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IPCablecom

IPCablecom2 data collection to support accounting

ITU-T Recommendation J.363

ITU-T

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IPCablecom2 data collection to support accounting

Summary

This Recommendation defines the requirements and functionality needed to support Accounting functions within this release of the IPCablecom2 Architecture. The main focus is to define how the collection of usage data is done to assure that the required billing functions can be supported, though usage data may also be used for other purposes (e.g., network or service trend analysis, network planning, and traffic engineering). In addition, this Recommendation details the various accounting events and their associated attributes.

Source

ITU-T Recommendation J.363 was approved on 29 November 2006 by ITU-T Study Group 9 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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1 Scope

This Recommendation defines the requirements and functionality needed to support Accounting functions within this release of the IPCablecom2 Architecture. The main focus is to define how the collection of usage data is done to assure that the required billing functions can be supported, though usage data may also be used for other purposes (e.g., network or service trend analysis, network planning, and traffic engineering). In addition, this Recommendation details the various accounting events and their associated attributes.

An Accounting Event message is a data record containing information about network usage and activities. A single Accounting Event may contain a complete set of data regarding usage or it may only contain part of the total usage information. When correlated by the Charging Data Function (CDF), information contained in multiple Accounting Events provides a complete record of the service. This complete record of the service is often referred to as a Call Detail Record (CDR). Accounting Events or CDRs may be sent to one or more back-office applications such as a billing system, fraud detection system, or pre-paid services processor.

The structure of an Accounting Event Message data record is designed to be flexible and extensible in order to carry information about network usage for a wide variety of services. It needs to support the correlation of accounting events generated in the session and bearer domains and to seamlessly interwork with the cable-specific access network.

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

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.366.4] ITU-T Recommendation J.366.4 (2006), *IPCablecom2 Multimedia Subsystem (IMS): Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3 Specification*.

[TS 32.240] ETSI TS 132.240 V6.3.0 (2005-09), *Charging Architecture and Principles*, Release 6.

[TS 32.260] ETSI TS 132.260 V6.4.0 (2005-09), *IP Multimedia Subsystem (IMS) charging*, Release 6.

[TS 32.299] ETSI TS 132.299 V6.5.0 (2005-12), *Diameter charging applications*, Release 6.

3 Terms and definitions

The terms and definitions defined in the 3GPP Technical Specification TS 32.260 [TS 32.260] are generally applicable; please refer to clause 3 of [TS 32.260]. In addition, this Recommendation uses the following terms:

3.1 **accounting**: The process of collecting usage data.

3.2 **billing correlation ID (BCID)**: A Billing Correlation ID (BCID) is an IPCablecom-defined term created for the multimedia session, which uniquely identifies the session within the IPCablecom Multimedia billing domain.

3.3 **DIAMETER**: The DIAMETER protocol provides an Authentication, Authorization and Accounting (AAA) framework for applications such as network access or IP mobility.

3.4 **charging**: The process of applying rating to usage data for a given session for the generation of a subscriber's bill.

3.5 **HFC access network**: The Hybrid-Fibre Coax Network, which provides physical transport of video and high-speed data services via DOCSIS.

3.6 **usage data**: A collection of data representing the usage of network resources for a given session.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

3GPP	Third Generation Partnership Project
AM	Application Manager
BCID	Billing Correlation ID
BSS	Business Support Systems
CCF	Charging Collection Function
CDF	Charging Data Function
CDR	Call Detail Record
CGF	Charging Gateway Function
CM	Cable Modem
CMS	Call Management Server
CMTS	Cable Modem Termination System
CSCF	Call Session Control Function
EM	Event Messages
E-MTA	Embedded Multimedia Terminal Adapter
GPRS	General Packet Radio Service
ICID	IMS Charging Identity
IMS	IP Multimedia Subsystem
IOI	Inter-Operator Identifier
IP	Internet Protocol
IP-CAN	IP Connectivity Access Network

P-CSCF	Proxy CSCF
PS	Policy Server
RADIUS	Remote Authentication Dial-In User Service
RKS	Record Keeping Server
S-CSCF	Serving CSCF
UE	User Equipment

5 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.

6 Technical overview

The IMS architecture, as defined and standardized by the Third Generation Partnership Project (3GPP) can be found in [b-TS 23.228]. This clause provides an overview of the IMS Charging Architecture, how it enables the IPCablecom2 Accounting Architecture, and defines any needed extensions to the IMS. In this clause, information is also provided on how this Accounting architecture relates to IPCablecom Multimedia Event Messages and, to a lesser extent, IPCablecom Event Messages specifications.

The general 3GPP Charging Architecture and Principles are defined in [TS 32.240], and the IMS Charging Subsystem is specified in [TS 32.260].

