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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document is part of a series of documents that specify charging functionality and charging management in GSM/UMTS networks. The GSM/UMTS core network charging architecture and principles are specified in TS 32.240 [1], which provides an umbrella for other charging management TSs that specify:

- the content of the Charging Data Records (CDRs) per domain / subsystem / service (offline charging);
- the content of real-time charging messages per domain / subsystem / service (online charging);
- the functionality of online and offline charging for those domains / subsystems / services;
- the interfaces that are used in the charging framework to transfer the charging information (i.e. CDRs or charging events).

The complete document structure for these TSs is defined in TS 32.240 [1].

The present document specifies the online charging description for Voice Call Service (VCS) charging from a Proxy Function, based on the functional description of the Voice Call Service charging in the EU Roaming Regulations III specifications [298, 299].

The concept of voice call is interpreted as any CS call, whatever the teleservice used (speech, 3.1 kHz audio, Fax, or CS data) except CS video telephony calls (BS 37, 64 kbit/s unrestricted digital info mode).

Voice over LTE is not included in this definition. This charging specification includes the online charging architecture and scenarios specific to VCS charging from a Proxy Function, as well as the mapping of the common 3GPP charging architecture specified in TS 32.240 [1] onto VCS. It further specifies the charging events for online charging. The present document is related to other 3GPP charging TSs as follows:

- The common 3GPP charging architecture is specified in TS 32.240 [1];
- The 3GPP Diameter application that is used for VCS online charging is specified in TS 32.299 [50].

Offline charging for the VCS is solely based on TS 32.250 [10] and is outside the scope of the present document.

All references, abbreviations, definitions, descriptions, principles and requirements, used in the present document, that are common across 3GPP TSs, are defined in TR 21.905 [100] "Vocabulary for 3GPP Specifications".

Those that are common across charging management in GSM/UMTS domains, services or subsystems are provided in the umbrella document TS 32.240 [1] and are copied into clause 3 of the present document for ease of reading. Finally, those items that are specific to the present document are defined exclusively in the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 32.240: "Telecommunication management; Charging management; Charging Architecture and Principles".

[2]-[9] Void.

[10] 3GPP TS 32.250: "Telecommunication management; Charging management; Circuit Switched (CS) domain charging".

[11] 3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".

[12]-[19] Void.

[20] 3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging".

[21]-[29] Void.

[30] 3GPP TS 32.270: "Telecommunication management; Charging management; Multimedia Messaging Service (MMS) charging".

[31]-[49] Void.

[50] 3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging application".

[51]-[55] Void.

[56] 3GPP TS 32.293: "Telecommunication management; Charging management; Proxy Function".

[57]-[99] Void.

[100] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[101] Void.

[102] Void.

[103] 3GPP TS 23.002: "Network Architecture".

[104]-[199] Void.

[200]-[206] Void.

[207] 3GPP TS 23.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL); Stage 2".

[208]-[211] Void.

[212] 3GPP TS 29.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL); CAMEL Application Part (CAP) specification".

[213]-[233] Void.

[234] 3GPP TS 29.163: "Interworking between the IP Multimedia (IM) Core Network (CN) subsystem and Circuit Switched (CS) networks".

[232]-[297] Void.

[298] EU Roaming regulation III; Structural Solutions; High Level Technical Specifications

[299] EU Roaming regulation III; Interface & Protocol; Detailed Technical Specifications

[300]-[399] Void.

[400]-[499] Void.

[500]-[599] Void.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [100] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [100].

CAMEL: network feature that provides the mechanisms to support operator specific services even when roaming outside HPLMN.

CAMEL subscription information: identifies a subscriber as having CAMEL services.

chargeable event: activity utilizing telecommunication network resources and related services for:

- user to user communication (e.g. a single call, a data communication session or a short message); or
- user to network communication (e.g. service profile administration); or
- inter-network communication (e.g. transferring calls, signalling, or short messages); or
- mobility (e.g. roaming or inter-system handover); and
- that the network operator may want to charge for.

As a minimum, a chargeable event characterises the resource / service usage and indicates the identity of the involved end user(s).

charged party: user involved in a chargeable event who has to pay parts or the whole charges of the chargeable event, or a third party paying the charges caused by one or all users involved in the chargeable event, or a network operator.

charging: function within the telecommunications network and the associated OCS/BD components whereby information related to a chargeable event is collected, formatted, transferred and evaluated in order to make it possible to determine usage for which the charged party may be billed (offline charging) or the subscriber"s account balance may be debited (online charging).

charging event: set of charging information forwarded by the CTF towards the CDF (offline charging) or towards the OCS (online charging). Each charging event matches exactly one chargeable event.

charging function: entity inside the core network domain, subsystem or service that is involved in charging for that domain, subsystem or service.

Circuit Switched (CS) domain: domain within GSM / UMTS in which information is transferred in circuit switched mode.

credit control: mechanism which directly interacts in real-time with an account and controls or monitors the charges, related to the service usage. Credit control is a process of: checking if credit is available, credit reservation, deduction of credit from the end user account when service is completed and refunding of reserved credit not used.

domain: part of a communication network that provides network resources using a certain bearer technology.

GSM only: qualifier indicating that this clause or paragraph applies only to a GSM system. For multi-system cases this is determined by the current serving radio access network.

in GSM,...: qualifier indicating that this paragraph applies only to GSM System.

in UMTS,...: qualifier indicating that this paragraph applies only to UMTS System.

"middle tier" (charging) TS: term used for the 3GPP charging TSs that specify the domain / subsystem / service specific, online and offline, charging functionality. These are all the TSs in the numbering range from TS 32.250 to TS 32.279, e.g. TS 32.250 [10] for the CS domain, or TS 32.270 [30] for the MMS service. Currently, there is only one "tier 1" TS in 3GPP, which is TS 32.240 [1] that specifies the charging architecture and principles. Finally, there are a number of top tier TSs in the 32.29x numbering range ([50] ff) that specify common charging aspects such as parameter definitions, encoding rules, the common billing domain interface or common charging applications.

online charging: charging mechanism where charging information **can** affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with bearer/session/service control is required.

