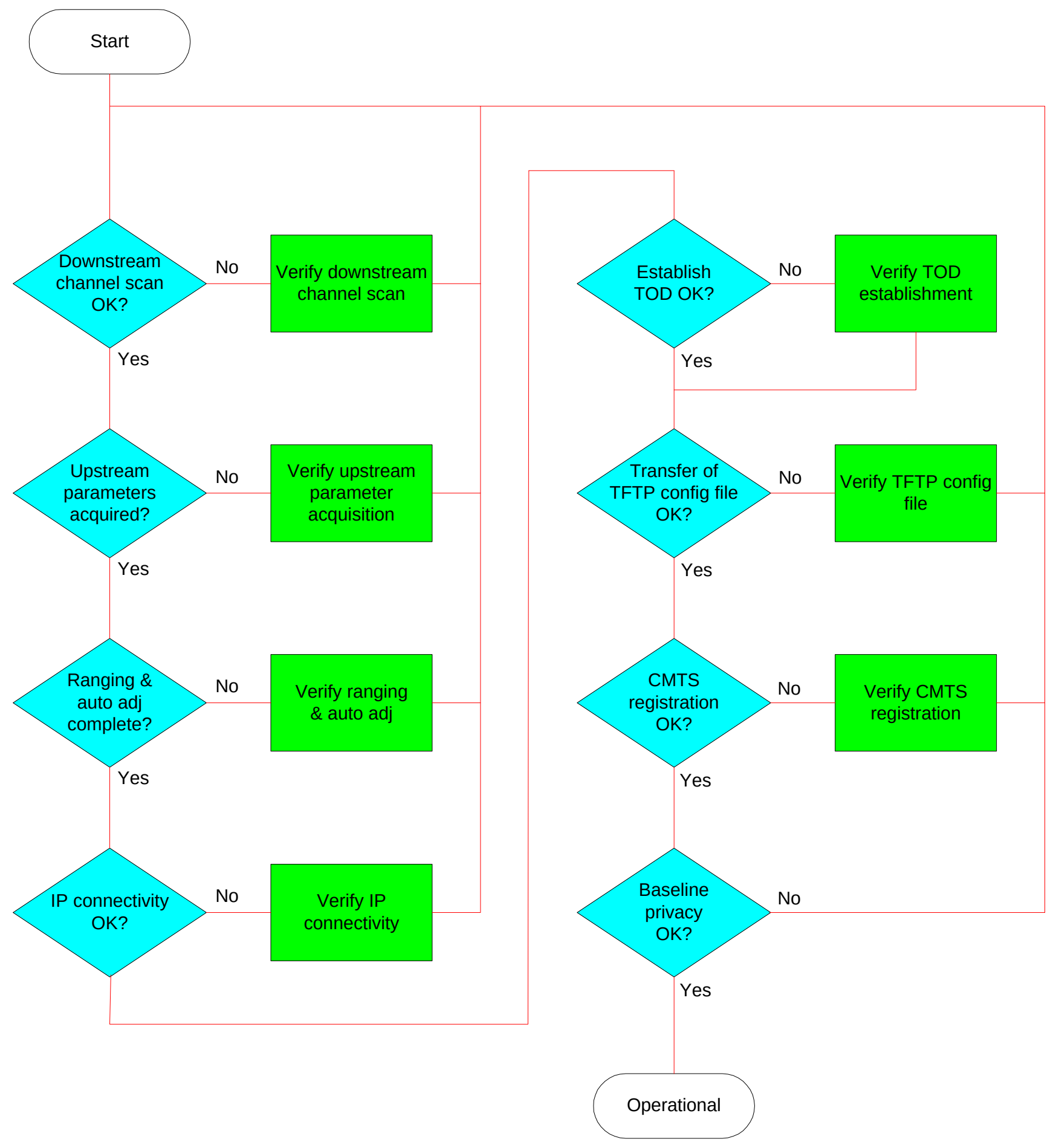
Cable Modem Initialisation



```
test-cmts#show interfaces cable 4/0 sid 60 connectivity
Sid   1st time     Times  %online     Online time          Offline time
        online      Online          min      avg     max     min     avg     max
60   Sep 11 2000 32     99.02   00:13   5h08m   3d18h   00:03   03:02   29:36

test-cmts#
```

Note

1st time online - Time at which the modem with this SID connected
Times online - Number of times the modem with this SID has connected
% **online** - Percentage of time the modem with this SID has been connected
Offline - Cable modem considered offline
Online time - Minimum, average & maximum number of hours & minutes modem with this SID has been connected
Offline time - Minimum, average & maximum number of hours & minutes modem with this SID has been disconnected

```
test-cmts#show interfaces cable 4/0 sid 60 counters verbose
Sid                           : 60
Input packets                 : 311806
Input octets                : 29596590
Output packets                  : 311799
Output octets                 : 28684568
BW requests received            : 312025
Grants issued                 : 311838
Rate exceeded BW request drops : 0
Rate exceeded DS packet drops  : 0
```

