Technical Specification Group Services and System Aspects ***TSGS#15(02)0131***

Meeting #15, Jeju-do, Korea, 5-14 March 2002

Source: **TSG SA WG2**
Title: **CRs on 23.060 Rel99 (v.3.10.0), Rel4 (v.4.3.0) and Rel5 (v.5.0.0):**
Agenda Item: **7.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #15.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

CRs applicable to Release 99, with mirror CR to Rel-4 and Rel-5:

S2 Tdoc #	Title	Spec	CR #	cat	Rel	WI
S2-020760	Allocation of unique prefixes to IPv6 terminals	23.060	305r2	F	99	TEI
S2-020761	Allocation of unique prefixes to IPv6 terminals	23.060	306r2	A	4	TEI4
S2-020762	Allocation of unique prefixes to IPv6 terminals	23.060	286r4	A	5	TEI5
S2-020541	CAMEL procedure call irrespective of GPRS-CSI/SMS-CSI	23.060	314	F	99	TEI
S2-020713	CAMEL procedure call irrespective of GPRS-CSI/SMS-CSI	23.060	315r1	A	4	TEI4
S2-020543	CAMEL procedure call irrespective of GPRS-CSI/SMS-CSI	23.060	316	A	5	TEI5
S2-020239	CAMEL trigger point C1 for the SRNS relocation procedure	23.060	300	F	99	TEI
S2-020240	CAMEL trigger point C1 for the SRNS relocation procedure	23.060	299	A	4	TEI4
S2-020241	CAMEL trigger point C1 for the SRNS relocation procedure	23.060	303	A	5	TEI5
S2-020717	Clarification on the significance of packet flow contexts	23.060	333r1	F	99	TEI
S2-020718	Clarification on the significance of packet flow contexts	23.060	334r1	A	4	TEI4
S2-020719	Clarification on the significance of packet flow contexts	23.060	335r1	A	5	TEI5
S2-020836	Clarification to the interactions Between GTP v0 and GTP v1	23.060	329r2	F	99	GPRS
S2-020837	Clarification to the interactions Between GTP v0 and GTP v1	23.060	330r2	A	4	TEI4
S2-020838	Clarification to the interactions Between GTP v0 and GTP v1	23.060	331r2	A	5	TEI5
S2-020712	Correction of CAMEL procedure calls at SRNS relocation	23.060	311r1	F	99	TEI
S2-020539	Correction of CAMEL procedure calls at SRNS relocation	23.060	312	A	4	TEI4
S2-020540	Correction of CAMEL procedure calls at SRNS relocation	23.060	313	A	5	TEI5
S2-020592	No encrypted IMSI for identity	23.060	323	F	99	TEI

	check					
S2-020593	No encrypted IMSI for identity check	23.060	324	A	4	TEI4
S2-020594	No encrypted IMSI for identity check	23.060	325	A	5	TEI5
S2-020606	Parameter correction in GSM to UMTS inter system RA update	23.060	326	F	99	GPRS
S2-020607	Parameter correction in GSM to UMTS inter system RA update	23.060	327	A	4	TEI4
S2-020608	Parameter correction in GSM to UMTS inter system RA update	23.060	328	A	5	TEI5
S2-020881rev2	Restoration of R'96 Any Time Interrogation functionality	23.060	302r1	F	99	TEI
S2-020882rev2	Restoration of R'96 Any Time Interrogation functionality	23.060	318	A	4	TEI4
S2-020883rev2	Restoration of R'96 Any Time Interrogation functionality	23.060	319	A	5	TEI5

CRs applicable to Release 4, with mirror CR to Release 5:

S2 Tdoc #	Title	Spec	CR #	cat	Rel	WI
S2-020104	Behaviour of the MS on entering a new PLMN	23.060	301	A	4	TEI4
S2-020242	Behaviour of the MS on entering a new PLMN	23.060	304	A	5	TEI5
S2-020644	Corrections on Clarification of handling of real-time PDP contexts due to incorrect implementation of CR 250	23.060	336	F	4	TEI4
S2-020645	Corrections on Clarification of handling of real-time PDP contexts due to incorrect implementation of CR 250	23.060	337	A	5	TEI5

CRs applicable to Release 5 only:

S2 Tdoc #	Title	Spec	CR #	cat	Rel	WI
S2-020590	Correction of arbitrary editorial changes	23.060	321	D	5	TEI5
S2-020729	Dual-stack IPv4/IPv6 GSNs	23.060	310r1	C	5	TEI5
S2-020727	General changes for GERAN Iu mode	23.060	287r4	B	5	TEI5
S2-020901	IMS Enhancements (PCO in Secondary PDP context)	23.060	308r1	F	5	IMS-CCR
S2-020789	IMS related adaptations	23.060	322r1	F	5	IMS-CCR
S2-020544	Introduction of CAMEL control of MT-SMS	23.060	317	B	5	CAMEL4
S2-020726	PDP context handling at Inter SGSN RA Update	23.060	320r1	F	5	TEI5

3GPP TSG-SA2#22
Phoenix, USA, 14th – 18th January 2002

Tdoc S2-020104

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **301** ⌘ rev ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Behaviour of the MS on entering a new PLMN
Source:	⌘	One2One Personal Communications
Work item code:	⌘	TEI4
Date:	⌘	14th January 2002
Category:	⌘	**A**
Release:	⌘	REL- 4

Use one of the following categories:
F *(essential 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)*

Reason for change:	⌘	When a MS moves from one PLMN to another PLMN, the expected practise is to ensure that the MS performs a RAU just as it could do in case of an inter SGSN RAU within one PLMN. However, for 2G the current version of TS 23.060 for Rel-4 provides another option which suggests that upon entering a new PLMN the MS shall enter IDLE state or perforum RAU. This CR proposes to remove this option for the following reasons: • There is ambiguity on whether the MS should perform a RAU or enter IDLE state. It is not specified how the MS determines which of the two operations should be performed • Changing PLMN is not different than changing RAI. • Alignment with the current of 23.060 for R99
Summary of change:	⌘	This CR intends to remove the ambiguity of the text by providing clarification on the option which states that the MS shall enter IDLE state when entering a new PLMN.
Consequences if not approved:	⌘	• Different handsets will behave differently upon entering a new PLMN (i.e. some will perform RAU and some will enter into IDLE state). • Misalignment with 23.060 for R99

Clauses affected:	⌘	6.9.1, 6.9.2
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.9.1 Location Management Procedures (GSM only)

The PLMN shall provide information for the MS to be able to:

- detect when it has entered a new cell or a new RA; and
- determine when to perform periodic RA updates.

The MS detects that it has entered a new cell by comparing the cell's identity with the cell identity stored in the MS's MM context. The MS detects that a new RA has been entered by periodically comparing the RAI stored in its MM context with that received from the new cell. The MS shall consider hysteresis in signal strength measurements.

When the MS camps on a new cell, possibly in a new RA, this indicates one of three possible scenarios:

- a cell update is required;
- a routeing area update is required; or
- a combined routeing area and location area update is required.

In all three scenarios the MS stores the cell identity in its MM context.

If the MS enters a new PLMN, the MS shall ~~either~~ perform a routeing area update, ~~or enter IDLE state.~~unless it is not allowed to do so for reasons specified in TS 24.008 [13] and TS 23.122 [7b].

In network mode of operation II and III, whenever an MS determines that it shall perform both an LA update and an RA update:

1. It shall initiate the LA update and then initiate the RA update, if the MS is in class A mode of operation.
2. It shall perform the LA update first if the MS is not in class A mode of operation.

Routeing Area Update Request messages shall be sent unciphered, since in the inter-SGSN routeing area update case the new SGSN shall be able to process the request.

Next Change

6.9.2 Location Management Procedures (UMTS only)

Refer to 3GPP TS 25.301 for further information on the location management procedures for the UMTS radio.

The PLMN shall provide information for the MS to be able to:

- detect when it has entered a new cell or a new RA; and
- determine when to perform periodic RA updates.

In this specification, only the Location Management procedures related to the CN are described. These procedures are:

- a routeing area update procedure; and
- Serving RNC relocation procedure.

An MS detects entering a new cell by comparing the cell identity identity with the cell identity stored in the MS. By comparing the RAI stored in the MS's MM context with the RAI received from the network, the MS detects that an RA update shall be performed. In RRC-CONNECTED mode (PMM-CONNECTED state or CS MM CONNECTED state), the MS is informed of RAI and Cell Identity by the serving RNC via an "MM information" message at the RRC layer. In RRC-IDLE state, the MS is informed of RAI and Cell Identity by the broadcast system information at the RRC layer.

If the MS enters a new PLMN, the MS shall perform a routeing area update, unless it is not allowed to do so for the reasons specified in TS 24.008 [13] and TS 23.122 [7b].

In network mode of operation II, whenever an MS determines that it shall perform both an LA update and an RA update, the MS shall start the LA update first. The MS should start the RA update procedure before the LA update is completed.

3GPP TSG TSG SA2-22
Phoenix, January 14th-18th, 2002

Tdoc S2-020239~~070~~

3GPP TSG-CN WG2 Meeting #21
Cancun, Mexico, 26th - 30th November 2001

Tdoc N2-011015
rev. Tdoc N2-010992

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **CR300** ⌘ rev ⌘ Current version: **3.A.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: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Corrections concerning the CAMEL trigger point C1 for the SRNS relocation procedure
Source:	⌘	Alcatel
Work item code:	⌘	CAMEL phase3
Date:	⌘	15~~09~~/01/02
Category:	⌘	**F** (essential correction)
Release:	⌘	R99

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)

Reason for change: ⌘ 1) The CAMEL trigger point C1 for SRNS relocation procedure shall be used only in the case of inter-SGSN SRNS relocation procedure- see CN2 N2-011015 accepted in Cancun.

2) Missing CAMEL handling in the case of relocation cancel-see CN2 N2-011013 CR284 Rev2 accepted in Cancun.

Summary of change: ⌘ 1) First Change : During the SRNS relocation procedure used in the case of 3G inter-SGSN Handover, the CAMEL trigger point C1 is reached to treat the PDP context disconnection and the CAMEL GPRS detach on the old SGSN.

However the clauses 6.9.2.2.1 (SRNS Relocation Procedure after Soft Handover), 6.9.2.2.2 (Combined Hard Handover and SRNS Relocation Procedure), 6.9.2.2.3 (Combined Cell / URA Update and SRNS Relocation Procedure) are treating also the case of intra-SRNS relocation procedure.

In the case of intra-SGSN SRNS relocation procedure, the GPRS dialogue for the GPRS session and the dialogue(s) for each PDP context are kept and change of position for the new RA is reported to the SCP as Event report in case of RA change, provided that the SCP requested it.

2) Second Change : The SRNS relocation procedure (used in the case of 3G inter-SGSN Handover) may be cancelled by the source RNC using the SRNS relocation Cancel procedure (described in paragraph 6.9.2.2.4 of 23.060).

The SRNS relocation Cancel procedure may be initiated during or after the relocation preparation procedure.

Before the CAMEL GPRS dialogue is terminated in the old SGSN. The GPRS dialogue is

retained in this case.

After the CAMEL GPRS dialogue is terminated in the old SGSN (after point C1 in figure 39, figure 42, figure 43 of 23.060). In this case, a CAMEL GPRS dialogue shall be re-initiated.

The purpose of the present Change request is to add in figure 43a the points C2 and C3 at the reception of relocation cancel message to allow the CAMEL GPRS dialogue to continue on the old SGSN because of the relocation failure.

Consequences if not approved: ⌘

1) First Change: The CAMEL trigger point C1 will be wrongly called also in the case of intra-SRNS relocation.
2) Second Change: No CAMEL supervision after relocation cancel. The GPRS session/PDP contexts supervision is not retained and CAMEL charging is not possible.

Clauses affected: ⌘ 3.2, 6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3, 6.9.2.2.4.

Other specs affected: ⌘

- ☐ Other core specifications ⌘
- ☐ Test specifications
- ☐ O&M Specifications

Other comments: ⌘ .C1) is defined as follows:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

— First modified section —

3.2 Abbreviations

Applicable abbreviations can be found in GSM 01.04[1]. For the purposes of the present document the following abbreviations apply:

AAL5	ATM Adaptation Layer type 5
APN	Access Point Name
ATM	Asynchronous Transfer Mode
AUTN	Authentication Token
BG	Border Gateway
BSSAP+	Base Station System Application Part +
BSSGP	Base Station System GPRS Protocol
BVCI	BSSGP Virtual Connection Identifier
CCU	Channel Codec Unit
CDR	Call Detail Record
CGF	Charging Gateway Functionality
CGI	Cell Global Identification
CK	Cipher Key
CMM	Circuit Mobility Management
CS	Circuit Switched
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DTM	Discontinuous Transfer Mode
EGPRS	Enhanced GPRS
ESP	Encapsulating Security Payload
GEA	GPRS Encryption Algorithm
GGSN	Gateway GPRS Support Node
GMM/SM	GPRS Mobility Management and Session Management
GPRS-SSF	GPRS Service Switching Function
GPRS-CSI	GPRS CAMEL Subscription Information
GSM-SCF	GSM Service Control Function
GSIM	GSM Service Identity Module
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
GTP-C	GTP Control Plane
GTP-U	GTP User Plane
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IK	Integrity Key
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IPX	Internet Packet eXchange
ISP	Internet Service Provider
KSI	Key Set Identifier
L2TP	Layer-2 Tunnelling Protocol
LL-PDU	LLC PDU
LLC	Logical Link Control
MAC	Medium Access Control
MIP	Mobile IP
MNRF	Mobile station Not Reachable Flag
MNRG	Mobile station Not Reachable for GPRS flag
MNRR	Mobile station Not Reachable Reason
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NGAF	Non-GPRS Alert Flag
N-PDU	Network Protocol Data Unit
NS	Network Service

NSAPI	Network layer Service Access Point Identifier
NSS	Network SubSystem
P-TMSI	Packet TMSI
PCU	Packet Control Unit
PDCH	Packet Data CHannel
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g., IP
PDU	Protocol Data Unit
PMM	Packet Mobility Management
PPF	Paging Proceed Flag
PPP	Point-to-Point Protocol
PTP	Point To Point
PVC	Permanent Virtual Circuit
RA	Routeing Area
RAB	Radio Access Bearer
RAC	Routeing Area Code
RAI	Routeing Area Identity
RANAP	Radio Access Network Application Protocol
RAU	Routeing Area Update
RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SGSN	Serving GPRS Support Node
SM	Short Message
SM-SC	Short Message service Service Centre
SMS-GMSC	Short Message Service Gateway MSC
SMS-IWMSC	Short Message Service Interworking MSC
SN-PDU	SNDCP PDU
SNDC	SubNetwork Dependent Convergence
SNDCP	SubNetwork Dependent Convergence Protocol
SPI	Security Parameter Index
SRNC	Serving RNC
SRNS	Serving RNS
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TFT	Traffic Flow Template
TEID	Tunnel Endpoint IDentifier
TLLI	Temporary Logical Link Identity
TOM	Tunnelling Of Messages
TOS	Type of Service
TRAU	Transcoder and Rate Adaptor Unit
UDP	User Datagram Protocol
UEA	UMTS Encryption Algorithm
UIA	UMTS Integrity Algorithm
URA	UTRAN Registration Area
USIM	User Service Identity Module
UTRAN	UMTS Terrestrial Radio Access Network

— Second modified section —

6.9.2.2 Serving RNS Relocation Procedures

Serving RNS relocation procedures move the UTRAN to CN connection point at the UTRAN side of the source RNC to the target RNC. The Serving RNS Relocation Procedures, described in the following sub-clauses, may be performed as “Lossless SRNS Relocation”, which means packet loss during the SRNS change is eliminated. For this purpose, the RNS and the MS have to provide PDCP layer functionality, which in the subsequent description is referred as the

lossless PDCP. The source RNC decides to perform the Serving RNS Relocation Procedure as “Lossless SRNS Relocation” based on capabilities of the UE and the RNS and based on QoS parameters (e.g SDU error ratio).