Online Charging System: the entity that performs real-time credit control. Its functionality includes transaction handling, rating, online correlation and management of subscriber account balances.

real-time: real-time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than 1 second.

successful call: connection that reaches the communication or data transfer phase e.g. the "answered" state for speech connections. All other connection attempts are regarded as unsuccessful.

tariff period: part of one (calendar) day during which a particular tariff is applied. Defined by the time at which the period commences (the switch-over time) and the tariff to be applied after switch-over.

tariff: set of parameters defining the network utilisation charges for the use of a particular bearer / session / service.

UMTS only: qualifier indicating that this clause or paragraph applies only to a UMTS system. For multi-system cases this is determined by the current serving radio access network.

voice call: any CircuitSwitched call, whatever the teleservice used (speech, 3.1 kHz audio, Fax, or CS data) except CS video telephony calls (BS 37, 64 kbit/s unrestricted digital info mode). Voice over LTE is not included in this definition.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

B	Interface between a VLR and its associated MSC(s).
C	Interface between an HLR and an MSC.
CAP	Reference point for CAMEL between a network element with integrated SSF and the OCS.
D	Interface between an HLR and a VLR.
Ge	Reference point between a gprsSSF and a gsmSCF.
Gr	Interface between an SGSN and an HLR.
Ro	Online charging reference point between a Proxy Function and the OCS.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [100] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [100].

3GPP	3rd Generation Partnership Project
CAMEL	Customized Applications for Mobile network Enhanced Logic
CAP	CAMEL Application Part
CCA	Credit Control Answer
CCR	Credit Control Request
CS	Circuit Switched
CTF	Charging Trigger Function
DCCA	Diameter Credit Control Application
DP	Detection Point
EU	European Union
GMSC	Gateway MSC
gsmSCF	GSM Service Control Function
gsmSRF	GSM Specialized Resource Function
gsmSSF	GSM Service Switching Function
GSM	Global System for Mobile communication
HLR	Home Location Register
HPLMN	Home PLMN
IMSI	International Mobile Subscriber Identity
ISDN	Integrated Services Digital Network
MF	Mobile Forwarded
MO	Mobile Originated

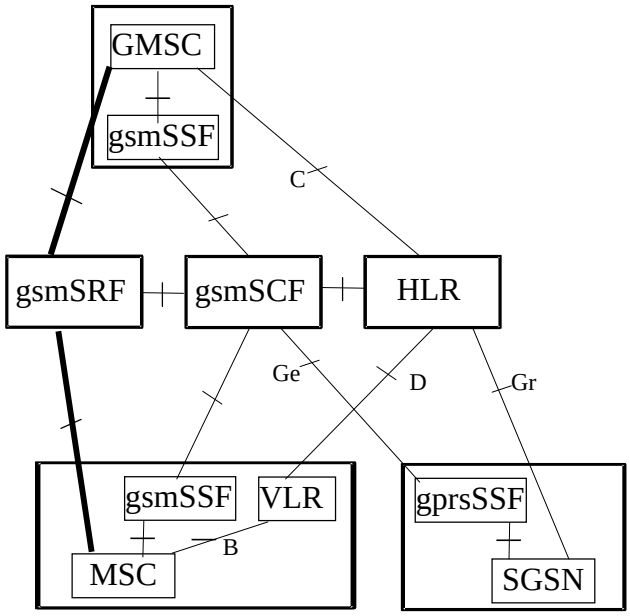
MS	Mobile Station
MSC	Mobile services Switching Centre
MSISDN	Mobile Station ISDN number
MT	Mobile Terminated
OCS	Online Charging System
PLMN	Public Land Mobile Network
UMTS	Universal Mobile Telecommunications System
VCS	Voice Call Service
VLR	Visitor Location Register

4 Architecture considerations

4.1 High level Voice Call Service (VCS) architecture

The high level 3G logical architecture in TS 23.002 [103] is used for CS domain charging as in TS 32.250 [10]. Figure 4.1.1 shows the CAMEL entities as described in TS 23.002 [103]. Refer to TS 23.002 [103] for a description of the reference points not covered in the present document.

NOTE: Most CAMEL-specific interfaces have no particular name. They are designated by the name of the two entities they link together, e.g. "the gsmSSF-gsmSCF interface".



NOTE: The bold lines are used for interfaces supporting user data only, the dashed lines are used for interfaces supporting signalling only.

Figure 4.1.1: Configuration of CAMEL entities

CS domain online charging is implemented by CAMEL techniques as described in TS 23.078 [207] and TS 29.078 [212], i.e. outside the scope of the 32 series of charging TSs.

4.2 VCS charging - Offline charging architecture

Not specified in the present document.

4.3 VCS charging - Online charging architecture

As an alternative to direct CAMEL-based online charging of subscribers for voice calls, an online charging interface between a voice Proxy Function and the OCS is established. The concept of voice call shall be interpreted as any CS call, whatever the teleservice used (speech, 3.1 kHz audio, Fax, or CS data) except CS video telephony calls (BS 37, 64 kbit/s unrestricted digital info mode). The voice control architecture is shown in Figure 4.3.1.

