

# **PacketCable™ Architecture Call Flows Technical Report**

## **PSTN Telephone to On-Net MTA**

**PKT-TR-CF-PSTN-ON-C01-071129**

**CLOSED**

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## Document Status Sheet

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## 1 INTRODUCTION

This document contains “use cases” and their associated end-to-end call flows for a basic set of PacketCable services. The purpose of the use cases and call flows is to show the contributions made by the many PacketCable 1.0 specifications to a representative PacketCable service. The end-to-end call flows described in this document are for reference purpose only and are not intended to be prescriptive or limit the realization of any PacketCable service. Although this document refers to “calls” and “call flows,” there are obviously very significant differences between how a voice communication is handled within a PacketCable network, and how a traditional circuit-switched “telephone call” is handled within the PSTN by traditional telecommunications carriers. No inferences of technical or other similarity between a PSTN “call” and a PacketCable “call,” or between PSTN telecommunications carriers, and providers of PacketCable networks, are intended or should be drawn from this document.

The following specifications are reflected in this call flow:

- DOCSIS
- DQoS for an embedded MTA
- Event Messages
- NCS
- Security
- TGCP

The following specifications are NOT reflected in this call flow:

- ISTEP
- MIBs
- Provisioning

The following table is used to indicated the various entities in all the call flow diagrams

Color	Interfaces
Black	MGCP (NCS, TGCP) (N, T)
Blue	DQOS (D)
Brown	SS7 (S)
Red	Event Messages (E)
Light Blue	Provisioning (P)
Pink	Undefined but necessary call flow (U)

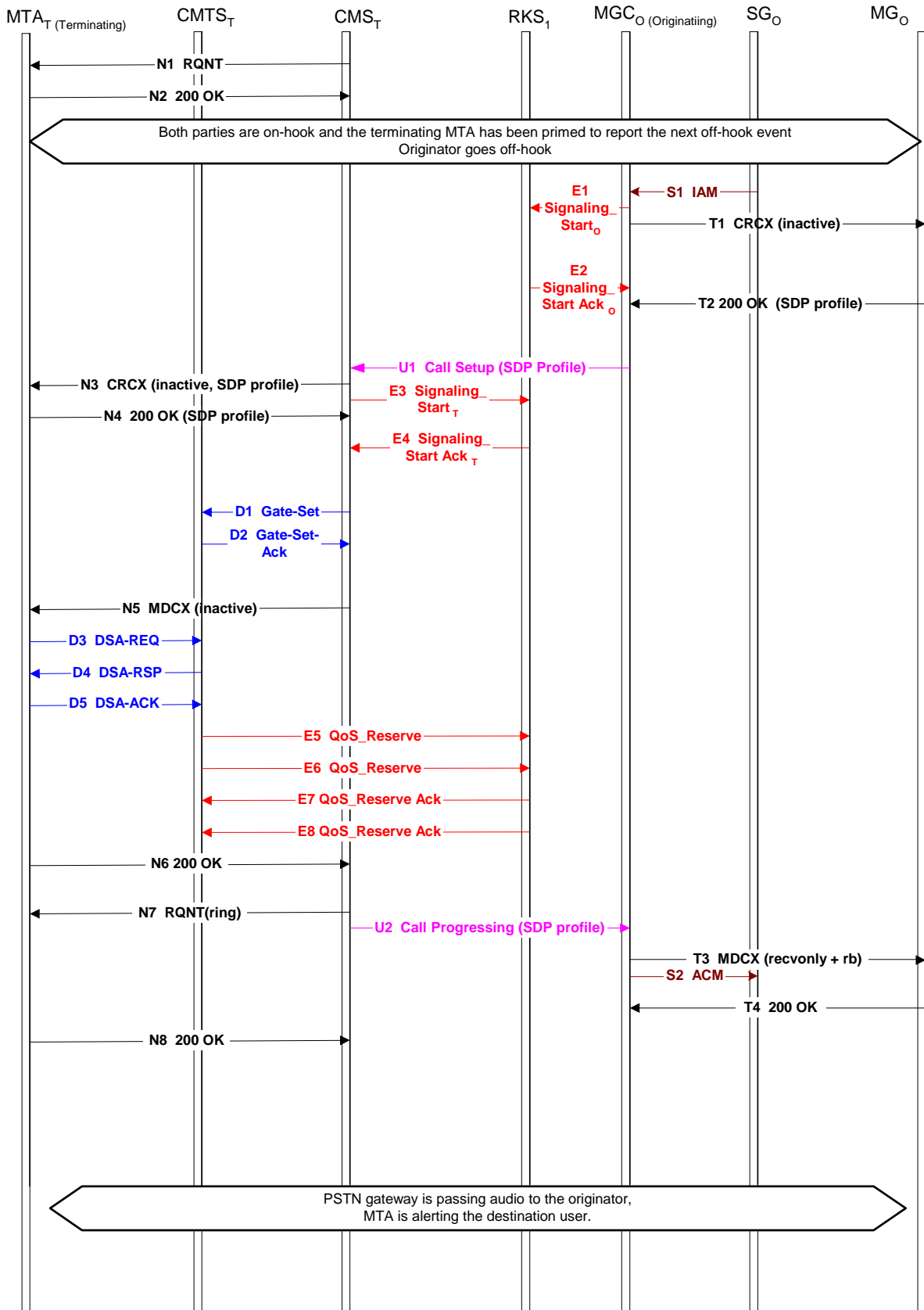
## 2 USE CASE: PSTN TELEPHONE TO ON-NET BASIC CALL

This case describes the most basic PacketCable PSTN Telephone to on-Net service, with a single MSO’s network connected to the PSTN. For PacketCable 1.0, it is assumed that the originating MG is using a MGC and SG, and the terminating MTA is using a CMS and CMTS. The MGC will generate Originating Event Messages for the RKS, and the CMS will generate Terminating Event Messages for the RKS.

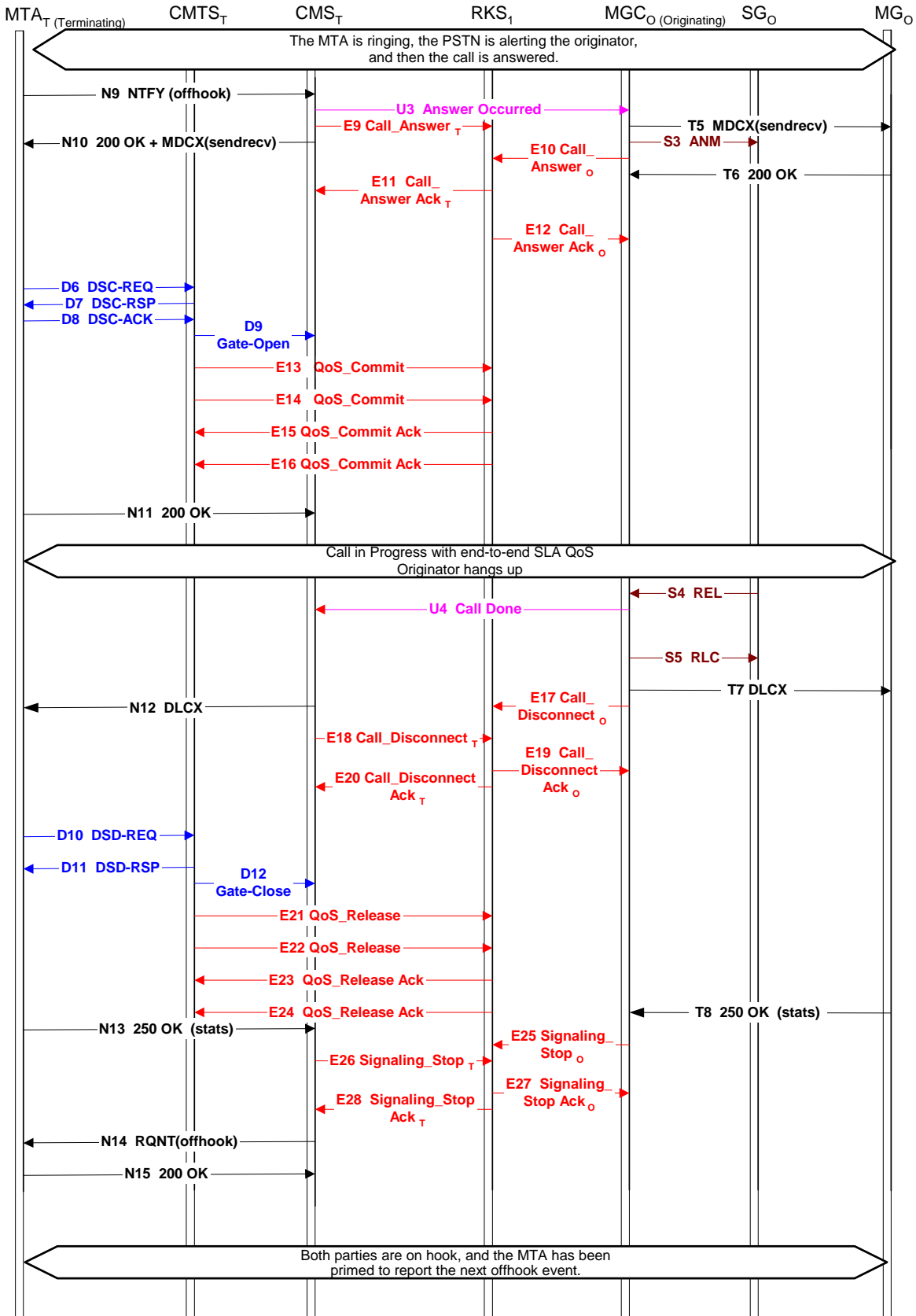
### 2.1 Call Flow Diagrams

The call flow indicates a normal PSTN Telephone to on-net call without any error conditions. Black N1 to Nx arrows will represent NCS messages, blue D1 to Dx arrows will represent DQOS messages, etc. (see table above).

