Technical Specification Group Services and System Aspects
Meeting #8, Düsseldorf, Germany, 26-28 June 2000

TSGS#8(00)0239

Source: **SA5 (Telecom Management)**

Title: **32.015 CR, "Packet domain charging enhancements on CAMEL phase 3" (S5-000308)**

Document for: **Approval**

Agenda Item: **6.5.3**

Spec	CR	Phas	Subject	Ca	Versi	Versi	Doc-2nd-
32.015	008	R99	Packet domain charging enhancements on CAMEL phase 3	F	3.1.1	3.2.0	S5-000308

3GPP TSG-SA5 (Telecom Management)
Meeting #12, Rom, 5–9 June 2000

SA5#12(00)0308

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	008	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: *(at least one should be marked with an X)*	(U)SIM		ME		UTRAN / Radio		Core Network	X

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

Subject:	Packet domain charging enhancements on CAMEL phase 3

Work item:	2., 3.2, 5.1, 5.8, 6.1, 8

Category: *(only one category shall be marked with an X)*				**Release:**		
	F	Correction	X		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	X		Release 99	X
					Release 00	

Reason for change:

Currently it's necessary to define CAMEL phase 3 specific parameters from 23.078 into the CDR layout for SGSN PDP context, SGSN MM and SMS MO.

Therefore a new parameter CAMEL subscription information has to be define with:
- SCP Address
- Service Key
– Level Of CAMEL Services
–Number Of DP encountered
- Default Transaction Handling
– APN_NI and APN_OI
- Free Format Data
- Free Format Data Append Indicator

and for SMS MO records the CAMEL SMS Modification Information enlarged with:
- SCP Address
– Service Key
– CAMEL Calling Party Number
– CAMEL Destination Subscriber Number
– CAMEL SMSC Address

The identifier SCP address refers to the network address(E.164 number) of the subscriber related SCP.

The parameter Service Key describes in case of usage of a CAMEL the service key.

The parameter Default GPRS Handling defines in case of a CAMEL service if the communication service attempt was continued or released after non-responding of SCP depending on the HLR subscriber administration.

The information flow 'Connect GPRS' contains the information element 'Access Point Name'. This IF is used by the gsmSCF to request the gprsSSF to modify the APN used when establishing a PDP Context. The proposal is to store the requested APN elements in the record before CAMEL supported APN for operator or network identified

part is used.

The field Free Format Data contains charging information sent by the gsmSCF in the information flow 'Furnish Charging Information GPRS' as defined in 29.078.

The parameter Append Free Format Data defines the treatment of Free Formata Date of subsequent information flow 'Furnish Charging Information GPRS'.

The parameter Level of CAMEL services and Number of DP encountered are definied as in circuit switch part.

Clauses affected: 32.015 version 3.1.1

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:

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.

[1] 3G TS 21.905: "3G vocabulary".

[2] void

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

[4] 3G TS 23.003: "Numbering, addressing and identification".

[5] void

[6] void

[7] 3G TS 23.040: "Technical realization of the Short Message Service (SMS); Point-to-Point (PP)".

[8] 3G TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[9] ~~void~~3G TS 23.078: " " Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 - Stage 2".

[10] void

[11] void

[12] void

[13] 3G TS 24.008: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[14] void

[15] void

[16] void

[17] void

[18] void

[19] void

[20] void

[21] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[22] 3G TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[23] ~~void~~3G TS 29.078: "Digital cellular telecommunications system (Phase 2+); CAMEL Application Part (CAP) specification - Phase 3".

[24] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[25] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[26] CCITT Recommendation Q.65: "Methodology – Stage 2 of the method for the characterization of services supported by an ISDN".

[27] CCITT Recommendation Q.922: "Digital subscriber signalling system no. 1 (DSS 1) – Data link layer – ISDN data link layer specification for frame mode bearer services".

[28] CCITT Recommendation Q.933: "Digital subscriber signalling system no. 1 (DSS 1) – Network layer – Signalling specification for frame mode basic call control".

[29] CCITT Recommendation V.42 bis: "Data communication over the telephone network – Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".

[30] CCITT Recommendation X.3: "Packet assembly disassembly facility (PAD) in a public data network".

[31] CCITT 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".

[32] CCITT Recommendation X.28: "DTE / DCE interface for a start-stop mode data terminal equipment accessing the packet assembly / disassembly facility (PAD) in a public data network situated in the same country".

[33] CCITT Recommendation X.29: "Procedures for the exchange of control information and user data between a packet assembly / disassembly (PAD) facility and a packet mode DTE or another PAD".

[34] CCITT Recommendation X.75: "Packet-switched signalling system between public networks providing data transmission services".

[35] CCITT Recommendation X.121: "International Numbering Plan for Public Data Networks".

