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Contents

Foreword

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1 Scope

The present document is part of a series of documents specifying charging functionality and charging management in Packet Switched networks (GSM/UMTS, EPS). The 3GPP core network charging architecture and principles are specified in 3GPP TS 32.240 [1], which provides an umbrella for other charging management documents that specify:

- the content of the 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 3GPP TS 32.240 [1].

The present document specifies the Offline and Online Charging description for the Packet Switched (PS) domain based on the functional stage 2 description in 3GPP TS 23.060 [201], 3GPP TS 23.401[208] and 3GPP TS 23.402 [209]. This charging description includes the offline and online charging architecture and scenarios specific to the PS domain, as well as the mapping of the common 3GPP charging architecture specified in TS 32.240 [1] onto the PS domain. It further specifies the structure and content of the CDRs for offline charging, and 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 parameters, abstract syntax and encoding rules for the CDRs are specified in TS 32.298 [51];
- A transaction based mechanism for the transfer of CDRs within the network is specified in TS 32.295 [54];
- The file based mechanism used to transfer the CDRs from the network to the operator"s billing domain (e.g. the billing system or a mediation device) is specified in TS 32.297 [52];
- The 3GPP Diameter application that is used for PS domain offline and online charging is specified in TS 32.299 [50].

Note that a CAMEL based prepaid function and protocol is also specified for the PS domain (3GPP TS 23.078 [206] and 3GPP TS 29.078 [202]). CAMEL entities and functions are outside the scope of the present document.

All terms, definitions and abbreviations used in the present document, which are common across 3GPP TSs, are defined in 3GPP TR 21.905 [100]. Those that are common across charging management in PS domains, services or subsystems are provided in the umbrella document 3GPP 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.

Furthermore, requirements that govern the charging work are specified in 3GPP TS 22.115 [102].

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".

[11-19] 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] 3GPP TS 32.271: "Telecommunication management; Charging management; Location Services (LCS) charging".

[32] 3GPP TS 32.273: "Telecommunication management; Charging management; Multimedia Broadcast and Multicast Service (MBMS) charging"

[33] 3GPP TS 32.274: "Telecommunication management; Charging management; Short Message Service (SMS) charging".

[34]- [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) encoding rules description".

[52] 3GPP TS 32.297: "Telecommunication management; Charging management; Charging Data Records (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]- [69] Void.

[70] Void.

[71] 3GPP TS 29.212: "Policy and Charging Control (PCC); Reference points".

[72] 3GPP TS 23.203: "Policy and Charging Control Architecture".

[73]- [99] Void.

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

[101] Void.

[102] 3GPP TS 22.115 "Service aspects; Charging and billing".

[103]- [199] Void.

[200] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".

[201] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[202] 3GPP TS 29.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL); CAMEL Application Part (CAP) specification".

[203] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[204] Void.

[205] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)"

[206] 3GPP TS 23.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL); Stage 2".

[207] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[208] 3GPP TS 23.401: "GPRS Enhancements for E-UTRAN Access".

[209] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[210] 3GPP TS 29.274: "Evolved GPRS Tunnelling Protocol for Control Plane (GTPv2-C); Stage 3".

[211] 3GPP TS 29.275: "Proxy Mobile IPv6 (PMIPv6) based Mobility and Tunnelling protocols; Stage 3".

[212] 3GPP TS 23.261: "IP flow mobility and seamless Wireless Local Area Network (WLAN) offload; Stage 2".

[213] 3GPP TS 23.272: "Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2".

[214] - [400] Void.

[401] IETF RFC 3588 (2003): "Diameter Base Protocol".

[402] IETF RFC 4006: "Diameter Credit Control" Application

[403] Void.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions defined in 3GPP TR 21.905 [100], 3GPP TS 32.240 [1] and 3GPP TS 22.060 [200], and the following apply:

2G-/3G-: prefixes 2G- and 3G- refer to functionality that supports only GSM or UMTS, respectively, e.g. 2G-SGSN refers only to the GSM functionality of an SGSN
When the term/prefix is omitted, reference is made independently from the GSM or UMTS functionality.

accounting: process of apportioning charges between the Home Environment, Serving Network and Subscriber.

billing: function whereby CDRs generated by the charging function(s) are transformed into bills requiring payment.

Billing Domain: Part of the operator network, which is outside the core network that receives and processes CDR files from the core network charging functions. It includes functions that can provide billing mediation and billing or other (e.g. statistical) end applications. It is only applicable to offline charging (see "Online Charging System" for equivalent functionality in online charging).

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.

CDR field Categories: the CDR fields are defined in the present document. They are divided into the following categories:

- **Mandatory (M):** field that shall always be present in the CDR.
- **Conditional (C):** field that shall be present in a CDR if certain conditions are met.
- **Operator Provisionable: Mandatory (O_M):** A field that operators have provisioned to always be included in the CDR.
- **Operator Provisionable: Conditional (O_C):** A field that operators have provisioned to be included in the CDR if certain conditions are met.

chargeable event: activity utilizing telecommunications 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 that 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: a function within the telecommunications network and the associated OCS/BD components whereby information related to a chargeable event is collected, formatted and transferred in order to make it possible to determine usage for which the charged party may be billed.

