TSGS#27(05)0029

Source: SA5 (Telecom Management)

Title: CR 32240 Charging architecture and principles

Document for: Approval

Agenda Item: 7.5.3

Doc-1st-Level	Spec	CR	R	Phase	Subject	Ca	VerCr	Doc-2nd-Level	Workitem
SP-050029	32.240	001	--	Rel-6	Correction of editorial errors and misalignments	F	6.0.0	S5-054159	CH
SP-050029	32.240	002	--	Rel-6	Error corrections & clarifications	F	6.0.0	S5-054160	CH
SP-050029	32.240	003	--	Rel-6	Correction of Credit Pooling for online charging	F	6.0.0	S5-054161	CH
SP-050029	32.240	004	--	Rel-6	Correction of the concept of Termination action	B	6.0.0	S5-054162	CH

3GPP TSG-SA5 (Telecom Management) ***Tdoc ⌘S5-054159***
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CHANGE REQUEST

⌘ **32.240** **CR** **001** ⌘ **rev** **-** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Correction of editorial errors and misalignments
Source:	⌘	SA5 (karl-heinz.nenner@t-mobile.net)
Work item code:	⌘	CH
Date:	⌘	28/01/2005
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

Ph2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-7	*(Release 7)*

Reason for change:	⌘	TS 32.240 currently has several misalignments with other TSs that are based on it and are still work in progress.
Summary of change:	⌘	Correction / completion of references, definitions, abbreviations and symbols. Move text to correct clause for proper context. Align / harmonise spelling of terms. Correct formatting, spelling, punctuation and word placement errors. Add missing description / explanation.
Consequences if not approved:	⌘	Misalignment between 3GPP charging specifications. Errors and misinterpretations in system implementation.

Clauses affected:	⌘	2, 3, 4.1, 4.1.2, 4.3.1.1, 4.3.2.2.3, 5.1, 5.2.1.3

Other specs affected: ⌘	Y	N		⌘
	☐	☐	Other core specifications	
	☐	☐	Test specifications	
	☐	☐	O&M Specifications	

Other comments: ⌘

Change in Clause 2

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.*

a) The 3GPP charging specifications

[1]-[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] 3GPP TS 32.252: "Telecommunication management; Charging management; Wireless Local Area Network (WLAN) charging".

[13]-[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 32.272: "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".

[342]-[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]-[69] Void.

[70] 3GPP TS 23.125: "Overall High Level Functionality and Architecture Impacts of Flow Based Charging; Stage 2"

[71]-[99] Void.

b) Common 3GPP specifications

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

[101] 3GPP TS 22.115 "Service aspects; Charging and billing".

[102] 3GPP TS 23.002: "Network architecture".

[103]-[199] Void.

c) other Domain and Service specific 3GPP / ETSI specifications

[200] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network

[201] 3GPP TS 22.003: "Circuit Teleservices Supported by a Public Land Mobile Network (PLMN)".

[202] 3GPP TS 22.004: "General on Supplementary Services".

[203] 3GPP TS 22.024: "Description of Charge Advice Information (CAI)".

[204] 3GPP TS 22.086: "Advice of Charge (AoC) supplementary services - Stage 1".

[205] 3GPP TS 23.009: "Handover procedures"

[206] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".

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

[208] 3GPP TS 23.140: "Multimedia Messaging Service (MMS); Functional description; Stage 2".

[290] 3GPP TS 23.271: "Location Services (LCS); Functional description; Stage 2".

[210] 3GPP TS 23.234: "3GPP system to Wireless Local Area Network (WLAN) interworking; System description".

[211] 3GPP TS 23.086: "Advice of Charge (AoC) supplementary services - Stage 2".

[212] 3GPP TS 22.024: "Description of Charge Advice Information (CAI)".

[213]-[299] Void.

d) Relevant ITU Recommendations

[300] ITU-T Recommendation D.93: "Charging and accounting in the international land mobile telephone service (provided via cellular radio systems)".

[301]-[309] Void.

[310] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[311]-[329] Void.

[330] ITU-T Recommendation Q.767: "Application of the ISDN user part of CCITT signalling System No.7 for international ISDN interconnections".

[331]-[349] Void.

[350] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[351] ITU-T Recommendation X.121: "International numbering plan for public data networks".

[352]-[399] Void.

e) Relevant IETF RFCs

[400] IETF RFC 959 (1985): "File Transfer Protocol".

[401] IETF RFC 3588 (2003): “Diameter base protocol”

[402] IETF Internet-Draft “Diameter Credit Control Application” ” v06

[403] IETF RFC1350: "The TFTP Protocol (Revision 2)"

End of Change in Clause 2

Change in Clause 3

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of the present document, the terms and definitions defined in 3GPP TR 21.905 [100] 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.

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

accounting meter record: record containing one or more counters employed to register the usage of resources en masse. Includes simple event counters and/ or cumulative call second counters.

Advice of Charge (AoC): real-time display of the network utilization charges incurred by the Mobile Station
The charges are displayed in the form of charging units. If a unit price is stored by the MS then the display may also include the equivalent charge in the home currency.

AoC service: combination of one or more services, both basic and supplementary, together with a number of other charging relevant parameters to define a customized service for the purpose of advice of charge.

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

Billing Domain: ~~P~~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.

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 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: ~~a~~ 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 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.

~~C~~**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.

circuit switched domain: domain within GSM / UMTS in which information is transferred in circuit switched mode.

~~C~~**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. ~~This definition is ffs. It needs to make sure that the definition encompasses the whole procedure of resource usage supervision up to, and including, the manipulation of the OCS account, in order to be consistent with the TS text. Include the definition in TS template when finished.~~

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

Fully qualified Partial CDR (FQPC): partial CDR that contains a complete set of the fields specified for the CDR type in the respective middle tier TS. 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~~ 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 Systems

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

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

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 3GPP TS 32.250 to 3GPP TS 32.279, 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 the present document 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.

observed IMEI ticket: record used to describe an EIR relevant event e.g. a blacklisted IMEI.

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 accounts/balances.

packet switched domain: domain within GSM / UMTS in which data is transferred in packet switched mode. Corresponds to the term "GPRS".

partial CDR: CDR that provides charging information on part of a user 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).

Rreal-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.

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.