### Off-On Basic Call Flow (part 1)



### Off-On Basic Call Flow (part 2)



## 2.2 Call Flow Details

Flow	Flow Description
<b>Initialization</b>	
<p>N1 &lt;NCS&gt;</p>	<p>CMS sends MTA a NotificationRequest instructing MTA<sub>t</sub> to provide dial-tone on off-hook event, and to collect digits according to the digit map.</p> <pre>RQNT 1201 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 N: ca@cal.cablelabs.com:5678 X: 0123456789AB R: hd(A, E(R(hu, [0-9#*T](D)), S(dl))) D: (0T   00T   303[2-9]xxxxxx   720[2-9]xxxxxx   1[2-9]xxxxxxxxxx   [3469]11   0[2-9]xxxxxxxxxx   01[2-9]xxxxxx)</pre>
<p>N2 &lt;NCS&gt;</p>	<p>MTA sends CMS an ACK in response to the command, repeating in the response the transaction id that the Call Agent attached to the request and providing a return code indicating success:</p> <pre>200 1201 OK</pre>
<b>Service Request</b>	
<p>S1 &lt;SS7&gt;</p>	<p>The SG sends the MGC an SS7 Initial Address Message (IAM)</p>
<p>E1 &lt;EM&gt;</p>	<p>MGC creates the BillingCorrelationID for this transaction. MGC sends RKS a Signaling_Start Event Message for the originating side.</p> <pre>Code: Accounting Request (4) Packet identifier: 0x23 (35) Length: 244 Authenticator Attribute value pairs   t:NAS IP Address(4) l:6, Value:10.32.32.40   t:Acct Status Type(40) l:6, Value:Interim Update(3)   t:Vendor Specific(26) l:84, Vendor:CableLabs(4491) Event Message Version ID: 1 BCID   Timestamp: 1041973756   Element ID: 41   Time Zone: DST: 0, Offset: -070000</pre>

Flow	Flow Description
	<pre> Event Counter: 25 Event Message Type: Signaling_Start (1) Element Type: MGC (3) Element ID: 41 Time Zone: DST: 0, Offset: -070000 Sequence Number: 49 Event Time: 2003010714 916.328 Status: 0x00000000     .... ..00 = Status: No Error (0x00000000)     .... ..0.. = Event Origin: Trusted Element (0x00000000)     .... 0... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 7 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:10, Vendor:CableLabs(4491)     t:Direction_indicator(37) l:4, Value:Originating(1) t:Vendor Specific(26) l:34, Vendor:CableLabs(4491)     t:MTA_Endpoint_Name(3) l:28, Value:" ds/dsl-1/1@mg.cablelabs.com " t:Vendor Specific(26) l:28, Vendor:CableLabs(4491)     t:Calling_Party_Number(4) l:22, Value:" 3036613880" t:Vendor Specific(26) l:28, Vendor:CableLabs(4491)     t:Called_Party_Number(5) l:22, Value:" 3036613887" t:Vendor Specific(26) l:28, Vendor:CableLabs(4491)     t:Routing_Number(25) l:22, Value:" 3036613870" t:Vendor Specific(26) l:16, Vendor:CableLabs(4491)     t:Carrier_identification_code(23) l:10, value:1234" t:Vendor Specific(26) l:14, Vendor:CableLabs(4491) Trunk Type : SS7 direct trunk group member (0X0003)                     </pre>

Flow	Flow Description
<p>T1 &lt;TGCP&gt;</p>	<p>MGC sends MG a create connection message. The connection is created in inactive mode.</p> <pre>CRCX 5049 ds/ds1-1/1@mg.cablelabs.com MGCP 1.0 TGCP 1.0 C: A3C47F21456789F0 L: mp:10; 10; 10; 10, a:PCMU; PCMA; G728; G729E, sc-rtp: 62/51; 60/50, sc-rtcp:81/71; 80/70 M: inactive X: 0123456789AC</pre>
<p>E2 &lt;EM&gt;</p>	<p>RKS sends MGC a RADIUS ACK in response to Signaling_Start for the originating side.</p> <pre>Code: Accounting Response (5) Packet identifier: 0x23 (35) Length: 20 Authenticator</pre>
<p>T2 &lt;TGCP&gt;</p>	<p>The MG sends the MGC an acknowledgement of the CRCX, adding its own SDP profile.</p> <pre>200 5049 OK I: FDE234C8  v=0 o=- 25678 753849 IN IP4 128.96.41.1 s=- c=IN IP4 128.96.41.1 t=0 0 m=audio 3456 RTP/AVP 0 8 15 96 a=mptime: 10 10 10 10 a=X-pc-csuites-rtp: 62/51 60/50 a=X-pc-csuites-rtcp:81/71 80/70 a=rtpmap:0 PCMU/8000 a=rtpmap:8 PCMA/8000 a=rtpmap:15 G728/8000 a=rtpmap:96 G729E/8000 a=X-pc-secret:base64:pV6BIIHWt+0gDkpgnuxgTfROxYAemhYJTHWgHnt1crTtEUKFatJfSdEFVQueo==</pre>
<p>U1 &lt;Undefined&gt;</p>	<p>The MGC sends the CMS all local call setup information. [proprietary]</p>
<p>N3 &lt;NCS&gt;</p>	<p>CMS sends MTA a Create Connection request. This message contains the session description from MG. This is a “no-ring” request because no ring pattern is specified.</p>

Flow	Flow Description
	<pre> CRCX 1202 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 C: A3C47F21456789F0 L: mp:10; 10; 10; 10, a:PCMU; PCMA; G728; G729E, sc-rtp:62/51; 60/50, sc-rtcp:81/71; 80/70 M: inactive X: 0123456789B0 R: hd N: ca@ca1.cablelabs.com:5678  v=0 o=- 25678 753849 IN IP4 128.96.41.1 s=- c=IN IP4 128.96.41.1 t=0 0 m=audio 3456 RTP/AVP 0 8 15 96 a=mptime: 10 10 10 10 a=X-pc-csuites-rtp:62/51 60/50 a=X-pc-csuites-rtcp:81/71 80/70 a=rtpmap:0 PCMU/8000 a=rtpmap:8 PCMA/8000a=rtpmap:15 G728/8000 a=rtpmap:96 G729E/8000 a=X-pc-secret:base64:pV6BIIHWt+0gDkpgnuxgTfROxYAemhYJTHWgHNT1crTtEUKFatJfSdEFVQueo==                     </pre>
<p><b>E3</b> &lt;EM&gt;</p>	<p>CMS creates the BillingCorrelationID for this transaction. CMS sends RKS a Signaling_Start Event Message for the terminating side.</p> <pre> Code: Accounting Request (4) Packet identifier: 0x24 (36) Length: 244 Authenticator Attribute value pairs   t:NAS IP Address(4) l:6, Value:10.32.32.40   t:Acct Status Type(40) l:6, Value:Interim Update(3)   t:Vendor Specific(26) l:84, Vendor:CableLabs(4491)   Event Message Version ID: 1   BCID     Timestamp: 1041973760     Element ID: 40     Time Zone: DST: 0, Offset: -070000                     </pre>

Flow	Flow Description
	<pre> Event Counter: 26 Event Message Type: Signaling_Start (1) Element Type: CMS (1) Element ID:      40 Time Zone: DST: 0, Offset: -070000 Sequence Number: 50 Event Time: 2003010714 920.805 Status: 0x00000000     .... ..00 = Status: No Error (0x00000000)     .... ..0.. = Event Origin: Trusted Element (0x00000000)     .... 0... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 7 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:10, Vendor:CableLabs(4491) t:Direction_indicator(37) l:4, Value:Terminating(2) t:Vendor Specific(26) l:34, Vendor:CableLabs(4491) t:MTA_Endpoint_Name(3) l:28, Value:" aaln/1@mtat.cablelabs.com " t:Vendor Specific(26) l:28, Vendor:CableLabs(4491) t:Calling_Party_Number(4) l:22, Value:"          3036613880" t:Vendor Specific(26) l:28, Vendor:CableLabs(4491) t:Called_Party_Number(5) l:22, Value:"          3036613887" t:Vendor Specific(26) l:28, Vendor:CableLabs(4491) t:Routing_Number(25) l:22, Value:"          3036613870"                     </pre>
<p>N4 &lt;NCS&gt;</p>	<p>MTA sends CMS a confirmation of transaction complete for CRCX. This confirmation includes its own SDP profile.</p> <pre> 200 1202 OK I: 32F345E2                     </pre>

Flow	Flow Description
	<pre>v=0 o=- 25678 753849 IN IP4 128.96.63.25 s=- c=IN IP4 128.96.63.25 t=0 0 m=audio 1296 RTP/AVP 0 8 15 96 a=mptime: 10 10 10 10 a=X-pc-csuites-rtp:62/51 60/50 a=X-pc-csuites-rtcp:81/71 80/70 a=rtpmap:0 PCMU/8000 a=rtpmap:8 PCMA/8000 a=rtpmap:15 G728/8000 a=rtpmap:96 G729E/8000 a=X-pc-secret:base64:+SW6XV3LJugCh1fvwhzNEoFpnshn7rrZjLTx4gy74QNVjXlCJ5z/xV6eoltQtw==</pre>
<p><b>E4</b> &lt;EM&gt;</p>	<p>RKS sends CMS a RADIUS ACK in response to Signaling_Start for the terminating side.</p> <pre>Code: Accounting Response (5) Packet identifier: 0x24 (36) Length: 20 Authenticator</pre>
<p><b>D1</b> &lt;DQoS&gt;</p>	<p>CMS sends CMTS<sub>t</sub> a Gate-Set message.</p> <pre>Transaction ID - 3178 Subscriber - 128.96.63.25 Gate ID - 37125</pre> <p>Event Generation Info</p> <pre>RKS- Addr-1 - RKS1 RKS-Port-1 - 1813 Flags - 0 (Do not batch) RKS- Addr-2 - RKS2 RKS-Port-2 - 1813 Billing Correlation ID -&lt;id&gt;(24 octects)</pre> <p>GateSpec</p> <pre>Direction 1 (up) Protocol 17 (UDP)</pre>

