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***3GPP***

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis

Valbonne - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

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# Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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 Proxy Function in Domestic Service Provider (DSP).

The present document contains the architecture and functions of the Proxy Function logical components and thereby derives the functionality of the Proxy Function interfaces. This charging description only defines the interworking between CAMEL and Diameter. The Ro interface between the Proxy Function and Online Charging System (OCS) is out of scope of the present document.

The present document is related to other 3GPP charging TSs as follows:

- The common 3GPP charging architecture is specified in TS 32.240 [1];

- Voice Call Service (VCS) charging is specified in TS 32.276[36].

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]-[29] Void.

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

[31] 3GPP TS 32.271: "Telecommunication management; Charging management; Location Services (LCS) charging".

[32] 3GPP TS 32.272: "Telecommunication management; Charging management; Push-to-Talk over Cellular (PoC) charging".

[33] 3GPP TS 32.273: "Telecommunication management; Charging management; Multimedia Broadcast/Multicast Service (MBMS) charging".

[34] 3GPP TS 32.274: "Telecommunication management; Charging management; Short Message Service (SMS) charging".

[35] 3GPP TS 32.275: "Telecommunication management; Charging management; MultiMedia Telephony (MMTel) charging".

[36] 3GPP TS 32.276: "Telecommunication management; Charging management; Voice Call Service Charging".

[37]-[49] Void.

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

[51] 3GPP TS 32.298: "Telecommunication management; Charging management; Charging Data Record (CDR) parameter description".

[52] 3GPP TS 32.297: "Telecommunication management; Charging management; Charging Data Record (CDR) file format and transfer".

[53] 3GPP TS 32.296: "Telecommunication management; Charging management; Online Charging System (OCS) applications and interfaces".

[54] 3GPP TS 32.295: "Telecommunication management; Charging management; Charging Data Record (CDR) transfer".

[55]-[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 22.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL); Service description; Stage 1".

[208]-[211] Void.

[212] 3GPP TS 23.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL) Phase X; Stage 2".

[213]-[217] Void.

[218] 3GPP TS 29.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL) Phase X; CAMEL Application Part (CAP) specification".

[219]-[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.

# 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].

**alternative roaming provider:** A roaming provider different from the domestic provider.

**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 CS 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.

**domestic service provider:** An undertaking that provides a roaming customer with domestic mobile communications services, either a Mobile Network Operator or a Mobile Virtual Network Operator.

**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.

**roaming customer**: a customer of a roaming provider of regulated roaming services, by means of a terrestrial public mobile communications network situated in the Union, whose contract or arrangement with that roaming provider permits Union-wide roaming.**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.

## 3.2 Symbols

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

CAP Reference point for CAMEL between a network element with integrated SSF and the OCS.

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].

3G 3rd Generation

3GPP 3rd Generation Partnership Project

ARP Alternative Roaming Provider

CAMEL Customized Applications for Mobile network Enhanced Logic

CAP CAMEL Application Part

CCA Credit Control Answer

CCR Credit Control Request

CGF Charging Gateway Function

CI Cell Identity

CS Circuit Switched

CSE CAMEL Service Environment

CTF Charging Trigger Function

DCCA Diameter Credit Control Application

DSP Domestic Service Provider

EU European Union

FCI Furnish Charging Information

GMSC Gateway MSC

gsmSCF GSM Service Control Function

gsmSSF GSM Service Switching Function

GSM Global System for Mobile communication

HLR Home Location Register

HPLMN Home PLMN

ICA Initiate Call Attempt

IMEI International Mobile Equipment Identity

IMSI International Mobile Subscriber Identity

ISDN Integrated Services Digital Network

ITU-T International Telecommunication Union - Telecommunications standardization sector

JIP Jurisdiction Information Parameter

LAC Location Area Code

LRN Location Routing Number

MAP Mobile Application Part

MCC Mobile Country Code (part of IMSI)

MLC Mobile Location Center

MNC Mobile Network Code (part of IMSI)

MO Mobile Originated

MOC Mobile Originated Call (attempt)

MO-LR Mobile Originated Location Request

MS Mobile Station

MSC Mobile services Switching Centre

MSISDN Mobile Station ISDN number

MSRN Mobile Station Roaming Number

MT Mobile Terminated

MTC Mobile Terminated Call (attempt)