IPCablecom2 network elements involved in the IMS Charging Architecture are required to implement the 3GPP requirements defined in [TS 32.240] and [TS 32.260]. Additional IPCablecom2 requirements are also defined in this Recommendation to allow for better integration of the IPCablecom2 accounting model with the existing IPCablecom Multimedia Recommendation. The IPCablecom2 charging requirements for IMS are covered in 6.2.1, and fully defined in subsequent clauses. Note that the IMS online charging is currently out of scope for IPCablecom2.

6.1 IMS charging architecture

GSM and UMTS networks provide functions that implement various charging mechanisms based on three levels: bearer usage (e.g., GPRS packet services), service usage (e.g., SMS and MMS), or a service subsystem (e.g., IMS). 3GPP IMS provides the means to implement offline and/or online charging mechanisms on these levels. In order to support these charging mechanisms, the network performs real-time monitoring of resource usage on the above three levels in order to detect the relevant chargeable events.

The IMS also defines intra- and inter-domain charging operations. In particular, IMS defines mechanisms for identifying the originating and terminating networks.

In addition to defining the charging mechanisms for the bearer, subsystem and service levels, the IMS also defines an extensible mechanism for correlating charging events from the bearer and subsystem. This is accomplished through the use of the Access-Network-Charging-Info parameter in the P-Charging-Vector SIP header. Such an approach allows the IMS to support non-GPRS based access networks with their own charging architecture as long as they generate a unique billing correlation identifier.

The following clauses describe the various IMS charging concepts.

6.1.1 Offline charging

As defined by 3GPP, offline charging is a mechanism where charging occurs after the usage collection is complete: the usage information does not affect, in real time, the service rendered. The final result of this charging mechanism is the forwarding of Call Detail Records (CDR) files to the Billing Domain.

The offline charging functionality relies on the IMS network nodes reporting accounting information upon reception of various SIP methods or ISUP messages, as most of the accounting-relevant information is contained in these messages. This reporting is achieved by sending Accounting Requests (ACR) using the IETF DIAMETER protocol from the IMS network elements to the Charging Data Function (CDF) which correlates the accounting events and provides CDRs to the billing applications.

Information used for IMS charging is passed between IMS nodes in the SIP P-Charging-Vector header. [ITU-T J.366.4] describes the IMS control messages in detail, including the use of the P-Charging-Vector SIP header [b-IETF RFC 3455]. This header contains the following information parameters:

– The IMS Charging Identity (`ICID`), mandatory parameter (`icid-value`): The ICID is the primary information element used to correlate records across the various IMS elements. The details of how correlation is done based on ICID are covered in [TS 32.260]. The ICID provides a similar function to the Billing Correlation Identifier (BCID) used in IPCablecom Event Messaging.

– The Inter-Operator Identifier (IOI) parameters (`orig-ioi and term-ioi)`: The IOI parameters may include the originating and/or terminating interoperator identifiers which are used to correlate charging records between different operators. IOI parameters identify the networks handling the IMS session.

– The Access Network Charging Information parameter (`access-network-charging-info`): The access-network-charging-info parameter is an instance of generic-param from the current charge-params component of P-Charging-Vector header and is defined in 7.2.A.5 of [ITU-T J.366.4]. This parameter contains access-network-specific information that allows IP-CAN accounting records to be correlated with the IMS Subsystem billing records. The existing IMS architecture defines this information in detail for GPRS access networks. IPCablecom2 defines additional values for the IP-CAN data for the Cable HFC Access Network. In particular, it is used to convey the IPCablecom Multimedia Billing Correlation ID (BCID) as described in 6.2.

In the SIP signalling session, the offline charging function address is encoded in the SIP P-Charging-Function-Addresses header [b-IETF RFC 3455], which is also described in [ITU-T J.366.4]. For Offline Charging, the P-Charging-Function-Addresses header contains addressing information for the Charging Collection Function (CCF). The CCF is the same as the CDF (Charging Data Function) in IMS Offline Charging.

6.1.2 Online charging

Online charging is a mechanism defined in 3GPP where the collected usage data information can affect, in real time, the service rendered. It requires a more direct interaction between the charging mechanism and the bearer, session, and service control via the use of Application Servers and the Media Resource Function Controller. The mechanism comprises the execution of credit control and subscriber account balance management on the online charging system. Note that for IPCablecom2, online charging is currently out of scope.

6.1.3 Inter-domain charging

IMS defines an Inter-Operator Identifier (IOI) that is used to identify the originating and terminating network operators involved in an IMS SIP dialog or transaction outside a dialog. The IOI is passed between IMS nodes in the SIP signalling in the P-Charging-Vector SIP header. The originator of a session passes the `orig-ioi` to the terminating side in the SIP requests, and the terminating side fills in the `term-ioi` in SIP responses.