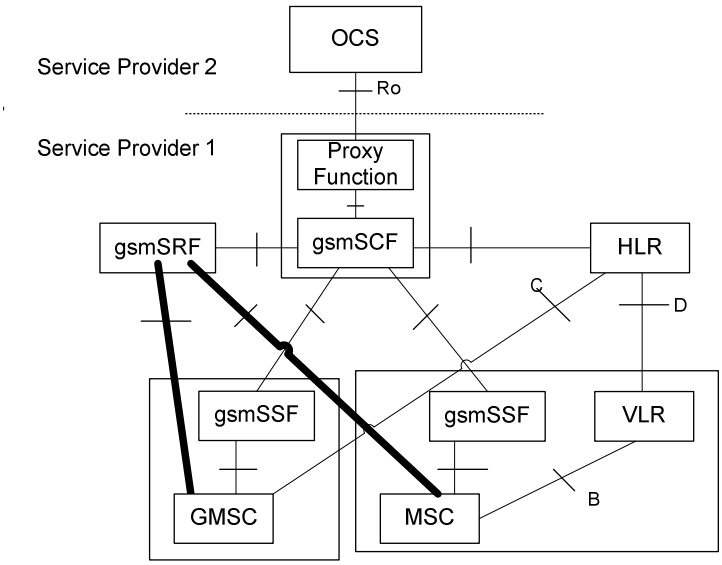


Figure 4.3.1: VCS from a Proxy Function online charging architecture

The signalling between the CS domain elements and a voice Proxy Function is implemented by CAMEL techniques as described in TS 23.078 [207] and TS 29.078 [212], i.e. outside the scope of the 32 series of charging TSs. The interface between a voice Proxy Function and the OCS utilizes Diameter Ro for the voice call service online charging as specified in the present document and utilizes the Proxy Function for mapping between CAMEL and Diameter as specified in TS 32.293 [56].

5 VCS charging principles and scenarios

5.1 VCS charging principles

The charging functions specified for VCS charging relate to:

- mobile originating calls;
- mobile terminating calls;
- mobile forwarded calls.

5.2 VCS charging - Offline charging scenarios

5.2.1 Basic principles

Not specified in the present document.

5.2.2 Rf message flows

Not specified in the present document.

5.2.3 CDR generation

Not specified in the present document.

5.2.4 Ga record transfer flows

Not specified in the present document.

5.2.5 Bx CDR file transfer

Not specified in the present document.

5.3 VCS charging - Online charging scenarios

5.3.1 Basic principles

VCS online charging may be performed by the Proxy Function using the common *Debit / Reserve Units* operation specified in TS 32.299 [50]. The Proxy Function shall be able to perform online charging for the following:

- charging information related to voice calls;

Session based online charging (SCUR) with centralized rating and centralized unit determination is required in the Proxy Function. The *Debit/ Reserve Units Request* and *Debit / Reserve Units Response* messages are specified for SCUR in TS 32.299 [50]. The *Debit / Reserve Units Request* messages are issued towards the OCS when certain conditions (chargeable events) are met and *Debit / Reserve Units Response* messages are received from the OCS in response. The VCS charging specific contents and purpose of each of these messages, as well as the chargeable events that trigger them, are described in the following subclauses. A detailed formal description of the online charging parameters defined in the present document can be found in TS 32.299 [50]. Further information on the general principles of the common 3GPP online charging application can also be found in TS 32.299 [50] and TS 32.240 [1].

Since an operator is able to determine if charging is started at three different points in the progress of a voice call: call attempt, called party alerting, or called party answer, a configuration option is defined in the Proxy Function for this

determination. On the Diameter interface, as defined below, the OCS is contacted on call attempt. This allows the OCS to identify the user account status and authorize (or not) the voice call attempt prior to utilizing network resources to transport the call. At this time, a quota is also requested. The Proxy Function starts depleting the quota at the configured point progress of the call. The time this occurs is stored as the start of charging time delivered in the next update *Debit / Reserve Units Request* message to the OCS.

The following chargeable events are defined for VCS charging:

- Voice call attempt. Upon encountering this event, an initial *Debit / Reserve Units Request* message, indicating the start of the voice call, is sent towards the OCS to authorize the voice call attempt. The Proxy Function requests quota for voice call, setting the service-identifier to the value representing the type of voice call to be charged. Depending on operator configuration, the Proxy Function shall begin quota deduction and store the current time as start of charging time.

- Voice call answered. No message is sent. Depending on operator configuration, the Proxy Function shall begin quota deduction and save the current time as start of charging time.

- Voice call not answered – MO/MF only (e.g., busy, no answer, not reachable, route select failure). Upon encountering this event, corresponding counts for the voice call are closed and a terminate *Debit / Reserve Units Request* message, indicating the end of the voice call, is triggered. If the operator configuration has indicated that charging has started prior to answer, the start of charging time is provided with the used service units.

- Voice call not answered and call is conditionally forwarded – MT only (e.g., call forwarding on not reachable). Corresponding counts for the voice call are closed and an update *Debit / Reserve Units Request* message is triggered. If the operator configuration has indicated that charging has started prior to answer, the start of charging time is provided with the used service units. The subsequent response indicates if charging for terminating leg is to be maintained.

- Voice call not answered and call is not conditionally forwarded – MT only (e.g., busy, no answer, not reachable, route select failure). Upon encountering this event, corresponding counts for the voice call are closed and a termination *Debit / Reserve Units Request* message, indicating the end of the voice call, is triggered. If the operator configuration has indicated that charging has started prior to answer, the start of charging time is provided with the used service units.

- End of voice call. Upon encountering this event, a terminate *Debit / Reserve Units Request* message, indicating the end of the voice call, is sent towards the OCS together with the final counts. The start of charging time is provided with the used service units.

- Ro specific chargeable events (e.g. threshold reached, quota exhaustion, validity time reached, forced re-authorization). Corresponding counts for the voice call are closed and an update *Debit / Reserve Units Request* message is triggered according the rules defined in TS 32.299 [50].

- Change of charging condition: E.g. user location change. When this event is encountered and the corresponding re-authorization trigger is armed, all current counts are captured and sent towards the OCS with an update *Debit and Reserve Units Request* message.

  Editors"s note: The encounter of this event in conjunction with the ability of the Trigger AVP is ffs.