Note

Input packets - Packets received by using this SID
Input octets - Octets received by using this SID
Output packets - Packets sent from this SID
Output octets - Octets sent from this SID
BW requests received - Bandwidth requests received by this SID
Grants issued - Bandwidth requests granted by this SID
Rate exceeded BW request drops - Bandwidth requests not granted by this SID to enforce bandwidth contract (COS settings)
Rate exceeded DS packet drops - Number of packets discarded due to traffic rate exceeding bandwidth contract and configured buffering

```
test-cmts#show cable modem maintenance
Interface      SID  MAC Address        SM Exhausted             SM Aborted
                                   Count          Time        Count        Time
Cable4/0/U0  60    0001.9659.47ab      23   Sep 14 16:19:18    0
test-cmts#
```

Note

SID - Service Identifier
MAC Address - MAC address of cable-modem 0 interface
SM Exhausted - Number of times a cable modem was dropped because it did not reply to station maintenance requests. A CM is removed from the station maintenance list after 16 times of periodic ranging opportunity without seeing the RNG_REQ from the modem
SM Aborted - Number of times the CM was dropped because its operational parameters were unacceptable. This includes such reasons as the power level is outside the acceptable range, or the timing offset keeps changing

Note

Rx SNR - Downstream SNR ratio level in dB as perceived by the cable modem. If the CMTS is not configured for SNMP reads from the modems, the CMTS will return a zero value.

The SNR ratio is the difference in amplitude between a baseband signal and the noise in a portion of the spectrum.

For 64 QAM the SNR should be **>23.5 dB** @ BER<10^8. For 256 QAM the SNR should be **>30 dB** @ BER <10^-8. (For input level between +15 and -8 dBmV, SNR must be > **30 dB**. For input level between -8 and -15 dBmV, SNR must be > **33 dB**.)

In practise, a **6 dB** or more SNR margin may be required for reliable operation

```
test-cmts#show  cable modem detail
Interface      SID  MAC address        Max CPE   Concatenation   Rx SNR
Cable4/0/U0 58   0001.9659.47bf   3            yes             31.14
Cable4/0/U0 59   0001.9659.47eb   3            yes             31.30
Cable4/0/U0 60   0001.9659.47ab   3            yes             31.28
Cable4/0/U0 61   0001.9659.47bb   3            yes             31.29
Cable4/0/U0 62   0001.9659.3ef7   3            yes             31.35
```

Note

SID - Service Identifier
MAC Address - MAC address of cable-modem 0 interface
Max CPE - The maximum number of hosts that can be simultaneously active on the cable modem
Concatenation - Concatenation combines multiple upstream packets into one packet to reduce packet overhead & overall latency, as well as increase transmission efficiency. Using concatenation, a DOCSIS cable modem makes only one bandwidth request for multiple packets, as opposed to making a different bandwidth request for each individual packet

Concatenation will only work if a single cable modem were to have multiple voice calls each running at the same data rate without VAD (voice activated) packet suppression

Concatenation can be a problem for VOIP if not configured correctly. Introduced in v12.0(7)XR & v12.0(8)SC IOS releases

Both the uBR924 & the CMTS must support the dynamic multi-SID and concatenation features for them to be used on the cable network. If you are using the Cisco uBR7200 series universal broadband router as the CMTS, Cisco IOS Release 12.0(7) XR or 12.1(1) T (or later) is required on both the Cisco uBR924 and Cisco uBR7200 series routers to use these features.

Cable Solutions
Brussels

Cisco Systems 2000
http://www.cisco.com

Diagram based on v12.1 IOS

```
test-cmts#show int cable 4/0 downstream
Cable4/0: Downstream is up
  1561037598 packets output, 3819385163 bytes, 0 discarded
  0 output errors
  6 total active devices, 5 active modems
test-cmts#
```

Note

packets output - Total number of packets transmitted out of this interface.
bytes - Total number of bytes transmitted out of this interface
discarded - Total number of packets discarded
output errors - Sum of all errors that prevented downstream transmission of packets

offline--- Cable modem considered offline
offline time---Time the cable modem went offline; the format is the same as other show cable modem commands (month, day, time, and year)
init (r1)--- CMTS received initial ranging from cable modem
init (r2)--- CMTS received initial ranging from cable modem & has sent fine tuning RF power, timing offset & frequency adjustments to cable modem
init (rc)--- Cable modem has performed fine tuning of RF powwer, timing offset & frequency adjustments sent by CMTS
init (d)--- First IP broadcast packet received from cable modem
init (i)--- DHCP reply received; IP address assigned but cable modem has **NOT** replied with an IP packet yet
init(t)--- Modem is ready to obtain Time of Day (ToD) from the server specified in the DHP offer.
init (o)--- Modem is ready to download TFTP config file as specified in DHCP offer.