There are three types of IOI records defined in IMS:

1) Type 1 IOIs identify the visited and home networks in roaming situations;

2) Type 2 IOIs identify the originating and terminating parties in an IMS session;

3) Type 3 IOIs identify the home network and the service provider.

Thus, this identifier is used for inter-domain billing purposes in three critical ways: It is used to identify the home and visiting network when the user is accessing services away from the home network; it is used to identify the originating and terminating network for a user session; and it is used to identify the home network and the service provider when these two entities are separate.

In each of these cases, the two networks may use the IOI for exchanging charging records or doing inter-operator settlements.

6.2 IPCablecom2 accounting architecture

IPCablecom2 Accounting takes the approach that the Cable HFC Access Network along with the IPCablecom Multimedia Subsystem defines a new type of IP-CAN for incorporation into the overall IMS architecture.

6.2.1 Design goals

The IPCablecom2 network accounting and usage design goals include:

- to enable the ability to account for network usage and service activities in real time;

  In this case, real time is relative to when the events are sent to the central repository and does not imply when the final bill may be available to the customer nor that events are sent to indicate incremental usage of network resources;
- to allow for multiple network elements to generate events which can be correlated to a given session or subscriber;
- to support the correlation of accounting events across the signalling and bearer planes;
- to facilitate the rapid introduction of features and services by minimizing the impact to other network elements and their need to signal feature and service related information.

6.2.2 Scope

IPCablecom2 network elements involved in the IPCablecom2 Accounting Architecture or the 3GPP Charging Architecture are required to support all the 3GPP requirements for offline charging. Additionally, the IPCablecom2 event reporting definition is limited to the Rf interface, a DIAMETER-based protocol interface between the IMS nodes (SIP CSCFs and AS) and the Charging Data Function and specifically, the definition of additional accounting record fields to meet the high-level design goals stated above.

Online charging is currently left out of the scope for IPCablecom2.

The 3GPP Ga and Bx interfaces are considered out of scope in IPCablecom2, so extensions to CDR formats are left unspecified.

6.2.3 Accounting reference points

Figure 1 shows the main IPCablecom2 components involved with Accounting, and the interfaces between each of the components.

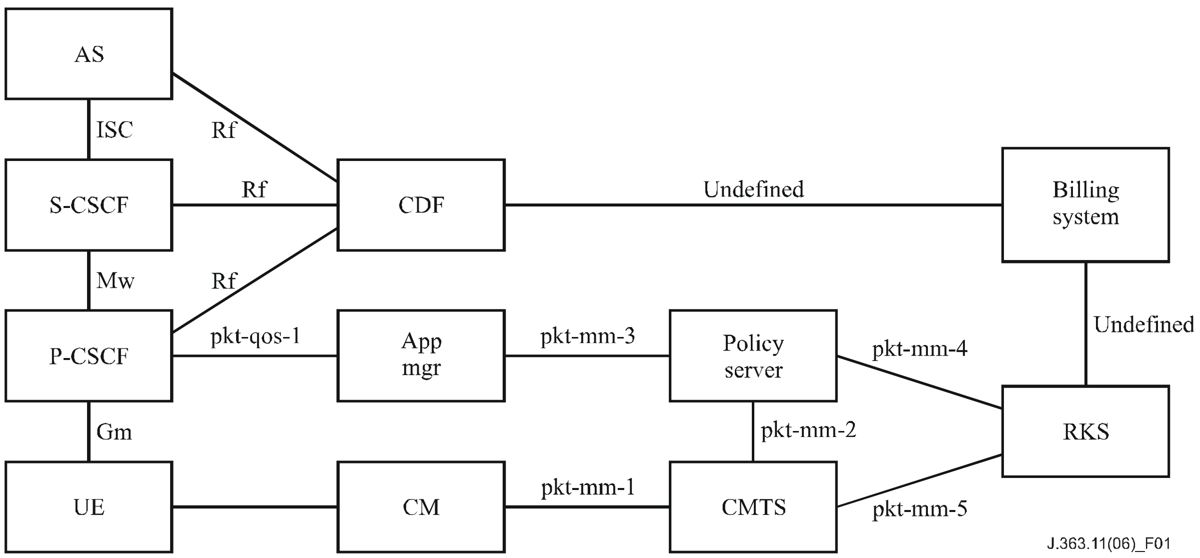

Figure 1 – IPCablecom2 accounting reference points

The reference points shown in Figure 1 are described in Table 1.

