PacketCable™ Architecture Call Flows Technical Report

On-Net MTA to PSTN Telephone

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

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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:

- ISTP
- 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)

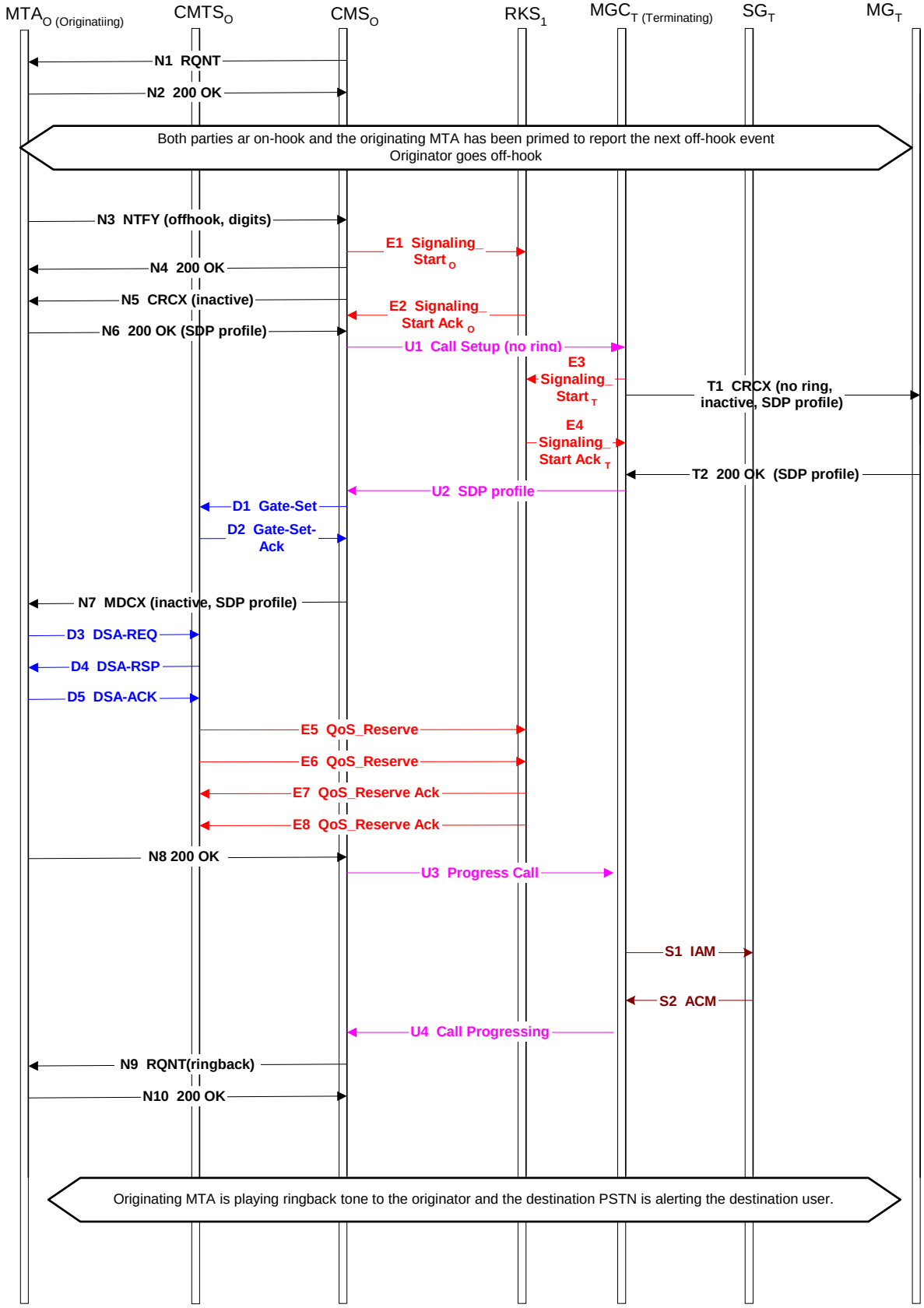
2 USE CASE: ON-NET TO PSTN TELEPHONE BASIC CALL

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

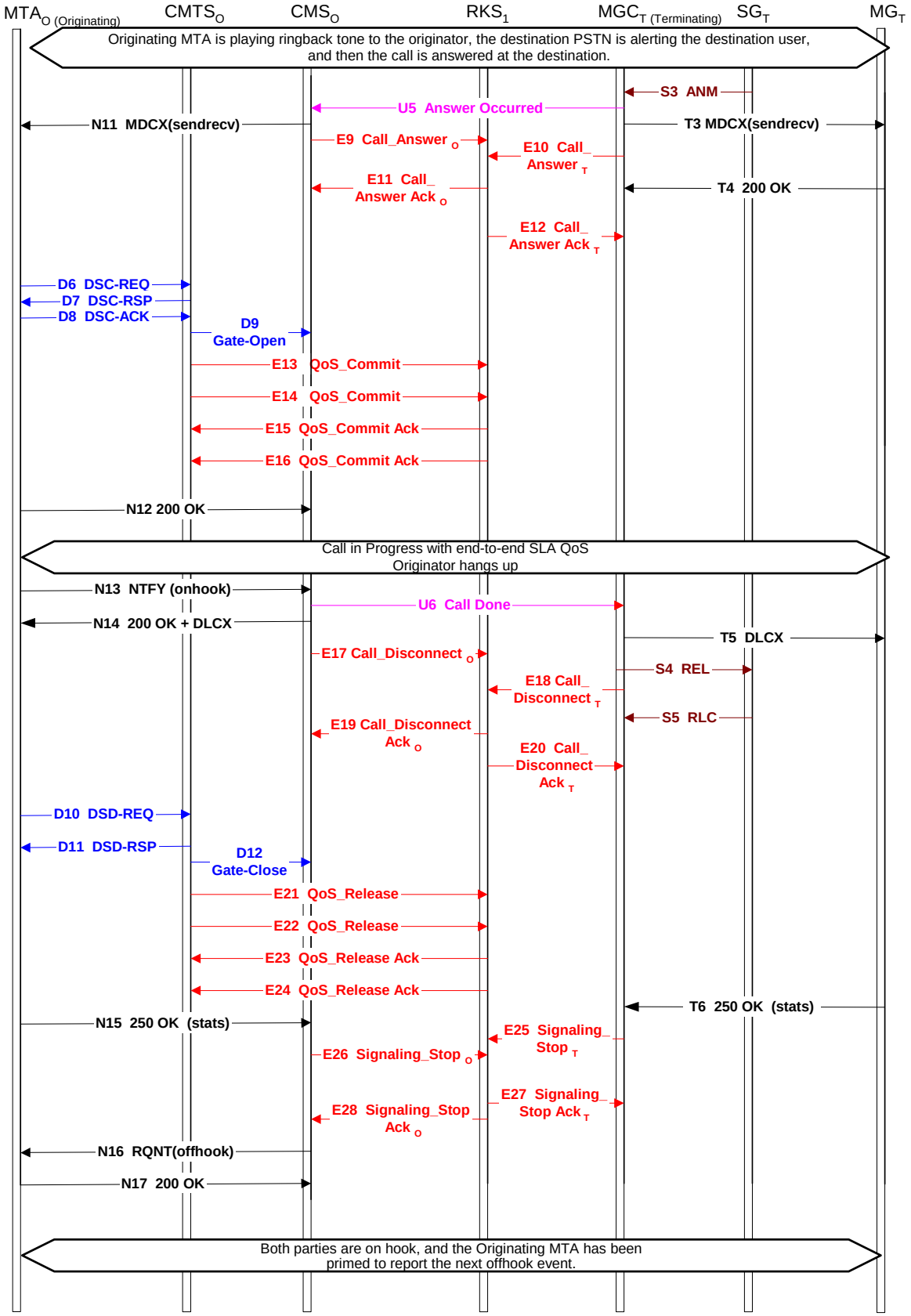
2.1 Call Flow Diagrams

The call flow indicates a normal on-net to PSTN Telephone 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).

On-Off Basic Call Flow (part 1)



On-Off Basic Call Flow (part 2)



2.2 Call Flow Details

Flow	Flow Description
Initialization	

N1
<NCS>
	CMS sends MTA a NotificationRequest instructing MTA to provide dial-tone on off-hook event, and then to collect digits according to the digit map.
	
	`RQNT 1201 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0`
	`N: ca@ca1.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]xxxxxxxxx | [3469]11 | 0[2-9]xxxxxxxxx | 01[2-9]xxxxxxx`

N2 <NCS>	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: `200 1201 OK`
Service Request	

N3
<NCS>
	MTA sends CMS a Notification message indicating that an off-hook was observed, and reports the collected digits.
	
	`NTFY 2001 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0`
	`N: ca@ca1.cablelabs.com:5678`
	`X: 0123456789AB`
	`O: hd,3,0,3,6,6,1,3,8,8,7`

E1
<EM>
	CMS creates the BillingCorrelationID for this transaction. CMS sends RKS a Signaling_Start Event Message for the originating side.
	