Flow	Flow Description
	<pre> Flags                0 Session Class        1 SourceAddress        128.96.63.25 DestinationAddress   128.96.41.1 SourcePort           0 Destination Port     3456 DS                   0x0a  DiffServ code point value for upstream packets T1                   200 T7                   200 T8                   0 r                    12400 b                    124  p                    12400 m                    124 M                    124 R                    12400 S                    800µs  GateSpec Direction            0 (down) Protocol              17 (UDP) Flags                0 Session Class        1 SourceAddress        128.96.41.1 DestinationAddress   128.96.63.25 SourcePort           0 Destination Port     1296 DS                   0 T1                   200 T7                   200 T8                   0 r                    12400 b                    124  p                    12400 m                    124 M                    124 R                    12400 S                    0                     </pre>
<p>D2 &lt;DQoS&gt;</p>	<p>CMTS sends CMS an acknowledgment of the Gate-Set with its GateID included in the message.</p>

Flow	Flow Description
	Transaction ID - 3178 Subscriber - 128.168.63.25 Gate ID - 37125 Activity Count - 2
N5 <NCS>	<p>CMS sends MTA a MDCX message. This message indicates that the MTA<sub>t</sub> should remain inactive but reserve send/receive bandwidth. This message also contains the session description of MTA<sub>t</sub>.</p> <pre> MDCX 1203 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 C: A3C47F21456789F0 I: 32F345E2 M: inactive X: 0123456789AE R: hu L: dq-gi:37125; N: ca@cal.cablelabs.com:5678  v=0 o=- 4723891 7428910 IN IP4 128.96.41.1 s=- c=IN IP4 128.96.41.1 t=0 0 m=audio 3456 RTP/AVP 0 8 15 96 a=mptime: 10 10 10 10 a=X-pc-csuites-rtp: 62/51 60/50 a=X-pc-csuites-rtcp:81/71 80/70 a=rtpmap: 0 PCMU/8000 a=rtpmap:8 PCMA/8000 a=rtpmap:15 G728/8000 a=rtpmap:96 G729E/8000 a=X-pc-secret: pV6BIIHWt+0gDkpgnuxgTfROxYAemhYJTHWgHNt1crTtEUKFatJfSdEFVQueo==                     </pre>
D3 <DQoS>	<p>MTA sends CMTS a DSA request asking for bandwidth allocation in the access network.</p> <pre> DSA-REQ Transaction ID 2  Upstream Service Flow Service Flow Reference 1 QoSParameterSetType Admitted(2) ServiceFlowScheduling UGS(6) Request/Transmission Policy 0x0000017F NominalGrantInterval 10000us                     </pre>

Flow	Flow Description
	<p>ToleratedGrantJitter 800us                      GrantsPerInterval 1                      UnsolicitedGrantSize 154</p> <p><i>DownStreamServiceFlow</i>                      Service Flow Reference 2                      QoSParameterSetType Admitted(2)                      MinimumReservedRate 112000                      MaxSustainedTrafficRate 112000                      AssumedMinResRatesPktSiz 140                      MaxTrafficBurst 1522                      TrafficPriority 5</p> <p><i>UpstreamPacketClassification</i>                      ServiceFlowReference 1                      PacketClassifierReference 1                      ClassifierPriority 128                      ClassifierActivationState Inactive (0)                      IPSourceAddress 128.96.63.25                      IPSourcePortStart 1296                      IPSourcePortEnd 1296                      IPDestinationAddress 128.96.41.1                      IPDestinationPortStart 3456                      IPDestinationportEnd 3456                      IPProtocol 17 (UDP)</p> <p><i>DownstreamPacketClassification</i>                      ServiceFlowReference 2                      PacketClassifierReference 2                      ClassifierPriority 128                      ClassifierActivationState 0 (inactive)                      IPSourceAddress 128.96.41.1                      IPDestinationAddress 128.96.63.25                      IPDestinationPortStart 1296                      IPDestinationPortEnd 1296                      IPProtocol 17 (UDP)</p> <p><i>Authorization Block</i>                      TLV Encoding that must include the Gate-id (37125)</p> <p><i>HMAC</i></p>
D4	CMTS sends MTA a DSA response indicating that the request has been granted.

Flow	Flow Description
<DQoS>	<p>DSA-RSP                      TransactionID 2                      ConfirmationCode 0 (Success)</p> <p><i>Upstream Service Flow</i>                      ServiceFlowReference 1                      ServiceFlowID 11001                      ServiceID 1801                      QoSParameterSetType Admitted(2)                      TimeoutAdmitted 200s                      ServiceFlowScheduling UGS(6)                      Request/TransPolicy 0x0000017F                      NominalGrantInterval 10000us                      ToleratedGrantJitter 800us                      GrantsPerInterval 1                      UnsolicitedGrantSize 154</p> <p><i>DownStreamServiceFlow</i>                      ServiceFlowReference 2                      ServiceFlowID 12001                      QoSParameterSetType Admitted(2)                      TimeoutAdmitted 200s                      Minimum ReservedRate 112000                      MaxSustainedTrafficRate 112000                      AssumedMinResRatePktSiz 140                      MaxTrafficBurst 1522                      TrafficPriority 5</p> <p><i>UpstreamPacketClassification</i>                      ServiceFlowReference 1                      ServiceFlowID 11001                      PacketClassifierReference 1                      PacketClassifierID 13001                      ClassifierPriority 128                      ClassifierActivationState Inactive (0)                      IPSourceAddress 128.96.63.25                      IPSourcePortStart 1296                      IPSourcePortEnd 1296                      IPDestinationAddress 128.96.41.1                      IPDestinationPortStart 3456                      IPDestinationPort End 3456                      IPProtocol UDP(17)</p>

Flow	Flow Description
	<p><i>DownstreamPacketClassification</i>                      ServiceFlowReference 2                      Service Flow Identifier 12001                      PacketClassifierReference 2                      PacketClassifierID 13002                      ClassifierPriority 128                      ClassifierActivationState Inactive (0)                      IPSourceAddress 128.96.41.1                      IPDestinationAddress 128.96.63.25                      IPDestinationPortStart 1296                      IPDestinationPortEnd 1296                      IPProtocol UDP(17)</p> <p><i>Authorization Block</i>                      TLV Encoding that must include the Resource-id (71210)</p> <p><b>HMAC</b></p>
<p>D5 &lt;DQoS&gt;</p>	<p>MTA sends CMTS an acknowledgement of the DSA-RSP.</p> <p>DSA-ACK                      TransactionID 2                      ConfirmationCode Success(0)</p>
<p>E5 &lt;EM&gt;</p>	<p>CMTS<sub>0</sub> send a QoS_Reserved message to RKS for upstream bandwidth.</p> <p>Code: Accounting Request (4)                      Packet identifier: 0x2 (2)                      Length: 202                      Authenticator                      Attribute value pairs                      t:NAS IP Address(4) l:6, Value:10.32.4.3                      t:Acct Status Type(40) l:6, Value:Interim Update(3)                      t:Vendor Specific(26) l:84, Vendor:CableLabs(4491)                      Event Message Version ID: 1                      BCID                      Timestamp: 623970361                      Element ID: 55555</p>

Flow	Flow Description
	<pre> Time Zone: DST: 0, Offset: -070000 Event Counter: 536870912 Event Message Type: QoS_Reserve (7) Element Type: CMTS (2) Element ID:      4 Time Zone: DST: 0, Offset: -070000 Sequence Number: 3 Event Time: 20021108144318.041 Status: 0x00000000     .... = Status: No Error (0x00000000)     .... = Event Origin: Trusted Element (0x00000000)     .... = Event Message Proxied: Not proxied (0x00000000) Priority: 128 Attribute Count: 4 Event Object: 0 t:EM_Header Data structure(1) 1:78, Value: t:Vendor Specific(26) 1:12, Vendor:CableLabs(4491) t:MTA_UDP_Portnum(26) 1:6, Value:1296 t:Vendor Specific(26) 1:12, Vendor:CableLabs(4491) t:SF_ID(30) 1:6, Value:315 t:Vendor Specific(26) 1:10, Vendor:CableLabs(4491) t:Flow Direction(50) 1:4, Value:Upstream(1) t:Vendor Specific(26) 1:52, Vendor:CableLabs(4491) QoS Status: 0x0000207d Activated (1)     .... = Status Indication: Resource Reserved but not     .... = Service Flow Scheduling Type: 1     .... = Grant Interval: 1     .... = Tolerated Grant Jitter: 1     .... = Grants Per Interval: 1     .... = Unsolicited Grant Size: 1                 </pre>

Flow	Flow Description
	<pre> ..... 0... .. = Traffic Priority: 1 .....0 .. = Maximum Sustained Rate: 1 .....0. .... = Maximum Traffic Burst: 1 .....0.. .... = Minimum Reserved Traffic Rate: 1 ..... 0... .. = Minimum Packet Size: 1 .....0 .. = Maximum Concatenated Burst: 1 .....1. .... = Status Request/Transmission Policy: 1 .....0.. .... = Nominal Polling Interval: 1 ..... 0... .. = Tolerated Poll Jitter: 1 .....0 .. = Type of Service Override: 1 .....0. .... = Maximum Downstream Latency: 1  Service Class Name: Service Flow Scheduling Type: 6 Grant Interval: 10000 Tolerated Grant Jitter: 800 Grants Per Interval: 1 Unsolicited Grant Size: 154 Status Request/Transmission Policy: 383 t:QoS_Descriptor(32) 1:46, Value:                     </pre>
<p>E6 &lt;EM&gt;</p>	<p>CMTS send a QOS reserve message to RKS for downstream bandwidth.</p> <pre> Code: Accounting Request (4) Packet identifier: 0x3 (3) Length: 198 Authenticator Attribute value pairs   t:NAS IP Address(4) 1:6, Value:10.32.4.3   t:Acct Status Type(40) 1:6, Value:Interim Update(3)   t:Vendor Specific(26) 1:84, Vendor:CableLabs(4491)   Event Message Version ID: 1   BCID                     </pre>

