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IPCablecom

IPCablecom2 application manager interface

ITU-T Recommendation J.365



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ITU-T Recommendation J.365

IPCablecom2 application manager interface

Summary

This Recommendation defines an IPCablecom2 Application Manager (IPAM) interface which allows the Proxy Call Session Control Function (P-CSCF) to support Quality of Service (QoS) operations within an IPCablecom Multimedia-enabled DOCSIS-access network.

Source

ITU-T Recommendation J.365 was approved on 29 November 2006 by ITU-T Study Group 9 (2005-2008) under the ITU-T Recommendation A.8 procedure.

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ITU-T Recommendation J.365

IPCablecom2 application manager interface

1 Scope

This Recommendation defines an IPCablecom2 Application Manager (IPAM) interface. This interface allows the Proxy Call Session Control Function (P-CSCF) to support Quality of Service (QoS) operations within an IPCablecom Multimedia-enabled DOCSIS-access network.

IPCablecom defines a framework to support SIP-based communication services. SIP messages may contain a Session Description Protocol (SDP) body that defines the attributes of the media streams being advertised. The interface defined in this Recommendation allows a P-CSCF to manage QoS resources by passing session identification information and SDP if available to an IPAM. It is the responsibility of the IPAM to translate the incoming messages into IPCablecom Multimedia messages and forward them to an IPCablecom Multimedia Policy Server.

It is an important objective of this work that interoperability between IPCablecom 2.0 and 3GPP IMS is provided. IPCablecom 2.0 is based upon 3GPP IMS, but includes additional functionality necessary to meet the requirements of cable operators. Recognizing developing converged solutions for wireless, wireline, and cable, it is expected that further development of IPCablecom 2.0 will continue to monitor and contribute to IMS developments in 3GPP, with the aim of alignment of 3GPP IMS and IPCablecom 2.0.

2 References

2.1 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T J.170] ITU-T Recommendation J.170 (2005), *IPCablecom security specification*.
- [ITU-T J.179] ITU-T Recommendation J.179 (2005), *IPCablecom support for multimedia*.
- [ITU-T J.361] ITU-T Recommendation J.361 (2006), *IPCablecom2 codec media*.
- [IETF RFC 3725] IETF RFC 3725 (2004), *Best Current Practices for Third Party Call Control (3pcc) in the Session Initiation Protocol (SIP)*.
- [IETF RFC 3890] IETF RFC 3890 (2004), *A Transport Independent Bandwidth Modifier for the Session Description Protocol (SDP)*.
- [SOAP 1.1] W3C Note 08 May 2000, *Simple Object Access Protocol (SOAP) 1.1*, <http://www.w3.org/TR/2000/NOTE-SOAP-20000508>.
- [SOAP 1.2] W3C Recommendation 24 June 2003, *SOAP Version 1.2. Part 1: Messaging Framework*, <http://www.w3.org/TR/2003/REC-soap12-part1-20030624/>.
Part 2: Adjuncts, <http://www.w3.org/TR/2003/REC-soap12-part2-20030624/>.
- [XML 1.0] W3C Recommendation 04 February 2004, *Extensible Markup Language (XML) 1.0 (Third Edition)*, <http://www.w3.org/TR/2004/REC-xml-20040204>.

2.2 Informative references

- [ITU-T J.360] ITU-T Recommendation J.360 (2006), *IPCablecom2 architecture framework*.
- [ITU-T J.360 App.II] ITU-T Recommendation J.360 (2006), *IPCablecom2 architecture framework*. Appendix II: *Quality of Service architecture technical overview*.
- [IETF RFC 2327] IETF RFC 2327 (1998), *SDP: Session Description Protocol*.
- [IETF RFC 2617] IETF RFC 2617 (1999), *HTTP Authentication: Basic and Digest Access Authentication*.
- [IETF RFC 3264] IETF RFC 3264 (2002), *An Offer/Answer Model with the Session Description Protocol (SDP)*.
- [IETF RFC 3311] IETF RFC 3311 (2002), *The Session Initiation Protocol (SIP) UPDATE Method*.
- [WSDL] W3C Note 15 March 2001, *Web Services Description Language (WSDL) 1.1*. <http://www.w3.org/TR/wsdl>.