Table 1 – Accounting reference point descriptions

Reference point	IPCablecom2 network components	Reference point description
Gm	UE – P-CSCF	SIP-based interface from the User Endpoint to the P-CSCF. All registration and session-related signalling to the user application is done over this interface.
Mw	P-CSCF – S-CSCF	SIP-based interface from the P-CSCF to the S-CSCF.
ISC	S-CSCF – AS	IMS Service Control Interface from the S-CSCF and the Application Server (AS).
Rf	P-CSCF, S-CSCF, AS – CDF	DIAMETER-based interface from between the IMS nodes (P-CSCF, S-CSCF, and AS) to the Charging Data Function (CDF).
pkt-qos-1	P-CSCF – IPCablecom2 Application Manager	A SOAP/XML-based Web Services interface between P-CSCF and Application Manager. This interface provides the mechanism for the P-CSCF to request QoS on behalf of the UE. See [b-ITU-T J.365].
pkt-mm-1	CMTS – CM	DOCSIS interface between the CMTS and the CM. The CMTS instructs the CM to set up, tear down or change a DOCSIS service flow in order to satisfy a QoS request via DSX signalling. See [b-ITU-T J.179].
pkt-mm-2	Policy Server – CMTS	COPS-based interface between the IPCablecom Multimedia Policy Server (PS) and the CMTS. It is used to control policy decisions on providing QoS to a UE session. See [b-ITU-T J.179].
pkt-mm-3	IPCablecom Application Manager – Policy Server	COPS-based interface between the Application Manager and the PS to trigger the PS to control the policy decisions for a UE session. See [b-ITU-T J.179].
pkt-em	Policy Server, CMTS – RKS	RADIUS-based interface between the IPCablecom Multimedia nodes (CMTS and PS) and the Record Keeping Server (RKS) as defined in [b-ITU-T J.179].

The UE communicates through the CM using the IP protocol (and in fact, the IMS-Gm traffic is carried over the IP protocol). In IPCablecom Multimedia, the interface between the RKS and the Business Support Systems (BSS) is undefined; however, in practice, CDRs are commonly batched and sent to the BSS over a batch interface using file transfer protocols such as FTP. In 3GPP IMS, the interface between the CDF and the billing system is defined as the Bx reference point. Given that each operator has CDR requirements unique to their service offerings and billing systems, IPCablecom2 places this interface out of scope.

6.3 Relationship to IPCablecom Multimedia Event Messages

The IPCablecom Multimedia subsystem is an IP-CAN to the IMS. IPCablecom Multimedia provides the foundation for QoS resource management on cable networks, such as QoS reservation, activation, and release. The IPCablecom Multimedia architecture also defines an accounting framework and specific Event Messages to track the status and usage data related to QoS policy decisions (requests, updates, deletions). Since this release of IPCablecom2 relies on IPCablecom Multimedia, it is critical for service operators to be able to correlate the various streams of accounting data related to a given session. This includes both the IMS-related accounting data based on the SIP sessions and the bearer-related accounting data based on the IPCablecom Multimedia sessions.

The pkt-qos-1 interface is used by the P-CSCF to request access network resources for a given session. The protocol exchanges between the P-CSCF and the IPCablecom Application Manager (AM) include the charging data needed to correlate accounting data between the two domains.

The pkt-qos-1 interface and theory of operation for QoS operations are defined in detail in the IPCablecom Application Manager Interface Recommendation [b-ITU-T J.365]. When initiating a session on behalf of a UE, the P-CSCF passes the IMS ICID identifier assigned to the session via the pkt-qos-1 interface to the IPCablecom Multimedia AM. The AM provides the Access Network Charging Information to the P-CSCF in the message response: it consists of the BCID. The BCID is also sent in IPCablecom Multimedia Event Messages from the PS and CMTS to the IPCablecom Multimedia Record Keeping Server (RKS).

The IPCablecom Multimedia BCID is defined to be unique within an IPCablecom Service Provider's domain. Since the correlation of the IPCablecom2 session-related information and the IPCablecom Multimedia QoS accounting records is done within the boundaries of an operator's domain, the BCID is the only IPCablecom Multimedia data item needed to perform the correlation.

Refer to [b-ITU-T J.365] for a detailed description of the format and value ranges for the BCID.

6.4 Relationship to IPCablecom Event Messages

Like IPCablecom2 Accounting, IPCablecom Event Messages (EM) define an event-based accounting architecture. This architecture is documented in [b-ITU-T J.164] and defines the complete accounting record format and associated network element triggers. It is expected that CSCFs will need to interwork directly with CMS to allow communication between E-MTAs and UEs and to allow the sharing of PSTN facilities. A critical capability that must be preserved is the ability to correlate accounting events for sessions that may traverse the two network elements.