online--- Cable modem registered, enabled for data
online(d)--- Cable modems ethernet interface is administratively shut off via provisioning file (DOCSIS TFTP config file)
online(pk)---Cable modem registered, BPI enabled and KEK assigned
online(pt)--- Cable modem registered, BPI enabled and TEK assigned
reject (m)--- DOCSIS shared secret in TFTP config file does not match shared secret on CMTS interface. Config file is corrupt or contains an invalid timestamp
reject (c)--- DOCSIS TFTP config file contained a COS parameter that bwas not acceptable to the CMTS. Modem may be using an old config file or cable modem is disabled due to security violation (attempt to create a new DOCSIS COS config when CMTS is configured to not permit that)
reject (pk)---KEK modem key assignment rejected
reject (pt)---TEK modem key assignment rejected

Modem will not be permitted to transmit or receive IP traffic when in **reject(xx)** mode. Maximum data rate to modem is fixed at 1Kbit/sec in each direction and all packets are discarded by the CMTS

```
test-cmts#show  cable modem cable 4/0 upstream 0
Interface      Prim  Online     Timing   Rec     QoS  CPE IP address      MAC address
               Sid   State      Offset   Power
Cable4/0/U0 60    online     2814     0.25    5    0     10.200.69.44    0001.9659.47ab
```

Note

SID - Service identifier
Timing Offset - Current round trip time at the CM. The value is used to synchronize upstream transmission to the CMTS and is measured in units of 6.25 microseconds / 32
Receive Power - This is the current receive power or last power before if went offline
QoS - Service class assigned to the cable modem
CPE - The maximum number of hosts that can be simultaneously active on the cable modem
IP address - Allocated IP address for this cable modem
MAC address - MAC address of cable-modem 0 interface

```
test-cmts#show interfaces cable 4/0 upstream 0
Cable4/0: Upstream 0 is up
  Received 2667 broadcasts, 0 multicasts, 3606022 unicasts
  0 discards, 6687 errors, 0 unknown protocol
  3608689 packets input, 0 uncorrectable
  5910 noise, 0 microreflections
  Total Modems On This Upstream Channel : 5 (5 active)
  Default MAC scheduler
  Queue[Rng Polls]  0/20, fifo queueing, 0 drops
  Queue[Cont Mslots]  0/104, fifo queueing, 0 drops
  Queue[CIR Grants]  0/20, fair queueing, 0 drops
  Queue[BE Grants]  0/30, fair queueing, 0 drops
  Queue[Grant Shpr]   0/30, calendar queueing, 0 drops
  Reserved slot table currently has 0 CBR entries
  Req IEs 661989437, Req/Data IEs 0
  Init Mtn IEs 10212350, Stn Mtn IEs 613096
  Long Grant IEs 1622754, Short Grant IEs 1357
  Avg upstream channel utilization : 1%
  Avg percent contention slots : 96%
  Avg percent initial ranging slots : 3%
  Avg percent minislots lost on late MAPs : 0%
  Total channel bw reserved 0 bps
  CIR admission control not enforced
  Current minislot count   : 6702330    Flag: 0
  Scheduled minislot count : 6702419    Flag: 0
test-cmts#
```

Note

Current Total Bandwidth Reserved - Total amount of bandwidth reserved by all modems sharing this upstream channel that require bandwidth reservation. The Class of Service for these modems specifies some non-zero value for the guaranteed-upstream rate. When one of these modems is admitted on the upstream, this field value is incremented by this guaranteed-upstream rate value

Note

Avg upstream channel utilization - Average percent of the upstream channel bandwidth being used
Avg percent contention slots - Average percent of slots available for modems to request bandwidth via contention mechanisms. Also indicates the amount of unused capacity in the network
Avg percent initial ranging slots - Average percent of slots in initial ranging state
Avg percent minislots lost on late MAPs - Average percent of slots lost because a MAP interrupt was too late

Note

Req IEs - Running counter of request IEs sent in MAPS
Req/Data IEs - Counter of request/data IEs sent in MAPS
Init Mtn IEs - Counter of Initial Maintenance IEs
Stn Mtn IEs - Number of station maintenance (ranging poll) IEs
Long Grant IEs - Number of long grant IEs
Short Grant IEs - Number of short grant IEs

Note

reserved slot table - At time command issued MAC scheduler had admitted 2 CBR slots in the reserved slot table.

Note

Rng Polls - The MAC scheduler queue showing number of ranging polls
Cont Mslos - The MAC scheduler queue showing number of forced contention request slots in MAPS
CIR Grants - The MAC scheduler queue showing number of CIR grants pending
BE Grants - The MAC scheduler queue showing number of best effort grants pending
Grant Shpr - The MAC scheduler queue showing number of grants buffered for traffic shaping