For “Lossless SRNS Relocation”, both the MS and the source RNS have to support and to use the lossless PDCP. When the SRNS changes, the old RNS forwards all received and not yet transferred downlink GTP-PDUs to the target RNS. GTP-PDUs forwarded to the target RNS indicate a PDCP sequence number if the contained N-PDUs were sent to the MS as a PDCP-SDUs, but are not yet acknowledged by lossless PDCP. The target RNS and the MS exchange respective sequence numbers of next expected PDCP-PDUs. This process indicates PDCP-PDUs that were already successfully transferred between the MS and the source RNS for downlink and uplink directions, respectively. This confirms all N-PDUs (PDCP-SDUs) successfully transferred before the change of the SRNS. These N-PDUs are discarded by the MS and the target RNS, respectively. The target RNS identifies the forwarded GTP-PDUs containing confirmed N-PDUs by the PDCP sequence number in the GTP-PDU. All other N-PDUs have to be transmitted via the new MS – RNS link.

6.9.2.2.1 SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state where the Iur interface carries both the control signalling and the user data.

The Serving SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, from a "standing still position". In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an Intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

Error! Reference source not found. shows SRNS relocation when source SRNC and target RNC are connected to different SGSNs. **Error! Reference source not found.** shows the situation after SRNS Relocation procedure and Routeing Area Update procedure have been completed. In the case described in **Error! Reference source not found.** and **Error! Reference source not found.**, the MS is in state PMM-CONNECTED.

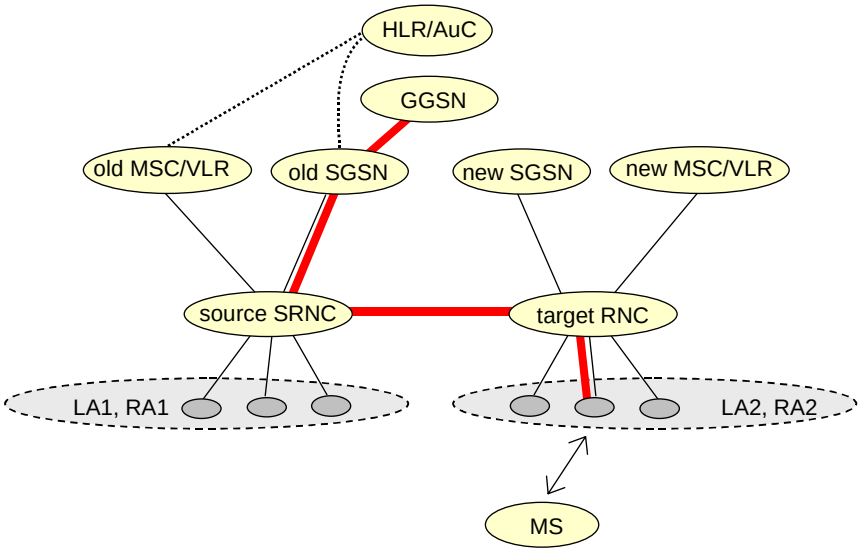


Figure 1: Before SRNS Relocation and Routeing Area Update

Before the Serving SRNS Relocation procedure and RA update, the MS is registered in the old SGSN. The source RNC is acting as a serving RNC (SRNC).

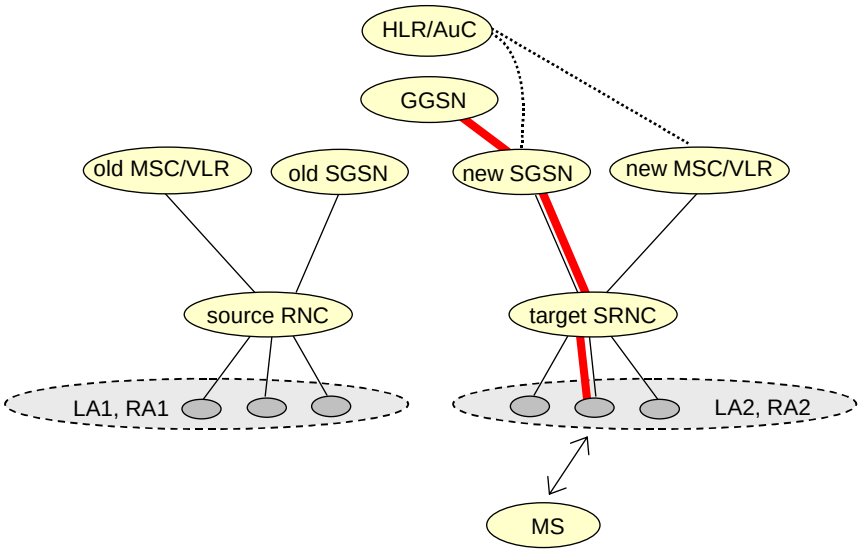


Figure 2: After SRNS Relocation and Routeing Area Update

After the Serving SRNS Relocation procedure and RA update, the MS is registered in the new SGSN The MS is in the state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as the serving RNC.

The Serving SRNS Relocation procedure is illustrated in **Error! Reference source not found.**. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

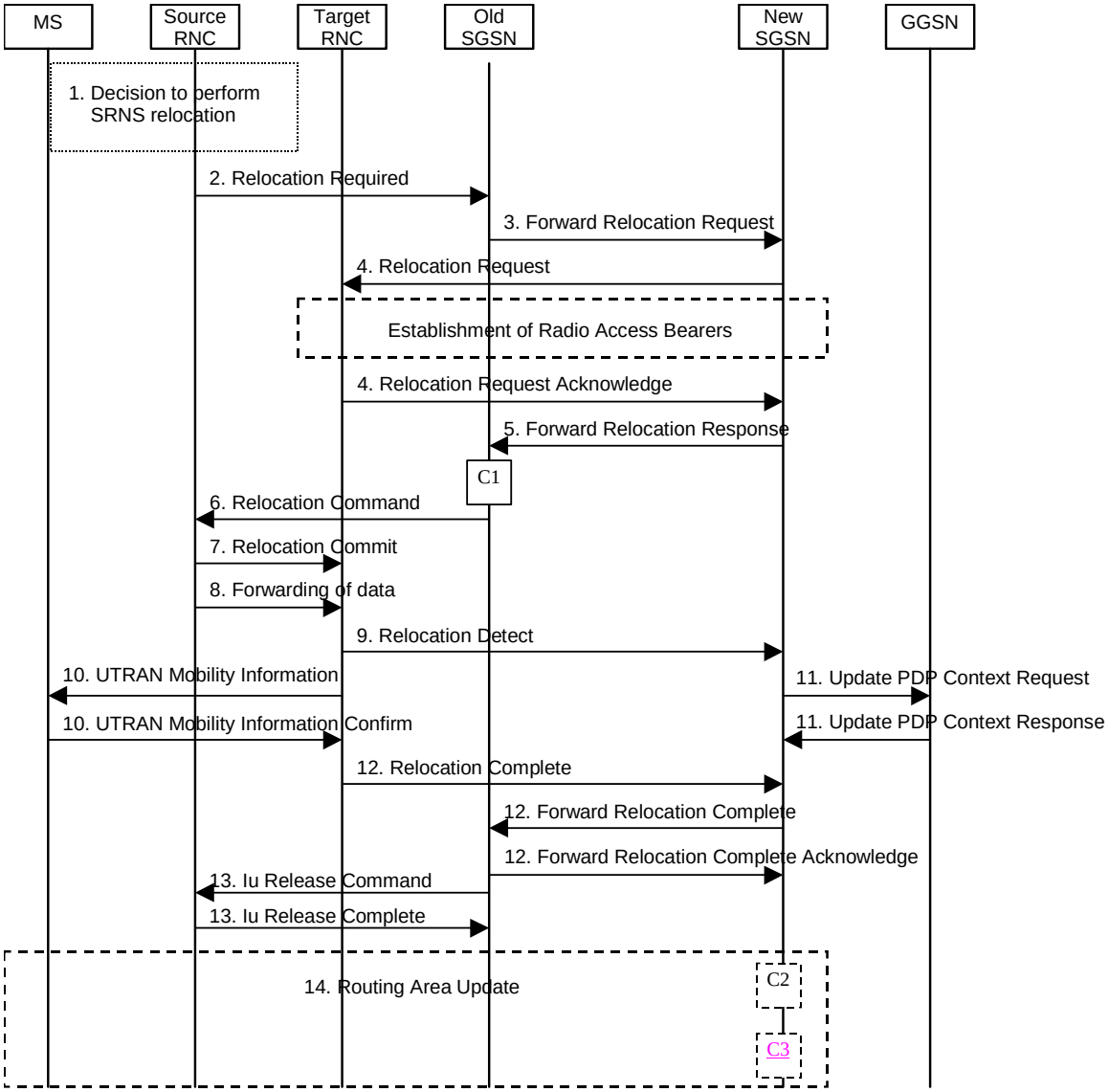


Figure 3: Serving SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between MS and source SRNC (data flows via the target RNC, which acts as a drift RNC); GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source SRNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation, the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in

subclause "Location Management Procedures (UMTS only)"). The Forward Relocation Request message is applicable only in the case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as the existing Radio Bearers will be reallocated between the MS and the target RNC when the target RNC takes the role of the serving RNC. For each requested RAB, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated; the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target RNC may receivesimultaneously downlink user packets both from the source SRNC and from the new SGSN.

   After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnels are established between the target RNC and the new-SGSN.

5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from the new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and the RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) Upon reception of the Relocation Command message from the PS domain, the source SRNC shall start the data-forwarding timer.

Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may starts data forwarding (step 7) and send Relocation Commit message (step 8) almost simultaneously except in the delivery order required case where step 7 triggers step 8. Target RNC may send Relocation Detect message (step 9) and UTRAN Mobility Information message (step 10) at the same time. Hence, target RNC may receive UTRAN Mobility Information Confirm message (step 10) while data forwarding (step 7) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

When the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC over the Iur interface. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-U PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-U PDUs next to be transmitted are not used by the target RNC. PDCP sequence numbers are only sent by the source RNC for radio bearers which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured.

If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink respectively.

Before sending the Relocation Commit uplink and downlink data transfer in the source, SRNC shall be suspended for RABs, which require maintaining the delivery order.

8) The source RNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the GTP-U PDUs, which are exchanged between the source RNC and the target RNC, are duplicated in the source RNC and routed at IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-U PDUs corresponding to transmitted but not yet acknowledged PDCP PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) The target SRNC sends a UTRAN Mobility Information message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

    The target SRNC establishes and/or restarts the RLC, and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile-terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets.

    Upon reception of the UTRAN Mobility Information message the MS may start sending uplink user data to the target SRNC. When the MS has reconfigured itself, it sends the UTRAN Mobility Information Confirm message to the target SRNC. This indicates that the MS is also ready to receive downlink data from the target SRNC.

    If the new SGSN has already received the Update PDP Context Response message from the GGSN, it shall forward the uplink user data to GGSN over this new GTP-U tunnel. Otherwise, the new SGSN shall forward the uplink user data to that GGSN IP address and TEID(s), which the new SGSN had received earlier by the Forward Relocation Request message.

11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).

12) When the target SRNC receives the UTRAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect and upon reception of Relocation Complete, the CN shall switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN shall signal to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

14) After the MS has finished the RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

~~CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

-The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

-Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result ""Continue"".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state in case the Iur interface is not available.

The Combined Hard Handover and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a hard handover decided by the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

If the target RNC is connected to a different SGSN than the source SRNC, an Inter-SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter-SGSN Routeing Area Update procedure.

Error! Reference source not found.shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. **Error! Reference source not found.**shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in **Error! Reference source not found.** and **Error! Reference source not found.** the MS is in PMM-CONNECTED state.

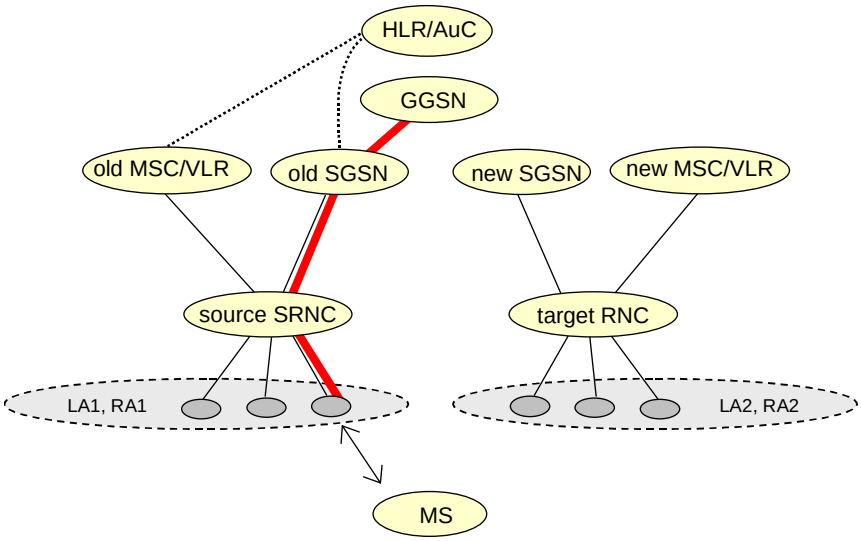


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.