Flow	Flow Description
	<pre> Timestamp: 1142102311 Element ID: 55555 Time Zone: DST: 0, Offset: -070000 Event Counter: 268435456 Event Message Type: QoS_Reserve (7) Element Type: CMTS (2) Element ID: 4 Time Zone: DST: 0, Offset: -070000 Sequence Number: 4 Event Time: 20021108144318.051 Status: 0x00000000 ..... = Status: No Error (0x00000000) ..... = Event Origin: Trusted Element (0x00000000) ..... = Event Message Proxied: Not proxied (0x00000000) Priority: 128 Attribute Count: 4 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:12, Vendor:CableLabs(4491) t:MTA_UDP_Portnum(26) l:6, Value:0 t:Vendor Specific(26) l:12, Vendor:CableLabs(4491) t:SF_ID(30) l:6, Value:316 t:Vendor Specific(26) l:10, Vendor:CableLabs(4491) t:Flow Direction(50) l:4, Value:Downstream(2) t:Vendor Specific(26) l:48, Vendor:CableLabs(4491) QoS Status: 0x00000f81 ..... = Status Indication: Resource Reserved but not Activated (1) ..... = Service Flow Scheduling Type: 1 ..... = Grant Interval: 1 ..... = Tolerated Grant Jitter: 1                     </pre>

Flow	Flow Description
	<pre> .....0. .... = Grants Per Interval: 1 .....0.. .... = Unsolicited Grant Size: 1 .....1... .... = Traffic Priority: 1 .....1 .... .... = Maximum Sustained Rate: 1 .....1. .... .... = Maximum Traffic Burst: 1 .....1.. .... .... = Minimum Reserved Traffic Rate: 1 .....1... .... .... = Minimum Packet Size: 1 .....0 ..... .... = Maximum Concatenated Burst: 1 .....0. .... .... = Status Request/Transmission Policy: 1 .....0.. .... .... = Nominal Polling Interval: 1 .....0... .... .... = Tolerated Poll Jitter: 1 .....0 ..... .... = Type of Service Override: 1 .....0. .... .... = Maximum Downstream Latency: 1  Service Class Name: Traffic Priority: 5 Maximum Sustained Rate: 112000 Maximum Traffic Burst: 1522 Minimum Reserved Traffic Rate: 112000 Minimum Packet Size: 140 t:QoS_Descriptor(32) 1:42, Value:                     </pre>
<p><b>E7</b> &lt;EM&gt;</p>	<p>RKS acknowledges the QoS_Reserve message.</p> <pre> Code: Accounting Response (5) Packet identifier: 0x2 (2) Length: 20 Authenticator                     </pre>

Flow	Flow Description
E8 <EM>	RKS acknowledges the QoS_Reserve message.  Code: Accounting Response (5) Packet identifier: 0x3 (3) Length: 20 Authenticator
N6 <NCS>	MTA sends CMS a confirmation of transaction complete for MDCX.  200 1203 OK  DQ-RI: 1162A
<i>At this point, all bandwidth has been allocated, and we are ready to let the phones ring</i>	
N7 <NCS>	CMS sends MTA a request to power-ring the telephone device attached to MTA.  RQNT 1204 aaln/1@mtat.cablelabs.com MGCP 1.0 NCS 1.0 X: 0123456789B0 N: ca@cal.cablelabs.com:5678 R: hd S: rg
U2 <Undefined>	The CMS requests the MGC to progress the call and passes the SDP profile of the MTA [proprietary].
T3 <TGCP>	MGC sends MG a modification request that audible-ringback be played by MTA to the originating caller.  MDCX 5050 ds/ds1-1/1@mg.cablelabs.com MGCP 1.0 TGCP 1.0 C: A3C47F21456789F0 I: FDE234C8 M: recvonly  S:rt

Flow	Flow Description
S2 <SS7>	The MGC forwards the SS7 Address Complete Message (ACM) to the SG.
T4 <TGCP>	MG sends MGC acknowledgement of the RQNT message.  200 5051 OK
N8 <NCS>	MTA sends CMS an acknowledgement of the RQNT message.  200 1204 OK
<b>phones are ringing ----- start Page 2 of call flow</b>	
N9 <NCS>	MTA sends CMS a notify message indicating the device attached to MTA has gone off-hook.  NTFY 1205 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 X: 0123456789B0 O: hd
U3 <Undefined>	The CMS notifies the MGC that the call has been answered [proprietary].
E9 <EM>	CMS sends RKS a Call_Answer Event Message to indicate the start of a call for the terminating side.  Code: Accounting Request (4) Packet identifier: 0x26 (38) Length: 187 Authenticator Attribute value pairs t:NAS IP Address(4) l:6, Value:10.32.32.40 t:Acct Status Type(40) l:6, Value:Interim Update(3) t:Vendor Specific(26) l:84, Vendor:CableLabs(4491) Event Message Version ID: 1 BCID Timestamp: 1041973756 Element ID: 40

Flow	Flow Description
	<pre> Time Zone: DST: 0, Offset: -070000 Event Counter: 25 Event Message Type: Call_Answer (15) Element Type: CMS (1) Element ID: 40 Time Zone: DST: 0, Offset: -070000 Sequence Number: 52 Event Time: 2003010714 929.431 Status: 0x00000000     .... = Status: No Error (0x00000000)     .... = Event Origin: Trusted Element (0x00000000)     .... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 3 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:32, Vendor:CableLabs(4491) Timestamp: 1041973760 Element ID: 40 Time Zone: DST: 0, Offset: -070000 Event Counter: 26 t:Related_Call_Billing_Correlation_ID(13) l:26, Value: t:Vendor Specific(26) l:28, Vendor:CableLabs(4491) t:Charge_Number(16) l:22, Value:" 3036613880" t:Vendor Specific(26) l:11, Vendor:CableLabs(4491) t:Financial Entity ID(49) l:5, Value:"440"                     </pre>
<p>T5 &lt;TGCP&gt;</p>	<p>The MGC sends the MG an MDCX message indicating removal of ring- back and cut- through.</p> <pre> MDCX 5052 ds/ds1-1/1@mg.cablelabs.com MGCP 1.0 TGCP 1.0 C: A3C47F21456789F0 I: FDE234C8                     </pre>

Flow	Flow Description
	<p>M: sendrecv X: 0123456789AF</p>
<p>N10 &lt;NCS&gt;</p>	<p>CMS sends MTA<sub>t</sub> an acknowledgement of the NTFY message with a piggybacked MDCX message indicating cut-through.</p> <pre> 200 1205 OK . MDCX 1206 aaln/1@mtat.cablelabs.com MGCP 1.0 NCS 1.0 C: A3C47F21456789F0 I: 32F345E2 N: ca@ca1.cablelabs.com:5678 M: sendrecv X: 0123456789D0 R: hu                     </pre>
<p>S3 &lt;SS7&gt;</p>	<p>The MGC forwards an SS7 Answer Message (ANS) to the Signaling Gateway.</p>
<p>E10 &lt;EM&gt;</p>	<p>MGC sends RKS a Call_Answer Event Message to indicate the start of a call for the originating side.</p> <pre> Code: Accounting Request (4) Packet identifier: 0x25 (37) Length: 187 Authenticator Attribute value pairs   t:NAS IP Address(4) l:6, Value:10.32.32.40   t:Acct Status Type(40) l:6, Value:Interim Update(3)   t:Vendor Specific(26) l:84, Vendor:CableLabs(4491)     Event Message Version ID: 1     BCID       Timestamp: 1041973760       Element ID: 41       Time Zone: DST: 0, Offset: -070000       Event Counter: 26                     </pre>

Flow	Flow Description
	<pre> Event Message Type: Call_Answer (15) Element Type: MGC(1) Element ID:      41 Time Zone: DST: 0, Offset: -070000 Sequence Number: 51 Event Time: 2003010714 929.431 Status: 0x00000000       .... = Status: No Error (0x00000000)       ....0.. = Event Origin: Trusted Element (0x00000000)       ....0... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 3 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:32, Vendor:CableLabs(4491) Timestamp: 1041973756 Element ID:      41 Time Zone: DST: 0, Offset: -070000 Event Counter: 25 t:Related_Call_Billing_Correlation_ID(13) l:26, Value: t:Vendor Specific(26) l:28, Vendor:CableLabs(4491) t:Charge_Number(16) l:22, Value:"      3036613880" t:Vendor Specific(26) l:11, Vendor:CableLabs(4491) t:Financial Entity ID(49) l:5, Value:"440"                     </pre>
<p>T6 &lt;TGCP&gt;</p>	<p>MG sends MGC a transaction complete acknowledgement of the MDCX message.</p> <p>200 5052 OK</p>
<p>E11 &lt;EM&gt;</p>	<p>RKS sends back CMS an acknowledgement of the Call_Answer Event Message for the terminating side.</p> <p>Code: Accounting Response (5)</p> <p>Packet identifier: 0x26 (38)</p>

