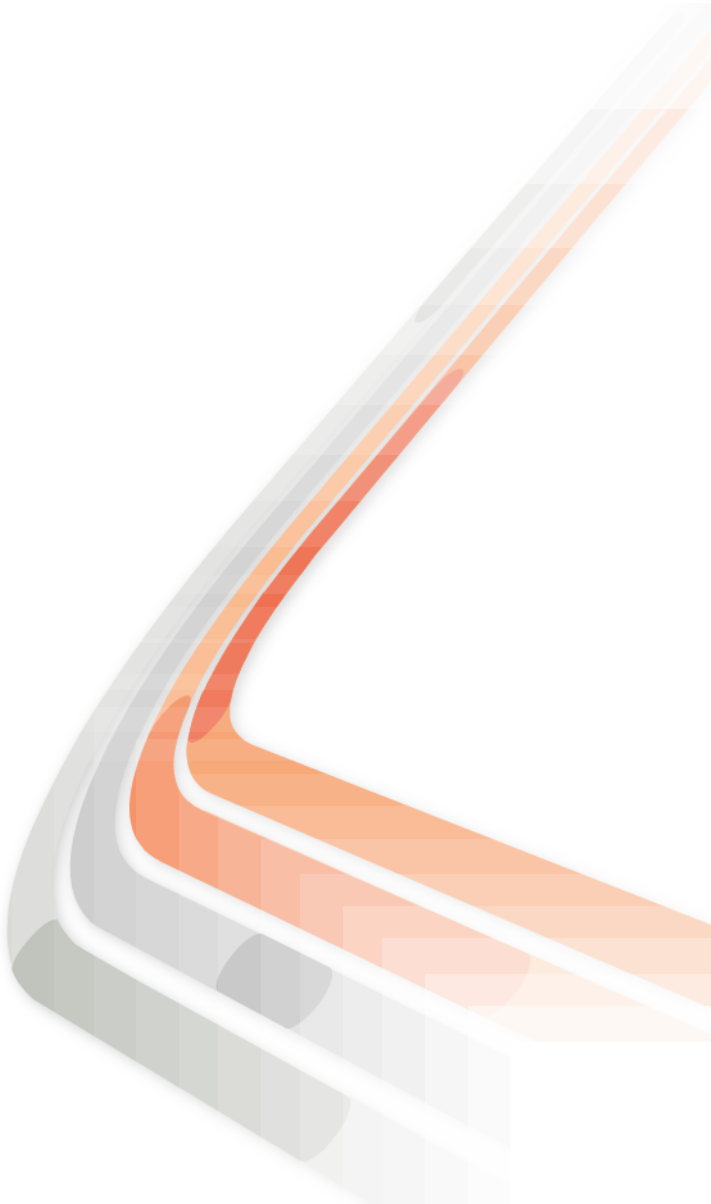
Troubleshooting Cisco CMTS Based Services

BRKSPG-2501



Agenda

- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting Voice Service
  - Troubleshooting Voice Subscriber Issues
- Troubleshooting L2VPN BSoD
- Summary
- Q & A

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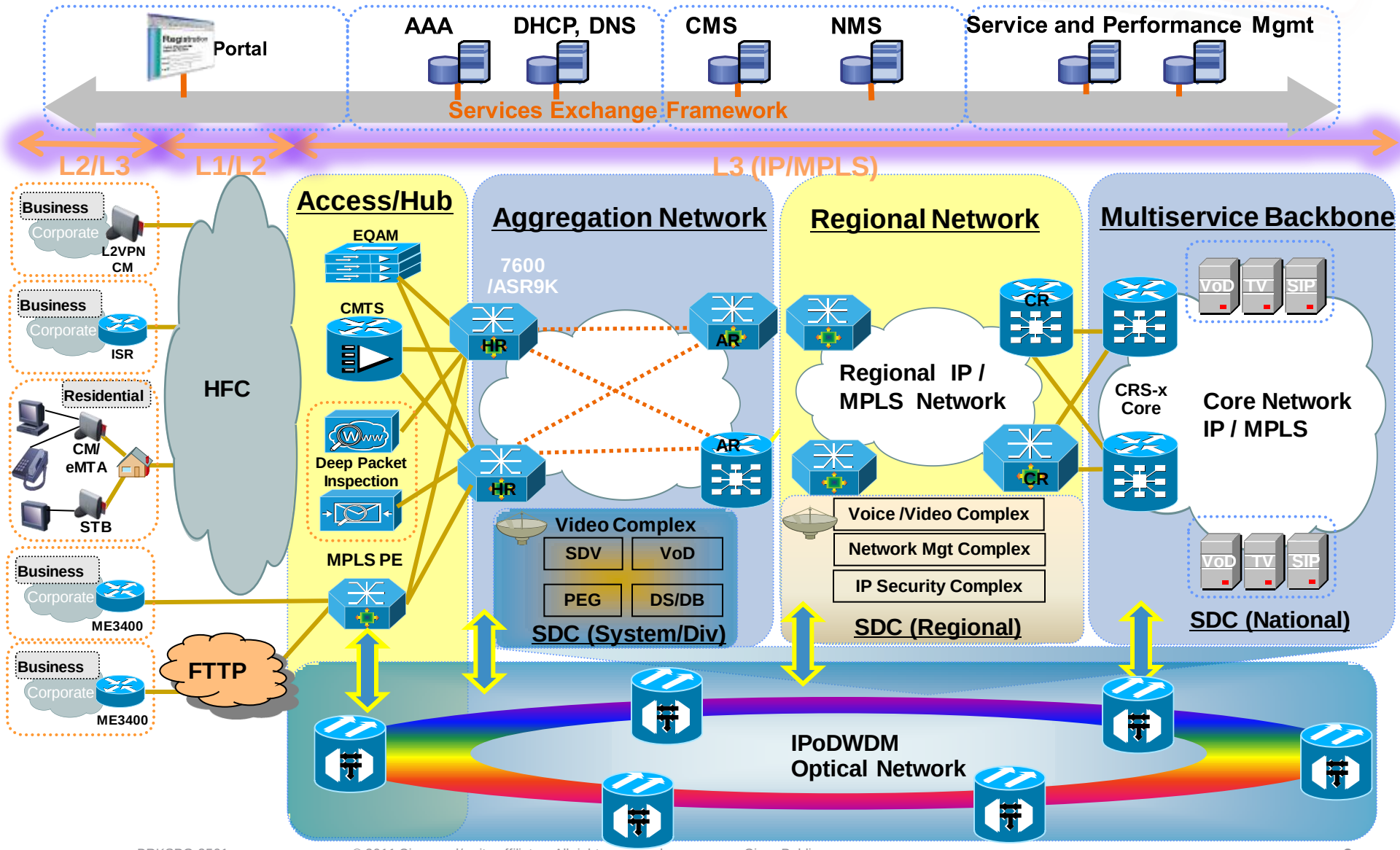
CMTS Services Landscape

- Massive HFC Infrastructure
- High Speed Data
  - DOCSIS 1.x and 2.0 services
  - DOCSIS 3.0 high speed services
- QoS Rich Services
  - Voice and PCMM services
  - IPTV
- Is that the end of line for CMTS ?

The Next Wave – BSoD

- Long history of VPN services over Fiber
- Substantial HFC infrastructure used for residential services only
- Efficient plant utilization for maximum ROI
- Business Services over DOCSIS – **BSoD**
- New diagnostic tools for new services