3 Terms and definitions

This Recommendation defines the following terms:

- 3.1 application manager:** A system that interfaces to Policy Server(s) for requesting QoS-based service on behalf of an end-user or network management system.
- 3.2 cable modem termination system:** Device at a cable head-end which implements the DOCSIS RFI MAC protocol and connects to CMs over an HFC network.
- 3.3 leg:** A single segment of a session associated with a UE (e.g., calling UE or called UE).
- 3.4 policy server:** A system that primarily acts as an intermediary between AM(s) and CMTS(s). It applies network policies to AM requests and proxies messages between the AM and CMTS.
- 3.5 quality of service:** Method used to reserve network resources and guarantee availability for applications.
- 3.6 request for comments:** Technical policy documents approved by the IETF which are available at <http://www.ietf.org/rfc.html>.

4 Abbreviations, acronyms and conventions

4.1 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AM	Application Manager
AS	Application Server
CMTS	Cable Modem Termination System
CSCF	Call Session Control Function
HTTP	Hypertext Transfer Protocol
IETF	Internet Engineering Task Force
IP	Internet Protocol

IPAM	IPCablecom Application Manager (sometimes abbreviated as PAM)
MAC	Media Access Control
P-CSCF	Proxy Call Session Control Function
PS	Policy Server
QoS	Quality of Service
RFC	Request for Comments
SIP	Session Initiation Protocol
SSL	Secure Socket Layer
UA	User Agent
W3C	World Wide Web Consortium
WS	Web Service
WSDL	Web Services Description Language
XML	Extensible Markup Language
XSD	XML Schema Definition

4.2 Conventions

Throughout this Recommendation, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST"	This word means that the item is an absolute requirement of this Recommendation.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this Recommendation.
"SHOULD"	This word means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
"MAY"	This word means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

5 Technical overview

This clause provides a high-level overview of the IPAM and how it fits in the overall IPCablecom architecture.

5.1 Architecture

The IPCablecom Multimedia Technical Report [ITU-T J.179] describes an architecture framework and reference model for IPCablecom Multimedia. The IPCablecom2 Architecture Framework Recommendation [ITU-T J.360] provides an overview of IPCablecom2 Reference Architecture and description of the various components. Within this architecture, the IPCablecom2 Application Manager is responsible for managing the QoS resources on behalf of the IPCablecom network.

Figure 1 illustrates the IP-Cablecom2 QoS architecture, and indicates the IPAM's interfaces.