- Tariff time change. When this event is encountered, all current counts are captured and a new counts are started. The counts are sent to the OCS in next *Debit and Reserve Units Request* message.

Management intervention may also force trigger a chargeable event.

The OCS online charging function may use the Furnish Charging Information procedure to add online charging session specific information to the CDR generated by the MSC as currently supported for CAMEL as specified in TS 23.078 [207]

In case the OCS fails, the Proxy Function shall support the Failure Handling procedure and Failover mechanism described in TS 32.299 [50]. These mechanisms give flexibility to have different failure handling scenarios when the OCS fails.

Three different actions shall be supported when the failure handling mechanism is executed:

- Terminate: The online session is finished. The associated voice call is terminated (answered calls) or not established (new calls). Failover for ongoing voice calls is not supported. Failover for new voice calls is always supported.

- Retry&Terminate: The online session is finished. The associated voice call is terminated (answered calls) or not established (new calls). Failover for ongoing voice calls is supported. Failover for new voice calls is always supported.

- Continue: The online session is finished. The associated voice call is established (new calls) or not terminated (ongoing calls). Failover for ongoing voice calls is supported. Failover for new voice calls is always supported. It shall be operator configurable to limit the maximum duration of the voice call in this situation.

The OCS may request session re-authorization of active quota.

The OCS may request service termination synchronously in response to a *Reserve Units Request* or asynchronously via Diameter Abort-Session-Request. In either case, the voice Proxy Function shall initiate termination of the voice call using CAMEL procedures, as specified in TS 23.078 [207].

The OCS may specify a termination action, as per TS 32.299 [50] clause 5.3.3 and clause 6.5.3, for the voice Proxy Function on consumption of the final granted units. The only action supported is TERMINATE.

The following capabilities defined in TS 32.299 [50] are not applicable to VCS charging:

- Credit pooling

- Envelope reporting

- Online control of offline charging information

- Support of multiple service

NOTE: The Multiple Operation and Multiple Unit Operation information elements are utilized as per Table 6.2.2.1. Only one service is supported per VCS charging session.

5.3.2 Ro message flows

5.3.2.1 Ro messages

An initial, update and terminate *Debit and Reserve Units Request* message, as defined in TS 32.299 [50], is used by the Proxy Function to transfer the collected charging information towards the OCS. The *Debit and Reserve Units Response* message is used by the OCS to assign quotas for the service identifier, and to instruct the Proxy Function whether to continue or terminate a voice call.

The following clauses describe the trigger conditions for the chargeable events described in clause 5.3.1. These chargeable events correspond to the triggers for collection of charging information and *Debit and Reserve Units Request message* transmission towards the OCS. The responses from the OCS are also specified in the clauses below.

5.3.2.2 Triggers for starting and stopping a VCS credit control session

A initial *Debit and Reserve Units Request* is sent to OCS when a voice call is attempted.

A terminate *Debit and Reserve Units Request* is sent to OCS when:

- voice call is not answered (MO/MF)

- voice call not answered and not conditionally forwarded (MT)

- voice call is terminated

- voice call termination is indicated by the OCS (e.g. Credit Limit Reached)

- Abort-Session-Request is received from the OCS, this also results in voice call termination.

5.3.2.3 Triggers for providing interim information for a VCS credit control session

An update *Debit / Reserve Units Request* is sent to OCS when:

- Voice call not answered and call is conditionally forwarded (MT) ;
- Granted quota runs out;
- Validity time for granted quota expires;
- Update is requested by the OCS;
- Change of charging conditions occur and according to re-authorisation trigger, re-authorisation is needed;
- Management intervention.

5.3.2.4 Furnish Charging Information procedure

The OCS online charging function may use this procedure to add online charging session specific information to the CDR maintained by the originating MSC by means of the *Debit and Reserve Units Request* operation. The Furnish Charging Information can be sent either in one *Debit and Reserve Units Response* message or several *Debit and Reserve Units Response* messages with append indicator.

The OCS online charging function can send multiple concatenated Furnish Charging Information elements per online charging session.

The total maximum of free format data Furnish Charging Information is 160 octets.

5.3.2.5 Support of Failure Situations

In case the OCS fails the Proxy Function must support the Failure Handling procedure and Failover mechanism described in TS 32.299 [50].

According to TS 32.299 [50], timer Tx determines the maximum interval the Proxy Function shall wait for an answer to each credit control request sent to the OCS. When Tx expires, Proxy Function shall execute the Failover and Failure Handling mechanisms according to the behaviour described in TS 32.299 [50].

Three different actions shall be supported when the failure handling mechanism is executed:

- Terminate: The online session is finished. The associated voice call is terminated (answered calls) or not established (new calls). Failover for ongoing voice calls is not supported. Failover for new voice calls is always supported.
- Retry&Terminate: The online session is finished. The associated voice call is terminated (answered calls) or not established (new calls). Failover for ongoing voice calls is supported. Failover for new voice calls is always supported.
- Continue: The online session is finished. The associated voice call is established (new calls) or not terminated (ongoing calls). Failover for ongoing voice calls is supported. Failover for new voice calls is always supported. It shall be operator configurable to limit the maximum duration of the voice call in this situation.

6 Definition of charging information

6.1 Data description for VCS charging - Offline charging

6.1.1 Rf message contents

Not specified in the present document.

6.1.2 Ga message contents

Not specified in the present document.

6.1.3 CDR description on the Bx interface

Not specified in the present document.

6.2 Data description for VCS charging - Online charging

6.2.1 Ro message contents

Voice call service online charging uses the *Debit Units and Reserve Units* operation defined in TS 32.299 [50]. The *Debit and Reserve Units Request message* triggers the rating of the voice call service and reserves units on the user's account. The *Debit and Reserve Units Response* message is a response including any reserved units or an error code if the user is out of credit. Detailed information about the diameter online charging application is described in TS 32.299 [50].