Cable Multi Service Networks



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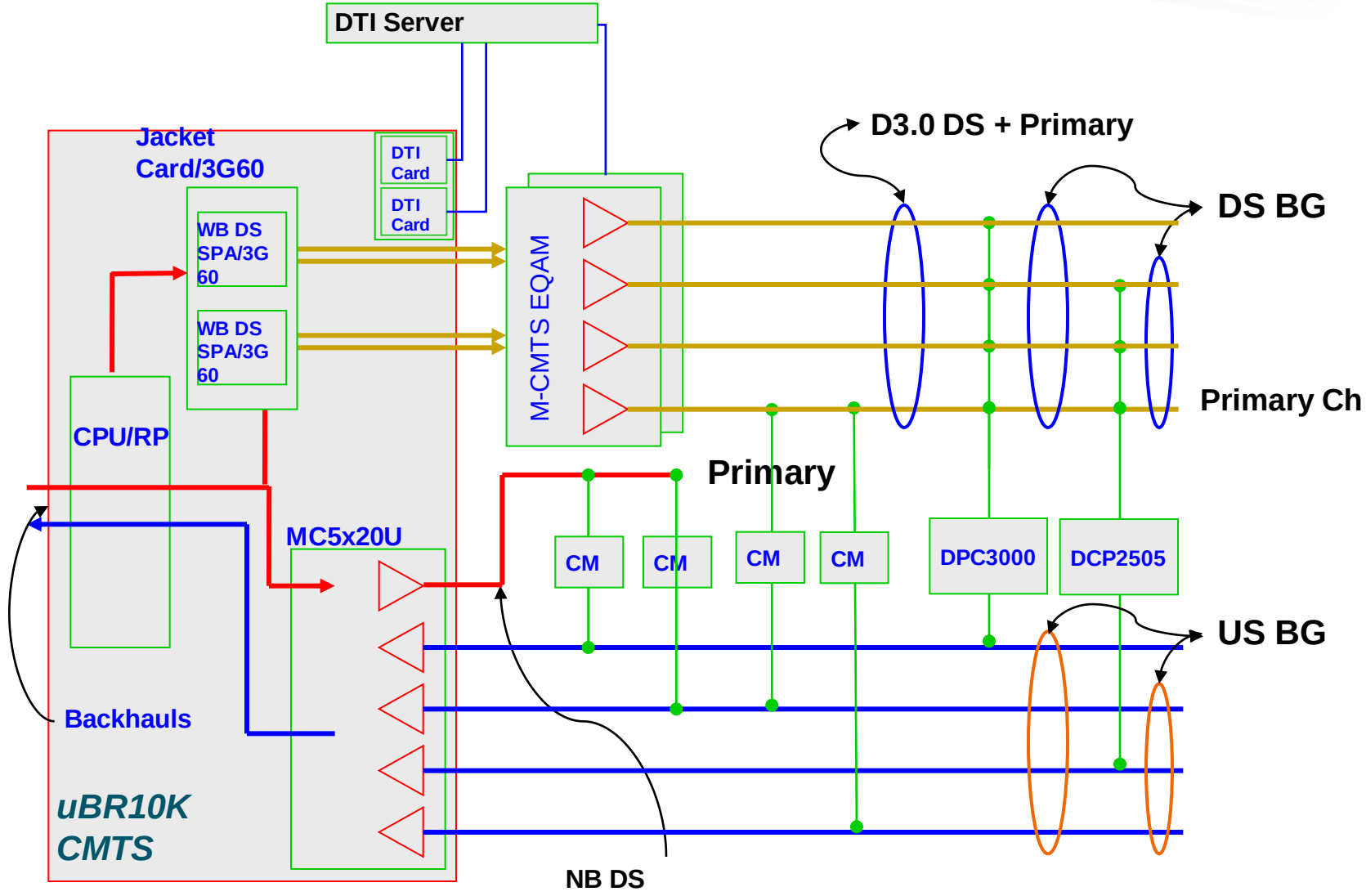
Troubleshooting High Speed Data Services

Common Issues

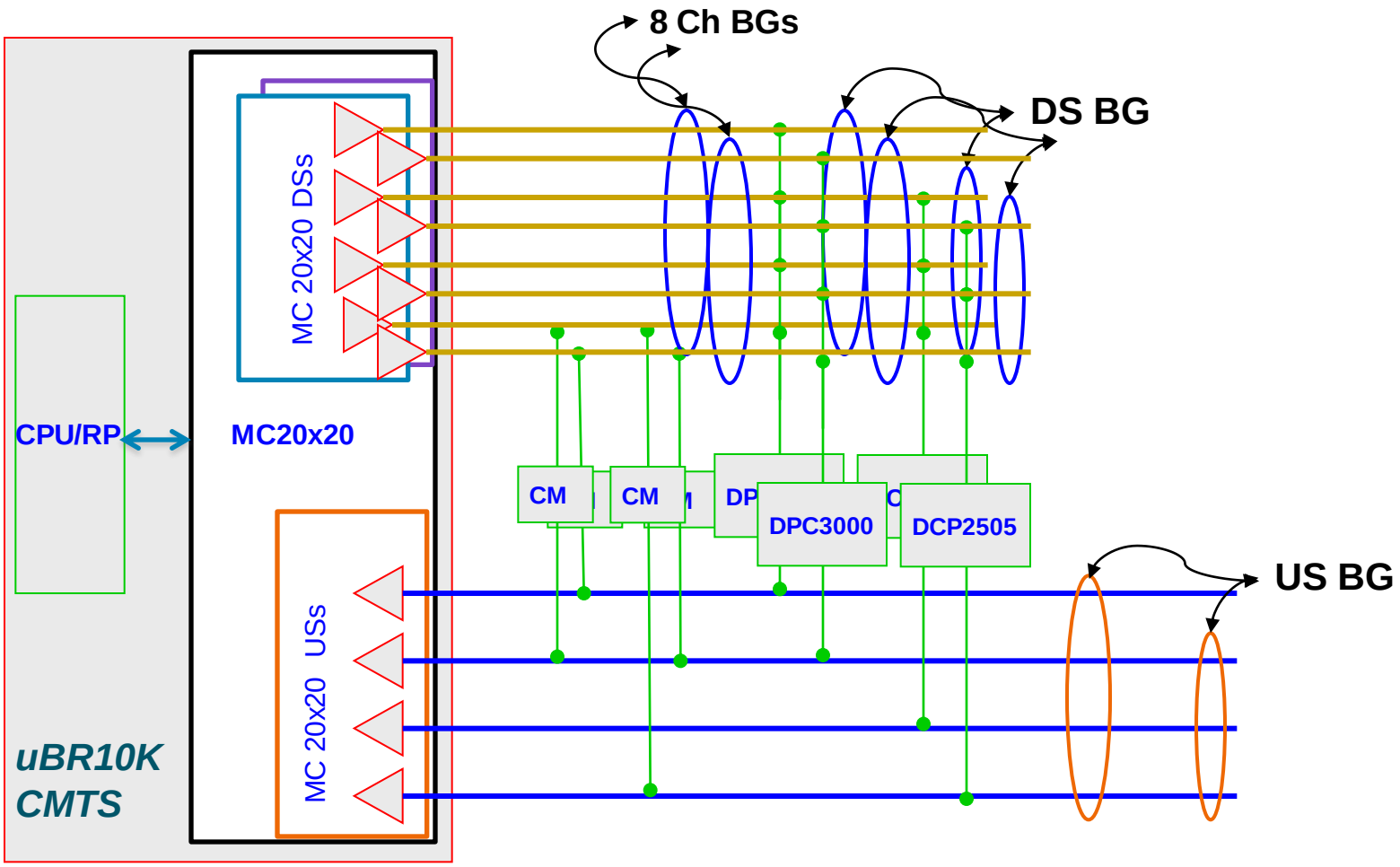
- DOCSIS 3.0 DS Channel Bonding Issues
  - CMs not coming up as w-online or Bonding Capable
  - Poor throughput issues
- DOCSIS 3.0 US Channel Bonding Issues
  - Poor US throughput on USCB modem