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 utilization 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): 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 a 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 Abbreviations

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

3G	3rd Generation
3GPP	3rd Generation Partnership Project
AF	Application Function
AMF	Account Balance Management Function
AoC	Advice of Charge
APN	Access Point Name
AS	Application Server
BD	Billing Domain
BS	Bearer Services
BSC	Base Station Controller
BSS	Base Station Subsystem

BTS	Base Transceiver Station
CAMEL	Customized Applications for Mobile network Enhanced Logic
CAP	CAMEL Application Part
CDF	Charging Data Function
CDR	Charging Data Record
CG	Charging Gateway
CGF	Charging Gateway Function
CRF	Charging Rules Function
CS	Circuit Switched
CSCF	Call Session Control Function (I-Interrogating; P-Proxy; and S-Serving)
CTF	Charging Trigger Function
~~CW~~	~~Charging gateWay~~
EBCF	Event Based Charging Function
ECUR	Event Charging with Unit Reservation
EIR	Equipment Identity Register
FQPC	Fully Qualified Partial CDR
~~G-CDR~~	~~GGSN (PDP context) generated - CDR~~
GGSN	Gateway GPRS Support Node
GMLC	Gateway MLC
GMSC	Gateway MSC
GPRS	General Packet Radio Service
gsmSCF	GSM Service Control Function
gsmSSF	GSM Service Switching Function
GSM	Global System for Mobile communication
GSN	GPRS Support Node (either SGSN or GGSN)
HLR	Home Location Register
HPLMN	Home PLMN
HSCSD	High Speed Circuit Switched Data
IEC	Immediate Event Charging
IETF	Internet Engineering Task Force
IMEI	International Mobile Equipment Identity
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IMS GWF	IMS GateWay Function
IP	Internet Protocol
ISC	IMS Service Control
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunication Union - Telecommunications standardization sector
LAC	Location Area Code
LAN	Local Area Network
LCS	Location Services
MAP	Mobile Application Part
~~M-CDR~~	~~Mobility management generated - Charging Data Record~~
ME	Mobile Equipment
MGW	Media GateWay
MLC	Mobile Location Center
MMI	Man-Machine Interface
MMS	Multimedia Messaging Service
MMSE	Multimedia Messaging Service Environment
MO	Mobile Originated
MOC	MO Call
MRF	Media Resource Function
MRFC	MRF Controller
MS	Mobile Station
MSC	Mobile Services Switching Centre
MSISDN	Mobile Station ISDN number
MT	Mobile Terminated
MTC	MT Call
NE	Network Element
OCF	Online Charging Function
OCS	Online Charging System
PDN	Packet Data Network

PDP	Packet Data Protocol, e.g. IP
PLMN	Public Land Mobile Network
PoC	Push-to-talk over Cellular
PS	Packet-Switched
PSPDN	Packet-Switched Public Data Network
QoS	Quality of Service
RF	Rating Function
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RPC	Reduced Partial CDR
SBCF	Session Based Charging Function
SCCP	Signalling Connection Control Part
SCF	Service Control Function
SCUR	Session Charging with Unit Reservation
~~SSF~~	~~Service Switching Function~~
SGSN	Serving GPRS Support Node
SIM	Subscriber Identity Module
SMS	Short Message Service
SSF	Service Switching Function
~~S-SMO-CDR~~	~~SGSN delivered Short message Mobile Originated - CDR~~
~~S-SMT-CDR~~	~~SGSN delivered Short message Mobile Terminated - CDR~~
TAP	Transferred Account Procedure
TPF	Traffic Plane Function
TR	Technical Report
TS	Technical Specification
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
USIM	Universal SIM
VAS	Value Added Service
VLR	Visitor Location Register
VMSC	Visited MSC
VPLMN	Visited PLMN
WLAN	Wireless LAN

3.3 Symbols

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

A	Interface between an MSC and a BSC.
Bc	Reference point for the CDR file transfer from the Circuit Switched CGF to the BD.
Bi	Reference point for the CDR file transfer from the IMS CGF to the BD.
Bl	Reference point for the CDR file transfer from the GMLC CGF to the BD.
Bm	Reference point for the CDR file transfer from the MMS CGF to the BD.
Bo	Reference point for the CDR file transfer from the OCF CGF to the BD.
Bp	Reference point for the CDR file transfer from the GPRS CGF to the BD.
Bs	Reference point for the CDR file transfer for CAMEL services to the BD, i.e. from the SCF CGF to the BD.
Bw	Reference point for the CDR file transfer from the WLAN CGF to the BD.
Bx	Reference point for CDR file transfer between any (generic) 3G domain, subsystem or service CGF and a BD.
CAP	Reference point for CAMEL between a network element with integrated SSF and the OCS.
Ga	Reference point for CDR transfer between a CDF and the CGF.
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.
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.

Gx	Reference point between a CRF and a TPF.
Gy	Online charging ~~R~~reference point ~~for online charging~~ between a TPF and an OCS.
Gz	Offline charging ~~R~~reference point ~~for CDR transfer~~ between a TPF and a CGF.
Iu	Interface between the RNS and the core network.
kbit/s	Kilobits per second. 1 kbit/s = 2^{10} bits per second.
Lr	Interface between Gateway MLCs.
Mbit/s	Megabits per second. 1 Mbit/s = 2^{20} bits per second.
Mc	Interface between the MGW and (G)MSC server.
Rf	Offline charging reference point between a 3G network element and the CDF.
Ro	Online charging reference point between a 3G network element and the OCS.
Rx	Reference point between the CRF and an AF.
Um	Interface between the Mobile Station (MS) and the GSM fixed network part.
Uu	Interface between the User Equipment (UE) and the UMTS fixed network part.
Wf	Offline charging ~~R~~reference point ~~for offline charging~~ between a 3GPP WLAN CTF and the CDF.
Wo	Online charging ~~R~~reference point ~~for online charging~~ between a 3GPP WLAN CTF and the OCS.

End of Change in Clause 3

Change in Clause 4.1

4.1 Charging mechanisms

GSM/UMTS networks provide functions that implement offline and/or online charging mechanisms on the bearer (e.g. GPRS), subsystem (e.g. IMS) and service (e.g. MMS) 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 charging levels are further described in clause 5.3.

In offline charging, the resource usage is reported from the network to the Billing Domain after the resource usage has occurred. In online charging, a subscriber account, located in an online charging system, is queried prior to granting permission to use the requested network resource(s).