Given the strong desire to leverage as much of the existing IMS work as possible, the IPCablecom accounting operation will not change. Rather, interworking between CMSs and CSCFs will be treated in one of the following ways:

1) CMSs and CSCFs are co-existent in the same operators network and thus the signalling is intra-domain;

2) CMSs and CSCFs are separate and in different operators networks and thus the signalling is inter-domain.

The advantage of this approach is that IMS has clearly defined procedures for both of these cases. It also allows the CMS to look like a CSCF from a signalling perspective.

While the two accounting framework are similar, the IPCablecom EM accounting specifications are different in how the accounting data is conveyed inside SIP sessions and some slight change in operation is required.

1) Correlation IDs are transferred in the SIP P-DCS-Billing-Info header in CMSS [b-ITU T J.178], as opposed to the P-Charging-Vector in IPCablecom2 Accounting as defined in this Recommendation; and

2) IPCablecom EM requires both the originating and terminating network elements to generate and exchange correlation IDs.

These two differences are easily accommodated by placing a few additional operational requirements on the CMS interfacing with a CSCF, please refer to [b-ITU-T J.178] for the detailed operational requirements placed on the CMS.

7 IPCablecom2 extensions to IMS charging

Since IPCablecom2 Accounting adopts the IMS Charging Subsystem, and given the operator requirements to correlate accounting events between IPCablecom Multimedia QoS and SIP sessions, some extensions are needed to support interactions between the IPCablecom2 IMS systems and the IPCablecom Multimedia IP-CAN. This clause identifies the required extensions to IMS, and also defines what functionality within the existing IMS Release 6 specifications is required in an IPCablecom2 implementation.

7.1 Required Subset of IMS Charging

The IMS Charging Subsystem defines the interfaces necessary to deliver accounting information from the IMS network elements up to the billing system. It also defines both offline and online charging mechanisms. IPCablecom2 Accounting relies on the use of the offline charging and the associated requirements of the Rf interface from the IMS components to the CDF. The mechanism for delivering charging information from the CDF to the billing system is left unspecified. IPCablecom2 Network Elements MUST implement the Rf interface as defined in [TS 32.240], [TS 32.260] and [TS 32.299]. IPCablecom2 Network Elements MUST support the P-Charging-Vector and P-Charging-Function-Address header requirements as defined in [ITU-T J.366.4].

7.2 Charging identification information in the pkt-qos-1 interface

This clause provides a high-level description of the roles played by the P-CSCF and IPCablecom2 Application Manager in the charging flows. The complete requirements can be found in [ITU-T J.366.4] and [b-ITU-T J.365].

The originating P-CSCF is responsible for generating the IMS ICID and the AM is responsible for generating the IPCablecom Multimedia BCID. Both the ICID and BCID are exchanged between these elements allowing for their values to be recorded in their respective accounting events.

The P-CSCF generates an ICID upon receipt of a dialog initiating INVITE from a UE and includes this in the first resource request made to the AM for that session. Upon receipt of a resource request with an ICID, the AM stores and associates this ICID value with the session identified by the IPCablecom Multimedia session identifier (sessionId). The AM is then responsible for generating a unique BCID for all of the IPCablecom Multimedia sessions (gates) associated with each leg of the call and include this BCID in an Event Generation Info object sent to the Policy Server over the pkt-mm-3 interface.

If the resource request is successful, the AM returns the generated BCID to the P-CSCF in the response to the resource request.

Likewise, the P-CSCF may receive a dialog initiating INVITE for a UE from an S-CSCF with an ICID already present. In this case, the P-CSCF includes the provided ICID in the first resource request made to the AM for that session. The AM operation is unchanged in this case.

7.3 Extensions to the SIP P-Charging-Vector header

Extensions to support transmitting the IPCablecom Multimedia BCID in SIP signalling between IMS nodes are being incorporated in [ITU-T J.366.4]. IMS nodes that report charging information over the Rf interface extract these data items from the P-Charging-Vector Header in the SIP signalling messages. IPCablecom2 Network Elements MUST support the P-Charging-Vector as defined in [ITU-T J.366.4].

7.4 Extensions for IMS Charging Reporting

This clause covers IPCablecom2 extensions to IMS Charging. IPCablecom2 Network Elements MUST support the extensions defined within this clause.

7.4.1 Extensions to the DIAMETER ACRs (Rf Interface)

IMS Charging data is delivered from IMS Nodes to the CDF using DIAMETER Accounting Request (ACR) messages, and the CDF responds to the IMS Nodes with Accounting Answer (ACA) messages. Data is communicated in DIAMETER Messages via Attribute-Value Pairs (AVPs). 3GPP has defined a set of parameters specific to IMS, and these parameters are AVPs that are grouped under the DIAMETER *Service-Information* AVP. See [TS 32.299] for the full definition of these AVPs. IPCablecom2 defines additional AVPs for the purpose of correlating IMS charging records with the accounting records generated by the IPCablecom Multimedia IP-CAN.

