDT: DHCPv6 SOLICIT After calling cmts_dhcpv6_cm_set_device_class_list, mac = 001d.d4d3.31d2 cminstp-
>device_class_list = 41
```

DOCSIS IPv6 Registration

IPv6 CM NS and DAD

```
Mar 24 13:30:31.038 EDT: CMTS IPV6DB: Host entry is a CM, SID 3, if_number 583.
Mar 24 13:30:31.038 EDT: CMTS IPV6DB: Created an address entry(0xFBB484E8) IP(0xFDDA7048) in host(0xFDDA73A8) 001d.d4d3.31d2, intf
Cable8/1/1, Sid 3.
0:F241:1300:18:21D:D4FF:FED3:31D2/128 flag = 0x6214
Mar 24 13:30:31.038 EDT: CMTS IPV6DB: DHCPv6 Reply, calling cmts_entry_add... 001d.d4d3.31d2, FD00:F241:1300:18:21D:D4FF:FED3:31D2
Mar 24 13:30:31.565 EDT: CMTS IPV6DB: Sid 3 not found while processing NS
Mar 24 13:30:31.565 EDT: Proxy DAD: Initiating DAD for FD00:F241:1300:18:21D:D4FF:FED3:31D2 for sid 3 prim_sid 3 in Cable8/1/1
Mar 24 13:30:31.565 EDT: Proxy DAD: << Proxy DAD v6addr exit for FD00:F241:1300:18:21D:D4FF:FED3:31D2 for prim_sid 3 in Cable8/1/1
Mar 24 13:30:31.565 EDT: Proxy DAD : GUA FD00:F241:1300:18:21D:D4FF:FED3:31D2 not added for CM 001d.d4d3.31d2
Mar 24 13:30:31.565 EDT: Proxy DAD: << Proxy DAD FINAL exit for FD00:F241:1300:18:21D:D4FF:FED3:31D2 for prim_sid 3 in Cable8/1/1
```

DOCSIS IPv6 Registration

Registration Request

```
Mar 24 17:08:59.098 EDT: Receive REG-REQ-MP from 001d.d4d3.3122, SID 3 on Cable8/1/1
Mar 24 17:08:59.098 EDT: CM 001d.d4d3.3122 on Cable8/1/1: Allocate 255 bytes REG-REQ-MP TLV buffer at 2823850C
Mar 24 17:08:59.098 EDT: CM 001d.d4d3.3122 on Cable8/1/1: Append 255 bytes of REG-REQ-MP TLV at offset 0
Mar 24 17:08:59.098 EDT:  Now parse REG-REQ-MP 1/1 for CM 001d.d4d3.3122
```

REG-REG-MP request from DSCB Cable Modem

RCPs and Registration Response

```
Mar 24 17:23:45.147 EDT: Found Vendor Capability Information TLV
Mar 24 17:23:45.147 EDT:          Found Vendor Id Sub-TLV {00 00 0C}
Mar 24 17:23:45.147 EDT:          This Is A Cisco Vendor Id
Mar 24 17:23:45.147 EDT: RCP index : 3
Mar 24 17:23:45.147 EDT: BG ID : 6952
Mar 24 17:23:45.147 EDT: RCC ID : 6
Mar 24 17:23:45.147 EDT: Found Vendor Specific Information TLV
Mar 24 17:23:45.147 EDT:          Found Vendor Id Sub-TLV {00 00 0C}
Mar 24 17:23:45.147 EDT:          This Is A Cisco Vendor Id
Mar 24 17:23:45.147 EDT: Found Vendor Specific Information TLV
Mar 24 17:23:45.147 EDT:          Found Vendor Id Sub-TLV {00 00 0C}
Mar 24 17:23:45.147 EDT:          This Is A Cisco Vendor Id
Mar 24 17:23:45.147 EDT: SFAC Bucket Number TLV, 1 entries
Mar 24 17:23:45.147 EDT: SFID 46 SFAC bucket number is 7
Mar 24 17:23:45.147 EDT: Parsing CM's Reg Info Complete
Mar 24 17:23:44.418 EDT: Response fragment 1/1 (558 bytes) Transmitted
Mar 24 17:23:45.130 EDT: Registration acknowledgement (0) from 001d.d4d3.31d2, SID 6 on Cable8/1/1/U1
```

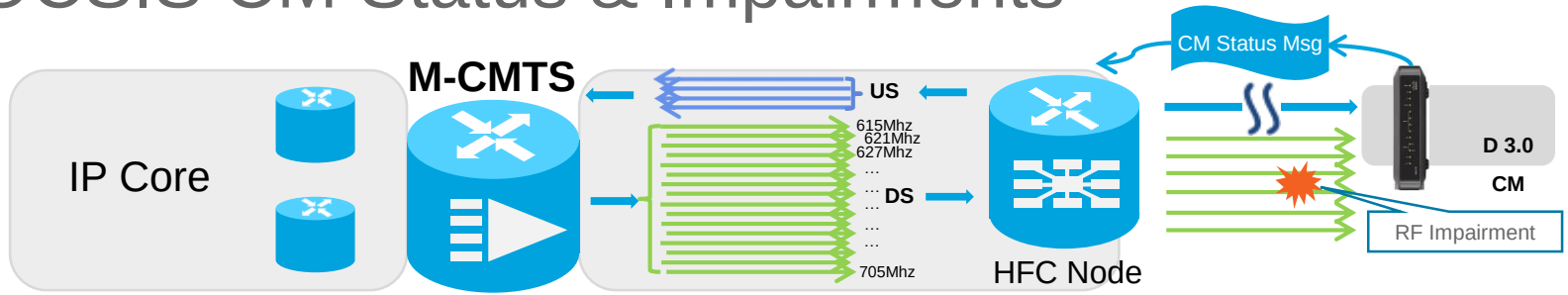
RCP from CM

CMTS selected Bonding Group

RCC 1 selected for CM

REG-RSP-MP for REG-REQ-MP

DOCSIS CM Status & Impairments



Sample Registration ACK with Partial Service