Flow	Flow Description
	<p>Length: 20 Authenticator</p>
<p>E12 &lt;EM&gt;</p>	<p>RKS sends back CMS an acknowledgement of the call Answer event message for the originating side.</p> <p>Code: Accounting Response (5) Packet identifier: 0x25 (37) Length: 20 Authenticator</p>
<p>D6 &lt;DQoS&gt;</p>	<p>MTA<sub>t</sub> sends CMTS<sub>t</sub> a DSC request asking for bandwidth commitment in the access network.</p> <p>DSC-REQ Transaction ID 3</p> <p><i>Upstream Service Flow</i> ServiceFlowIdentifier 11001 QoSParameterSetType Admitted+Activated (6) ServiceFlowScheduling UGS(6) Request/TransPolicy 0x0000017F NominalGrantInterval 10000us ToleratedGrantJitter 800us GrantsPerInterval 1 UnsolicitedGrantSize 154</p> <p><i>DownStreamServiceFlow</i> ServiceFlowIdentifier 12001 QoSParameterSetType Admitted+Activated (6) MinimumReservedRate 112000 AssumedMinResRatePktSiz 140 MaxSustainedTrafficRate 112000 MaxTrafficBurst 1522 TrafficPriority 5</p> <p><i>UpstreamPacketClassification</i> ServiceFlowIdentifier 11001 PacketClassifierIdentifier 13001 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.63.25</p>

Flow	Flow Description
	<pre> IPSourcePortStart 1296 IPSourcePortEnd 1296 IPDestinationAddress 128.96.41.1 IPDestinationPortStart 3426 IPDestinationPortEnd 3426 IPProtocol UDP(17)  DownstreamPacketClassification ServiceFlowIdentifier 12001 PacketClassifierIdentifier 13002 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.41.1 IPDestinationAddress 128.96.63.25 IPDestinationPortStart 1296 IPDestinationPortEnd 1296 IPProtocol UDP(17)  Authorization Block TLV encoding that must include the Gate-id (37125)  HMAC                     </pre>
<p>D7 &lt;DQoS&gt;</p>	<pre> CMTS sends MTA a DSC response indicating that the DSC request has been granted.  DSC-RSP  Transaction ID 3 Confirmation code Success (0)  Upstream Service Flow ServiceFlowIdentifier 11001 Service ID 1801 QoSParameterSetType Admitted+Activated (6) Timeoutadmitted 200s TimeoutActive 10s ServiceFlowScheduling UGS(6) Request/TransPolicy 0x0000017F NominalGrantInterval 10000us ToleratedGrantJitter 800us GrantsPerInterval 1 UnsolicitedGrantSize 154                     </pre>

Flow	Flow Description
	<pre> DownStreamServiceFlow ServiceFlowIdentifier 12001 QoSParameterSetType Admitted+Activated (6) TimeoutAdmitted 200s TimeoutActive 10s MinimumReservedRate 112000 AssumedMinResRatePktSiz 140 MaxSustainedTrafficRate 112000 MaxTrafficBurst 1522 TrafficPriority 5  UpstreamPacketClassification ServiceFlowIdentifier 11001 PacketClassifierIdentifier 13001 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.63.25 IPSourcePortStart 1296 IPSourcePortEnd 1296 IPDestinationAddress 128.96.41.1 IPDestinationPortStart 3456 IPDestinationPortEnd 3456 IPProtocol UDP(17)  DownstreamPacketClassification ServiceFlowIdentifier 12001 PacketClassifierIdentifier 13002 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.41.1 IPDestinationAddress 128.96.63.25 IPDestinationPortStart 1296 IPDestinationPortEnd 1296 IPProtocol UDP(17)  HMAC                     </pre>
<p>D8 &lt;DQoS&gt;</p>	<p>MTA sends CMTS an acknowledgement of the DSC-RSP. DSC-ACK</p>

Flow	Flow Description
	TransactionID 3 ConfirmationCode Success (0)
D9 <DQoS>	CMTS sends CMS a Gate-Open message indicating bandwidth has been committed.  GateOpen Transaction ID - 0000 Gate ID - 37125
E13 <EM>	RKS acknowledges the QoS_Reserve message.  Code: Accounting Response (5) Packet identifier: 0x3 (3) Length: 20 Authenticator
E14 <EM>	CMTS <sub>o</sub> will send QoS_Commit to RKS to indicate the resources have been committed in the downstream.  Code: Accounting Request (4) Packet identifier: 0x7 (7) Length: 198 Authenticator Attribute value pairs t:NAS IP Address(4) l:6, Value:10.32.4.3 t:Acct Status Type(40) l:6, Value:Interim Update(3) t:Vendor Specific(26) l:84, Vendor:CableLabs(4491) Event Message Version ID: 1 BCID Timestamp: 1142102311 Element ID: 55555 Time Zone: DST: 0, Offset: -070000 Event Counter: 268435456 Event Message Type: QoS_Commit (19) Element Type: CMTS (2) Element ID: 4

Flow	Flow Description
	<pre> Time Zone: DST: 0, Offset: -070000 Sequence Number: 8 Event Time: 20021108144331.009 Status: 0x00000000     .... = Status: No Error (0x00000000)     ....0.. = Event Origin: Trusted Element (0x00000000)     ....0... = Event Message Proxied: Not proxied (0x00000000) Priority: 128 Attribute Count: 4 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:12, Vendor:CableLabs(4491)     t:MTA_UDP_Portnum(26) l:6, Value:0 t:Vendor Specific(26) l:12, Vendor:CableLabs(4491)     t:SF_ID(30) l:6, Value:316 t:Vendor Specific(26) l:10, Vendor:CableLabs(4491)     t:Flow Direction(50) l:4, Value:Downstream(2) t:Vendor Specific(26) l:48, Vendor:CableLabs(4491) QoS Status: 0x0000f83 Activated (3)     ....11 = Status Indication: Resource Reserve +     ....0.. = Service Flow Scheduling Type: 1     ....0... = Grant Interval: 1     ....0.... = Tolerated Grant Jitter: 1     ....0..... = Grants Per Interval: 1     ....0..... = Unsolicited Grant Size: 1     ....1.... = Traffic Priority: 1     ....1..... = Maximum Sustained Rate: 1     ....1..... = Maximum Traffic Burst: 1     ....1..... = Minimum Reserved Traffic Rate: 1     ....1..... = Minimum Packet Size: 1                 </pre>

Flow	Flow Description
	<pre> .....0 ..... = Maximum Concatenated Burst: 1 .....0. .... = Status Request/Transmission Policy: 1 .....0.. .... = Nominal Polling Interval: 1 ..... 0... .... = Tolerated Poll Jitter: 1 .....0 ..... = Type of Service Override: 1 .....0. .... = Maximum Downstream Latency: 1  Service Class Name:  Traffic Priority: 5 Maximum Sustained Rate: 112000 Maximum Traffic Burst: 1522 Minimum Reserved Traffic Rate: 112000 Minimum Packet Size: 140  t:QoS_Descriptor(32) 1:42, Value:                     </pre>
<p><b>E15</b> &lt;EM&gt;</p>	<p>RKS acknowledges the QoS_Commit for CMTS.  Code: Accounting Response (5)  Packet identifier: 0x6 (6)  Length: 20  Authenticator</p>
<p><b>E16</b> &lt;EM&gt;</p>	<p>RKS acknowledges the QoS_Commit for CMTS.  Code: Accounting Response (5)  Packet identifier: 0x7 (7)  Length: 20  Authenticator</p>
<p><b>N11</b> &lt;NCS&gt;</p>	<p>MTA sends CMS a transaction complete acknowledgement of the MDCX message.  200 1206 OK</p>
<p><b>Folks are talking and the originator hangs up</b></p>	

Flow	Flow Description
<p>S4 &lt;SS7&gt;</p>	<p>The SG sends the MGC an SS7 ISUP REL message.</p> <p>REL.</p>
<p>U4 &lt;Undefined&gt;</p>	<p>The MGC notifies the CMS that call is terminated. &lt;proprietary&gt;.</p>
<p>S5 &lt;SS7&gt;</p>	<p>The MGC forwards an SS7 ISUP RLC message to the SG.</p>
<p>T7 &lt;TGCP&gt;</p>	<p>The MGC sends the MG a DeleteConnection message.</p> <p>DLCX 5053 ds/ds1-1/1@mg.cablelabs.com MGCP 1.0 TGCP 1.0  C: A3C47F21456789F0  I: FDE234C8</p>
<p>N12 &lt;NCS&gt;</p>	<p>CMS sends MTA<sub>t</sub> a delete connection message.</p> <p>DLCX 1207 aaln/1@mtat.cablelabs.com MGCP 1.0 NCS 1.0  C: A3C47F21456789F0  I: 32F345E2</p>
<p>E17 &lt;EM&gt;</p>	<p>MGC sends a Call_Disconnect message to RKS to indicate the end of call for the originating side.</p> <p>Code: Accounting Request (4)  Packet identifier: 0x28 (40)  Length: 130  Authenticator  Attribute value pairs  t:NAS IP Address(4) l:6, Value:10.32.32.40  t:Acct Status Type(40) l:6, Value:Interim Update(3)  t:Vendor Specific(26) l:84, Vendor:CableLabs(4491)  Event Message Version ID: 1  BCID  Timestamp: 1041973756  Element ID: 41</p>

Flow	Flow Description
	<pre> Time Zone: DST: 0, Offset: -070000 Event Counter: 25 Event Message Type: Call_Disconnect (16) Element Type: MGC (1) Element ID:      41 Time Zone: DST: 0, Offset: -070000 Sequence Number: 54 Event Time: 2003010714 939.659 Status: 0x00000000       .... = Status: No Error (0x00000000)       .... = Event Origin: Trusted Element (0x00000000)       .... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 1 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:14, Vendor:CableLabs(4491) Source Document: BAF (0x0001) Event Object: 16 t:Call_Termination_Cause(11) l:8, Value:                     </pre>
<p>E18 &lt;EM&gt;</p>	<p>CMS sends a Call_Disconnect message to RKS to indicate the end of call for the terminating side.</p> <pre> Code: Accounting Request (4) Packet identifier: 0x27 (39) Length: 130 Authenticator Attribute value pairs t:NAS IP Address(4) l:6, Value:10.32.32.40 t:Acct Status Type(40) l:6, Value:Interim Update(3) t:Vendor Specific(26) l:84, Vendor:CableLabs(4491)                     </pre>