The *Debit and Reserve Units Request* message for the "intermediate interrogation" and "final interrogation" reports the actual number of "units" that were used, from what was previously reserved. This determines the actual amount debited from the subscriber's account.

The following clauses describe the different fields used in the VCS charging messages.

Table 6.2.1.1 describes the use of these messages for online charging.

Table 6.2.1.1: Online charging messages reference table

Message	Source	Destination
Debit and Reserve Units Request	Proxy Function	OCS
Debit and Reserve Units Response	OCS	Proxy Function

6.2.2 Debit / Reserve Units Request message

Table 6.2.2.1 illustrates the basic structure of a *Debit / Reserve Units Request* message from the Proxy Function as used for voice call service online charging.

Table 6.2.2.1: Debit / Reserve Units Request message contents

Information Element	Category	Description
Session Identifier	M	Used as described in TS 32.299 [50].
Originator Host	M	Used as described in TS 32.299 [50].
Originator Domain	M	Used as described in TS 32.299 [50].
Destination Domain	M	Used as described in TS 32.299 [50].
Operation Identifier	M	Used as described in TS 32.299 [50].
Operation Token	M	Used as described in TS 32.299 [50].
Operation Type	M	Used as described in TS 32.299 [50].
Operation Number	M	Used as described in TS 32.299 [50].
Destination Host	O_C	Used as described in TS 32.299 [50].
User Name	O_C	Used as described in TS 32.299 [50].
Origination State	O_C	Used as described in TS 32.299 [50].
Origination Timestamp	O_C	Used as described in TS 32.299 [50].
Subscriber Identifier	O_C	Used as described in TS 32.299 [50]. As a minimum the MSISDN and IMSI shall be included.
Termination Cause	O_C	Used as described in TS 32.299 [50].
~~Requested Action~~	-	Not used for VCS charging.
Multiple Operation	O_M	Used as described in TS 32.299 [50].
Multiple Unit Operation	O_C	Used as described in TS 32.299 [50].
Subscriber Equipment Number	O_C	Used as described in TS 32.299 [50].
Proxy Information	O_C	Used as described in TS 32.299 [50].
Route Information	O_C	Used as described in TS 32.299 [50].
Service Information	O_M	Described in clause 6.3.1.1

6.2.3 Debit / Reserve Units Response message

Table 6.2.3.1 illustrates the basic structure of a Debit / Reserve Units Response message as used for the Proxy Function as used for voice call service online charging. This message is always used by the OCS as specified below.

Table 6.2.3.1: Debit / Reserve Units Response message

Information Element	Category	Description
Session Identifier	M	Used as described in TS 32.299 [50].
Operation Result	M	Used as described in TS 32.299 [50].
Originator Host	M	Used as described in TS 32.299 [50].
Originator Domain	M	Used as described in TS 32.299 [50].
Operation Identifier	M	Used as described in TS 32.299 [50].
Operation Type	M	Used as described in TS 32.299 [50].
Operation Number	M	Used as described in TS 32.299 [50].
Operation Failover	O_C	Used as described in TS 32.299 [50].
Multiple Unit Operation	O_C	Used as described in TS 32.299 [50].
Operation Failure Action	O_C	Used as described in TS 32.299 [50].
Operation Event Failure Action	-	Not used for VCS charging.
Redirection Host	O_C	Used as described in TS 32.299 [50].
Redirection Host Usage	O_C	Used as described in TS 32.299 [50].
Redirection Cache Time	O_C	Used as described in TS 32.299 [50].
Proxy Information	O_C	Used as described in TS 32.299 [50].
Route Information	O_C	Used as described in TS 32.299 [50].
Failed Parameter	O_C	Used as described in TS 32.299 [50].
Service Information	O_C	Described in in clause 6.3.1.1.

6.3 VCS charging specific parameters

6.3.1 Definition of VCS charging information

6.3.1.1 VCS charging information assignment for Service Information

The VCS information element used for voice call service charging is provided in the Service Information information element.

Table 6.3.1.1.1: Service Information used for VCS charging

Information Element	Category	Description
Service Information	O_M	A set of information elements holding the specific parameters as defined in TS 32.299 [50].
IMS Information	O_C	This is a structured information element and holds IMS specific parameters. The complete structure is defined in TS 32.260 [20].
Node Functionality	M	This information element contains the function of the node: i.e. 'Proxy-Function'.
Role Of Node	O_M	This information element specifies whether the Proxy Function is serving an Originating (MO) call, a Terminating (MT) call, or an Forwarding (MF) call.
Calling Party Address	O_M	This information element contains the Calling Part Number converted from the CS domain to a Tel or SIP URI as per TS 29.163 [234] for the P-Asserted-Identity header. NOTE: The address presentation restriction indication would be utilized for the transformation as per TS 29.163 [234] but would not be included directly for charging purposes as this is not currently utilized for CS domain or IMS charging.
Called Party Address	O_C	This information element contains the Called Party Number converted from the CS domain to a Tel or SIP URI as per TS 29.163 [234] for the Request-URI. For an MO call, this IE contains the Called Party Number after processing by the Proxy Function (e.g., number normalization). It is included only when different from the contents of the Requested Party Address IE.
Requested Party Address	O_C	This information element contains the Called Party BCD Number converted from the CS domain to a Tel or SIP URI as per TS 29.163 [234] for the Request-URI. This IE is included only for an MO call.
Service Specific Info	O_C	This field contains service specific data.
PS Information	O_C	This is a structured information element and holds PS specific parameters. The complete structure is defined in TS 32.251 [11].
User Location Info	O_C	Used based on the definition in TS 32.251 [11].
MS TimeZone	O_C	Used based on the definition in TS 32.251 [11].
User Location Info Time	O_C	Used based on the definition in TS 32.251 [11].
VCS Information	O_M	A set of information element holding the VCS parameters. The details are defined in clause 6.3.1.2.