	`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`

Flow	Flow Description
	BCID Timestamp: 1041973756 Element ID: 40 Time Zone: DST: 0, Offset: -070000 Event Counter: 25 Event Message Type: Signaling_Start (1) Element Type: CMS (1) Element ID: 40 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: 5 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:" aaln/1@mta.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"

Flow	Flow Description
N4 <NCS>	CMS sends MTA an acknowledgement of the notification. 200 2001 OK
N5 <NCS>	CMS sends MTA a create connection message. The connection is created in inactive mode. Packetization parameters are passed in the CRCX message. 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 N: ca@ca1.cablelabs.com:5678 X: 0123456789AC R: hu
E2 <EM>	RKS sends CMS a RADIUS ACK in response to Signaling_Start for the originating side. Code: Accounting Response (5) Packet identifier: 0x23 (35) Length: 20 Authenticator
N6 <NCS>	MTA sends CMS an acknowledgement of the CRCX, adding its own SDP profile. 200 1202 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 G729/8000 a=X-pc-secret:

Flow	Flow Description
	base64: pV6BIIHWt+0gDkpgnuxgTfROxYAemhYJTHWgHNt1crTtEUKFatJfSdEFVQuueo==
U1 <Undefined>	CMS sends MGC all local call setup information. [proprietary]
E3 <EM>	MGC creates the BillingCorrelationID for this transaction. MGC sends RKS a Signaling_Start Event Message for the terminating side. 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: 41 Time Zone: DST: 0, Offset: -070000 Event Counter: 26 Event Message Type: Signaling_Start (1) Element Type: MGC (1) Element ID: 41 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: 5

Flow	Flow Description
	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:" ds/ds1-1/1@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"
T1 <TGCP>	MGC send MG Create Connection request. This message contains the session description from the MTA. This is a “no- ring” request because no ring pattern is specified. 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 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+0gDkpgnuxgTfROxYAemhYJTHWgHNt1crTtEUKFatJfSdEFVQuueo==
E4 <EM>	RKS sends MGC a RADIUS ACK in response to Signaling_Start for the terminating side.

Flow	Flow Description
	Code: Accounting Response (5) Packet identifier: 0x24 (36) Length: 20 Authenticator
T2 <TGCP>	MG sends MGC an acknowledgement of receipt of Create Connection message. This confirmation includes its own SDP profile. 200 5049 OK I: 32F345E2 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/xV6eo1tQtw==
U2 <Undefined>	MGC sends CMS SDP profile and gate info relay. [proprietary]
D1 <DQoS>	CMS sends CMTS a Gate-Set message. Transaction ID – 3178 Subscriber - 128.06.41.1 Gate ID - 37125 Event Generation Info RKS- Addr-1 - RKS1 RKS-Port-1 - 1813 Flags - 0 (Do not batch) RKS- Addr-2 - RKS2 RKS-Port-2 - 1813

Flow	Flow Description
	Billing Correlation ID –<id>(24 octects) GateSpec Direction 1 (up) Protocol 17 (UDP) Flags 0 Session Class 1 SourceAddress 128.96.41.1 DestinationAddress 128.96.63.25 SourcePort 0 Destination Port 1296 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 128.96.63.25 DestinationAddress 128.96.41.1 SourcePort 0 Destination Port 3456 DS 0 T1 200 T7 200 T8 0 r 12400 b 124 p 12400 m 124 M 124

Flow	Flow Description
	R 12400 S 0
D2 <DQoS>	CMTS sends CMS an acknowledgment of the Gate-Set with its GateID included in the message. Transaction ID – 3178 Subscriber - 128.96.41.1 Gate ID - 37125 Activity Count - 2
N7 <NCS>	CMS sends MTA a MDCX message. This message indicates that the MTA should remain inactive, but for reserve send/receive bandwidth. This message also contains the session description of the MG. MDCX 1203 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 C: A3C47F21456789F0 I: FDE234C8 M: inactive X: 0123456789AE R: hu L: dq-gi:37125; N: ca@ca1.cablelabs.com:5678 v=0 o=- 4723891 7428910 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/xV6eo1tQtw==
D3 <DQoS>	MTA sends CMTS a DSA request asking for bandwidth allocation in the access network. DSA-REQ Transaction ID 2 *Upstream Service Flow*

Flow	Flow Description
	Service Flow Reference 1 QoSParameterSetType Admitted(2) ServiceFlowScheduling UGS(6) Request/Transmission Policy 0x0000017F NominalGrantInterval 10000us ToleratedGrantJitter 800us GrantsPerInterval 1 UnsolicitedGrantSize 154 *DownStreamServiceFlow* Service Flow Reference 2 QoSParameterSetType Admitted(2) MimimumReservedRate 112000 MaxSustainedTrafficRate 112000 AssumedMinResRatesPktSiz 140 MaxTrafficBurst 1522 TrafficPriority 5 *UpstreamPacketClassification* ServiceFlowReference 1 PacketClassifierReference 1 ClassifierPriority 128 ClassifierActivationState Inactive (0) IPSourceAddress 128.96.41.1 IPSourcePortStart 3456 IPSourcePortEnd 3456 IPDestinationAddress 128.96.63.25 IPDestinationPortStart 1296 IPDestinationportEnd 1296 IPProtocol 17 (UDP) *DownstreamPacketClassification* ServiceFlowReference 2 PacketClassifierReference 2 ClassifierPriority 128 ClassifierActivationState 0 (inactive) IPSourceAddress 128.96.63.25 IPDestinationAddress 128.96.41.1 IPDestinationPortStart 3456 IPDestinationPortEnd 3456 IPProtocol 17 (UDP) *Authorization Block* TLV Encoding that must include the Gate-id (37125)