DOCSIS 3.0 DS Channel Bonding Issues

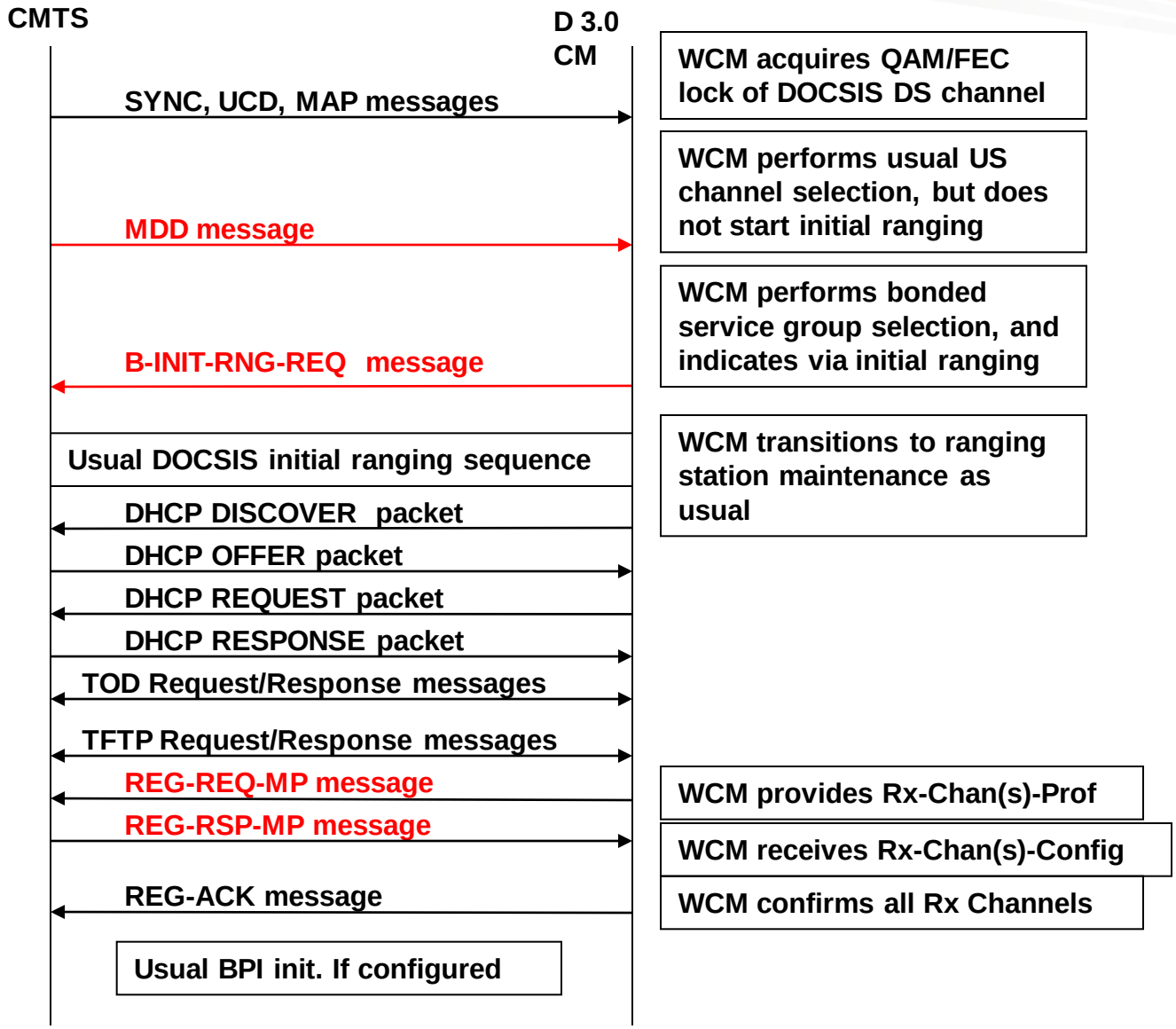
DOCSIS 3.0 M-CMTS System



DOCSIS 3.0 I-CMTS System



DOCSIS 3.0 Registration Diagram

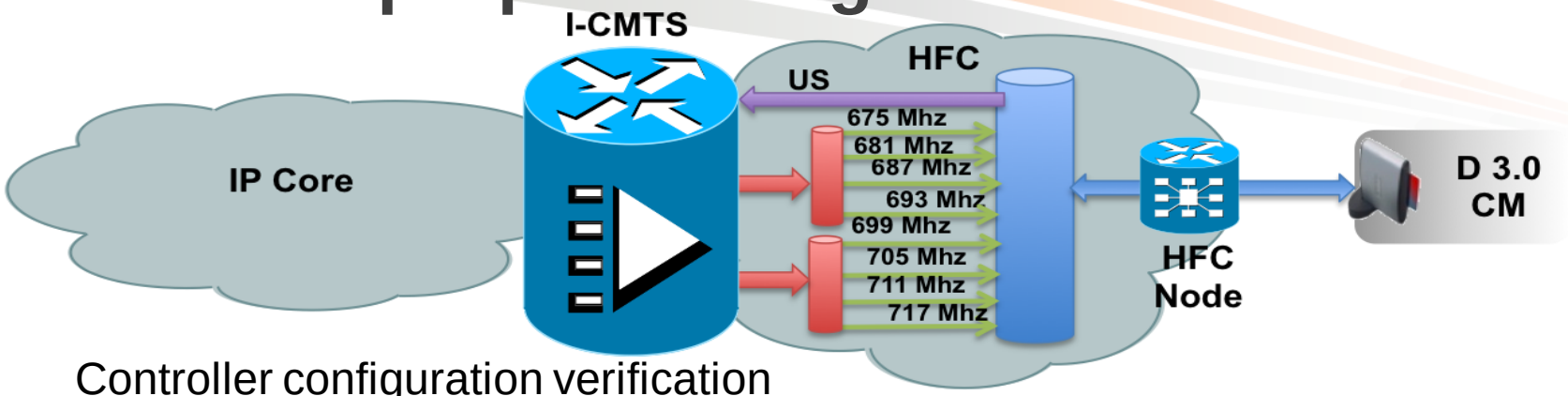


CMs Not Coming Up As W-Online

Possible Reasons

- 1. Improper configuration
  - 1.a – Verify IC 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



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 bonding-group-id 577
 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

DS Bonding Group config

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 (AllUS)   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   29.337    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

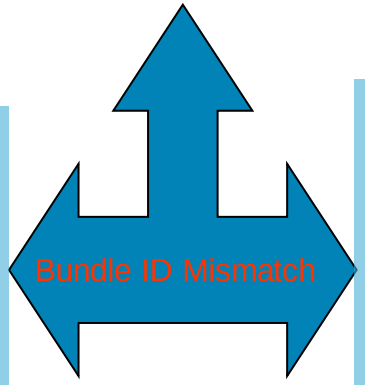
1.b – Invalid MDD State for a Fiber Node

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: Cable6/0/0 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
                                  QAM FEC failure
                                  MDD Recovery
                                  QAM FEC recovery
```

```
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
    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:             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) ticks
```

1.b – Debug CM's Ranging to Registration

Bonding Initial Request on MD-DS-SG 1

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
```

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

DHCP Boot Request from CM

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: filename =
Feb 17 11:25:32.518: DHCP Option 53  - Message Type: 1 - DHCPDISCOVER
```

1.b – Debug CM's Ranging to Registration

Registration Request

REG-REG-MP request from DSCB CM