Note

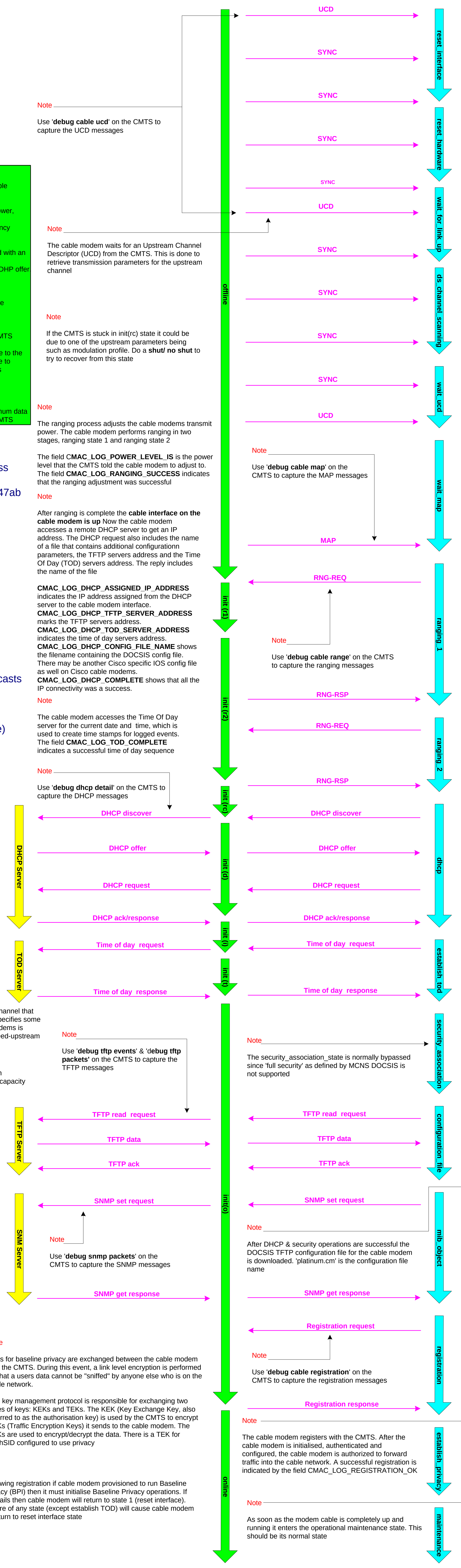
Total Modems On Upstream Channel - Number of cable modems currently sharing this upstream channel. This field also shows how many of these modems are active

Note

Received broadcasts - Broadcast packets received through this upstream interface
Multicasts - Multicast packets received through this upstream interface
Unicasts - Unicast packets received through this interface
Packets input - Packets received through upstream interface free from errors
Corrected - Error packets received through upstream interface that were corrected
Uncorrectable - Error packets received through upstream interface that could not be corrected
Discards - Packets discarded by this interface
Errors - Sum of all errors that prevented upstream transmission of packets
Unknown - Packets received that were generated using a protocol unknown to the Cisco uBR7246
Noise - Upstream packets corrupted by line noise
Microreflections - Upstream packets corrupted by microreflections

Noise and microreflection packets may be registered during unused contention bandwidth request slots or during slots which have collisions.

Use 'show cable hop' for correctable and uncorrectable FEC errors to gain an insight into how many IP packets are lost on that interface



Note

Use '**debug cable ucd**' on the CMTS to capture the UCD messages

Note

The cable modem waits for an Upstream Channel Descriptor (UCD) from the CMTS. This is done to retrieve transmission parameters for the upstream channel

Note

If the CMTS is stuck in init(rc) state it could be due to one of the upstream parameters being such as modulation profile. Do a **shut/ no shut** to try to recover from this state

Note

The ranging process adjusts the cable modems transmit power. The cable modem performs ranging in two stages, ranging state 1 and ranging state 2

The field C**MAC_LOG_POWER_LEVEL_IS** is the power level that the CMTS told the cable modem to adjust to. The field **CMAC_LOG_RANGING_SUCCESS** indicates that the ranging adjustment was successful

Note

After ranging is complete the **cable interface on the cable modem is up** Now the cable modem accesses a remote DHCP server to get an IP address. The DHCP request also includes the name of a file that contains additional configurationn parameters, the TFTP servers address and the Time Of Day (TOD) servers address. The reply includes the name of the file

CMAC_LOG_DHCP_ASSIGNED_IP_ADDRESS indicates the IP address assigned from the DHCP server to the cable modem interface.
CMAC_LOG_DHCP_TFTP_SERVER_ADDRESS marks the TFTP servers address.
CMAC_LOG_DHCP_TOD_SERVER_ADDRESS indicates the time of day servers address.
CMAC_LOG_DHCP_CONFIG_FILE_NAME shows the filename containing the DOCSIS config file. There may be another Cisco specific IOS config file as well on Cisco cable modems.
CMAC_LOG_DHCP_COMPLETE shows that all the IP connectivity was a success.

Note

The cable modem accesses the Time Of Day server for the current date and time, which is used to create time stamps for logged events. The field **CMAC_LOG_TOD_COMPLETE** indicates a successful time of day sequence

Note

Use '**debug dhcp detail**' on the CMTS to capture the DHCP messages

Note

Use '**debug cable map**' on the CMTS to capture the MAP messages

Note

Use '**debug cable range**' on the CMTS to capture the ranging messages

Note

Use '**debug tftp events**' & '**debug tftp packets'** on the CMTS to capture the TFTP messages

Note

The security_association_state is normally bypassed since 'full security' as defined by MCNS DOCSIS is not supported

Note

Use '**debug snmp packets**' on the CMTS to capture the SNMP messages

Note

After DHCP & security operations are successful the DOCSIS TFTP configuration file for the cable modem is downloaded. 'platinum.cm' is the configuration file name

Note

Use '**debug cable registration**' on the CMTS to capture the registration messages

Note

Keys for baseline privacy are exchanged between the cable modem and the CMTS. During this event, a link level encryption is performed so that a users data cannot be "sniffed" by anyone else who is on the cable network.