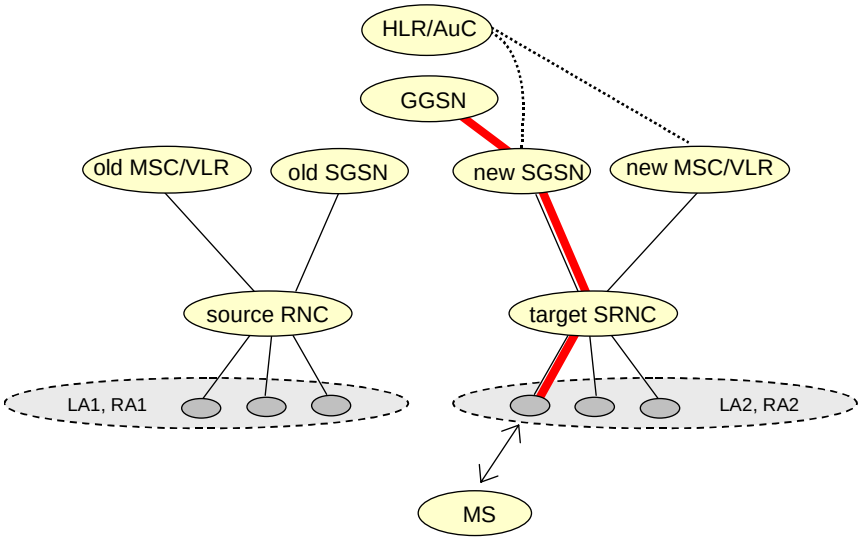


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

After the SRNS relocation and RA update, the MS is registered in the new SGSN and in the new MSC/VLR. The MS is in state PMM-CONNECTED towards the new SGSN and in MM IDLE state towards the new MSC/VLR. The target RNC is acting as serving RNC.

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in **Error! Reference source not found.**. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

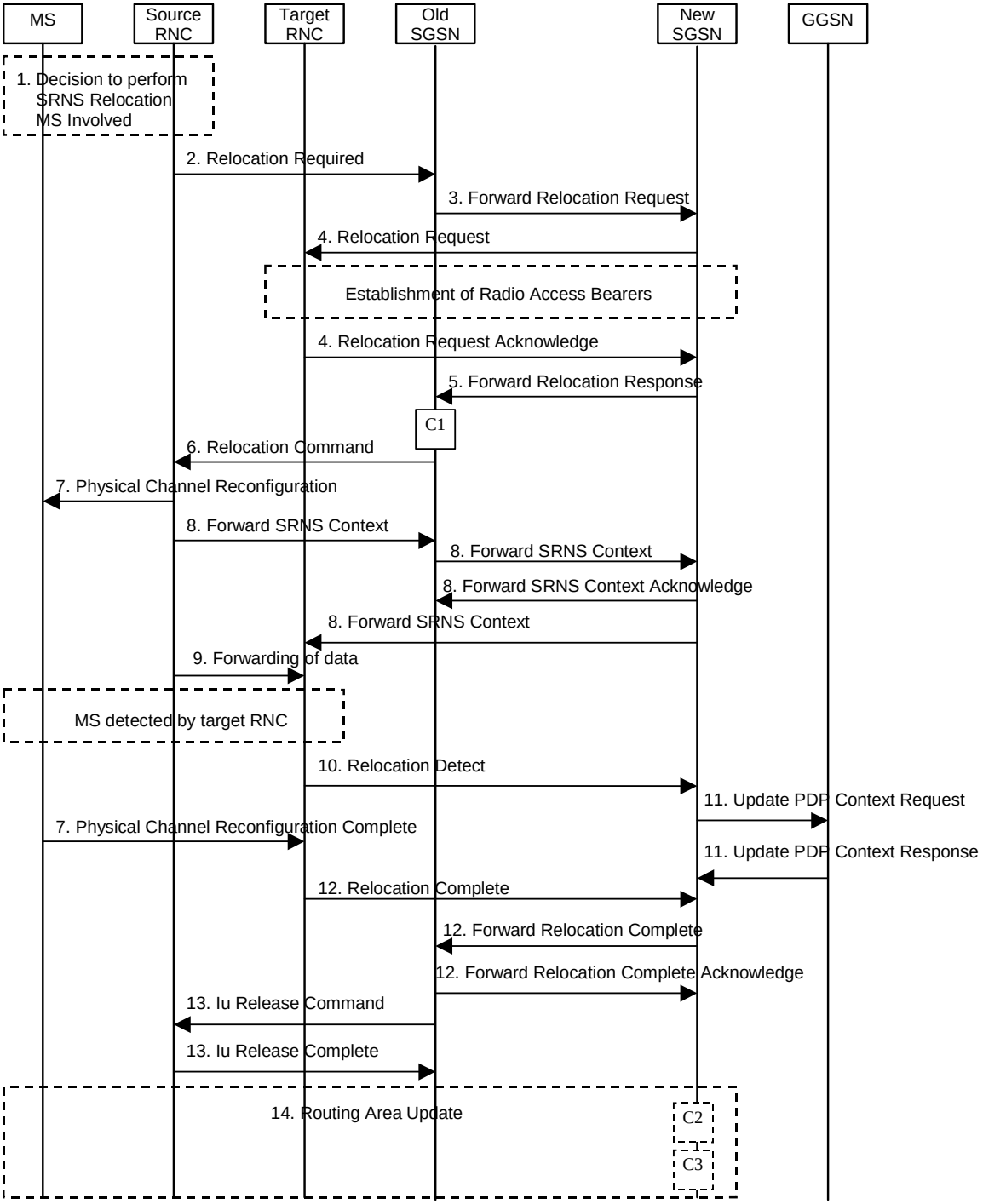


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

1) Based on measurement results and knowledge of the UTRAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between the MS and the source SRNC (no drift RNC available); GTP-U tunnel(s) between the source SRNC and the old SGSN; GTP-U tunnel(s) between the old SGSN and the GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source RNC To Target RNC Transparent Container includes the necessary information for relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) to the new SGSN. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS only)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and the Iu Transport Association, which corresponds to the down-link Tunnel Endpoint Identifier for user data. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.

   After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnel(s) are established between the target RNC and the new SGSN. However at this point, the target RNC has not yet established the Radio Bearer(s) with the MS yet.

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source SRNC. The Target RNC Information, one information element for each RAB to be set up, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer.

Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may send RRC message to MS (step 7), Forward SRNS Context message to the old SGSN (step 8) and starts data forwarding (step 9) almost simultaneously.

When the source SRNC is ready, the source RNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among

others Location Area Identification and Routeing Area Identification.
Before the RRC message is sent (e.g, Physical Channel Reconfiguration) uplink and downlink data transfer in the source RNC shall be suspended for RABs which require to maintain the delivery order.

When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. If the Forward SRNS Context message with the sequence numbers is received, the exchange of packets with the MS may start. If this message is not yet received, the target RNC may start the packet transfer for all RABs, which do not require maintaining the delivery order.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is acknowledged by a Forward SRNS Context Acknowledge message. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. PDCP sequence numbers are sent by the source RNC for the radio bearers which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

   If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink, respectively.

   The target RNC establishes and/or restarts the RLC and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target RNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then the target RNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source RNC, the MS shall discard these packets.

9) The source RNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source RNC and the target RNC are duplicated in the source RNC and routed at the IP layer towards the target RNC. For each radio bearer using lossless PDCP, the GTP-PDUs corresponding to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with the corresponding downlink PDCP sequence numbers.

10) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE Involved", the relocation execution trigger may be received from the Uu interface; i.e., when target RNC detects the MS on the lower layers. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

11) Upon reception of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS relocation is an inter-SGSN SRNS relocation, the new SGSN sends an Update PDP Context Request (New SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) message to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the target SRNC receives the Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate a Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired, the source RNC responds with an Iu Release Complete message.

14) After the MS has finished the reconfiguration procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

~~CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

-The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

-Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

In **Error! Reference source not found.**, the procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur interface carries control signalling but no user data.

The Combined Cell / URA Update and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a cell re-selection in the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

Before the Combined Cell / URA Update and SRNS Relocation and the Routeing Area Update, the MS is registered in the old SGSN. The source RNC is acting as serving RNC.

After the Combined Cell / URA Update and SRNS Relocation and the Routeing Area Update, the MS is registered in the new SGSN. The MS is in state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as serving RNC.

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in **Error! Reference source not found.**. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

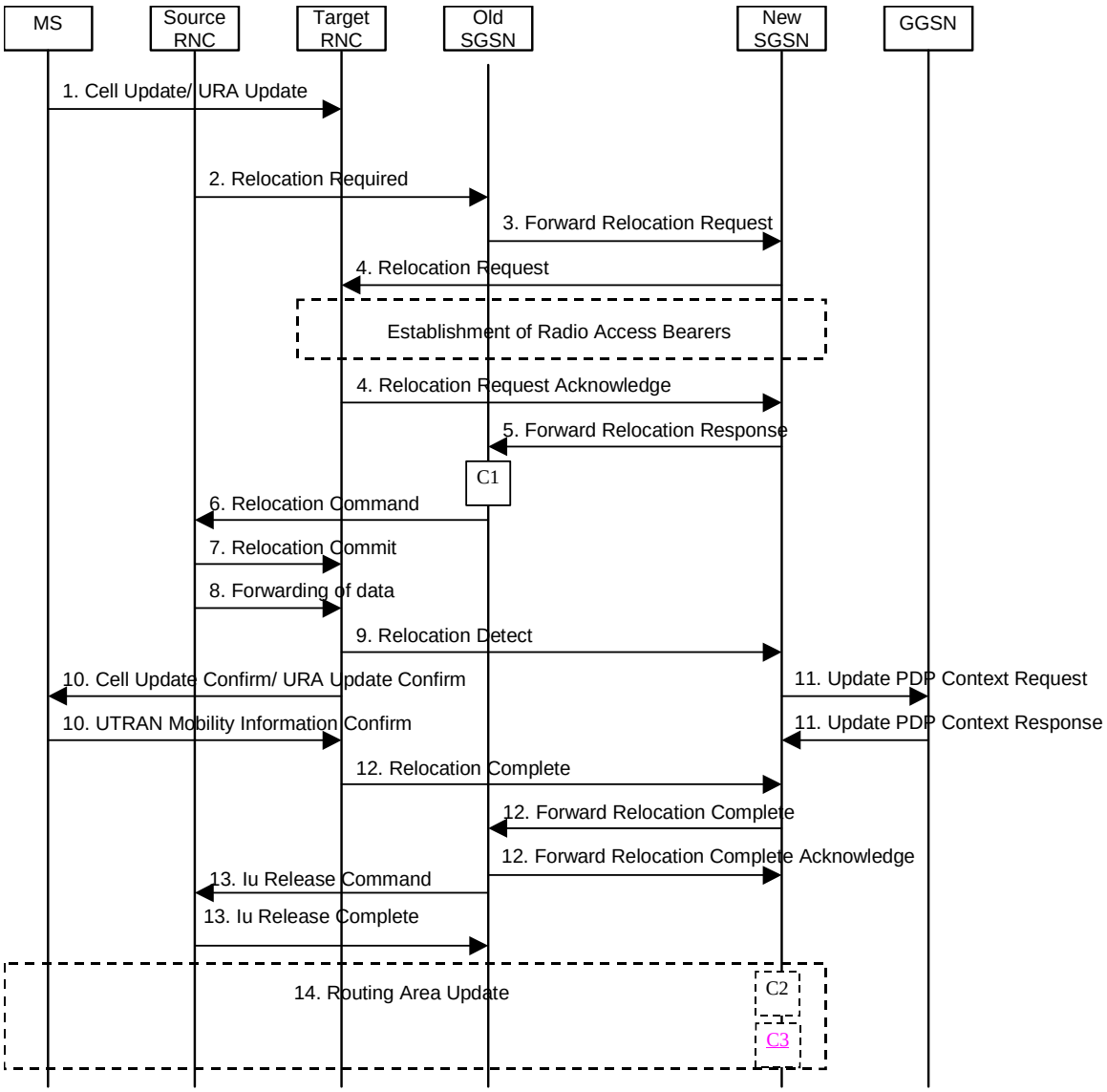


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). The source SRNC decides whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this subclause describes the case where a combined cell / URA update and SRNS relocation applies. In this case no radio bearer is established between the source SRNC and the UE. Nonetheless the following tunnel(s) are established: GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In the case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) message to the new SGSN. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to

this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN, see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS only)". The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

   After successful allocation of all necessary resources for accepted RABs including the Iu user plane, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target-RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.

   After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnels are established between the target RNC and the new-SGSN.

5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from the source SRNC the forwarded downlink packets, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) Upon reception of the Relocation Command message from the PS domain, the source SRNC shall start the data-forwarding timer.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may send Relocation Commit message (step 7) and starts data forwarding (step 8) almost simultaneously. Target RNC may send Relocation Detect message (step 9) and Cell Update Confirm/URA Update Confirm message (step 10) at the same time. Hence, target RNC may receive the UTRAN Mobility Information Confirm message from MS (step 10) while data forwarding (step 8) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

   When the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC over the Iur interface. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. PDCP sequence numbers are only sent by the source RNC for radio bearers which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured. For PDP context(s) using delivery

order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink respectively.

8) The source RNC begins the forwarding of data for the RABs subject to data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the GTP-U PDUs exchanged between the source RNC and the target RNC are duplicated in the source RNC and routed at the IP layer towards the target RNC. For each radio bearer using lossless PDCP, the GTP-PDUs corresponding to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with the corresponding downlink PDCP sequence numbers.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) The target SRNC sends a Cell Update Confirm / URA Update Confirm message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

    Upon reception of the Cell Update Confirm / URA Update Confirm message the MS may start sending uplink user data to the target SRNC. When the MS has reconfigured itself, it sends the UTRAN Mobility Information Confirm message to the target SRNC. This indicates that the MS is also ready to receive downlink data from the target SRNC.

    If the new SGSN has already received the Update PDP Context Response message from the GGSN, it shall forward the uplink user data to the GGSN over this new GTP-U tunnel. Otherwise, the new SGSN shall forward the uplink user data to that GGSN IP address and TEID(s), which the new SGSN had received earlier by the Forward Relocation Request message.

    The target SRNC and the MS exchange the PDCP sequence numbers; PDCP-SNU and PDCP-SND. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms the reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the target SRNC shall discard these packets.

11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the target SRNC receives the UTRAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

14) After the MS has finished the Cell / URA update and RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

~~CAMEL procedure calls shall be performed; see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

-The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

-Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL GPRS Routeing Area Update-Session

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

6.9.2.2.4 SRNS Relocation Cancel Procedure

The purpose of the SRNS Relocation Cancel procedure is to cancel an ongoing SRNS relocation. The SRNS Relocation Cancel procedure may be initiated during or after the Relocation Preparation procedure and it is always triggered by the source RNC.

The SRNS Relocation Cancel procedure is illustrated in Figure 43a. The sequence is valid for cancelling both an intra-SGSN SRNS relocation and an inter-SGSN SRNS relocation.

