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Troubleshooting Cisco CMTS Based Services

BRKSPG-2501

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Agenda

- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting DOCSIS Timing Issues
- Troubleshooting DOCSIS Load Balancing
- Troubleshooting Voice Services
  - Troubleshooting Voice Subscriber Issues
  - Troubleshooting DSG Services
- Summary
- Q & A

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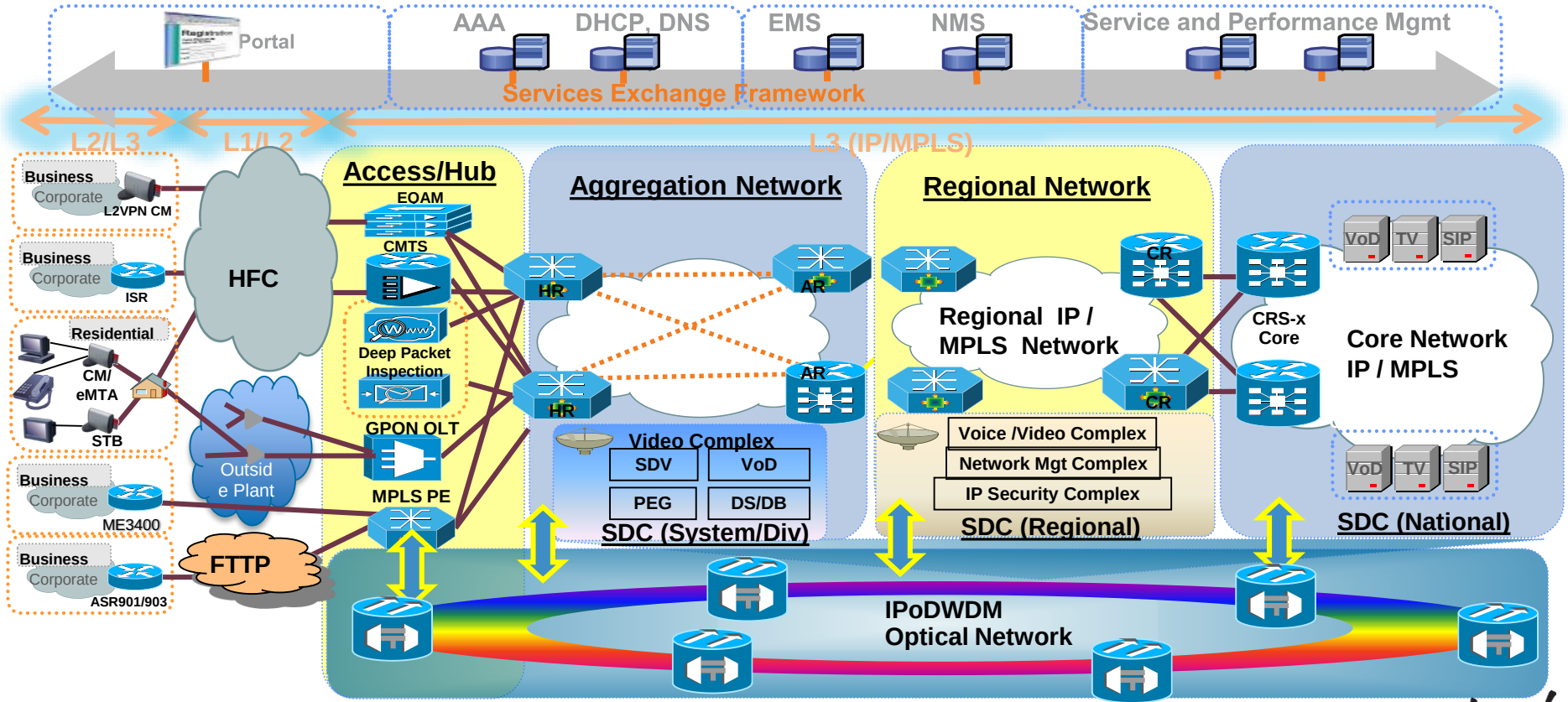
Cable Multi-Service Networks



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Troubleshooting High Speed Data Services

Common Issues

- DOCSIS 3.0 DS Channel Bonding Issues
  - CMs not coming up as w-online or Bonding Capable
  - Poor throughput issues
- DOCSIS 3.0 US Channel Bonding Issues
  - Poor US throughput on USCB modem

DOCSIS 3.0 DS Channel Bonding Issues

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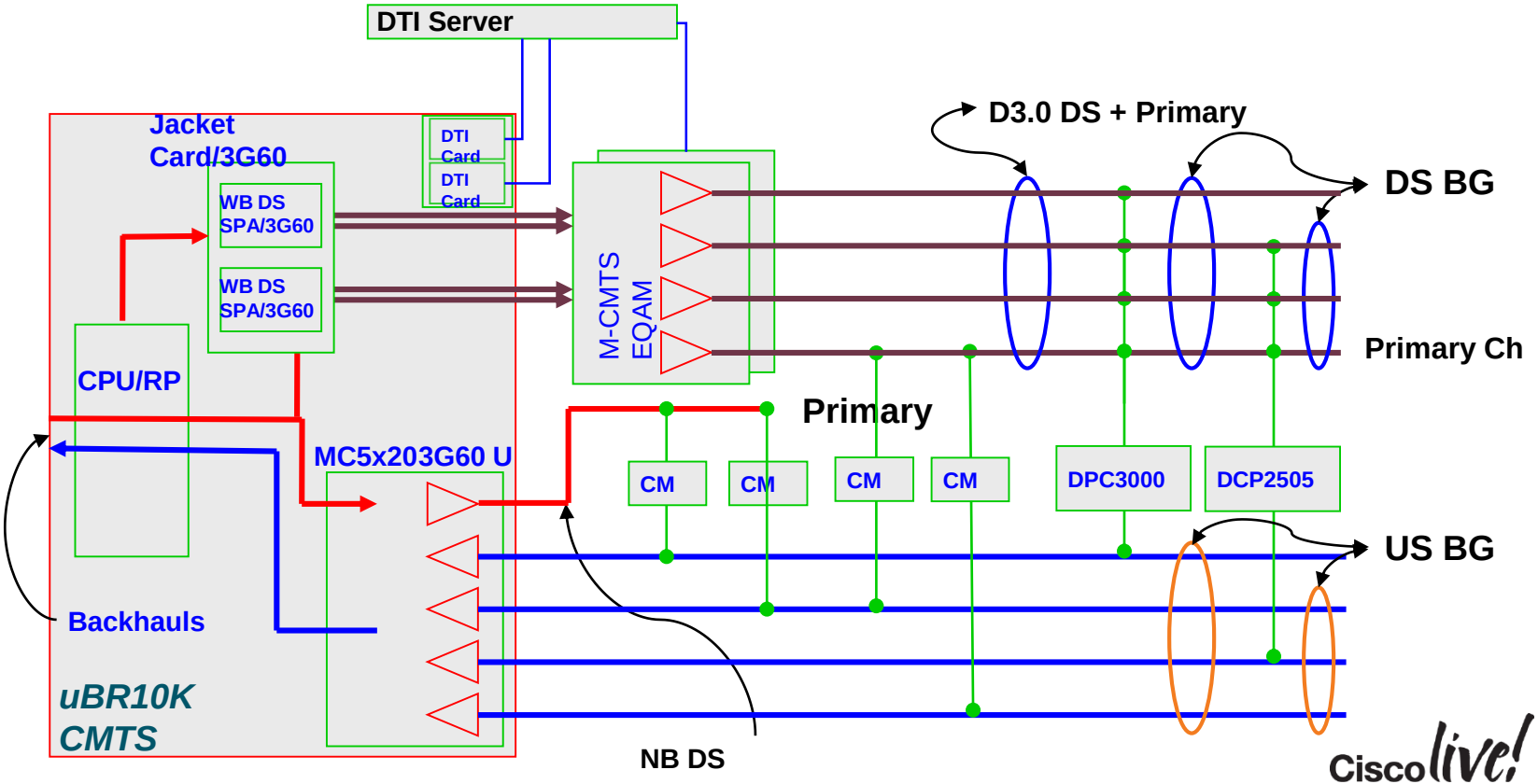
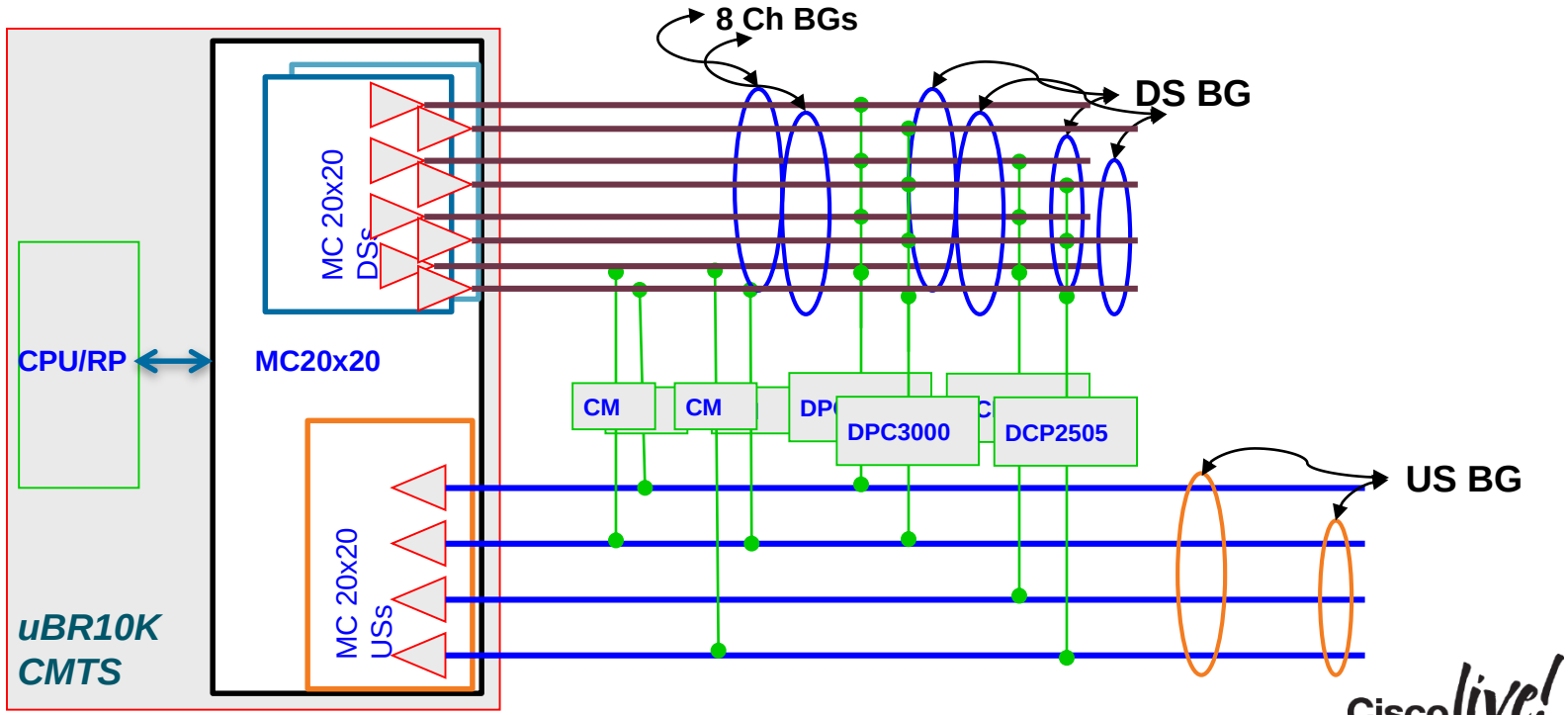
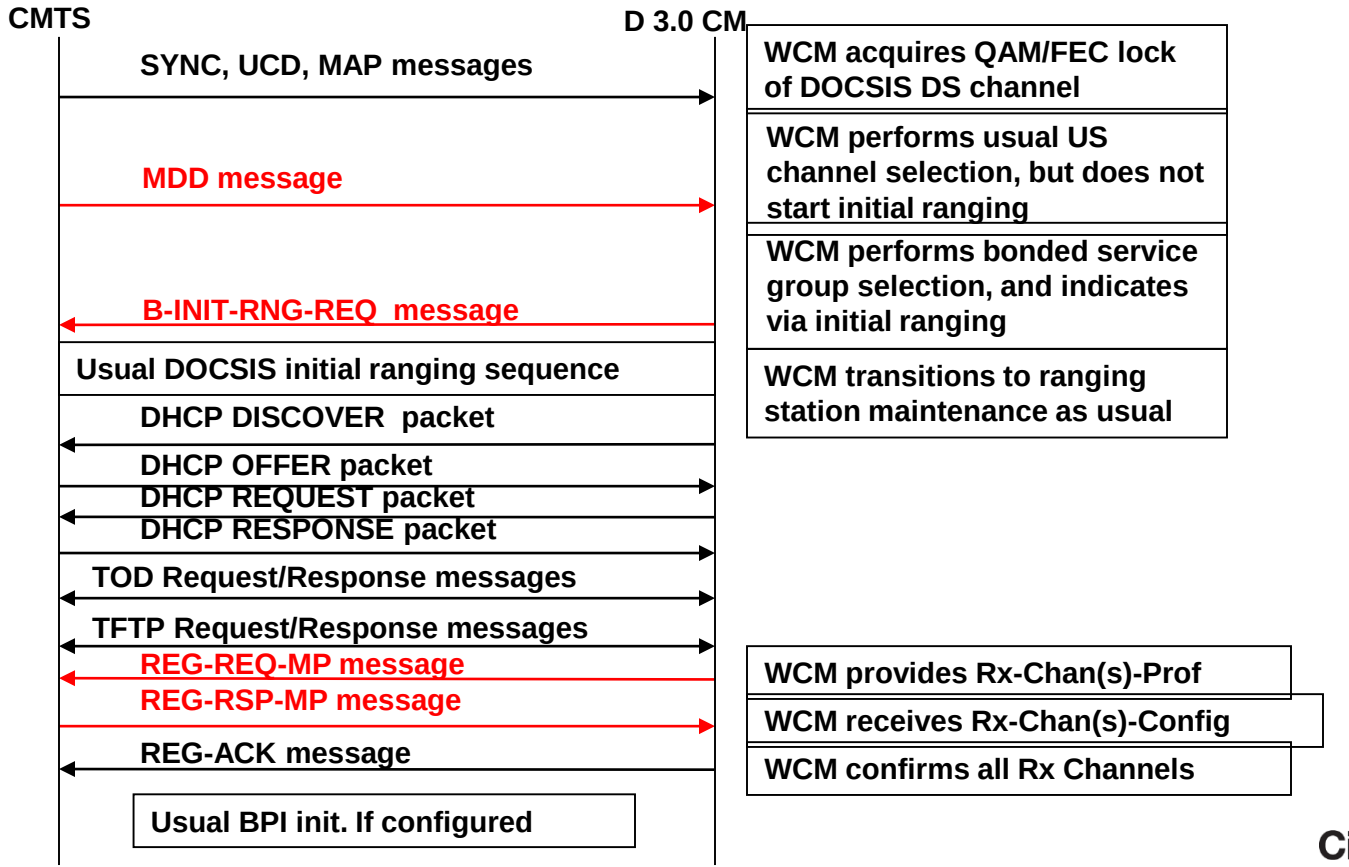
DOCSIS 3.0 M-CMTS System



DOCSIS 3.0 I-CMTS System



DOCSIS 3.0 Registration Diagram



CMs Not Coming Up As W-Online

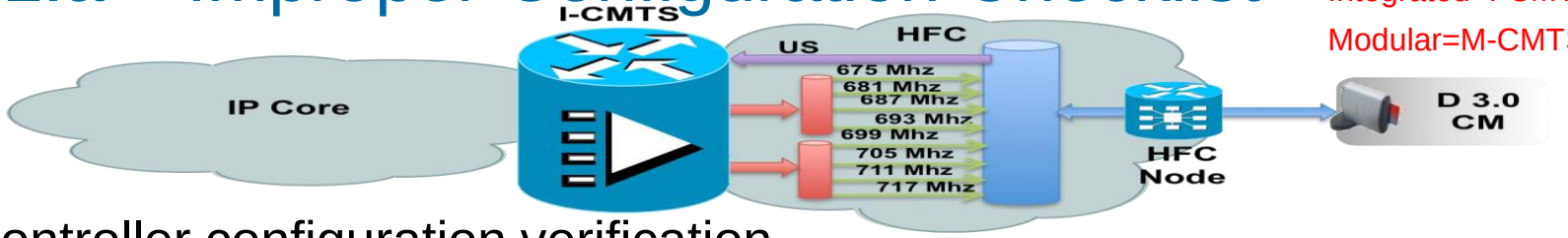
Possible Reasons

- 1. Improper configuration
  - 1.a - Verify Integrated controller and interface, WB interface, CGD and Fiber-node configuration
  - 1.b - MDD issues
- 2. Connectivity issues between the M-CMTS components
  - 2.a - Between M-CMTS components and DTI server
  - 2.b - Between the CMTS and EQAM
- 3. RF side combining issues at the headend

1.a – Improper Configuration Checklist

Integrated=I-CMTS

Modular=M-CMTS



Controller configuration verification

```
Controller Integrated-Cable 6/0/0
 rf-channel 0 cable downstream channel-id 49
 rf-channel 0 frequency 675000000 annex B modulation 256qam interleave 32
 rf-channel 0 rf-power 50.0
 no rf-channel 0 rf-shutdown
 rf-channel 1 cable downstream channel-id 50
 rf-channel 1 frequency 681000000 annex B modulation 256qam interleave 32
 rf-channel 1 rf-power 50.0
 no rf-channel 1 rf-shutdown
 rf-channel 2 cable downstream channel-id 51
 rf-channel 2 frequency 687000000 annex B modulation 256qam interleave 32
 rf-channel 2 rf-power 50.0
 no rf-channel 2 rf-shutdown
 rf-channel 3 cable downstream channel-id 52
 rf-channel 3 frequency 693000000 annex B modulation 256qam interleave 32
 rf-channel 3 rf-power 50.0
 no rf-channel 3 rf-shutdown
```