Typical examples of network resource usage are a voice call of certain duration, the transport of a certain volume of data, or the submission of a MM of a certain size. The network resource usage requests may be initiated by the UE (MO case) or by the network (MT case).

Typical examples of relevant chargeable events are the start, modification or end of a voice call or GPRS PDP context, or the arrival of a MM on the MMS R/S.

Offline and online charging may be performed simultaneously and independently for the same chargeable event. Clause 5.5 provides further insight into potential utilisation of the charging information produced by the offline and online charging mechanisms.

End of Change in Clause 4.1

Change in Clause 4.1.2

4.1.2 Online charging

Online charging is a process where charging information for network resource usage is collected concurrently with that resource usage in the same fashion as in offline charging. However, authorization for the network resource usage must be obtained by the network prior to the actual resource usage to occur. This authorization is granted by the Online Charging System upon request from the network.

When receiving a network resource usage request, the network assembles the relevant charging information and generates a charging event towards the OCS in real-time. The OCS then returns an appropriate resource usage authorization. The resource usage authorization may be limited in its scope (e.g. volume of data or duration), therefore the authorization may have to be renewed from time to time as long as the user's network resource usage persists.

~~The network resource usage request may be initiated by the UE (MO case) or by the network (MT case).~~

Note that the charging information utilized in online charging is not necessarily identical to the charging information employed in offline charging.

In conclusion, online charging is a mechanism where charging information can affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with the control of network resource usage is required.

End of Change in Clause 4.1.2

Change in Clause 4.3.1.1

4.3.1.1 Charging Trigger Function

The Charging Trigger Function (CTF) generates charging events based on the observation of network resource usage as described in clause 4.1.1. In every network and service element that provides charging information, the CTF is the focal point for collecting the information pertaining to chargeable events within the network element, assembling this information into matching charging events, and sending these charging events towards the Charging Data Function. The

CTF is therefore a mandatory, integrated component in all network elements that provide offline charging functionality, as depicted in figure 4.2. It is made up of two functional blocks:

- Accounting Metrics Collection

The process that monitors signalling functions for calls, service events or sessions established by the network users, or the handling of user traffic for these calls, service events or sessions, or service delivery to the user via these calls, service events or sessions. It is required to provide metrics that identify the user and the user's consumption of network resources and/or services in real--time. The exact behaviour and functionality of this process e.g.:

- trigger conditions for collection of charging information,
- information elements to collect,
- which service events, signalling or user traffic to monitor,
- relationship to services / bearers / sessions,

depends on functions / services that the NE provides. The Account Metrics Collection can therefore be considered as the network element dependent part of the CTF.

Depending on implementation choice, NE functions (e.g. the handling of service events or signalling / user traffic) may be distributed among multiple physical “devices” within the NE. In order to be able to capture the required charging information from the service events or signalling / user traffic, the design of the Accounting Metrics Collection has to match the physical design / distribution of these functions within the NE. This implies that in case of such distributed NE functionality, the Accounting Metrics Collection becomes a distributed functionality itself.

- Accounting Data Forwarding

This process receives the collected accounting metrics and determines the occurrence of chargeable events from a set of one or more of these metrics. It then assembles charging events that match the detected chargeable events, and forwards the charging events towards the Charging Data Function via the Rf reference point. The charging events provide information pertinent to the chargeable event, i.e. characterising the network resource usage together with an identification of the involved user(s). There is no assumption of any synchronisation between the reception of individual accounting metrics, however, it must be possible for the Accounting Data Forwarding to complete its overall functionality per charging event in real-time.

While the exact information received by the Account Data Forwarding from the Account Metrics Collection, and the relevant chargeable events, are specific to each type of network element, the overall functionality of receiving, assembling and forwarding the charging information can be considered generic. Hence the Accounting Data Forwarding is considered the NE independent part of the CTF.

The behaviour of the CTF with respect to the definition of the chargeable events, the matching charging events and the information elements to collect is specified per domain, subsystem and service in the respective middle tier charging TS ([10] – [49]).

End of Change in Clause 4.3.1.1

Change in Clause 4.3.2.2.3

4.3.2.2.3 Rating Function

The Rating Function (RF) determines the value of the network resource usage (described in the charging event received by the OCF from the network) on behalf of the OCF. To this end, the OCF furnishes the necessary information to the RF, and receives the rating output, via the Re reference point. The RF may handle a wide variety of rateable instances, such as:

- Rating of data volume (e.g. based on charging initiated by an access network entity, i.e. on the bearer level);

- Rating of session / connection time (e.g. based on charging initiated by a SIP application, i.e. on the subsystem level);
- Rating of service events (e.g. based on charging of web content or MMS, i.e. on the service level).

End of Change in Clause 4.3.2.2.3

Change in Clause 5.1

5.1 Charging data generation and quota supervision

The CTF embedded in all charging relevant network elements collects charging information within the NE concerning the use of network resources by the mobile end users. These network resources may pertain to bearer (e.g. CS, PS, WLAN), subsystem (e.g. IMS sessions) or service (e.g. MMS) usage / consumption. The various charging levels are further described in clause 5.3.

The purpose of offline charging is to transform the charging information into CDRs that are post-processed within the Billing Domain, e.g. for the purpose of generating bills. While the collection of charging information used for the CDRs occurs during the network resource usage, there is no impact of offline charging on the use of the resources. All activities involved in the transformation of the charging information into end user bills, and the collection of the end user charges incurred in these bills, occur *offline* to, or after, the network resource usage.

The purpose of online charging is to furnish charging information to the OCS in order to perform credit control before the network resource usage is permitted. To this end, a prepaid subscriber account has to exist in the OCS, against which the resource usage is billed after the value of the resource usage has been determined. Hence all activities to assess the requested resource usage, to determine monetary or other values, and to debit these units from the subscriber account, must occur prior to or at least, during the resource usage, i.e. *online* with respect to resource usage. Depending on the circumstances, a final evaluation must occur when resource usage ends. Two cases must be distinguished:

- The requested resource can be determined and billed in a one-off procedure. In that case, the resource usage is debited from the subscriber account immediately when processing the charging event, and the permission for the resource usage is returned to the network. An example of this may be the forwarding of a terminating short message from the MSC to the end user. In this scenario, it is generally required that the network can guarantee resource usage execution in order to avoid overbilling the user.