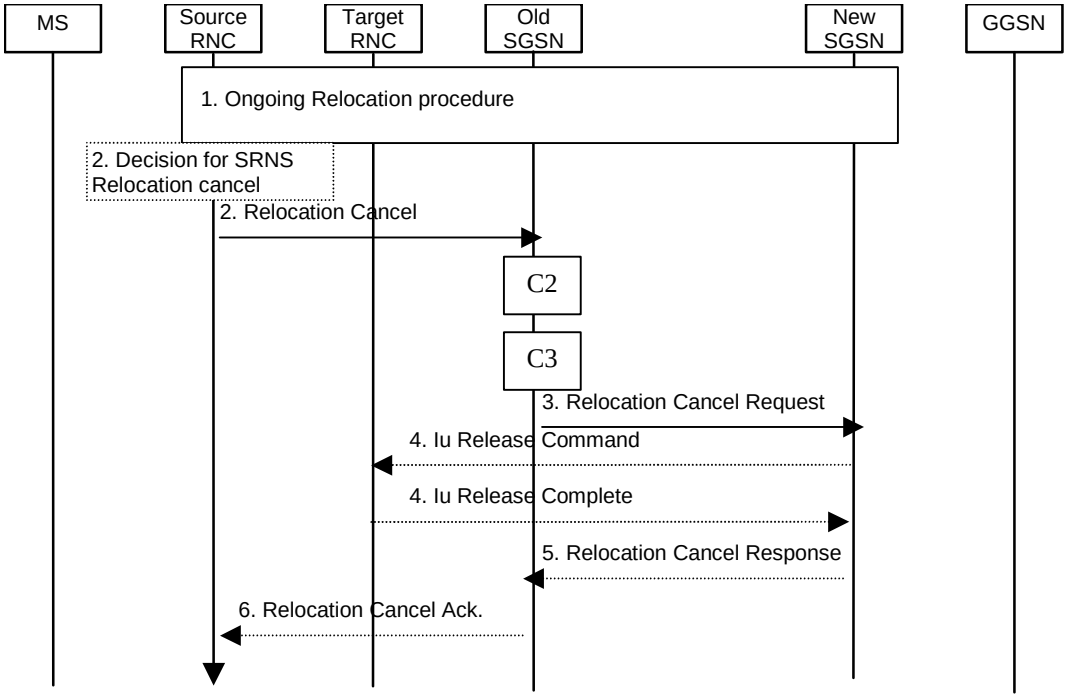


Figure 43a: SRNS Relocation Cancel Procedure

1) An SRNS Relocation procedure has started, as specified in section 6.9.2.2.1.

2) Before the completion of the SRNS Relocation procedure, either during or after the SRNS Relocation Preparation, the source RNC may decide to cancel the ongoing SRNS Relocation. This decision may be triggered by a timer expiry or by an error event in the source RNC. In this case, the source RNC sends a Relocation Cancel (Cause) to the old SGSN.

2) The old SGSN sends a Relocation Cancel Request (IMSI) to the new SGSN to indicate that the ongoing SRNS relocation for the MS, specified by IMSI, should be cancelled at the target RNC.

4) The new SGSN sends an Iu Release Command (Cause) to request from the target RNC to release the Iu resources already allocated for the SRNS relocation, or to cancel the ongoing allocation of Iu resources for the SRNS relocation. Cause is set equal to "Relocation Cancelled" as defined in 25.413 [56b]. The target RNC releases the requested Iu resources and responds with an Iu Release Complete.

5) The new SGSN acknowledges the cancellation of the ongoing SRNS Relocation by sending a Relocation Cancel Response to the old SGSN.

6) Finally, the old SGSN responds to the source RNC with a Relocation Cancel Ack message.

If an inter-SGSN SRNS Relocation is cancelled and the CAMEL procedures CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach have been performed during the SRNS Relocation procedure, then the following CAMEL procedures shall be performed (see referenced procedures in 3GPP TS 23.078):

~~In case of inter SGSN relocation CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

The procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

3GPP TSG SA2#22 **Tdoc S2-020240~~069~~**
Phoenix, January 14th to 18th, 2002

3GPP TSG-CN WG2 Meeting #21 **Tdoc N2-011016**
Cancun, Mexico, 26th - 30th November 2001 ***rev. TDOC N2-010993***

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **CR299** ⌘ rev ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Corrections concerning the CAMEL trigger point C1 for the SRNS relocation procedure
Source:	⌘	Alcatel
Work item code:	⌘	CAMEL phase3
Date:	⌘	09/01/02
Category:	⌘	**A** (essential correction)
Release:	⌘	REL-4

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)

Reason for change:	⌘	1) The CAMEL trigger point C1 for SRNS relocation procedure is used only in the case of inter-SGSN SRNS relocation procedure-see CN2 N2-011016 accepted in Cancun. 2) Alignement of SRNS relocation cancel procedure with CN2 N2-11014 CR284 REV2 accepted by CN2 in Cancun.
Summary of change:	⌘	1) First change: during the SRNS relocation procedure used in the case of 3G inter-SGSN Handover, the CAMEL trigger point C1 is reached to treat the PDP context disconnection and the CAMEL GPRS detach on the old SGSN. However the clauses 6.9.2.2.1 (SRNS Relocation Procedure after Soft Handover), 6.9.2.2.2 (Combined Hard Handover and SRNS Relocation Procedure), 6.9.2.2.3 (Combined Cell / URA Update and SRNS Relocation Procedure) are treating also the case of intra-SRNS relocation procedure. In the case of intra-SGSN SRNS relocation procedure, the GPRS dialogue for the GPRS session and the dialogue(s) for each PDP context are kept and change of position for the new RA is reported to the SCP as Event report in case of RA change, provided that the SCP requested it. 2) Second change: more precised trigger reasons for C2) and C3) - see the revision 2 of CR284 accepted by CN2 in Cancun.
Consequences if	⌘	1)First change:The CAMEL trigger point C1 will be wrongly called also in case of intra

not approved:	SRNS relocation. 2) Second change : unclear triggering of C2) and C3).

Clauses affected:	⌘	6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3, 6.9.2.2.4	
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘
Other comments:	⌘	C1) is defined as follows: C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach. They are called in the following order: The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue". Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result ""Continue"".	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

— First modified section —

6.9.2.2.1 Serving RNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state where the Iur interface carries both the control signalling and the user data.

The Serving SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, from a "standing still position". In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects an Intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about new location of the MS.

Figure 37 shows user data routing before SRNS relocation when source SRNC and target RNC are connected to different SGSNs. Figure 38 shows the user data routing after SRNS Relocation procedure and Routeing Area Update procedure is completed. In case depicted in Figure 37 and Figure 38, the MS is in state PMM-CONNECTED.

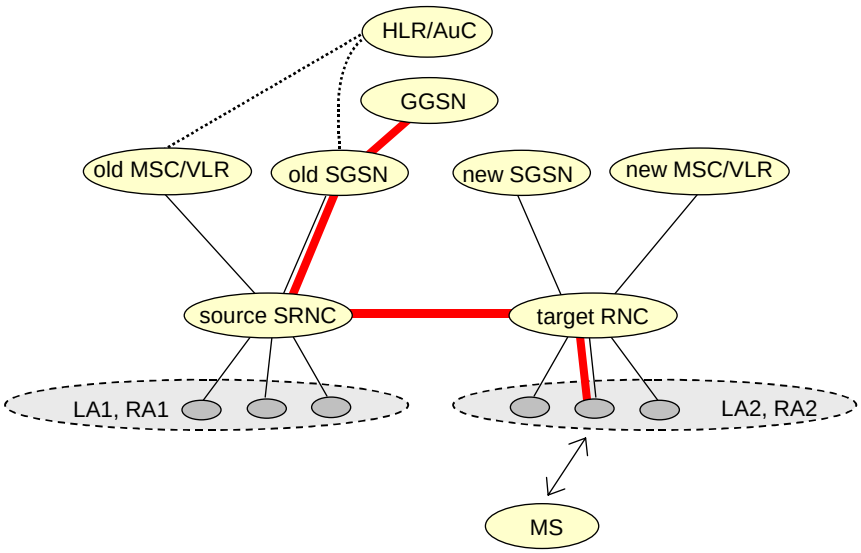


Figure 37: Before SRNS Relocation and Routeing Area Update

Before the SRNS Relocation procedure and RA update, the MS is registered in the old SGSN. The source RNC is acting as a serving RNC (SRNC).

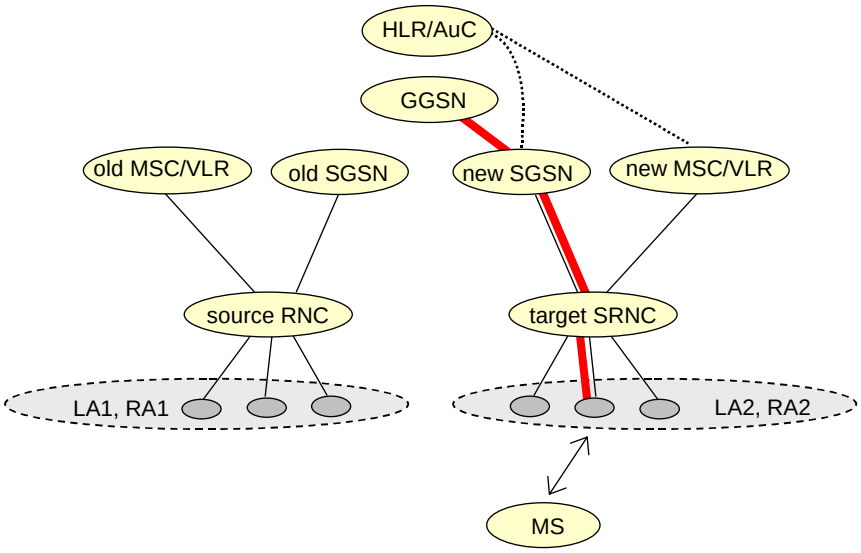


Figure 38: After SRNS Relocation and Routeing Area Update

After the SRNS Relocation procedure and RA update, the MS is registered in the new SGSN. The MS is in the state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as the serving RNC.

The Serving SRNS Relocation procedure is illustrated in Figure 39. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

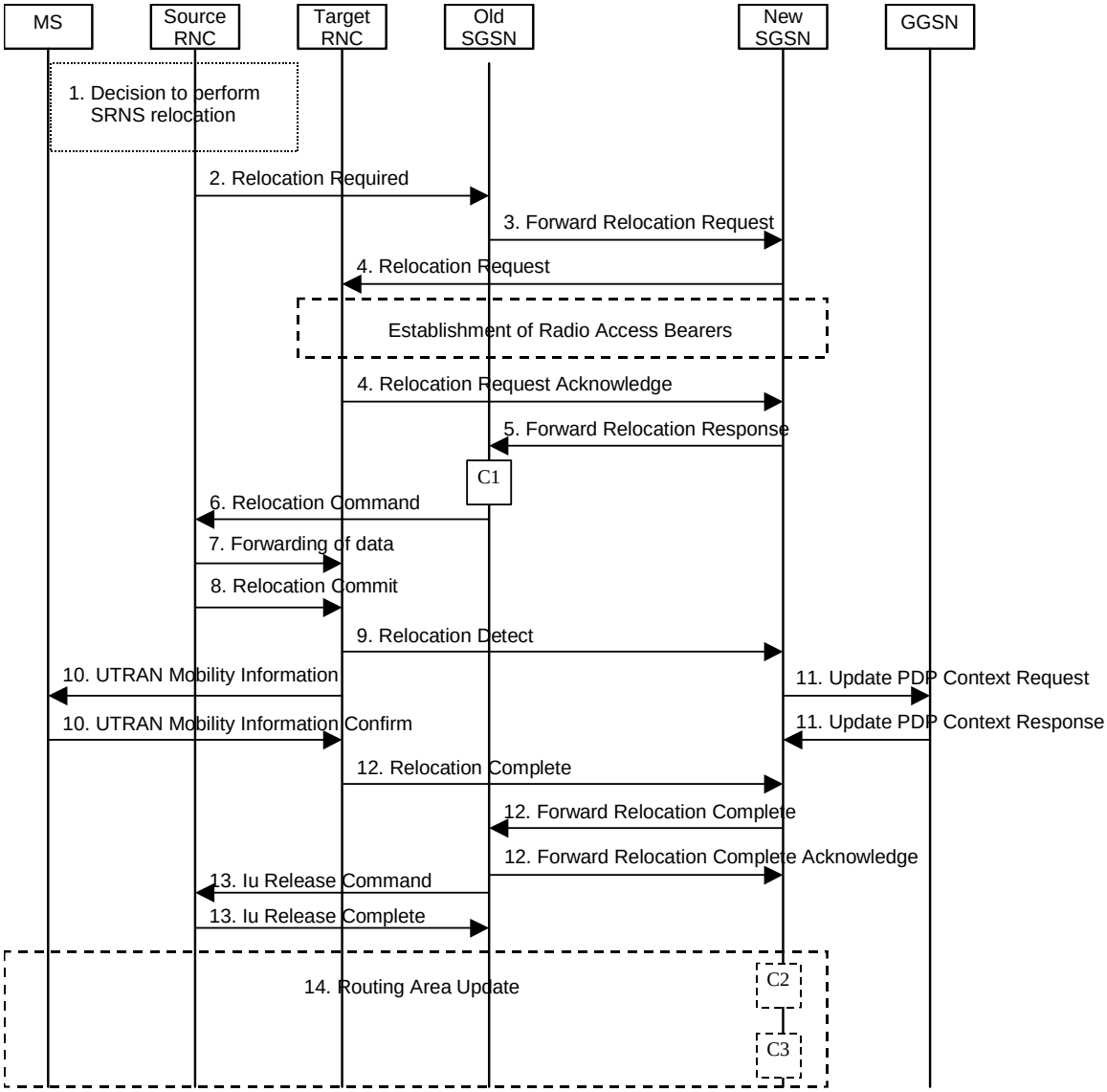


Figure 39: SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between MS and source SRNC (data flows via the target RNC, which acts as a drift RNC); GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source SRNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation, the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. The PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure

in subclause "Location Management Procedures (UMTS only)"). The Forward Relocation Request message is applicable only in the case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source-RNC to target RNC transparent container, RABs to be setup) to the target RNC. Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as the existing Radio Bearers will be reallocated between the MS and the target RNC when the target RNC takes the role of the serving RNC. For each requested RAB, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated; the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.

5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from the new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and the RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data. Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may start data forwarding (step 7) and send Relocation Commit message (step 8) almost simultaneously except in the delivery order required case where step 7 triggers step 8. Target RNC may send Relocation Detect message (step 9) and UTRAN Mobility Information message (step 10) at the same time. Hence, target RNC may receive UTRAN Mobility Information Confirm message (step 10) while data forwarding (step 7) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

8) Before sending the Relocation Commit the uplink and downlink data transfer in the source, SRNC shall be suspended for RABs, which require delivery order. The source RNC shall start the data-forwarding timer. When the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC over the Iur interface. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP□PDUs next to be transmitted in the uplink and downlink directions and the next

PDCP sequence numbers that would have been used to send and receive data from the MS. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC. PDCP sequence numbers are only sent by the source RNC for radio bearers, which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured.

If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink, respectively.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) The target SRNC sends a UTRAN Mobility Information message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC establishes and/or restarts the RLC, and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile-terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets.

Upon reception of the UTRAN Mobility Information message the MS may start sending uplink user data to the target SRNC. When the MS has reconfigured itself, it sends the UTRAN Mobility Information Confirm message to the target SRNC. This indicates that the MS is also ready to receive downlink data from the target SRNC.

If new the SGSN has already received the Update PDP Context Response message from the GGSN, it shall forward the uplink user data to GGSN over this new GTP-U tunnel. Otherwise, the new SGSN shall forward the uplink user data to that GGSN IP address and TEID(s), which the new SGSN had received earlier by the Forward Relocation Request message.