```
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
```

RCPs and Registration response

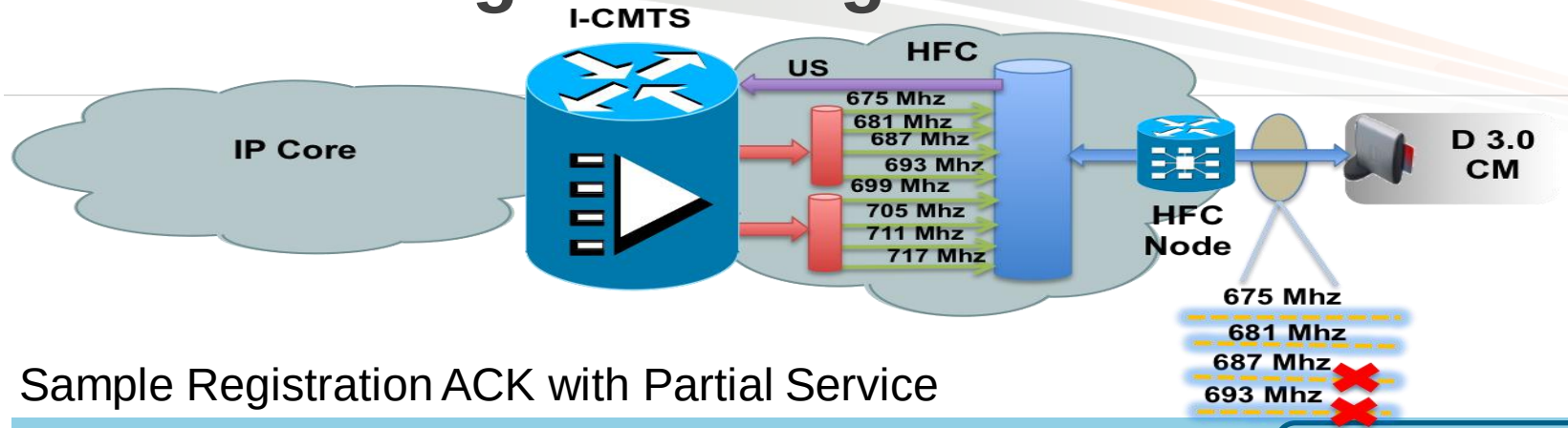
```
Feb 17 11:25:35.669: Found Network Access TLV
Feb 17 11:25:35.669: Ntw Access Control : 1
Feb 17 11:25:35.669: Found Max CPEs TLV
<snip.
Feb 17 11:25:35.669: Found Modem Capabilities TLV
Feb 17 11:25:35.669:          Concatenation Support : 1
<snip>
Feb 17 11:25:35.669: Found RCP TLV
Feb 17 11:25:35.669: 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
  <snip>
RF   : 6/0/1 3
  Status                    : UP
  FEC/QAM Failure           : 0
```

Status reported by CM for individual DS channel

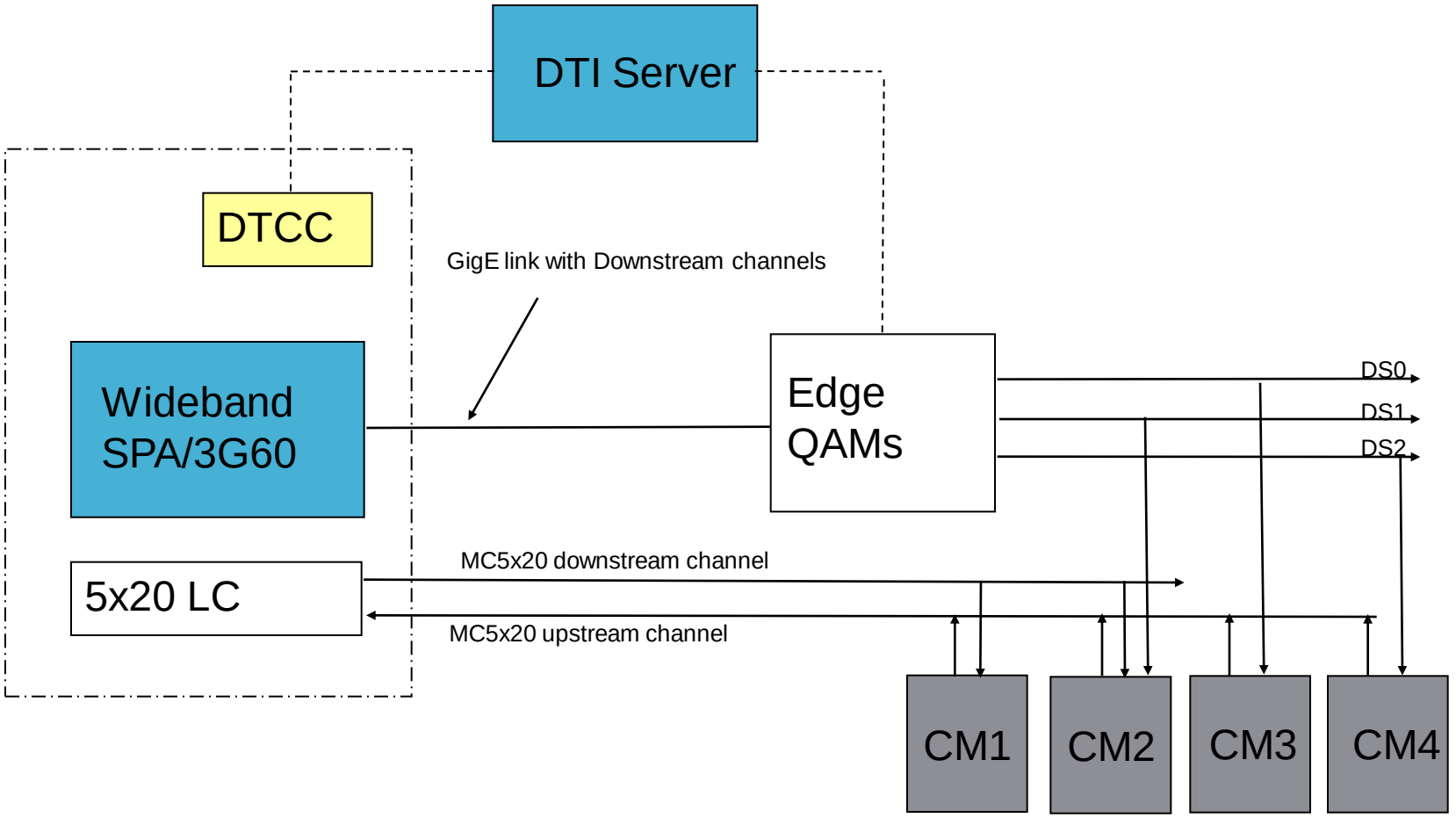
No MDD failure on this channel

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

- “ACTIVE” LED status on DTI port

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

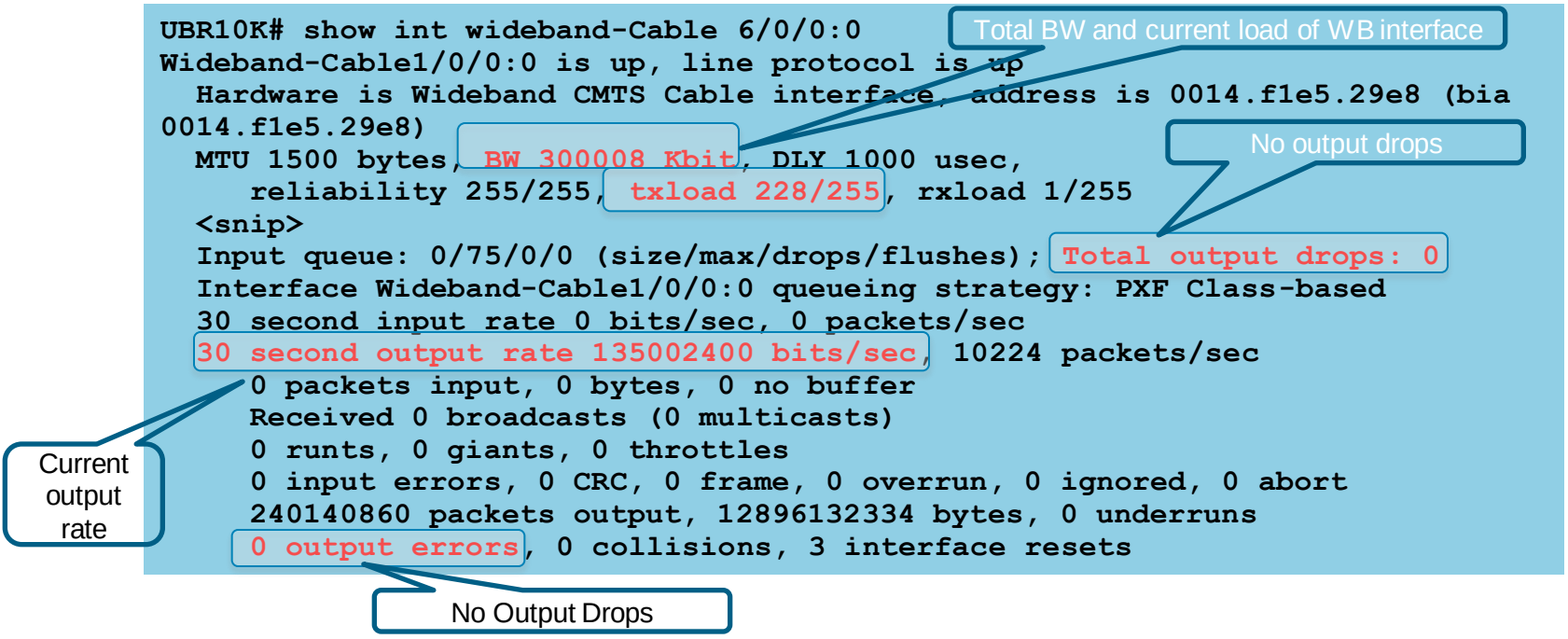
- 1. Look at overall interface numbers on CMTS
  - rf-channel bandwidth sharing, DBS Vs Static
- 2. Per CM throughput verification
  - Identify the subscriber's CM having a problem
    - Perform throughput test
    - Look at the real numbers on CMTS
  - Install a test CM at headend on same US/DS interface,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

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 HW-Module Counters on CMTS

- Show controller Integrated x/y/z counters rf-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    29.337   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
```

Current load on each channel

- 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 1/0/0:0
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

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. Show pxf cpu queue qid

12.3(23)BC7

```
UBR10K#show pxf cpu queue 363555
ID                                  : 854
CIR (in-use/configured)             : 0/0
EIR (in-use/configured)             : 256/256
MIR (in-use/configured)             : 58835/58835
Link                                : 32512
MIR Truncated BW                    : 5823
Flowbit (period/offset)             : 512/128
Burst Size                          : 1024 bytes
Actual Bundle FIFO Size             : 0
Bandwidth                           : 112505 Kbps
Channel                             : 0
Packet Descriptor Base              : 0x000D4800
Length/Average/Max/Alloc            : 216/0/256/256
Enqueues (packets/octets)       : 16460426/3676560776
Dequeues (packets/octets)       : 16460207/3676220760
Drops (tail/random/max_threshold): 2104690/0/0
Drops (no_pkt_handle/buffer_low) : 0/0
WRED (weight/avg_smaller)           : 0/0
WRED (next qid/drop factor)         : 0/0
WRED (min_threshold/max_threshold/scale/slope):
precedence 0                        : 0/0/0/0
precedence 1                        : 0/0/0/0
precedence 2                        : 0/0/0/0
precedence 3                        : 0/0/0/0
precedence 4                        : 0/0/0/0
precedence 5                        : 0/0/0/0
precedence 6                        : 0/0/0/0
precedence 7                        : 0/0/0/0
```

PXF Qid

High tail drops, no packet buffer drops

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

DOCSIS 3.0 US Channel Bonding Issues

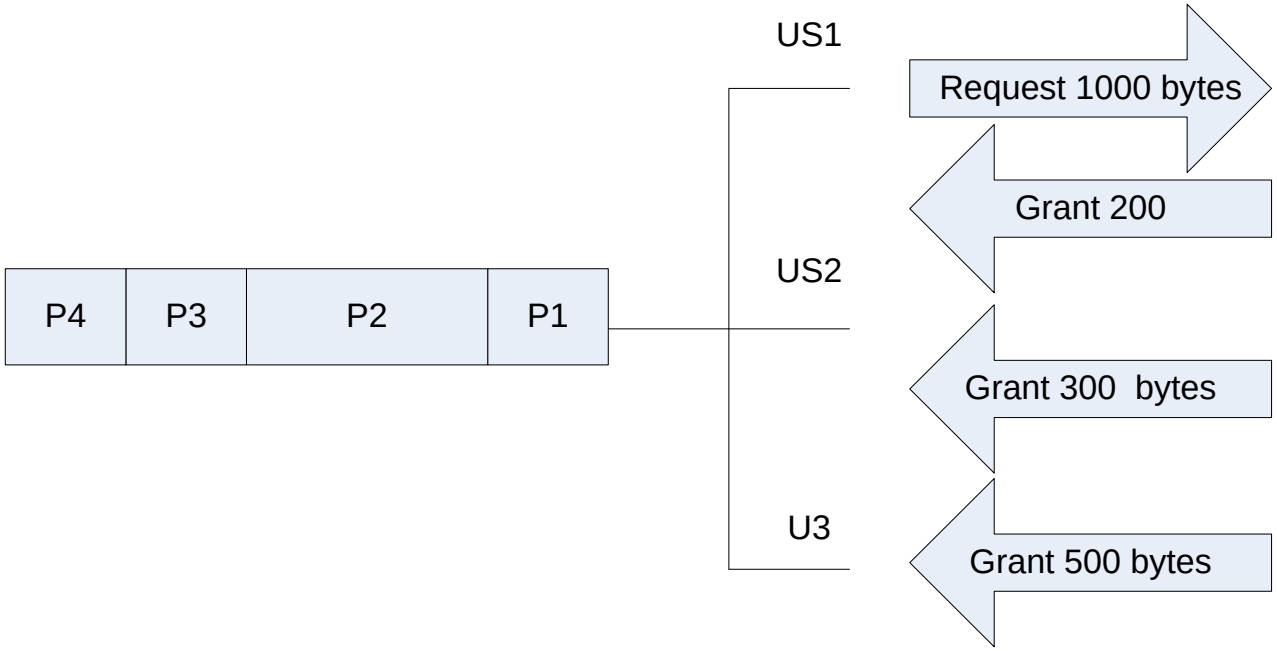
D3.0 Upstream Channel Bonding

- Upstream bonding

  Single flow can consume all BW on multiple USs

- Continuous Concatenation & Fragmentation (CCF)