The key management protocol is responsible for exchanging two types of keys: KEKs and TEKs. The KEK (Key Exchange Key, also referred to as the authorisation key) is used by the CMTS to encrypt TEKs (Traffic Encryption Keys) it sends to the cable modem. The TEKs are used to encrypt/decrypt the data. There is a TEK for eachSID configured to use privacy

Note

Following registration if cable modem provisioned to run Baseline Privacy (BPI) then it must initialise Baseline Privacy operations. If BPI fails then cable modem will return to state 1 (reset interface). Failure of any state (except establish TOD) will cause cable modem to return to reset interface state

Note

The cable modem registers with the CMTS. After the cable modem is initialised, authenticated and configured, the cable modem is authorized to forward traffic into the cable network. A successful registration is indicated by the field CMAC_LOG_REGISTRATION_OK

Note

As soon as the modem cable is completely up and running it enters the operational maintenance state. This should be its normal state

Note

Use '**debug cable-modem mac log**' to capture these realtime log messages

```
CMAC_LOG_STATE_CHANGE                          reset_interface_state

CMAC_LOG_STATE_CHANGE                          reset_hardware_state

CMAC_LOG_STATE_CHANGE                          wait_for_link_up_state
CMAC_LOG_DRIVER_INIT_IDB_RESET                 0x8050D4F4
CMAC_LOG_LINK_DOWN
CMAC_LOG_LINK_UP

CMAC_LOG_STATE_CHANGE                          ds_channel_scanning_state
CMAC_LOG_UCD_MSG_RCVD                          1
CMAC_LOG_DS_64QAM_LOCK_ACQUIRED                405000000
CMAC_LOG_DS_CHANNEL_SCAN_COMPLETED

CMAC_LOG_STATE_CHANGE                          wait_ucd_state
CMAC_LOG_UCD_MSG_RCVD                          1
CMAC_LOG_UCD_MSG_RCVD                          1
CMAC_LOG_ALL_UCDS_FOUND

CMAC_LOG_STATE_CHANGE                          wait_map_state
CMAC_LOG_FOUND_US_CHANNEL                      1
CMAC_LOG_UCD_MSG_RCVD                          1
CMAC_LOG_UCD_NEW_US_FREQUENCY                  19984000
CMAC_LOG_SLOT_SIZE_CHANGED                     8
CMAC_LOG_UCD_UPDATED
CMAC_LOG_MAP_MSG_RCVD
CMAC_LOG_INITIAL_RANGING_MINISLOTS             40

MAC_LOG_STATE_CHANGE                           ranging_1_state
CMAC_LOG_RANGING_OFFSET_SET_TO                 9610
CMAC_LOG_POWER_LEVEL_IS                        30.0  dBmV (commanded)
CMAC_LOG_STARTING_RANGING
CMAC_LOG_RANGING_BACKOFF_SET                   0
CMAC_LOG_RNG_REQ_QUEUED                        0
CMAC_LOG_RNG_REQ_TRANSMITTED
CMAC_LOG_RNG_RSP_MSG_RCVD
CMAC_LOG_RNG_RSP_SID_ASSIGNED                  60
CMAC_LOG_ADJUST_RANGING_OFFSET                 2815
CMAC_LOG_RANGING_OFFSET_SET_TO                 12425

CMAC_LOG_STATE_CHANGE                          ranging_2_state
CMAC_LOG_RNG_REQ_QUEUED                        60
CMAC_LOG_RNG_REQ_TRANSMITTED
CMAC_LOG_RNG_RSP_MSG_RCVD
CMAC_LOG_RANGING_SUCCESS

CMAC_LOG_STATE_CHANGE                          dhcp_state
CMAC_LOG_DHCP_TFTP_SERVER_ADDRESS              10.200.68.11
CMAC_LOG_DHCP_TOD_SERVER_ADDRESS               10.200.69.33
CMAC_LOG_DHCP_SET_GATEWAY_ADDRESS
CMAC_LOG_DHCP_TZ_OFFSET                        604800
CMAC_LOG_DHCP_CONFIG_FILE_NAME                 platinum.cm
CMAC_LOG_DHCP_ERROR_ACQUIRING_SEC_SVR_ADDR
CMAC_LOG_DHCP_ERROR_ACQUIRING_LOG_ADDRESS
CMAC_LOG_DHCP_COMPLETE

CMAC_LOG_STATE_CHANGE                          establish_tod_state
CMAC_LOG_TOD_REQUEST_SENT                      10.200.69.33
CMAC_LOG_TOD_REPLY_RECEIVED                    3177750522
CMAC_LOG_TOD_COMPLETE

CMAC_LOG_STATE_CHANGE                          security_association_state
CMAC_LOG_SECURITY_BYPASSED

CMAC_LOG_STATE_CHANGE                          configuration_file_state
CMAC_LOG_LOADING_CONFIG_FILE                   platinum.cm
CMAC_LOG_CONFIG_FILE_PROCESS_COMPLETE

CMAC_LOG_STATE_CHANGE                          mib_object_state
CMAC_LOG_MIB_OBJECT_PROCESS_STARTED
CMAC_LOG_MIB_OBJECT_MSG                        Snd(SetRequest):
CMAC_LOG_MIB_OBJECT_VARBIND  Obj type=2mib-2.69.1.2.1.7.1,
                                               val=4
CMAC_LOG_MIB_OBJECT_MSG                        Rcv(GetResponse):
                                  error status=0(No error), error index=0
CMAC_LOG_MIB_OBJECT_VARBIND Obj type=2mib-2.69.1.2.1.7.1, val=4
CMAC_LOG_MIB_OBJECT_PROCESS_EXITING
CMAC_LOG_MIB_OBJECT_PROCESS_COMPLETED
CMAC_LOG_STATE_CHANGE                          registration_state
4d22h: 427991.641 CMAC_LOG_REG_REQ_MSG_QUEUED
4d22h: 427991.645 CMAC_LOG_REG_REQ_TRANSMITTED
4d22h: 427991.649 CMAC_LOG_REG_RSP_MSG_RCVD
4d22h: 427991.653 CMAC_LOG_COS_ASSIGNED_SID                 1/60
4d22h: 427991.653 CMAC_LOG_RNG_REQ_QUEUED                   60
4d22h: 427991.657 CMAC_LOG_REGISTRATION_OK

CMAC_LOG_STATE_CHANGE                          establish_privacy_state
CMAC_LOG_PRIVACY_NOT_CONFIGURED