- The OCS cannot a priori know the amount of resources that the end user may eventually consume, or it cannot be assumed a priori that the resource usage request can be (completely) fulfilled. In this case, a certain amount is blocked, or reserved, on the subscriber's account on the OCS, and permission to use an amount of resources that matches the reservation is returned to the network. When the granted resources have been fully used, the network must send a new request to the OCS. When resource usage has been executed, the actual amount of resource usage must be returned by the NE to the OCS so that eventually over-reserved amounts can be recredited to the subscriber account, assuring that the correct amount gets debited.

Charging information is collected by the CTF based on chargeable events that describe the user(s) and their requested network resource usage. The chargeable events are specific to each domain / service / subsystem and specified in the respective middle tier charging ~~tier~~ TS. For each chargeable event, a matching charging event is formed and immediately sent to its destination, i.e. the CDF in offline charging or the OCF in online charging. Again, the event information is specific to the domain / service / subsystem and defined in the respective middle tier charging TS. While the accounting metrics (provided by the Accounting Metrics Collection part of the CTF) used in online and offline charging are generally identical, the information comprising chargeable events (determined by the Accounting Data Forwarding part of the CTF) may be different between online and offline charging. Note also that online and offline charging may occur simultaneously, i.e. for the same resource usage the CTF may send an offline charging event to the CDF and an online charging event to the OCF. In that particular case, credit control occurs for that resource usage but at the same time, CDRs are created in offline charging. However, this may result in inconsistencies if credit control denies the resource usage e.g. due to the expiration of the subscriber account on the OCS. Therefore, if CDRs are required for online charged resource usage, it may be a better solution to generate these CDRs in the OCS, as depicted in clause 4.3.2.3.

Both online and offline charging can be categorised into two distinct classes, namely event based charging and session based charging. Event based charging implies that a chargeable event is defined as a single end-user-to-network transaction, e.g. the sending of a multimedia message. This chargeable event is then mapped to an appropriate charging event, resulting in a single CDR or in a single credit control and resource usage authorisation procedure. In contrast, session based charging is characterised by the existence of a user session, such as a circuit call, a GPRS PDP context, or an IMS session. This user session is then matched by a charging session, resulting in the generation of multiple chargeable/charging events and the creation of one or more CDRs in offline charging or the performance of a credit

control session in online charging. The following paragraphs describe the event versus session based charging in more detail for both online and offline charging.

- **Event based charging**. The (chargeable) event is recognised in the NE that handles it, based on e.g. signalling exchange between the user equipment and the NE. The event is then mapped onto a single charging event as specified in the middle tier charging TS that applies to that NE.

  - In *online* charging, the charging event is transferred to the EBCF via the Ro or CAP reference point, and the chargeable event is authorised after successfully performing credit control on the subscriber account. The complete procedure must occur in real-time. If the chargeable event is not authorised by the OCS (e.g. when the subscriber account does not contain sufficient credit), the NE rejects the resource usage pertaining to that chargeable event.

    The event charging procedure may occur with or without reservation of amounts from the subscriber's account ("Event Charging with Unit Reservation" (ECUR) or "Immediate Event Charging" (IEC), respectively), as described above. Furthermore, if the procedure does include reservation, the OCS may decide to authorise more than one occurrence of the chargeable event (e.g. multiple short messages may be authorised upon the first SMS request from the user).

  - In *offline* charging, the charging event is transferred to the CDF via the Rf reference point. The CDF produces a matching CDR, which is then sent to the CGF via the Ga reference point. The CDR will eventually be transferred to the BD in a CDR file, together with other CDRs of the same or different types, according to file transfer configuration by the operator. While there is no real-time requirement on any particular part of this procedure, the system should be capable of completing the process from the detection of the chargeable event up to, and including, CDR transfer to the CGF, in near real-time.

- **Session based charging**. The start of the user session is recognised by the NE that handles the session, based on e.g. signalling exchange between the user equipment and the NE. This chargeable event is then mapped onto a charging event as specified in the middle tier charging TS that applies to that NE.

  - In *online* charging, the charging event is transferred to the SBCF via the Ro or CAP reference point and the start of the user session is authorised after successfully performing credit control on the subscriber account. As there is no information available at this time concerning the overall evaluation of the session (e.g. complete duration or data volume of the session), session based charging always involves reservation of amounts from the subscriber's account ("Session based Charging with Unit Reservation" (SCUR)): the OCS reserves credit from the subscriber account and returns the corresponding quota (e.g. number of minutes or bytes allowed) to the NE. The NE, in turn, uses the provided quota to supervise the actual network resource consumption. When the quota is used up, the network element either issues a new charging event, similar to the beginning of the session, or terminates the session if previously instructed to do so by the OCS. Once the session is terminated in the network element, the consumed quota is reported back to the OCS. The credit control session is then terminated, and the OCS returns the value of any unused quota (as reported by the NE) to the subscriber's account. The complete procedure of receiving, processing and responding to an online charging event, must occur in real-time.

    For each charging event received during the session, the OCS decides whether to authorise the resource usage or whether to decline the request (e.g. when the subscriber account does not contain sufficient credit). If, at any time within the session, the OCS determines not to authorise the chargeable event, it rejects the request sent by the network element, causing the NE to disallow the resource usage pertaining to that chargeable event. It must be noted that this does not necessarily terminate the user session. E.g. in the case of credit exhaustion, the session could be redirected to a credit recharging site.

  - In *offline* charging, the charging event is transferred to the CDF via the Rf reference point. Upon termination of the subscriber session, or when a new chargeable event occurs (as specified in the respective middle tier charging TS), further charging events are sent for the session from the NE to the CDF. The CDF formats one or more of these events into CDRs according to CDR formats specified in the middle tier TSs, and in accordance with CDR generation triggers configured by the operator. Upon its completion, the CDR will be sent forward to the CGF via the Ga reference point, and a new CDR will be opened by the CDF for the same session. Finally, the CDRs will eventually be transferred to the BD in a CDR file, together with other CDRs of the same or different types, according to file transfer configuration by the operator.

    The system should be capable of completing the process of chargeable event detection and charging event forwarding, CDR generation / closure and CDR forwarding as closely as possible in real-time. However, a significant time may pass between the reception of the first charging event for a CDR and the time the CDR is closed, depending on the CDR generation triggers configured by the operator.