Flow	Flow Description
	HMAC
D4 <DQoS>	CMTS sends MTA_0 a DSA response indicating that the request has been granted. DSA-RSP TransactionID 2 ConfirmationCode 0 (Success) *Upstream Service Flow* 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 *DownStreamServiceFlow* ServiceFlowReference 2 ServiceFlowID 12001 QoSParameterSetType Admitted(2) TimeoutAdmitted 200s Minimum ReservedRate 112000 MaxSustainedTrafficRate 112000 AssumedMinResRatePktSiz 140 MaxTrafficBurst 1522 TrafficPriority 5 *UpstreamPacketClassification* ServiceFlowReference 1 ServiceFlowID 11001 PacketClassifierReference 1 PacketClassifierID 13001 ClassifierPriority 128 ClassifierActivationState Inactive (0) IPSourceAddress 128.96.41.1 IPSourcePortStart 3456 IPSourcePortEnd 3456

Flow	Flow Description
	IPDestinationAddress 128.96.63.25 IPDestinationPortStart 1296 IPDestinationPort End 1296 IPProtocol UDP(17) *DownstreamPacketClassification* ServiceFlowReference 2 Service Flow Identifier 12001 PacketClassifierReference 2 PacketClassifierID 13002 ClassifierPriority 128 ClassifierActivationState Inactive (0) IPSourceAddress 128.96.63.25 IPDestinationAddress 128.96.41.1 IPDestinationPortStart 3456 IPDestinationPortEnd 3456 IPProtocol UDP(17) *Authorization Block* TLV Encoding that must include the Resource-id (71210) HMAC
D5 <DQoS>	MTA sends CMTS an acknowledgement of the DSA-RSP. DSA-ACK TransactionID 2 ConfirmationCode Success(0)
E5 <EM>	CMTS send a QoS_Reserve message to RKS for upstream bandwidth. 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)

Flow	Flow Description
	Event Message Version ID: 1 BCID Timestamp: 623970361 Element ID: 55555 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 ....00 = 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:1296 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) t:Vendor Specific(26) l:52, Vendor:CableLabs(4491) QoS Status: 0x0000207d ....01 = Status Indication: Resource Reserved but not Activated (1) .... .1.. = Service Flow Scheduling Type: 1

Flow	Flow Description
	.... 1... = Grant Interval: 1 ....1 .... = Tolerated Grant Jitter: 1 ....1. .... = Grants Per Interval: 1 .... .1.. .... = Unsolicited Grant Size: 1 .... 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) l:46, Value:
E6 <EM>	CMTS send a QOS reserve message to RKS for downstream bandwidth. Code: Accounting Request (4) Packet identifier: 0x3 (3) 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)

Flow	Flow Description
	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_Reserve (7) Element Type: CMTS (2) Element ID: 4 Time Zone: DST: 0, Offset: -070000 Sequence Number: 4 Event Time: 20021108144318.051 Status: 0x00000000 ....00 = 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: 0x00000f81 ....01 = Status Indication: Resource Reserved but not Activated (1)

Flow	Flow Description
	.... .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 ....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) l:42, Value:
E7 <EM>	RKS acknowledges the QoS_Reserve message. Code: Accounting Response (5) Packet identifier: 0x2 (2) Length: 20 Authenticator

Flow	Flow Description

E8
<EM>
	RKS acknowledges the QoS_Reserve message.
	
	`Code: Accounting Response (5)`
	`Packet identifier: 0x3 (3)`
	`Length: 20`
	`Authenticator`

N8
<NCS>
	MTA sends CMS a confirmation of transaction complete for MDCX.
	
	`200 1203 OK`
	
	`DQ-RI: 1162A`

At this point, all bandwidth has been allocated, and we are ready to let the phones ring	
U3 <Undefined>	CMS notifies the MGC to progress the call [proprietary]
S1 <SS7>	MGC sends Signaling Gateway an SS7 Initial Address Message (IAM).
S2 <SS7>	MGC notifies the CMS that the call is progressing in the PSTN [proprietary].
U4 <Undefined>	MGC notifies the CMS that the call is progressing in the PSTN [proprietary].

N9
<NCS>
	CMS sends MTA a notification requesting that audible-ringback be played by MTA to the originating caller.
	