```
Feb 17 11:25:40.930: Cable6/0/0: CM 0022.ce9a.9fc0 REG-ACK response
Feb 17 11:25:40.930: partial-service:
Feb 17 11:25:40.930:     0x0000: 31 04 06 02 03 02
Feb 17 11:25:40.930: Cable6/0/0: CM 0022.ce9a.9fc0 ds-chid 51 is impaired
Feb 17 11:25:40.930: Cable6/0/0: CM 0022.ce9a.9fc0 ds-chid 52 is impaired
```

Partial Service indicating impaired channels

Modem Status

```
UBR10K2#show cab mode 0022.ce9a.9fc0 wideband rcs-status
RF  : 6/0/0 1
  Status                    : UP
  FEC/QAM Failure           : 0
  MDD Failure               : 0
  <snip>
  Flaps                     : 0
  Flap Duration             : 00:00
RF  : 6/0/1 0
  Status                    : UP
RF  : 6/0/1 3
  Status                    : UP
  FEC/QAM Failure           : 0
```

Status reported by CM for individual DS channel

No MDD failure on this channel

No Flaps on this channel

DS Channel from controller 6/0/1

DOCSIS Load-Balancing

Docsis LB config and rule

```
cable load-balance docsis-enable
cable load-balance rule 1 disable-throughput-lowerbound us 100
cable load-balance rule 2 disable-throughput-lowerbound ds 1000
cable load-balance docsis-policy 1 rule 1
cable load-balance docsis-policy 1 rule 2
```

Docsis LB rule definition

Tag and service class definition

```
cable tag 110
 name HSD_BIZ
 service-class us_hsd_biz
!
cable tag 101
 name HSD_RES
Service-class us_hsd_res
!
service-class name us_hsd_res
cable service class 101 name us_hsd_res
cable service class 101 upstream
cable service class 110 name us_hsd_biz
cable service class 110 upstream
```

Service Class for business service

Service Class for residential service

Fiber-Node configuration

```
cable fiber-node 2
description SAMPLE_NODE
downstream Modular-Cable 8/0/1 rf-channel 0-3 20-23
upstream Cable 8/0 connector 18
```

DS and US chans. In FN

RLBG configuration

```
cable load-balance docsis-group 25 index 86
 restricted
 downstream Modular-Cable 8/0/1 rf-channel 0-11
 upstream Cable8/0/1 0-2
 method utilization
 threshold load 30
 policy pure-ds-load
 init-tech-list 3
 docsis-policy 1
 tag HSD_BIZ
```

DS RF channels 0-11

RLBG with HSD_BIZ tag