6.3.1.2 Definition of the VCS information

VCS specific charging information is provided within the VCS Information.

Table 6.3.1.2.1: Structure of the VCS Information

Information Element	Category	Description
Bearer Capability	O_C	This IE indicates the type of the bearer capability connection to the user. This IE includes several fields: info transfer capability, coding standard, info transfer rates, transfer mode, establishment configuration, structure, user info layer 1 protocol, layer 1 identity, user rate, negotiation, sync/async, flow control, and several others.
Network Call Reference Number	O_M	This IE gives the network call reference number assigned to the call by the GMSC/MSC. It must be combined with the identity of the MSC that allocated it in order to unambiguously identify the call.
MSC Address	O_M	This IE identifies the international E.164 address of the MSC that generated the network call reference number.
Basic Service Code	O_C	This IE indicates the type of basic service utilized. This can be either a bearer service or a teleservice.
Bearer Service	O_C	This IE indicates the bearer service utilized.
Teleservice	O_C	This IE indicates the teleservice utilized.
ISUP Location Number	O_C	This IE indicates the location number of the served user. It containsan E.164 number as transported in ISUP.

Information Element	Category	Description
VLR Number	O_C	This IE identifies the international E.164 address of the VLR serving the user.
Forwarding Pending	O_C	This IE indicates that the MSC received a forwarded-to-number and that the call will be forwarded due to GSM supplementary service call forwarding in the GMSC. This is applicable to MT calls only.
ISUP Cause	O_C	This IE indicates the reason the call was released.
Call Start Time	O_C	This IE contains the initial time at the MSC initiating the dialog.
Start of Charging	O_C	This IE contains the time origin for charging and may be equivalent to the time call setup is initiated or the time the call is answered depending on configuration in the Voice Proxy. It is only sent when call setup is successful.
Call Stop Time	O_C	This IE contains the time when the call is released.
Free Format Data	O_C	This IE contains online charging specific information that is to be included in CDRs generated by the MSC.

Table 6.3.1.2.2: Structure of the Multiple Unit Operation for VCS

Information Element	Category	Description
Granted Service Unit	O_C	This IE contains the amount of granted service units for a particular category.
Tariff Time Change	O_C	This IE contains the switch time when the tariff will be changed.
CC Time	O_C	This IE contains the amount of granted time.
CC Money	-	Not used in VCS.
CC Total Octets	-	Not used in VCS.
CC Input Octets	-	Not used in VCS
CC Output Octets	-	Not used in VCS
CC Service Specific Units	-	Not used in VCS.
Requested Service Unit	O_C	This IE contains an indication that units are needed for a particular category.
CC Time	-	Not used in VCS.
CC Total Octets	-	Not used in VCS.
CC Input Octets	-	Not used in VCS
CC Output Octets	-	Not used in VCS
CC Service Specific Units	-	Not used in VCS.
Used Service Unit	O_C	This IE contains the amount of used non-monetary service units measured for a particular category to a particular quota type.
Reporting Reason	O_C	Used as defined in TS 32.299 [50], clause 7.2.
Tariff Change Usage	O_C	This IE identifies the reporting period for the used service unit, i.e. before, after or during tariff change.
CC Time	O_C	This IE contains the amount of used time.
CC Total Octets	-	Not used in VCS.
CC Input Octets	-	Not used in VCS
CC Output Octets	-	Not used in VCS
CC Service Specific Units	-	Not used in VCS.
Event Charging Time Stamp	-	Not used in VCS.
Service Identifier	O_C	This IE contains identity of the used service. This ID with the Service-Context-ID together forms an unique identification of the service.
Rating Group	O_C	This IE contains the identifier of a rating group.
G-S-U Pool Reference	-	Not used in VCS
Validity Time	O_C	This IE contains the time in order to limit the validity of the granted quota for a given category instance.
Result Code	-	Not used in VCS.
Final Unit Indication	O_C	This IE indicates that the Granted Service Unit contains the final units for the service as defined in TS 32.299 [50].

Information Element	Category	Description
Final Unit Action	M	Used as defined in TS 32.299 [50],
Restriction Filter Rule	-	Not used in VCS.
Filter Id	-	Not used in VCS.
Redirect Server	-	Not used in VCS.
Redirect Address Type	-	Not used in VCS.
Redirect Server Address	-	Not used in VCS.
Time Quota Threshold	-	Not used in VCS.
Volume Quota Threshold	-	Not used in VCS.
Unit Quota Threshold	-	Not used in VCS.
Quota Holding Time	-	Not used in VCS.
Quota Consumption Time	-	Not used in VCS.
Reporting Reason	O_C	Used as defined in TS 32.299 [50], clause 7.2.
Trigger	-	Not used in VCS.
PS Furnish Charging Information	-	Not used in VCS.
Refund Information		Not used in VCS.
AF Correlation Information	-	Not used in VCS.
Envelope	-	Not used in VCS.
Envelop Reporting	-	Not used in VCS.
Time Quota Mechanism	-	Not used in VCS.
Service Specific Info	-	Not used in VCS.
QoS Information	-	Not used in VCS.

6.3.1.3 Support of Charging Information in VCS offline charging

Not specified in the present document.

6.3.1.4 Support of Charging Information in VCS online charging

Table 6.3.1.4.1 specifies per Operation type, the charging data that are sent by the Proxy Function in the *Debit / Reserve Units Request message* for the different call types MO, MT, and MF.