For all RABs, the target RNC should:

start uplink reception of data and start transmission of uplink GTP-PDUs towards the new SGSN;

start processing the already buffered and the arriving downlink GTP-PDUs and start downlink transmission towards the MS.

11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).

12) When the target SRNC receives the UTRAN Mobility Information Confirm message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect and upon reception of Relocation Complete, the CN shall switch the user plane from source RNC to target SRNC. If the SRNS Relocation is

an inter-SGSN SRNS relocation, the new SGSN shall signal to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

14) After the MS has finished the RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

~~The CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".
- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result ""Continue"".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

— Second modified section —

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state in case the Iur interface is not available.

The Combined Hard Handover and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a hard handover decided by the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

If the target RNC is connected to a different SGSN than the source SRNC, an Inter-SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter-SGSN Routeing Area Update procedure.

Figure 40 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 41 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 40 and Figure 41 the MS is in PMM-CONNECTED state.

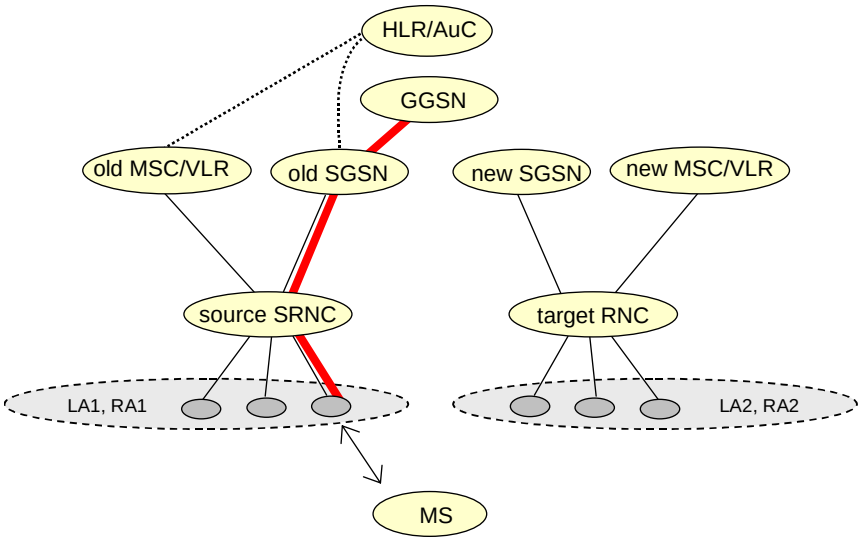


Figure 40: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.

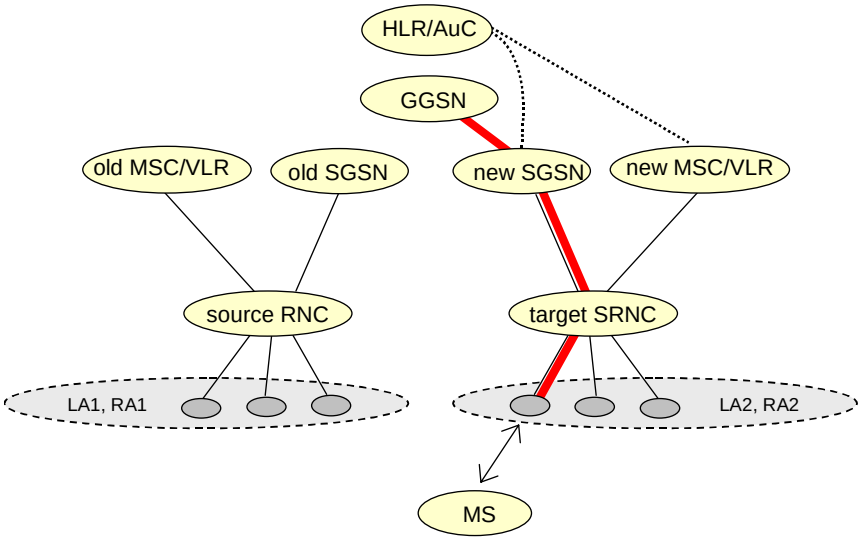


Figure 41: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

After the SRNS relocation and RA update, the MS is registered in the new SGSN and in the new MSC/VLR. The MS is in state PMM-CONNECTED towards the new SGSN and in MM IDLE state towards the new MSC/VLR. The target RNC is acting as serving RNC.

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 42. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

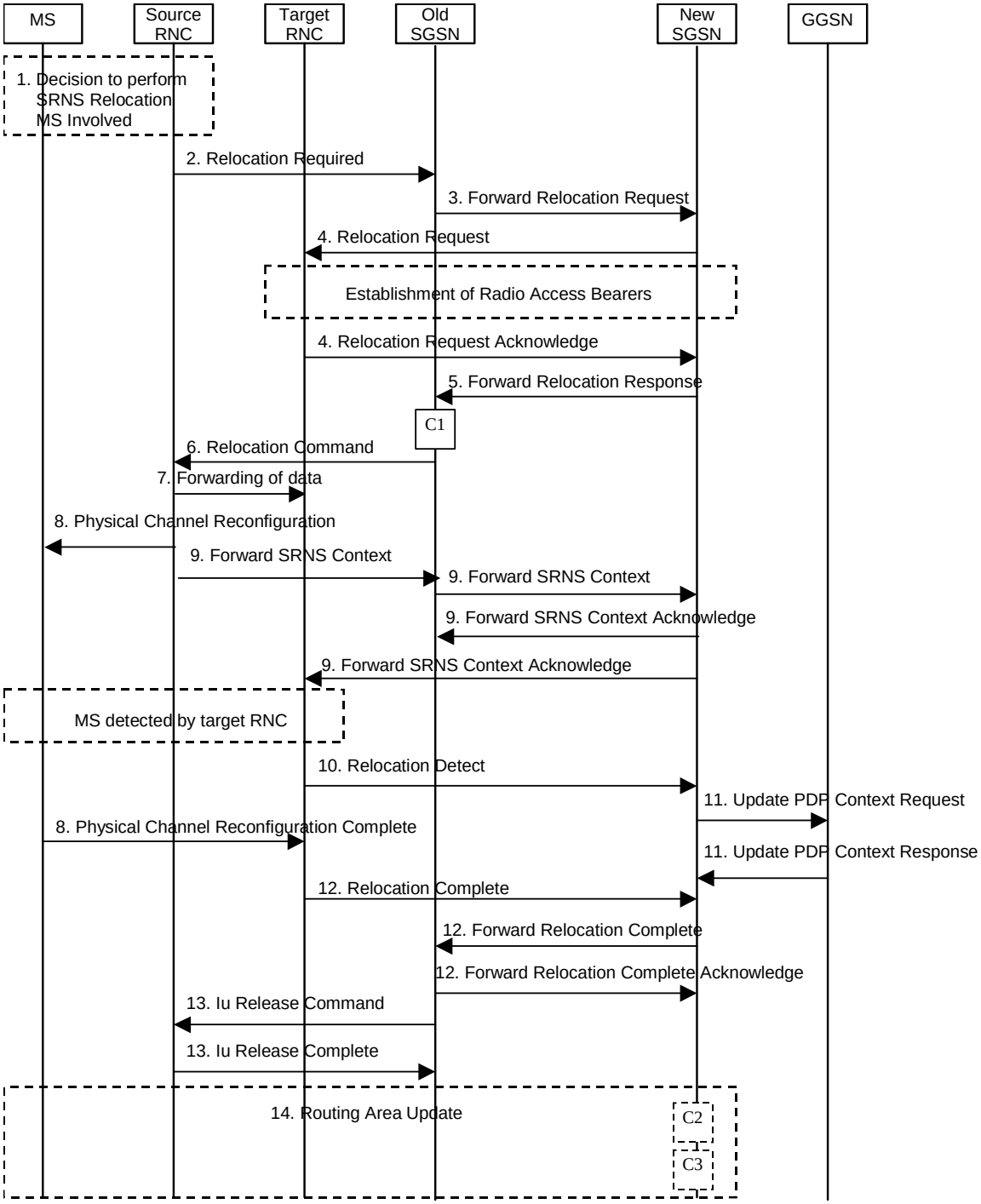


Figure 42: Combined Hard Handover and SRNS Relocation Procedure

1) Based on measurement results and knowledge of the UTRAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between the MS and the source SRNC (no drift RNC available); GTP-U tunnel(s) between the source SRNC and the old SGSN; GTP-U tunnel(s) between the old SGSN and the GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source RNC To Target RNC Transparent Container includes the necessary information for relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) to the new SGSN. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS only)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RAB To Be Setup) to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and the Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target-RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source SRNC. The Target RNC Information, one information element for each RAB to be set up, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) The source SRNC may, according to the QoS profile, begins the forwarding of data for the RABs to be subject for data forwarding.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may start data forwarding (step 7), send Physical Channel Reconfiguration message to MS (step 8) and forward SRNS Context message to the old SGSN (step 8) almost simultaneously.

   The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the GTP-PDUs exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

8) Before sending the Physical Channel Reconfiguration the uplink and downlink data transfer shall be suspended in the source SRNC for RABs, which require delivery order. When the source SRNC is ready, the source RNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.
Before the RRC message is sent (e,g, Physical Channel Reconfiguration) uplink and downlink data transfer in the source RNC shall be suspended for RABs which require to maintain the delivery order. .

   When the MS has reconfigured itself, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. If the Forward SRNS Context message with the sequence numbers is received, the exchange of packets with the MS may start. If this message is not yet received, the target RNC may start the packet transfer for all RABs, which do not require maintaining the delivery order.

9) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is acknowledged by a Forward SRNS Context Acknowledge message. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. PDCP sequence numbers are only sent by the source RNC for the radio bearers which used losslessPDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

   If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context uplink and downlink, respectively.

   The target RNC establishes and/or restarts the RLC and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target RNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received by the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets.

10) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE Involved", the relocation execution trigger may be received from the Uu interface; i.e., when target RNC detects the MS on the lower layers. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

11) Upon reception of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS relocation is an inter-SGSN SRNS relocation, the new SGSN sends an Update PDP Context Request (New SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) message to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the target SRNC receives the Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate a Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the

target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or, if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired, the source RNC responds with an Iu Release Complete message.

14) After the MS has finished the reconfiguration procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

~~The CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

-The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

-Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

In Figure 42, the procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

— Third modified section —

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur interface carries control signalling but no user data.

The Combined Cell / URA Update and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a cell re-selection in the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

Before the Combined Cell / URA Update and SRNS Relocation and the Routeing Area Update, the MS is registered in the old SGSN. The source RNC is acting as serving RNC.

After the Combined Cell / URA Update and SRNS Relocation and the Routeing Area Update, the MS is registered in the new SGSN. The MS is in state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as serving RNC.

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in Figure 43. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

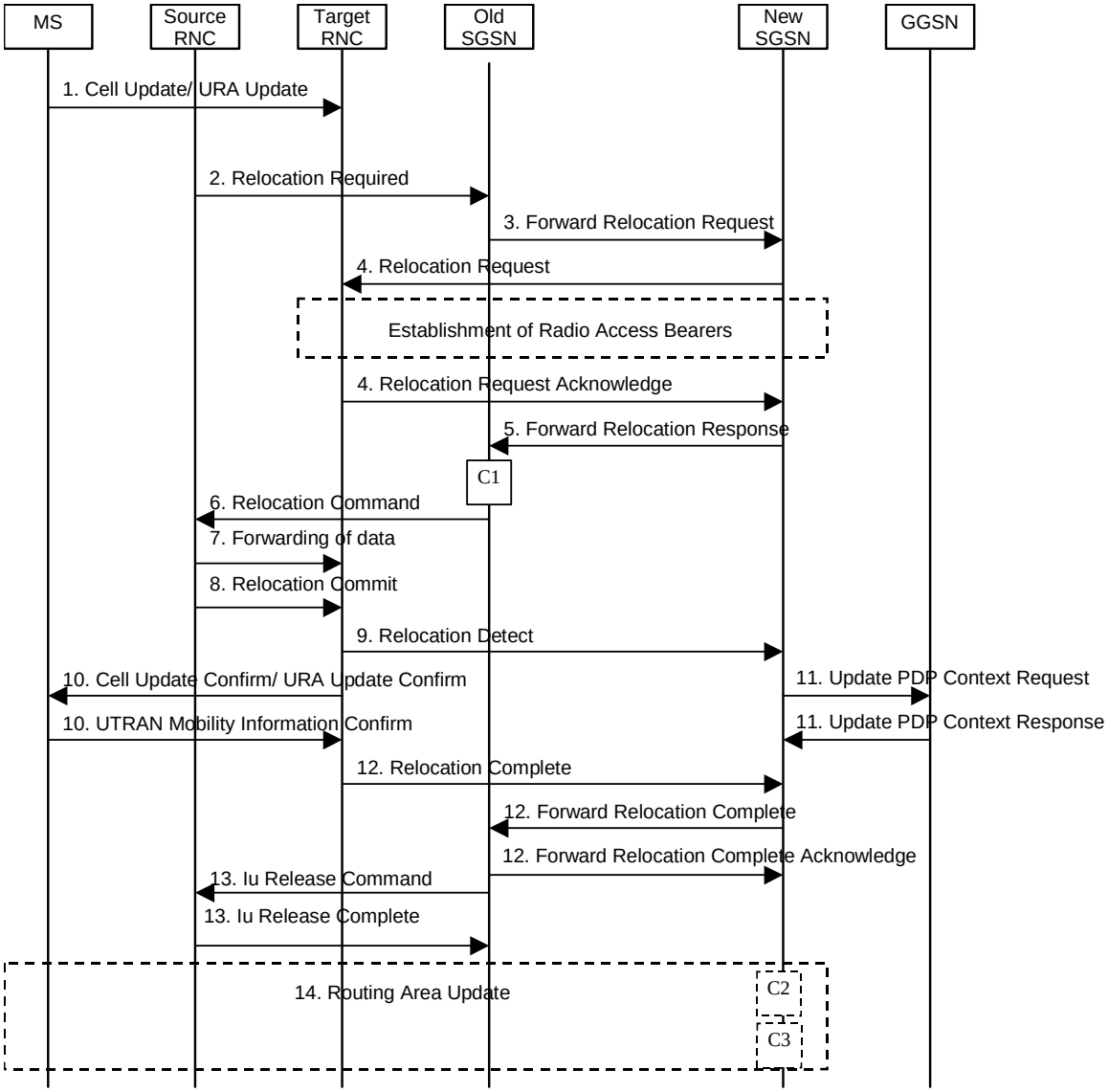


Figure 43: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). The source SRNC decides whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this subclause describes the case where a combined cell / URA update and SRNS relocation applies. In this case no radio bearer is established between the source SRNC and the UE. Nonetheless the following tunnel(s) are established: GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In the case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) message to the new SGSN. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the

same time a timer is started on the MM and PDP contexts in the old SGSN, see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS only)". The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

   After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and a Iu Transport Association which corresponds to the downlink Tunnel Endpoint Identifier for user data. The target-RNC may simultaneously receive for each RAB to be set up downlink user packets both from the source SRNC and from the new SGSN.