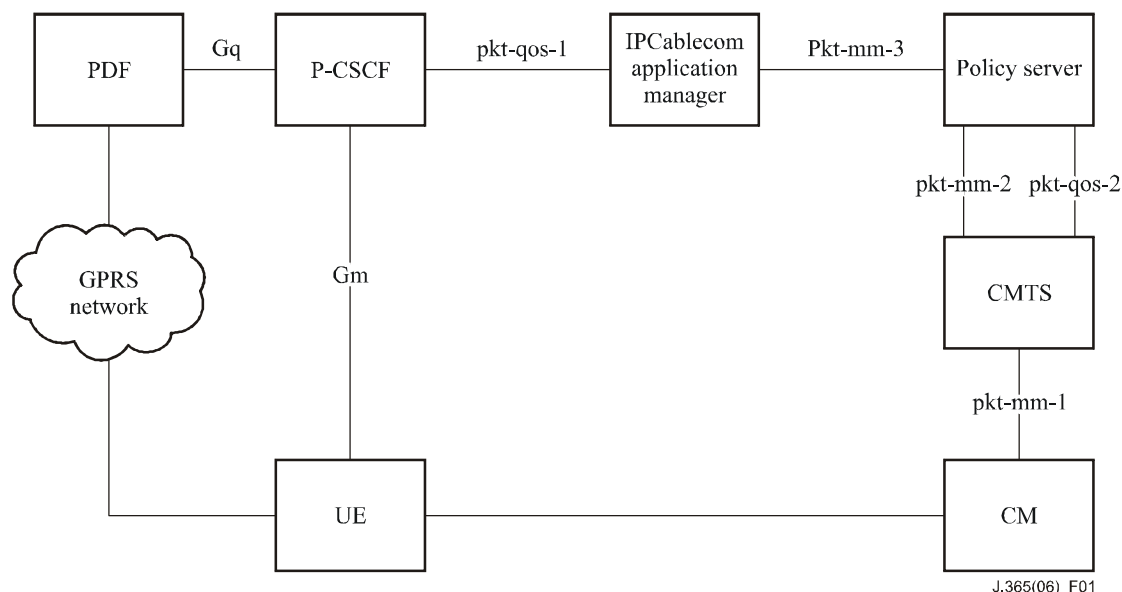


Figure 1/J.365 – IP-Cablecom2 QoS architecture

5.2 IP-Cablecom2 Application Manager overview

The IPAM enables a P-CSCF to manage QoS resources in the access network based on the Session Description Protocol (SDP) parameters contained in the offer and answer as defined in [IETF RFC 3264]. The IPAM uses the IP-Cablecom Multimedia pkt-mm-3 interface to communicate these requirements to an IP-Cablecom Multimedia Policy Server.

A typical SIP session set-up involves a UE (the calling UE) attempting to signal another UE (the called UE) of its desire to establish a session. In the simple case the following occurs:

- 1) The calling UE sends an INVITE message, containing an SDP offer, to the P-CSCF.
- 2) The P-CSCF uses the IPAM interface to reserve resources for the calling UE and then forwards the INVITE to the IMS. The reservation will be based initially on the SDP offered.
- 3) The INVITE is routed to the called UE's P-CSCF. The P-CSCF signals to its IPAM that resources need to be reserved for the called UE. The reservation will be based initially on an estimation of resources required using the caller's SDP (offer). The INVITE is then forwarded to the called UE.
- 4) When the called UE answers, a 200 OK message containing an SDP answer is sent back through the called UE's P-CSCF, routed through the IMS to the calling UE's P-CSCF, and then to the calling UE itself. During this process the P-CSCFs commit the previously reserved QoS, which is modified to reflect any changes in requirements based on the called UE's SDP (answer).
- 5) When the session completes, a BYE message is exchanged between the calling and called UEs through their respective P-CSCFs. During this process each UE's P-CSCF releases the previously committed QoS resources.

For each SIP offer/answer message received by a P-CSCF, the P-CSCF should signal the IPAM on behalf of the UE for which it is acting in processing the current message (e.g., the UE from which it received the SIP message or to which it will send the current SIP message received from the IMS). Intermediary proxies along the signalling path that are not directly responsible for any UEs involved

in the dialog should not signal any IPAM. Each P-CSCF has to signal the IPAM with the offer and answer, as both are needed to have a full view of the session's requirements.

For each session leg, the IPAM interprets the SDP contained in both the offer and answer, parsing the SDP and reading the media information including the media type, media codecs, source and destination IP addresses and ports, and then formulates an IPCablecom Multimedia Gate-Set message that is forwarded to the IPCablecom Multimedia Policy Server.

For each session leg, the IPAM creates IPCablecom Multimedia gate(s) for each media type specified. Based on the mode specified (sendonly, recvonly, sendrecv), the IPAM creates the appropriate upstream and downstream gates. For example, the SDP for a two-way video session would contain two media types: audio and video. For this type of session, the IPAM creates a total of four IPCablecom Multimedia gates consisting of an upstream gate for audio, a downstream gate for audio, an upstream gate for video and a downstream gate for video. While it is possible and may seem reasonable to create gates for the RTCP streams which are associated with the RTP streams, this is not normally done in a cable environment. This is because each gate requires the use of dedicated resources such as DOCSIS Service IDs (SIDs) which can be in very limited supply especially in legacy cable modems. Therefore, RTCP streams are normally carried on the default best-effort service flow.