Flow	Flow Description
	<pre> Event Message Version ID: 1 BCID   Timestamp: 1041973760   Element ID:      40   Time Zone: DST: 0, Offset: -070000   Event Counter: 26 Event Message Type: Call_Disconnect (16) Element Type: CMS (1) Element ID:      40 Time Zone: DST: 0, Offset: -070000 Sequence Number: 53 Event Time: 2003010714 935.932 Status: 0x00000000       .... = Status: No Error (0x00000000)       .... = Event Origin: Trusted Element (0x00000000)       .... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 1 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:14, Vendor:CableLabs(4491) Source Document: BAF (0x0001) Event Object: 16 t:Call_Termination_Cause(11) l:8, Value:                     </pre>
<p><b>E19</b> &lt;EM&gt;</p>	<p>RKS acknowledges the Call_Disconnect message to MGC for the originating side.</p> <pre> Code: Accounting Response (5) Packet identifier: 0x28 (40) Length: 20 Authenticator                     </pre>

Flow	Flow Description
<b>E20</b> <EM>	RKS acknowledges the Call_Disconnect message to CMS for the terminating side.  Code: Accounting Response (5) Packet identifier: 0x27 (39) Length: 20 Authenticator
<b>D10</b> <DQoS>	MTA sends CMTS a DSD request asking for release of bandwidth in the access network.  DSD-REQ TransactionID 5 ServiceFlowID 11001 ServiceFlowID 12001
<b>D11</b> <DQoS>	CMTSsends MTA a DSD response indicating that the DSD request has been granted.  DSD-RSP TransactionID 5 Confirmation Code Success
<b>D12</b> <DQoS>	CMTS sends CMS a message indicating that the gate has been closed and that no further media will be forwarded.  Gate-Close Transaction ID - 0000 Gate ID - 37125 PKTCBL Reason - 1/0 [code/subcode]
<b>E21</b> <EM>	CMTS sends a QoS_Release message to indicate the end of usage of resources for the upstream.  Code: Accounting Request (4) Packet identifier: 0x8 (8) Length: 138 Authenticator Attribute value pairs t:NAS IP Address(4) 1:6, Value:10.32.4.3 t:Acct Status Type(40) 1:6, Value:Interim Update(3) t:Vendor Specific(26) 1:84, Vendor:CableLabs(4491)

Flow	Flow Description
	<pre> Event Message Version ID: 1 BCID   Timestamp: 623970361   Element ID: 55555   Time Zone: DST: 0, Offset: -070000   Event Counter: 536870912 Event Message Type: QoS_Release (8) Element Type: CMTS (2) Element ID: 4 Time Zone: DST: 0, Offset: -070000 Sequence Number: 9 Event Time: 20021108144341.025 Status: 0x00000000       .... = Status: No Error (0x00000000)       .... = Event Origin: Trusted Element (0x00000000)       .... = Event Message Proxied: Not proxied (0x00000000) Priority: 128 Attribute Count: 2 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:12, Vendor:CableLabs(4491)   t:SF_ID(30) l:6, Value:315 t:Vendor Specific(26) l:10, Vendor:CableLabs(4491)   t:Flow Direction(50) l:4, Value:Upstream(1)                     </pre>
<p>E22 &lt;EM&gt;</p>	<p>CMTS sends a QoS_Release message to indicate the end of usage of resources for the downstream.</p> <pre> Code: Accounting Request (4) Packet identifier: 0x9 (9) Length: 138 Authenticator                     </pre>

Flow	Flow Description
	<pre> Attribute value pairs   t:NAS IP Address(4) 1:6, Value:10.32.4.3   t:Acct Status Type(40) 1:6, Value:Interim Update(3)   t:Vendor Specific(26) 1:84, Vendor:CableLabs(4491)     Event Message Version ID: 1     BCID       Timestamp: 623970361       Element ID: 55555       Time Zone: DST: 0, Offset: -070000       Event Counter: 536870912     Event Message Type: QoS_Release (8)     Element Type: CMTS (2)     Element ID: 4     Time Zone: DST: 0, Offset: -070000     Sequence Number: 10     Event Time: 20021108144341.035     Status: 0x00000000       .... = Status: No Error (0x00000000)       .... = Event Origin: Trusted Element (0x00000000)       .... = Event Message Proxied: Not proxied (0x00000000)     Priority: 128     Attribute Count: 2     Event Object: 0     t:EM_Header Data structure(1) 1:78, Value:   t:Vendor Specific(26) 1:12, Vendor:CableLabs(4491)     t:SF_ID(30) 1:6, Value:315   t:Vendor Specific(26) 1:10, Vendor:CableLabs(4491)     t:Flow Direction(50) 1:4, Value:Downstream(2)           </pre>

Flow	Flow Description
<p>E23 &lt;EM&gt;</p>	<p>RKS acknowledges CMTS for the release of upstream resources.</p> <p>Code: Accounting Response (5)                      Packet identifier: 0x8 (8)                      Length: 20                      Authenticator</p>
<p>E24 &lt;EM&gt;</p>	<p>RKS acknowledges CMTS<sub>0</sub> for the release of downstream resources.</p> <p>Code: Accounting Response (5)                      Packet identifier: 0x9 (9)                      Length: 20                      Authenticator</p>
<p>T8 &lt;TGCP&gt;</p>	<p>MG sends MGC an acknowledgement of the DLCX and includes the call statistics collected by the MG.</p> <p>250 5053 OK                      P: PS=1245, OS=62345, PR=780, OR=45123, PL=10, JI=27, LA=48, PC/RPS=790, PC/ROS=45700,                      PC/RPL=15, PC/RJI=27</p>
<p>N13 &lt;NCS&gt;</p>	<p>MTA sends CMS an acknowledgement of the DLCX and includes the call statistics collected by the MTA.</p> <p>250 1207 OK                      P: PS=790, OS=45700, PR=1230, OR=61875, PL=15, JI=27, LA=48, PC/RPS=1245, PC/ROS=62345,                      PC/RPL=10, PC/RJI=27</p>
<p>E25 &lt;EM&gt;</p>	<p>MGC sends to RKS Signaling_Stop to indicate the stop of control signaling for the originating side.</p> <p>Code: Accounting Request (4)                      Packet identifier: 0x2a (42)                      Length: 173                      Authenticator                      Attribute value pairs                      t:NAS IP Address(4) l:6, Value:10.32.32.40                      t:Acct Status Type(40) l:6, Value:Interim Update(3)                      t:Vendor Specific(26) l:84, Vendor:CableLabs(4491)</p>

Flow	Flow Description
	<pre> Event Message Version ID: 1 BCID   Timestamp: 1041973756   Element ID:      41   Time Zone: DST: 0, Offset: -070000   Event Counter: 25 Event Message Type: Signaling_Stop (2) Element Type: CMS (1) Element ID:      40 Time Zone: DST: 0, Offset: -070000 Sequence Number: 56 Event Time: 2003010714 939.669 Status: 0x00000000       .... = Status: No Error (0x00000000)       .... = Event Origin: Trusted Element (0x00000000)       .... = Event Message Proxied: Not proxied (0x00000000) Priority: 0 Attribute Count: 3 Event Object: 0 t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:32, Vendor:CableLabs(4491)   Timestamp: 1041973760   Element ID:      40   Time Zone: DST: 0, Offset: -070000   Event Counter: 26   t:Related_Call_Billing_Correlation_ID(13) l:26, Value: t:Vendor Specific(26) l:11, Vendor:CableLabs(4491)   t:Financial Entity ID(49) l:5, Value:"440" t:Vendor Specific(26) l:14, Vendor:CableLabs(4491)   Source Document: BAF (0x0001)   Event Object: 16                     </pre>

Flow	Flow Description
	t:Call_Termination_Cause(11) 1:8, Value:
E26 <EM>	<p>CMS sends to RKS Signaling_Stop to indicate the stop of control signaling for the terminating side.</p> <p>Code: Accounting Request (4)            Packet identifier: 0x2a (42)            Length: 173            Authenticator            Attribute value pairs</p> <p>t:NAS IP Address(4) 1:6, Value:10.32.32.40            t:Acct Status Type(40) 1:6, Value:Interim Update(3)            t:Vendor Specific(26) 1:84, Vendor:CableLabs(4491)</p> <p>Event Message Version ID: 1            BCID            Timestamp: 1041973756            Element ID: 40            Time Zone: DST: 0, Offset: -070000            Event Counter: 25</p> <p>Event Message Type: Signaling_Stop (2)            Element Type: CMS (1)            Element ID: 40            Time Zone: DST: 0, Offset: -070000            Sequence Number: 56            Event Time: 2003010714 939.669            Status: 0x00000000</p> <p>.....00 = Status: No Error (0x00000000)            .....0.. = Event Origin: Trusted Element (0x00000000)            .....0... = Event Message Proxied: Not proxied</p> <p>(0x00000000)</p> <p>Priority: 0            Attribute Count: 3            Event Object: 0</p>

Flow	Flow Description
	<pre> t:EM_Header Data structure(1) l:78, Value: t:Vendor Specific(26) l:32, Vendor:CableLabs(4491) Timestamp: 1041973760 Element ID:      40 Time Zone: DST: 0, Offset: -070000 Event Counter: 26 t:Related_Call_Billing_Correlation_ID(13) l:26, Value: t:Vendor Specific(26) l:11, Vendor:CableLabs(4491) t:Financial Entity ID(49) l:5, Value:"440" t:Vendor Specific(26) l:14, Vendor:CableLabs(4491) Source Document: BAF (0x0001) Event Object: 16 t:Call_Termination_Cause(11) l:8, Value:                     </pre>
<p>E27 &lt;EM&gt;</p>	<p>RKS acknowledges the Signaling_Stop from the MGC for the originating side.</p> <pre> Code: Accounting Response (5) Packet identifier: 0x29 (41) Length: 20 Authenticator                     </pre>
<p>E28 &lt;EM&gt;</p>	<p>RKS acknowledges the Signaling_Stop from the CMS for the terminating side.</p> <pre> Code: Accounting Response (5) Packet identifier: 0x2a (42) Length: 20 Authenticator                     </pre>
<p>N14 &lt;NCS&gt;</p>	<p>CMS sends MTA a request for notification of new off-hook event.</p> <pre> RQNT 1208 aaln/1@mtat.cablelabs.com MGCP 1.0 NCS 1.0 X: 0123456789D0 N: ca@cal.cablelabs.com:5678 R: hd(A, E(R(hu, [0-9#*T](D)), S(d1))) D: (0T   00T   303[2-9]xxxxxxx   720[2-9]xxxxxxx   1[2-9]xxxxxxxxxxx   [3469]11   0[2-9]xxxxxxxxxxx   01[2-                     </pre>