```
cable load-balance docsis-group 26 index 87
 restricted
 downstream Modular-Cable 8/0/1 rf-channel 12-23
 upstream Cable8/0/1 3-4
 method utilization
 threshold load 30
 policy pure-ds-load
 init-tech-list 3
 docsis-policy 1
 tag HSD_RES
```

RLBG with HSD_RES tag

DOCSIS Load-Balancing

Show and Test Commands

- Show internal Commands
- Test commands for actionable load-balance
- Show cable load-balance stat
- Show cable load-balance target
- Show cable load-balance load [wide]

Load-Balancing States

State	
Initial	Up but no modems to load-balance to it
Up	Up and passing traffic
Down	Down and not part of LB
Testing	Load balance test, unusable until done
Suspicious	Failed initialization, but has modems on the channel. Recent LB activity to this channel has failed
Disabled	Reinitialization fails after 10 retries
Unstable	Reinitialization fails, and after repeated initialization attempts.

Show Cable Modem Verbose

```
F241-36-04-cBR8-01#scm 848d.c7eb.16cc ver | i LB
LB group ID assigned                : 2147508224
LB group ID in config file          : N/A
LB policy ID                        : 0
LB policy ID in config file         : 0
LB priority                         : 0
```

Show Cable Load-balance Load Wideband

```
F241-36-04-cBR8-01#show cable load-balance load wide
DOCSIS load-balancing wideband load
Interface     Size    Group      Throughput(Kbps)/bw(Mbps)
Avg-Util
Wi1/0/0:0     4       65024                      0/150          0%
Wi1/0/0:0     4       65025                      0/150          0%
Wi1/0/0:0     4       2147508224                 0/150          0%
Wi1/0/0:0     4       2147508225                 0/150          0%
Wi1/0/0:1     4       65024                      0/150          0%
Wi1/0/0:1     4       65025                      0/150          0%
```

DOCSIS Load-Balancing

Show Commands

- Show cable modem *mac-address* internal

```
F241-36-04-cBR8-01# scm 5039.55f9.9385 internal load
Modem Hardware Information :
----------------------------
CM MAC Address                        : 5039.55f9.9385
CM MAC Version                        : DOC2.0
CM Wideband Capable                   : N
Modem CMTS Status Information :
-------------------------------
Modem Status                        : {Modem= online(pt),
Security=assign(tek)}
Modem US Bonding Mode               : Single-Channel
Modem DS Bonding Mode               : Single-Channel
Modem US Channels Information :
-------------------------------
Upstream Host Interface, TCS        : Cable1/0/0 0x4
UDC Enabled                         : N
US Frequency Range Capability       : Standard (5-42 MHz)
Extended Upstream Transmit Power    : 0dB
Multi-Transmit Channel Mode         : N
Upstream Channel                    : US2
Modem DS Channels Information :
-------------------------------
```

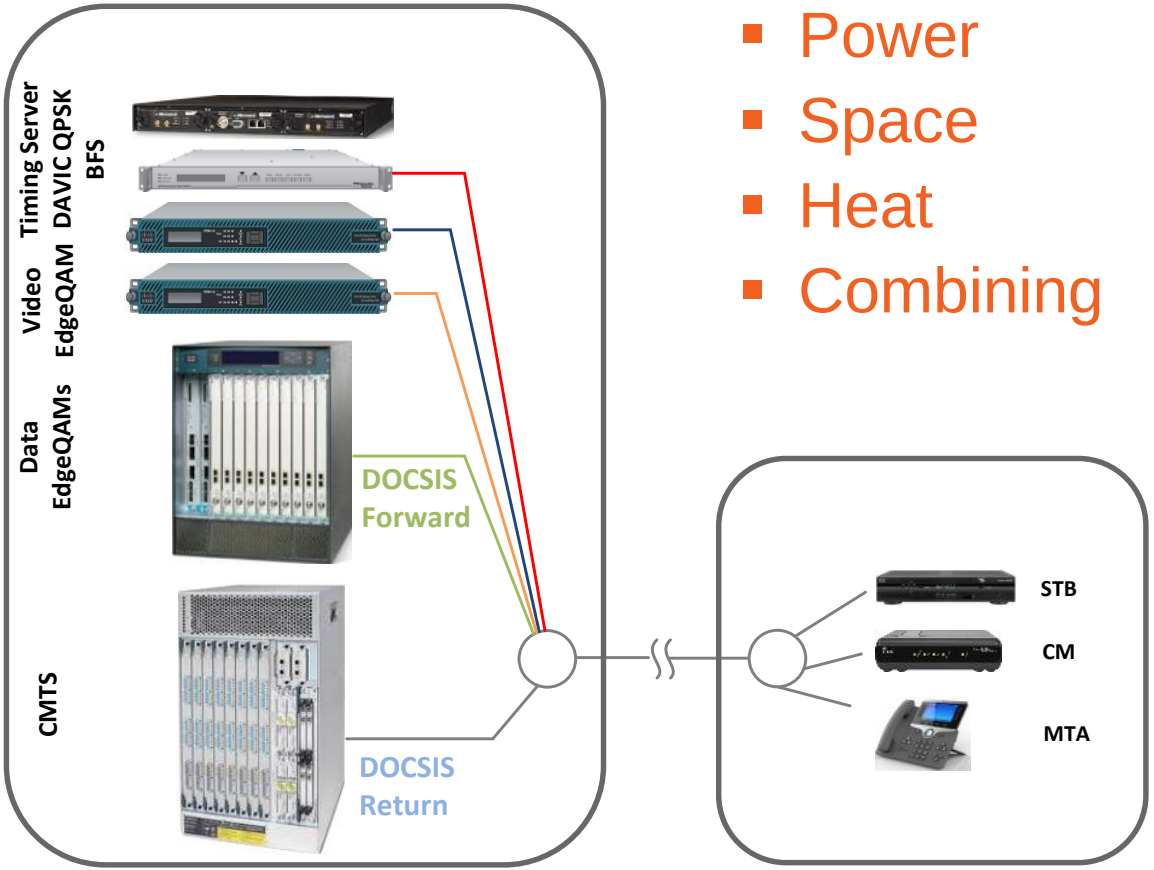
Show Cable Modem Internal