4 rf-channels in one coax

Unique DS channel-id

Integrated-Cable interface configuration verification

```
interface Integrated-Cable6/0/0:0
 cable bundle 1
 cable dynamic-bw-sharing
 cable rf-bandwidth-percent 46
```

Bundle ID inherited from LC, need to match with wideband interface

BW has to be configured

1.a – Improper Configuration Checklist

Wideband interface verification

```
interface Wideband-Cable6/0/0:0
 cable bundle 1
 cable dynamic-bw-sharing
 cable rf-channel 0 bandwidth-percent 50
 cable rf-channel 1 bandwidth-percent 50
 cable rf-channel 2 bandwidth-percent 50
 cable rf-channel 3 bandwidth-percent 50
 cable rf-channel controller 1 channel 0 bandwidth-percent 50
 cable rf-channel controller 1 channel 1 bandwidth-percent 50
 cable rf-channel controller 1 channel 2 bandwidth-percent 50
 cable rf-channel controller 1 channel 3 bandwidth-percent 50
```

Bundle ID that should match under modular/IC interface

Fiber-node configuration verification

```
Show cable fiber-node
Fiber-Node 2
      downstream Integrated-Cable 6/0/0:  0-3
      downstream Integrated-Cable 6/0/1:  0-3
      upstream Cable 6/0:  0-3
    FN Config Status: Configured (status flags = 0x01)
    MDD Status: Valid
```

Fiber Node with RF channels

MDD has to be valid

CGD association verification

```
show cable cgd-associations
CGD Host  Resource  DS Channels          Upstreams (All US) Active Remote DS
Ca6/0/0   6/0/0     0-3                  0-3          Yes       0-3
Ca6/0/1   6/0/1     0-3                  0-3          Yes       0-3
```

Integrated cable intf. With RF channels

1.a – Improper Configuration Checklist

Primary channel SYNC and MAP verification

```
UBR10K#show controller integrated-cable 6/0/0 counters rf-channel
Controller RF     MPEG                  MPEG       MPEG     Sync          MAP Queue
           Chan   Packets Tx            bps        Mbps     Packets Tx    Packets Tx
6/0/0      0      5406341508            29337376   29.743   1105170888    20849541696
6/0/0      1      5352261326            29280123   29.280   1105170887    20849541695
6/0/0      2      5352239729            29274528   29.274   1105170887    20849541695
6/0/0      3      5352276150            29251244   29.251   1105170887    20849541695
```

Sync and MAP packets on PC channel

RF-Channel mapping verification

```
UBR10K#show controller integrated-cable 6/0/0 mapping rf-chan
Ctrlr    RF       MC          MC Rem.    WB          WB          WB Rem.
         channel  BW %        Ratio      channel     BW %        Ratio
6/0/0    0        20          -          6/0/0:0     50          -
                                         6/0/1:0     50          -
6/0/0    1        20          -          6/0/0:0     50          -
                                         6/0/1:0     50          -
6/0/0    2        20          -          6/0/0:0     50          -
                                         6/0/1:0     50          -
6/0/0    3        20          -          6/0/0:0     50          -
                                         6/0/1:0     50          -
```

WB interface BW

1.b – Invalid MDD State for a Fiber Node

Fiber node Configuration

```
sh cable fiber-node
Fiber-Node 2
downstream Integrated-Cable 6/0/0:  0-3
downstream Integrated-Cable 6/0/1:  0-3
upstream Cable 6/0:  0-3
FN Config Status: Configured (status flags = 0x01)
MDD Status: InValid
        Bundle ID Inconsistent
```

Bonding Group Configuration

```
interface Wideband-Cable6/0/0:0
 load-interval 30
 cable bundle 125
 cable dynamic-bw-sharing
 cable rf-channel 0 bandwidth-percent 70
 cable rf-channel 1 bandwidth-percent 70
 cable rf-channel 2 bandwidth-percent 70
 cable rf-channel 3 bandwidth-percent 70
```

Host Interface Configuration

```
interface Cable6/0/0
 load-interval 30
 downstream Integrated-Cable 6/0/0 rf-
channel 0-3
 no cable mtc-mode
 cable cm-status enable 1-10
 no cable packet-cache
 cable bundle 123
 cable downstream channel-id 119
```

Checkpoints for bad MDD:

DS Frequencies has to be same on CMTS and EQAM

Unique DS channel IDs for DSs under fiber-node configuration

Non-overlapping frequencies for DSs and USs under fiber-node

1.b – MDD Verification

- Debugs to verify MDD generation on CMTS
  - debug cable interface cable x/y/z verbose
  - debug cable mdd
- Debugs needed for ranging and registration
  - debug cable mac-address <CM mac-add> verbose
  - debug cable mdd
  - debug cable ranging
  - debug cable registration
  - debug cable tlv
  - Debug cable dhcp
  - debug cable service-ds-selection

1.b – Sample MDD Debug from PC Channel

```
Mar 24 09:06:00.648: Cable5/0/0 MDD datagramsize 333, msg len
331, ehdr type_or_len 313, tlv_size 303 max_pak_size 1518
MDD MESSAGE
 FRAME HEADER
  FC, MAC_PARM, LEN       - 0xC2, 0x00, 0x014B
   MAC MANAGEMENT MESSAGE HEADER
    DA, SA          - 01E0.2F00.0001,0014.F1E6.20D0
    msg LEN                 - 0x0139
    DSAP, SSAP              - 0, 0
    control,version,type    - 0x03, 0x04, 0x21
    change_count            - 0x29
    num_fraqment, seq_num   - 0x01, 0x01
    dcid                    - 24
MDD TLV, Total TLV size - 303
      MDD TLV
       Downstream Active Channel List
         Channel ID:             24
         Frequency:              675000000Hz
         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:             25
         Frequency:              681000000Hz
         Modulation Order/Annex: 256 QAM/Annex B
         Primary Capable:       Not Primary-Capable
         CM-STATUS Event Bitmask:0x36
                                 MDD Timeout
```

```
Downstream Active Channel List
    Channel ID:             26
    Frequency:              687000000Hz
    Modulation Order/Annex: 256 QAM/Annex B
    Primary Capable:        Not Primary-Capable
<snip>
Downstream Active Channel List
    Channel ID:             27
    Frequency:              693000000Hz
<snip>
    MAC Domain Downstream Service Group
    MD-DS-SG ID:            1
    Channel IDs:            24
                            25
                            26
                            27
Downstream Ambiguity Resolution Frequency List
         Frequencies:            675000000Hz
                                 681000000Hz
                                 687000000Hz
                                 693000000Hz
       IP Initialization Parameters
         IP Provisioning Mode:   IPv4
       Receive Channel Profile Reporting Control
         Center Freq spacing:    6 MHz
         Verbose Reporting:      No
       Early Authentication and Encryption (EAE)
         Early Authentication:   Disabled
       Symbol Clock Locking Indicator
         Locked to Master:       Locked
CM-STATUS Event Control
         Event Type Code:        MDD Timeout
         Event Holdoff Timer:    50 (20 ms)
```

1.b – Debug CM's Ranging to Registration

Initial Ranging

```
Feb 17 11:25:31.494: Bonding Initial Ranging request from 0022.ce9a.9fc0, SID 0 [16383] on
Interface Cable6/0/0/U3: MD-DS-SG-ID 1, Cap flags 192Src sap 199
Feb 17 11:25:31.494: Initial Ranging: Downstream channel ID is 49 (CGD host DS chan Id 49)
Feb 17 11:25:31.494: CM mac address found. Assigned Primary SID 181.
Feb 17 11:25:31.494: cmts_tcc_uschan_add: CM 0022.ce9a.9fc0 tcs 0 chan 3 tech 2 ref 0
Feb 17 11:25:31.494: cmts_sid_assigned(): add sid to table and IPC to LC: 181
```

Bonding Initial Request on MD-DS-SG 1

Ambiguity and Ranging response

```
Feb 17 11:25:31.494: Ambiguity Resolution Validate Candidate: (B_INIT_RNG_REQ) found[ 1 ]
uschan = 0xF, reachable = 0x8, failed = 0x0.
Feb 17 11:25:31.494: Ambiguity Resolution: Done with sg_id = 1, (tcs 0x8).
Feb 17 11:25:31.494: Ambiguity Resolution: B_INIT_RNG_REQ notified. ucid  4 (tcs 0x8).
Feb 17 11:25:31.494: CM Ambiguity Resolution Done SG_ID=1
Feb 17 11:25:31.494: Timing error 1024, power error 0.00dB, freq error 280(thres 640 adj
0) [sm per 20.0 sec]
Feb 17 11:25:31.494: Ca6/0/0/U3: Send RNG-RSP (1) for 0022.ce9a.9fc0, SID 181, DS RFID 480
```

Ranging Response from CMTS

IP address assignment begins

```
Feb 17 11:25:32.518: DHCPGLEAN input idb Bundle1 MAC 0022.ce9a.9fc0 SID 181
type 1
Feb 17 11:25:32.518: op = 1 - BOOTREQUEST  htype = 1  hlen = 6  hops = 0
Feb 17 11:25:32.518: xid = 0x5363FF88   secs = 0   flags = 0x0
Feb 17 11:25:32.518: ciaddr = 0.0.0.0              yiaddr = 0.0.0.0
Feb 17 11:25:32.518: siaddr = 0.0.0.0              giaddr = 0.0.0.0
Feb 17 11:25:32.518: chaddr = 0022.ce9a.9fc0       sname =
Feb 17 11:25:32.518: DHCP Option 53  - Message Type: 1 - DHCPDISCOVER
```

DHCP Boot Request from CM

1.b – Debug CM's Ranging to Registration

Registration Request

```
Feb 17 11:25:35.666: Receive REG-REQ-MP from 0022.ce9a.9fc0, SID 181 on Cable6/0/0
Feb 17 11:25:35.666: cmts_cm_lookup_extended: hwidb = Cable6/0/0, SID 181
Feb 17 11:25:35.666: cmts_cm_lookup_extended: IPv4 CM Found, flag 0x16, IP 10.1.1.18, mac
0022.ce9a.9fc0
Feb 17 11:25:35.666:  Now parse REG-REQ-MP 1/1 for CM 0022.ce9a.9fc0
```

REG-REG-MP request from DSCB CM

RCPs and Registration response

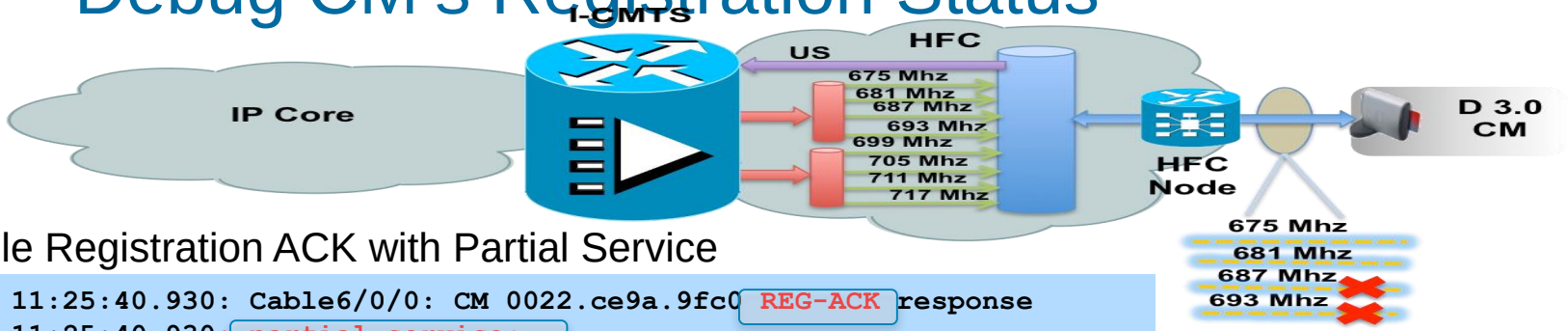
```
Feb 17 11:25:35.669: Found Network Access TLV
Feb 17 11:25:35.669: Ntw Access Control : 1
Feb 17 11:25:35.669: Found Max CPEs TLV
Feb 17 11:25:35.669: Found Modem Capabilities TLV
Feb 17 11:25:35.669:    Concatenation Support : 1
<snip>
Feb 17 11:25:35.669: Found RCP TLV
Feb 17 11:25:35.669: RCP ID:
Feb 17 11:25:35.669: 0x0000: 00 10 00 00 02
Feb 17 11:25:35.669: Found RCP TLV
Feb 17 11:25:35.669: RCP ID:
Feb 17 11:25:35.669: 0x0000: 00 10 00 00 04
<snip>
Feb 17 11:25:35.669: Selected RCC 1 with total current cms 0 for Cable6/0/0 8 channel modem
0022.ce9a.9fc0, (8 rcc rfs) BG 577
Feb 17 11:25:35.669: Performing admission control check for MTC CM 0022.ce9a.9fc0
Feb 17 11:25:39.660: Now sending 2 REG-RSP-MP fragment(s) for CM 0023.be50.e628
Feb 17 11:25:40.902: Registration acknowledgement (0) from 0022.ce9a.9fc0, SID 181 on Cable6/0/0/U0
Feb 17 11:25:40.902: CM is waiting REG-ACK, now handle confirmation code : 0
```

RCP from CM

RCC 1 selected for CM

REG-RSP-MP for REG-REQ-MP

1.b – Debug CM's Registration Status



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 the way modem reports

```
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

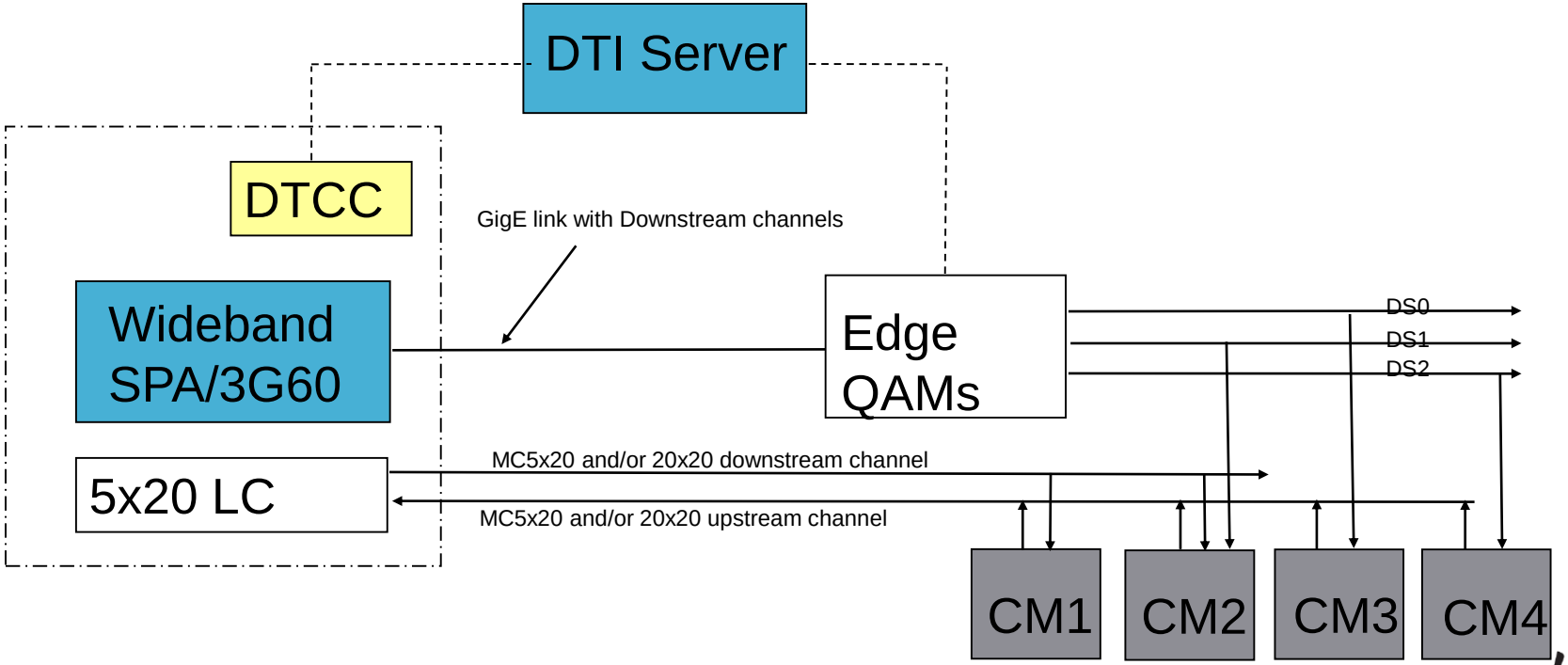
No MDD failure on this channel

No Flaps on this channel

DS Channel from controller 6/0/1

2 – Connectivity Between M-CMTS Components

DTI in M-CMTS system



2.a – Connectivity Between M-CMTS and DTI

- Verify that the CMTS and EQAM are locked to the same DTI clock source
- Issue “show cable clock”

```
UBR10K2#show cable clock
Number of TCC Cards in the Chassis: 2
Active TCC Card is in slot: 1 subslot: 0,(DTCC Eightbells card)
Clock reference used by the active card is DTI
Active TCC card in slot 1/0
TCC Card 1/0 DTI status:
----------------------------------------
    Active Client port              : 2
    Active Client status            : normal
    Active Client Server status     : freerun
    Active Client frame error rate  : < 2%
    Active Client CRC error count   : 0x02
    Standby Client Signal detected  : no
```

DTI used for Clocking

Status has to be normal

<2% error rate is normal

2.b – Connectivity Between CMTS and EQAM

- The effect
  - Link flap may cause CMs to re-initialize
  - Interface up/down message for MC and WB interface in the logs
  - CM may be online on PC channel from 5x20
  - With “cable wideband auto-reset", 3.0 CMs will bounced on re-establishment
  - CMTS relies on timers for detection of indirect link failure