An IPCablecom2 P-CSCF MUST include these AVPs in Charging records once the data has been made available in the pkt-qos-1 interface. Charging data may also be passed from the P-CSCF to other IMS nodes in SIP signalling. The other IPCablecom2 Network Elements MUST include these AVPs in Charging Records when the data has been received in the P-Charging-Vector header in a SIP message. The following are the additional AVPs for IPCablecom2 as represented in Table 7.2 (3GPP-specific AVPs) in [TS 32.299].

The BCID contains 4 bytes of NTP timestamp, 8 bytes of the unique identifier of the network element that generated the ID, 8 bytes giving the time zone, and 4 bytes of monotonically increasing sequence number at that network element. It is encoded as a hexadecimal string of up to 48 characters as specified in [ITU-T J.366.4].

Table 2 – Additional 3GPP-specific AVPs for IPCablecom2

AVP name	AVP code	Used in				Value type	AVP Flag rules				
		ACR	ACA	CCR	CCA		Must	May	Should not	Must not	May Encr.
PCMM-BCID	TBD	X	–	TBD	TBD	UTF8String	V,M	P			N
PCMM-Information	TBD	X	–	TBD	TBD	Grouped	V,M	P			N
NOTE – Table 2 is an extension to a table in [TS 32.299]. The meaning of the various items are defined there.											

The *Service-Information* AVP (AVP code 873), as defined in [TS 32.299], groups all of the 3GPP service-specific information. It is modified as follows:

```
Service-Information :: =        < AVP Header: 873>

                    [PS-Information]
                    [WLAN-Information]
                    [IMS-Information]
                    [MMS-Information]
                    [LCS-Information]
                    [PoC-Information]
                    [MBMS-Information]
                    [PCMM-Information]
```

The new *PCMM-Information* AVP groups all of the data acquired from the IPCablecom Multimedia Access Network. AVP IDs are yet to be assigned.

The following subclauses define these IPCablecom Multimedia-related AVPs in detail.

7.4.1.1 PCMM-BCID

The *PCMM-BCID* AVP (AVP code TBD) is of type UTF8String, and holds the IPCablecom Multimedia BCID that uniquely identifies the IPCablecom Multimedia session for the purposes of billing correlation. The BCID is fully defined in [b-ITU-T J.179], and is represented here as a hexadecimal string of up to 48 characters as passed in SIP signalling in the P-Charging-Vector [ITU-T J.366.4].

7.4.1.2 PCMM-Information

The *PCMM-Information* AVP (AVP code TBD) is of type Grouped, and holds the information about the IPCablecom Multimedia session for the purposes of billing correlation.

It has the following ABNF grammar:

```
PCMM-Information :: =        < AVP Header: TBD>
                             [ PCMM-BCID ]
```

Appendix I

IPCablecom2 Accounting functionality example

(This appendix does not form an integral part of this Recommendation)

In this clause, a simple set of flows are presented that show how the interaction with the IPCablecom Multimedia Subsystem impacts the flows. By extension, these impacts can be applied to all the flow scenarios covered in [TS 32.260].

Figure I.1 shows the IPCablecom2 Charging components with the flow of messages needed to establish a session.