  Improved form of concatenation and fragmentation



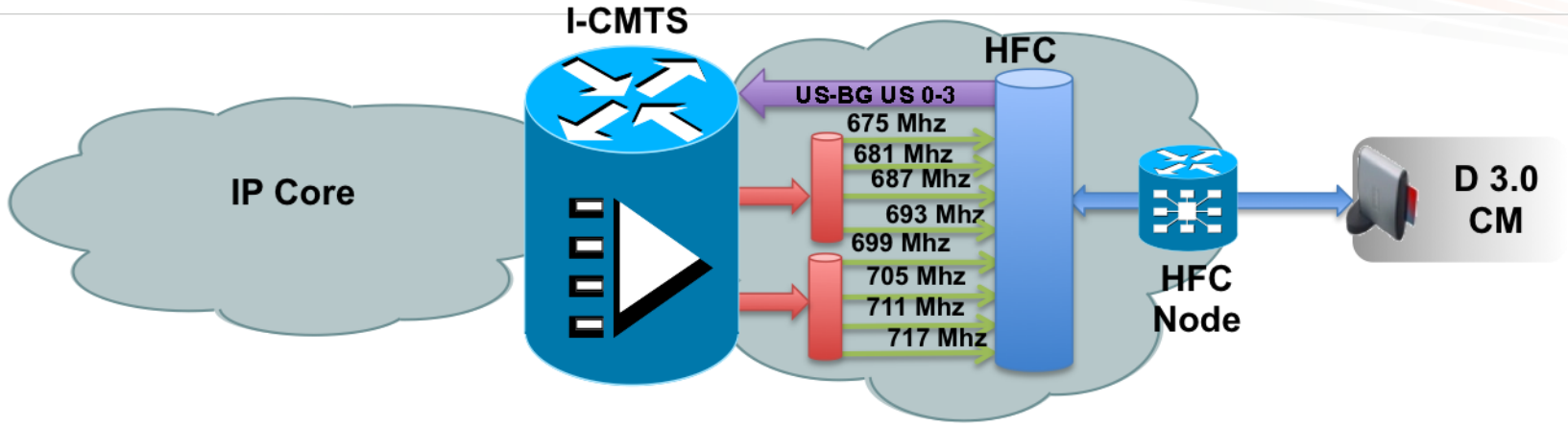
Troubleshooting USCB Modem Issues

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



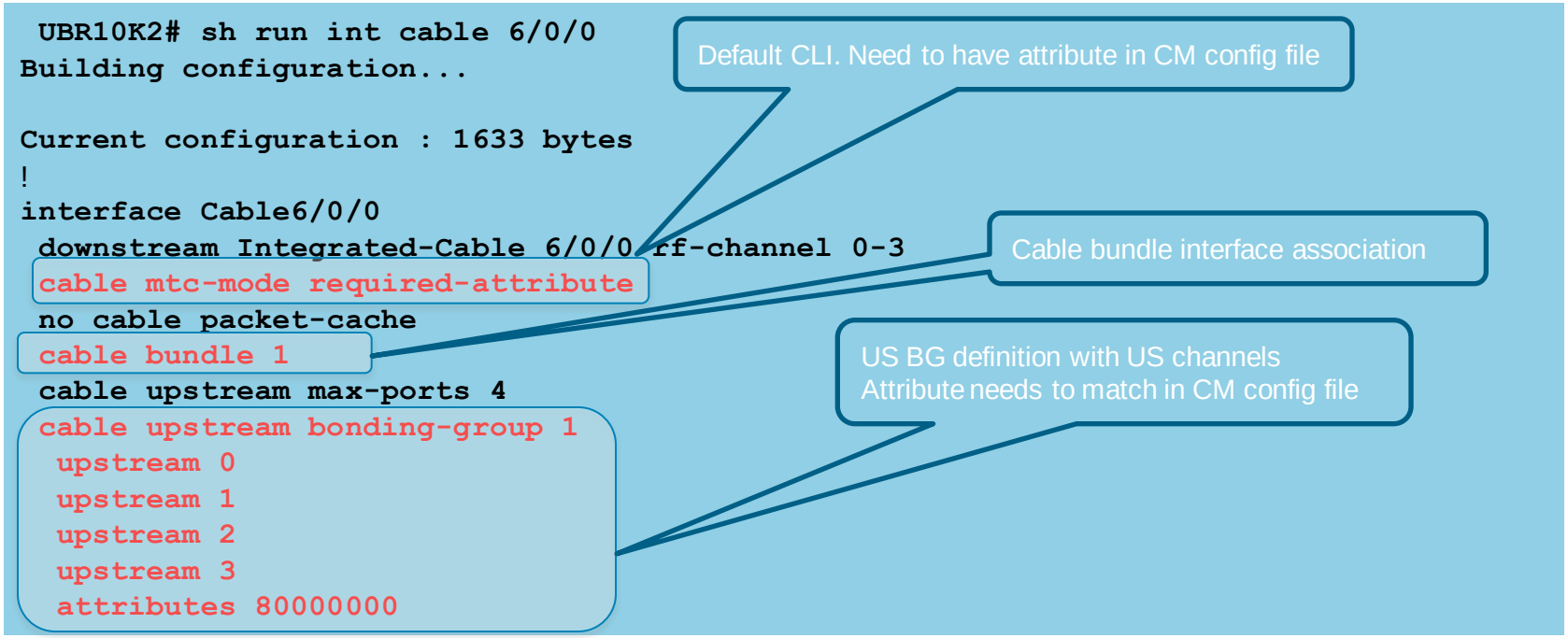
- CMTS configuration checklist

  Is DSCB configured?

  USCB requires DSCB

1.a – Configuration Verification

Cable Interface Configuration



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
  Primary-DS: 6/0/0:2   US-SG-ID: 1
    MDD US-List    : U0,1,2,3
    MDD Ambiguity : U0,1,2,3
  Primary-DS: 6/0/0:3   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  D I
                                             State               Sid  (dBmv)  Offset CPE  P N
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
<snip>
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 575 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 – SID Tracker

Sid Tracker Stats

- Sid counters

```
UBR10K#sh int cable 6/0/0 sid 204 counters verbose
Sid                                 : 204
Request polls issued                : 0
BWReqs {Cont,Pigg,RPoll,Other}      : 1352321, 11034093, 0, 0
No grant buf BW request drops       : 401
Rate exceeded BW request drops      : 13
<snip>
Good Codewords rx                   : 7412780
Corrected Codewords rx              : 186
Uncorrectable Codewords rx          : 11010
```

Total US BWReqs

BW Reqs dropped should be close to 0

High Uncorrectable Errs indicate US noise

- For throughput >= 40M

  2 SID clusters with 2 max request per sid

1.c – Service Flow Segments

Deep dive in to US slow stats

```
UBR10K2# show int cable 6/0/0 service-flow 417 verbose

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
SID Cluster Switching Information
Total Bytes Requested                           : 0
Total Time                                      : 0
Outstanding Bytes                               : 0
Max Requests                                    : 1
Classifiers: NONE
```