```
UBR10K2#show controllers modular-Cable 1/0/0 brief
SPA 0 is present
status LED: [green]
<snip>
Gigabit Ethernet Port Selected : Port 0
Receive Interface              : Out of Reset
Receive Interface              : Enabled
Transmit Interface             : Out of Reset
<snip>
SFP [Port 0] : 1000BASE-SX Present
 Tx Enabled , LOS Not Detected , TxFault Not Detected
 Link Status [Port 0] : UP
<snip>
RF Channel information
Modulation Data :GE Interframe Gap = 12 , MPEG-TS Frames per pkt = 7
SPA IP address = 12.30.4.101       SPA MAC Addr = 0014.F1E6.2070
QAM         MOD     ANNEX      TKB Interval      Rate adjust    State
0           QAM 256  Annex B      2423              132          Enabled
```

Poor Throughput Issues

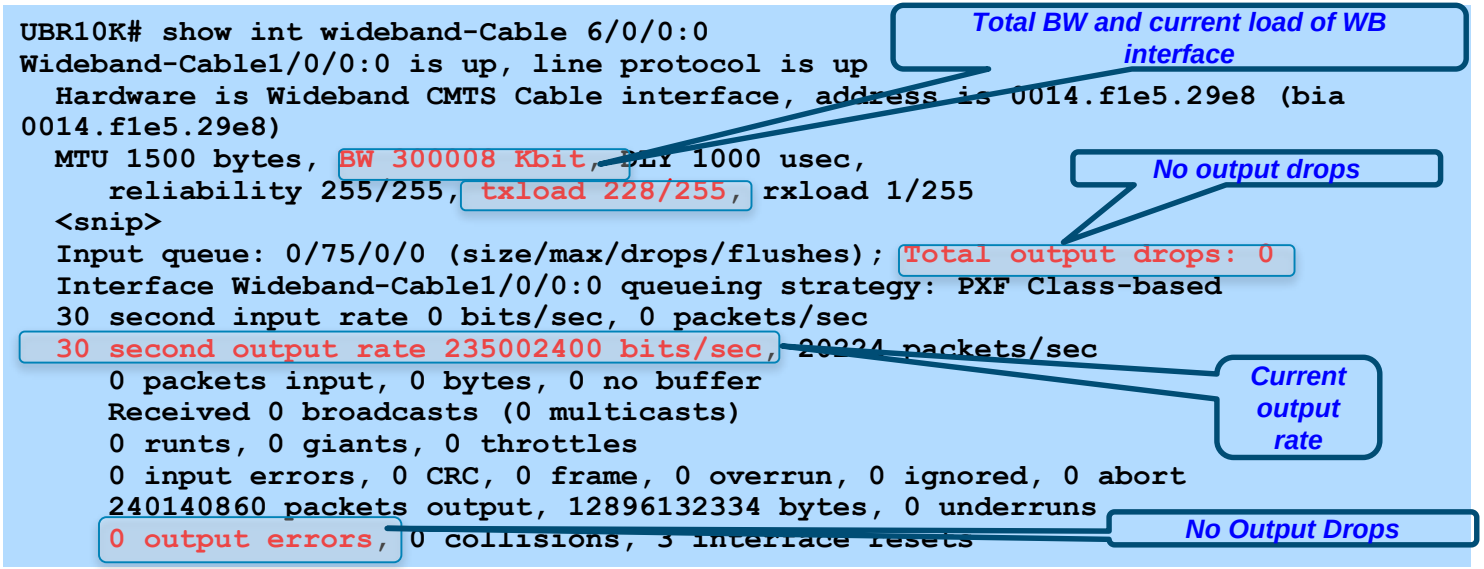
CMs Reporting Poor Throughput

Best Way To Troubleshoot Is

- 1. Look at overall interface numbers on CMTS
  - rf-channel bandwidth sharing, DBS Vs Static
- 2. Per CM throughput verification
  - Identify the subscriber's CM having a problem
    - Perform throughput test
    - Look at the real numbers on CMTS
  - Install a test CM at headend on same US/DS interface, if possible
    - Perform FTP test from server behind CMTS
    - Look at the real numbers on CMTS
- 3. Configure DS Bonding Resiliency
  - DS Bonding resiliency configuration and debugs

1. CMTS Interface Numbers

- Configuration check for rf-channel bandwidth sharing
  - Dynamic Bandwidth Sharing, DBS, recommended
- show interfaces wideband-Cable x/y/z:j



1. Show rf-channel Counters on CMTS

- Show controller Integrated x/y/z counters rf-channel

Current load on each channel

```
UBR10K#show controller integrated-cable 6/0/0 counters rf-channel
SPA     RF    MPEG                  MPEG       MPEG     Sync          MAP Queue
        Chan  Packets Tx            bps        Mbps     Packets Tx    Packets Tx
6/0/0   0     5406341508            29337376   29.743   1105170888    20849541696
6/0/0   1     5352261326            29280123   29.280   0             0
6/0/0   2     5352239729            29274528   29.274   0             0
6/0/0   3     5352276150            29251244   29.251   0             0
```

- Show hw-module bay x/y/z counters wideband-channel j

  - Look for Tx packets increment

- Monitor channel utilization in EQAM (for M-CMTS deployment)

2. Per CM DS and US Throughput Verification

Show Commands to be Used

- Show cable modem <mac/ip-add> wide rcs-status
  - Make sure CM is not in “Partial Service”
    - MAC state will be “p-online(pt)” for DS partial service
- Show cable modem <mac/ip-add> service-flow

```
UBR10K2#show cable modem 0022.ce9a.9fc0 service-flow
SUMMARY:
MAC Address     IP Address      Host          MAC              Prim Num Primary    DS
                                Interface     State            Sid  CPE Downstream RfId
0022.ce9a.9fc0 10.1.1.18        C6/0/0/U0     w-online(pt)     181   1   In6/0/0:0  480
Forwarding Interface: Wideband-Cable 6/0/0:0
Sfid  Dir Curr  Sid   Sched  Prio MaxSusRate  MaxBrst   MinRsvRate  Throughput
          State       Type
371   US  act   181   BE     0    5000000     8192      0           846
372   DS  act   N/A   BE     0    101000000   3044      0           99000124
```

Primary Sid of CM

Wideband intf is for forwarding. Modular intf. For WB CM in partial service mode

Current throughput

- US MAP grants and pxf QID

```
UPSTREAM SERVICE FLOW DETAIL:
SFID  SID   Requests   Polls      Grants     Delayed   Dropped   Packets
                                             Grants    Grants
371   181   0          0          1323750    0         0         123933740
DOWNSTREAM SERVICE FLOW DETAIL:
SFID  RP_SFID QID   Flg Policer              Scheduler            FredIF
                    Xmits      Drops         Xmits      Drops
372   33153   36355 134787     0             14131275   0         Wi6/0/0:0
```

No Dropped or Delayed grants

PXF Qid for DS service flow

2. pxf cpu queue stats

12.2(33)SCB onwards

```
UBR10K#show cable mode 0022.ce9a.9fc0 service-flow verbose
<snip>
Bytes                                  : 190345753
Rate Limit Delayed Packets             : 0
Rate Limit Dropped Packets             : 0
Current Throughput                     : 99000124 bits/sec
Application Priority                   : 0

LC_sfid: 372    rp_sfid: 36355  SF-ByteCount: 104678  SF-PacketCount: 539
  SF-ConformXmitBytes: 104678
  SF-ConformXmitPkts: 539
  SF-ExceedXmitBytes:  0
  SF-ExceedXmitPkts:  0
  SF-ConformDropBytes: 0
  SF-ConformDropPkts: 0
  SF-ExceedDropBytes:  0
  SF-ExceedDropPkts:  0

Queuing/Jib Tables:
  ibus_channel: 49152 ds_key_index: 0    phs_rule: 0 tx_control: 0xD
jib_flag: 0  keyseq_mapcntrl: 0x0  ds_stat_index: 3  min_res_pkt_size: 0
jib_hdr_id: 0x0  docsis_hdr_len: 0   docsis_overhead_len: 12  ds_port: 0
  qid:  134788   tx_pkts: 23539 qtail_drop_pkts: 0
```

LC and RP sfid

Qtail_dropped packets

3. 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

3. 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

```
interface Wideband-Cable6/0/0:0
cable bundle 1
cable rf-channel 0 bandwidth-percent 25
cable rf-channel 1 bandwidth-percent 25
cable rf-channel 2 bandwidth-percent 25
cable rf-channel 3 bandwidth-percent 25
```

```
interface Wideband-Cable6/0/0:3
cable ds-resiliency
!
interface Wideband-Cable6/0/0:4
cable ds-resiliency
!
interface Wideband-Cable6/0/0:5
cable ds-resiliency
```

DS Bonding resiliency enabled under BG

Debugs needed

```
debug cable wbcmts resiliency
debug cable interface c6/0/0 mac-address 001e.6bfc.d732
```

Debugs for wideband resiliency

All 3 non PC channels are up so far

All channels are up in BG

```
Jul 25 17:09:37.299: cmts_rf_resil_rp_received_ipc: RECV IPC from slot 6 subslot 0 type 197
SLOT 6/0: Jul 25 17:09:37.277: CM 001e.6bfc.d732 n_rfch 3 CM_RFID 48
SLOT 6/0: Jul 25 17:09:37.277:  r 0 state UP[11] rfid 49
SLOT 6/0: Jul 25 17:09:37.277:  r 1 state UP[11] rfid 50
SLOT 6/0: Jul 25 17:09:37.277:  r 2 state UP[11] rfid 51
SLOT 6/0: Jul 25 17:09:37.277:  n_rfdown 0 n_rfup 3 n_bg_rfup 3 n_bg_rfdown 0 move2nb 0 m2n 0
```

3. DS Bonding Resiliency debugs

One DS Channel down

```
Jul 25 17:09:47.471: cmts_rf_resil_rp_received_ipc: RECV IPC from slot 6 subslot 0 type 197
SLOT 6/0: Jul 25 17:09:47.449: CM 001e.6bfc.d732 n_rfch 3 CM_RFID 48
SLOT 6/0: Jul 25 17:09:47.449:  r 0 state UP[11] rfid 49
SLOT 6/0: Jul 25 17:09:47.449:  r 1 state DOWN_PENDING[14] rfid 50
<snip>
SLOT 6/0: Jul 25 17:10:02.701:  r 1 state DOWN[13] rfid 50
```

Channel went down for CM because of impairments

RP to look for RBG for Wi 6/0/0:0

RBG comes up with remaining channels

```
Jul 25 17:10:07.807: RP GOT REQUEST TO MOVE CM
Jul 25 17:10:07.807: Wideband-Cable6/0/0:0 Looking up wb channel for 6/0/0:0 if_num 232 wcmts_channel_id 65
Jul 25 17:10:07.807:  Looking up wb channel for 6/0/0:0
Jul 25 17:10:07.807:  Original bg id 65 wb index 0 wb chan num 0 and original bitmask 0x0000000F rfdown mask
0x00000004
Jul 25 17:10:07.807: Checking RF index 0 channel number 0 for Wideband-Cable6/0/0:0 with max bonded 32 total RF BW 39
Jul 25 17:10:07.807: Checking RF index 1 channel number 1 for Wideband-Cable6/0/0:0 with max bonded 32 total RF BW 39
Jul 25 17:10:07.807: Checking RF index 3 channel number 3 for Wideband-Cable6/0/0:0 with max bonded 32 total RF BW 25
Jul 25 17:10:07.807: Original wb mode 3  with wb index 0 wb chan num 0 and original bitmask 0x0000000F needed bitmask
Jul 25 17:10:07.807: Creating Dyn WB interface 6/0/0:3 with bundle 1 for bitmask 0x0000000B
Jul 25 17:10:07.807: RESIL <CR10K Request dispatcher>: parse_cmd <interface Wideband-Cable 6/0/0:3>
Jul 25 17:10:07.807: RESIL <CR10K Request dispatcher>: parse_cmd <cable bundle 1>
Jul 25 17:10:07.811: RESIL <CR10K Request dispatcher>: parse_cmd <end>
Jul 25 17:10:07.811: RESIL <CR10K Request dispatcher>: parse_cmd <cable rf-channel 0 bandwidth-percent 1>
<snip>
Jul 25 17:10:09.811: %LINEPROTO-5-UPDOWN: Line protocol on Interface Wideband-Cable6/0/0:3, changed state to up
```

Dynamic WB intf. Created for RBG

WB RBG with 3 chans. Comes up

3. DS Bonding Resiliency show commands

Show cable rf-status

```
 Logical   Suspend   Suspend   Flap   Flap
RF         Status    Status    Fails  Count  Time
--------   -------   -------   -----  -----  ----
6/0/0 0    UP        N/A       0      0
      1    DOWN      Yes       0      1      Jul 25 17:08:47
      2    UP        N/A       0      0
      3    UP        N/A       0      0
```

2nd channel went down

Show cable resiliency

```
                BG   Resil BG                                  RF
Resil BG I/F    ID    State     Count      Time          Ctrl   Num
------------ ---  --------- -----  --------------- ----  -----
Wi6/0/0:3       3   Assigned    2     Jul 25 17:09:42 2    0 2 3
Wi6/0/0:4       4   Assigned    1     Jul 25 17:09:42 2    0 1 3
Wi6/0/0:5       5   Assigned    1     Jul 25 17:09:42 2    0 1 2
```

Current chans in a RBG

Show cable modem resiliency

```
Orig BG                  Curr BG
I/F      MAC Address     ID   I/F         RFs ID   I/F         RFs
-------  --------------  ---  ----------  --- ---  ----------  --
C6/0/0   001e.6bfc.d732  65   Wi6/0/0:0   4   68   Wi6/0/0:3   3
C6/0/0   0025.2e2d.74cc  65   Wi6/0/0:0   4   69   Wi6/0/0:4   3
C6/0/0   0025.2ebf.29dd  65   Wi6/0/0:0   4   70   Wi6/0/0:5   3
```

Channels in old and new BG for a CM

Resiliency WB running config

```
interface Wideband-Cable6/0/0:3
cable bundle 1
cable ds-resiliency
cable rf-channel 0 bandwidth-percent 1
cable rf-channel 2 bandwidth-percent 1
cable rf-channel 3 bandwidth-percent 1
```

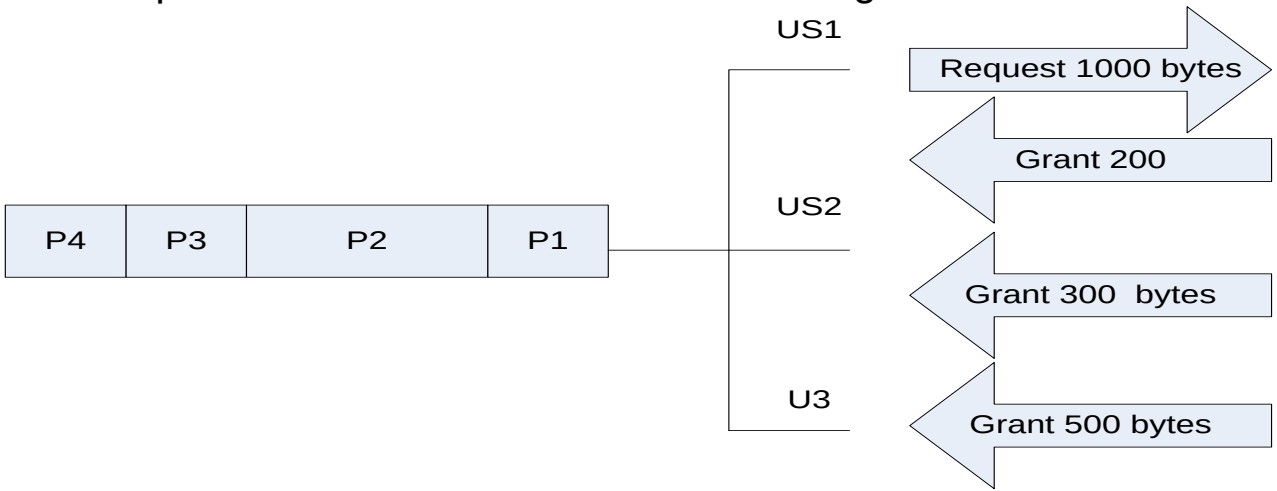
```
interface Wideband-Cable6/0/0:4
cable bundle 1
cable ds-resiliency
cable rf-channel 0 bandwidth-percent 1
cable rf-channel 1 bandwidth-percent 1
cable rf-channel 3 bandwidth-percent 1
```

DOCSIS 3.0 US Channel Bonding Issues

Cisco live!

D3.0 Upstream Channel Bonding

- Upstream bonding
  - Single flow can consume all BW on multiple USs
- Continuous Concatenation & Fragmentation (CCF)
  - Improved form of concatenation and fragmentation



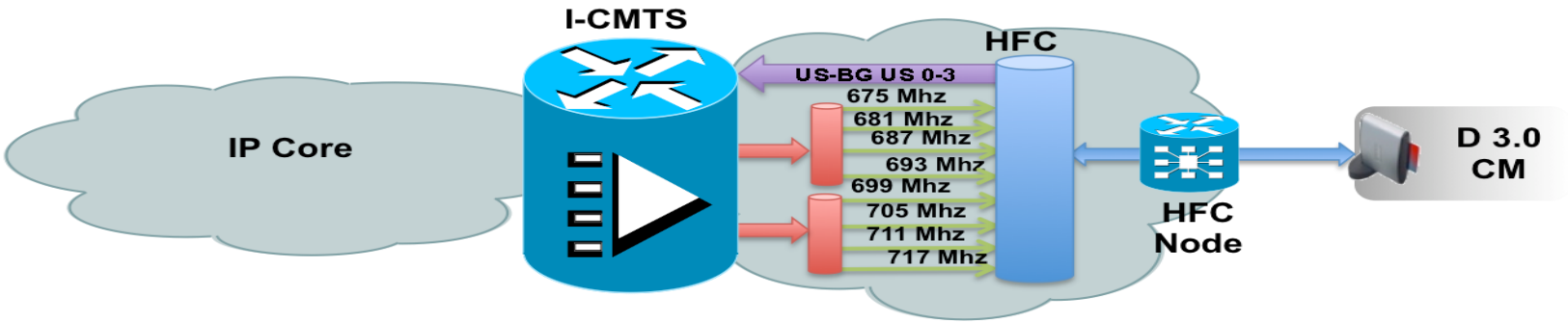
Troubleshooting USCB Modem Issues

Common Problem

1 - Poor US throughput on USCB modem

- 1.a - Configuration issues
- 1.b – Modem in Partial Service mode
- 1.c - Show commands and sid tracker verification

1 – CMTS Configuration Issues



- CMTS configuration checklist
  - Is DSCB configured?

    USCB requires DSCB

1.a – Configuration Verification

Cable Interface Configuration

```
 UBR10K2# sh run int cable 6/0/0
Building configuration...