	`RQNT 1204 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0`
	`X: 0123456789AE`
	`N: ca@ca1.cablelabs.com:5678`
	`R: hu`
	`S: rt`

N10 <NCS>	MTA sends CMS an acknowledgement of the RQNT message. `200 1204 OK`

Flow	Flow Description
phones are ringing ------- start Page 2 of call flow	
S3 <SS7>	Signaling Gateway forwards MGC an SS7 Answer Message (ANM).
U5 <Undefined>	MGC notifies CMS that the call has been answered [proprietary].

N11
<NCS>
	CMS sends MTA an MDCX message indicating removal of ring-back and cut-through.
	
	`MDCX 1205 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0`
	`C: A3C47F21456789F0`
	`I: FDE234C8`
	`N: ca@ca1.cablelabs.com:5678`
	`M: sendrecv`
	`X: 0123456789AF`
	`R: hu`

T3
<TGCP>
	MGC sends MG an MDCX message indicating mode change to send receive (Cut Through).
	
	`MDCX 5050 ds/ds1-1/1@mg.cablelabs.com MGCP 1.0 TGCP 1.0`
	`C: A3C47F21456789F0`
	`I: 32F345E2`
	`M: sendrecv`

E9
<EM>
	CMS sends RKS a Call_Answer Event Message to indicate the start of a call for the originating 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)`

Flow	Flow Description
	Event Message Version ID: 1 BCID Timestamp: 1041973756 Element ID: 40 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 ....00 = 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: 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"

Flow	Flow Description
E10 <EM>	MGC sends RKS a Call_Answer Event Message to indicate the start of a call for the terminating side. 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 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 ....00 = 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)

Flow	Flow Description
	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"
T4 <TGCP>	MG sends MGC a transaction complete acknowledgement of the MDCX message. 200 5050 OK
E11 <EM>	RKS sends back CMS an acknowledgement of the Call_Answer Event Message for the originating side. Code: Accounting Response (5) Packet identifier: 0x26 (38) Length: 20 Authenticator
E12 <EM>	RKS sends back MGC an acknowledgement of the call Answer event message for the terminating side. Code: Accounting Response (5) Packet identifier: 0x25 (37) Length: 20 Authenticator
D6 <DQoS>	MTA sends CMTS a DSC request asking for bandwidth commitment in the access network. DSC-REQ Transaction ID 3 *Upstream Service Flow* ServiceFlowIdentifier 11001 QoSParameterSetType Admitted+Activated (6) ServiceFlowScheduling UGS(6)

Flow	Flow Description
	Request/TransPolicy 0x0000017F NominalGrantInterval 10000us ToleratedGrantJitter 800us GrantsPerInterval 1 UnsolicitedGrantSize 154 *DownStreamServiceFlow* ServiceFlowIdentifier 12001 QoSParameterSetType Admitted+Activated (6) MinimumReservedRate 112000 AssumedMinResRatePktSiz 140 MaxSustainedTrafficRate 112000 MaxTrafficBurst 1522 TrafficPriority 5 *UpstreamPacketClassification* ServiceFlowIdentifier 11001 PacketClassifierIdentifier 13001 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.41.1 IPSourcePortStart 3456 IPSourcePortEnd 3456 IPDestinationAddress 128.96.63.25 IPDestinationPortStart 1296 IPDestinationPortEnd 1296 IPProtocol UDP(17) *DownstreamPacketClassification* ServiceFlowIdentifier 12001 PacketClassifierIdentifier 13002 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.63.25 IPDestinationAddress 128.96.41.1 IPDestinationPortStart 3456 IPDestinationPortEnd 3456 IPProtocol UDP(17) *Authorization Block* *TLV encoding that must include the Gate-id (37125)*

Flow	Flow Description
	HMAC
D7 <DQoS>	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 *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 128.96.41.1 IPSourcePortStart 3456 IPSourcePortEnd 3456 IPDestinationAddress 128.96.63.25

Flow	Flow Description
	IPDestinationPortStart 1296 IPDestinationPortEnd 1296 IPProtocol UDP(17) *DownstreamPacketClassification* ServiceFlowIdentifier 12001 PacketClassifierIdentifier 13002 ClassifierChangeAction Replace (1) ClassifierPriority 128 ClassifierActivationState Active (1) IPSourceAddress 128.96.63.25 IPDestinationAddress 128.96.41.1 IPDestinationPortStart 3456 IPDestinationPortEnd 3456 IPProtocol UDP(17) HMAC
D8 <DQoS>	MTA sends CMTS an acknowledgement of the DSC-RSP. DSC-ACK 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>	CMTS will send QoS_Commit to RKS to indicate the resources have been committed in the upstream. Code: Accounting Request (4) Packet identifier: 0x6 (6) 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)

Flow	Flow Description
	t:Vendor Specific(26) l: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_Commit (19) Element Type: CMTS (2) Element ID: 4 Time Zone: DST: 0, Offset: -070000 Sequence Number: 7 Event Time: 20021108144327.161 Status: 0x00000000 ....00 = 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:1296 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) t:Vendor Specific(26) l:52, Vendor:CableLabs(4491) QoS Status: 0x0000207f ....11 = Status Indication: Resource Reserved + Activated (3)