USCB modem

No Lost or discarded Segments

Show cable modem <mac/ip> service-flow verbose can be used for same stats

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
     BG pending grant list entries: 0
     <snip>
     Avg upstream channel utilization : 1%
```

Individual US BW

Drops in BE flow

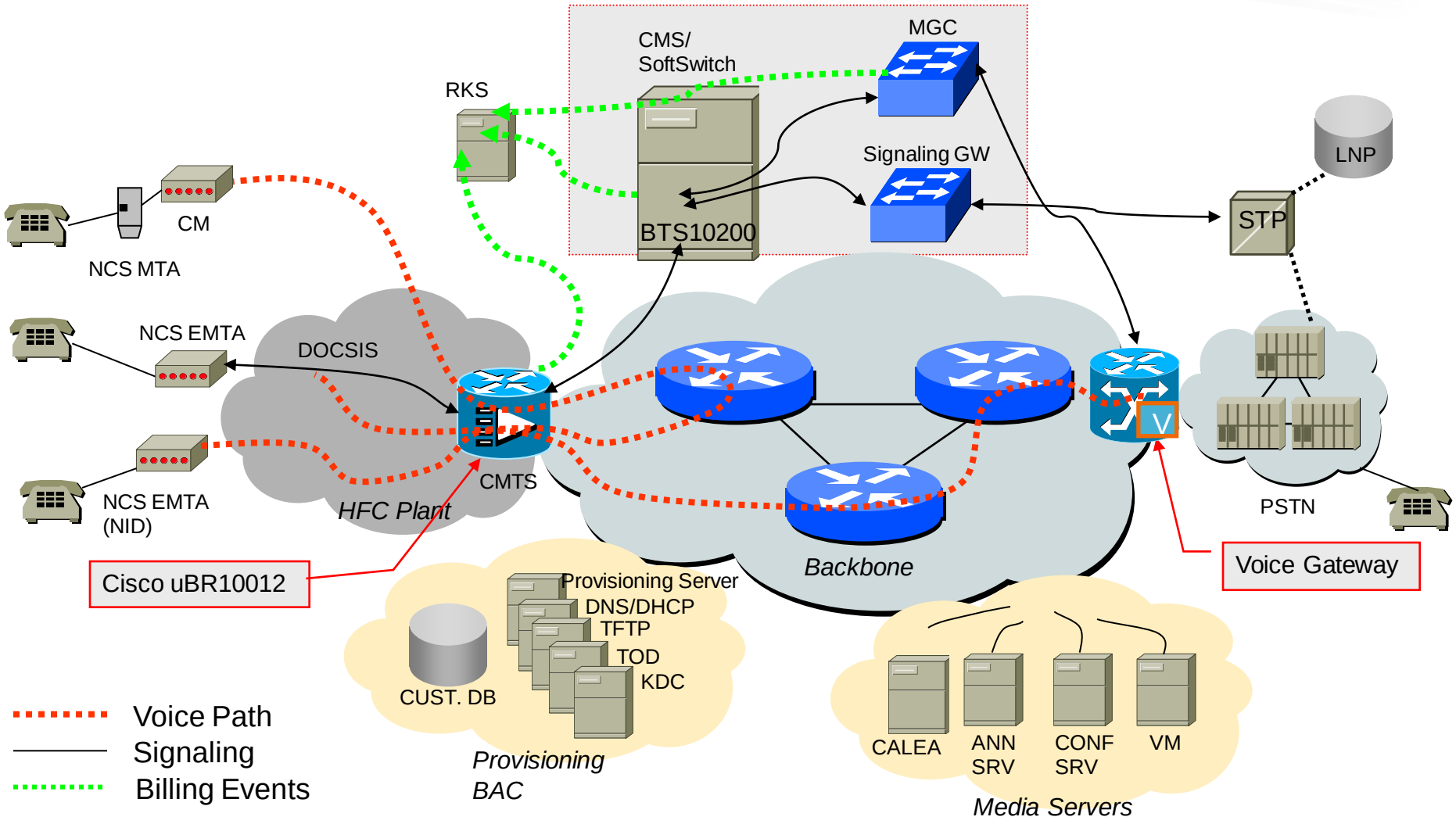
Agenda

- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting Voice Service
  - Troubleshooting Voice Subscriber Issues
- Troubleshooting L2VPN BSoD
- Q & A
- Summary

PacketCable™

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

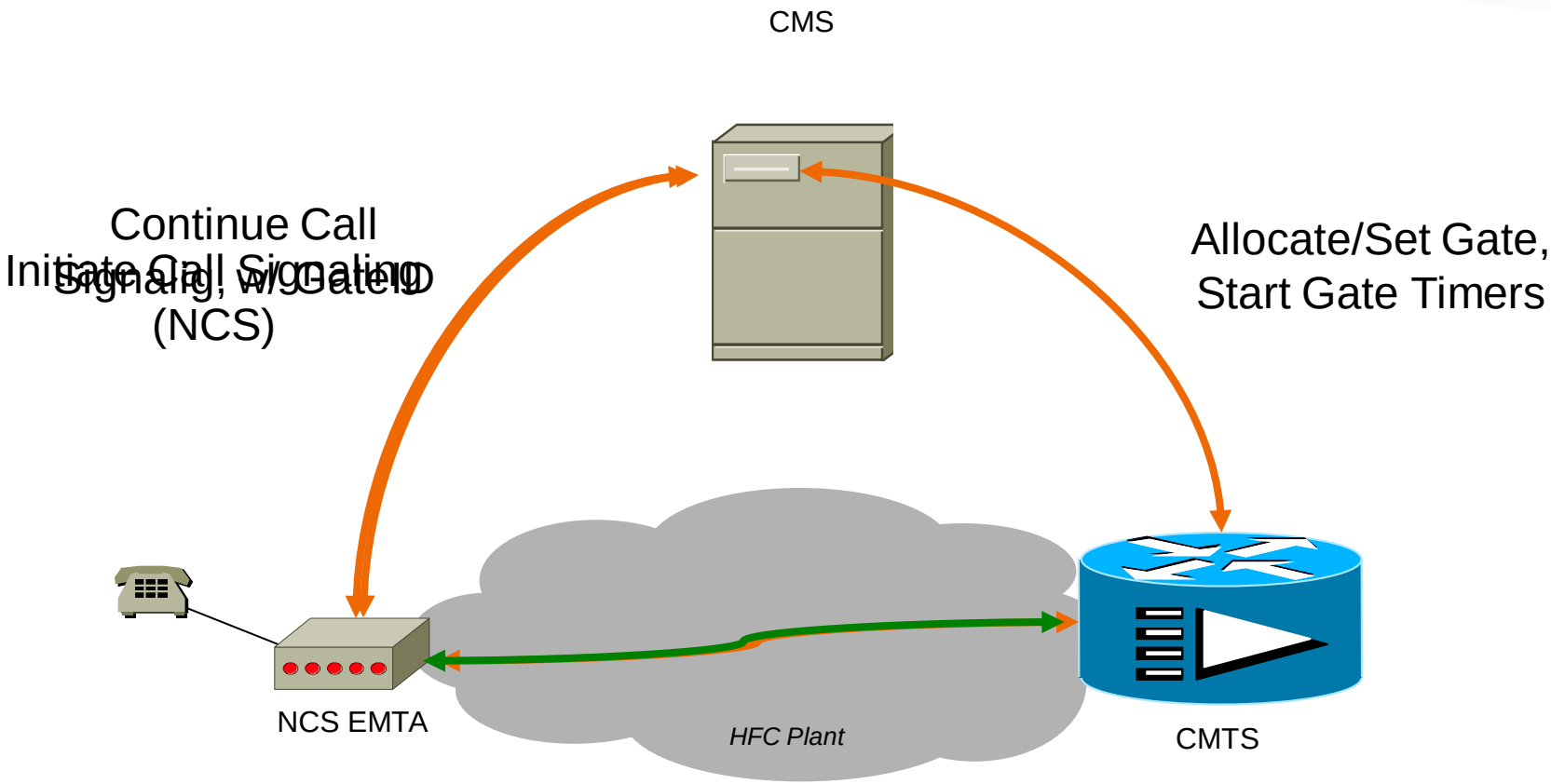
PacketCable™ Reference Architecture



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”

```
CMTS#show cable modem 0000.cadd.a3ef qos
Sfid  Dir  Curr State  Sid  Sched Type  Prio  MaxSusRate  MaxBrst  MinRsvRate  Throughput
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