Flow	Flow Description
	9 ]xxxxxxxx
N15 <NCS>	MTA <sub>t</sub> sends CMS an acknowledgement of the RQNT.  200 1208 OK
<b>Both parties on-hook and ready to report off-hook</b>	

### 3 GLOSSARY

<b>AAA</b>	Authentication, Authorization and Accounting
<b>AES</b>	Advanced Encryption Standard. A block cipher, used to encrypt the media traffic in PacketCable.
<b>AF</b>	Assured Forwarding. This is a DiffServ Per Hop Behavior.
<b>AH</b>	Authentication header. An IPSec security protocol that provides message integrity for complete IP packets, including the IP header.
<b>AMA</b>	Automated Message Accounting. A standard form of call detail records (CDRs) developed and administered by Bellcore (now Telcordia Technologies).
<b>ASD</b>	Application-Specific Data. A field in some Kerberos key management messages that carries information specific to the security protocol for which the keys are being negotiated.
<b>AT</b>	Access Tandem
<b>ATM</b>	Asynchronous Transfer Mode. A protocol for the transmission of a variety of digital signals using uniform 53-byte cells.
<b>BAF</b>	Bellcore AMA Format, also known as AMA.
<b>BCID</b>	Billing Correlation ID
<b>BPI+</b>	Baseline Privacy Plus Interface Specification. The security portion of the DOCSIS 1.1 standard that runs on the MAC layer.
<b>CA</b>	Certification Authority. A trusted organization that accepts certificate applications from entities, authenticates applications, issues certificates and maintains status information about certificates.
<b>CA</b>	Call Agent. The part of the CMS that maintains the communication state, and controls the line side of the communication.
<b>CBC</b>	Cipher Block Chaining Mode. An option in block ciphers that combine (XOR) the previous block of ciphertext with the current block of plaintext before encrypting that block of the message.
<b>CBR</b>	Constant Bit Rate
<b>CDR</b>	Call Detail Record. A single CDR is generated at the end of each billable activity. A single billable activity may also generate multiple CDRs.
<b>CIC</b>	Circuit Identification Code. In ANSI SS7, a two-octet number that uniquely identifies a DSO circuit within the scope of a single SS7 Point Code.
<b>CID</b>	Circuit ID (Pronounced "kid"). This uniquely identifies an ISUP DS0 circuit on a Media Gateway. It is a combination of the circuit's SS7 gateway point code and Circuit Identification Code (CIC). The SS7 DPC is associated with the Signaling Gateway that has domain over the circuit in question.
<b>CIF</b>	Common Intermediate Format
<b>CIR</b>	Committed Information Rate
<b>CM</b>	DOCSIS Cable Modem
<b>CMS</b>	Cryptographic Message Syntax
<b>CMS</b>	Call Management Server. Controls the audio connections. Also called a Call Agent in MGCP/SGCP terminology. This is one example of an Application Server.
<b>CMTS</b>	Cable Modem Termination System. The device at a cable head-end which implements the DOCSIS RFI MAC protocol and connects to CMs over an HFC network.
<b>CMSS</b>	CMS-to-CMS Signaling
<b>Codec</b>	COder-DECoder
<b>COPS</b>	Common Open Policy Service protocol. Currently an internet draft, which describes a client/server model for supporting policy control over QoS Signaling Protocols and provisioned QoS resource management.
<b>CoS</b>	Class of Service. The type 4 tuple of a DOCSIS configuration file.
<b>CSR</b>	Customer Service Representative

<b>DA</b>	Directory Assistance
<b>DE</b>	Default. This is a DiffServ Per Hop Behavior.
<b>DES</b>	Data Encryption Standard
<b>DHCP</b>	Dynamic Host Configuration Protocol
<b>DHCP-D</b>	DHCP Default. Network Provider DHCP Server
<b>DNS</b>	Domain Name Service
<b>DOCSIS</b>	Data-Over-Cable Service Interface Specifications
<b>DPC</b>	Destination Point Code. In ANSI SS7, a 3-octet number which uniquely identifies an SS7 Signaling Point, either an SSP, STP, or SCP.
<b>DQoS</b>	Dynamic Quality-of-Service. Assigned on the fly for each communication depending on the QoS requested.
<b>DSCP</b>	DiffServ Code Point. A field in every IP packet that identifies the DiffServ Per Hop Behavior. In IP version 4, the TOS byte is redefined to be the DSCP. In IP version 6, the Traffic Class octet is used as the DSCP.
<b>DSFID</b>	Downstream Service Flow ID. See SFID
<b>DTMF</b>	Dual-tone Multi Frequency (tones)
<b>EF</b>	Expedited Forwarding. A DiffServ Per Hop Behavior.
<b>E-MTA</b>	Embedded MTA. A single node that contains both an MTA and a cable modem.
<b>EO</b>	End Office
<b>ESP</b>	IPSec Encapsulating Security Payload. Protocol that provides both IP packet encryption and optional message integrity, not covering the IP packet header.
<b>ETSI</b>	European Telecommunications Standards Institute
<b>FEID</b>	Financial Entity ID
<b>FGD</b>	Feature Group D signaling
<b>FQDN</b>	Fully Qualified Domain Name. Refer to IETF RFC 2821 for details.
<b>GC</b>	Gate Controller
<b>GTT</b>	Global Title Translation
<b>HFC</b>	Hybrid Fiber/Coaxial cable). An HFC system is a broadband bi-directional shared media transmission system using fiber trunks between the head-end and the fiber nodes, and coaxial distribution from the fiber nodes to the customer locations.
<b>HMAC</b>	Hashed Message Authentication Code. A message authentication algorithm, based on either SHA-1 or MD5 hash and defined in IETF RFC 2104.
<b>HTTP</b>	Hypertext Transfer Protocol. Refer to IETF RFC 1945 and RFC 2068.
<b>IANA</b>	Internet Assigned Numbered Authority. See <a href="http://www.ietf.org">www.ietf.org</a> for details.
<b>IC</b>	Inter-exchange Carrier
<b>IETF</b>	Internet Engineering Task Force. A body responsible, among other things, for developing standards used on the Internet. See <a href="http://www.ietf.org">www.ietf.org</a> for details
<b>IKE</b>	Internet Key Exchange. A key-management mechanism used to negotiate and derive keys for SAs in IPSec.
<b>IKE-</b>	A notation defined to refer to the use of IKE with pre-shared keys for authentication.
<b>IKE+</b>	A notation defined to refer to the use of IKE with X.509 certificates for authentication.
<b>IP</b>	Internet Protocol. An Internet network-layer protocol.
<b>IPSec</b>	Internet Protocol Security. A collection of Internet standards for protecting IP packets with encryption and authentication.
<b>ISDN</b>	Integrated Services Digital Network
<b>ISTP</b>	Internet Signaling Transport Protocol
<b>ISUP</b>	ISDN User Part. A protocol within the SS7 suite of protocols that is used for call signaling within an SS7 network.
<b>ITU</b>	International Telecommunications Union
<b>ITU-T</b>	International Telecommunications Union–Telecommunications Standardization Sector
<b>IVR</b>	Interactive Voice Response system
<b>KDC</b>	Key Distribution Center
<b>LATA</b>	Local Access and Transport Area

<b>LD</b>	Long Distance
<b>LIDB</b>	Line Information Database. Contains customer information required for real-time access such as calling card personal identification numbers (PINs) for real-time validation.
<b>LLC</b>	Logical Link Control. The Ethernet packet header and optional 802.1P tag which may encapsulate an IP packet. A sublayer of the Data Link Layer.
<b>LNP</b>	Local Number Portability. Allows a customer to retain the same number when switching from one local service provider to another.
<b>lsb</b>	Least significant bit
<b>LSSGR</b>	LATA Switching Systems Generic Requirements
<b>MAC</b>	Message Authentication Code. A fixed-length data item that is sent together with a message to ensure integrity, also known as a MIC.
<b>MAC</b>	Media Access Control. It is a sublayer of the Data Link Layer. It normally runs directly over the physical layer.
<b>MC</b>	Multipoint Controller
<b>MCU</b>	Multipoint Conferencing Unit
<b>MD5</b>	Message Digest 5. A one-way hash algorithm that maps variable length plaintext into fixed-length (16 byte) ciphertext.
<b>MDCP</b>	Media Device Control Protocol. A media gateway control specification submitted to IETF by Lucent. Now called SCTP.
<b>MDU</b>	Multi-Dwelling Unit. Multiple units within the same physical building. The term is usually associated with high-rise buildings
<b>MEGACO</b>	Media Gateway Control IETF working group. See <a href="http://www.ietf.org">www.ietf.org</a> for details.
<b>MG</b>	Media Gateway. Provides the bearer circuit interfaces to the PSTN and transcodes the media stream.
<b>MGC</b>	Media Gateway Controller. The overall controller function of the PSTN gateway. Receives, controls and mediates call-signaling information between the PacketCable and PSTN.
<b>MGCP</b>	Media Gateway Control Protocol. Protocol follow-on to SGCP. Refer to IETF 2705.
<b>MIB</b>	Management Information Base
<b>MIC</b>	Message Integrity Code. A fixed-length data item that is sent together with a message to ensure integrity, also known as a Message Authentication Code (MAC).
<b>MMC</b>	Multi-Point Mixing Controller. A conferencing device for mixing media streams of multiple connections.
<b>MSB</b>	Most Significant Bit
<b>MSO</b>	Multi-System Operator. A cable company that operates many head-end locations in several cities.
<b>MSU</b>	Message Signal Unit
<b>MTA</b>	Multimedia Terminal Adapter. Contains the interface to a physical voice device, a network interface, CODECs, and all signaling and encapsulation functions required for VoIP transport, class features signaling, and QoS signaling.
<b>MTP</b>	The Message Transfer Part. A set of two protocols (MTP 2 and 3) within the SS7 suite of protocols that are used to implement physical, data link, and network-level transport facilities within an SS7 network.
<b>MWD</b>	Maximum Waiting Delay
<b>NANP</b>	North American Numbering Plan
<b>NANPNAT</b>	North American Numbering Plan Network Address Translation
<b>NAT network layer</b>	Network Address Translation. Layer 3 in the Open System Interconnection (OSI) architecture. This layer provides services to establish a path between open systems.
<b>NCS</b>	Network Call Signaling