Current configuration : 1633 bytes
!
interface Cable6/0/0
 downstream Integrated-Cable 6/0/0 rf-channel 0-3
 cable mtc-mode required-attribute
 no cable packet-cache
 cable bundle 1
 cable upstream max-ports 4
 cable upstream bonding-group 1
  upstream 0
  upstream 1
  upstream 2
  upstream 3
  attributes 80000000
```

Default CLI. Need to have attribute in CM config file

Cable bundle interface association

US BG definition with US channels
Attribute needs to match in CM config file

Attributes value: 8=1000

bit0 = Bonding, bit1= Low Latency, bit2=High Availability,
bit3-15=Reserved for future use

1.a – Configuration Verification contd..

Fiber-node configuration verification

```
cable fiber-node 2
  downstream Integrated-Cable 6/0/0 rf-channel 0-3
  downstream Integrated-Cable 6/0/1 rf-channel 0-3
  upstream Cable 6/0 connector 0-3
```

US connector addition under fiber-node

MDD status verification

```
Fiber-Node 2
       downstream Integrated-Cable 6/0/0:  0-3
       downstream Integrated-Cable 6/0/1:  0-3
       upstream Cable 6/0:  0-3
    FN Config Status: Configured (status flags  0x01)
    MDD Status: Valid
```

MDD status has to be Valid

Mac-domain service group verification

```
UBR10K2# show cable mac-domain cable 5/0/0 upstream-service-group
Cable MD 6/0/0
  US-SG-ID  : 1          US-Chan : U0,1,2,3
  Primary-DS: 6/0/0:0    US-SG-ID: 1
    MDD US-List   : U0,1,2,3
    MDD Ambiguity : U0,1,2,3
  Primary-DS: 6/0/0:1    US-SG-ID: 1
    MDD US-List   : U0,1,2,3
    MDD Ambiguity : U0,1,2,3
```

US service Group with US channel association

1.b – Partial Service Verification-Debugs USCB Ranging and Registration

- debug cable mac-address 0022.ce9a.9fc0 verbose
- Debug cable mdd
- Debug cable registration
- Debug cable range initial
- debug cable md-sg
- debug cable range
- debug cable range protocol
- Debug cable ubg

1.b – Updated MDD with US Channels

Debug cable mdd will have active US channels

```
<snip> Downstream Ambiguity Resolution Frequency List
         Frequencies:              675000000Hz
                                   681000000Hz
                                   687000000Hz
                                   693000000Hz
  <snip>
     IP Initialization Parameters
         IP Provisioning Mode:    IPv4
       Receive Channel Profile Reporting Control
         Center Freq spacing:     6 MHz
         Verbose Reporting:       No
<snip>
       MAC Domain Upstream active chan list
         MD-US Chan ID/CM-STATUS:  1/0x0000
       MAC Domain Upstream active chan list
         MD-US Chan ID/CM-STATUS:  2/0x0000
       MAC Domain Upstream active chan list
         MD-US Chan ID/CM-STATUS:  3/0x0000
<snip>
       Upstream Ambiguity Resolution Channel List
         MD-US Chan ID:            0 1 2 3
       Upstream Frequency Range  0
       Upstream Transmit Power Reporting: On
       CM-STATUS non-channel-specific events :  Seq out of range
```

Active US channel list

US Ambiguity channel list

1.b – Debug CM's Initial RNG-REQ

```
Mar 10 13:37:22.946: Bonding Initial Ranging request from 0022.ce9a.9fc0, SID 0 [16383] on
  Interface Cable6/0/0/U2: MD-DS-SG-ID 1, Cap flags 192Src sap 205
Mar 10 13:37:22.946: Initial Ranging: Downstream channel ID is 49 (CGD host DS chan Id 49)
Mar 10 13:37:22.946: CM mac address found. Assigned Primary SID 204.
Mar 10 13:37:22.946: cmts_tcc_uschan_add: CM 0022.ce9a.9fc0 tcs 0 chan 2 tech 2 ref 0
Mar 10 13:37:22.946: Modem 0022.ce9a.9fc0: Host Ca6/0/0/U2: ds_channel_id 49, rfid 480
Mar 10 13:37:22.946: Ambiguity Resolution Validate Candidate: (B_INIT_RNG_REQ) found[ 1 ] uschan =
  0xF, reachable = 0x4, failed = 0x0.
<snip>
 Mar 10 13:37:22.946: Timing error 1025, power error 0.00dB, freq error 358(thres 640 adj 0) [sm
  per 20.
Mar 10 13:37:22.946: Initial Ranging: Downstream channel ID is 49 (CGD host DS chan Id 49) ds-sg 1
  us-sg 1
Mar 10 13:37:22.946: Ca6/0/0/U2: Send RNG-RSP (1) for 0022.ce9a.9fc0, SID 204, DS RFID 480
<snip>
Mar 10 13:37:23.970: DHCPINFO hwidb Bundle1 MAC 0022.ce9a.9fc0 SID 204 dhcp_op 1
```

1.b – Debug CM's REG-REQ and REG-RSP

```
Mar 10 13:37:27.114: Receive REG-REQ-MP from 0022.ce9a.9fc0, SID 204 on Cable6/0/0

<snip>

Mar 10 13:37:27.118:  Now sending 2 REG-RSP-MP fragment(s) for CM 0023.be50.e628

Mar 10 13:37:27.118: REG-RSP-MP Status : ok (0), REG-ACK required from CM (0)

<snip>

Mar 10 13:37:31.794: Ranging request from 0022.ce9a.9fc0, SID 204 [16383/49/480] on Interface
  Cable6/0/0/U1

Mar 10 13:37:31.794: Multi-Channel Initial Ranging

Mar 10 13:37:31.794: Ca6/0/0/U1: Send RNG-RSP (1) for 0022.ce9a.9fc0, SID 204, DS RFID 480

Mar 10 13:37:32.034: Ranging request from 0022.ce9a.9fc0, SID 204 [16383/49/480] on Interface
  Cable6/0/0/U0

<snip>

Mar 10 13:37:32.094: Ranging request from 0022.ce9a.9fc0, SID 204 [16383/49/480] on Interface
  Cable6/0/0/U3
```

1.c – Expanded Show Commands

Show cable modem with UB for MTC modems

```
UBR10K2#show cable modem 0022.ce9a.9fc0
MAC Address     IP Address      I/F          MAC                Prim RxPwr  Timing Num I
                                             State              Sid  (dBmv) Offset CPE P
0022.ce9a.9fc0 10.1.1.18       C6/0/0/UB    w-online(pt)       204  1.00   1025   1   N
```

C6/0/0/p - for partial service mode

UB Added for USCB modem

Deep look in to US stats

```
UBR10K2#show cable modem 0022.ce9a.9fc0 verbose
MAC Address                     : 0023.be50.e628
MD-DS-SG / MD-US-SG             : 1 / 1
Multi-Transmit Channel Mode     : Y
Upstream Channel                : US0       US1       US2       US3
Ranging Status                  : sta       sta       sta       sta
Upstream SNR (dB)               : 36.12     36.12     36.12     36.12
Received Power (dBmV)           : 0.00      0.50      1.00      0.00
Reported Transmit Power (dBmV)  : 51.25     51.25     51.25     49.75
Peak Transmit Power (dBmV)      : 56.00     56.00     56.00     56.00
Minimum Transmit Power (dBmV)   : 18.00     18.00     18.00     18.00
Timing Offset            (97.6 ns): 1025    1025      1025      1025
Initial Timing Offset           : 769       769       1025      769
Good Codewords rx               : 36472     36473     36475     36475
Corrected Codewords rx          : 0         0         0         0
Uncorrectable Codewords rx      : 0         0         0         0
```

DS and US Service Groups for CM

Ranging Status in Station Maintenance. Not in Partial Service

Other possible Ranging Status: im,sm,Cont,dr,dt and di

1.c – SID Tracker

- On PRE or LC, Issue “debug cable interface Cable x/y/z sid <sid> track”
- On LC, Issue “show int Cable x/y/z up debug sid-tracking <sid> 0 40000”

```
clc_6_0#sh int cable 6/0/0 up debug sid-track 204 0 40000
cmts_show_sid_track Cable6/0/0 sid 204
Count: 2490
[0   ]:BWREQ_3   100062974     0-usecs bytes:128     req_id:1          sid:204/ 1  psid 204/ 1  osid 204/ 1 cpu: 12
[1   ]:GRANT     100064895  1921-usecs bytes:136     req_id:1          sid:204   chan:1     lo-queue: 0
<snip>
[3566]:BWREQ_3   495227019 14174-usecs bytes:7640    req_id:1342  sid:204/ 1  psid 204/ 1  osid 204/ 3 cpu: 5
[3567]:GRANT     495228817  1798-usecs bytes:1802    req_id:1342  sid:204   chan:1     lo-queue: 0
[3568]:PG        495228819     2-usecs bytes:5846    req_id:1342  sid:204   chan:1
[3569]:GRANT     495228828     9-usecs bytes:1802    req_id:1342  sid:204   chan:2     lo-queue: 0
[3570]:GRANT     495228837     9-usecs bytes:1802    req_id:1342  sid:204   chan:3     lo-queue: 0
[3571]:GRANT     495228845     8-usecs bytes:1802    req_id:1342  sid:204   chan:4     lo-queue: 0
[3572]:GRANT     495234817  5972-usecs bytes:484     req_id:1342  sid:204   chan:1     lo-queue: 0
[3573]:BWREQ_3P  495238448  3631-usecs bytes:1880    req_id:1343  sid:204/ 1  psid 204/ 1  osid 204/ 1 cpu: 4
[3574]:GRANT     495238818   370-usecs bytes:1698    req_id:1343  sid:204   chan:1     lo-queue: 0
[3575]:PG        495238820     2-usecs bytes:190     req_id:1343  sid:204   chan:1
[3576]:GRANT     495242818  3998-usecs bytes:200     req_id:1343  sid:204   chan:1     lo-queue: 0
[3577]:BWREQ_3   495252594  9776-usecs bytes:7640    req_id:1344  sid:204/ 2  psid 204/ 2  osid 204/    cpu: 5
[3578]:GRANT     495252821   227-usecs bytes:1802    req_id:1344  sid:204   chan:1     lo-queue: 0
[3579]:GRANT     495252832    11-usecs bytes:1802    req_id:1344  sid:204   chan:2     lo-queue: 0
[3580]:PG        495252834     2-usecs bytes:4052    req_id:1344  sid:204   chan:2
[3581]:GRANT     495252841     7-usecs bytes:1802    req_id:1344  sid:204   chan:3     lo-queue: 0
[3582]:GRANT     495252849     8-usecs bytes:1802    req_id:1344  sid:204   chan:4     lo-queue: 0
[3583]:GRANT     495258820  5971-usecs bytes:484     req_id:1344  sid:204   chan:1     lo-queue: 0
```

US BW request for128 bytes on ch 1

US BW Granted after 1921 usecs on ch 1

7640 bytes requested

1802 bytes issued on 1

Pending Grant of 5846

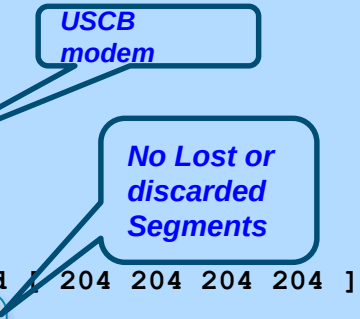
1802 bytes granted on ch 2,3 and 4

Piggyback BW Request

1.c – Service Flow Segments

- Deep diver in to US service flow

```
UBR10K2# show cable modem <mac/ip> service-flow verbose
<snip>
Sfid                                                : 417
Mac Address                                         : 0022.ce9a.9fc0
Type                                                : Primary
Direction                                           : Upstream
Current State                                       : Active
Current QoS Indexes [Prov, Adm, Act]                : [3, 3, 3]
<snip>
US Bonded                                           : YES
Upstream Bonding Group                              : UBG-1
Transmit Channel Set                                : 0xF
Sid Cluster                                         : SC-0, Sid [ 204 204 204 204 ]
Segments Valid                                      : 19692352
Segments Discarded                                  : 0
Segments Lost                                       : 0
```



- 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

1.c – Bonding Group Counters

Look for Available Bandwidth

```
UBR10K2#show int cable 6/0/0 upstream bonding-group
Cable6/0/0: Upstream Bonding Group 1
     192700 packets input, 18817225 octets input
     Segments: 192648 valid, 5 discarded, 5 lost
     Reserved Bandwidth Max : 0 bits/sec
     Reserved Bandwidth     : 0 bits/sec
     Available Bandwidth    : 10240000 bits/sec
     Total Service Flows On This Bonding Group: 14
```

Bonding Group number

Bonding Group BW Stats

Look for drops in scheduler queues

```
UBR10K2#show int cable 6/0/0 mac-scheduler 1
     DOCSIS 1.1 MAC scheduler for Cable6/0/0/U1: rate 2560000
     wfq:None
     Queue[Rng Polls] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 1
     Queue[CIR Grants] 0/256, 0 drops, flows 0 fs_demand_ms 0, max 1
     Queue[BE(7) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(6) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(5) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(4) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(3) Grants] 0/128, 2305 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(2) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(1) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 0
     Queue[BE(0) Grants] 0/128, 0 drops, flows 0 fs_demand_ms 0, max 2  <snip>
     Avg upstream channel utilization : 1%
```

Individual US BW

Drops in BE flow

Agenda

- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting DOCSIS Timing Issues
- Troubleshooting DOCSIS Load Balancing
- Troubleshooting Voice Services
  - Troubleshooting Voice Subscriber Issues
  - Troubleshooting DSG Services
- Summary
- Q & A

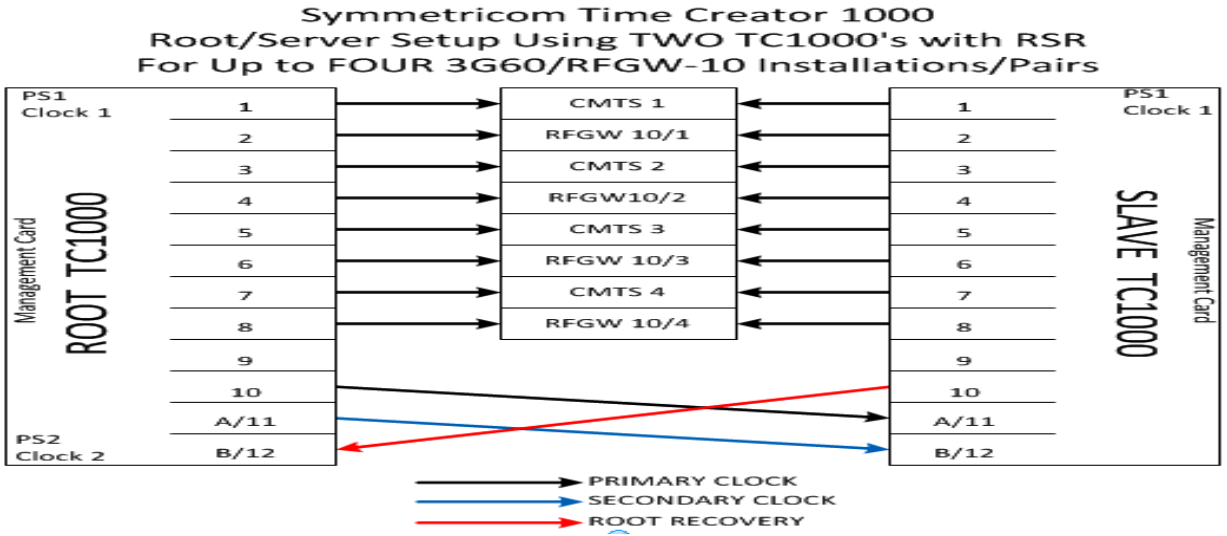
Troubleshooting DOCSIS Timing Issues

- DOCSIS timing issues could be a HUGE reason for
  - Subscribers Issues
    - Subscribers reporting sluggish throughput performance
    - New CMs not coming up online
    - CMs fall offline gradually on LCs or on CMTS
  - Hardware issues
    - N+1 Redundancy in RFGW-10 not working
    - DS384 cards in RFGW-10 not booting up or stuck in boot cycle

- Possible Reasons
  - DOCSIS clock issues on M-CMTS and RFGW-10
  - Stable DOCSIS clock source not present on RFGW-10

M-CMTS DOCSIS Timing Architecture

- DTI servers should be installed in root/slave mode
  - –Root server providing timing to DTI clients and Slave DTI server
  - –Slave server receiving clock from Root and providing clocking to DTI clients
- DTI clients (M-CMTS+RFGW-10) should have clock from Root and Slave server



DOCSIS Clock Verification on M-CMTS

Show cable clock status on M-CMTS

```
UBR10K#show cable clock dti status
Status of DTI component:
Active TCC card in slot 2/1
TCC Card 1/1 DTI status:
-----------------------------------------
    Active Client port              : 2
    Active Client status            : normal
    Active Client Server status     : freerun
    Active Client frame error rate  : < 2%
    Active Client CRC error count   : 0xAD
    Standby Client Signal detected  : yes

TCC Card 2/1 DTI status:
-----------------------------------------
    Active Client port              : 2
    Active Client status            : normal
    Active Client Server status     : freerun
    Active Client frame error rate  : < 2%
    Active Client CRC error count   : 0x15
    Standby Client Signal detected  : yes
```

CMTS getting clock from TCC in 2/1

DTI Port 2 is in Normal

error rate has to be < 2%

Active Client status as warmup, fast, bridging and holdover signals timing issue

DOCSIS Clock Verification on M-CMTS..Contd

Verify log/syslogs messages

Issue following commands on CMTS and RFGW-10

- show log | include DTCC
- show log | include TCC
- show log | inc DTI
- Show log | inc DPLL (only on RFGW-10)
- Show log | inc UPX (only on RFGW-10)

Port 2 is identified as DTI/1/1/1 and Port1 as DTI1/1/0
Port DTI 1/1/0 went down

Port 2 on DTI 1/1 become UP

DTCC Port down on M-CMTS