[36] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[37] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[38] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[39] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[40] ISO8824 (90) / X.208 (88): "Information technology - open System Interconnection - Specification of Abstract Syntax Notation One (ASN.1)".

[41] ISO8824-1 (94) / X.680 (94): "Information technology - Abstract Syntax Notation One (ASN.1) - Specification of Basic Notation".

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
CAMEL	Customised Applications for Mobile network Enhanced Logic
CAP	CAMEL Application Part
CDR	Call Detail Record
C-ID	Charging ID
CG	Charging Gateway
CGF	Charging Gateway Functionality
EDP	Event Detection Point
GTP	GPRS Tunnel Protocol
CMIP	Common Management Information Protocol
FCI	Furnish Charging Information
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
RAC	Routing Area Code
SCF	Service Control Function
SCI	Send Charging Information
SGSN	Serving GPRS Support Node
SNDCP	Sub-Network Dependent Convergence Protocol
SNMP	Simple Network Management Protocol
SS7	Signalling System No. 7
SSF	Service Switching Function
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
TDP Trigger Detection Point
TID Tunnel Identifier

5 Charging Principles

5.1 Requirements

1) Every GPRS operator collects and processes their own charging information.

2) GPRS charging shall support anonymous access to the GPRS bearer service.

3) As much as is possible the GPRS charging functions should support open interfaces for possible use in future cellular digital packet based networks.

4) It shall be possible to provide reverse charging as a subscription option. However, reverse charging may not be applicable to certain external data network protocols.

5) Every PDP context shall be assigned a unique identity number for billing purposes. (i.e. the charging id).

6) Data volumes on both the uplink and downlink direction shall be counted separately. The data volumes shall reflect the application data as precisely as possible as delivered by the user.

7) The charging mechanisms shall provide the duration of the PDP context with date and time information.

8) The GPRS operator may define a subset of the charging information specified by GPRS charging standards. This means that it shall be possible to configure the SGSN and GGSN for the CDR information generated.

9) The SGSN and GGSN are not obliged to have non-volatile memory.

   This means that a GSN may loose its data when reset. The only permanent information that shall be stored in a GSN is the configuration data (e.g. cell/RA definition in SGSN).

10) SGSN shall support charging of CAMEL services.

5.8 Charging support for CAMEL

CAMEL GPRS interworking can be activated for GPRS session, SGSN PDP context and mobile originated SMS based on subscription information stored in HLR. Control point for all CAMEL interactions in GPRS network domain reside at gprsSSF typically co-located with SGSN. GGSN is not aware of CAMEL service at all. For more information about CAMEL interworking see [9].

A M-CDR, S-CDR and S-SMO-CDR include basic information about CAMEL service information, such as service key and SCF address, and service usage, such as CAMEL modification information and amount of signalling. CAMEL service may also send transparent free format data in one or several messages to be stored in the CDR. Each received free format data indicates whether it is overwritten or appended to previously received free format data.

CAMEL service may deny the GPRS attach, PDP context activation or sending of short message. CAMEL service may also change the APN determined by SGSN before activating PDP context or it may change the destination information of short message.

CAMEL feature to download advice of charge parameters does not need to be supported because sending of these parameters down to MS and usage in the MS is not standardised for GPRS terminals. The message itself shall however be supported and in case of a relative tariff switch is received, then at that tariff switch time volume counts shall be reported to CAMEL service.
Tariff switch times configured in GSN and those received from CAMEL service are independent and only one valid.

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.
CAMEL Information	C	Set of CAMEL information related to PDP context. For more information see Description of Record Fields.

6.1.2 GPRS charging data in GGSN (G-CDR)

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

Table 6: GPRS GGSN PDP context data

Field		Description
Record Type	M	GPRS GGSN 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 MSISDN	O	The primary MSISDN of the subscriber.
GGSN Address	M	The IP address of the GGSN used.
Charging ID	M	PDP context identifier used to identify this PDP context in different records created by GSNs
SGSN Address	M	List of SGSN addresses used during this record.
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, or IHOSS:OSP
Served PDP Address	M	PDP address, e.g. an IPv4, IPv6 or X.121.
Remote PDP Address	O	List of PDP addresses of the remote host or DTE e.g. an IPv4, IPv6, or X.121 (Included if the PDP type is X.25)
Dynamic Address Flag	C	Indicates whether served PDP address is dynamic, that is allocated during PDP context activation.
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 tariff period. Initial and subsequently changed QoS and corresponding data values are listed. Data volumes are in octets above the GTP layer and are separated for uplink and downlink traffic.
Record Opening Time	M	Time stamp when this record was opened.
Duration	M	Duration of this record in the GGSN.
Cause for Record Closing	M	The reason for the release of record from this GGSN.
Diagnostics	O	A more detailed reason for the release of the connection.
Record Sequence Number	C	Partial record sequence number, 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.
Charging Characteristics	C	The Charging Characteristics flag set retrieved from the HLR.

