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Title: **32.015 CR, "Principles for accurate volume counting" (S5-000309)**

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Agenda Item: **6.5.3**

Spec	CR	Phas	Subject	Ca	Versi	Versi	Doc-2nd-
32.015	007	R99	Principles for accurate volume counting	B	3.1.1	3.2.0	S5-000309

3GPP S5 Meeting #12
Rome, Italy, 5-9 May 2000

Document **SA5#12(00)0309**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

32.015	CR	007	Current Version:	V.3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA#8	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		For information		Non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: SA5#12 **Date:** 9 June 2000

Subject: Principles for accurate volume counting

Work item: Charging

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:
In UMTS architecture the 3G-SGSN can not anymore count exactly the data volume for downlink due to the tunnel end point being at the RNC and not the SGSN. Any buffed data to be sent towards the mobile can be discarded or unsent at RAB closure.

This CR allows the SGSN instruct the RNC to report the unsent downlink data volumes for the RAB and report these volumes in the S-CDR.

Clauses affected:

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

3.2 Abbreviations

For the purposes of the present document the following abbreviations apply. Additional applicable abbreviations can be found in TS 21.905 [1].

APN	Access Point Name
BG	Border Gateway
BS	Billing System
BSS	Base Station Subsystem
CDR	Call Detail Record
C-ID	Charging ID
CG	Charging Gateway
CGF	Charging Gateway Functionality
GTP	GPRS Tunnel Protocol
CMIP	Common Management Information Protocol
F/W	Firewall
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
G-CDR	Gateway GPRS Support Node – Call Detail Record
IHOSS:OSP	Internet Hosted Octet Stream Service:Octect Stream Protocol
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
MS	Mobile Station
M-CDR	Mobility Management - Call Detail Record
NE	Network Element
NSS	Network and Switching Subsystem
NMG	Network Management Gateway
NMN	Network Management Node
OMC	Operations and Maintenance Centre
OSF	Operations System Function
OSP	Octet Stream Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g., IP or X.25
PLMN	Public Land Mobile Network
PPP	Point to Point Protocol
PSPDN	Packet Switched Public Data Network
PTM-M	Point to Multipoint - Multicast
PTM-G	Point to Multipoint - Group Call
PTM SC	Point to Multipoint Service Centre
RAB	Radio Access Bearer
RAC	Routing Area Code
RNC	Radio Network Controller
SGSN	Serving GPRS Support Node
SNDCP	Sub-Network Dependent Convergence Protocol
SNMP	Simple Network Management Protocol
SS7	Signalling System No. 7
S-CDR	Serving GPRS Support Node – Call Detail Record
S-SMO-CDR	SGSN delivered Short message Mobile Originated – Call Detail Record
S-SMT-CDR	SGSN delivered Short message Mobile Terminated – Call Detail Record
TID	Tunnel Identifier

3.3 Symbols

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

A	Interface between an MSC and a BSC.
Ga	Charging data collection interface between a CDR transmitting unit (e.g. GGSN or SGSN) and a CDR receiving functionality (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	Reference point between GPRS and an external packet data network.
Gn	Interface between two GSNs within the same PLMN.
Gp	Interface between two GSNs in different PLMNs. The Gp interface allows support of GPRS network services across areas served by the co-operating GPRS PLMNs.
Gr	Interface between an SGSN and an HLR.
Gs	Interface between an SGSN and an MSC/VLR.
kbit/s	Kilobits per second.
R	Reference point between a non-ISDN compatible TE and MT. Typically this reference point supports a standard serial interface.
Um	Interface between the mobile station (MS) and the GPRS fixed network part. The Um interface is the GPRS network interface for providing packet data services over the radio to the MS. The MT part of the MS is used to access the GPRS services through this interface.

5 Charging Principles

5.3 Charging Data Collection Principles

Call data record generation and contents should be flexible and unnecessary redundancy in data should be avoided.

1. There are two main records types (one for the SGSN and one for the GGSN related to PDP contexts). Each PDP context generates its own record. A third record is provided for mobility management in the SGSN. The SGSN may also provide two SMS related records in case of short message delivery.

2. Optional basic location information may be included in the PDP context records.

3. Records shall only include relevant information, i.e. traffic activity since last record.

   The criteria for record generation is based on real time needs, information safety (backup) and some specific events, such as expiry of the partial record timer(s), transferred data volume limit(s), inter SGSN routing area update.

4. Change of tariff period (if used) should not cause new CDRs to be sent to avoid peaks in data transfer. Instead such events should close the existing volume counters and open new ones when appropriate traffic is detected. This can be done by having a new record in the same message. It is up to the operator how often the CDRs are transferred from a GSN.