MT-LR Mobile Terminated Location Request

NE Network Element

NI-LR Network Induced Location Request

NP Number Portability

NPDB Number Portability Data Base

OCF Online Charging Function

OCS Online Charging System

O-CSI Originating CAMEL Subscription Information

PLMN Public Land Mobile Network

PSTN Public Switched Telephony Network

RAC Routing Area Code

RAN Radio Access Network

RNC Radio Network Controller

SAC Service Area Code

SCI Subscriber Controlled Input or Send Charging Information

SRF Specialised Resource Function

SS7 Signalling System No. 7

SSF Service Switching Function

T-CSI Terminating CAMEL Subscription Information

TDP Trigger Detection Point

UMTS Universal Mobile Telecommunications System

UTRAN Universal Terrestrial Radio Access Network

VAS Value Added Service

VCC Voice Call Continuity

VCS Voice Call Service

VLR Visitor Location Register

VMSC Visited MSC

VPLMN Visited PLMN

VT-CSI Visited Terminating CAMEL Subscription Information

# 4 Required functionality of the Proxy Function

# 5 Architectural concept

## 5.1 Architecture reference model for Alternative Roaming Provider (ARP)

### 5.1.1 Proxy Function for Voice Call Service

Figure 5.1.1.1 shows the Proxy Function for voice control in the framework of the overall Single IMSI architecture for EU Roaming as defined in the high-level technical specification [298].

Proxy Function

VMSC

CAP

Visited Network

DSP

Home Network

ARP

Diameter

OCS

GMSC

CAP

Figure 5.1.1.1: The Proxy Function architecture for Voice Call Service

The Proxy Function entails a functional entity in the DSP’s network that handles CAMEL and Diameter interworking.

The signaling between the CS domain elements and the Proxy Function is implemented by CAMEL techniques as described in TS 23.078 [212] and TS 29.078 [218]. The signalling between the ARP OCS and the Proxy Function for online charging is implemented as specified in TS 32.276 [36].

# 6 Functionalities and message flows

## 6.1 Reference point required functionality

## 6.2 Message flows

### 6.2.1 Mobile Originated Call

This message flow is for illustrative purpose and depicts a Mobile Originated Call in which charging starts at call attempt.The handling of regulated user, routing and call control as defined in EU Roaming regulation III Interface & Protocol Detailed Technical specifications [299] are out of the 32 series charging specifications.

1

.

Initial DP

2

.

CCR

3

.

CCA

5

.

Apply Charging

7

.

Apply Charging

Report

8

.

CCR

9

.

CCA

13

.

CCR

14

.

CCA

4

.

Request Report BCSM Event

15

.

Release Call

12

.

OCS

ARP

VMSC/gsmSSF

Proxy Function/gsmSCF

DSP

(

Home Network

)

Visited Network

10

.

Apply Charging

11 Event Report BCSM

Apply Charging Report

6

.

Continue

Call Start

[Update]

[Update]

[Initial]

[Initial]

[Termination]

[Termination]

Figure 6.2.1.1 Mobile Originated Call When the ARP subscriber is roaming

1. The Proxy Function/ gsmSCF receives the Initial DP of the CAP dialogue that is initiated from the VMSC/gsmSSF in the VPLMN’s network.

Note 1: The Proxy Function further contains service logic that handles the CAP dialogue towards the VPLMN and the Diameter session towards the ARP and that maps information between these two dialogues.

2. The Proxy Function/gsmSCF initiates a Diameter session towards ARP OCS with CCR [Intial] to request the quotas for voice call service.

3. ARP OCS sends the CCA [Initial] with the granted quotas, such as the duration of a call 5 minutes.

4. The Proxy Function/gsmSCF sends Request Report BCSM Event to VMSC/gsmSSF to monitor for a call-related event, and then sends a notification back to the gsmSCF.

5. The Proxy Function/gsmSCF instructs the VMSC/gsmSSF to apply charging mechanisms to control the call duration.

6. The Proxy Function/gsmSCF requests the VMSC/gsmSSF to proceed with call processing.

7. The VMSC/gsmSSF reports to the gsmSCF the information requested in the Apply Charging.

8. The Proxy Function/gsmSCF sends CCR [Update] to request the quotas.

9. ARP OCS sends the CCA [Update] with the granted quatos again, such as more 5 minutes fot the duration of a call.

10. The Proxy Function/gsmSCF instructs the VMSC/gsmSSF to apply charging mechanisms to control the call duration.

11. The ARP User as the calling party end the call. The VMSC/gsmSSF sends the Event Report BCSM.

12. The VMSC/gsmSSF reports to the gsmSCF the information requested in the Apply Charging.

13. The Proxy Function/gsmSCF sends the CCR [Termination] to ARP OCS.

14. The ARP OCS answers the quest with CCA [Termination].

15. The Proxy Function/gsmSCF tears down the call for all parties involved in the call.

### 6.2.2 Mobile Terminated Call

This message flow is for illustrative purpose and depicts a Mobile Terminated call at DSP in which charging starts at call attempt. CAMEL control of Mobile Terminated calls may be done through interaction with the GMSC or through interaction with the VMSC.The MT call based VMSC is out of consideration as defined in EU Roaming regulation III Interface & Protocol Detailed Technical specifications [299]. The handling of regulated user, routing and call control as defined in EU Roaming regulation III Interface & Protocol Detailed Technical specifications [299] are also out of scope of this specification.