6.1.3 GPRS mobile station mobility management data in SGSN (M-CDR)

If the collection of MS mobility management data is enabled then GPRS SGSN shall start collecting information each time the mobile is attached to the SGSN.

Table 7: GPRS SGSN mobile station mobility management data

Field		Description
Record Type	M	GPRS SGSN mobility management record.
Served IMSI	M	IMSI of the MS.
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 record creation.
Cell Identity	O	Cell id at the time of the record creation.
Change of Location	O	A list of changes in Routing Area Identity, each time stamped.
Record Opening Time	M	Timestamp when this record was opened.
Duration	O	Duration of this record.
SGSN Change	C	Present if this is first record after SGSN change.
Cause for Record Closing	M	The reason for the release of the record in 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.
Charging Characteristics	C	The Charging Characteristics flag set retrieved from the HLR.
CAMEL Information	C	Set of CAMEL related to Attach/Detach session. For more information see Description of Record Fields.

6.1.4 GPRS MO SMS data in SGSN (S-SMO-CDR)

If enabled, an S-SMO-CDR SGSN Mobile originated SMS record shall be produced for each short message sent by a mobile subscriber via SGSN.

Table 8: SGSN Mobile originated SMS record

Field		Description
Record Type	M	SGSN Mobile Originated SMS.
Served IMSI	M	The IMSI of the subscriber.
Served IMEI	O	The IMEI of the ME, if available.
Served MSISDN	O	The primary MSISDN of the subscriber.
MS Network Capability	M	The mobile station network capability.
Service Centre	M	The address (E.164) of the SMS-service centre.
Recording Entity	M	The E.164 number of the SGSN.
Location Area Code	O	The Location Area Code from which the message originated.
Routing Area Code	O	The Routing Area Code from which the message originated.
Cell Identity	O	The Cell Identity from which the message originated.
Event Time Stamp	M	The time at which the message was received by the SGSN from the subscriber.
Message Reference	M	A reference, provided by the MS uniquely identifying this message.
SMS Result	C	The result of the attempted delivery if unsuccessful.
Record Extensions	O	A set of network/ manufacturer specific extensions to the record.
Node ID	O	Name of the recording entity.
Local Record Sequence Number	O	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.
Charging Characteristics	C	The Charging Characteristics flag set retrieved from the HLR.
Destination Number	O	The destination short message subscriber number.
CAMEL Information	C	Set of CAMEL information related to SMS session. For more information see Description of Record Fields.

6.1.5 GPRS MT SMS data in SGSN (S-SMT-CDR)

If enabled, an SGSN Mobile terminated SMS record shall be produced for each short message received by a mobile subscriber via SGSN.

Table 9: SGSN Mobile terminated SMS record

Field		Description
Record Type	M	SGSN Mobile terminated SMS.
Served IMSI	M	The IMSI of the subscriber.
Served IMEI	O	The IMEI of the ME, if available.
Served MSISDN	O	The primary MSISDN of the subscriber.
MS Network Capability	M	The mobile station network capability
Service Centre	M	The address (E.164) of the SMS-service centre.
Recording Entity	M	The E.164 number of the SGSN.
Location Area Code	O	The Location Area Code to which the message was delivered.
Routing Area Code	O	The Routing Area Code to which the message was delivered.
Cell Identity	O	The Cell Identity to which the message was delivered.
Event Time Stamp	M	Delivery time stamp, time at which message was sent to the MS by the SGSN.
SMS Result	C	The result of the attempted delivery if unsuccessful.
Record Extensions	O	A set of network/ manufacturer specific extensions to the record.
Node ID	O	Name of the recording entity.
Local Record Sequence Number	O	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.

6.1.6 Description of Record Fields

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

6.1.6.1 Access Point Name Network/Operator Identifier

These fields contain the actual connected~~logical~~ Access Point Name Network/Operator Identifier determined either by MS, SGSN or modified by CAMEL service. An APN can also be a wildcard, in which case the SGSN selects the access point address.~~.~~

The APN Network Identifier containing more than one label corresponds to an Internet domain name. The APN Operator Identifier is composed of three labels. The first and second labels together shall uniquely identify the GPRS PLMN (e.g. “operator name>.<operator group>.gprs”). ~~.~~

See TS 23.003 [4] and TS 23.060 [8] for more information about APN format and access point decision rules.

~~6.1.6.7~~6.1.6.x. Destination Number

This field contains short message Destination Number requested by the user.

~~6.1.6.7~~ 6.1.6.x CAMEL Information

This field includes following CAMEL information elements for PDP context (S-CDR), Attach/Detach session (M-CDR) and Mobile originated SMS (S-SMO-CDR) if corresponding CAMEL service is activated.