   After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnels are established between the target RNC and the new-SGSN.

5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from the source SRNC the forwarded downlink packets, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs subject to data forwarding and starts the data-forwarding timer. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may send data forwarding (step 7) and start Relocation Commit message (step 8) almost simultaneously. Target RNC may send Relocation Detect message (step 9) and Cell Update Confirm/URA Update Confirm message (step 10) at the same time. Hence, target RNC may receive the UTRAN Mobility Information Confirm message from MS (step 10) while data forwarding (step 8) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

   Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

8) Before sending the Relocation Commit the uplink and downlink data transfer in the source, SRNC shall be suspended for RABs, which require delivery order.

   When the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC over the Iur interface. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. . PDCP sequence numbers are only sent by the source RNC for radio bearers, which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

   If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink respectively.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) The target SRNC sends a Cell Update Confirm / URA Update Confirm message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

    Upon reception of the Cell Update Confirm / URA Update Confirm message the MS may start sending uplink user data to the target SRNC. When the MS has reconfigured itself, it sends the UTRAN Mobility Information Confirm message to the target SRNC. This indicates that the MS is also ready to receive downlink data from the target SRNC.

    If the new SGSN has already received the Update PDP Context Response message from the GGSN, it shall forward the uplink user data to the GGSN over this new GTP-U tunnel. Otherwise, the new SGSN shall forward the uplink user data to that GGSN IP address and TEID(s), which the new SGSN had received earlier by the Forward Relocation Request message.

    The target SRNC and the MS exchange the PDCP sequence numbers; PDCP-SNU and PDCP-SND. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile terminated packets successfully transferred before the SRNC relocation procedure. . If PDCP-SND confirms the reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the target SRNC shall discard these packets.

11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the target SRNC receives the UTRAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is

an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

14) After the MS has finished the Cell / URA update and RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

~~The CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".
- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL GPRS Routeing Area Update-Session

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue". For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

— Fourth modified section —

6.9.2.2.4 SRNS Relocation Cancel Procedure

The purpose of the SRNS Relocation Cancel procedure is to cancel an ongoing SRNS relocation. The SRNS Relocation Cancel procedure may be initiated during or after the Relocation Preparation procedure and may be initiated by the source RNC.

The SRNS Relocation Cancel procedure is illustrated in Figure 44. The sequence is valid for cancelling both an intra-SGSN SRNS relocation and an inter-SGSN SRNS relocation.

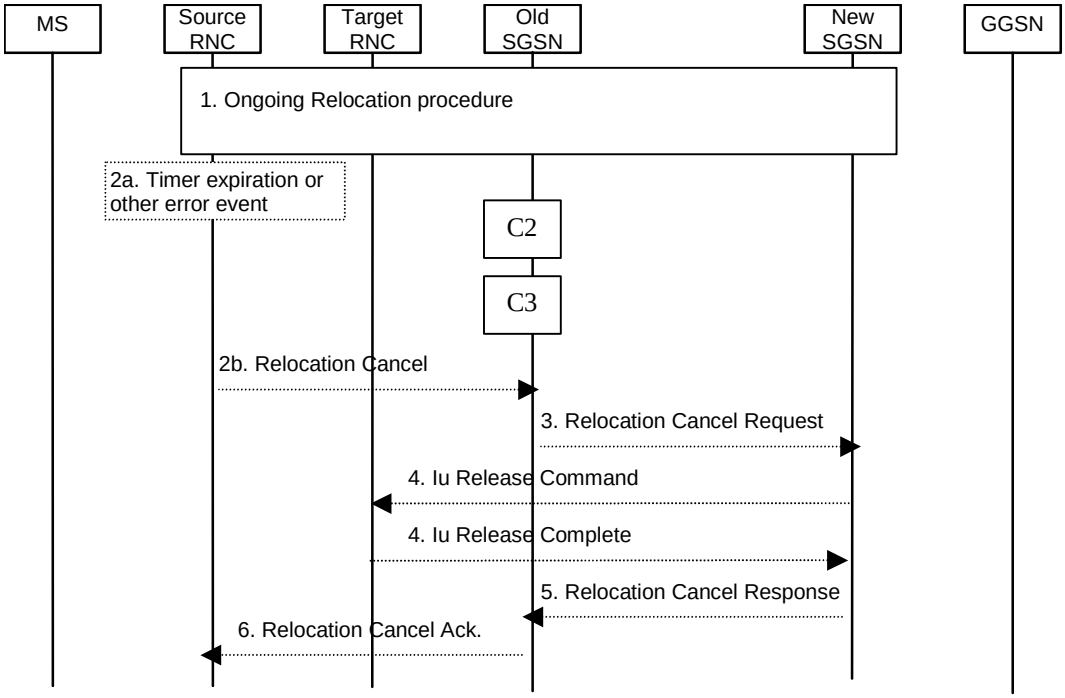


Figure 44: SRNS Cancel Relocation Procedure

1) An SRNS Relocation procedure has started, as specified in section 6.9.2.2.1.

2a) The SRNS Cancel Relocation may be initiated by a timer expiry or by an error event in the source RNC.

2b) When one of conditions in 2a is satisfied, the source RNC sends a Relocation Cancel (Cause) to the old SGSN. Cause indicates the reason for cancelling the ongoing SRNS relocation.

3) The old SGSN sends a Relocation Cancel Request (IMSI, RANAP Cause) to the new SGSN to indicate that the ongoing SRSN relocation should be cancelled. RANAP Cause contains the cause value received by the source RNC in the Relocation Cancel message.

4) The new SGSN sends an Iu Release Command (Cause) to request from the target RNC to release the Iu resources already allocated for the SRNS relocation, or to cancel the ongoing allocation of Iu resources for the SRNS relocation. Cause is set equal to RANAP Cause, i.e. to whatever cause value was included in the Relocation Cancel Request received from old SGSN. The target RNC releases the requested Iu resources and responds with an Iu Release Complete.

5) The new SGSN acknowledges the cancellation of the ongoing SRNS Relocation by sending a Relocation Cancel Response to the old SGSN.

6) The old SGSN responds to the source RNC with a Relocation Cancel Ack message.

If an inter-SGSN SRNS Relocation is cancelled and the CAMEL procedures CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach have been performed during the SRNS Relocation procedure, then the following CAMEL procedures shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

The procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

~~In case of inter SGSN relocation CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

~~C2) CAMEL_GPRS_Routeing_Area_Update_Session.~~

~~The procedure returns as result "Continue".~~

~~C3) CAMEL_GPRS_Routeing_Area_Update_Context.~~

~~The procedure is called several times: once per PDP context. It returns as result "Continue".~~

~~For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.~~

3GPP TSG SA2#22
Phoenix, January 14th to 18th, 2002

Tdoc S2-020241

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **CR303** ⌘ rev ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Corrections concerning the CAMEL trigger point C1 for the SRNS relocation procedure
Source:	⌘	Alcatel
Work item code:	⌘	CAMEL phase3
Date:	⌘	15/01/02
Category:	⌘	**A** (essential correction)
Release:	⌘	REL-5

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)

Reason for change:	⌘	1) The CAMEL trigger point C1 for SRNS relocation procedure is used only in the case of inter-SGSN SRNS relocation procedure-see CN2 N2-011016 accepted in Cancun. 2) Alignement of SRNS relocation cancel procedure with CN2 N2-11014 CR284 REV2 accepted by CN2 in Cancun.
Summary of change:	⌘	1) First change: during the SRNS relocation procedure used in the case of 3G inter-SGSN Handover, the CAMEL trigger point C1 is reached to treat the PDP context disconnection and the CAMEL GPRS detach on the old SGSN. However the clauses 6.9.2.2.1 (SRNS Relocation Procedure after Soft Handover), 6.9.2.2.2 (Combined Hard Handover and SRNS Relocation Procedure), 6.9.2.2.3 (Combined Cell / URA Update and SRNS Relocation Procedure) are treating also the case of intra-SRNS relocation procedure. In the case of intra-SGSN SRNS relocation procedure, the GPRS dialogue for the GPRS session and the dialogue(s) for each PDP context are kept and change of position for the new RA is reported to the SCP as Event report in case of RA change, provided that the SCP requested it. 2) Second change: more precised trigger reasons for C2) and C3) - see the revision 2 of CR284 accepted by CN2 in Cancun.
Consequences if not approved:	⌘	1)First change:The CAMEL trigger point C1 will be wrongly called also in case of intra SRNS relocation.

	2) Second change : unclear triggering of C2) and C3).

Clauses affected:	⌘	6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3, 6.9.2.2.4		
Other specs affected:	⌘	Other core specifications Test specifications O&M Specifications	⌘	
Other comments:	⌘	C1) is defined as follows: C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach. They are called in the following order: The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue". Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result ""Continue"".		

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

— First modified section —

6.9.2.2 Serving RNS Relocation Procedures

In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

Serving RNS relocation procedures move the RAN to CN connection point at the RAN side of the source RNC to the target RNC. The Serving RNS Relocation Procedures, described in the following sub-clauses, may be performed as “Lossless SRNS Relocation”, which means packet loss during the SRNS change is eliminated. For this purpose, the RNS and the MS have to provide PDCP layer functionality, which in the subsequent description is referred as the lossless PDCP. The source RNC decides to perform the Serving RNS Relocation Procedure as “Lossless SRNS Relocation” based on capabilities of the UE and the RNS and based on QoS parameters (e.g SDU error ratio).

For “Lossless SRNS Relocation”, both the MS and the source RNS have to support and to use the lossless PDCP. When the SRNS changes, the old RNS forwards all received and not yet transferred downlink GTP-PDUs to the target RNS. GTP-PDUs forwarded to the target RNS indicate a PDCP sequence number if the contained N-PDUs were sent to the MS as a PDCP-SDUs, but are not yet acknowledged by lossless PDCP. The target RNS and the MS exchange respective sequence numbers of next expected PDCP-PDUs. This process indicates PDCP-PDUs that were already successfully transferred between the MS and the source RNS for downlink and uplink directions, respectively. This also confirms all N-PDUs (PDCP-SDUs) successfully transferred before the change of the SRNS. These N-PDUs are discarded by the MS and the target RNS, respectively. The target RNS identifies the forwarded GTP-PDUs containing confirmed N-PDUs by the PDCP sequence number in the GTP-PDU. All other N-PDUs have to be transmitted via the new MS – RNS link6.9.2.2.1 Serving RNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state where the Iur interface carries both the control signalling and the user data. This procedure is not applicable for GERAN.

The Serving SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, from a "standing still position". In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects an Intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about new location of the MS.

Figure 1 shows user data routing before SRNS relocation when source SRNC and target RNC are connected to different SGSNs. Figure 2 shows the user data routing after SRNS Relocation procedure and Routeing Area Update procedure is completed. In case depicted in Figure 1 and Figure 2, the MS is in state PMM-CONNECTED.

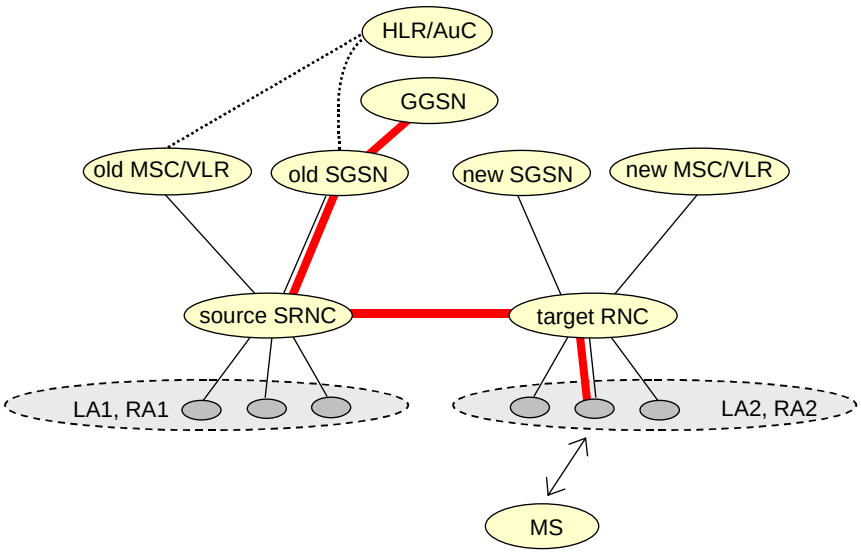


Figure 1: Before SRNS Relocation and Routeing Area Update

Before the SRNS Relocation procedure and RA update, the MS is registered in the old SGSN. The source RNC is acting as a serving RNC (SRNC).

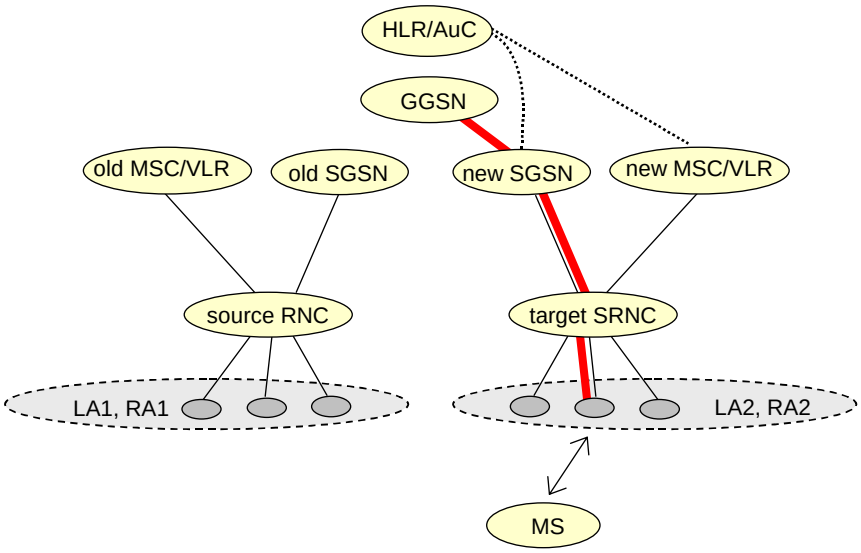


Figure 2: After SRNS Relocation and Routeing Area Update

After the SRNS Relocation procedure and RA update, the MS is registered in the new SGSN. The MS is in the state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as the serving RNC.