```
Downstream Channel DCID RF Channel : 9     1/0/0:8
Primary Downstream                 : In1/0/0:8 (RfId : 4104)
Modem Load-Balance Information In CMTS Config :
CMTS CFG CM Restricted to RLBG          : FALSE
CMTS CFG CM Restricted to RLBG Static   : FALSECMTS CFG CM Restricted to
RLBG Dynamic  : FALSE
Modem Load-Balance Information In CM Config File :
CFG LB group ID in config file          : N/A
CFG Service Type ID in config file      :
CFG LB policy ID in config file         : 2
Modem Load-Balance Information Applied :
LB group ID assigned                : 65024
LB Service Type ID                  :
LB Tag                              :
LB policy ID                        : 2
LB priority                         : 0
LB Last CM Operation                : LB_NO_SKIP_CM_REG_ONLINE_NB
LB Last Counts State                : 4
LB Balance Status DS                : LB_NO_SKIP
LB Balance Status US                : LB_NO_SKIP
LB Channel History                  :
Modem D30 LB Status Information :LB Failures Info     :
      LB Failures US : 0
      LB Failures DS : 0
LB  Debug Variables     :
     LB triggered dxc : 0
     LB target rcc_id : 0
     LB target rfid   : 65535
     LB group id      : 65024
     LB reg group id  : 0
     LB priority      : 0
     LB policy_id     : 2