Table 6.3.1.4.1: Supported fields in *Debit / Reserve Units Request* message

Information Element	Node Type	Proxy Function		
	Call Type	MO	MT	MF
	Supported Operation Types	I/U/T	I/U/T	I/U/T
Session Identifier		IUT	IUT	IUT
Originator Host		IUT	IUT	IUT
Originator Domain		IUT	IUT	IUT
Destination Domain		IUT	IUT	IUT
Operator Identifier		IUT	IUT	IUT
Operation Token		IUT	IUT	IUT
Operation Type		IUT	IUT	IUT
Operation Number		IUT	IUT	IUT
Destination Host		IUT	IUT	IUT
User Name		IUT	IUT	IUT
Origination State		IUT	IUT	IUT
Origination Timestamp		IUT	IUT	IUT
Subscriber Identifier		IUT	IUT	IUT
Termination Cause		--T	--T	--T
Requested Action		-	-	-
Multiple Operation		IUT	IUT	IUT
Multiple Unit Operation		IUT	IUT	IUT
Subscriber Equipment Number		IUT	IUT	IUT
Proxy Information		IUT	IUT	IUT
Route Information		IUT	IUT	IUT
Service Information		IUT	IUT	IUT
Service Information with IMS Information				
Node Functionality		IUT	IUT	IUT
Role of Node		IUT	IUT	IUT
Calling Party Address		IUT	IUT	IUT
Called Party Address		IUT	IUT	IUT
Requested Party Address		IUT	-	-
Service Specific Info		IUT	IUT	IUT
Service Information with PS Information				
User Location Info		IUT	IUT	IUT
MS TimeZone		IUT	IUT	IUT
User Location Info Time		IUT	IUT	IUT
Service Information with VCS Information				
Bearer Capability		IUT	IUT	IUT
Network Call Reference Number		IUT	IUT	IUT
MSC Address		IUT	IUT	IUT
Basic Service Code		IUT	IUT	IUT
ISUP Location Number		IUT	IUT	IUT
VLR Number		IUT	IUT	IUT
Forwarding Pending		-	IUT	-
ISUP Cause		--T	--T	--T
Call Start Time		IUT	IUT	IUT
Start of Charging		IUT	IUT	IUT
Call Stop Time		--T	--T	--T
Free Format Data		-	-	-
Multiple Unit Operation				
Granted Service Unit		-	-	-
Requested Service Unit		IU-	IU-	IU-
CC Time		-	-	-
CC Total Octets		-	-	-
CC Input Octets		-	-	-
CC Output Octets		-	-	-
CC Service Specific Units		-	-	-
Used Service Unit		-UT	-UT	-UT
Reporting Reason		-UT	-UT	-UT
Tariff Change Usage		-UT	-UT	-UT
CC Time		-UT	-UT	-UT
CC Total Octets		-	-	-
CC Input Octets		-	-	-
CC Output Octets		-	-	-

CC Service Specific Units	-	-	-
Event Charging Time Stamp	-	-	-
Service Identifier	IUT	IUT	IUT
Rating Group	IUT	IUT	IUT
G-S-U Pool Reference	-	-	-
Validity Time	-	-	-
Result Code	-	-	-
Final Unit Indication	-	-	-
Final Unit Action	-	-	-
Restriction Filter Rule	-	-	-
Filter Id	-	-	-
Redirect Server	-	-	-
Redirect Address Type	-	-	-
Redirect Server Address	-	-	-
Time Quota Threshold	-	-	-
Volume Quota Threshold	-	-	-
Unit Quota Threshold	-	-	-
Quota Holding Time	-	-	-
Quota Consumption Time	-	-	-
Reporting Reason	-UT	-UT	-UT
Trigger	-	-	-
PS Furnish Charging Information	-	-	-
Refund Information	-	-	-
AF Correlation Information	-	-	-
Envelope	-	-	-
Envelop Reporting	-	-	-
Time Quota Mechanism	-	-	-
Service Specific Info	---	---	---
QoS Information	-	-	-

Table 6.3.1.4.2 specifies per Operation type, the charging data that are sent in the *Debit / Reserve Units Response message* for the different call types MO, MT, and MF.

Table 6.3.1.4.2: Supported fields in *Debit / Reserve Units Response* message

Information Element	Node Type	Proxy Function	Proxy Function	Proxy Function
	Call Type	MO	MT	MF
	Supported Operation Types	I/U/T	I/U/T	I/U/T
Session Identifier		IUT	IUT	IUT
Operation Result		IUT	IUT	IUT
Originator Host		IUT	IUT	IUT
Originator Domain		IUT	IUT	IUT
Operation Identifier		IUT	IUT	IUT
Operation Type		IUT	IUT	IUT
Operation Number		IUT	IUT	IUT
Operation Failover		IUT	IUT	IUT
Multiple Unit Operation		IUT	IUT	IUT
Operation Failure Action		IUT	IUT	IUT
Operation Event Failure Action		-	-	-
Redirection Host		IUT	IUT	IUT
Redirection Host Usage		IUT	IUT	IUT
Redirection Cache Time		IUT	IUT	IUT
Proxy Information		IUT	IUT	IUT
Route Information		IUT	IUT	IUT
Failure Parameter		IUT	IUT	IUT
Service Information		IUT	IUT	IUT
Service Information with IMS Information				
Node Functionality		-	-	-
Role of Node		-	-	-
Calling Party Address		-	-	-
Called Party Address		-	-	-
Requested Party Address		-	-	-
Service Specific Info		-	-	-
Service Information with PS Information				
User Location Info		-	-	-
MS TimeZone		-	-	-
User Location Info Time		-	-	-
Service Information with VCS Information				
Bearer Capability		-	-	-
Network Call Reference Number		-	-	-
MSC Address		-	-	-
Basic Service Code		-	-	-
ISUP Location Number		-	-	-
VLR Number		-	-	-
Forwarding Pending		-	-	-
ISUP Cause		-	-	-
Call Start Time		-	-	-
Start of Charging		-	-	-
Call Stop Time		-	-	-
Free Format Data		IUT	IUT	IUT
Multiple Unit Operation				
Granted Service Unit		IU-	IU-	IU-
Tariff Time Change		IU-	IU-	IU-
CC Time		IU-	IU-	IU-
CC Total Octets		-	-	-
CC Input Octets		-	-	-
CC Output Octets		-	-	-
CC Service Specific Units		-	-	-
Requested Service Unit		-	-	-
Used Service Unit		-	-	-
Service Identifier		IU-	IU-	IU-
Rating Group		IU-	IU-	IU-
G-S-U Pool Reference		-	-	-
Validity Time		IU-	IU-	IU-
Result Code		-	-	-
Final Unit Indication		IU-	IU-	IU-
Final Unit Action		IU-	IU-	IU-
Restriction Filter Rule		-	-	-