```
Nov 12 20:28:43.121: %UBR10KTCC-1-DTIPORTCLIENT: DTCC slot 1/1 port 1 DTI client status changed to
Active normal
Nov 12 20:28:43.121: %UBR10KTCC-1-DTIPORTCLIENT: DTCC slot 1/1 port 2 DTI client status changed to
Standby
Nov 12 20:28:52.974: %SNMP-5-LINK_DOWN: LinkDown:Interface DTI1/1/0 changed state to down
```

DTCC Port come back up from Standby

```
Nov 12 20:31:41.711: %UBR10KTCC-1-DTIPORTPHYS: DTCC slot 1/1 port 2 DTI physical status changed:
Link status:Link detected, frame error rate: > 5%
Nov 12 20:31:42.711: %UBR10KTCC-1-DTIPORTPHYS: DTCC slot 1/1 port 2 DTI physical status changed:
Link status:Link detected, frame error rate: < 2%
Nov 12 20:31:42.984: %SNMP-5-LINK_UP: LinkUp:Interface DTI1/1/1 changed state to up
```

DOCSIS Clock Verification on M-CMTS..Contd

DTI card Down on M-CMTS

```
Nov 13 19:41:37.672: %IPCOIR-3-TIMEOUT: Timeout waiting for a response from slot 2/1.
Nov 13 19:41:37.672: %IPCOIR-2-CARD_UP_DOWN: Card in slot 2/1 is down.  Notifying 2cable-dtcc
driver.
Nov 13 19:41:37.672: %SNMP-5-LINK_DOWN: LinkDown:Interface DTI2/1/0 changed state to down
Nov 13 19:41:37.672: %SNMP-5-LINK_DOWN: LinkDown:Interface DTI2/1/1 changed state to down
```

Standby card come back up

```
Nov 13 19:41:38.384: %UBR10KTCC-2-ACTIVE_TCC: DTCC card 1/1 is active with DTI as clock reference
UC DTI: Notification sent to DTI module to set card 1/1 as active
UC Set role: card 1/1 role set to Active

Nov 13 19:41:38.384: %UBR10KTCC-4-CHG_CLK_REF: Clock reference source set to DTI for DTCC card 1/1
by process Card Config
Nov 13 19:41:38.680: %UBR10KTCC-2-ACTIVE_TCC: DTCC card 1/1 is active with DTI as clock reference
UC DTI: Notification sent to DTI module to set card 1/1 as active
UC Set role: card 1/1 role set to Active

Nov 13 19:41:38.680: %UBR10KTCC-4-CHG_CLK_REF: Clock reference source set to DTI for DTCC card 1/1
```

DOCSIS Clock verification on RFGW-10

Show cable clock status on RFGW-10

```
RFGW10#sh cable clock
DTI Client status: TCC 13 - Active
-----------------
Client status                    : normal
Client clock type                : ITU stratum 3
Client firmware version          : 0x00000114
Client dti version               : 1
Client transition t3 count       : 0
Client transition t4 count       : 1
Client transition t6 count       : 0
Client transition t7 count       : 0
<snip>
DTI Client Port 1 Status:
-------------------------
   Port Status               : Active
   Signal detected           : yes
   CRC error count           : 182
   Frame error rate          : < 2%
   Cable advance             : 0x0500
    -- Connected server information ---Server
status                     : free-run
Root Server clock type           : ITU type 1
```

```
DTI Client status: TCC 14 - Standby
-----------------
Client status                    : normal
Client clock type                : ITU stratum 3
Client firmware version          : 0x00000114
Client dti version               : 1
Client transition t3 count       : 0
Client transition t4 count       : 1
Client transition t6 count       : 0
Client transition t7 count       : 0
Client port switch count         : 1
Client Integral Frequency Term   : -15704
Client EFC Value                 : -31333

DTI Client Port 1 Status:
-------------------------
   Port Status               : Active
   Signal detected           : yes
   CRC error count           : 3
   Frame error rate          : < 2%
   Cable advance             : 0x0F00
     -- Connected server information ---
Server status                    : normal
Root Server clock type           : ITU type 1
```

Transition counters T3-T7 indicates clocking instability to client

Hardware issues on RFGW-10 and CMTS

DS384 cards down on RFGW-10

```
RFGW-10#Show Inventory
Supervisor Led Color : Green
Module 1 Status Led Color : Green
Module 2 Status Led Color : Green
Module 3 Status Led Color : Red
Module 4 Status Led Color : Green
Module 5 Status Led Color : Green
Module 6 Status Led Color : Red
Module 7 Status Led Color : Red
Module 8 Status Led Color : Red
Module 9 Status Led Color : Green
Module 12 Status Led Color : Red
Module 13 Status Led Color : Off
Module 14 Status Led Color : Yellow
```

DS384 card failed to boot up in slot 12

```
Nov  5 22:47:30.447 Eastern: %RFGW-3-LINECARD_ERRMSG_ERR: SLOT
12:BB_ERRMSG_DS_PHY_UPX_BOOTUP_OK_ERR_REASON:FWReady:failed to detect
a FW Ready signal from the Dogfish FPGA.
Nov  5 22:47:30.447 Eastern: %RFGW-3-LINECARD_ERRMSG_ERR: SLOT
12:BB_ERRMSG_HW_CTRL_INIT_FAILED: bb_hw_control: fpga setup failed
Nov  5 22:47:30.449 Eastern: %RFGW-3-LINECARD_ERRMSG_ERR: SLOT
12:BB_ERRMSG_HW_CTRL_INIT_FAILED: bb_hw_control: HW
Nov  5 22:47:30.989 Eastern: %RFGW-2-LINECARD_ERRMSG_CRIT: SLOT
12:ERROR, process bb_hw_control launch too many times (1)
```

DS384 cards reporting UPX/DPLL errors

```
Nov  4 06:41:12.109 UTC: %RFGW-0-LINECARD_ERRMSG_EMERG: SLOT
12:LC_ERRMSG_FAILOVER_TRIGGER UPX Hi priority event (SET): module:1
idx:26 desc:DF VCXO 32M DPLL not locked,
```

DTCC continuously changing status

```
Nov  5 22:58:59.494 UTC: %UBR10KTCC-6-DTIPORTCLIENT: DTCC slot 1/1 port 1 DTI client status changed to Active
bridging
Nov  5 22:58:59.494 UTC: %UBR10KTCC-5-DTISLOT: DTCC slot 2/1: card role changed to Active
Nov  5 22:59:00.494 UTC: %UBR10KTCC-5-DTISLOT: DTCC slot 1/1: card role changed to Standby
Nov  5 23:00:02.894 UTC: %UBR10KTCC-6-DTIPORTCLIENT: DTCC slot 1/1 port 1 DTI client status changed to Active
normal
Nov  5 23:05:53.243 UTC: %UBR10KTCC-6-DTIPORTCLIENT: DTCC slot 1/1 port 1 DTI client status changed to Active
bridging
Nov  6 00:28:41.747 UTC: %UBR10KTCC-6-DTIPORTCLIENT: DTCC slot 1/1 port 1 DTI client status changed to Active
normal
```

Agenda

- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting DOCSIS Timing Issues
- Troubleshooting DOCSIS Load Balancing
- Troubleshooting Voice Services
  - Troubleshooting Voice Subscriber Issues
  - Troubleshooting DSG Services
- Summary
- Q & A

Troubleshooting DOCSIS Load Balancing issues

Common Issue

1. DOCSIS 3.0 CM not placed in proper DOCSIS LB group
    - 1.a – Improper DOCSIS LB configuration
    - 1.b - Special RLBG consideration

1.a – Improper Configuration Checklist

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

DS and US chans. In FN

Fiber-Node configuration

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

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

1.a – Show commands and debugs

Debugs needed for DLB issues

```
Debug cable mac-address <mac of CM>
verbose
Debug cable load-balance
Debug cable load-balance docsis-lb
```

Show cable load-balance

```
DOCSIS 3.0 LB Enabled: Yes
DOCSIS      Group Status Interval DCC mask   Policy Method Threshold
Group       Index                /UCC               DS/US  M/E/U/P/S
1           81    RE     30       0x10(3)/N 1      u/u    10/30/70/70/50
25          86    RE     30       0x10(3)/N 1      u/u    10/30/70/70/50
61          82    GE     50       0x10(3)/N 0      u/u    5/10/70/70/50
```

Debugs during Registration for WB CM bonding on 8/0/1 rf chan 0-3

```
SLOT 8/0: Feb 14 20:13:37.207 PST: Found Network Access TLV
SLOT 8/0: Feb 14 20:13:37.207 PST: Ntw Access Control : 1
SLOT 8/0: Feb 14 20:13:37.207 PST: Found Max CPEs TLV
SLOT 8/0: Feb 14 20:13:37.207 PST: Maximum Number Of CPEs : 17
SLOT 8/0: Feb 14 20:13:37.207 PST: Found Upstream Service Flow TLV
SLOT 8/0: Feb 14 20:13:37.207 PST:    Service Flow Reference : 1
SLOT 8/0: Feb 14 20:13:37.207 PST:    QoS Parameter Set Type : 0x7
SLOT 8/0: Feb 14 20:13:37.207 PST:    Service Class Name : us_hsd_biz
SLOT 8/0: Feb 14 20:13:37.207 PST: Found Downstream Service Flow TLV
```

CM registering with us_hsd_biz Service Class

Modem assigned to GLBG instead of RLBG..Why?

```
Feb 14 20:13:37:250 lb: CM 0025.2eab.87ac stid not configured. Get LBGID 0
Feb 14 20:13:37:250 lb: CM 0025.2eab.87ac try to set LBG by tag HSD_BIZ
Feb 14 20:13:37:250 lb: D3.0 modem 0025.2eab.87ac is in FN 2
Feb 14 20:13:37:250 lb: CM 0025.2eab.87ac clear group 86 by RLBG FN
Feb 14 20:13:37:250 lb: Assign 3.0 GLBG 62535 to CM 0025.2eab.87ac md_cm_sg 7602433
```

CM assigned to GLBG ?

1.b – Special RLBG consideration

Channels in RLBG has to be the Subset of FN, not Superset

Instead of 0-11 DS chans. in RLBG

```
cable load-balance docsis-group 25 index 86
 restricted
downstream Modular-Cable 8/0/1 rf-channel 0-11
tag HSD_BIZ
```

We need 0-3 DS chans. in RLBG

```
cable load-balance docsis-group 25 index 86
 restricted
 downstream Modular-Cable 8/0/1 rf-channel 0-3
tag HSD_BIZ
```

Load Balance Debugs during registration

```
SLOT 8/0: Feb 14 10:42:05.997 PST: lb: Assign CM 0025.2eab.87ac LBG ID 0
SLOT 8/0: Feb 14 10:42:05.997 PST: lb: CM 0025.2eab.87ac stid not configured. Get LBGID 0
SLOT 8/0: Feb 14 10:42:05.997 PST: lb: CM 0025.2eab.87ac try to set LBG by tag HSD_BIZ
SLOT 8/0: Feb 14 10:42:05.997 PST: lb: D3.0 modem 0025.2eab.87ac is in FN 2
SLOT 8/0: Feb 14 10:42:05.997 PST: lb: Assign CM 0025.2eab.87ac LBG ID 86
SLOT 8/0: Feb 14 10:42:05.997 PST: lb: CM 0025.2eab.87ac Grp 86 Policy ID 1 from LB Group
```

Show cable modem <mac> verbose

```
MAC Address                          : 0025.2eab.87ac
<snip>
Downstream Channel DCID RF Channel : 150   8/0/1:0
Downstream Channel DCID RF Channel : 149   8/0/1:1
Downstream Channel DCID RF Channel : 151   8/0/1:2
Downstream Channel DCID RF Channel : 152   8/0/1:3
LB group ID assigned (index)         : 25 (86)
LB group ID in config file (index)   : N/A (N/A)
LB policy ID                         : 1
LB policy ID in config file          : 0
LB priority                          : 0
Tag                                  : HSD_BIZ
```

CM assigned to proper RLBG

CM tagged properly

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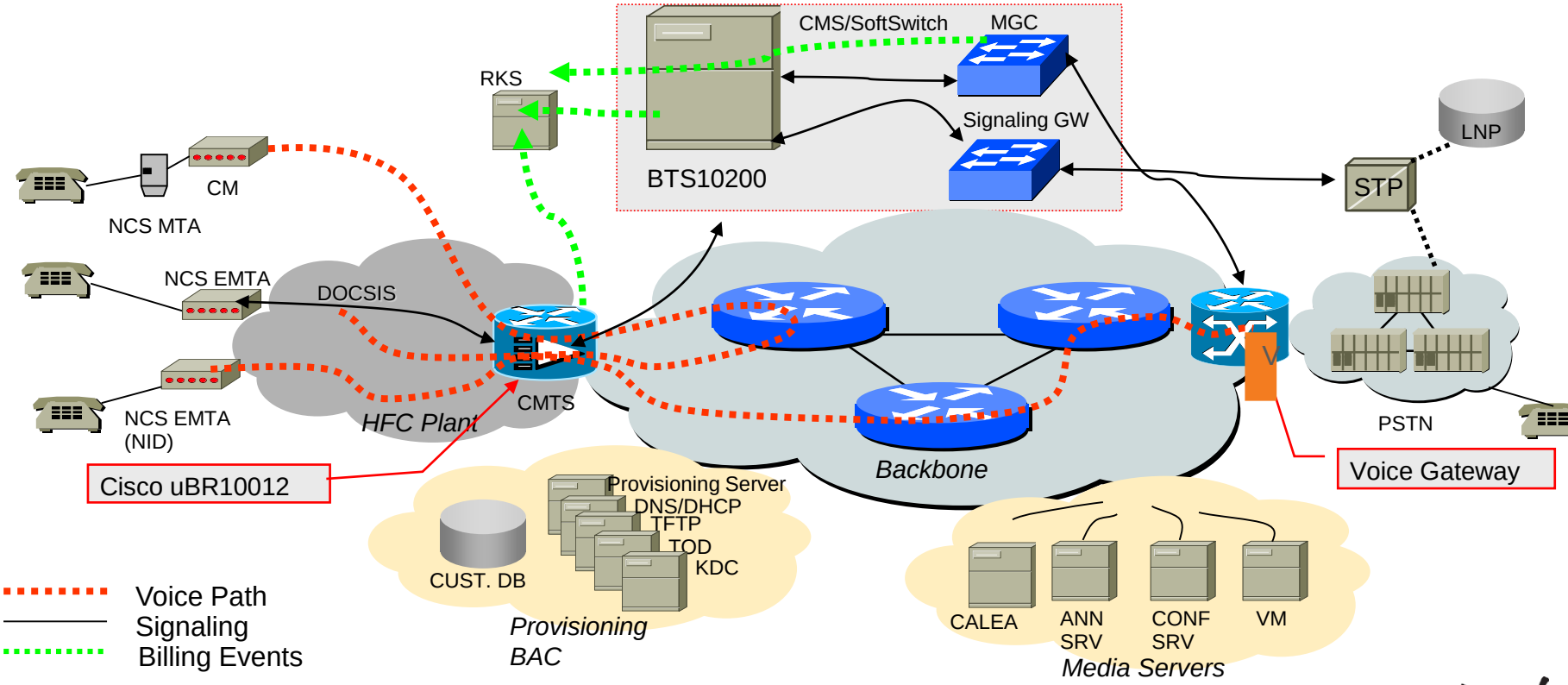
PacketCable™

The PacketCable architecture defines a platform to deliver Voice-over-Internet Protocol (VoIP) telephone service over a DOCSIS cable network

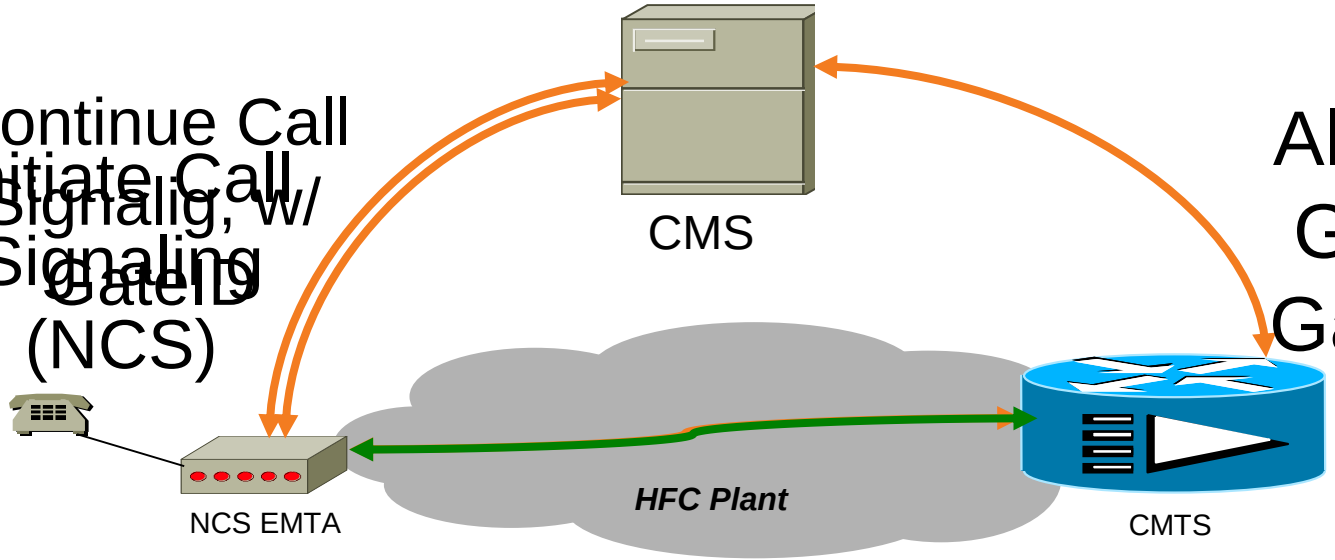
PacketCable™ Reference Architecture



Common Voice Subscriber Issues

- 1 - No dial tone
  - 1.a - EMTA not registered
  - 1.b - Signaling flow not present
  - 1.c - High upstream utilization
- 2 - No audio and One way audio
  - 2.a - Gate establishment issues
  - 2.b - Dynamic service flow establishment issues
  - 2.c - Other possible issues
    - Not enough BW for DS
    - High US utilization
    - Low SNR in HFC
- 3 - Choppy audio
  - 3.a – Service Flow Bandwidth Issues
  - 3.b – PXF drops

PacketCable™ DQoS



DSA, DSC with GateID

CMTS verifies DSX against Gate, stops Gate Timers

DOCSIS 1.1 UGS Active !

1 – No Dial Tone

- EMTA Not Registered and Signaling Flow Issues
  - 1.a - Check if the CM is online and MTA has IP add.