- CAMEL Access Point Name NI (S-CDR)

  This field contains the network identifier part of APN before modification by the SCF.

- CAMEL Access Point Name OI (S-CDR)

  This field contains the operator identifier part of APN before modification by the SCF.

- CAMEL Calling Party Number (S-SMO-CDR)

  This field contains the Calling Party Number modified by the CAMEL service.

- CAMEL Destination Subscriber Number (S-SMO-CDR)

  This field contains the short message Destination Number modified by the CAMEL service.

- CAMEL SMSC Address (S-SMO-CDR)

  This field contains the SMSC address modified by the CAMEL service.

- SCF address (S-CDR, M-CDR, S-SMO-CDR)

  This field identifies the CAMEL server serving the subscriber. Address is defined in HLR as part of CAMEL subscription information

- Service key (S-CDR, M-CDR, S-SMO-CDR)

  This field identifies the CAMEL service logic applied. Service key is defined in HLR as part of CAMEL subscription information.

- Default Transaction/SMS Handling (S-CDR, M-CDR, S-SMO-CDR)

  This field indicates whether or not a CAMEL encountered default GPRS- or SMS-handling. This field shall be present only if default call handling has been applied. Parameter is defined in HLR as part of CAMEL subscription information.

- Free Format Data (S-CDR, M-CDR, S-SMO-CDR)

  This field contains charging information sent by the gsmSCF in the Furnish Charging Information GPRS messages as defined in 3G TS 29.078[23]. The data can be sent either in one FCI message or several FCI messages with append indicator. This data is transferred transparently in the CAMEL sections of the relevant call records.

  If the FCI is received more then once during one CAMEL call, the append indicator defines whether the FCI information is appended to previous FCI and stored in the relevant record or the information of the last FCI received is stored in the relevant record (the previous FCI information shall be overwritten).

  In the event of partial output the currently valid 'Free format data' is stored in the partial record.

- FFD Append Indicator (S-CDR, M-CDR)

  This field contains an indicator whether CAMEL free format data is to be appended to free format data stored in previous partial CDR. This field is needed in CDR postprocessing to sort out valid free format data for that call leg from sequence of partial records. Creation of partial records is independent on received FCIs and thus valid free format data may be divided to different partial records.

  If field is missing then free format data in this CDR replaces all received free format data in previous CDRs. Append indicator is not needed in the first partial record. In following partial records indicator shall get value true if all FCIs received during that partial record have append indicator. If one or more of the received FCIs for that call leg during the partial record do not have append indicator then this field shall be missing.

- Level Of CAMEL services (S-CDR, M-CDR)

  This field describes briefly the complexity of CAMEL invocation. Categories are same than in circuit switched services and measure of resource usage in VPLMN requested by HPLMN.

  - 'Basic' means that CAMEL feature is invoked during the PDP context activation phase only (e.g.: to modify APN_NI / APN_OI).

  - 'Call duration supervision' means that PDP context duration or volume supervision is applied in the gprsSSF of the VPLMN (Apply Charging message is received from the gsmSCF)

- Number of DP encountered (S-CDR, M-CDR)

  This field indicates how often armed CAMEL detection points (TDP and EDP) were encountered and is a measure of signalling between VPLMN and CAMEL service and complements 'Level of CAMEL service' field.