6 Interface description

This clause defines the operations, elements, messages, and Web Service profile for the IPAM interface. The IPAM implements a document-style SOAP interface, each operation being associated with a specific input and output message. Operations and message types are defined within the Web Services Description Language (WSDL) and XML Schema Definition (XSD provided in Annexes A and B).

A P-CSCF invoking operations on this interface **MUST** send and receive messages as specified in the WSDL provided in Annex B.

An IPAM implementing the interface **MUST** use a document-style (document-literal) encoded SOAP interface as specified in the WSDL provided in Annex B.

An IPAM implementing the interface **MUST** process and respond to message types as specified in the WSDL provided in Annex B.

An IPAM wishing to support additional operations **MAY** extend the WSDL provided but **MUST NOT** modify the specified operations and message types.

6.1 Operations

This interface supports three operations: reserveQos, commitQos, and releaseQos. These operations allow a P-CSCF to manage QoS resources in an IPCablecom Multimedia-enabled cable access network. The operations supported by the IPAM allow a P-CSCF to optionally verify that resources are available in the access network using the reserveQos operation. The commitQos operation allows a P-CSCF to commit previously reserved resources, or to immediately commit resources that have not been previously reserved. The releaseQos operation allows a P-CSCF to free up resources that have previously been reserved or committed when a session is cancelled or has ended.

In order for a P-CSCF to manage QoS resources, it **MUST** execute one of the operations defined in Table 1 at the appropriate point in the session set-up. [IETF RFC 3264] defines an offer/answer model using SDP which is the basis for when a P-CSCF executes one of these operations. As specified, an offer/answer exchange is atomic, and therefore the P-CSCF does not have to maintain state across offer/answer exchanges.

[RFC 3311] defines an UPDATE method within SIP allowing a UE to update existing session parameters. The UPDATE may be issued while an offer/answer exchange is in progress; however, this can be treated as an update to a reservation.

An IPAM **MUST** update the reserved or committed resources for a given sessionID to reflect the most recently received reserveQos and commitQos operation parameters.

By providing discrete reserveQos and commitQos operations, the P-CSCF can initially request that resources are reserved based on an offer. This allows the P-CSCF to verify that resources are available before notifying the called UE. When an SDP answer is received from the called UE, the P-CSCF can update the previously reserved resources which are modified to reflect the negotiated session parameters. When a successful response (e.g., 200 OK) is received from the called UE, the P-CSCF can commit the previously reserved resources. Note that the SDP answer may be received in a 200 OK, in which case the resources can be immediately committed.

This Recommendation does not mandate the order in which the P-CSCF executes call processing (e.g., waiting for acknowledgement for a QoS operation before forwarding session signalling or not). Rather, such operation is dependent on the network operation and their desired customer experience, impacts to call establishment times, etc.

Table 1 outlines the available operations and their associated input and output messages. Each message is defined in detail in 6.3.

Table 1/J.365 – Web service operations

Operation name	Style	Messages	
reserveQos	Document	Input	reserveQosRequest (see 6.3.1)
		Output	reserveQosResponse (see 6.3.2)
commitQos	Document	Input	commitQosRequest (see 6.3.3)
		Output	commitQosResponse (see 6.3.4)
releaseQos	Document	Input	releaseQosRequest (see 6.3.5)
		Output	releaseQosResponse (see 6.3.6)

When a P-CSCF wishes to reserve QoS resources, it **MUST** issue a reserveQos request to the IPAM.

When a P-CSCF wishes to commit QoS resources, it **MUST** issue a commitQos request to the IPAM.

When the P-CSCF wishes to remove previously reserved or committed QoS resources, it **MUST** issue a releaseQos request to the IPAM.