1

.

Initial DP

2

.

CCR

3

.

CCA

5

.

Apply Charging

7

.

Apply Charging

Report

8

.

CCR

9

.

CCA

13

.

CCR

14

.

CCA

4

.

Request Report BCSM Event

15

.

Release Call

12

.

OCS

ARP

GMSC/gsmSSF

Proxy Function/gsmSCF

DSP

(

Home Network

)

10

.

Apply Charging

11 Event Report BCSM (DP T\_Disconnect)

Apply Charging Report

6

.

Continue

Call Start

[Update]

[Update]

[Initial]

[Initial]

[Termination]

[Termination]

Figure 6.2.2.1 Mobile Terminated Call When the ARP subscriber is roaming

1. The Proxy Function/ gsmSCF receive the Initial DP of the CAP dialogue that is initiated from the GMSC/gsmSSF in the Home network.

Note : The Proxy Function further contains service logic that handles the CAP dialogue towards the HPLMN and the Diameter session towards the ARP and that maps information between these two dialogues.

2. The Proxy Function/gsmSCF initiates a Diameter session towards ARP OCS with CCR [Initial] to request the quotas for voice call service of called party.

3. ARP OCS sends the CCA [Initial] with the granted quotas, such as the duration of a call 5 minutes.

4. The Proxy Function/gsmSCF sends Request Report BCSM Event to GMSC/gsmSSF to monitor for a call-related event, and then sends a notification back to the gsmSCF.

5. The Proxy Function/gsmSCF instructs the GMSC/gsmSSF to apply charging mechanisms to control the call duration.

6. The Proxy Function/gsmSCF requests the GMSC/gsmSSF to proceed with call processing.

7. The GMSC/gsmSSF reports to the gsmSCF the information requested in the Apply Charging.

8. The Proxy Function/gsmSCF sends CCR [Update] to request the quotas.

9. ARP OCS sends CCA [Update] with the granted quatos, such as more 5 minutes fot the duration of a call.

10. The Proxy Function/gsmSCF instructs the GMSC/gsmSSF to apply charging mechanisms to control the call duration.

11. The ARP User as the called party end the call. The GMSC/gsmSSF sends the Event Report BCSM with DP-T-Disconnect.

12. The GMSC/gsmSSF reports to the gsmSCF the information requested in the Apply Charging.

13. The Proxy Function/gsmSCF sends the CCR [Termination] to ARP OCS.

14. The ARP OCS answers the request with CCA [Termination].

15. The Proxy Function/gsmSCF tears down the call for all parties involved in the call.

### 6.2.3 Mobile Forwarded Call

For conditionally and unconfitionally call forwarding, the call in different phase would be handled the same as the normal MO call or MT call message flows. For example, the charging provision for B is as normal MT in the call leg between calling-party (A) and the called-party (B), the charging provision for B is as normal MO in the call leg between called-party (B) and the forwarded-to-party(C). In order to avoid the duplication, the detailed message flows of Mobile Forwarded call are not present here.

# 7 Definition of charging information

Annex A (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 2013-09 |  |  |  |  | Skeleton |  |  |
| 2013-10 |  |  |  |  | General Sections for Proxy Function (S5-131758) | 0.0.0 | 0.1.0 |
| 2013-10 |  |  |  |  | MCC clean-up | 0.1.0 | 0.1.1 |
| 2013-11 |  |  |  |  | Editorial refinements and removal of redundancies (S5-131954)  Architecture Concept for Proxy Function (S5-132119)  Voice Call Service online charging scenarios (S5-132103) | 0.1.1 | 0.2.0 |
| 2014-01 |  |  |  |  | The examples of message flow for Proxy Function (S5-140311) | 0.2.0 | 0.3.0 |
| 2014-03 |  |  |  |  | Unify the entity name of message flow and description text (S5‑140700) | 0.3.0 | 0.4.0 |
| 2014-06 | SA#64 | SP-140328 |  |  | Presented for information and approval | 0.4.0 | 1.0.0 |
|  |  |  | Upgrade to Rel-12 | 1.0.0 | 12.0.0 |
| 2014-09 | SA#65 |  |  |  | Change of keywords | 12.0.0 | 12.0.1 |
| 2016-01 |  |  |  |  | Update to Rel-13 (MCC) | 12.0.1 | 13.0.0 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2017-03 | SA#75 |  |  |  |  | Promotion to Release 14 without technical change | 14.0.0 |
| 2018-06 | - | - | - | - | - | Update to Rel-15 version (MCC) | **15.0.0** |
| 2020-07 | - | - | - | - | - | Update to Rel-16 version (MCC) | **16.0.0** |