nRTPS signaling flow with priority 4

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
```

Gate has to be in COMMIT state

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

2.b – Service Flow Establishment

DSX Messages

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

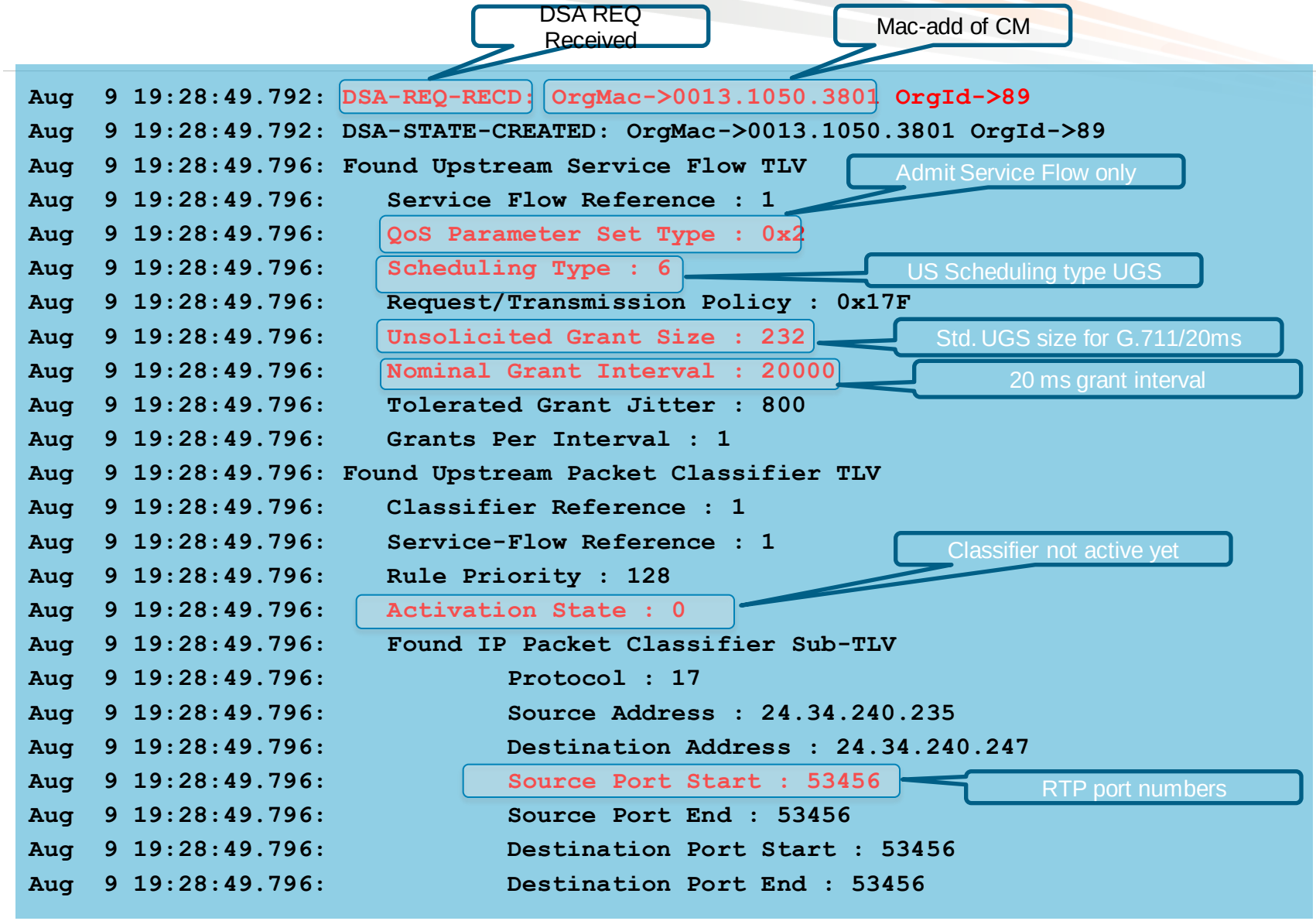
  debug cable mac-address <cm mac> verbose

  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
```

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

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 int cable 5/0/0 service-flow  142 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
<snip>
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 int cable 5/0/0 service-flow  143 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
<snip>
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

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

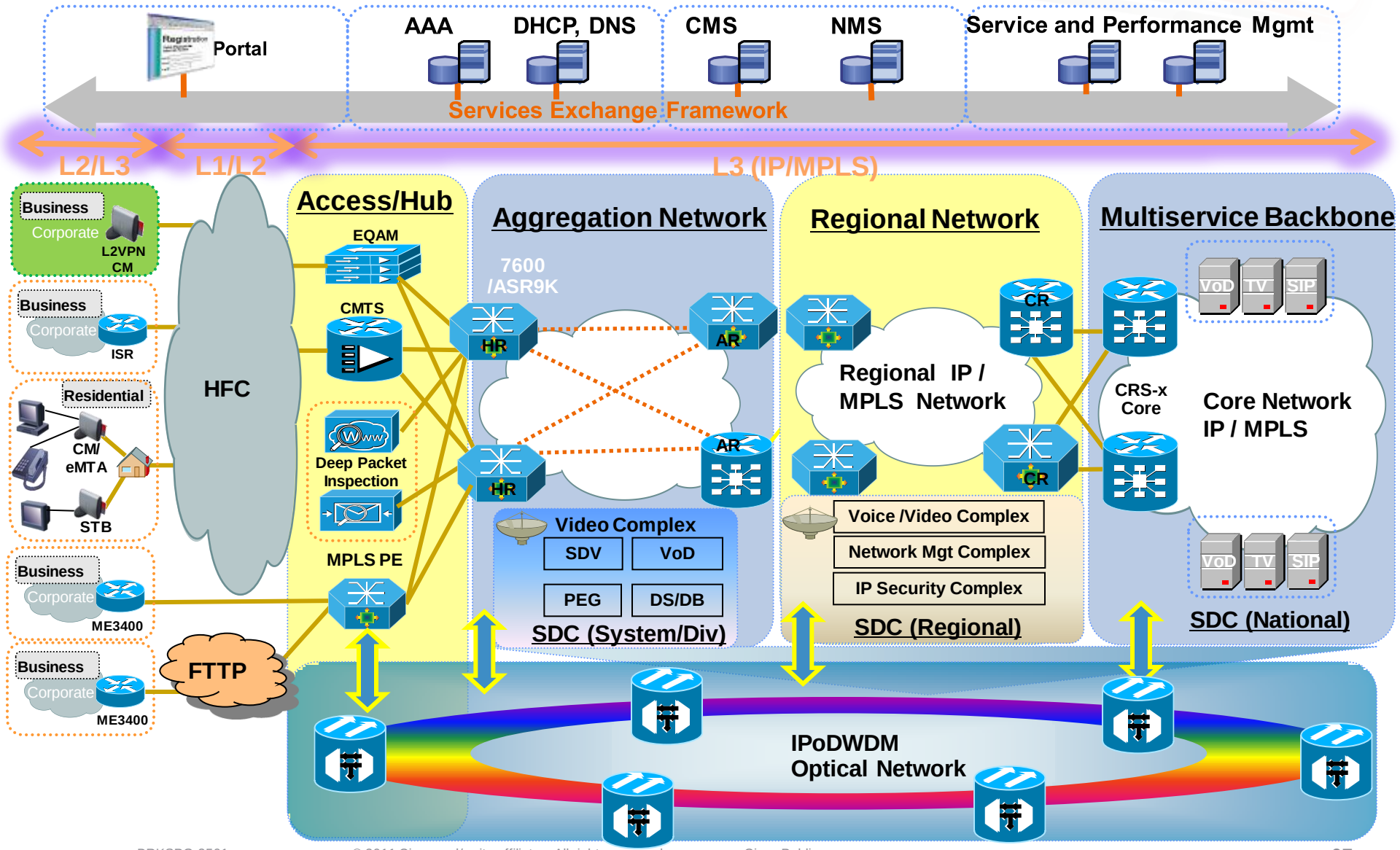
- CMTS Based Services Evolution
- Troubleshooting High Speed Data
  - DOCSIS 3.0 DS and US Channel Bonding Issues
- Troubleshooting Voice Service
  - Troubleshooting Voice Subscriber Issues
- Troubleshooting L2VPN BSoD
- Q & A
- Summary

Troubleshooting L2VPN Business Service over DOCSIS (BSoD)

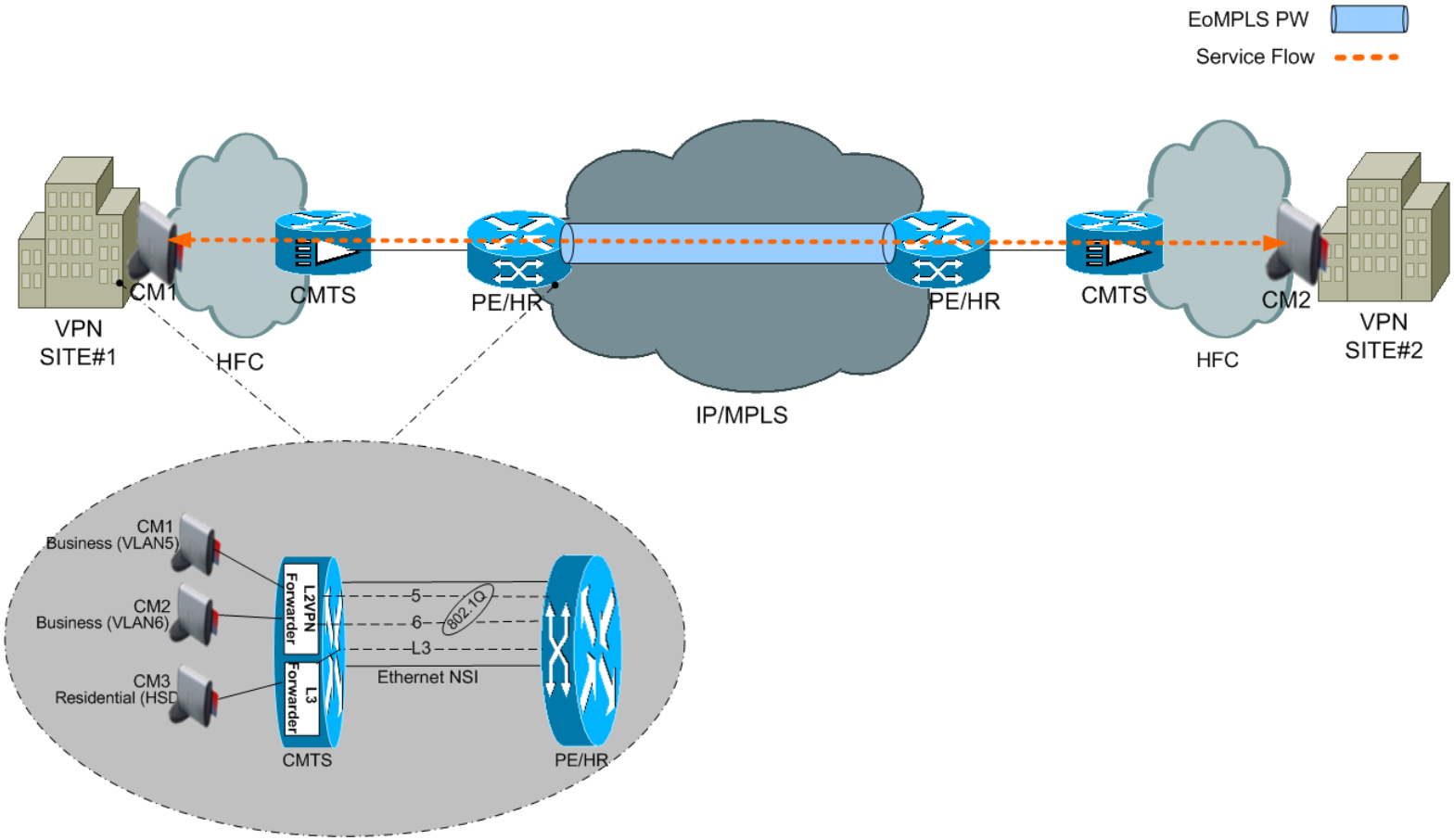
Business Services over DOCSIS (BSoD)