Flow	Flow Description
	.... .1.. = Service Flow Scheduling Type: 1 .... 1... = Grant Interval: 1 ....1 .... = Tolerated Grant Jitter: 1 ....1. .... = Grants Per Interval: 1 .... .1.. .... = Unsolicited Grant Size: 1 .... 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) l:46, Value:
E14 <EM>	CMTS 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

Flow	Flow Description
	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 Time Zone: DST: 0, Offset: -070000 Sequence Number: 8 Event Time: 20021108144331.009 Status: 0x00000000 ....00 = 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 ....11 = Status Indication: Resource Reserve +

Flow	Flow Description
	Activated (3) .... .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 ....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) l:42, Value:
E15 <EM>	RKS acknowledges the QoS_Commit for CMTS Code: Accounting Response (5) Packet identifier: 0x6 (6) Length: 20 Authenticator

Flow	Flow Description
E16 <EM>	RKS acknowledges the QoS_Commit for CMTS, Code: Accounting Response (5) Packet identifier: 0x7 (7) Length: 20 Authenticator
N12 <NCS>	MTA sends CMS a transaction complete acknowledgement of the MDCX message. 200 1205 OK
Folks are talking and the originator hangs up	
N13 <NCS>	MTA sends CMS a notification that the attached device has gone on-hook. NTFY 2002 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 X: 0123456789AF N: ca@ca1.cablelabs.com:5678 O: hu
U6 <Undefined>	CMS notifies MGC that call is terminated. <proprietary>
T5 <TGCP>	MGC sends MG a delete connection message. DLCX 5051 ds/ds1-1/1@mg.cablelabs.com MGCP 1.0 TGCP 1.0 C: A3C47F21456789F0 I: 32F345E2
N14 <NCS>	CMS sends MTA an acknowledgement of the NTFY and includes a piggybacked delete connection message. 200 2002 OK . DLCX 1206 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 C: A3C47F21456789F0 I: FDE234C8
E17 <EM>	CMS sends a Call_Disconnect message to RKS to indicate the end of call for the originating side. Code: Accounting Request (4)

Flow	Flow Description
	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: 40 Time Zone: DST: 0, Offset: -070000 Event Counter: 25 Event Message Type: Call_Disconnect (16) Element Type: CMS (1) Element ID: 40 Time Zone: DST: 0, Offset: -070000 Sequence Number: 54 Event Time: 2003010714 939.659 Status: 0x00000000 ....00 = Status: No Error (0x00000000) .... .0.. = Event Origin: Trusted Element (0x00000000) .... 0... = 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:

Flow	Flow Description
S4 <SS7>	MGC sends SG an SS7 ISUP REL message.
E18 <EM>	MGC sends a Call _Disconnect message to RKS to indicate the end of call for the terminating side. 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) Event Message Version ID: 1 BCID Timestamp: 1041973760 Element ID: 41 Time Zone: DST: 0, Offset: -070000 Event Counter: 26 Event Message Type: Call_Disconnect (16) Element Type: MGC (1) Element ID: 41 Time Zone: DST: 0, Offset: -070000 Sequence Number: 53 Event Time: 2003010714 935.932 Status: 0x00000000 ....00 = Status: No Error (0x00000000) .... .0.. = Event Origin: Trusted Element (0x00000000) .... 0... = Event Message Proxied: Not proxied (0x00000000) Priority: 0

Flow	Flow Description
	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:
S5 <SS7>	Signaling Gateway forwards SS7 ISUP RLC message to MGC.
E19 <EM>	RKS acknowledges the Call_Disconnect message to CMS for the originating side. Code: Accounting Response (5) Packet identifier: 0x28 (40) Length: 20 Authenticator
E20 <EM>	RKS acknowledges the Call_Disconnect message to MGC for the terminating side. Code: Accounting Response (5) Packet identifier: 0x27 (39) Length: 20 Authenticator
D10 <DQoS>	MTA sends CMTS a DSD request asking for release of bandwidth in the access network. DSD-REQ TransactionID 5 ServiceFlowID 11001 ServiceFlowID 12001
D11 <DQoS>	CMTS sends MTA a DSD response indicating that the DSD request has been granted. DSD-RSP TransactionID 5

Flow	Flow Description
	Confirmation Code Success
D12 <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]
E21 <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) 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 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 ....00 = Status: No Error (0x00000000) .... .0.. = Event Origin: Trusted Element (0x00000000)

Flow	Flow Description
	.... 0... = 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)
E22 <EM>	CMTS sends a QoS_Release message to indicate the end of usage of resources for the downstream. Code: Accounting Request (4) Packet identifier: 0x9 (9) Length: 138 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 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