CMAC_LOG_STATE_CHANGE                          maintenance_state
```

```
Router#show controllers cable-modem 0 mac state

MAC State:             maintenance_state
Ranging SID:            60
Registered:            TRUE
Privacy Established:     FALSE

MIB Values:
  Mac Resets:      10
  Sync lost:       0
  Invalid Maps:     0
  Invalid UCDs:     0
  Invalid Rng Rsp:   0
  Invalid Reg Rsp:   0
  T1 Timeouts:      0
  T2 Timeouts:      0
  T3 Timeouts:      24
  T4 Timeouts:      0
  Range Aborts:     0

DS ID:                       1
DS Frequency:             405000000
DS Symbol Rate:            5056941
DS QAM Mode                64QAM
DS Search:
  79 453000000 855000000 6000000
  80  93000000 105000000 6000000
  81 111025000 117025000 6000000
  82 231012500 327012500 6000000
  83 333025000 333025000 6000000
  84 339012500 399012500 6000000
  85 405000000 447000000 6000000
  86 123012500 129012500 6000000
  87 135012500 135012500 6000000
  88 141000000 171000000 6000000
  89 219000000 225000000 6000000
  90 177000000 213000000 6000000
  91  55752700  67753300 6000300
  92  79753900  85754200 6000300
  93 175758700 211760500 6000300
  94 121756000 169758400 6000300
  95 217760800 397769800 6000300
  96  73753600 115755700 6000300
  97 403770100 595779700 6000300
  98 601780000 799789900 6000300
  99 805790200 997799800 6000300

US ID:                1
US Frequency:             19984000
US Power Level:            30.0 (dBmV)
US Symbol Rate:            1280000
Ranging Offset:           12424
Mini-Slot Size:         8
Change Count:             39

Preamble Pattern:        CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC CC CC
                    CC CC CC CC CC CC CC CC  CC CC CC CC CC CC 0D 0D
Burst Descriptor  0:
  Interval Usage Code:      1
  Modulation Type:         1
  Differential Encoding:    2
  Preamble Length:        64
  Preamble Value Offset:    952
  FEC Error Correction:     0
  FEC Codeword Info Bytes:  16
  Scrambler Seed:          338
  Maximum Burst Size:       1
  Guard Time Size:         8
  Last Codeword Length:     1
  Scrambler on/off:        1

Burst Descriptor  1:
  Interval Usage Code:      3
  Modulation Type:         1
  Differential Encoding:    2
  Preamble Length:        128
  Preamble Value Offset:    896
  FEC Error Correction:     5
  FEC Codeword Info Bytes:  34
  Scrambler Seed:          338
  Maximum Burst Size:       0
  Guard Time Size:         48
  Last Codeword Length:     1
  Scrambler on/off:        1

Burst Descriptor  2:
  Interval Usage Code:      4
  Modulation Type:         1
  Differential Encoding:    2
  Preamble Length:        128
  Preamble Value Offset:    896
  FEC Error Correction:     5
  FEC Codeword Info Bytes:  34
  Scrambler Seed:          338
  Maximum Burst Size:       0
  Guard Time Size:         48
  Last Codeword Length:     1
  Scrambler on/off:        1

Burst Descriptor  3:
  Interval Usage Code:      5
  Modulation Type:         1
  Differential Encoding:    2
  Preamble Length:        72
  Preamble Value Offset:    944
  FEC Error Correction:     5
  FEC Codeword Info Bytes:  75
  Scrambler Seed:          338
  Maximum Burst Size:       6
  Guard Time Size:         8
  Last Codeword Length:     1
  Scrambler on/off:        1

Burst Descriptor  4:
  Interval Usage Code:      6
  Modulation Type:         1
  Differential Encoding:    2
  Preamble Length:         80
  Preamble Value Offset:    936
  FEC Error Correction:     8
  FEC Codeword Info Bytes:  220
  Scrambler Seed:          338
  Maximum Burst Size:       0
  Guard Time Size:         8
  Last Codeword Length:     1
  Scrambler on/off:        1

Config File:
  Network Access:          TRUE
  Maximum CPEs:            3
  SNMP MIB Object:         X
  Baseline Privacy:
   Auth. Wait Timeout:     10
   Reauth. Wait Timeout:   10
   Auth. Grace Time:       600
   Op. Wait Timeout:       1
   Retry Wait Timeout:     1
   TEK Grace Time:         600
   Auth. Reject Wait Time: 60
  COS  1:
   Assigned SID:          60
   Max Downstream Rate:    10000000
   Max Upstream Rate:      1024000
   Upstream Priority:     7
   Min Upstream Rate:      0
   Max Upstream Burst:     0
   Privacy Enable:        FALSE

Ranging Backoff Start:     0 (at initial ranging)
Ranging Backoff End:       3 (at initial ranging)
Data Backoff Start:       0 (at initial ranging)
Data Backoff End:         4 (at initial ranging)

IP Address:                 10.200.69.44
Net Mask:                  255.255.255.240
TFTP Server IP Address:     10.200.68.11
Time Server IP Address:     10.200.69.33
Config File Name:           platinum.cm
Time Zone Offset:           604800
Log Server IP Address:      0.0.0.0

Drop Ack Enabled:     TRUE

Mac Sid Status
Max Sids: 4  Sids In Use: 1
Mac Sid 0:
   Sid: 60    State: 2
Mac Sid 1:
   Sid: 0    State: 1
Mac Sid 2:
   Sid: 0    State: 1
Mac Sid 3:
   Sid: 0    State: 1
Test sid queue:            0

Router#
```