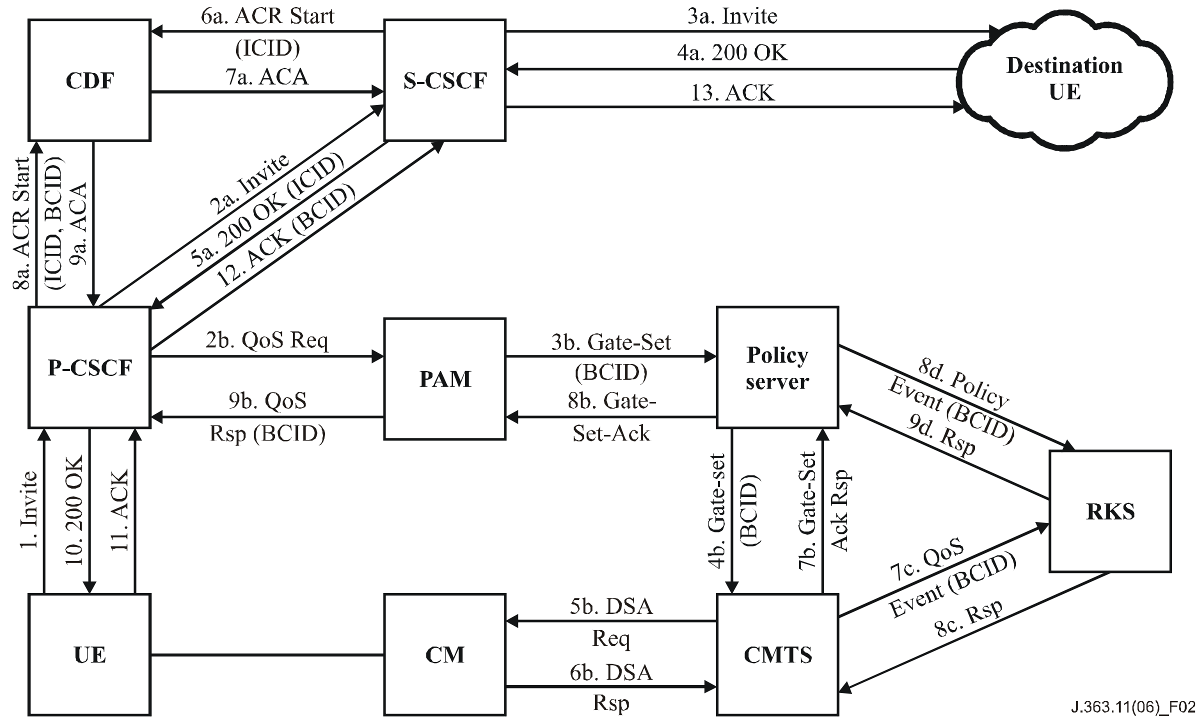

Figure I.1 – IPCablecom2 Offline Charging high-level flow

Message 1 is the initial Invite from the UE to the P-CSCF. Messages 2a through 5a are the IMS Session Establishment messages. Messages 6a and 6b are the session start charging messages from the S-CSCF.

Messages 2b through 9b are the IPCablecom Multimedia QoS Set-up messages. This activity can be done in parallel or series with the IMS session set-up. The Application Manager generates the BCID, and passes that on to all components that generate accounting messages. Messages 7c/8c and 8d/9d are the IPCablecom Multimedia Event Messages sent to the IPCablecom Record Keeping Server in parallel with the other signalling activity.

Once the P-CSCF has received response from both the S-CSCF and the IPCablecom Multimedia subsystem, it sends the 200 OK response to the UE (message 10), and the IMS charging record to the CDF (messages 8a and 9a). Note that the charging message sent in this step contains both the IMS ICID and the IPCablecom Multimedia BCID.

Upon receipt of the 200 OK, the UE sends an ACK to the P-CSCF (message 11) which then adds the BCID to the P-Charging-Vector header as part of the access-network-charging-info parameter and forwards to the S-CSCF (message 12). At this point, the S-CSCF will be in possession of the BCID which can be placed is subsequent accounting events generated by the S-CSCF.

Figure I.2 shows a call flow corresponding to the messages shown in Figure I.1.