6.2 Elements

This clause provides a definition for the elements passed within messages across the WS interface. Annex A contains an XSD for these element types.

6.2.1 partyInfo

The partyInfo element is a complex type which identifies the parameters associated with an individual leg of a session.

Within the IPAM, the partyInfo element is used to define the IPCablecom Multimedia Gates as well as providing information used in the execution of business policies and generation of billing events.

In IPCablecom Multimedia, QoS information for a media flow is conveyed/stored in an object called a Gate. A Gate is associated with a subscriber identifier (SubscriberID) which is either the

active cable modem or CPE IP address. The CMTS and the subscriber's cable modem filter traffic onto the flow associated with the Gate by using a traffic classifier. The classifier is defined by specifying a 5-tuple containing the source and destination IP addresses, source and destination ports, and the protocol.

The SubscriberID, Classifier, and TrafficProfile objects used to construct the IPCablecom Multimedia Gate for each flow that makes up a session are derived from the partyInfo elements contained in an array of partyInfo.

Table 2 defines the elements contained within the partyInfo type.

Table 2/J.365 – PartyInfo elements

Element name	Type	Definition
id	String	See 6.2.1.1
legId	String	See 6.2.1.2
isLocal	Boolean	See 6.2.1.3
sdp	String	See 6.2.1.4
signalingAddress	String	See 6.2.1.5

6.2.1.1 id

This is a unique identifier for a subscriber, typically the public identifier, e.g., alice@mso.net.

This id **MUST** be the same for a particular subscriber, no matter what location he/she is at when initiating or responding to a session request.

This id **SHOULD** contain an identifier that allows the IPAM to identify the associated SDP to a subscriber for the purpose of optionally evaluating subscriber-based policy rules.

6.2.1.2 legId

This is a unique identifier for a session leg (originating or terminating) that is needed to disambiguate legs that share the same session identifier and signalling address such as is the case when a session is forked. Typically, the P-CSCF will use the branch parameter from the SIP via the header they insert as the unique legId element, but any unique identifier can be generated or used by the P-CSCF.

The P-CSCF **MUST** use the same legId to identify a leg during the same transaction. This field **MUST** be supplied when this UE is local to the P-CSCF.

The legId is also used to release QoS resources for a particular leg, but not the whole session. For example, on a re-INVITE that is rejected by a 488 response, releasing the QoS resources for a particular leg by specifying the legId will only release resources reserved as a result of the re-INVITE and not resources reserved/committed for the previous offer/answer exchange.

6.2.1.3 isLocal

This is a boolean flag (true/false) that informs the IPAM whether or not this UE is local to the P-CSCF within the context of this operation request. A UE is local to a P-CSCF if the P-CSCF is the first point of contact in the signalling plane between the UE and the IMS.

The IPAM **MUST** assume a default value of false if this element is not supplied.

The P-CSCF **MUST** set this flag to true if it is responsible for setting QoS for this UE as part of the operation being performed.

Note that once this flag is set to true within a session managed by an IPAM, it **MUST** remain true for the remainder of the session.

6.2.1.4 sdp

This is the SDP contained in the offer/answer.

The P-CSCF MUST pass the unchanged SDP contained in the offer/answer if available.

6.2.1.5 signalingAddress

This is the signalling transport address of the UE initiating or responding to a session request.

The P-CSCF MUST supply the signalingAddress if isLocal is set to true.

The IPAM MUST use this field as the subscriberId field in IPCablecom Multimedia messages if present.

6.2.2 sessionId

call-id SEMICOLON from-tag [SEMICOLON to-tag]

The call-id, from-tag and to-tag MUST be extracted from the corresponding SIP headers fields. If the to-tag is not present in the SIP message, the sessionId will only contain the call-id and the from-tag. Because the to- and from-tags can be reversed (depending on which UE is issuing a request), the IPAM MUST match sessionIds with the same call-id and same (from-tag to-tag) pair. For example, the two following sessionIds are equivalent:

123456-00e0953431@151.104.2.3;590432;276439

123456-00e0953431@151.104.2.3;276439;590432

6.2.3 arrayOfPartyInfo

An array of partyInfo elements (as defined in 6.2.1) representing the UEs involved in this dialog.