```
CMTS#show cable modem 0000.cadd.a3ef
MAC Address    IP Address      I/F       MAC          Prim RxPwr  Timing  Num BPI
                                         State        Sid  (dB)   Offset  CPE Enb
0000.cadd.a3ef 10.1.1.1        C8/0/2/U1 online       4    0.50  1515    1   N

show cable modem 0000.cadd.a3ef cpe
IP address        MAC address
14.80.82.141      0000.cadd.a3f0
```

CM is online

IP of MTA

  - 1.b - Signaling flow not present
    - Issue “Show cable modem <mac-address> service-flow”

nRTPS signaling flow with priority 4

```
CMTS#show cable modem 0000.cadd.a3ef qos
Sfid  Dir Curr  Sid   Sched  Prio MaxSusRate  MaxBrst   MinRsvRate  Throughput
          State       Type
108   US  act   4     BE     1    2000000     3044      0           0
131   US  act   63    NRTPS  4    64000       3044      32000       197
109   DS  act   N/A   BE     1    6600000     12000     0           5
132   DS  act   N/A   BE     4    64000       96000     32000       110
```

    - nRTPS recommended for Signaling Flow

1 – No Dial Tone

- High US Utilization

- 1.c - Check for Avg. US utilization
  - show int cable 8/0/2 mac-scheduler 1

```
DOCSIS 1.1 MAC
 scheduler for Cable8/0/2/U1
<snip>
Avg upstream channel utilization : 96%
```

- Many things needs to be checked on BTS/CA
  - Outside the scope

2 – No Audio and One Way Audio

- 2.a – Gate Establishment Checking
- show packetcable gate summary

```
CMTS#show packetcable gate su
GateID     i/f      SubscriberID    GC-Addr          State    Type   SFID(us)  SFID(ds)
6576     Ca6/1/0    14.80.82.141    14.80.85.36      COMMIT   DQoS   91        92
22940    Ca6/1/0    14.80.82.144    14.80.85.36      COMMIT   DQoS   93        94
Total number of  gates = 2
Total Gates committed(since bootup or clear counter) = 17
```

  - Other possible states : ALLOC, AUTH, RSVD,INVLD and UNKWN

- Debugs needed to check gate establishment
  - Debug packetcable subscriber <mta-ip> verbose
  - Debug packetcable gate database
  - Debug packetcable gate control
  - Debug packetcable gate docsis-mapping
  - Debug packetcable gate commit

Gate has to be in COMMIT state

2.b – Service Flow Establishment

- DSX Messages
- DSX messages for dynamic service flow establishment
- Debugs for DSX messages and verification

    debug cable mac-address <cm mac> verbose

    debug cable tlv

    debug cable qos

    debug cable dynsrv

2.b – Dynamic Service Flow – Sample Debugs

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

2.b – Sample Debugs..contd..

```
Aug  9 19:28:49.796: Found Downstream Service Flow TLV
Aug  9 19:28:49.796:    Service Flow Reference : 2
Aug  9 19:28:49.796:    QoS Parameter Set Type : 0x2
Aug  9 19:28:49.796:    Traffic Priority : 5
Aug  9 19:28:49.796:    Maximum Sustained Traffic Rate : 87200
Aug  9 19:28:49.796:    Maximum Traffic Burst : 1522
Aug  9 19:28:49.796:    Minimum Reserved Traffic Rate : 87200
Aug  9 19:28:49.796:    Minimum Reserved Rate Packet Size : 218
Aug  9 19:28:49.796: Found Downstream Packet Classifier TLV
Aug  9 19:28:49.796:    Classifier Reference : 2
Aug  9 19:28:49.796:    Service-Flow Reference : 2
Aug  9 19:28:49.796:    Rule Priority : 128
Aug  9 19:28:49.796:    Activation State : 0
Aug  9 19:28:49.796:    Found IP Packet Classifier Sub-TLV
Aug  9 19:28:49.796:            Protocol : 17
Aug  9 19:28:49.796:            Source Address : 24.34.240.247
Aug  9 19:28:49.796:            Destination Address : 24.34.240.235
Aug  9 19:28:49.796:            Destination Port Start : 53456
Aug  9 19:28:49.796:            Destination Port End : 53456
Aug  9 19:28:49.796: Auth Block:
Aug  9 19:28:49.796: 0x0000: 01 06 01 04 00 00 14 3E
Aug  9 19:28:49.796: Sfref = 1, SFID = 103 <- Service Flow IDs assigned by CMTS
Aug  9 19:28:49.796: Sfref = 2, SFID = 104
Aug  9 19:28:49.796: Cfr-ref = 1, CFID = 33, SF-ref 1, SFID 103
Aug  9 19:28:49.796: Cfr-ref = 2, CFID = 34, SF-ref 2, SFID 104
Aug  9 19:28:49.796: Added Auth Block(633A2828) len=14
Aug  9 19:28:49.796: DSA-RSP-SENT: CM->0013.1050.3801 TranscId->89 ConfCode->0
Aug  9 19:28:49.896: DSA-ACK-RECD: OrgMac->0013.1050.3801 OrgId->89 ConfCode->0
Aug  9 19:28:50.196: DSA-REQ End : Transaction over-T8 timer expired. OrgMac->0013.1050.3801 OrgId->89
Aug  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

Cisco live!

2.b – DSX Message Stats

- Use “show controller cable x/y/z”

```
Cable5/0/0 Downstream is up
  Frequency 615.0000 MHz, Channel Width 6 MHz, 256-QAM, Symbol Rate 5.360537 Msps
  FEC ITU-T J.83 Annex B, R/S Interleave I=32, J=4
  Downstream channel ID: 119
<snip>
  Dynamic Services Stats:
  DSA: 0  REQs  21368 RSPs  0 ACKs
  0 Successful DSAs  41 DSA Failures
  DSC: 0  REQs  24761 RSPs  0 ACKs
  0 Successful DSCs  0 DSC Failures
  DSD:  38 REQs  21335 RSPs
  0 Successful DSDs  37 DSD Failures
  DBC: 0 REQs  0 RSPs(Rcvd)  0 ACKs
  0 Successful DBCs  0 DBC Failures  0 DBC Partial
  0 DBC Protocol Violations
```

Only RSPs captured under DS

DSA failures has to be 0

DSC failures has to be 0

DSD failures has to be 0

- Use “show controller cable x/y/z upstream j” for DSA, DSC and DSD Request stats

2.c – Other Possible Issues

- Not enough bandwidth available for DS
  - Issue “show interface cable x/y/z downstream”
    - Look for “Total downstream reserved/reservable bandwidth”
- High CPU for PRE and/or LC
  - Issue “show proc cpu” on PRE and on affected LC
  - Excessive SNMP polling
- Higher Upstream channel utilization
  - Issue “show interface cable x/y/z mac-schedular j”
    Look for “Avg upstream channel utilization” and other flow related BW reservation
  - Uncorrectable FEC and CRC errors should be between 1-5%
- Low SNR in HFC network
  - Issue “show controller cable x/y/z”
    - Look for “US phy MER(SNR)_estimate for good packets” around 25db+

3 – Choppy Audio Issues

- 3.a – Service Flow Bandwidth Issues
  - Typically happens because of dropped packets
  - Check for dynamic service flows for eMTA and packet count
  - Use "**show cable modem <mac/ip-add> service-flow**" Or

show interfaces c5/0/0 service-flow | inc dyn | inc eeb6

Sfid	Sid	Mac Address	QoS Param Index			Type	Dir	Curr	Active
			Prov	Adm	Act			State	Time
142	77	0000.cad6.eeb6	0	10	10	dyn(S)	US	act	22:11
143	N/A	0000.cad6.eeb6	0	11	11	dyn(S)	DS	act	22:11

3.a – Choppy Voice – Show Service-Flow

```
CMTS#show cable modem 0000.cad6.eeb6 service-flow verbose
Sfid                                    : 142
Mac Address                             : 0000.cad6.eeb6
Type                                    : Secondary(Dynamic)
Direction                               : Upstream
Current State                           : Active
Current QoS Indexes [Prov, Adm, Act]    : [0, 10, 10]
Active Time                             : 23:16
Sid                                     : 77
Admitted QoS Timeout                    : 200 seconds
Current Throughput                      : 87200 bits/sec, 50 packets/sec
Application Priority                : 3
Classifiers:
Classifier Id                        : 78
Service Flow Id                      : 142
CM Mac Address                       : 0000.cad6.eeb6
Direction                            : upstream
Activation State                     : active
Classifier Matching Priority         : 128
PHSI                                 : 0
Number of matches                    : -
IP Classification Parameters:
        IP Source Address            : 14.80.82.141
        Source IP Address Mask       : 255.255.255.255
        Destination IP Address       : 14.80.82.7
        Destination IP Address Mask  : 255.255.255.255
```

US dynamic service flow

US Service Flow

218 bytes@50 PPS=87200 bps

Source IP of US flow

Destination IP of US flow

3.a – Choppy Voice – Show Service-Flow

```
CMTS#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

3.b – Choppy Voice – PXF Drops

Check for DS pxf Drops

- Get the DS pxf_qid using command
  - Show cable modem <mac/ip address> service-flow (verbose)

DOWNSTREAM SERVICE FLOW DETAIL:

SFID	RP_SFID	**QID**	Flg	Policer		Scheduler		FrwdIF
				Xmits	Drops	Xmits	Drops	
143	37756	136278		14926	0	14926	0	Mo1/1/0:0

- Use “Show pxf cpu queue <qid>” and look for

  Drops (tail/random/max_threshold) : 0/0/0
  Drops (no_pkt_handle/buffer_low) : 0/0
  WRED (weight/avg_smaller) : 0/0

Agenda

- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting DOCSIS Timing Issues
- Troubleshooting DOCSIS Load Balancing
- Troubleshooting Voice Services
  - Troubleshooting Voice Subscriber Issues
  - Troubleshooting DSG Services
- Summary
- Q & A

Troubleshooting DSG Services

Common Issue

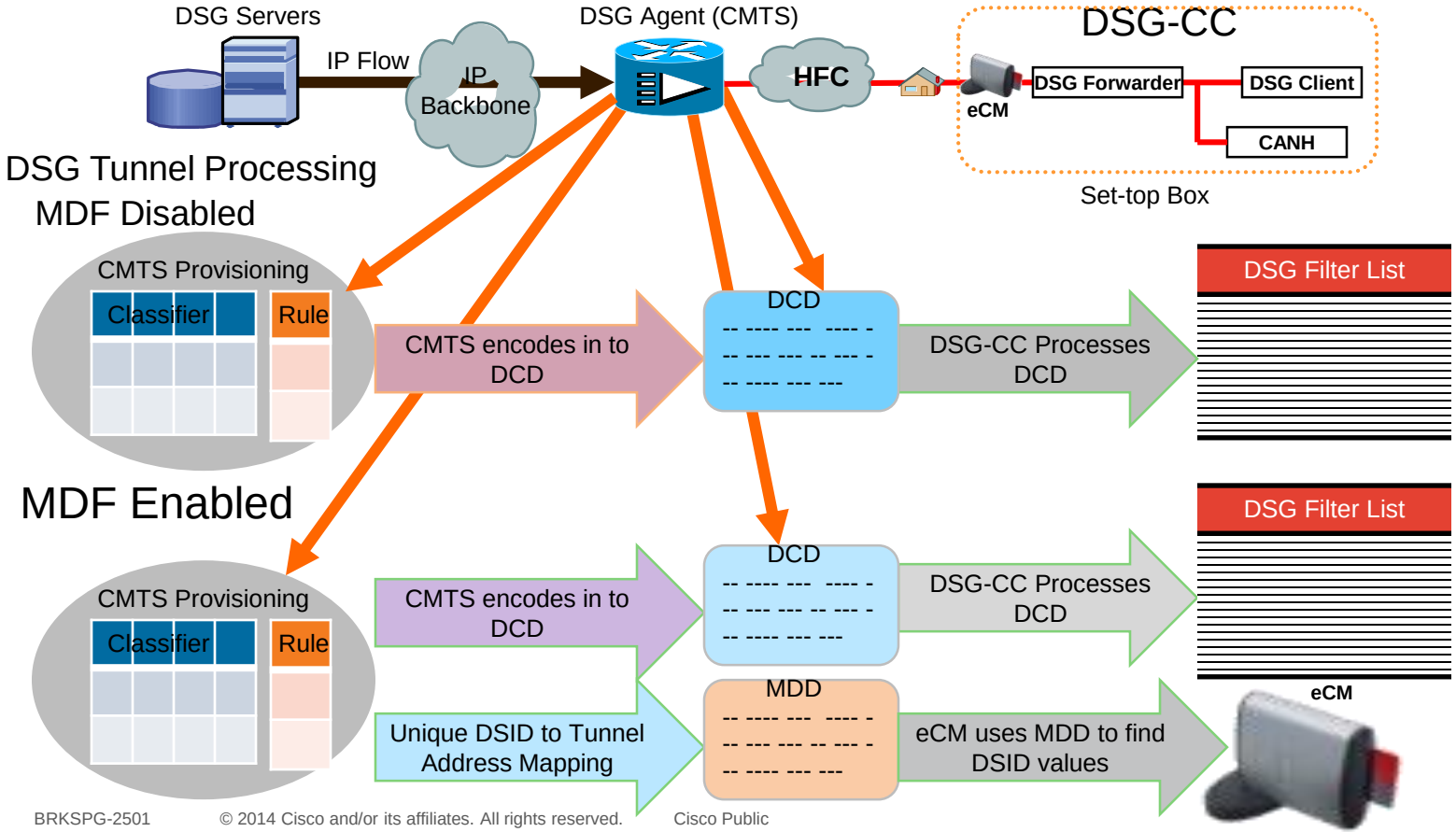
- DSG STB is in one-way mode OR not working at all
  - Improper Configuration
  - DCD issues and US noise or impairments
  - DSG STB do not support TLV-13 (DSG DA-to-DSID)
  - Older firmware on DSG STB

DSG STB in one-way mode OR not working at all

Possible Reasons

- 1. Improper configuration
  - 1.a – Verify Multicast routing, client-list, DSG Tunnel, DSG classifiers and Interface allocation configuations
- 2. DCD and US issues on the cable interface
  - 2.a – Cable modem not online
  - 2.b – DCD not incrementing on cable interface
- 3. Presence of TLV-13 (DSG DA-to-DSID) in MDD
- 4. Older firmware on DSG STB

DSG Operation at a glance



1.a DSG multicast routing and client 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
ip mroute-cache
no cable match address 180
!
interface TenGigabitEthernet1/0/0
ip pim sparse-mode
ip mroute-cache
```

Enable Multicast routing

ACL to allow 232/8

ACL to protect rouge multicast source from HSD

PIM and route-cache enabled on interfaces

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
```

ADSG Client-list configuration

```
cable dsg client-list 6 id-index 1 ca-system-id E00
cable dsg client-list 6 id-index 2 mac-addr 0001.a6ff.0006
cable dsg client-list 107 id-index 1 ca-system-id E00
cable dsg client-list 107 id-index 2 mac-addr 0001.a6ff.006b
cable dsg client-list 108 id-index 1 ca-system-id E00
cable dsg client-list 108 id-index 2 mac-addr 0001.a6ff.006c
cable dsg client-list 111 id-index 1 ca-system-id E00
cable dsg client-list 111 id-index 2 mac-addr 0001.a6ff.006f
cable dsg client-list 1000 id-index 1 ca-system-id E00
cable dsg client-list 1000 id-index 2 mac-addr 0001.a6fe.0000
cable dsg client-list 2000 id-index 1 application-id 2
```

1.a DSG tunnel and classifiers configuration

DSG tunnel configuration with multicast mac add

```
cable dsg tunnel 1000 mac-addr 0100.e80a.0a00 tg 1 clients 1000
cable dsg tunnel 1006 mac-addr 0100.e80a.0a06 tg 1 clients 6
cable dsg tunnel 1107 mac-addr 0100.e80a.0a6b tg 1 clients 107
cable dsg tunnel 1108 mac-addr 0100.e80a.0a6c tg 1 clients 108
cable dsg tunnel 1111 mac-addr 0100.e80a.0a6f tg 1 clients 111
cable dsg tunnel 2000 mac-addr 0100.e80a.0b00 tg 1 clients 2000
cable dsg tunnel 2006 mac-addr 0100.e80a.0b06 tg 1 clients 6
cable dsg tunnel 2107 mac-addr 0100.e80a.0b6b tg 1 clients 107
cable dsg tunnel 2108 mac-addr 0100.e80a.0b6c tg 1 clients 108
cable dsg tunnel 2111 mac-addr 0100.e80a.0b6f tg 1 clients 111
```

ADSG Interface configuration

```
interface Cable5/0/0
cable downstream dsg tg 1 channel 500
!
interface Cable5/0/1
cable downstream dsg tg 1 channel 501
!
interface Cable5/0/2
cable downstream dsg tg 1 channel 502
!
<snip>
```

DSG config applied per intf.

ADSG Classifiers configuration

Classifiers add IP layer info to DCD

CMTS to include cfr in DCD

```
cable dsg cfr 1000 dest-ip 232.10.10.0 tunnel 1000 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 1006 dest-ip 232.10.10.6 tunnel 1006 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 1107 dest-ip 232.10.10.107 tunnel 1107 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 1108 dest-ip 232.10.10.108 tunnel 1108 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 1111 dest-ip 232.10.10.111 tunnel 1111 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 2000 dest-ip 232.10.11.0 tunnel 2000 dest-port 13821 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 2006 dest-ip 232.10.11.6 tunnel 2006 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 2107 dest-ip 232.10.11.107 tunnel 2107 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 2108 dest-ip 232.10.11.108 tunnel 2108 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
cable dsg cfr 2111 dest-ip 232.10.11.111 tunnel 2111 dest-port 2000 13821 priority 1 src-ip 67.244.183.99 in-dcd yes
```

1.a DSG multicast routing configuration verification

Show ip pim interface

PIM working fine on WAN