Flow	Flow Description
	Status: 0x00000000 ....00 = Status: No Error (0x00000000) .... .0.. = Event Origin: Trusted Element (0x00000000) .... 0... = 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:Downstream(2)
E23 <EM>	RKS acknowledges CMTS for the release of upstream resources. Code: Accounting Response (5) Packet identifier: 0x8 (8) Length: 20 Authenticator
E24 <EM>	RKS acknowledges CMTS for the release of downstream resources. Code: Accounting Response (5) Packet identifier: 0x9 (9) Length: 20 Authenticator
T6 <TGCP>	MG sends MGC an acknowledgement of the DLCX and includes the call statistics collected by the MTA. 250 50512 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
N15 <NCS>	MTA sends CMS an acknowledgement of the DLCX and includes the call statistics collected by the MTA. 250 1206 OK P: PS=1245, OS=62345, PR=780, OR=45123, PL=10, JI=27, LA=48, PC/RPS=790, PC/ROS=45700,

Flow	Flow Description
	PC/RPL=15, PC/RJI=27
E25 <EM>	MGC sends to RKS Signaling_Stop to indicate the stop of control signaling for the originating side. 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) 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: MGC(1) Element ID: 41 Time Zone: DST: 0, Offset: -070000 Sequence Number: 56 Event Time: 2003010714 939.669 Status: 0x00000000 ....00 = 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

Flow	Flow Description
	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:
E26 <EM>	CMS sends to RKS Signaling_Stop to indicate the stop of control signaling for the originating side. 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) Event Message Version ID: 1 BCID Timestamp: 1041973756 Element ID: 40 Time Zone: DST: 0, Offset: -070000 Event Counter: 25 Event Message Type: Signaling_Stop (2) Element Type: CMS (1)

Flow	Flow Description
	Element ID: 40 Time Zone: DST: 0, Offset: -070000 Sequence Number: 56 Event Time: 2003010714 939.669 Status: 0x00000000 ....00 = 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: 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:
E27 <EM>	RKS acknowledges the Signaling_Stop from the MGC for the terminating side. Code: Accounting Response (5) Packet identifier: 0x2a (42) Length: 20 Authenticator

Flow	Flow Description
E28 <EM>	RKS acknowledges the Signaling_Stop from the CMS for the originating side. Code: Accounting Response (5) Packet identifier: 0x29 (41) Length: 20 Authenticator
N16 <NCS>	CMS sends MTA a request for notification of new off-hook event. RQNT 1206 aaln/1@mta.cablelabs.com MGCP 1.0 NCS 1.0 X: 0123456789D0 N: ca@ca1.cablelabs.com:5678 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]xxxxxxxxx | [3469]11 | 0[2-9]xxxxxxxxx | 01[2-9]xxxxxxx
N17 <NCS>	MTA sends CMS an acknowledgement of the RQNT. 200 1206 OK
Both parties on-hook and ready to report off-hook	

3 GLOSSARY

AAA	Authentication, Authorization and Accounting
AES	Advanced Encryption Standard. A block cipher, used to encrypt the media traffic in PacketCable.
AF	Assured Forwarding. This is a DiffServ Per Hop Behavior.
AH	Authentication header. An IPSec security protocol that provides message integrity for complete IP packets, including the IP header.
AMA	Automated Message Accounting. A standard form of call detail records (CDRs) developed and administered by Bellcore (now Telcordia Technologies).
ASD	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.
AT	Access Tandem
ATM	Asynchronous Transfer Mode. A protocol for the transmission of a variety of digital signals using uniform 53-byte cells.
BAF	Bellcore AMA Format, also known as AMA.
BCID	Billing Correlation ID
BPI+	Baseline Privacy Plus Interface Specification. The security portion of the DOCSIS 1.1 standard that runs on the MAC layer.
CA	Certification Authority. A trusted organization that accepts certificate applications from entities, authenticates applications, issues certificates and maintains status information about certificates.
CA	Call Agent. The part of the CMS that maintains the communication state, and controls the line side of the communication.
CBC	Cipher Block Chaining Bode. 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.
CBR	Constant Bit Rate
CDR	Call Detail Record. A single CDR is generated at the end of each billable activity. A single billable activity may also generate multiple CDRs.
CIC	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.
CID	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.
CIF	Common Intermediate Format
CIR	Committed Information Rate
CM	DOCSIS Cable Modem
CMS	Cryptographic Message Syntax
CMS	Call Management Server. Controls the audio connections. Also called a Call Agent in MGCP/SGCP terminology. This is one example of an Application Server.
CMTS	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.
CMSS	CMS-to-CMS Signaling
Codec	COder-DECoder
COPS	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.
CoS	Class of Service. The type 4 tuple of a DOCSIS configuration file.
CSR	Customer Service Representative