For both event and session based charging, it has been specified above that the NE shall disallow the requested resource usage when the associated chargeable event is not authorised by the OCS. The most typical case for the OCS to refuse authorisation is the expiry of the subscriber account. However, depending on operator policy, even in the case of account expiry the OCS may determine to allow the resource usage to occur or to continue. For example, if the interruption of the user session renders the complete session useless to the end user, it would be unfair to debit the user's account for the portion of the session that was executed. While the decision making procedures and the special treatment of this situation are internal to the OCS, the important aspect to note is that the OCS *must grant authorisation* towards the network in order to allow the event to occur or the session to continue, effectively making the event or session free of charge.

Clause 5.2 provides a detailed analysis of the possible relationships between charging events, credit control processes, CDRs and CDR files as well as their triggers.

Both Charging Data Record and online charging data generation and contents should be flexible and unnecessary redundancy in data should be avoided. Clause 5.4 describes how the generation of charging data can be configured by the network operator in order to support the above requirement.

Charging data are collected for successful and selected unsuccessful resource usage attempts. The resource usage attempt is seen as being successful in the network element (where the chargeable event is detected) when the user event is successfully completed, or the user session has started. Further details, such as the indication of failure and failure reasons in charging events and CDRs, are specified in the middle tier charging TSs.

End of Change in Clause 5.1

Change in Clause 5.2.1.3

5.2.1.3 Transfer of CDR files via Bx

The CGF is responsible for persistent CDR storage, for preparing CDR files and transferring them to the BD via the Bx reference point. To this end, the CGF provides one or more files on which to store the CDRs after potential reformatting to comply with the Bx file format specified in TS 32.297 [52].

The CDRs may be routed to one of several simultaneously open files inside the CGF depending on certain CDR parameters, such as CDR type, or on other criteria such as the originating CDF. CDR files are closed on the CGF based on certain operator configured parameters, for example:

- file size limit,
- file duration (time) limit,
- time of day,
- maximum number of CDRs.

This implies that the closure of a CDR file occurs asynchronously to the reception of CDRs on the CGF. When a CDR file is closed, the CGF must assure that a new CDR file is available to store incoming CDRs in line with the CDR routing facility described above.

Once CDR files are closed, they are ready for transfer to the BD. The CGF shall support both "push" transfer mode (i.e. CGF triggers and controls file transfer to BD) and "pull" transfer mode (i.e. BD triggers and controls file transfer). In push mode, the CGF uploads the files to the BD according to operator specified parameters, such as time of day, number of available files, etc. In pull mode, the BD may request the files from the CGF at any point in time at the discretion of the BD.

For all procedures involved in CDR reception, processing and storing, the CGF shall be capable of complying with near real--time requirements. Details on the protocol application for the open Bx interface and the functionality of the CGF can be found in TS 32.297 [52]. The semantics and formal description of the CDR parameters are specified in TS 32.298 [51].

End of Change in Clause 5.2.1.3
End of Document

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2003	S_22	SP-030623	--	--	Submitted to TSG SA#22 for Information	1.0.0	
Sep 2004	S_25	SP-040550	--	--	Submitted to TSG SA#25 for Approval	2.0.0	6.0.0

3GPP TSG-SA5 (Telecom Management) ***Tdoc ⌘S5-054160***
Meeting #41, Lisbon, PORTUGAL, 24 - 28 January 2005

CR-Form-v7.1

CHANGE REQUEST

⌘ **32.240** **CR** **002** ⌘ **rev** **-** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Error corrections & clarifications
Source:	⌘	SA5 (karl-heinz.nenner@t-mobile.net)
Work item code:	⌘	CH
Date:	⌘	28/01/2005
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
Rel-4 (Release 4)
Rel-5 (Release 5)
Rel-6 (Release 6)
Rel-7 (Release 7)

Reason for change:	⌘	TS 32.240 currently has several errors, ambiguities and lack of clarification in the described basic charging concepts.
Summary of change:	⌘	Clarify the task of the Rating Function and Re reference point information. Correct errors, inconsistencies and ambiguities in description of "Charging data generation and quota supervision".
Consequences if not approved:	⌘	Errors and misinterpretations in system development.

Clauses affected:	⌘	4.3.2.2.3, 4.4.2.4, 5.1

Other specs affected: ⌘	Y	N		⌘
	☐	☐	Other core specifications	
	☐	☐	Test specifications	
	☐	☐	O&M Specifications	

Other comments: ⌘

Change in Clause 4.3.2.2.3

4.3.2.2.3 Rating Function

The Rating Function (RF) determines the value of the network resource usage (described in the charging event received by the OCF from the network) on behalf of the OCF. To this end, the OCF furnishes the necessary information, obtained from the charging event, to the RF, and receives in return the rating output (monetary or non-monetary units), via the Re reference point. The RF may handle a wide variety of rateable instances, such as:

- Rating of data volume (e.g. based on charging initiated by an access network entity);
- Rating of session / connection time (e.g. based on charging initiated by a SIP application);
- Rating of service events (e.g. based on charging of web content or MMS).

End of Change in Clause 4.3.2.2.3

Change in Clause 4.4.2.4

4.4.2.4 Re

The Re reference point supports interaction between the OCF and a Rating Function (RF) in order to determine the value of chargeable events in terms of monetary or non-monetary units. This interface application is defined in TS 32.296 [53].

End of Change in Clause 4.4.2.4

Change in Clause 5.1

5.1 Charging data generation and quota supervision

The CTF embedded in all charging relevant network elements collects charging information within the NE concerning the use of network resources by the mobile end users. These network resources may pertain to bearer (e.g. CS, PS, WLAN), subsystem (e.g. IMS sessions) or service (e.g. MMS) usage / consumption. The various charging levels are further described in clause 5.3.

The purpose of offline charging is to transform the charging information into CDRs that are post-processed within the Billing Domain, e.g. for the purpose of generating bills. While the collection of charging information used for the CDRs occurs during the network resource usage, there is no impact of offline charging on the use of the resources. All activities involved in the transformation of the charging information into end user bills, and the collection of the end user charges incurred in these bills, occur *offline* to, or after, the network resource usage.