5. ~~5.~~ Both SSGN and GGSN nodes shall collect information from same chargeable sessions (PDP contexts). A unique reference (Charging ID and GGSN address) is needed to enable connection between information from several records produced from same PDP context.

6. The RNC shall collect the amount of not transferred downlink data, i.e., data that the RNC has either discarded or forwarded to a 2G-SGSN, for an MS's RABs when instructed by the 3G-SGSN.

5.4 Volume counting in RNC

The 3G-SGSN counts all downlink data sent to the RNC over Iu interface. Any discarded data between MS and RNC causes inaccurate charging, as the 3G-SGSN cannot account for this and subsequently causing overcharging. Additionally any buffered data in the RNC at RAB release or forwarded to another SGSN during handover is possible counted again i.e. twice, which causes overcharging.

To avoid inaccurate charging at the 3G-SGSN, the 3G-SGSN will always instruct the RNC at RAB setup to count the unsent downlink data towards the MS.

The reporting of unsent data by the RNC to the 3G-SGSN will only occur at RAB release. This occurs at either the termination of the PDP context or handover.

The 3G-SGSN shall not use the optional 'Data Volume Request' message to RNC in any situation, as this shall cause a significant performance impact to both the RNC and 3G-SGSN.

When 3G-SGSN receives a report of unsent data volume from the RNC at RAB release. The 3G-SGSN shall report this value to the 'RNC Unsent Downlink Volume' field in the S-CDR.

6 Charging Data Collection

6.1.1 GPRS charging data in SGSN (S-CDR)

If the collection of SGSN data is enabled then the following GPRS SGSN data shall be available for each PDP context.

Table 5: GPRS SGSN PDP context data

Field		Description
Record Type	M	GPRS SGSN PDP context record.
Network Initiated PDP Context	C	Present if this is a network initiated PDP context.
Anonymous Access Indicator	C	Set to true to indicate anonymous access (and that the Served IMSI is not supplied)
Served IMSI	M	IMSI of the served party (if Anonymous Access Indicator is FALSE or not supplied).
Served IMEI	C	The IMEI of the ME, if available.
Served MSISDN	O	The primary MSISDN of the subscriber.
SGSN Address	M	The IP address of the current SGSN.
MS Network Capability	O	The mobile station Network Capability.
Routing Area	O	Routing Area at the time of the record creation.
Local Area Code	O	Location area code at the time of the record creation.
Cell Identity	O	Cell id at the time of the record creation.
Charging ID	M	PDP context identifier used to identify this PDP context in different records created by GSNs
GGSN Address Used	M	The IP address of the GGSN currently used. The GGSN address is always the same for an activated PDP.
Access Point Name Network Identifier	M	The logical name of the connected access point to the external packet data network (network identifier part of APN).
APN Selection Mode	O	An index indicating how the APN was selected.
PDP Type	M	PDP type, e.g. X.25, IP, PPP, IHOSS:OSP
Served PDP Address	M	PDP address of the served IMSI, e.g. an IPv4, IPv6 or X.121.

List of Traffic Data Volumes	M	A list of changes in charging conditions for this PDP context, each time stamped. Charging conditions are used to categorise traffic volumes, such as per QoS/tariff period. Initial and subsequently changed QoS and corresponding data values are listed. Data volumes are in Octets above the SNDCP layer and are separated for uplink and downlink traffic.
Record Opening Time	M	Time stamp when PDP context activation is created in this SGSN or record opening time on following partial records
Duration	M	Duration of this record in the SGSN.
SGSN Change	C	Present if this is first record after SGSN change.
Cause for Record Closing	M	The reason for the release of record from this SGSN.
Diagnostics	O	A more detailed reason for the release of the connection.
Record Sequence Number	C	Partial record sequence number in this SGSN. Only present in case of partial records.
Node ID	O	Name of the recording entity
Record Extensions	O	A set of network/ manufacturer specific extensions to the record.
Local Record Sequence Number	O	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.
Access Point Name Operator Identifier	M	The Operator Identifier part of the APN.
Charging Characteristics	C	The Charging Characteristics flag set retrieved from the HLR.
RNC Unsent Downlink Volume	C	The downlink data volume which the RNC has not sent to MS.

6.1.6 Description of Record Fields

This subclause contains a brief description of each field of the CDRs described in the previous subclause.

6.1.6.9 List of Traffic Data Volumes

This list includes one or more containers, which each include the following fields:

Data Volume Uplink, Data Volume Downlink, Change Condition and Time Stamp.

Data Volume includes the number of octets transmitted during the use of packet data services.

Change condition defines the reason for closing the container (see 5.7.1 and 5.7.3), such as tariff time change, QoS change or closing the CDR. Change time is a time stamp which defines the moment when the new volume counts are started or CDR is closed. All the active PDP contexts do not need to have exactly the same time stamp e.g. due to same tariff time change (variance of the time stamps is implementation and traffic load dependent and is out of the scope of standardisation).