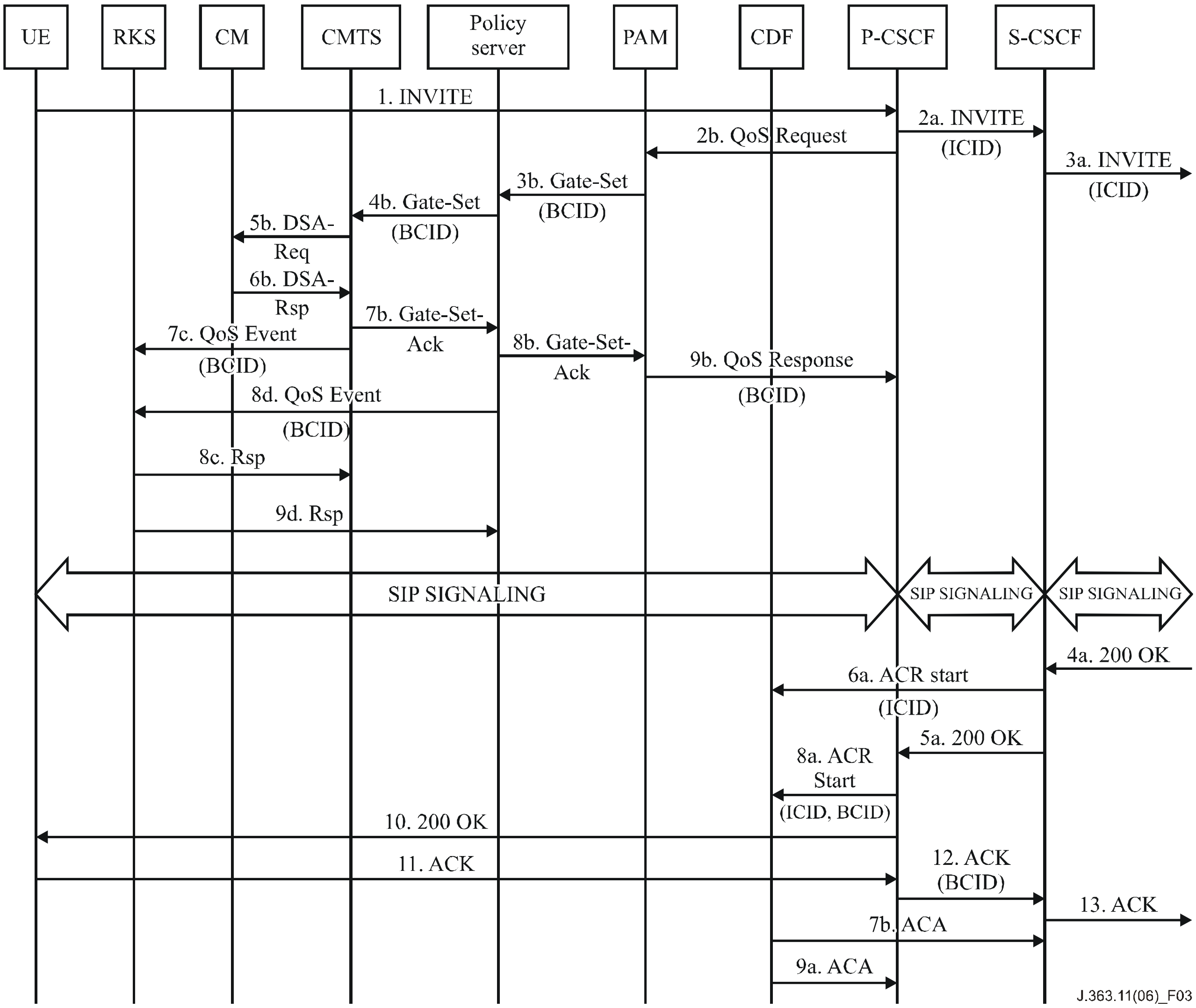

Figure I.2 – IPCablecom2 Offline Charging call flow example

1) The UE sends an INVITE to the P-CSCF to initiate a session.

2a) The P-CSCF, using standard procedures, creates an ICID and inserts it into the P-Charging-Vector header and sends the INVITE to the S-CSCF.

3a) The S-CSCF proceeds with normal session initiation.

2b) At the same time that the P-CSCF forwards the INVITE in step 2a, the P-CSCF begins to reserve QoS resources for the session and sends a QoS Request to the AM. The QoS Request contains the ICID to allow the IPCablecom Multimedia system to correlate usage events with IMS charging events.

3b) The AM creates a unique BCID that is contained in all usage events for this session. The AM then sends a Gate-Set to the IPCablecom Multimedia Policy Server to request the necessary QoS resources. This Gate-Set message includes the AM generated BCID.

4b-9d) The IPCablecom Multimedia system does normal processing.

8b) The Policy Server returns a Gate-Set Ack message to the AM when completed.

9b) The AM sends a QoS response back to the P-CSCF indicating that the QoS resources have been reserved and includes the BCID which uniquely identifies this session for use in usage and charging events.

While this is occurring, other SIP signalling is being done to set up the session.

4a) When the other side is ready, it sends a 200 OK message to the S-CSCF.

5a) The S-CSCF forwards this to the P-CSCF.

6a) The S-CSCF sends an ACR Start message to the CDF with the ICID that it received from the P-CSCF in step 2a. The ICID is the unique session identifier in IMS for charging events associated with this session. The CDF will respond with an ACA in message 7b.

8a) When the P-CSCF has received both the 200 OK and the QoS response from the AM, it sends an ACR Start message to the CDF. It includes both the ICID and the BCID in the message. This will allow the downstream usage and charging systems to correlate the IPCablecom Multimedia and IMS events for this session. The CDF will respond with an ACA in message 9a.

10) The P-CSCF forwards the 200 OK to the UE.

11) The UE responds with an ACK.

12) The P-CSCF includes the BCID in the P-Charging-Vector header in the ACK message to the S-CSCF. Subsequent Accounting Events from the S-CSCF will now contain both the ICID and BCID.

13) The S-CSCF forwards the ACK towards the terminating UE. Note that it does not include the BCID in the forwarded message as the access network charging information only has local significance and is not exchanged with the terminating half of the network.

This completes the session set-up. The key to correlate the IPCablecom Multimedia access network usage events with the IMS charging events is the ACR from the P-CSCF in step 8a. This is the single message that includes both the ICID and the BCID in events that are sent to the usage and charging systems.

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