8 Charging Data Record Structure

8.1 ASN.1 definitions for CDR information

Within the current GSM 12-series of specifications the ASN.1 definitions are based on X.208 [40] which has been superseded by X.680. This newer version not only includes new features but also removes some that were present in X.208. It was agreed that where possible, the GPRS work would be based on those ASN.1 features that were common to both. However, where necessary, the new features in X.680 [41] be used in some places. X.208 feature that are no longer in X.680 will not be used.

```
Changes (enhancements) in GSM1205-DataTypes:

CallEventRecordType     ::= INTEGER
{
    moCallRecord            (0),
    mtCallRecord            (1),
    roamingRecord           (2),
    incGatewayRecord        (3),
    outGatewayRecord        (4),
    transitCallRecord       (5),
    moSMSRecord             (6),
    mtSMSRecord             (7),
    moSMSIWRecord           (8),
    mtSMSGWRecord           (9),
    ssActionRecord          (10),
    hlrIntRecord            (11),
    locUpdateHLRRecord      (12),
    locUpdateVLRRecord      (13),
    commonEquipRecord       (14),
    moTraceRecord           (15),
    mtTraceRecord           (16),
    termCAMELIntRecord      (17),
    sgsnPDPRecord           (18),
    ggsnPDPRecord           (19),
    sgsnMMRecord            (20),
    sgsnSMORecord           (21),
    sgsnSMTRecord           (22)

}
GPRS_Charging-DataTypes {... }

DEFINITIONS IMPLICIT TAGS   ::=

BEGIN

-- EXPORTS everything

IMPORTS

CellId, Diagnostics, CallDuration, ManagementExtensions, TimeStamp, MSISDN, LocationAreaCode,
MessageReference, RecordingEntity, SMSResult, LevelOfCAMELService, CalledNumber, CallingNumber
FROM GSM1205-DataTypes{ ccitt (0) identified-organization (4) etsi(0) mobileDomain (0)
gsmOperation-Maintenance (3) moduleId (3) gsm-12-05 (5) InformationModel (0) asn1Module (2) 1 }
```

```
AddressString, ISDN-AddressString, IMSI, IMEI, DefaultGPRS-Handling, DefaultSMS-Handling
FROM MAP-CommonDataTypes { ccitt identified-organization (4) etsi(0) mobileDomain (0) gsmNetworkId
(1) moduleId (3) map-CommonDataTypes (18) version2 (2) }


ObjectInstance
FROM CMIP-1 {joint-iso-ccitt ms(9) cmip(1) version1 (1) protocol (3)}

ManagementExtension
FROM Attribute-ASN1Module {joint-iso-ccitt ms(9) smi(3) part2 (2) asn1Module(2) 1}

AE-title
FROM ACSE-1 {joint-iso-ccitt association-control(2) abstract-syntax(1) apdus(0) version(1) };
--
-- Note that the syntax of AE-title to be used is from
-- CCITT Rec. X.227 / ISO 8650 corrigendum and not "ANY"
--
-------------------------------------------------------------------------------
--
--  CALL AND EVENT RECORDS
--
-------------------------------------------------------------------------------

CallEventRecord ::= CHOICE
{
    sgsnPDPRecord           [0] SGSNPDPRecord,
    ggsnPDPRecord           [1] GGSNPDPRecord,
    sgsnMMRecord            [2] SGSNMMRecord,
    sgsnSMORecord           [3] SGSNSMORecord,
    sgsnSMTRecord           [4] SGSNSMTRecord
}

GGSNPDPRecord   ::= SET
{
    recordType              [0] CallEventRecordType,
    networkInitiation       [1] NetworkInitiatedPDPContext OPTIONAL,
    anonymousAccessIndicator    [2] BOOLEAN OPTIONAL,
    servedIMSI              [3] IMSI,
    ggsnAddress             [4] GSNAddress,
    chargingID              [5] ChargingID,
    sgsnAddress             [6] SEQUENCE OF GSNAddress,
    accessPointNameNI       [7] AccessPointNameNI,
    pdpType                 [8] PDPType,
    servedPDPAddress        [9] PDPAddress,
    remotePDPAddress        [10] SEQUENCE OF PDPAddress OPTIONAL,
    dynamicAddressFlag      [11] DynamicAddressFlag OPTIONAL,
    listOfTrafficVolumes    [12] SEQUENCE OF ChangeOfCharCondition,
    recordOpeningTime       [13] TimeStamp,
    duration                [14] CallDuration,
    causeForRecClosing      [15] CauseForRecClosing,
    diagnostics             [16] Diagnostics OPTIONAL,
    recordSequenceNumber    [17] INTEGER OPTIONAL,
    nodeID                  [18] NodeID OPTIONAL,
    recordExtensions        [19] ManagementExtensions OPTIONAL,
    localSequenceNumber     [20] LocalSequenceNumber OPTIONAL,
    apnSelectionMode        [21] APNSelectionMode,
    chargingCharacteristics [22] ChargingCharacteristics CONDITIONAL

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 [19] ChargingCharacteristics CONDITIONAL