- 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

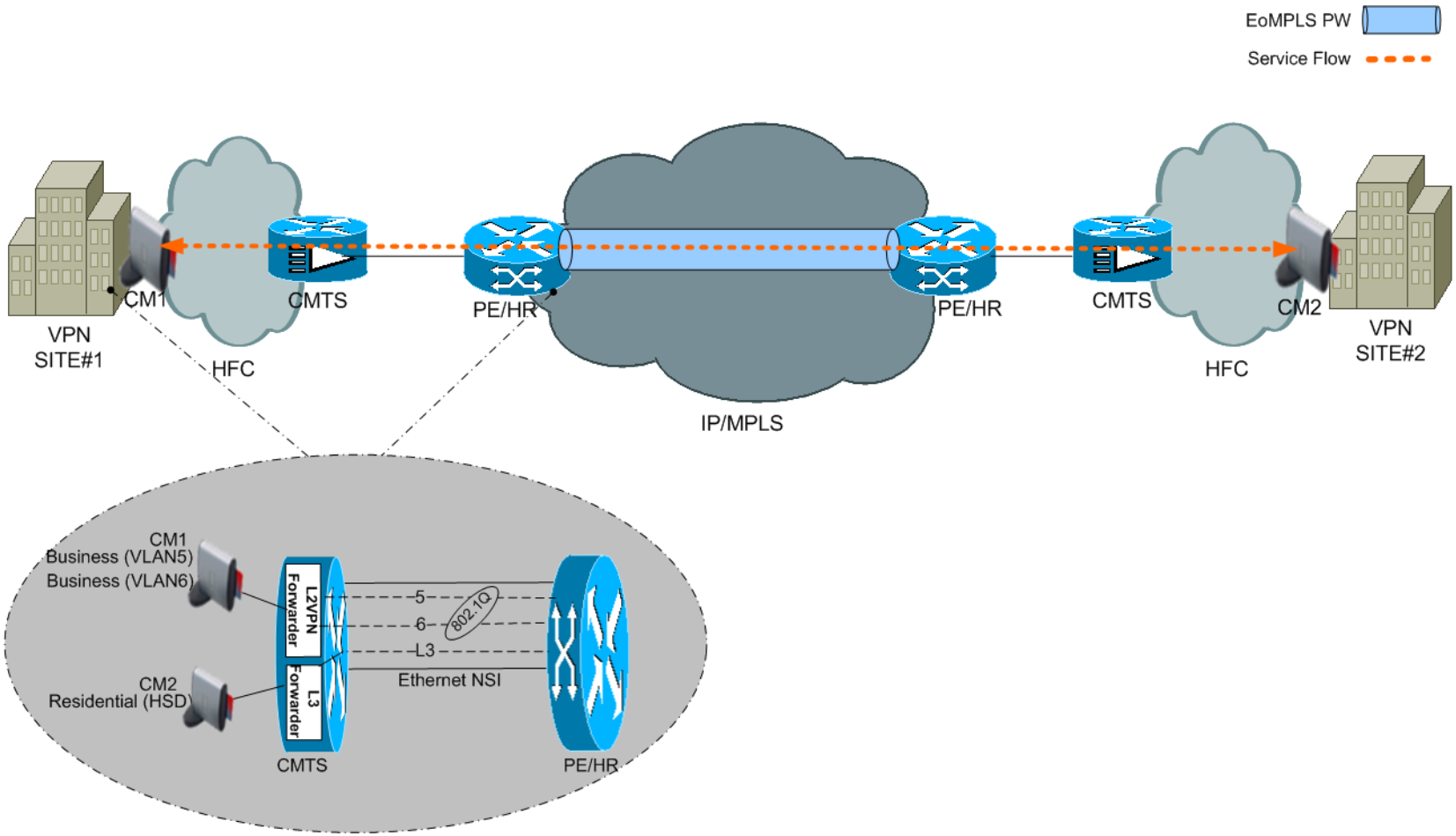
Cable Multi Service Networks



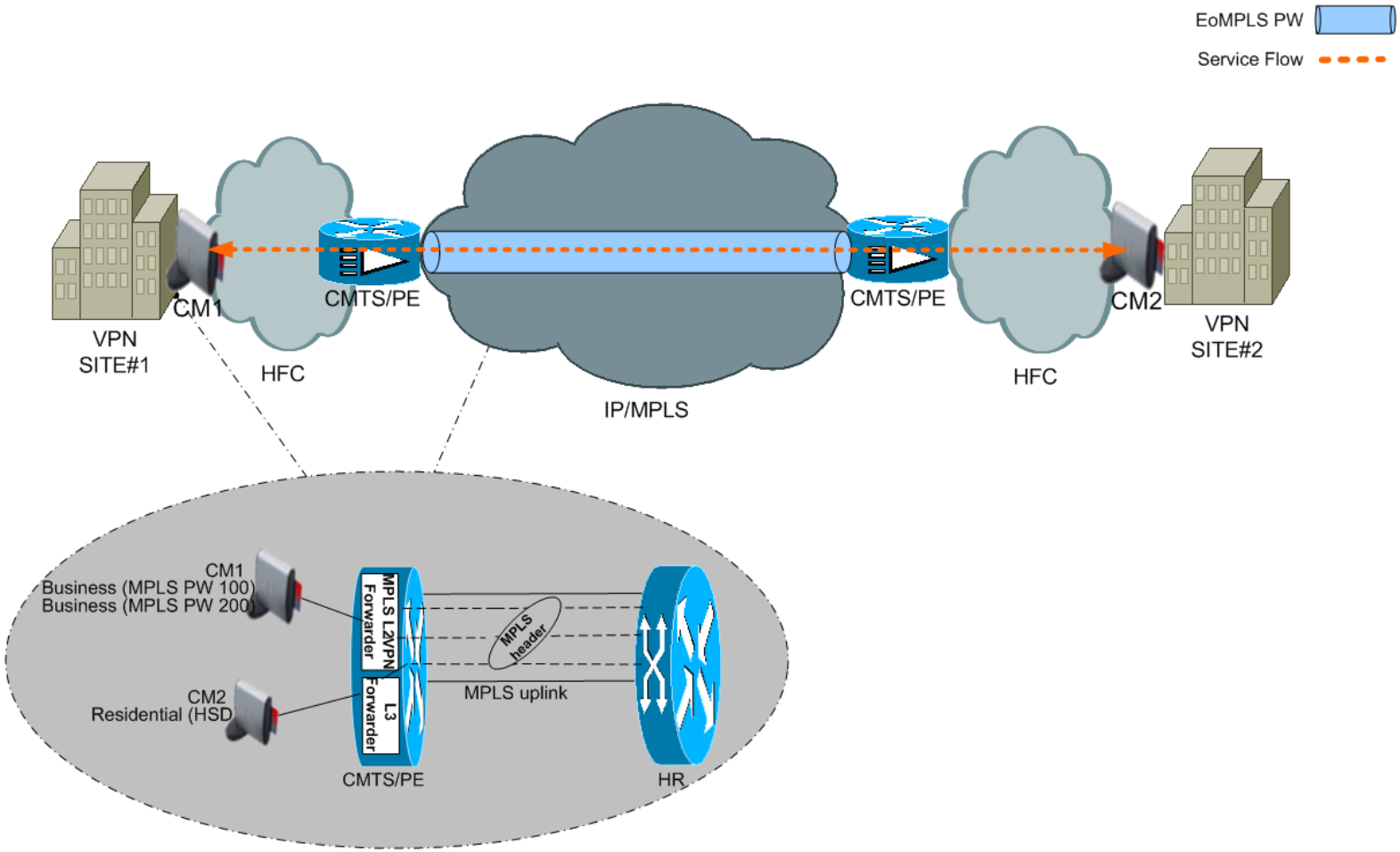
Transparent LAN Service (TLS) over DOCSIS



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

- 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
 Discard packets      : 0
 Discard 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

Summary

- Evolution of CMTS Based Services
- Common Data Service Issues and Troubleshooting
- Common VoIP Service issues
- L2VPN BSoD Variations and troubleshooting

“Effective troubleshooting will decrease downtime and increase customer satisfaction”

Q&A

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