reset_interface_state
reset_hardware_state
wait_for_link_up_state
ds_channel_scanning_state
wait_ucd_state
wait_map_state
ranging_1_state
ranging_2_state
dhcp_state
establish_tod_state
security_association_state
configuration_file_state
mib_object_state
registration_state
establish_privacy_state
maintenance_state

Note

MAC State - Current operational state of the MAC uBR900 layer
Ranging SID - Service ID used for ranging requests
Registered - Whether or not the Cisco uBR900 is currently registered with the CMTS
Privacy Established - Whether or not keys for baseline privacy exchanged between Cisco uBR900 series & CMTS, establishing privacy

Mac Resets - Times uBR900 series reset or initialized this interface
Sync lost - Times uBR900 series lost synchronization with the downstream channel
Invalid Maps - Times uBR900 series received invalid MAP messages
Invalid UCDs - Times uBR900 series received invalid UCD messages
Invalid Rng Rsp - Times uBR900 series received invalid ranging response messages
Invalid Reg Rsp - Times uBR900 series received invalid registration response messages
T1 Timeouts - uBR900 series not receiving valid UCD from CMTS within specified time
T2 Timeouts - uBR900 series not receiving maintenance opportunities for ranging messages from CMTS within specified time
T3 Timeouts - uBR900 series not receiving a response within specified time from CMTS to RNG-REQ msg during initial maintenance
T4 Timeouts - uBR900 series not receiving response within specified time from CMTS to periodic maintenance request
Range Aborts - Times ranging process was aborted by CMTS

Note

DS Channel ID
received on a single node or RF segment. **Note:** Changing this parameter will force all modems offline
DS Frequency - Downstream frequency in symbols per second. Each symbol is 6 bits in 64QAM & 8 bits in 256 QAM
DS Symbol Rate - Downstream frequency in symbols per second
DS QAM Mode - Downstream modulation scheme being used by uBR900, 64/256 QAM
DS Search - Frequency bands scanned by uBR900 when searching for downstream channel. uBR900 series default frequency

US ID

port as follows: US ID 1 = u0, US ID 2 = u1 etc
US Frequency - Transmission frequency used by uBR900 in the upstream direction
US Power Level - Transmit power level of uBR900 in the upstream direction
US Symbol Rate - Upstream symbol rate in symbols per second
Ranging Offset - Delay correction (in increments of 6.25 µs/64) applied by uBR900 to CMTS upstream frame time derived at uBR900.

equal to round-trip delay of uBR900 from CMTS.
Mini-Slot Size
Change Count - Incremented by 1 by CMTS whenever the values of this channel descriptor change. If value of count in subsequent

disregard remainder of message
Preamble Pattern - Byte pattern used for the preamble.