    cAMELInformationMM      [20] CAMELInformationMM OPTIONAL
}

SGSNPDPRecord   ::= SET
{
    recordType              [0] CallEventRecordType,
```

```
    networkInitiation       [1] NetworkInitiatedPDPContext OPTIONAL,
    anonymousAccessIndicator    [2] BOOLEAN OPTIONAL,
    servedIMSI              [3] IMSI,
    servedIMEI              [4] IMEI OPTIONAL,
    sgsnAddress             [5] GSNAddress,
    msNetworkCapability     [6] MSNetworkCapability OPTIONAL,
    routingArea             [7] RoutingAreaCode OPTIONAL,
    locationAreaCode        [8] LocationAreaCode OPTIONAL,
    cellIdentity            [9] CellId OPTIONAL,
    chargingID              [10] ChargingID,
    ggsnAddressUsed         [11] GSNAddress,
    accessPointNameNI       [12] AccessPointNameNI,
    pdpType                 [13] PDPType,
    servedPDPAddress        [14] PDPAddress,
    listOfTrafficVolumes    [15] SEQUENCE OF ChangeOfCharCondition,
    recordOpeningTime       [16] TimeStamp,
    duration                [17] CallDuration,
    sgsnChange              [18] SGSNChange OPTIONAL,
    causeForRecClosing      [19] CauseForRecClosing,
    diagnostics             [20] Diagnostics OPTIONAL,
    recordSequenceNumber    [21] INTEGER OPTIONAL,
    nodeID                  [22] NodeID OPTIONAL,
    recordExtensions        [23] ManagementExtensions OPTIONAL,
    localSequenceNumber     [24] LocalSequenceNumber OPTIONAL,
    apnSelectionMode        [25] APNSelectionMode
    accessPointNameOI       [26] AccessPointNameOI,
    chargingCharacteristics [27] ChargingCharacteristics CONDITIONAL
    cAMELInformationPDP     [28] CAMELInformationPDP OPTIONAL
}

SGSNSMORecord   ::= SET
{
    recordType              [0] CallEventRecordType,
    servedIMSI              [1] IMSI,
    servedIMEI              [2] IMEI OPTIONAL,
    servedMSISDN            [3] MSISDN OPTIONAL,
    msNetworkCapability     [4] MSNetworkCapability,
    serviceCentre           [5] AddressString,
    recordingEntity         [6] RecordingEntity,
    locationArea            [7] LocationAreaCode OPTIONAL,
    routingArea             [8] RoutingAreaCode OPTIONAL,
    cellIdentity            [9] CellId OPTIONAL,
    messageReference        [10] MessageReference,
    originationTime         [11] TimeStamp,
    smsResult               [12] SMSResult OPTIONAL,
    recordExtensions        [13] ManagementExtensions OPTIONAL,
    nodeID                  [14] NodeID OPTIONAL,
    localSequenceNumber     [15] LocalSequenceNumber OPTIONAL,
    chargingCharacteristics [16] ChargingCharacteristics CONDITIONAL
    destinationNumber       [17] CalledNumber OPTIONAL,
    cAMELInformationSMS     [18] CAMELInformationSMS OPTIONAL
}

SGSNSMTRecord   ::= SET
{
    recordType              [0] CallEventRecordType,
    servedIMSI              [1] IMSI,
    servedIMEI              [2] IMEI OPTIONAL,
    servedMSISDN            [3] MSISDN OPTIONAL,
    msNetworkCapability     [4] MSNetworkCapability,
    serviceCentre           [5] AddressString,
    recordingEntity         [6] RecordingEntity,
    locationArea            [7] LocationAreaCode OPTIONAL,
    routingArea             [8] RoutingAreaCode OPTIONAL,
    cellIdentity            [9] CellId OPTIONAL,
    originationTime         [10] TimeStamp,
    smsResult               [11] SMSResult OPTIONAL,
    recordExtensions        [12] ManagementExtensions OPTIONAL,
    nodeID                  [13] NodeID OPTIONAL,
    localSequenceNumber     [14] LocalSequenceNumber OPTIONAL,
    chargingCharacteristics [15] ChargingCharacteristics CONDITIONAL
}

-------------------------------------------------------------------------------
--
--  OBJECT IDENTIFIERS
--
-------------------------------------------------------------------------------

gsm1205InformationModel  OBJECT IDENTIFIER  ::=
    { ccitt (0) identified-organization (4) etsi (0) mobileDomain (0)
    gsm-Operation-Maintenance (3) gsm-12-05 (5) informationModel (0) }

gsm1205ASN1Module   OBJECT IDENTIFIER   ::=
    { gsm1205InformationModel asn1Module(2) }
```

```
gsm1205ManagedObjectClass OBJECT IDENTIFIER::=
    { gsm1205InformationModel managedObjectClass(3) }

gsm1205Package OBJECT IDENTIFIER::=
    { gsm1205InformationModel package(4) }

gsm1205NameBinding OBJECT IDENTIFIER::=
    { gsm1205InformationModel nameBinding(6) }

gsm1205Attribute OBJECT IDENTIFIER::=
    { gsm1205InformationModel attribute(7) }

gsm1205Action OBJECT IDENTIFIER::=