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

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

NPA-NXX	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).
NTP	Network Time Protocol. An internet standard used for synchronizing clocks of elements distributed on an IP network.
NTSC	National Television Standards Committee. Defines the analog color television broadcast standard used today in North America.
OID	Object Identifier
OSP	Operator Service Provider
OSS	Operations Systems Support. The back-office software used for configuration, performance, fault, accounting, and security management.
OSS-D	OSS Default. Network Provider Provisioning Server.
PAL	Phase Alternate Line. The European color television format that evolved from the American NTSC standard.
PCM	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.
PDU	Protocol Data Unit
PHB	Per-Hop Behavior
PHS	Payload Header Suppression. A DOCSIS technique for compressing the Ethernet, IP, and UDP headers of RTP packets.
PKCROSS	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).
PKCS	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.
PKI	Public-Key Infrastructure. A process for issuing public key certificates, which includes standards, Certification Authorities, communication between authorities and protocols for managing certification processes.
PKINIT	Public-Key Cryptography for Initial Authentication. The extension to the Kerberos protocol that provides a method for using public-key cryptography during initial authentication.
PSC	Payload Service Class Table, a MIB table that maps RTP payload type to a Service Class Name.
PSFR	Provisioned Service Flow Reference. An SFR that appears in the DOCSIS configuration file.
PSTN	Public Switched Telephone Network
QCIF	Quarter Common Intermediate Format
QoS	Quality of Service. Guarantees network bandwidth and availability for applications.
RADIUS	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.
RAS	Registration, Admissions and Status. RAS Channel is an unreliable channel used to convey the RAS messages and bandwidth changes between two H.323 entities.
RC4	Rivest Cipher 4. A variable length stream cipher. Optionally used to encrypt the media traffic in PacketCable.
RFC	Request for Comments. Technical policy documents approved by the IETF which are available on the World Wide Web at http://www.ietf.cnri.reston.va.us/rfc.html
RFI	The DOCSIS Radio Frequency Interface specification.

RJ-11	Registered Jack-11. A standard 4-pin modular connector commonly used in the United States for connecting a phone unit into a wall jack.
RKS	Record Keeping Server. The device which collects and correlates the various Event Messages.
RSA	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.
RSA Key Pair	A public/private key pair created for use with the RSA cryptographic algorithm.
RSVP	Resource Reservation Protocol
RTCP	Real-Time Control Protocol
RTO	Retransmission Timeout
RTP	Real-time Transport Protocol. A protocol for encapsulating encoded voice and video streams. Refer to IETF RFC 1889..
SA	Security Association. A one-way relationship between sender and receiver offering security services on the communication flow.
SAID	Security Association Identifier. Uniquely identifies SAs in the DOCSIS Baseline Privacy Plus Interface (BPI+) security protocol.
SCCP	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.
SCP	Service Control Point. A Signaling Point within the SS7 network, identifiable by a Destination Point Code that provides database services to the network.
SCTP	Stream Control Transmission Protocol
SDP	Session Description Protocol
SDU	Service Data Unit. Information delivered as a unit between peer service access points.
SF	Service Flow. A unidirectional flow of packets on the RF interface of a DOCSIS system.
SFID	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.
SFR	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.
SG	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.
SGCP	Simple Gateway Control Protocol. Earlier draft of MGCP.
SHA – 1	Secure Hash Algorithm 1. A one-way hash algorithm.
SID	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.
SIP	Session Initiation Protocol. An application-layer control (signaling) protocol for creating, modifying, and terminating sessions with one or more participants.
SIP+	Session Initiation Protocol Plus. An extension to SIP.
S-MTA	Standalone MTA. A single node that contains an MTA and a non-DOCSIS MAC (e.g., ethernet).
SNMP	Simple Network Management Protocol
SOHO	Small Office/Home Office

SS7	Signaling System number 7. An architecture and set of protocols for performing out-of-band call signaling with a telephone network.
SSP	Service Switching Point. SSPs are points within the SS7 network that terminate SS7 signaling links and also originate, terminate, or tandem switch calls.
STP	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.
TCAP	Transaction Capabilities Application Protocol. A protocol within the SS7 stack that is used for performing remote database transactions with a Signaling Control Point.
TCP	Transmission Control Protocol
TD	Timeout for Disconnect
TFTP	Trivial File Transfer Protocol
TFTP-D	Default – Trivial File Transfer Protocol
TGS	Ticket Granting Server. A sub-system of the KDC used to grant Kerberos tickets.
TGW	Telephony Gateway
TIPHON	Telecommunications and Internet Protocol Harmonization Over Network
TLV	Type-Length-Value. A tuple within a DOCSIS configuration file.
TN	Telephone Number
ToD	Time-of-Day Server
TOS	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.
TSG	Trunk Subgroup
USFID	Upstream Service Flow ID. See SFID
UDP	User Datagram Protocol. A connectionless protocol built upon Internet Protocol (IP).
VAD	Voice Activity Detection
VBR	Variable Bit Rate
VoIP	Voice over IP