<b>NPA-NXX</b>	Numbering Plan Area (more commonly known as area code) NXX (sometimes called exchange) represents the next three numbers of a traditional phone number. The N can be any number from 2-9 and the Xs can be any number. The combination of a phone number's NPA-NXX will usually indicate the physical location of the call device. The exceptions include toll-free numbers and ported numbers (see LNP).
<b>NTP</b>	Network Time Protocol. An internet standard used for synchronizing clocks of elements distributed on an IP network.
<b>NTSC</b>	National Television Standards Committee. Defines the analog color television broadcast standard used today in North America.
<b>OID</b>	Object Identifier
<b>OSP</b>	Operator Service Provider
<b>OSS</b>	Operations Systems Support. The back-office software used for configuration, performance, fault, accounting, and security management.
<b>OSS-D</b>	OSS Default. Network Provider Provisioning Server.
<b>PAL</b>	Phase Alternate Line. The European color television format that evolved from the American NTSC standard.
<b>PCM</b>	Pulse Code Modulation. A commonly employed algorithm to digitize an analog signal (such as a human voice) into a digital bit stream using simple analog-to-digital conversion techniques.
<b>PDU</b>	Protocol Data Unit
<b>PHB</b>	Per-Hop Behavior
<b>PHS</b>	Payload Header Suppression. A DOCSIS technique for compressing the Ethernet, IP, and UDP headers of RTP packets.
<b>PKCROSS</b>	Public-Key Cryptography for Cross-Realm Authentication. Utilizes PKINIT for establishing the inter-realm keys and associated inter-realm policies to be applied in issuing cross-realm service tickets between realms and domains in support of Intradomain and Interdomain CMS-to-CMS signaling (CMSS).
<b>PKCS</b>	Public-Key Cryptography Standards. Published by RSA Data Security Inc. These Standards describe how to use public key cryptography in a reliable, secure and interoperable way.
<b>PKI</b>	Public-Key Infrastructure. A process for issuing public key certificates, which includes standards, Certification Authorities, communication between authorities and protocols for managing certification processes.
<b>PKINIT</b>	Public-Key Cryptography for Initial Authentication. The extension to the Kerberos protocol that provides a method for using public-key cryptography during initial authentication.
<b>PSC</b>	Payload Service Class Table, a MIB table that maps RTP payload type to a Service Class Name.
<b>PSFR</b>	Provisioned Service Flow Reference. An SFR that appears in the DOCSIS configuration file.
<b>PSTN</b>	Public Switched Telephone Network
<b>QCIF</b>	Quarter Common Intermediate Format
<b>QoS</b>	Quality of Service. Guarantees network bandwidth and availability for applications.
<b>RADIUS</b>	Remote Authentication Dial-In User Service. An internet protocol (IETF RFC 2138 and RFC 2139) originally designed for allowing users dial-in access to the internet through remote servers. Its flexible design has allowed it to be extended well beyond its original intended use.
<b>RAS</b>	Registration, Admissions and Status. RAS Channel is an unreliable channel used to convey the RAS messages and bandwidth changes between two H.323 entities.
<b>RC4</b>	Rivest Cipher 4. A variable length stream cipher. Optionally used to encrypt the media traffic in PacketCable.
<b>RFC</b>	Request for Comments. Technical policy documents approved by the IETF which are available on the World Wide Web at <a href="http://www.ietf.cnri.reston.va.us/rfc.html">http://www.ietf.cnri.reston.va.us/rfc.html</a>
<b>RFI</b>	The DOCSIS Radio Frequency Interface specification.

<b>RJ-11</b>	Registered Jack-11. A standard 4-pin modular connector commonly used in the United States for connecting a phone unit into a wall jack.
<b>RKS</b>	Record Keeping Server. The device which collects and correlates the various Event Messages.
<b>RSA</b>	A public-key, or asymmetric, cryptographic algorithm used to provide authentication and encryption services. RSA stands for the three inventors of the algorithm; Rivest, Shamir, Adleman.
<b>RSA Key Pair</b>	A public/private key pair created for use with the RSA cryptographic algorithm.
<b>RSVP</b>	Resource Reservation Protocol
<b>RTCP</b>	Real-Time Control Protocol
<b>RTO</b>	Retransmission Timeout
<b>RTP</b>	Real-time Transport Protocol. A protocol for encapsulating encoded voice and video streams. Refer to IETF RFC 1889..
<b>SA</b>	Security Association. A one-way relationship between sender and receiver offering security services on the communication flow.
<b>SAID</b>	Security Association Identifier. Uniquely identifies SAs in the DOCSIS Baseline Privacy Plus Interface (BPI+) security protocol.
<b>SCCP</b>	Signaling Connection Control Part. A protocol within the SS7 suite of protocols that provides two functions in addition to those provided within MTP. The first function is the ability to address applications within a signaling point. The second function is Global Title Translation.
<b>SCP</b>	Service Control Point. A Signaling Point within the SS7 network, identifiable by a Destination Point Code that provides database services to the network.
<b>SCTP</b>	Stream Control Transmission Protocol
<b>SDP</b>	Session Description Protocol
<b>SDU</b>	Service Data Unit. Information delivered as a unit between peer service access points.
<b>SF</b>	Service Flow. A unidirectional flow of packets on the RF interface of a DOCSIS system.
<b>SFID</b>	Service Flow ID. A 32-bit integer assigned by the CMTS to each DOCSIS Service Flow defined within a DOCSIS RF MAC domain. SFIDs are considered to be in either the upstream direction (USFID) or downstream direction (DSFID). Upstream Service Flow IDs and Downstream Service Flow IDs are allocated from the same SFID number space.
<b>SFR</b>	Service Flow Reference. A 16-bit message element used within the DOCSIS TLV parameters of Configuration Files and Dynamic Service messages to temporarily identify a defined Service Flow. The CMTS assigns a permanent SFID to each SFR of a message.
<b>SG</b>	Signaling Gateway. An SG is a signaling agent that receives/sends SCN native signaling at the edge of the IP network. In particular, the SS7 SG function translates variant ISUP and TCAP in an SS7-Internet Gateway to a common version of ISUP and TCAP.
<b>SGCP</b>	Simple Gateway Control Protocol. Earlier draft of MGCP.
<b>SHA – 1</b>	Secure Hash Algorithm 1. A one-way hash algorithm.
<b>SID</b>	Service ID. A 14-bit number assigned by a CMTS to identify an upstream virtual circuit. Each SID separately requests and is granted the right to use upstream bandwidth.
<b>SIP</b>	Session Initiation Protocol. An application-layer control (signaling) protocol for creating, modifying, and terminating sessions with one or more participants.
<b>SIP+</b>	Session Initiation Protocol Plus. An extension to SIP.
<b>S-MTA</b>	Standalone MTA. A single node that contains an MTA and a non-DOCSIS MAC (e.g., ethernet).
<b>SNMP</b>	Simple Network Management Protocol
<b>SOHO</b>	Small Office/Home Office

<b>SS7</b>	Signaling System number 7. An architecture and set of protocols for performing out-of-band call signaling with a telephone network.
<b>SSP</b>	Service Switching Point. SSPs are points within the SS7 network that terminate SS7 signaling links and also originate, terminate, or tandem switch calls.
<b>STP</b>	Signal Transfer Point. A node within an SS7 network that routes signaling messages based on their destination address. This is essentially a packet switch for SS7. It may also perform additional routing services such as Global Title Translation.
<b>TCAP</b>	Transaction Capabilities Application Protocol. A protocol within the SS7 stack that is used for performing remote database transactions with a Signaling Control Point.
<b>TCP</b>	Transmission Control Protocol
<b>TD</b>	Timeout for Disconnect
<b>TFTP</b>	Trivial File Transfer Protocol
<b>TFTP-D</b>	Default – Trivial File Transfer Protocol
<b>TGS</b>	Ticket Granting Server. A sub-system of the KDC used to grant Kerberos tickets.
<b>TGW</b>	Telephony Gateway
<b>TIPHON</b>	Telecommunications and Internet Protocol Harmonization Over Network
<b>TLV</b>	Type-Length-Value. A tuple within a DOCSIS configuration file.
<b>TN</b>	Telephone Number
<b>ToD</b>	Time-of-Day Server
<b>TOS</b>	Type of Service. An 8-bit field of every IP version 4 packet. In a DiffServ domain, the TOS byte is treated as the DiffServ Code Point, or DSCP.
<b>TSG</b>	Trunk Subgroup
<b>USFID</b>	Upstream Service Flow ID. See SFID
<b>UDP</b>	User Datagram Protocol. A connectionless protocol built upon Internet Protocol (IP).
<b>VAD</b>	Voice Activity Detection
<b>VBR</b>	Variable Bit Rate
<b>VoIP</b>	Voice over IP