Filter Id	-	-	-
Redirect Server	-	-	-
Redirect Address Type	-	-	-
Redirect Server Address	-	-	-
Time Quota Threshold	-	-	-
Volume Quota Threshold	-	-	-
Unit Quota Threshold	-	-	-
Quota Holding Time	-	-	-
Quota Consumption Time	-	-	-
Reporting Reason	-	-	-
Trigger	-	-	-
PS Furnish Charging Information	-	-	-
Refund Information	-	-	-
AF-Correlation Information	-	-	-
Envelope	-	-	-
Envelop Reporting	-	-	-
Time Quota Mechanism	-	-	-
Service Specific Info	-	-	-
QoS Information	-	-	-

6.3.2 Formal VCS charging parameter description

6.3.2.1 VCS CDR parameters

Not specified in the present document.

6.3.2.2 VCS AVPs

The detailed charging event parameter definitions are specified in 3GPP TS 32.299 [50].

6.4 Bindings for VCS Charging

This clause describes the mapping between the charging information messages and fields described for VCS Charging and the Diameter messages and AVPs.

As defined in TS 32.299 [50], the corresponding Diameter Credit-Control Application (DCCA) commands for the *Debit and Reserve Units Request* message is Credit-Control-Request (CCR) and for the *Debit and Reserve Units Response* message is Credit-Control-Answer (CCA).

Table 6.4.1 specifies the bindings for parameters used for VCS Charging for the *Debit and Reserve Units* operation defined in this document.

Table 6.4.1: Bindings between Information Elements and AVPs

Information Element	AVP
IMS Information	IMS-Information
Node Functionality	Node-Functionality
Role of Node	Role-of-Node
Calling Party Address	Calling-Party-Address
Called Party Address	Called-Party-Address
Requested Party Address	Requested-Party-Address
PS Information	PS-Information
User Location Info	3GPP-User-Location-Info
MS TimeZone	3GPP-MS-TimeZone
User Location Info Time	User-Location-Info-Time
VCS Information	VCS-Information
Bearer Capability	Bearer-Capability
Network Call Reference Number	Network-Call-Reference-Number
MSC Address	MSC-Address
Basic Service Code	Basic-Service-Code
Bearer Service	Bearer-Service
Teleservice	Teleservice
ISUP Location Number	ISUP-Location-Number
VLR Number	VLR-Number
Forwarding Pending	Forwarding-Pending
ISUP Cause	ISUP-Cause
Call Start Time	Start-Time
Start of Charging	Start-of-Charging
Call Stop Time	Stop-Time
Free Format Data	PS-Free-Format-Data
Multiple Unit Operation	Multiple-Services-Credit-Control
Granted Service Unit	Granted-Service-Unit
Tariff Time Change	Tariff-Time-Change
CC Time	CC-Time
Requested Service Unit	Requested-Service-Unit
Used Service Unit	Used-Service-Unit
Tariff Change Usage	Tariff-Change-Usage
Service Identifier	Service-Identifier
Rating Group	Rating-Group
Final Unit Indication	Final-Unit-Indication
Final Unit Action	Final-Unit-Action

Annex A (informative): Relationship of VCS chargeable events to CAMEL events

A.1 General

There is a similarity to the chargeable events identified in the present document in clause 5.3.1, to those events defined for use in CAMEL in TS 23.078 [207]. This relationship, provided for information only, is identified in Table A.1.1. The table focuses on CAMEL Phase 2, but is also generally applicable to later phases. This relationship does not imply a specific implementation in the voice Proxy Function as there could be multiple ways to implement voice call charging using CAMEL techniques. As an example, the end of voice call could be detected by explicit notification of a listed event in an Event Report BCSM; receipt of an Apply Charging Report with call inactive indication; or receipt of Call Information Report.

Table A.1.1. Relationship of VCS chargeable events to CAMEL events

Event	BCSM Event for MO	BCSM Event for MT	BCSM Event for MF
Voice call attempt	DP2 Collected Info	DP12 Terminating_Attempt_Authorized	DP2 Collected_Info
Voice call answered	DP7 O_Answer	DP15 T-Answer	DP7 O_Answer
Voice call not answered	DP4 Route_Select_Failure DP5 O_Busy DP6 O_No_Answer DP10 O_Abandon	This event is not applicable, see subsequent events in table.	DP4 Route_Select_Failure DP5 O_Busy DP6 O_No_Answer DP10 O_Abandon
Voice call not answered and call is conditionally forwarded	Not applicable	DP13 T_Busy DP14 T_No_Answer	Not applicable
Voice call not answered and call is not conditionally forwarded	Not applicable	DP13 T_Busy DP14 T_No_Answer DP18 T_Abandon	Not applicable
End of voice call	DP9 O_Disconnect	DP17 T_Disconnect	DP9 O_Disconnect

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2014-06	SA#64	SP-140327			Presented for approval	1.3.0	2.0.0
					Upgrade to Rel-12	2.0.0	12.0.0
2014-09					Introducing new keywords	12.0.0	12.0.1
2015-09	SA#69	SP-150427	001	1	Removal of inconsistencies for VCS Charging	12.0.1	12.1.0

History

Document history		
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