The purpose of online charging is to furnish charging information to the OCS in order to perform credit control before the network resource usage is permitted. To this end, a prepaid subscriber account has to exist in the OCS, against which the resource usage can beis billed after the value of the resource usage has been determined. Hence all activities to assess the requested resource usage, to determine its value in monetary or other unitsvalues, and to debit these units from the subscriber account, must occur prior to or at least, during the resource usage, i.e. *online* with respect to resource usage. Depending on the circumstances, a final evaluation must occur when resource usage ends. Hence, Ttwo cases must be distinguished:

- Direct Debiting: Tthe requested resource can be determined and billed in a one-off procedure. In that case, the resource usage is debited from the subscriber account immediately when processing the charging event, and the permission for the resource usage is returned to the network. An example of this may be the forwarding of a terminating short message from the MSC to the end user. In this scenario, it is generally required that the network can guarantee resource usage execution in order to avoid overbilling the user.

- Unit Reservation: Tthe OCS cannot a priori know the amount of resources that the end user may eventually consume, or it cannot be assumed a priori that the resource usage request can be (completely) fulfilled. In this case, a certain amount of (monetary or non-monetary) units is blocked, or reserved, on the subscriber's account on the OCS, and permission to use an amount of resources that matches the unit reservation is returned to the network. When the granted resources units have been fully used or a new, not yet authorised chargeable event occurs, the network must send a new request for unit allocation to the OCS. When resource usage has been executed, the actual amount of resource usage (i.e. the used units) must be returned by the NE to the OCS so that eventually over-reserved amounts can be recredited to the subscriber account, assuring that the correct amount gets debited.

Charging information is collected by the CTF based on chargeable events that describe the user(s) and their requested network resource usage. The chargeable events are specific to each domain / service /subsystem and specified in the respective middle charging tier TS. For each chargeable event, a matching charging event is formed and immediately sent to its destination, i.e. the CDF in offline charging or the OCF in online charging. Again, the event information is specific to the domain / service / subsystem and defined in the respective middle tier charging TS. While the accounting metrics (provided by the Accounting Metrics Collection part of the CTF) used in online and offline charging are generally identical, the information comprising chargeable events (determined by the Accounting Data Forwarding part of the CTF) may be different between online and offline charging. Note also that online and offline charging may occur simultaneously, i.e. for the same resource usage the CTF may send an offline charging event to the CDF and an online charging event to the OCF. In that particular case, credit control occurs for that resource usage but at the same time, CDRs are created in offline charging. However, this may result in inconsistencies if credit control denies the resource usage e.g. due to the expiration of the subscriber account on the OCS. Therefore Alternatively, if CDRs are required for online charged resource usage, it maythis can be a better solution toachieved by generateing these CDRs in the OCS, as depicted in clause 4.3.2.3.

Both online and offline charging can be categorised into two distinct classes, namely event based charging and session based charging. Event based charging implies that a chargeable event is defined as a single end-user-to-network transaction, e.g. the sending of a multimedia message. This chargeable event is then mapped to an appropriate charging event, resulting in a single CDR or in a single credit control and resource usage authorisation procedure. In contrast, session based charging is characterised by the existence of a user session, such as a circuit call, a GPRS PDP context, or an IMS session. This user session is then matched by a charging session, resulting in the generation of multiple

chargeable/charging events and the creation of one or more CDRs in offline charging or the performance of a credit control session in online charging. The following paragraphs describe the event versus session based charging in more detail for both online and offline charging.

- **Event based charging**. The (chargeable) event is recognised in the NE that handles it, based on e.g. signalling exchange between the user equipment and the NE. The event is then mapped onto a single charging event as specified in the middle tier charging TS that applies to that NE.

  - In *online* charging, the charging event is transferred to the EBCF via the Ro or CAP reference point, and the chargeable event is authorised after successfully performing credit control on the subscriber account. The complete procedure must occur in real-time. If the chargeable event is not authorised by the OCS (e.g. when the subscriber account does not contain sufficient credit), the NE rejects the resource usage pertaining to that chargeable event.

  - The event charging procedure may occur with or without reservation of ~~amounts~~ units from the subscriber's account ("Event Charging with Unit Reservation" (ECUR) or "Immediate Event Charging" (IEC), respectively), as described above. Furthermore, if the procedure does include reservation, the OCS may choose~~decide~~ to authorise one or more ~~than one~~ occurrences of the chargeable event (i.e. allot one or more "service" units). ~~e.g.~~ For example, multiple short messages may be authorised upon the first SMS request from the user~~)~~.

  - In *offline* charging, the charging event is transferred to the CDF via the Rf reference point. The CDF produces a matching CDR, which is then sent to the CGF via the Ga reference point. The CDR will eventually be transferred to the BD in a CDR file, together with other CDRs of the same or different types, according to file transfer configuration by the operator. While there is no real-time requirement on any particular part of this procedure, the system should be capable of completing the process from the detection of the chargeable event up to, and including, CDR transfer to the CGF, in near real-time.

- **Session based charging**. The start of the user session is recognised by the NE that handles the session, based on e.g. signalling exchange between the user equipment and the NE. This chargeable event is then mapped onto a charging event as specified in the middle tier charging TS that applies to that NE.

  - In *online* charging, ~~the~~an "initial" charging event (session start) is transferred to the SBCF via the Ro or CAP reference point and the start of the user session is authorised after successfully performing credit control on the subscriber account. The NE may delay the actual start of the user session until authorisation has been obtained (cf. 4.3.2.1). As there is no information available at this time concerning the overall evaluation of the session (e.g. complete duration or data volume of the session), session based charging always involves reservation of ~~amounts~~ units from the subscriber's account ("Session based Charging with Unit Reservation" (SCUR)): the OCS reserves credit from the subscriber account and returns the corresponding quota (e.g. units specifying the number of minutes or bytes allowed) to the NE. The NE, in turn, uses the provided quota to supervise the actual network resource consumption. In the case that another chargeable event occurs for the session, the network element issues an "interim" charging event in order to also authorise this new chargeable event. When the quota is used up, the network element either issues another interim ~~new~~ charging event, requesting further units to be allotted, ~~similar to the beginning of the session,~~ or terminates the session if previously instructed to do so by the OCS. Once the session is terminated in the network element, the consumed ~~quota is~~units are reported back to the OCS with a "final" charging event. The credit control session is then terminated, and the OCS returns the value of any unused quota (as reported by the NE) to the subscriber's account. The complete procedure of receiving, processing and responding to an online charging event, must occur in real-time. Note that this procedure can occur in parallel for several concurrent services running on the same user session.

    For each charging event received during the session, the OCS decides whether to authorise the resource usage or whether to decline the request (e.g. when the subscriber account does not contain sufficient credit). If, at any time within the session, the OCS determines not to authorise the chargeable event, it rejects the request sent by the network element, causing the NE to disallow the resource usage pertaining to that chargeable event. It must be noted that this does not necessarily terminate the user session. E.g. in the case of credit exhaustion, the session could be redirected to a credit recharging site.