    { gsm1205InformationModel action(9) }

gsm1205Notification OBJECT IDENTIFIER   ::=
    { gsm1205InformationModel notification(10) }

-------------------------------------------------------------------------------
--
--  COMMON DATA TYPES
--
-------------------------------------------------------------------------------

AccessPointNameNI   ::= IA5String (SIZE(1..63))
    --
    -- Network Identifier part of APN in "dot" representation
    -- see TS 23.003
    --

AccessPointNameOI   ::= IA5String (SIZE(1..37))
    --
    -- Operator Identifier part of APN in dot representation
    -- see TS 23.003
    --

APNSelectionMode::= ENUMERATED
{
    --
    -- See Information Elements TS 29.060
    --
    MSorNetworkProvidedSubscriptionVerified             (0),
    MSProvidedSubscriptionNotVerified                   (1),
    NetworkProvidedSubscriptionNotVerified              (2)
}

CAMELAccessPointNameNI  ::= AccessPoitNameNI

CAMELAccessPointNameOI  ::= AccessPoitNameOI

CAMELInformationMM      ::= SET
{
    sCFAddress                      [1] SCFAddress OPTIONAL,
    serviceKey                      [2] ServiceKey OPTIONAL,
    defaultTransactionHandling      [3] DefaultGPRSHandling OPTIONAL,
    numberOfDPEncountered           [4] NumberOfDPEncountered OPTIONAL,
    levelOfCAMELService             [5] LevelOfCAMELService OPTIONAL,
    freeFormatData                  [6] FreeFormatData OPTIONAL,
    fFDAppendIndicator              [7] FreeFormatDataAppendIndicator OPTIONAL
}

CAMELInformationPDP ::= SET
{
    sCFAddress                      [1] SCFAddress OPTIONAL,
    serviceKey                      [2] ServiceKey OPTIONAL,
    defaultTransactionHandling      [3] DefaultGPRSHandling OPTIONAL,
    cAMELAccessPointNameNI          [4] CAMELAccessPointNameNI OPTIONAL,
    cAMELAccessPointNameOI          [5] CAMELAccessPointNameOI OPTIONAL,
    numberOfDPEncountered           [6] NumberOfDPEncountered OPTIONAL,
    levelOfCAMELService             [7] LevelOfCAMELService OPTIONAL—,
    freeFormatData                  [8] FreeFormatData OPTIONAL,
    fFDAppendIndicator              [9] FreeFormatDataAppendIndicator OPTIONAL
}

CAMELInformationSMS     ::= SET
{
    sCFAddress                      [1] SCFAddress OPTIONAL,
    serviceKey                      [2] ServiceKey OPTIONAL,
    defaultSMSHandling              [3] DefaultSMSHandling OPTIONAL,
    cAMELCallingPartyNumber         [4] CallingNumber OPTIONAL,
    cAMELDestinationSubscriberNumber[5] CalledNumber OPTIONAL,
    cAMELSMSCAddress                [6] AddressString OPTIONAL,
    freeFormatData                  [7] FreeFormatData OPTIONAL
}

CauseForRecClosing  ::= INTEGER
```

```
{
    --
    -- in GGSN the value sGSNChange should be used for partial record
    -- generation due to SGSN Address List Overflow
    --
    -- cause codes 0 to 15 are defined in GSM12.05 as 'CauseForTerm' (cause for termination)
    --
    normalRelease           (0),
    abnormalRelease         (4),
    cAMELInitCallRelease    (5),
    volumeLimit             (16),
    timeLimit               (17),
    sGSNChange              (18),
    maxChangeCond           (19),
    managementIntervention  (20)
}

ChangeCondition ::= ENUMERATED
{
    qoSChange               (0),
    tariffTime              (1),
    recordClosure           (2)
}

ChangeOfCharCondition   ::= SEQUENCE
    --
    -- used in PDP context record only
    --
{
    qosRequested            [1] QoSInformation OPTIONAL,
    qosNegotiated           [2] QoSInformation OPTIONAL,
    dataVolumeGPRSUplink    [3] DataVolumeGPRS,
    dataVolumeGPRSDownlink  [4] DataVolumeGPRS,
    changeCondition         [5] ChangeCondition,
    changeTime              [6] TimeStamp
}

ChangeLocation  ::= SEQUENCE
    --
    -- used in SGSNMMRecord only
    --
{
    locationAreaCode        [0] LocationAreaCode,
    routingAreaCode         [1] RoutingAreaCode,
    cellId                  [2] CellID OPTIONAL,
    changeTime              [3] TimeStamp
}

ChargingID  ::= INTEGER (0..4294967295)
    --
    -- generated in GGSN, part of PDP context, see TS 23.060
    -- 0..4294967295 is equivalent to 0..2**32-1

DataVolumeGPRS  ::= INTEGER
    --
    -- The volume of uncompressed data transferred in octets.
    --

DynamicAddressFlag  ::= BOOLEAN

ETSIAddress ::= AddressString
    --
    --first octet for nature of address, and numbering plan indicator (3 for X.121)
    --other octets TBCD
