3GPP TSG_CN#6 / SMG3 #6 NP-99469
Meeting **#6, Nice, France**
13th - 15th December 1999

Source:	**SA2**
Title:	**LS on CDR creation for non-charging liable subscriptions**
Agenda item:	**4.2**
Document for:	**Information**

TSG SA2 #10 **Tdoc S2-99F44**
Abiko, Japan, 29 Nov - 3 Dec 1999

From: TSG SA WG2
To: TSG CN
CC: TSG SA WG5, TSG CN WG2

Liaison Statement on CDR creation for non-charging liable subscriptions

S2 would like to bring to the awareness of TSG CN an issue related to the completion of charging in R99. The issue is related to the creation of the CDRs in case of non-charging liable subscriptions, e.g. in case of prepaid subscriptions. S2 has conditionally accepted a Change Request on the suppressing of the unnecessary CDRs on subscribers that are not liable for charging. In this context, S2 conditional acceptance signifies that the CR shall be a part of Release 99 if TSG CN should accept this feature as a part of R99. (TdocS2-99E09 is included with this LS.)

The issue emerges when a user not liable for charging is billed through other methods than online charging, e.g. pre-paid or flat rate. Thus, when the subscriber is in the home PLMN the creation of the CDRs is unnecessary and will be suppressed. For roaming subscribers, the CDRs are still created also in case of non-charging liable subscriptions.

Because this causes a few CRs to TSG CN WG2, S2 would like to ask the TSG CN if it would be possible to add this feature into R99 specifications in order to complete this work.

3GPP TSG SA WG2 Meeting #10
Japan, 29 Nov – 3 Dec 1999

Document S2-99E09
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.

23.060	CR	066r1	Current Version:	3.1.0 DRAFT 3

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

For submission to:	SA#6	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: Nokia **Date:** 23.11.1999

Subject: Improving charging efficiency

Work item:

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:

Normally, the SGSN and the GGSN collect charging information on MSs which they are serving. The SGSN collects charging information for each attached MS and for each active PDP context. The GGSN collects charging information for each active PDP context.

Alternative charging mechanisms, such as prepaid or flat rate billing, do not require generating charging information (CDRs) in the SGSN and in the GGSN. Sending CDRs for such MSs and/or PDP contexts to Charging Gateway Functionality increases load in the communication channel.

This CR introduces a method of decreasing the load in the communication channel. CDRs may not be sent for MSs and/or PDP contexts which are not liable for charging. If the feature is not supported in the SGSN and in the GGSN, the SGSN and the GGSN will send CDRs normally. It is operator-specific whether charging information is collected for those MSs and/or PDP contexts which are not liable for charging. For roaming subscribers, CDRs should be generated.

Subscribed charging characteristics is added to the packet domain subscription data stored in HLR. At attach or at inter-SGSN routing area update, the packet domain subscription data is transferred to the SGSN. At PDP context activation, the charging characteristics of the PDP context is transferred from the SGSN to the GGSN.

Clauses affected: 9.2.2.1, 13.1, 13.2, 13.3, 15.1, 15.1.1

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	29.060, 29.002
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:	

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1. Each step is explained in the following list.