The Serving SRNS Relocation procedure is illustrated in Figure 3. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

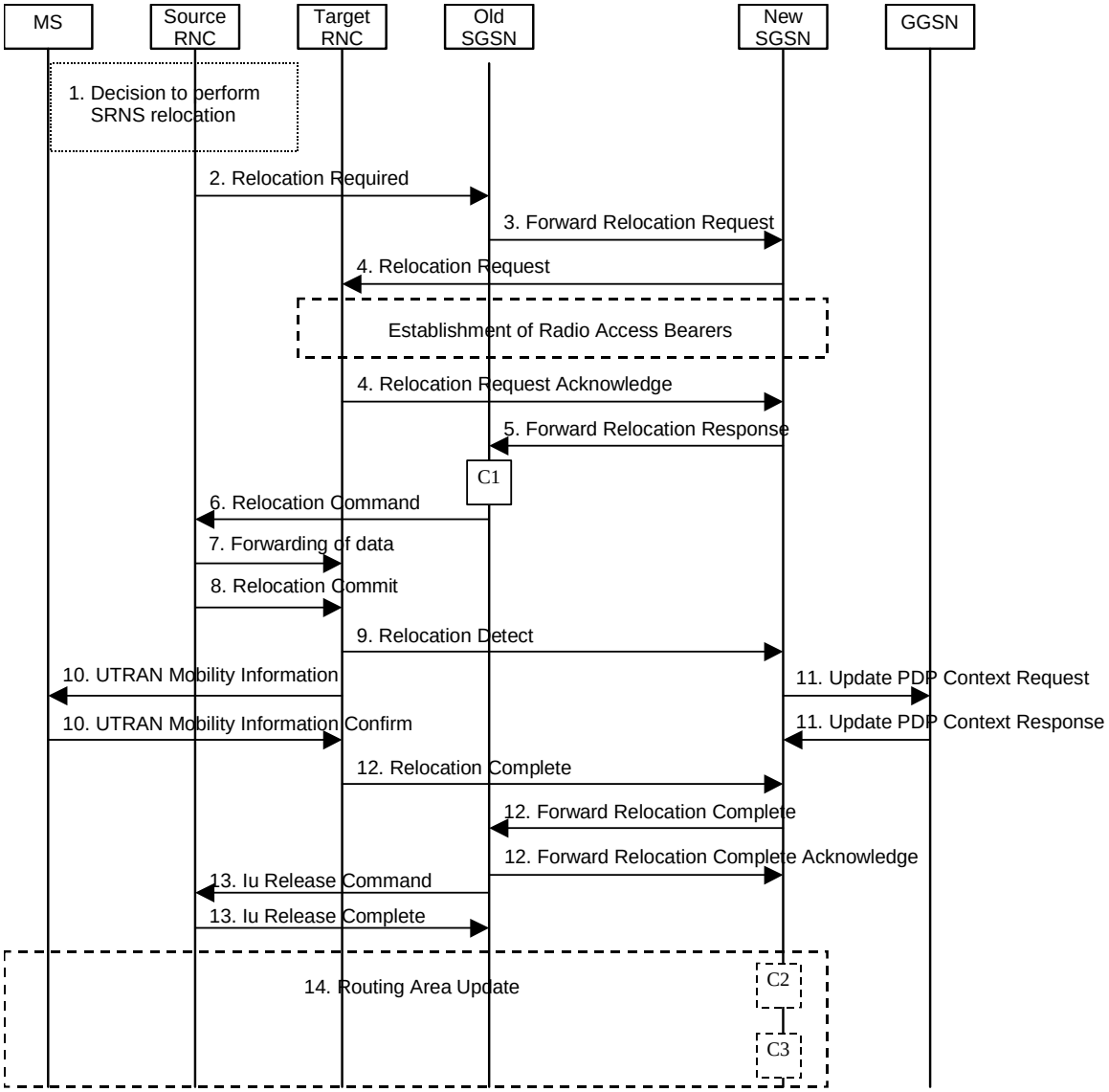


Figure 3: SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between MS and source SRNC (data flows via the target RNC, which acts as a drift RNC); GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source SRNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation, the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. The PDP context contains GGSN Address

for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (Iu mode only)"). The Forward Relocation Request message is applicable only in the case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source-RNC to target RNC transparent container, RABs to be setup) to the target RNC. Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as the existing Radio Bearers will be reallocated between the MS and the target RNC when the target RNC takes the role of the serving RNC. For each requested RAB, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated; the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.

5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from the new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and the RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data. Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may start data forwarding (step 7) and send Relocation Commit message (step 8) almost simultaneously except in the delivery order required case where step 7 triggers step 8. Target RNC may send Relocation Detect message (step 9) and UTRAN Mobility Information message (step 10) at the same time. Hence, target RNC may receive UTRAN Mobility Information Confirm message (step 10) while data forwarding (step 7) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

8) Before sending the Relocation Commit the uplink and downlink data transfer in the source, SRNC shall be suspended for RABs, which require delivery order. The source RNC shall start the data-forwarding timer. When the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC over the Iur interface. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role

from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP□PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC. PDCP sequence numbers are only sent by the source RNC for radio bearers, which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured.

If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink, respectively.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) The target SRNC sends a UTRAN Mobility Information message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC establishes and/or restarts the RLC, and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile-terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets.

Upon reception of the UTRAN Mobility Information message the MS may start sending uplink user data to the target SRNC. When the MS has reconfigured itself, it sends the UTRAN Mobility Information Confirm message to the target SRNC. This indicates that the MS is also ready to receive downlink data from the target SRNC.

If new the SGSN has already received the Update PDP Context Response message from the GGSN, it shall forward the uplink user data to GGSN over this new GTP-U tunnel. Otherwise, the new SGSN shall forward the uplink user data to that GGSN IP address and TEID(s), which the new SGSN had received earlier by the Forward Relocation Request message.

For all RABs, the target RNC should:

start uplink reception of data and start transmission of uplink GTP-PDUs towards the new SGSN;

start processing the already buffered and the arriving downlink GTP-PDUs and start downlink transmission towards the MS.

11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).

12) When the target SRNC receives the UTRAN Mobility Information Confirm message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect and upon reception of Relocation

Complete, the CN shall switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN shall signal to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

14) After the MS has finished the RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078)~~The CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result ""Continue"".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state in case the Iur interface is not available. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving a mobile in Iu mode.

The Combined Hard Handover and SRNS Relocation procedure is used to move the RAN to CN connection point at the RAN side from the source SRNC to the target RNC, while performing a hard handover decided by the RAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

If the target RNC is connected to a different SGSN than the source SRNC, an Inter-SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter-SGSN Routeing Area Update procedure.

Figure 4 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 5 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 4 and Figure 5 the MS is in PMM-CONNECTED state. Both figures are also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.

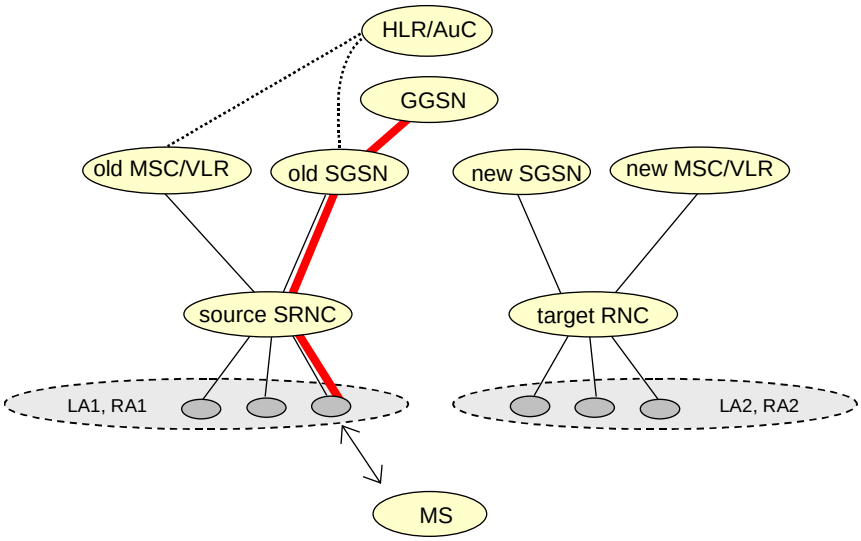


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.

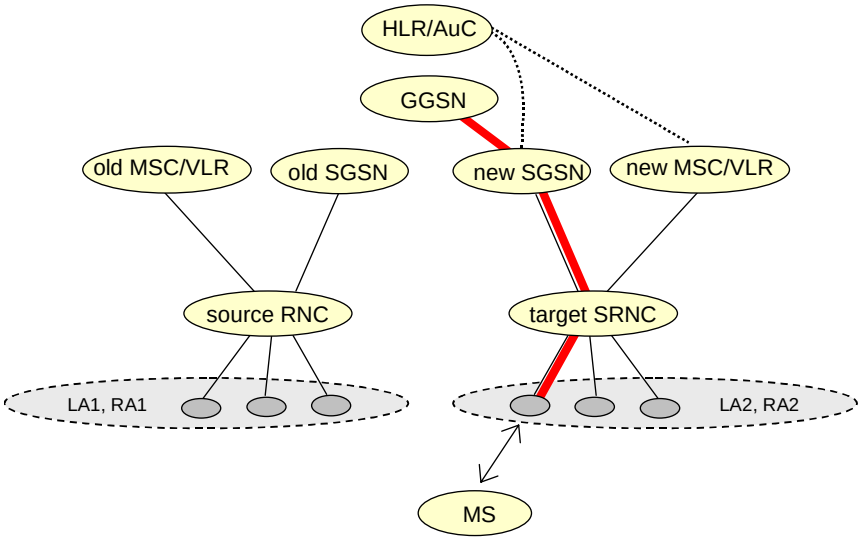


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

After the SRNS relocation and RA update, the MS is registered in the new SGSN and in the new MSC/VLR. The MS is in state PMM-CONNECTED towards the new SGSN and in MM IDLE state towards the new MSC/VLR. The target RNC is acting as serving RNC.

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 6. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. Furthermore, this signalling flow is also applicable for BSS to RNS relocation and vice-versa, as well as BSS to BSS relocation.

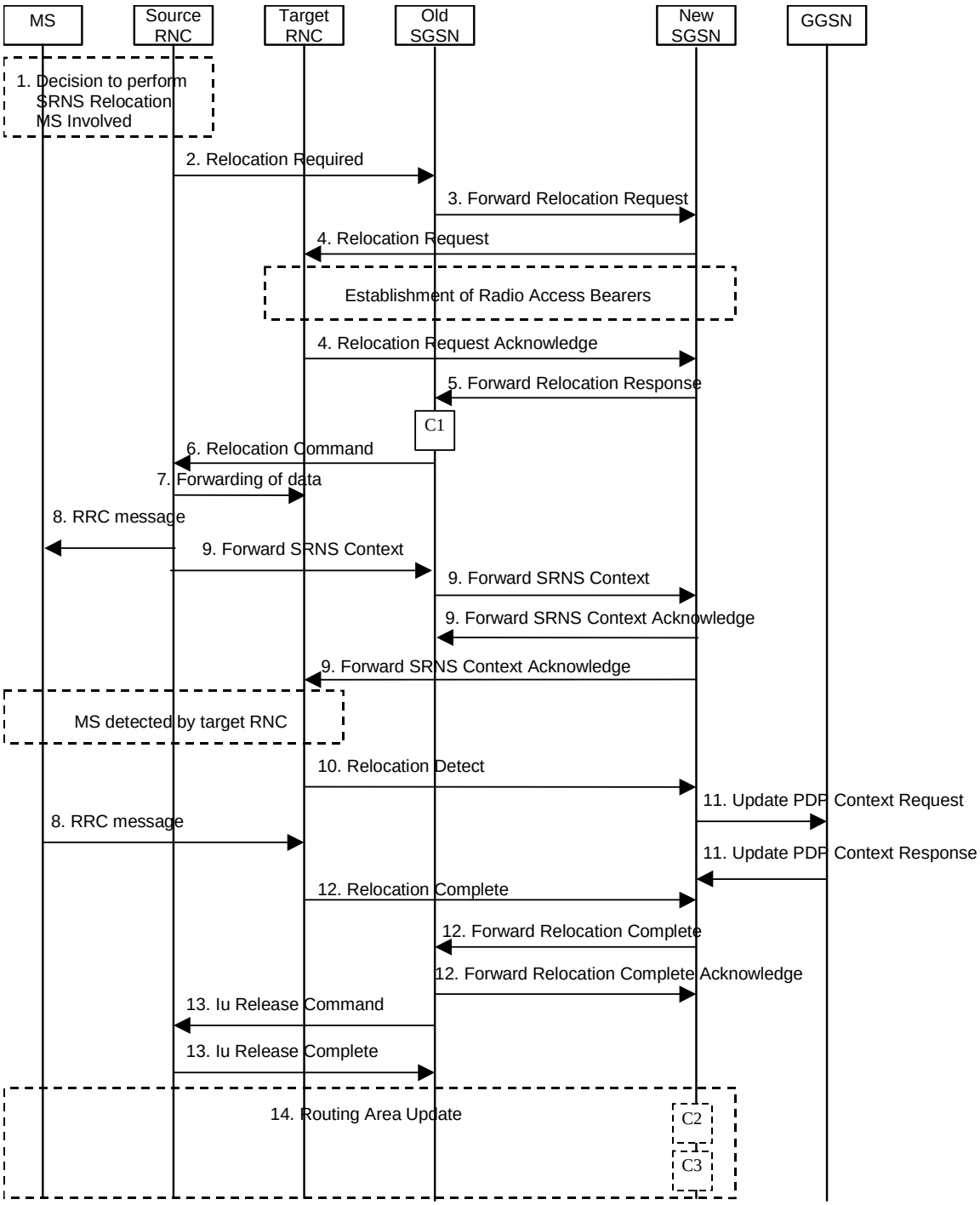


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

1) Based on measurement results and knowledge of the RAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between the MS and the source SRNC (no drift RNC available); GTP-U tunnel(s) between the source SRNC and the old SGSN; GTP-U tunnel(s) between the old SGSN and the GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source RNC To Target RNC Transparent Container includes the necessary information for

relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routeing Area Update procedure in subclause "Location Management Procedures (Iu mode only)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RAB To Be Setup) to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and the Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration in UTRAN case, or Handover From UTRAN, or Handover Command in GERAN Iu mode case) to be sent transparently via CN and source SRNC to the MS. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target-RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source SRNC. The Target RNC Information, one information element for each RAB to be set up, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) The source SRNC may, according to the QoS profile, begins the forwarding of data for the RABs to be subject for data forwarding.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may start data forwarding (step 7), send the RRCmessage to MS (step 8) and forward SRNS Context message to the old SGSN (step 9) almost simultaneously.

The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the GTP-PDUs exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

8) Before sending the RRC message the uplink and downlink data transfer shall be suspended in the source SRNC for RABs, which require delivery order. The RRC message is for example Physical Channel Reconfiguration for RNS to RNS relocation, or Intersystem to UTRAN Handover for BSS to RNS relocation, or Handover from UTRAN Command for BSS relocation, or Handover Command for BSS to BSS relocation. When the source SRNC is ready, the source RNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.

   When the MS has reconfigured itself, it sends an RRC message e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. If the Forward SRNS Context message with the sequence numbers is received, the exchange of packets with the MS may start. If this message is not yet received, the target RNC may start the packet transfer for all RABs, which do not require maintaining the delivery order.

9) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is acknowledged by a Forward SRNS Context Acknowledge message. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. PDCP sequence numbers are only sent by the source RNC for the radio bearers which used losslessPDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

   If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context uplink and downlink, respectively.