```
Address          Interfacee                Ver/   Nbr    Query  DR     DR
                                           Mode   Count  Intvl  Prior
10.15.128.1      Bundle1                   v2/S   0      30     1      10.15.128.1
24.164.210.213   TenGigabitEthernet1/0/0   v2/S   1      30     1      24.164.210.213
24.164.210.215   TenGigabitEthernet3/0/0   v2/S   1      30     1      24.164.210.215
```

Show ip pim neighbor

PIM Adj. established

```
PIM Neighbor Table
Mode: B - Bidir Capable, DR - Designated Router, N - Default DR Priority,
      P - Proxy Capable, S - State Refresh Capable
Neighbor Add   Interface                 Uptime/Expires  Ver  DR Prio/Mode
24.164.210.212 TenGigabitEthernet1/0/0   6d22h/00:01:43  v2   1 / S P
24.164.210.214 TenGigabitEthernet3/0/0   6d22h/00:01:22  v2   1 / S P
```

Show ip mroute

```
(67.244.183.99, 232.10.10.0), 6d07h/00:02:50, flags: sTI
  Incoming interface: GigabitEthernet3/0/0, RPF nbr 24.24.16.14
  Outgoing interface list:
    Bundle1, Forward/Sparse, 6d07h/00:02:02, H

(67.244.183.99, 232.10.10.6), 6d07h/00:02:50, flags: sTI
  Incoming interface: GigabitEthernet3/0/0, RPF nbr 24.24.16.14
  Outgoing interface list:
    Bundle1, Forward/Sparse, 6d07h/00:02:02, H
```

S,G entries in multicast routing table

Packets received and forwarded in multicast group

Show ip mroute count

```
Group: 232.10.10.0, Source count: 1, Packets forwarded:
59538411, Packets received: 59538432
  Source: 67.244.183.99/32, Forwarding:
59538411/108/912/773, Other: 59538432/21/0

Group: 232.10.10.6, Source count: 1, Packets forwarded:
1346076, Packets received: 1346076
  Source: 67.244.183.99/32, Forwarding:
1346076/19/721/113, Other: 1346076/0/0

Group: 232.10.10.108, Source count: 1, Packets
forwarded: 1345534, Packets received: 1345534
  Source: 67.244.183.99/32, Forwarding:
1345534/18/711/107, Other: 1345534/0/0

Group: 232.10.10.111, Source count: 1, Packets
forwarded: 1345491, Packets received: 1345491
  Source: 67.244.183.99/32, Forwarding:
1345491/18/713/110, Other: 1345491/0/0

Group: 232.10.10.107, Source count: 1, Packets
forwarded: 1345558, Packets received: 1345558
  Source: 67.244.183.99/32, Forwarding:
1345558/18/707/103, Other: 1345558/0/0 <snip>
```

1.a DSG tunnel configuration verification

Check Client-id and tunnel association

```
uBR10012#show cable dsg tunnel 1000 clients
Tunnel client client client          client          vendor
Id     listId  id     id type       address         group
------ ------- ------ ------------- --------------- ------
1000   1000    1      CA System ID  0x0E00
               2      MAC Addr      0001.a6ff.0000
```

Client-id to tunnel-id association

Check tunnel cfrs configuration for all tunnels

```
uBR10012#show cable dsg tunnel 1000 cfrs
Tunnel cfr   cf    cfr  destination ip  source ip      srcPre d_port d_port
Id     id    state pri  address         address        length start  end
------ ----- ----- ---- --------------- -------------- ------ ------ ------
1000   1000  en    1    232.10.10.0     67.244.183.99  32     2000   13821
```

Source-Dest IP add for tunnel

Check DSG tunnel counters for all tunnels

```
uBR10012#show cable dsg tunnel 1000 statistics
tunnel cfr   cfr   destination ip source ip      total          total
id     id    state address       address        forwarded      received
------ ----- ----- --------------- -------------- -------------- --------------
1000   1000  en    232.10.10.0     67.244.183.99  339941423      339941444

uBR10012#show cable dsg tunnel 1006 statistics
tunnel cfr   cfr   destination ip source ip      total          total
id     id    state address       address        forwarded      received
------ ----- ----- --------------- -------------- -------------- --------------
1006   1006  en    232.10.10.6     67.244.183.99  27362242       27362242
```

Packets forwarded and received per tunnel

Check cable intf. Tunnel association

```
uBR10012#show cable dsg tunnel 1000 interfaces
tunnel  downstream      rule
id      interface       id
------- --------------- ----
1000    Cable5/0/1      1
        Cable5/0/2      1
<snip>
        Cable6/0/1      1
        Cable6/0/2      1
 <snip>

        Cable6/1/0      1
        Cable6/1/1      1
<snip>

        Cable7/0/0      1
        Cable7/0/1      1

<snip>
        Cable7/1/0      1
        Cable7/1/1      1
<snip>
```

Tunnel-id to DS interface association

2.a/2.b Cable modem online and DCD verification

Cable modem online with cpe

CM online and CPE has IP

```
uBR10012#scm 3c62.00dc.3644
MAC Address    IP Address      I/F          MAC          Prim  RxPwr  Timing  Num        I
                                            State        Sid   (dBmv)  Offset  CPE        P
3c62.00dc.3644 10.100.47.229   C7/0/2/U0    online(pt)   4605  0.00    1466    1          N
IP address     MAC address     Dual IP      Device Class
10.151.27.89   3c62.00dc.3646  N            Host
```

Show cable modem ip/mac verbose

```
uBR10012#scm 3c62.00dc.3644  verb
MAC Address : 3c62.00dc.3644
IP Address : 10.100.47.229
IPv6 Address : ---
<snip>
Number of Multicast DSIDs Support : 0
MDF Capability Mode : 0
IGMP/MLD Version : IGMPv2
```

CM do not support MDF

Check DCD for cable interface incrementing

DCDs sent incrementing, 0 failed DCD

DCDs are being sent on an interface

```
uBR10012#sh int c6/1/5 dsg downstream dcd
IF             dcd    dcd dsg   num of dcd sent   num of dcd fail   num of dcd change   num of cnt fragment
Name           state  Tx  fwd
-----------    -----  --- ----  --------------    --------------    ----------         --------
Mo6/1/1:16     en     on  en      123269            0                 10                 1
Mo6/1/1:17     en     on  en      123269            0                 10                 1
Mo6/1/1:20     en     on  en      123269            0                 10                 1
```

“Debug cable dsg dcd” on LC

```
clc_6_1#
SLOT 6/1: Jan 25 13:20:06.583 EST: Cable6/1/0 123030 DCD msg sent, 9 change count 0 fails
SLOT 6/1: Jan 25 13:20:06.583 EST: Cable6/1/0 DCD Message Dump:
SLOT 6/1: Jan 25 13:20:06.583 EST: 0x0000: C2 00 01 17 00 00 01 E0 2F 00 00 01 60 73 5C 71
SLOT 6/1: Jan 25 13:20:06.583 EST: 0x0010: F7 74 01 05 00 00 03 03 20 00 09 01 01 32 20 01
SLOT 6/1: Jan 25 13:20:06.583 EST: 0x0020: 01 01 02 01 01 04 0C 03 02 0E 00 02 06 00 01 A6
SLOT 6/1: Jan 25 13:20:06.583 EST: 0x0030: FE 00 00 05 06 E8 0A 0A 00 00 00 06 02 03 E8 17
SLOT 6/1: Jan 25 13:20:06.583 EST: 0x0040: 1D 02 02 03 E8 05 01 01 09 14 05 04 E8 0A 0A 00
```

3/4 TLV-13 and DSG Firmware issues

- Presence of TLV-13 (DSG DA-to-DSID) in MDD
  - Starting 12.2(33)SCG release (Ganges) Multicast addresses with DSID association in MDD
    - ”debug cable mdd” can be used to see that
- Disable MDF
  - Issue ”cable multicast mdf-disable dsg” and “cable multicast mdf-disable WB-Incapable-CM”
  - Reset or delete affected CMs
- Get the Logs from DSG box
  - Remote login in to DSG box or load diag code if possible
  - SNMP walk of dsgIfStdTunnelFilterTable on eCM IP to get MAC add, DSID, DSG Filter parameters and packet counters
- Upgrade DSG firmware that supports MDF

Summary

- Evolution of CMTS Based Services
- Common Data Service Issues and Troubleshooting
- DOCSIS Timing Issues
- DOCSIS Load Balancing
- Common VoIP Service issues
- DSG troubleshooting
- Troubleshooting BSoD (Appendix A)

“Effective Troubleshooting Will Decrease Downtime and Increase Customer Satisfaction”


Q&A
Cisco live!

Call to Action

- Visit the World of Solutions for
  - Cisco Campus
  - Walk in Labs
  - Technical Solution Clinics
- Meet the Engineer
- Lunch time Table Topics
- DevNet zone related labs and sessions
- Recommended Reading: for reading material and further resources for this session, please visit www.pearson-books.com/CLMilan2015

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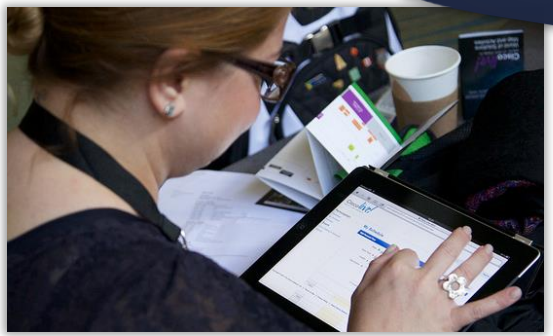
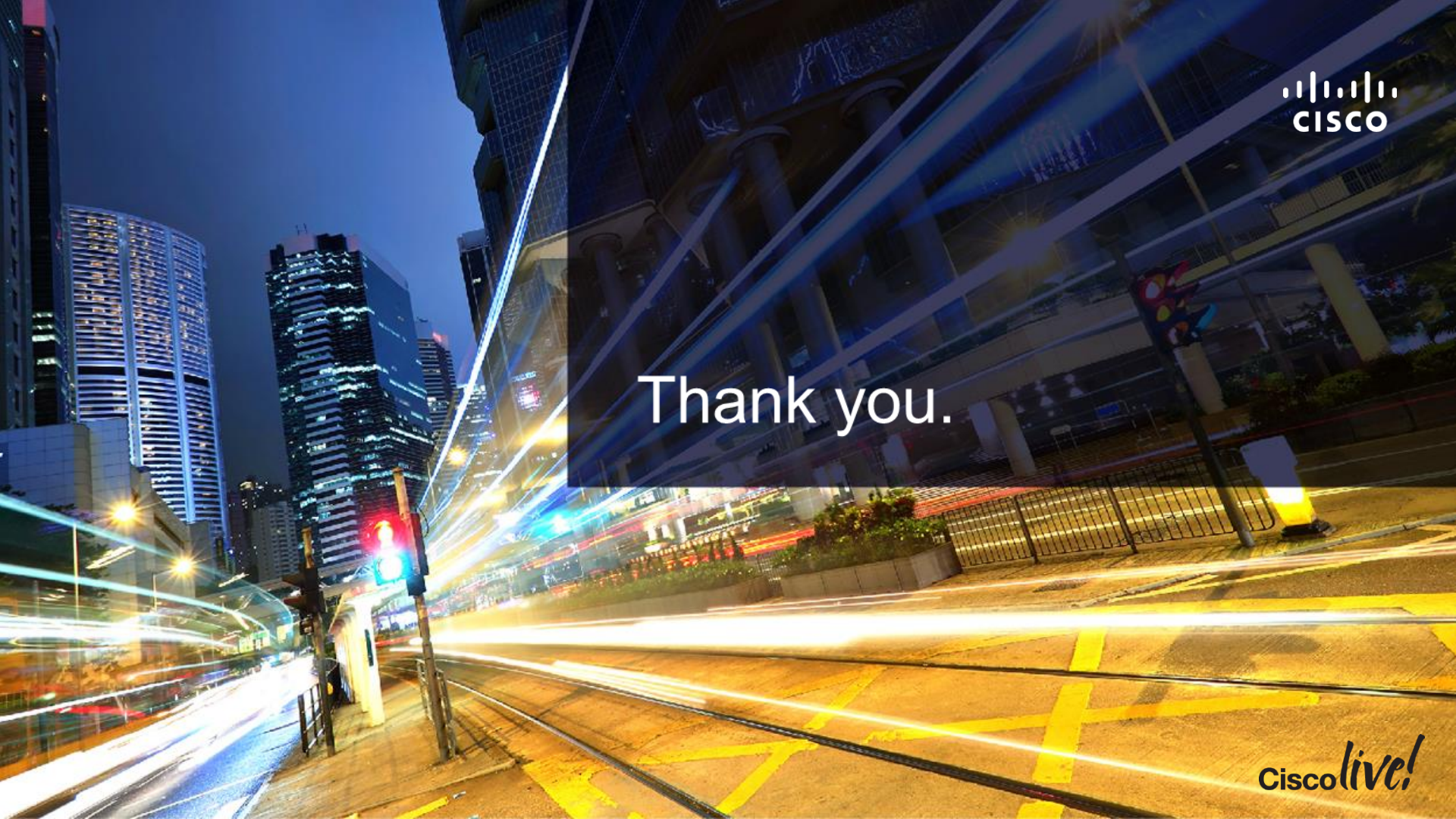
- All surveys can be completed via the Cisco Live Mobile App or the Communication Stations




Thank you.
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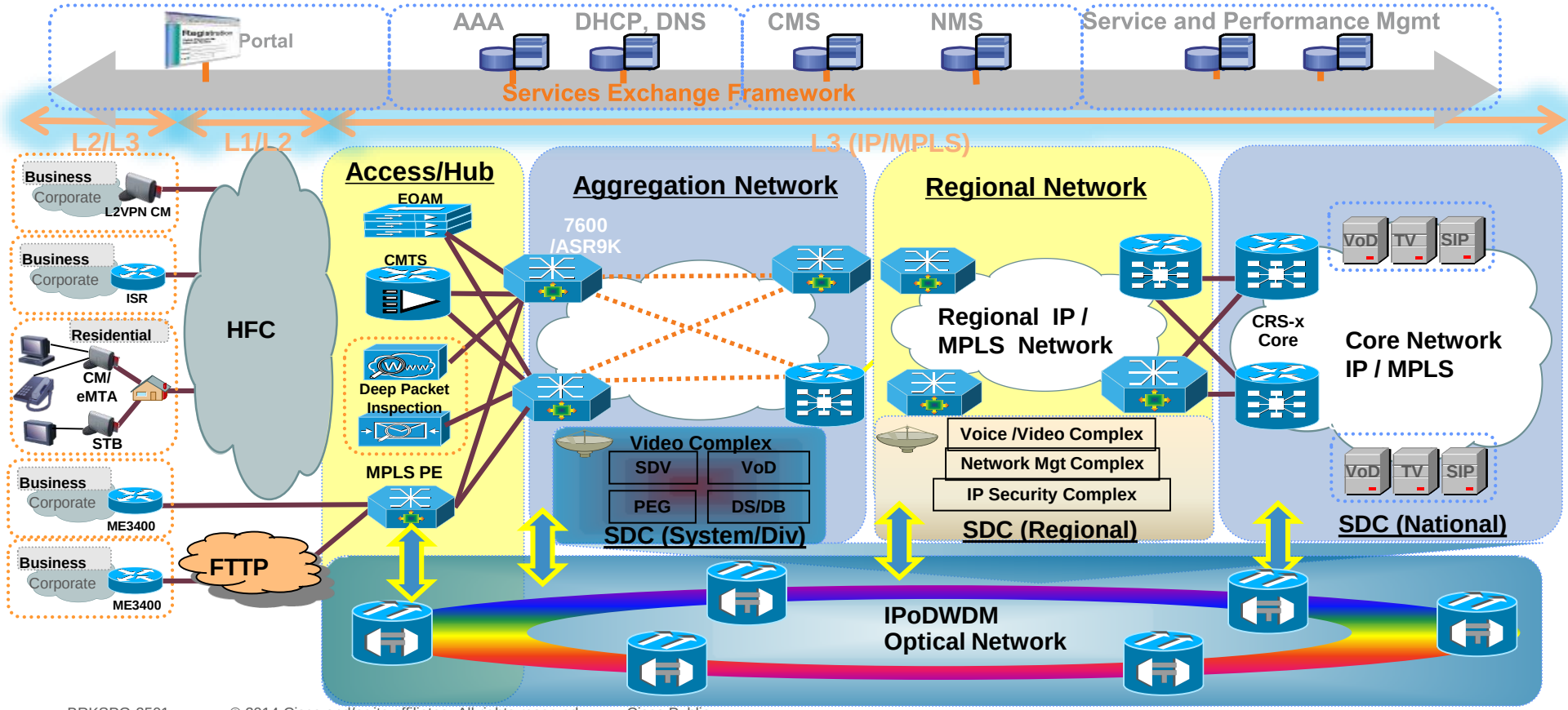
Troubleshooting BSoD (Appendix A)

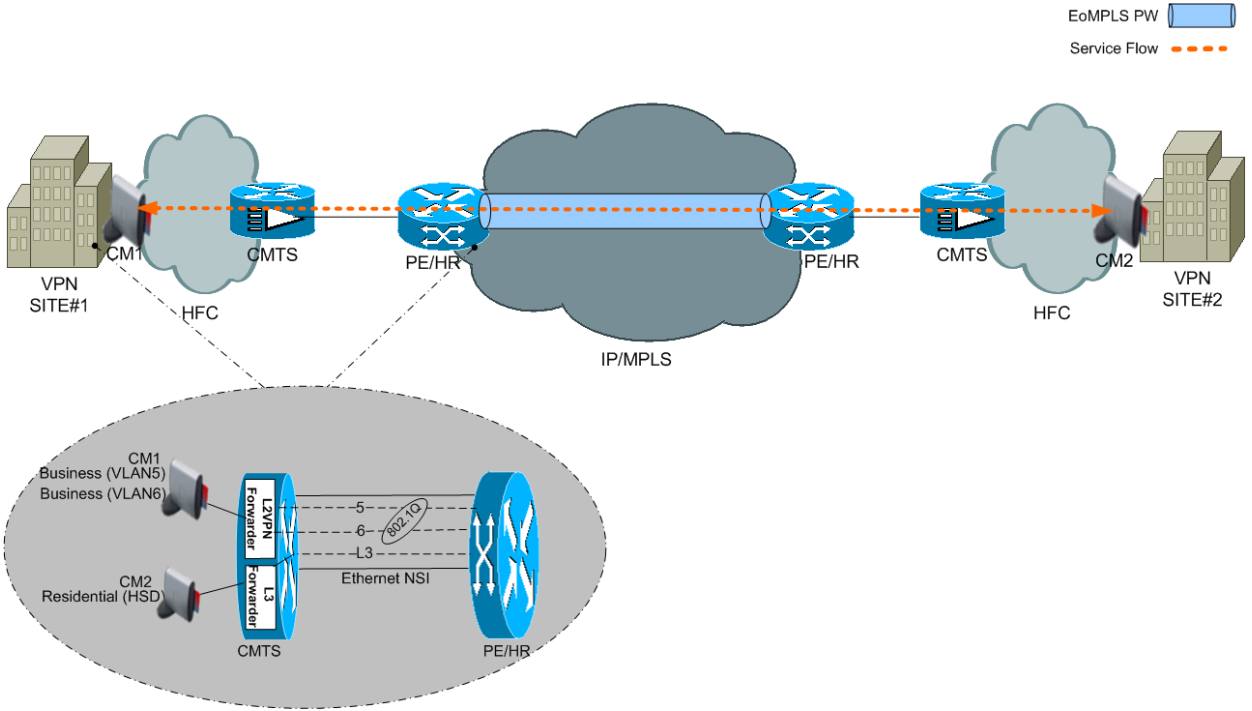
Business Services over DOCSIS (BSoD)

- CMTS – Traditional High Speed Data vs newer BSoD usage
- HFC plant typically under-utilized in business hours
- Business services over HFC can maximize Return of Investment (ROI)
- CableLabs standardized Layer2 VPN Business Services over DOCSIS (BSoD)
- Multiple BSoD flavors
  - Transparent LAN Services over DOCSIS – Cisco Proprietary
  - Dot1Q based L2VPN BSoD – CableLabs Standard
  - MPLS based L2VPN BSoD – CableLabs Compliant

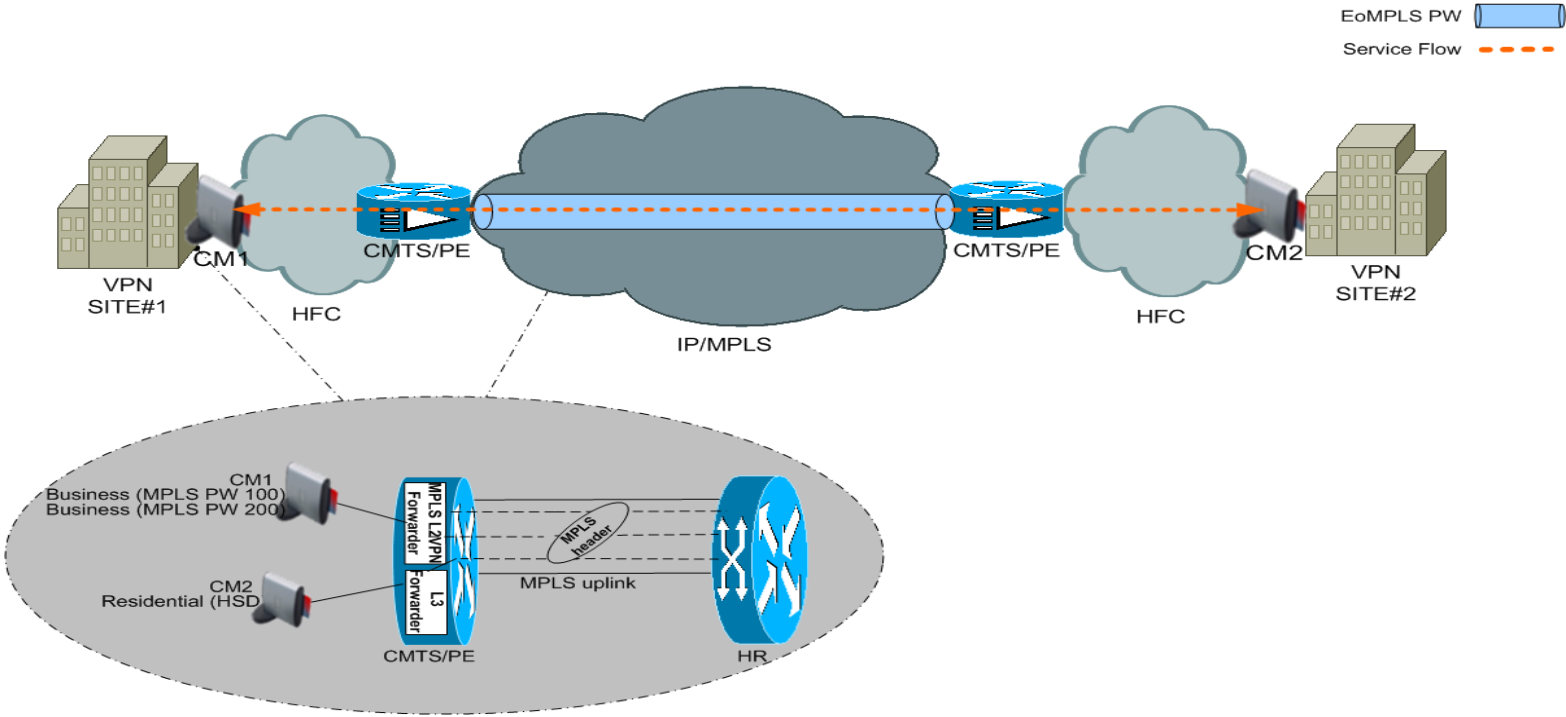
Cable Multi Service Networks



Dot1Q Based L2VPN BSoD



MPLS Based L2VPN BSoD



Troubleshooting L2VPN BSoD

1. Verify Cable Modem is Online(pt)
2. Verify whether the CM is registered as L2VPN
3. Verify whether the MPLS pseudowire (PW) is UP

1. Verify CM Is Online

- ✓ TLS
- ✓ DOt1Q BSOD
- ✓ MPLS BSoD