The P-CSCF MUST provide an array of partyInfo elements for each reserveQos and commitQos operation. The array MUST contain one partyInfo element for each leg of the session that QoS resources are being requested.

6.2.4 emergencyCall

A flag indicating if this session is an emergency call.

The IPAM MUST assume a default value of false if this element is not supplied.

When the emergencyCall flag is true, the IPAM MUST set the sessionClassId to 0x0F (priority 7, preempt) in the corresponding IPCablecom Multimedia Gate-Set messages.

6.2.5 icId

This optional parameter holds the IMS charging identifier (ICID).

The IPAM MUST store and associate this ICID value with the session identified by the sessionId.

6.2.6 bcId

An optional Billing Correlation ID MAY be returned by the IPAM and used by an RKS, or some other back-office application to correlate Event Messages that are generated by an IPCablecom Multimedia Policy Server and CMTS.

If configured, the IPAM MUST generate a unique BCID for all of the IPCablecom Multimedia gates associated with each leg of the session and include this BCID in an Event Generation Info object sent to the Policy Server over the pkt-mm-3 interface.

The IPAM MUST return the generated BCID to the P-CSCF if configured to do so.

6.3 Messages

6.3.1 reserveQosRequest

A reserveQosRequest message is sent when a P-CSCF wishes to verify that QoS resources are available following the receipt of an offer from a UE.

This message is sent when a SIP INVITE or UPDATE message is received by the P-CSCF and is used by the IPAM to initially reserve resources in the access network ensuring that those resources are available when the called UE ultimately answers the session establishment request. If resources are not available, the P-CSCF has the opportunity to signal back to the calling UE, if the operator wishes, to block sessions that will not have associated QoS resources.

A P-CSCF MAY send a reserveQosRequest message as part of a reserveQos operation when it receives an offer (INVITE or UPDATE) from a UE that it is responsible for, or from the IMS destined for a UE that it is responsible for. A P-CSCF MAY also send a reserveQosRequest message as part of a reserveQos operation when it receives an answer in a provisional (1XX) response from a UE that it is responsible for, or from the IMS destined for a UE that it is responsible for.

A P-CSCF MAY send a 503 Service Unavailable response to the calling UE if QoS resources are not available.

An IPAM MUST send IPCablecom Multimedia Gate-Set requests containing a reserved envelope over the pkt-mm-3 interface for all local UEs associated with this session when a reserveQosRequest message is received. The IPAM MUST generate the IPCablecom Multimedia flowspec envelope as specified in 7.1.

Table 3 below defines the contents of the reserveQosRequest message.

Table 3/J.365 – reserveQosRequest message elements

Element name	Requirement	Type	Definition
sessionId	Mandatory	String	See 6.2.2.
arrayOfPartyInfo	Mandatory	Array	See 6.2.3.
emergencyCall	Optional	Boolean	See 6.2.4.
icId	Optional	String	See 6.2.5.

6.3.2 reserveQosResponse

The reserveQosResponse message MUST be sent from the IPAM in response to a reserveQosRequest.

Table 4 defines the contents of the reserveQosResponse message.

Table 4/J.365 – reserveQosResponse message elements

Element name	Requirement	Type	Definition
responseCode	Mandatory	Integer	A response code representing the success or failure of the operation. The following defines the possible response codes returned: 0: Success 1: General failure 2: Resource unavailable 3: Failed to parse request message 4: Unknown UE 200-255: Vendor-specific error
Description	Optional	String	A string describing the reason for the failure. This is primarily meant for logging and debugging purposes and is provided as information for the operator. The content of this field is left undefined and is vendor specific.
bcId	Optional	Complex	Billing Correlation ID – The RKS, or some other back-office application, uses the BCID to correlate Event Messages that are generated for a single transaction. This is one of the fields in the Event Message Header.