  - In *offline* charging, the "initial" charging event is transferred to the CDF via the Rf reference point. Upon termination of the subscriber session, or when a new chargeable event occurs (as specified in the respective middle tier charging TS), further charging events ("final" or "interim" events, respectively) are sent for the session from the NE to the CDF. The CDF formats one or more of these events into CDRs according to CDR formats specified in the middle tier TSs, and in accordance with CDR generation triggers configured by the

operator. Upon its completion, the CDR will be sent forward to the CGF via the Ga reference point, and a new CDR will be opened by the CDF for the same session. Finally, the CDRs will eventually be transferred to the BD in a CDR file, together with other CDRs of the same or different types, according to file transfer configuration by the operator.

The system should be capable of completing the process of chargeable event detection and charging event forwarding, CDR generation / closure and CDR forwarding as closely as possible in real-time. However, a significant time may pass between the reception of the first charging event for a CDR and the time the CDR is closed, depending on the CDR generation triggers configured by the operator.

For both event and session based charging, it has been specified above that the NE shall disallow the requested resource usage when the associated chargeable event is not authorised by the OCS. The most typical case for the OCS to refuse authorisation is the expiry of the subscriber account. However, depending on operator policy, even in the case of account expiry the OCS may determine to allow the resource usage to occur ~~or~~ / to continue. For example, if the interruption of the user session renders the complete session useless to the end user, it would be unfair to debit the user's account for the portion of the session that was executed. While the decision making procedures and the special treatment of this situation are internal to the OCS, the important aspect to note is that the OCS *must grant authorisation* towards the network in order to allow the event to occur or the session to continue, effectively making the event or (remainder of the) session free of charge.

Clause 5.2 provides a detailed analysis of the possible relationships between charging events, credit control processes, CDRs and CDR files as well as their triggers.

Both Charging Data Record and online charging data generation and contents should be flexible and unnecessary redundancy in data should be avoided. Clause 5.4 describes how the generation of charging data can be configured by the network operator in order to support the above requirement.

Charging data are collected for successful and selected unsuccessful resource usage attempts. The resource usage attempt is seen as being successful in the network element (where the chargeable event is detected) when the user event is successfully completed, or the user session has started. Further details, such as the indication of failure and failure reasons in charging events and CDRs, are specified in the middle tier charging TSs.

Note that some of the terminology used in this clause differs from the IETF DCCA [402] that forms the basis for the online charging application. For example, the DCCA uses "session" and "event" more in terms of the credit control protocol rather than in terms of user activity, as the present document does. The mapping of the concepts and terminology used to describe the concepts, is described in 3GPP TS 32.299 [50].

End of Change in Clause 5.1
End of document

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2003	S_22	SP-030623	--	--	Submitted to TSG SA#22 for Information	1.0.0	
Sep 2004	S_25	SP-040550	--	--	Submitted to TSG SA#25 for Approval	2.0.0	6.0.0

3GPP TSG-SA5 (Telecom Management) **S5-054161**
Meeting #41, Lisbon, Portugal 24 - 28 January 2005

CR-Form-v7

CHANGE REQUEST

⌘ **32.240** CR **003** ⌘ rev **-** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Correction of Credit Pooling for online charging
Source:	⌘	SA5 (ggfj@nortelnetworks.com)
Work item code:	⌘	CH
Date:	⌘	28/1/2005
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-6	*(Release 6)*

Reason for change:	⌘	DCC protocol already includes a credit pooling capability which it would be desirable to re-use.
Summary of change:	⌘	An additional section describing the usage of credit pooling is added.
Consequences if not approved:	⌘	Use of credit pooling not described.

Clauses affected:	⌘	5.5.2

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

Change in 5.5.2

5.5.2 Credit control and balance management

~~To be completed. Among others, the following items should be considered:~~

~~**Credit pooling**~~
~~Quotas granted by the Online Charging System may be associated with credit pools as described in Diameter Credit Control [402]. This mechanism can be used to avoid credit fragmentation in the case that there are multiple services running simultaneously.~~

~~Considerations of proper amounts for reservation~~

Editor's note: There may be more issues to consider in this clause, e.g. considerations of proper amounts for reservation

5.5.2.1 Use of credit pooling

Credit fragmentation can occur when it is necessary to grant separate quotas. Granting each quota causes some of the user's credit to be reserved at the Server. It is then possible that all the user's credit may be reserved when the user wishes to start using a new service. The new service may then be denied, despite the fact that there remains unused credit in the user's account.

To avoid such credit fragmentation and unnecessary load on the server, it is possible for multiple quotas provided to be linked into a credit pool. The client may then consider the quotas to form a single pool of credit, from which all services draw units.

The reference to a credit pool includes a translation factor derived from the rating parameter, which translates from units of a specific type (time/volume) to the abstract units in the pool.

The use of credit pooling is described in the Diameter Credit Control Application [402].

End of Change

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2003	S_22	SP-030623	--	--	Submitted to TSG SA#22 for Information	1.0.0	
Sep 2004	S_25	SP-040550	--	--	Submitted to TSG SA#25 for Approval	2.0.0	6.0.0

3GPP TSG-SA5 (Telecom Management) ***Tdoc ⌘S5-054162***
Meeting #41, Lisbon, PORTUGAL, 24 - 28 January 2005

CR-Form-v7

CHANGE REQUEST

⌘ **32.240** **CR** **004** ⌘ **rev** **-** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Correction of the concept of Termination action
Source:	⌘	SA5 (ggfj@nortelnetworks.com)
Work item code:	⌘	CH
Date:	⌘	28/01/2005
Category:	⌘	**B**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-7	*(Release 7)*

Reason for change:	⌘	The termination action concept is already in some parts of the TS 32.240, but not explicitly mentioned
Summary of change:	⌘	The termination action concept is formally introduced.
Consequences if not approved:	⌘	Incomplete description of the online charging procedures.

Clauses affected:	⌘	5.2.2			
Other specs affected:	⌘	**Y**	**N**		
		X		Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

5.2.2 Charging Data Transfer in Online Charging

In online charging, charging events mirroring the resource usage request of the user are transferred from the CTF to the OCF via the Ro reference point. The CTF determines whether the request corresponds to an user / network event (event based charging, e.g. MMS) or whether a session shall be started (session based charging, e.g. GPRS PDP context). Generally, this property is built into the network capability, or service, that the NE provides, and described in the middle tier charging TSs.