```
CMTS-uBR10k#sh cable modem 0022.3a61.7bcf
Load for five secs: 0%/0%; one minute: 0%; five minutes: 0%
Time source is NTP, 19:29:47.278 EDT Wed Mar 24 2010

                                                                        D
MAC Address    IP Address     I/F          MAC            Prim RxPwr  Timing Num I
                                           State          Sid  (dBmv) Offset CPE P
0022.3a61.7bcf 17.101.75.100  C5/1/0/U0    offline        9    0.75   1183   0   N
```

- Possible reasons for CM to be offline
  - 1a. Basic DOCSIS issues
    - DHCP, TFTP, ToD and DOCSIS layer issues
  - 1b. Feature not supported on CMTS Software Version
    - TLS: 12.2(15)BC or later crypto releases
    - Dot1Q: 12.2(33)SCA or later crypto releases
    - MPLS: 12.2(33)SCC or later crypto releases

1. Verify CM Is Online

- 1c. Feature not supported on CM software version

```
CMTS-uBR10k#sh cable modem 0022.3a61.7bcf verbose [Snippet]
sysDescr                      : Cisco DOCSIS Cable Modem<<HW_REV: 2.1; VENDOR: Cisco; BOOTR:
2.1.6d; SW_REV: v2.0.2r1256-100222; MODEL: DPC2100R2>>
Modem Status                  : {Modem= online(pt), Security=assign(tek)}
Security Capabilities         : {Priv=BPI+, EAE=N, Key_len=56}
L2VPN Capabilities            : {L2VPN=Y, eSAFE=N}
Sid/Said Limit                : {Max US Sids=16, Max DS Saids=15}
Optional Filtering Support    : {802.1P=Y, 802.1Q=Y, DUT=Y}
```

- 1d. CMTS not configured for L2VPN BSoD

```
CMTS-uBR10k#sh cable logging layer2events
Cable logging: LAYER2EVENTS Enabled
002073: Mar 24 19:52:16.714 EDT: %UBR10000-6-CM_OFFLINE_WITH_MPLS_L2VPN_NOT_ENABLE: DOCSIS
MPLS L2VPN not enabled, sending CM 0022.3a61.7bcf offline
```

- 1e. Incorrect L2VPN encoding in the CM configuration file

```
Debug message:CMTS L2 VPN debugging is on
002134: Mar 24 19:54:59.973 EDT: cmts_docsis_l2vpn_add sanity failed: mac 0022.3a61.7bcf,
sid 16,vlanid 0,vpnid 2020
```

- Cable Modem is online(pt)

```
CMTS-uBR10k#sh cable modem 0022.3a61.7bcf
MAC Address     IP Address      I/F          MAC            Prim RxPwr  Timing Num I
                                             State          Sid  (dBmv) Offset CPE P
0022.3a61.7bcf 17.101.75.100   C5/1/0/U0    online(pt)     9    17.75  1183   0   N
```

2. Verify Whether CM is Registered as L2VPN

Dot1Q BSoD

```
CMTS-uBR10k#sh cable l2-vpn xconnect dot1q-vc-
map 0022.3a61.7bcf verbose
MAC Address             : 0022.3a61.7bcf
Prim Sid                : 17
Cable Interface         : Cable5/1/0
L2VPNs provisioned      : 1
DUT Control/CMIM        : Enable/0x8000FFFF
VPN ID                  : 0234560002
L2VPN SAID              : 12302
Upstream SFID Summary   : 29
Upstream SFID [29    ] : SID 17    UserPrio 3
Downstream CFRID[SFID]: Primary SF
CMIM                    : 0x60
Ethernet Interface      : GigabitEthernet3/1/0
DOT1Q VLAN ID           : 5
Total US pkts           : 0
Total US bytes          : 0
Total US pkt Discards   : 0
Total US byte Discards: 0
Total DS pkts           : 0
Total DS bytes          : 0
Total DS pkt Discards   : 0
Total DS byte Discards: 0
```

MPLS BSoD

```
CMTS-PE#sh cable l2-vpn xconnect mpls-vc-map
0022.3a61.7bcf verbose
MAC Address             : 0022.3a61.7bcf
Prim Sid                : 16
Cable Interface         : Cable5/1/0
L2VPNs provisioned      : 1
DUT Control/CMIM        : Enable/0x8000FFFF
VPN ID                  : 2020
L2VPN SAID              : 12296
SAII                    : 000007D1
TAII                    : 000007D1
Upstream SFID Summary   : 27
Upstream SFID [27    ] : SID 16    MPLS-EXP 4
Downstream CFRID[SFID] Summary: Primary SF
CMIM                    : 0x60
MPLS PEER IpAddress     : 99.1.1.22
MPLS PW VCID            : 2001
MPLS PW TYPE            : Ethernet
MPLS PW Circuit ID      : Bu254:2001
MPLS PW Remote State    : Down
MPLS PW Local  State    : UP
Total US pkts           : 0
Total US bytes          : 0
Total US pkt Discards   : 0
Total US byte Discards: 0
Total DS pkts           : 0
Total DS bytes          : 0
Total DS pkt Discards   : 0
Total DS byte Discards: 0
```

2b. Verify L2VPN Parallel eXpress Forwarding (PXF)

Dot1Q BSoD

```
CMTS-uBR10k#sh pxf cable l2-vpn 0022.3a61.7bcf
Load for five secs: 0%/0%; one minute: 0%; five
minutes: 0%
Time source is NTP, 12:02:28.927 EDT Thu Mar 25
2010

MAC Address 0022.3a61.7bcf
  upstream index 13, us_sid 17, vlan_hdr
0x6005,CM MAC addr 0022.3a61.7bcf,
    vcci 142, flags 0x0, esmac 0000.0000.0000,
cmim 0x0
    packets 0, bytes 0, discard packets 0,
discard bytes 0
  downstream index 13, vcci 145, l2vpn_said 17
ds_classif_result 0x8809E
    packets 0, bytes 0 discard packets 0,
discard bytes 0
```

MPLS BSoD

```
CMTS-PE#sh pxf cable l2-vpn atom mac 0022.3a61.7bcf
ATOM L2VPN Information for CM 0022.3a61.7bcf Start:
 DOCSIS ATOM L2VPN Upstream Information:
 ATOM Enable SID      : 16
 vcci maptable flags  : 0x4000
 atom_us_index        : 30
 upstream index       : 30
 us_sid               : 16
 CM MAC addr          : 0022.3a61.7bcf
 vcci_out             : 0x0
 mac_rew_index        : 0x0
 rew_extension        : 0x2F
 ingress_flags        : 0x40
 upstream punt        : Disabled
 CM MAC table flags   : 0x8000
 esmac                : 0000.0000.0000
 cmim                 : 0x0
 Forward packets      : 0
 Forward bytes        : 0
 Discard packets      : 0
 Discard bytes        : 0
 DOCSIS ATOM L2VPN Downstream Information:
 Downstream index     : 2001
 flags                : 0x1
 l2vpn_said           : 16
 ds_classif_result    : 0x8809D
 Forward packets      : 0
 Forward bytes        : 0
```

3. Verify Whether the MPLS PW Is UP

✓ DOt1Q BSOD

✓ MPLS BSoD

```
Dot1Q-PE#sh mpls l2transport vc 2001
Load for five secs: 2%/1%; one minute: 2%; five minutes: 2%
Time source is NTP, 14:14:06.941 EDT Thu Mar 25 2010
Local intf     Local circuit              Dest address    VC ID      Status
-------------  -------------------------- --------------- ---------- ----------
Gi4/23.1       Eth VLAN 11                99.1.1.22       2001       DOWN
```

```
CMTS-PE#sh mpls l2transport vc 2001
Load for five secs: 0%/0%; one minute: 0%; five minutes: 0%
Time source is NTP, 14:17:52.398 EDT Thu Mar 25 2010
Local intf     Local circuit              Dest address    VC ID      Status
-------------  -------------------------- --------------- ---------- ----------
Bu254          DOCSIS 2001                99.1.1.22       2001       DOWN
```

Possible reasons for MPLS PW down

- No Label Switch Path (LSP) established
- No targeted LDP session
- Interface MTU mismatch

3a. Verify Whether the MPLS PW Is UP

Dot1Q BSOD

```
Dot1Q-PE#sh mpls l2transport vc 2001 detail
Local interface: Gi4/23.1 up, line protocol up, Eth VLAN 11 up
  Interworking type is Ethernet
  Destination address: 99.1.1.22, VC ID: 2001, VC status: up
    Output interface: Te1/1, imposed label stack {51 64}
    Preferred path: not configured
    Default path: active
    Next hop: 11.1.0.5
  Create time: 4w0d, last status change time: 00:00:57
  Signaling protocol: LDP, peer 99.1.1.22:0 up
    Targeted Hello: 99.1.1.12(LDP Id) -> 99.1.1.22, LDP is UP
    Status TLV support (local/remote)   : enabled/supported
      LDP route watch                   : enabled
      Label/status state machine        : established, LruRru
      Last local dataplane   status rcvd: No fault
      Last local SSS circuit status rcvd: No fault
      Last local SSS circuit status sent: No fault
      Last local  LDP TLV    status sent: No fault
      Last remote LDP TLV    status rcvd: No fault
      Last remote LDP ADJ    status rcvd: No fault
    MPLS VC labels: local 89, remote 64
    Group ID: local 0, remote 0
    MTU: local 4470, remote 4470
    Remote interface description:
  Sequencing: receive disabled, send disabled
  Control Word: Off (configured: autosense)
  SSO Descriptor: 99.1.1.22/2001, local label: 89
    SSM segment/switch IDs: 16465/8252 (used), PWID: 8204
  VC statistics:
    transit packet totals: receive 34063315, send 11784915
    transit byte totals:   receive 10849943060, send 1205412300
    transit packet drops:  receive 0, seq error 0, send 0
```

3a. Verify Whether the MPLS PW Is UP

MPLS BSoD

```
CMTS-PE#sh mpls l2transport vc 2001 detail
Load for five secs: 0%/0%; one minute: 0%; five minutes: 1%
Time source is NTP, 20:29:41.852 EDT Wed Mar 24 2010

Local interface: Bu254 up, line protocol up, DOCSIS 2001 up
  Destination address: 99.1.1.22, VC ID: 2001, VC status: up
    Output interface: Gi3/1/0, imposed label stack {101 31}
    Preferred path: not configured
    Default path: active
    Next hop: 11.11.0.101
  Create time: 00:33:28, last status change time: 00:07:40
  Signaling protocol: LDP, peer 99.1.1.22:0 up
    Targeted Hello: 99.1.1.13(LDP Id) -> 99.1.1.22
    Status TLV support (local/remote)    : enabled/supported
      Label/status state machine         : established, LruRru
      Last local dataplane   status rcvd: no fault
      Last local SSS circuit status rcvd: no fault
      Last local SSS circuit status sent: no fault
      Last local  LDP TLV    status sent: no fault
      Last remote LDP TLV    status rcvd: no fault
    MPLS VC labels: local 94, remote 31
    Group ID: local 0, remote 0
    MTU: local 1500, remote 1500
    Remote interface description:
  Sequencing: receive disabled, send disabled
  SSO Descriptor: 99.1.1.22/2001, local label: 94
    SSM segment/switch IDs: 8198/4100 (used), PWID: 4100
  VC statistics:
    packet totals: receive 23951, send 23951
    byte totals:   receive 2730414, send 2395100
    packet drops:  receive 0, seq error 0, send 0
```

Troubleshooting MPLS L2VPN BSoD (Cont..)

Useful debug commands

- Debug cable l2-vpn
- Debug cable tlvs
- Debug cable mac-address
- Debug mpls l2transport vc status event

Note: Use caution when enabling above commands in production routers