    -- See TS 29.002
    --

FFDAppendIndicator  ::= BOOLEAN

FreeFormatData  ::= OCTET STRING (SIZE(1..160)
    --
    -- Free formated data as sent in the FurnishChargingInformationGPRS
    -- see TS 29.002
    --

GSNAddress  ::= IPAddress

IPAddress   ::= CHOICE
{
    iPBinaryAddress  IPBinaryAddress,
    iPTextRepresentedAddress     IPTextRepresentedAddress
}
IPBinaryAddress ::= CHOICE
{
    iPBinV4Address          [0] OCTET STRING (SIZE(4)),
    iPBinV6Address          [1] OCTET STRING (SIZE(16))
```

```
}
IPTextRepresentedAddress    ::= CHOICE
{   --
    -- IP address in the familiar "dot" notation
    --
    iPTextV4Address         [2] IA5String (SIZE(7..15)),
    iPTextV6Address         [3] IA5String (SIZE(15..45))
}

LocalSequenceNumber ::= INTEGER (0..4294967295)
    --
    -- Sequence number of the record in this node
    -- 0.. 4294967295 is equivalent to 0..2**32-1, unsigned integer in four octets

MSNetworkCapability ::= OCTET STRING (SIZE(1))

NetworkInitiatedPDPContext  ::= BOOLEAN
    --
    -- Set to true if PDP context was initiated from network side
    --

NodeID  ::= IA5 string (SIZE(1..20))

PDPAddress  ::= CHOICE
{
    iPAddress               [0] IPAddress,
    eTSIAddress             [1] ETSIAddress
}

PDPType     ::= OCTET STRING (SIZE(2))
    --
    --OCTET 1: PDP Type Organization
    --OCTET 2: PDP Type Number
    -- See TS 29.060
    --

QoSDelay        ::= ENUMERATED
{
    --
    -- See Quality of service TS 24.008
    --
    delayClass1             (0),
    delayClass2             (1),
    delayClass3             (2),
    delayClass4             (3)
}

QoSInformation  ::=SEQUENCE
{
    reliability             [0] QoSReliability,
    delay                   [1] QoSDelay,
    precedence              [2] QoSPrecedence,
    peakThroughput          [3] QoSPeakThroughput,
    meanThroughput          [4] QoSMeanThroughput
}

QoSMeanThroughput   ::= ENUMERATED
{
    --
    -- See Quality of service TS 24.008
    --
    bestEffort              (0),
    mean100octetPh          (1),
    mean200octetPh          (2),
    mean500octetPh          (3),
    mean1000octetPh         (4),
    mean2000octetPh         (5),
    mean5000octetPh         (6),
    mean10000octetPh        (7),
    mean20000octetPh        (8),
    mean50000octetPh        (9),
    mean100000octetPh       (10),
    mean200000octetPh       (11),
    mean500000octetPh       (12),
    mean1000000octetPh      (13),
    mean2000000octetPh      (14),
    mean5000000octetPh      (15),
    mean10000000octetPh     (16),
    mean20000000octetPh     (17),
    mean50000000octetPh     (18)
}

QoSPeakThroughput   ::= ENUMERATED
{
    --
    -- See Quality of service TS 24.008
```

```
    --
    unspecified             (0),
    upTo100OctetPs          (1),
    upTo200OctetPs          (2),
    upTo400OctetPs          (3),
    upTo800OctetPs          (4),
    upTo1600OctetPs         (5),
    upTo3200OctetPs         (6),
    upTo6400OctetPs         (7),
    upTo12800OctetPs        (8),
    upTo25600OctetPs        (9)
}

QoSPrecedence   ::= ENUMERATED
{
    --
    -- See Quality of service TS 24.008
    --
    unspecified             (0),
    highPriority            (1),
    normalPriority          (2),
    lowPriority             (3)
}

QoSReliability  ::= ENUMERATED
{
    --
    -- See Quality of service TS 24.008
    --
    unspecifiedReliability  (0),
    acknowledgedGTP         (1),
    unackGTPAcknowLLC       (2),
    unackGTPLLCAcknowRLC    (3),
    unackGTPLLCRLC          (4),
    unacknowUnprotectedData (5)
}

RoutingAreaCode ::= OCTET STRING (SIZE(1))
    --
    -- See TS 24.008    --
    --

SCFAddress  ::= AddressString
    --
    -- See TS 29.002    ---
    --

SGSNChange  ::= BOOLEAN
    --
    -- present if first record after inter SGSN routing area update
    -- in new SGSN
    --

ChargingCharacteristics ::= OCTET STRING (SIZE(1))
    --
    --  Descriptions for the bits of the flag set:
    --
    --  Bit 1: H (Hot billing)          := '00000001'B
    --  Bit 2: F (Flat rate)            := '00000010'B
    --  Bit 3: P (Prepaid service)      := '00000100'B
    --  Bit 4: N (Normal billing)       := '00001000'B
    --  Bit 5: - (Reserved, set to 0)   := '00010000'B
    --  Bit 6: - (Reserved, set to 0)   := '00100000'B
    --  Bit 7: - (Reserved, set to 0)   := '01000000'B
    --  Bit 8: - (Reserved, set to 0)   := '10000000'B
    --
```