Note that TS 23.078 [207] also specifies online charging capability in the SGSN and MSC based on CAMEL, i.e. using the CAP reference point towards the OCS. This functionality is outside the scope of the present document.

In event based charging, a network / user event (e.g. MM submission) corresponds to a single chargeable event. In session based charging, at least two chargeable events are needed, one each to describe the start and the end of the session, respectively. Multiple interim events are possible in order to describe changes of session characteristics (e.g. change of PDP context QoS or change of IMS session media types), or when certain limits, e.g. time or volume, are exceeded. The CTF transforms each chargeable event into a charging event and forwards these charging events to the OCF in real-time.

For event based charging, the credit control procedure in the OCS may or may not involve reservation of units from the subscriber account, as described in clause 5.1. In the case of event based charging without reservation (IEC):

- The CTF forwards the charging event to the OCS;
- The OCS determines the value of the requested resource usage and debits this value from the subscriber account;
- The OCS returns the resource usage authorisation to the network element;
- The network element executes the resource usage according to the user request and the OCS authorisation.

The following exceptions and abnormal cases are defined for the IEC scenario:

1) The OCS rejects the resource usage request. In this case, the NE disallows the resource usage.

If the credit control procedure does involve reservation (ECUR):

- The CTF forwards the charging event to the OCS;
- The OCS determines the value of the requested resource usage and reserves this value from the subscriber account;
- The OCS returns the resource usage authorisation to the network element;
- The network element executes the resource usage according to the user request and the OCS authorisation.
- After completion (or failure) of the resource usage, the NE informs the OCS accordingly about the completion or failure;
- In line with the result report from the network element, the OCS either debits the reserved amount from the subscriber account (success), or it returns the reserved amount back to the subscriber account (failure).

The following exceptions and abnormal cases are defined for the ECUR scenario:

1) The OCS rejects the resource usage request. In this case, the NE disallows the resource usage.
2) The resource usage execution fails, e.g. due to network failure or user abort. In this case, the network element informs the OCS of the failure, and the previously reserved amounts are returned onto the subscriber account.

Note 1: Returning previously reserved amounts of units to the user's account is up to operator policy in the OCS. The authorization of multiple chargeable events as per the "event based charging" description in clause 5.1 is not yet covered in the above scenario.

Session based online charging always involves reservation within the credit control procedure (SCUR), as there is no way for the OCS to predict the amount of resource usage that occurs during the user session. To begin with, the CTF forward generates a charging chargeable event that corresponds to the resource usage request and maps onto the user session, and forwards it to the OCF. In the OCS, the online charging session is started and a certain amount reserved from the user subscriber account. This amount is determined by the OCS based on the information in the charging event

and on local configuration, i.e. operator policy. A resource usage quota, matching the reserved amount, is then returned by the OCS, at which point the user session starts in the NE. Further charging events are sent from the NE to the OCS upon the detection of further chargeable events within the session .e.g. the expiry of in intervals configured on the NE or instructed by the OCS, or when the authorised quota expires, or when session characteristics change (e.g. change of QoS of a PDP context). The OCS then furnishes a new quota to the NE as required, or rejects the charging event, e.g. due to expiry of credit on the subscriber account. The OCS also furnishes the NE's behaviour on quota expiry (termination action). When the user session terminates normally in the NE, a final statement on the actually used network resources is returned to the OCS, enabling the OCS to calculate the final value of the actual resource usage session and to properly debit the corresponding final amount from the subscriber account (possibly resulting in a re-crediting of previously reserved amounts). This also terminates the credit control session for the particular user session. The following exceptions and abnormal cases are defined for the SCUR scenario:

1) For optimisation purposes, the network element may allow the user session to start prior to receiving the initial authorisation from the OCS, i.e. prior to the start of the credit control session.

2) The OCS rejects the initial resource usage request at session start, i.e. no credit control session is started. In this case, the NE disallows the start of the session or, if the session was already allowed to start as described in item 1 above, enforces the termination of the user session.

3) The OCS rejects the resource usage request in mid session. In this case, the NE's behaviour conforms with the instruction returned by the OCS, e.g.:

   - terminate the user session;

   - limit the characteristics of the user session, e.g. allow only Web/WAP pages that are free of charge;

   - direct the session to a special notification site or an account recharging server

4) The OCS may send unsolicited termination commands with the same effect as described in item 3 above.

5) Unexpected termination of user session, e.g. due to network failure or due to user abort. In this case, the behaviour of the network is as specified above for session termination, but all available information of the failure is returned to the OCS in the final statement. Further action of the OCS in regard of calculating the session value and debiting or crediting the user's account depends on the exact circumstances and operator policy.

In any of the above cases, the termination of the user session coincides with the termination of the credit control session, e.g. even when a user session is allowed to continue upon account expiry, the credit control session will also continue, but "zero" rated.

Note 2: the intention of the above clause is not to enforce closing the user session when the credit control session breaks down.

It is important for operators to carefully consider the reservation policy on the OCS. On the one hand, if small amounts are reserved, the NE must renew the authorisation very frequently, creating high signalling and processing loads. Additionally, this policy has a comparatively high likelihood of longer, or higher-value, user sessions being forcefully terminated due to expiry of the subscriber account after many small quotas have been used for small chunks of the subscriber session. In contrast, assigning high reservations avoids the above problems, but may interdict the user from the execution of additional, parallel resource usages: due to the high previous reservation, there is no credit left on the account for another resource usage request. The situation described in this paragraph is particularly complex when correlation between multiple charging levels is necessary, see clause 5.3.4. A potential method of relieving this problem is the pooling of credit quotas as described in clause 5.5.2 below.

The middle tier charging TSs specify the chargeable events and the content of the associated charging events and responses. TS 32.299 [50] specifies the interface application for the Ro reference point, including the message types and the domain / subsystem / service independent contents of the messages. In addition to the credit control functions, the OCS may also be capable of producing CDRs based on the execution of the above credit control procedures. To this end, the OCS must implement a CDF, and it uses the Ga and Bo reference points to forward its CDRs to a CGF and the CDR files to the BD. These functions of the OCS, however, are outside the scope of 3GPP standardisation.

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