Charging Data Record (CDR): A formatted collection of information about a chargeable event (e.g. time of call set-up, duration of the call, amount of data transferred, etc) for use in billing and accounting. For each party to be charged for parts of or all charges of a chargeable event a separate CDR shall be generated, i.e. more than one CDR may be

generated for a single chargeable event, e.g. because of its long duration, or because more than one charged party is to be charged.

Charging event: a 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.

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.

Fully qualified Partial CDR (FQPC): partial CDR that contains a complete set of the fields specified in the present document. This includes all the mandatory and conditional fields as well as those fields that the PLMN operator has provisioned to be included in the CDR. The first Partial CDR shall be a Fully qualified Partial CDR.

GPRS: packet switched bearer and radio services for GSM and UMTS systems.

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.

inter-system change: change of radio access between different radio access technologies such as GSM and UMTS.

IP-CAN bearer: An IP transmission path of defined capacity, delay and bit error rate, etc. See TS 21.905 [8] for the definition of bearer.

IP-CAN session: The association between a UE represented by an IPv4 address and/or an IPv6 prefix, and UE identity information, if available, and a PDN represented by a PDN ID (e.g. an APN). An IP-CAN session incorporates one or more IP-CAN bearers. Support for multiple IP-CAN bearers per IP-CAN session is IP-CAN specific. An IP-CAN session exists as long as UE IP addresses are established and announced to the IP network.

middle tier (charging) TS: 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 3GPP TS 32.250 [10] to 3GPP TS 32.271 [31], e.g. 3GPP TS 32.250 [10] for the CS domain, or 3GPP 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.

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

offline charging: charging mechanism where charging information **does not** affect, in real-time, the service rendered.

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.

packet switched domain: domain in which data is transferred between core network elements in packet switched mode.

partial CDR: CDR that provides information on part of a subscriber session. A long session may be covered by several partial CDRs. Two formats are considered for Partial CDRs. One that contains all of the necessary fields (FQPC); the second has a reduced format (RPC).

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

Reduced Partial CDR (RPC): partial CDRs that only provide mandatory fields and information regarding changes in the session parameters relative to the previous partial CDR. For example, location information is not repeated in these CDRs if the subscriber did not change its location.

settlement: payment of amounts resulting from the accounting process.

Selected IP Traffic Offload (SIPTO): Offload of selected types of IP traffic (e.g. internet traffic) towards a defined IP network close to the UE's point of attachment to the access network. SIPTO is applicable to traffic offload for the macro-cellular access network and for the H(e)NB subsystem.

subscriber: A subscriber is an entity (associated with one or more users) that is engaged in a Subscription with a service provider. The subscriber is allowed to subscribe and unsubscribe services, to register a user or a list of users authorised to enjoy these services, and also to set the limits relative to the use that associated users make of these services.

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.

user: An entity, not part of the 3GPP System that uses network resources by means of a subscription. The user may or may not be identical to the subscriber holding that subscription.

User Equipment (UE): A device allowing a user access to network services. For the purpose of 3GPP specifications the interface between the UE and the network is the radio interface. A User Equipment can be subdivided into a number of domains, the domains being separated by reference points. Currently defined domains are the USIM and ME Domains. The ME Domain can further be subdivided into several components showing the connectivity between multiple functional groups. These groups can be implemented in one or more hardware devices. An example of such connectivity is the TE – MT interface. Further, an occurrence of a User Equipment is an MS for GSM as defined in GSM TS 04.02.

3.2 Symbols

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

A	Interface between an MSC and a BSC.
Bp	Reference point for the CDR file transfer from the Packet Switched CGF to the BD.
C	Interface between a HLR and a SMSC.
D	Interface between a MSC and a HLR.
E	Interface between a MSC and a SMSC.
Ga	Reference point between a CDF and the CGF for CDR transfer.
Gb	Interface between an SGSN and a BSC.
Gc	Interface between an GGSN and an HLR.
Gd	Interface between an SMS-GMSC and an SGSN, and between a SMS-IWMSC and an SGSN.
Ge	Interface between a SGSN and a CAMEL GSM SCF
Gf	Interface between an SGSN and an EIR.
Gi	Interface between the Packet-Switched domain and an external packet data network.
Gn	Interface between two GSNs within the same PLMN.
Gp	Interface between two GSNs in different PLMNs.
Gr	Interface between an SGSN and an HLR.
Gs	Interface between an SGSN and an MSC/VLR.Iu Interface between the 3G SGSN and the UTRAN
Gy	Online charging reference point between a PCEF and an OCS.
Gz	Offline charging reference point between a PCEF and a CGF.
kbit/s	Kilobits per second. 1 kbit/s = 2^{10} bits per second.
Mbit/s	Megabits per second. 1 Mbit/s = 2^{20} bits per second.
R	Reference point between a non-ISDN compatible TE and MT. Typically this reference point supports a standard serial interface.
Rf	Offline Charging Reference Point between a PCN network element and CDF.
Ro	Online Charging Reference Point between a PCN network element and the OCS.
Um	Interface between the Mobile Station (MS) and the GSM fixed network part.