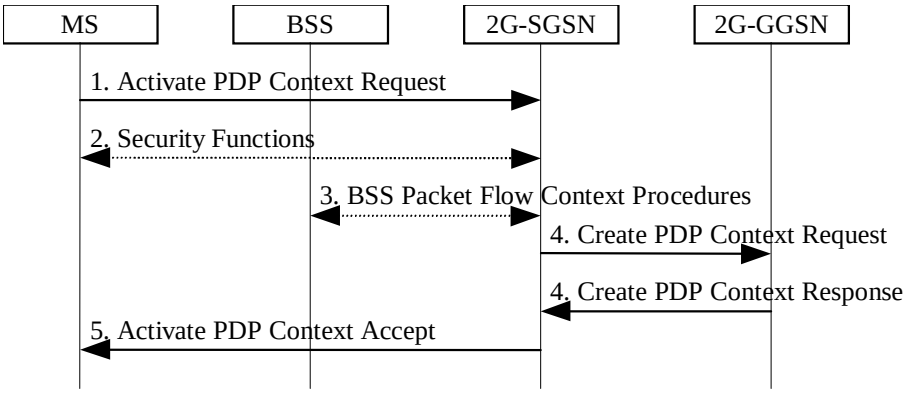

Figure 1: PDP Context Activation Procedure for GPRS

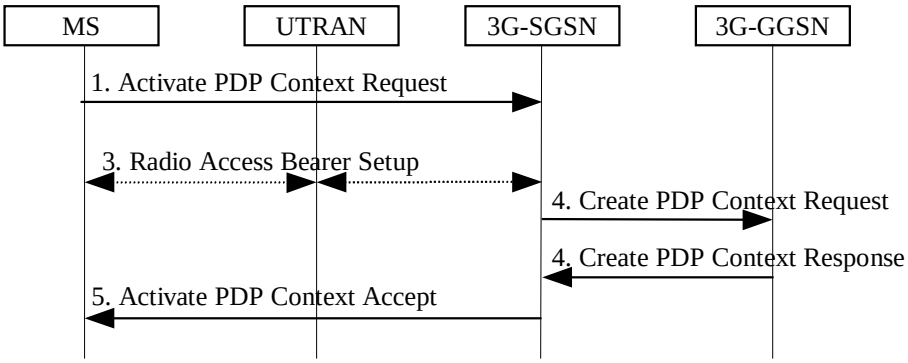

Figure 2: PDP Context Activation Procedure for UMTS

1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.

2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

   For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

   If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options, Charging Characteristics) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode. Charging Characteristics indicates which kind of charging the PDP context is liable for. The SGSN shall copy Charging Characteristics from the Subscribed Charging Characteristics in the Packet Domain Subscription Data.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

< next modified section>

13 Information Storage

This clause describes information storage structures required for the packet domain, and the recovery and restoration procedures needed to maintain service if inconsistencies in databases occur and at lost or invalid database information.

13.1 HLR

IMSI is the prime key to the packet domain subscription data stored in the HLR. There may be several sets of packet domain subscription data per IMSI. This is illustrated in Figure 3.

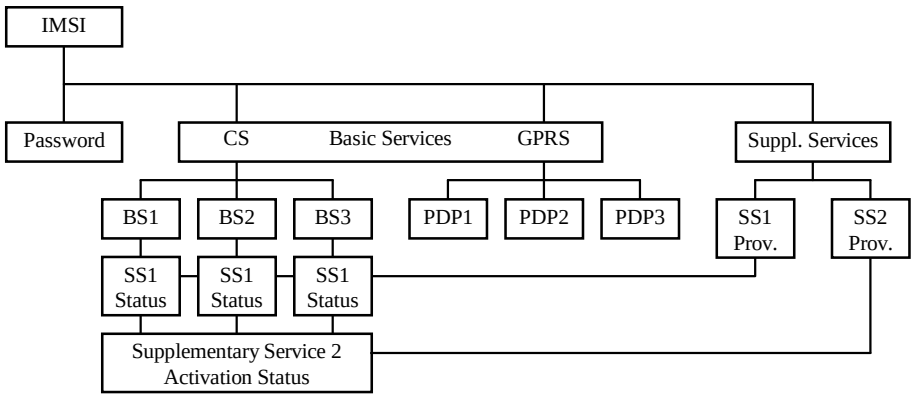

Figure 3: Packet Domain Subscription Data

As Figure 3 indicates, the packet domain subscription data is at the same level as basic services. Each PDP subscription is seen as a basic service. Supplementary services are provisioned as part of the overall subscription. Activation of SSs is either at the basic service level (SS1) or at the overall subscription level (SS2).

Table 1 shows the packet domain subscription data contained in the HLR.