First container includes following optional fields: QoS Requested (not in G-CDR) and QoS Negotiated. In following containers QoS Negotiated is present if previous change condition is QoS change.

Following is an example of a list, which has three containers (sets of volume counts) caused by one QoS change and one tariff time change.

Table 10: Example list of traffic data volumes

QoS Requested = QoS1 QoS Negotiated = QoS1	QoS Negotiated = QoS2	
Data Volume Uplink = 1 Data Volume Downlink = 2	Data Volume Uplink = 5 Data Volume Downlink = 6	Data Volume Uplink = 3 Data Volume Downlink = 4
Change Condition = QoS change Time Stamp = TIME1	Change Condition = Tariff change Time Stamp = TIME2	Change Condition = Record closed Time Stamp = TIME3

First container includes initial QoS values and corresponding volume counts. Second container includes new QoS values and corresponding volume counts before tariff time change. Last container includes volume counts after the tariff time change. Following total volume counts can be itemised (tariff1 is used before and tariff2 after the tariff time change):

		Container
QoS1+Tariff1	uplink = 1, downlink = 2	1
QoS2+Tariff1	uplink = 5, downlink = 6	2
QoS2+Tariff2	uplink = 3, downlink = 4	3
QoS1	uplink = 1, downlink = 2	1
QoS2	uplink = 8, downlink = 10	2+3
Tariff1	uplink = 6, downlink = 8	1+2
Tariff2	uplink = 3, downlink = 4	1

The amount of data counted in the GGSN shall be the data volume sent over the GTP layer. Therefore the data countedalready includes the IP/X.25 PDP bearer protocols.

The data volume counted in the SGSN covers the amount of data transferred in the SNDCP PDUs. Therefore the data counted already includes the IP/X.25 PDP bearer protocols.

In order to avoid that downstream packets transmitted from the old SGSN to the new SGSN at inter SGSN RA update induce the increase of the PDP CDR downstream volume counters in both SGSN the following rule is followed:

- For PDP contexts using LLC in unacknowledged mode: an SGSN shall update the PDP CDR when the packet has been sent by the SGSN towards the MS;

- In GSM, for PDP contexts using LLC in acknowledged mode: an 2G-SGSN shall only update the PDP CDR at the reception of the acknowledgement of the correct reception of a downstream packet by the MS. This implies that for downstream packets under transmission at inter SGSN RA update a packet sent by the old SGSN actually received by the MS and acknowledged by the MS towards the new SGSN through the RA update complete message induces the update of the PDP CDR record by the new SGSN.

- In UMTS, The not transferred downlink data 'RNC Unsent Downlink Volume' can be accounted for in the S-CDR , i.e., data that the RNC has either discarded or forwarded during handover.

Data volumes retransmitted (by RLC or LLC) due to poor radio link conditions shall not be counted.

6.1.6.x RNC Unsent Downlink Volume

This field contains the unsent downlink volume that the RNC has either discarded or forwarded to 2G-SGSN and already included in S-CDR. This field is present when RNC has provided unsent downlink volume count at RAB release and can be used by a downstream system to apply proper charging for this PDP context.

8 Charging Data Record Structure

8.1 ASN.1 definitions for CDR information

```
SGSNMMRecord    ::= SET
{
    recordType              [0] CallEventRecordType,
    servedIMSI              [1] IMSI,
    servedIMEI              [2] IMEI OPTIONAL,
    sgsnAddress             [3] GSNAddress,
    msNetworkCapability     [4] MSNetworkCapability OPTIONAL,
    routingArea             [5] RoutingAreaCode OPTIONAL,
    locationAreaCode        [6] LocationAreaCode OPTIONAL,
    cellIdentity            [7] CellId OPTIONAL,
    changeLocation          [8] SEQUENCE OF ChangeLocation OPTIONAL,
    recordOpeningTime       [9] TimeStamp,
    duration                [10] CallDuration OPTIONAL,
```

```
    sgsnChange              [11] SGSNChange OPTIONAL,
    causeForRecClosing      [12] CauseForRecClosing,
    diagnostics             [13] Diagnostics OPTIONAL,
    recordSequenceNumber    [14] INTEGER OPTIONAL,
    nodeID                  [15] NodeID OPTIONAL,
    recordExtensions        [16] ManagementExtensions OPTIONAL,
    localSequenceNumber     [17] LocalSequenceNumber OPTIONAL,
    servedMSISDN            [18] MSISDN OPTIONAL
    chargingCharacteristics [22] ChargingCharacteristics CONDITIONAL,
    rNCUnsentDownlinkVolume [23] DataVolumeGPRS OPTIONAL
}
```