Note

Network Access - Indicates whether or not the Cisco uBR900 series has access to the HFC network
Maximum CPEs - Max number of host computers that can be active on uBR900s Ethernet interface at any one time
Auth. Wait Timeout - Seconds uBR900 waits for reply after sending Authorization Request message to CMTS
Reauth. Wait Timeout - Seconds uBR900 waits for reply after it has sent an Authorization Request message to CMT in response to reauthorization request or Authorization Invalid message fro CMTS
Auth. Grace Time - Seconds before current authorization is set to expire that grace timer begins, signaling uBR900 to begin Baseline Privacy Initiative (BPI) reauthorization process
Op. Wait Timeout - Seconds TEK state machine waits for reply from CMTS after sending its initial Key Request for its SID's keying material
Retry Wait Timeout - Seconds TEK state machine waits for replacement key for this SID after TEK grace timer has expired & request for replacement key has been made
TEK Grace Time - Seconds before current TEK is set to expire that TEK grace timer begins, signaling TEK state machine to request replacement key
Auth. Reject Wait Time - Seconds uBR900 waits before sending another Authorization Request message toe CMTS after it has received Authorization Reject message

Note

Burst Descriptor - Compound type/length/value (TLV) encoding that defines, for each type of upstream usage interval, the physical-layer characteristics used during that interval. Each burst descriptor given identifying number
Interval Usage Code - Each upstream transmit burst belongs to a class given a number called the IUC (interval usage code). MAP messages allocate certain portions of the upstream TDMA capacity to different types of messages. Each message type uses a burst profile. The following types currently defined:

1. Request: bandwidth request slot
2. Request/Data: bandwidth request or data slot
3. Initial Maintenance: initial link registration contention slot
4. Station Maintenance: link keep-alive slot
5. Short Data Grant: short data burst slot
6. Long Data Grant: long data burst slot

Modulation Type - Upstream modulation format (1 = QPSK; 2 = 16QAM)
Differential Encoding - Indicates whether or not differential encoding is used. (1 = yes; 2 = no)
Preamble Length - Length of preamble in bits. Value an integral number of symbols, multiple of 2 for QPSK, multiple of 4 fo 16QAM
FEC Error Correction - Length of forward error correction in bytes. Range is 0-10 bytes. Value of 0 implies no forward error correction
FEC Codeword Info Bytes - Number of information bytes in the FEC codeword
Scrambler Seed - 15-bit seed value loaded at beginning of each burst after register has been cleared. Not used if scrambler is off
Maximum Burst Size - Max number of bytes that can be transmitted during this burst type. When the interval type is Short Data Grant, value must be > 0. If value is 0, the burst size limited elsewhere.
Guard Time Size - Amount of time in symbols between center of last symbol of a burst & center of first symbol of the preamble of an immediately following burst in an upstream transmission from uBR900 to CMTS.
Last Codeword Length - Indicates whether length of last codeword is fixed or shortened. (1 = fixed; 2 = shortened)
Scrambler on/off - Indicates whether or not a scrambler is enabled in the upstream modulator. (1 = on; 2 = off)

Note

Assigned SID - Service ID assigned by the CMTS for the corresponding service class
Max Downstream Rate - Max downstream rate in bits per second that CMTS is permitted to forward to CPE unicast MAC addresses learned or configured as mapping to this uBR900. (Does not include MAC packets addressed to broadcast or multicast MAC addresses)
Max Upstream Rate - Max upstream rate in bits per second that uBR900 series can forward to RF network. This includes packet PDU data packets addressed to broadcast or multicast addresses
Upstream Priority - Relative priority assigned to this service class for data transmission in upstream channel. Higher numbers indicate highe priority
Min Upstream Rate - Date rate in bits per second that will be guaranteed to this service class on the upstream channel
Max Upstream Burst - Max transmit burst in bytes allowed for service class on upstream channel
Privacy Enable - Indicates if Baseline Privacy is enabled for this service class.
Ranging Backoff Start - The number of initial ranging opportunities skipped by the modem will be a random number expressed as a power of 2 start & end. All modems are supposed to pick a different random number. Valid values are from 0 to 15
Ranging Backoff End - Final back-off window for initial ranging contention, expressed as a power of 2. Valid values are from 0 to 15
Data Backoff Start - Initial back-off window for contention data and requests, expressed as a power of 2. Valid values are from 0 to 15
Data Backoff End - Final back-off window for contention data and requests, expressed as a power of 2. Valid values are from 0 to 15
IP Address - IP address of the cable interface
Net Mask - Subnet mask of the cable interface
TFTP Server IP Address - IP address of the CMTS TFTP server
Time Server IP Address - IP address of the CMTS Time of Day (TOD) server
Config File Name - Name of the configuration file that is downloaded from the TFTP server to provide the Cisco uBR900 series with its DOCSIS TFTP configuration file
Time Zone Offset - Offset of local time zone from Greenwich Mean Time (GMT) in seconds used with the TOD server reply. Nothing to do with receiving anything from the DHCP server