     LB reg_policy_id : 2
```

Cable Access Platform

Video/CMTS Headend

- DOCSIS 3.0 High Speed Data and Voice Services
- Digital Broadcast Video, Switched Digital Video, and Video on Demand
- QPSK / BFS for Video Out of Band and In-Band
- ADSG
- Emergency Services



Multiple Devices

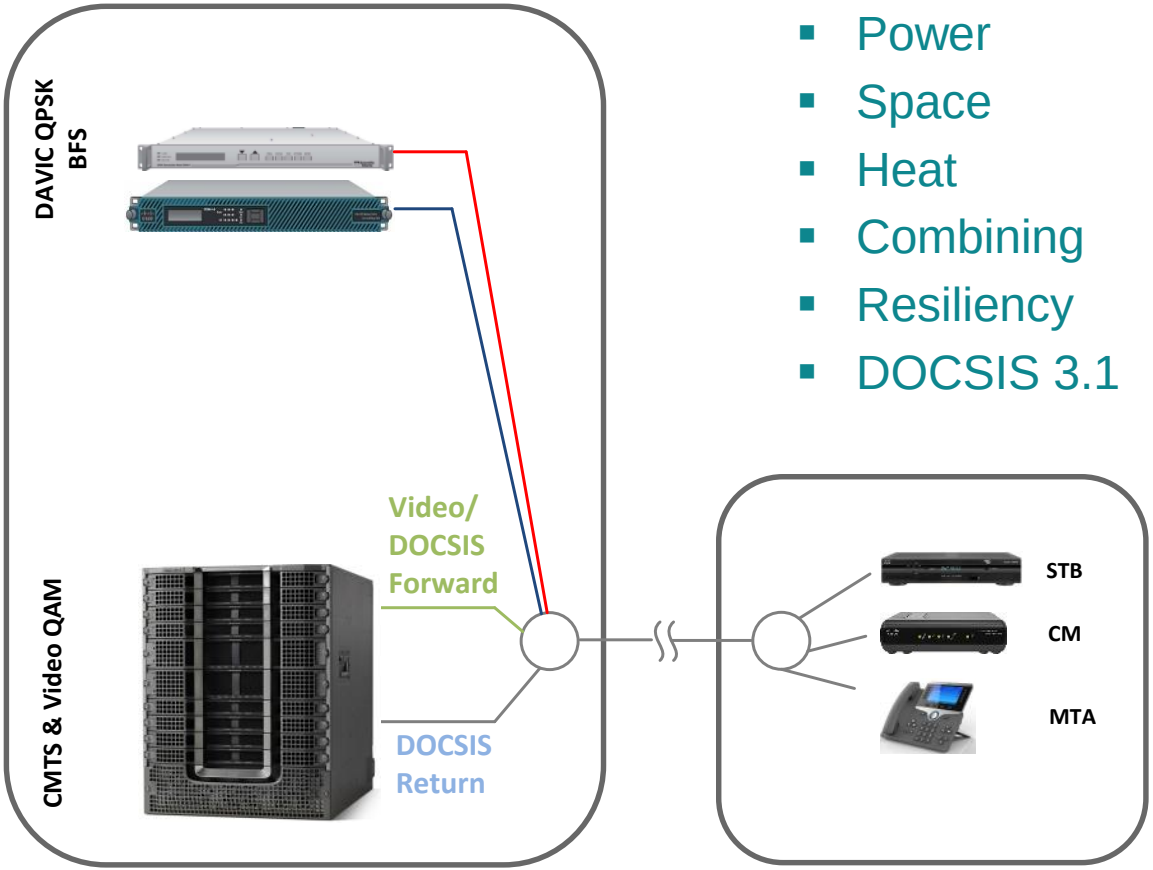
- Power
- Space
- Heat
- Combining

Converged Cable Access Platform- CCAP

Converged Platform !!

Converged

- **DOCSIS 3.1** High Speed Data and Voice Services
- Digital Broadcast Video, Switched Digital Video, and Video on Demand off CBR8
- BFS and DAVIC QPSK for Video OOB and IB information
- ADSG



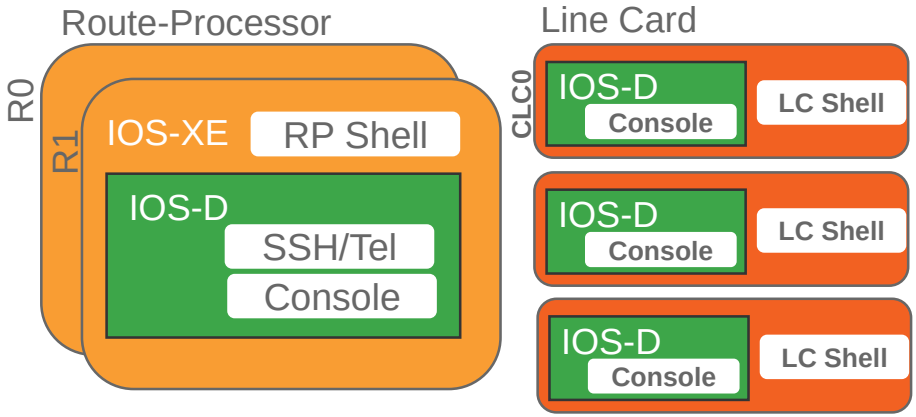
GAINS

- Power
- Space
- Heat
- Combining
- Resiliency
- DOCSIS 3.1

Shell Access

RP and Linecard Shell, LC Console

- IOS-XE runs a Linux operating system
- IOS-D process within the system emulates a IOS Command Line
- Shell Access for tracefile(s), development access
- Console Access for linecard specific commands, etc.
- cBR-8 Shell Access is **restricted** by design (Challenge and Response system)



Shell Access

```
(configure) platform shell
request platform software system shell
```

Access the Line Card Shell

```
telnet cc-slot0
```

Access the RP and LC Console

```
request platform software console attach slot/0
```