6.3.3 commitQosRequest

A commitQosRequest message is sent when the P-CSCF receives an answer in the form of a 200 OK or 18X with SDP message. At this stage, the IPAM has all the info it needs and MUST commit resources by setting the state of IPCablecom Multimedia gates to committed as well as setting the classifiers and QoS resources to reflect the information contained in the updated SDP. Given that resources may have been reserved at the session initiation stage, the commitment of the resources can be expected to succeed (as long as the committed resources do not exceed the reserved ones).

A P-CSCF MUST send a commitQosRequest message as part of a commitQos operation when it receives an answer (OK or ACK with SDP) to a previously forwarded offer.

An IPAM MUST send IPCablecom Multimedia Gate-Set requests containing a committed envelope over the pkt-mm-3 interface for all resources associated with the sessionId specified. The IPAM MUST generate the IPCablecom Multimedia flowspec envelope as specified in 7.1.

Table 5 defines the contents of the commitQosRequest message.

Table 5/J.365 – commitQosRequest message elements

Element name	Requirement	Type	Definition
sessionId	Mandatory	String	See 6.2.2.
arrayOfPartyInfo	Optional	Array	See 6.2.3. An array of partyInfo elements as defined in 6.2.1 and containing any final SDP to be used to commit resources.
emergencyCall	Optional	Boolean	See 6.2.4.
icId	Optional	String	See 6.2.5.

6.3.4 commitQosResponse

The commitQosResponse message MUST be sent from the IPAM in response to a commitQosRequest.

Table 6 defines the contents of the commitQosResponse message.

Table 6/J.365 – commitQosResponse message elements

Element name	Requirement	Type	Definition
result	Mandatory	Integer	A response code representing the success or failure of the operation. The following defines the possible response codes returned: 0: Success 1: General failure 2: Resource unavailable 3: Failed to parse request message 4: Unknown UE 200-255: Vendor-specific errors
description	Optional	String	A string describing the reason for the failure. This is primarily meant for logging and debugging purposes and is provided as information for the operator. The content of this field is left undefined and is vendor specific.
bcId	Optional	Complex	Billing Correlation ID – The RKS, or some other back office application, uses the BCID to correlate Event Messages that are generated for a single transaction. This is one of the fields in the Event Message Header.

6.3.5 releaseQosRequest

A releaseQosRequest message is sent when the P-CSCF determines that a dialog has terminated (in re-INVITE scenarios, some negative final responses might not terminate a dialog, e.g., a 488 due to a re-INVITE). An exception to the rule above is when a non-2xx response is received as a final response to an INVITE, in which case a releaseQosRequest message MUST be sent specifying an additional argument to the sessionId, which is the legId of the UE for which resources need to be released. On an initial INVITE, resources will be released for that UE only, unless there are no other UEs left that might create a dialog with the originating UE. In the case where the initial INVITE was forked for instance, one terminating UE might reply with a final non-2xx response, while another terminating UE follows this reply with a 200 OK; thus, the P-CSCF needs to have a way to signal the IPAM not to release all resources for a session.

Similarly on a re-INVITE, the P-CSCF would signal to the IPAM that a re-INVITE failed by sending a releaseQosRequest message and specifying the legId of the UE for which the re-INVITE was not confirmed. This way, resources reserved for the new offer are released and resources reserved/committed prior to the re-INVITE are maintained.

A P-CSCF MUST send a releaseQosRequest message as part of a releaseQos operation when it receives a termination (BYE or CANCEL) from a UE that it is responsible for, or from the IMS destined for a UE that it is responsible for. In the case where a dialog is terminated upon receipt of a BYE request for instance, the legId SHOULD NOT be included, which will result in releasing all resources associated with the dialog identified by the sessionId. Note that when QoS for both the