Table 1: HLR Packet Domain Subscription Data

Field	Description	GPRS	UMTS
IMSI	IMSI is the main reference key.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Subscribed Charging Characteristics	The charging characteristics of the MS, e. g. normal subscription, prepaid subscription, flat rate subscription, and/or hot billing subscription.	X	X
SGSN Number	The SS7 number of the SGSN currently serving this MS.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
MS PS Purged for	Indicates that the MM and PDP contexts of the MS are deleted from the SGSN.	X	X
MNRG	Indicates that the MS is not reachable through an SGSN, and that the MS is marked as not reachable at the SGSN and possibly at the GGSN.	X	X
GGSN-list	The GSN number and optional IP address pair related to the GGSN that shall be contacted when activity from the MS is detected and MNRG is set. The GSN number shall be either the number of the GGSN or the protocol-converting GSN as described in the subclauses "MAP-based GGSN - HLR Signalling" and "GTP and MAP-based GGSN - HLR Signalling".	X	X
Each IMSI contains zero or more of the following PDP context subscription records:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address. This field shall be empty if dynamic addressing is allowed.	X	X
Access Point Name	A label according to DNS naming conventions describing the access point to the external packet data network.	X	X
QoS Profile Subscribed	The quality of service profile subscribed. QoS Profile Subscribed is the default level if a particular QoS profile is not requested.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 2 shows the context fields for one MS.

Table 2: SGSN MM and PDP Contexts

Field	Description	GPRS	UMTS
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Subscribed Charging Characteristics	The charging characteristics of the MS, e. g. normal subscription, prepaid subscription, flat rate subscription, and/or hot billing subscription.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
Authentication Triplets	Authentication and ciphering parameters.	X	X
Authentication Vectors	Authentication and ciphering parameters for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID	Tunnel Endpoint Identifier.	X	X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
TFT [FFS]	Traffic flow template.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id	Packet flow identifier.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent	X	

	to the MS.		
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. Table 3 shows the context fields for one MS.

Table 3: SGSN MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
AA-TID	Anonymous Access Tunnel Identifier.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN currently used.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
GGSN Address in Use	The IP address of the GGSN currently used.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.
SND	GTP sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 4 shows the PDP context fields for one PDP Address.

Table 4: GGSN PDP Context

Field	Description	GPRS	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Charging Characteristics	The charging characteristics of the PDP context, e. g. normal, prepaid, flat rate, and/or hot billing.	X	X
Reordering Required [FFS]	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.	X	X

If a PDP context is enabled for network-requested PDP context activation, then IMSI, PDP Type, PDP Address, SGSN Address and MNRG contain valid information also when the PDP context is inactive and when the MS is GPRS-detached.

<next modified section>

15 Operational Aspects

15.1 Charging

Charging information for the packet domain is collected for each MS by SGSNs and GGSNs that are serving the MS. The operator can control whether charging shall be collected in the SGSN and the GGSN on an individual MS basis by appropriately setting the Subscribed Charging Characteristics in the HLR subscription profile.

The information that the operator uses to generate a bill to a subscriber is operator-specific. Billing aspects, e.g., a regular fee for a fixed period, are outside the scope of the present document.

Every packet domain operator collects and processes their own charging information.

The SGSN collects charging information for each MS related with the radio network usage while the GGSN collects charging information for each MS related with the external data network usage. Both GSNs also collect charging information on usage of the network resources.

15.1.1 Charging Information

Charging information is collected for the PS subscriber.

As a minimum, the SGSN shall collect the following charging information for MSs which are liable for charging:

- usage of the radio interface: the charging information shall describe the amount of data transmitted in MO and MT directions categorised with QoS and user protocols;
- usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the packet data protocol addresses;
- usage of the general packet domain resources: the charging information shall describe the usage of other packet domain-related resources and the MS's network activity (e.g., mobility management); and
- location of MS: HPLMN, VPLMN, plus optional higher-accuracy location information.

As a minimum, the GGSN shall collect the following charging information for MSs which are liable for charging:

- destination and source: the charging information shall describe the destination and source addresses with a level of accuracy as defined by the packet domain operator;
- usage of the external data networks: the charging information shall describe the amount of data sent and received to and from the external data network; and
- usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the PDP addresses.