   The target RNC establishes and/or restarts the RLC and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target RNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received by the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile terminated packets successfully transferred before the SRNC relocation. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets.

10) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE Involved", the relocation execution trigger may be received from the Uu interface; i.e., when target RNC detects the MS on the lower layers. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

11) Upon reception of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS relocation is an inter-SGSN SRNS relocation, the new SGSN sends an Update PDP

Context Request (New SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) message to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the target SRNC receives the appropriate RRC message, e.g. Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message in UTRAN case, or the Handover To UTRAN Complete message or Handover Complete message in GERAN case, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate a Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or, if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired, the source RNC responds with an Iu Release Complete message.

14) After the MS has finished the reconfiguration procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078)~~The CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

-The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

-Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

In Figure 6, the procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur/Iur-g interface carries control signalling but no user data In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

The Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS Relocation procedure is used to move the RAN to CN connection point at the RAN side from the source SRNC to the target RNC, while performing a cell re-selection in the RAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routeing area is changed, this procedure is followed by an Intra-SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

Before the Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS Relocation and before the Routeing Area Update, the MS is registered in the old SGSN. The source RNC is acting as serving RNC or serving BSS.

After the Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS Relocation and after the Routeing Area Update, the MS is registered in the new SGSN. The MS is in state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as serving RNC.

The Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS relocation procedure for the PS domain is illustrated in Figure 7. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. This signalling flow is also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.

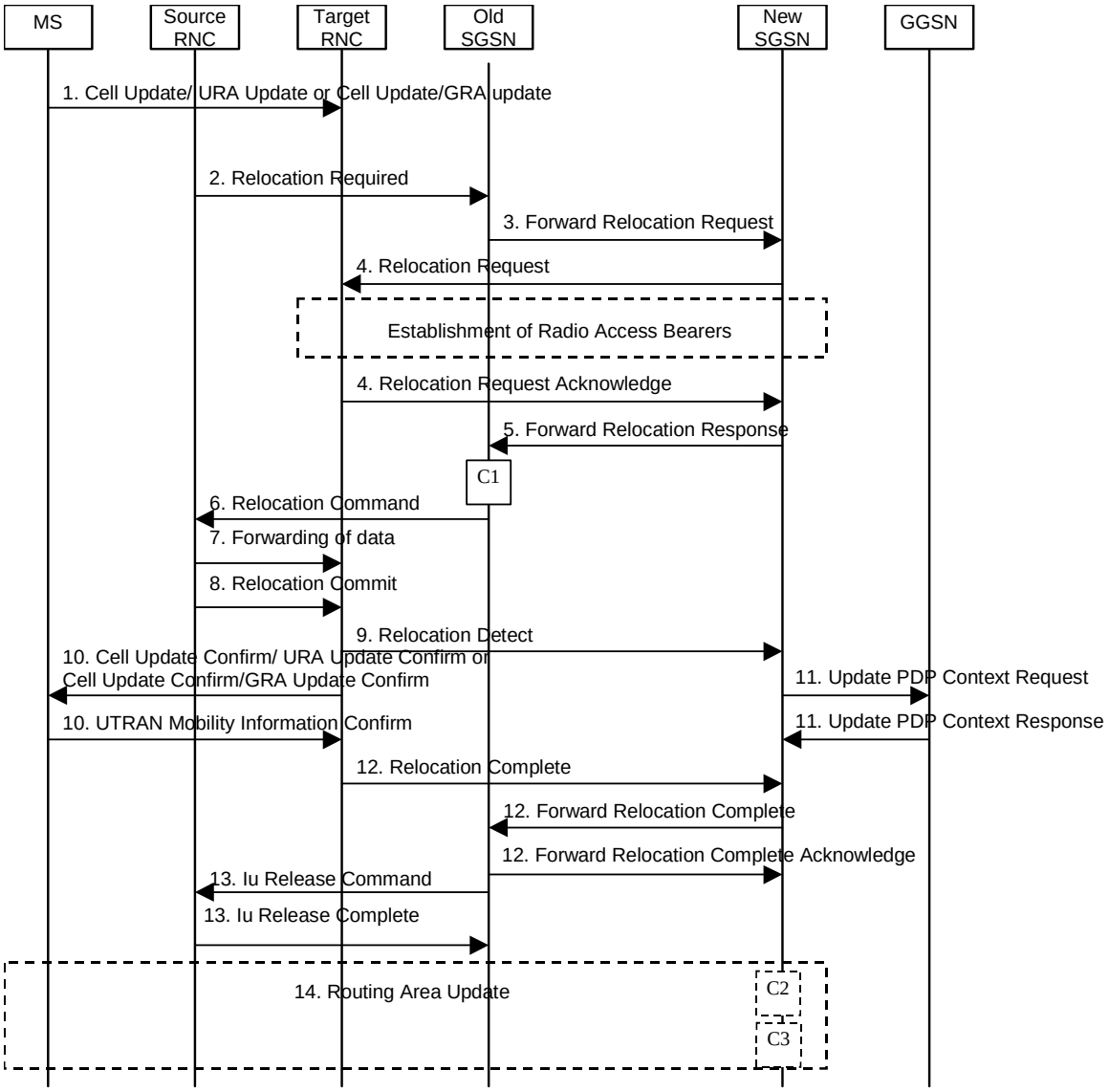


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update or a Cell Update / GRA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). The source SRNC decides whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this subclause describes the case where a combined cell / URA update and SRNS relocation applies. In this case no radio bearer is established between the source SRNC and the UE. Nonetheless the following tunnel(s) are established: GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.

2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including MS Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In the case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) message to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN, see Routeing Area Update procedure in subclause "Location Management Procedures (Iu mode only)". The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

   After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and a Iu Transport Association which corresponds to the downlink Tunnel Endpoint Identifier for user data. The target-RNC may simultaneously receive for each RAB to be set up downlink user packets both from the source SRNC and from the new SGSN.

   After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnels are established between the target RNC and the new-SGSN.

5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from the source SRNC the forwarded downlink packets, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward

downlink data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs subject to data forwarding and starts the data-forwarding timer. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

   Note: The order of steps, starting from step 7 onwards, does not necessarily reflect the order of events. For instance, source RNC may send data forwarding (step 7) and start Relocation Commit message (step 8) almost simultaneously. Target RNC may send Relocation Detect message (step 9) and Cell Update Confirm/URA Update Confirm (or Cell Update Confirm/GRA Update Confirm) message (step 10) at the same time. Hence, target RNC may receive the UTRAN or GERAN Mobility Information Confirm message from MS (step 10) while data forwarding (step 8) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

   Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

8) Before sending the Relocation Commit the uplink and downlink data transfer in the source, SRNC shall be suspended for RABs, which require delivery order.

   When the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC over the UTRAN Iur interface or over the GERAN Iur-g interface, respectively. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC, and to move the SRNS role from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. . PDCP sequence numbers are only sent by the source RNC for radio bearers, which used lossless PDCP [57]. The use of lossless PDCP is selected by the RNC when the radio bearer is set up or reconfigured. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

   If delivery order is required (QoS profile), consecutive GTP-PDU sequence numbering shall be maintained throughout the lifetime of the PDP context(s). Therefore, during the entire SRNS relocation procedure for the PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for uplink and downlink respectively.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) The target SRNC sends a Cell Update Confirm / URA Update Confirm or Cell Update Confirm / GRA Update Confirm message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

    Upon reception of the Cell Update Confirm / URA Update Confirm or Cell Update Confirm / GRA Update Confirm message the MS may start sending uplink user data to the target SRNC. When the MS has reconfigured itself, it sends the UTRAN Mobility Information Confirm message to the target SRNC. This indicates that the MS is also ready to receive downlink data from the target SRNC.

    If the new SGSN has already received the Update PDP Context Response message from the GGSN, it shall forward the uplink user data to the GGSN over this new GTP-U tunnel. Otherwise, the new SGSN shall forward

the uplink user data to that GGSN IP address and TEID(s), which the new SGSN had received earlier by the Forward Relocation Request message.

The target SRNC and the MS exchange the PDCP sequence numbers; PDCP-SNU and PDCP-SND. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP in the source RNC. PDCP-SND confirms all mobile terminated packets successfully transferred before the SRNC relocation procedure. . If PDCP-SND confirms the reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in the RNC per radio bearer, which used lossless PDCP in the source RNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the SRNC relocation. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the target SRNC shall discard these packets.

11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

14) After the MS has finished the Cell / URA update or the Cell / GRA update and RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078)~~The CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

If the SRNS Relocation is intra-SGSN, then the above mentioned CAMEL procedures calls shall not be performed.

If Routeing Area Update occurs, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078):

C2) CAMEL GPRS Routeing Area Update-Session

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue". For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

6.9.2.2.4 SRNS Relocation Cancel Procedure

The purpose of the SRNS Relocation Cancel procedure is to cancel an ongoing SRNS relocation. The SRNS Relocation Cancel procedure may be initiated during or after the Relocation Preparation procedure and may be initiated by the source RNC.

The SRNS Relocation Cancel procedure is illustrated in Figure 8. The sequence is valid for cancelling both an intra-SGSN SRNS relocation and an inter-SGSN SRNS relocation.

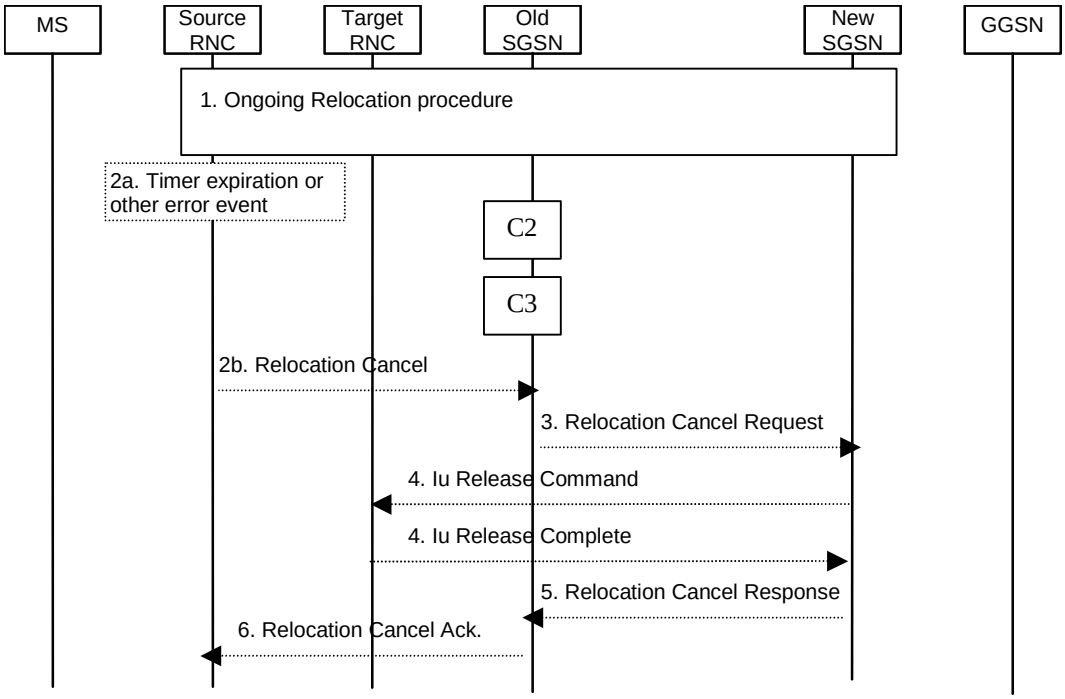


Figure 8: SRNS Cancel Relocation Procedure

1) An SRNS Relocation procedure has started, as specified in section 6.9.2.2.1.

2a) The SRNS Cancel Relocation may be initiated by a timer expiry or by an error event in the source RNC.

2b) When one of conditions in 2a is satisfied, the source RNC sends a Relocation Cancel (Cause) to the old SGSN. Cause indicates the reason for cancelling the ongoing SRNS relocation.

3) The old SGSN sends a Relocation Cancel Request (IMSI, RANAP Cause) to the new SGSN to indicate that the ongoing SRSN relocation should be cancelled. RANAP Cause contains the cause value received by the source RNC in the Relocation Cancel message.

4) The new SGSN sends an Iu Release Command (Cause) to request from the target RNC to release the Iu resources already allocated for the SRNS relocation, or to cancel the ongoing allocation of Iu resources for the SRNS relocation. Cause is set equal to RANAP Cause, i.e. to whatever cause value was included in the Relocation Cancel Request received from old SGSN. The target RNC releases the requested Iu resources and responds with an Iu Release Complete.

5) The new SGSN acknowledges the cancellation of the ongoing SRNS Relocation by sending a Relocation Cancel Response to the old SGSN.

6) The old SGSN responds to the source RNC with a Relocation Cancel Ack message.

In case of inter SGSN relocation CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

The procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

If the SRNS Relocation is inter-SGSN, then the following CAMEL procedure calls shall be performed (see referenced procedures in 3GPP TS 23.078)~~In case of inter SGSN relocation CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:~~

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

The procedure is called several times: once per PDP context. It returns as result "Continue".

For C2 and C3: refer to Routing Area Update procedure description for detailed message flow.

3GPP TSG-SA2#22
Phoenix, USA, 14th – 18th January 2002

Tdoc S2-020242

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **304** ⌘ rev ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Behaviour of the MS on entering a new PLMN
Source:	⌘	One2One Personal Communications
Work item code:	⌘	TEI4
Date:	⌘	14th January 2002
Category:	⌘	**A**
Release:	⌘	REL- 5

Use one of the following categories:
F *(essential 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)*

Reason for change:	⌘	When a MS moves from one PLMN to another PLMN, the expected practise is to ensure that the MS performs a RAU just as it could do in case of an inter SGSN RAU within one PLMN. However, for 2G the current version of TS 23.060 for Rel-5 provides another option which suggests that upon entering a new PLMN the MS shall enter IDLE state or perforum RAU. This CR proposes to remove this option for the following reasons: • There is ambiguity on whether the MS should perform a RAU or enter IDLE state. It is not specified how the MS determines which of the two operations should be performed • Changing PLMN is not different than changing RAI. • Alignment with the current of 23.060 for R99
Summary of change:	⌘	This CR intends to remove the ambiguity of the text by providing clarification on the option which states that the MS shall enter IDLE state when entering a new PLMN.
Consequences if not approved:	⌘	• Different handsets will behave differently upon entering a new PLMN (i.e. some will perform RAU and some will enter into IDLE state). • Misalignment with 23.060 for R99

Clauses affected:	⌘	6.9.1, 6.9.2
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.9.1 Location Management Procedures (GSM only)

The PLMN shall provide information for the MS to be able to:

- detect when it has entered a new cell or a new RA; and
- determine when to perform periodic RA updates.

The MS detects that it has entered a new cell by comparing the cell's identity with the cell identity stored in the MS's MM context. The MS detects that a new RA has been entered by periodically comparing the RAI stored in its MM context with that received from the new cell. The MS shall consider hysteresis in signal strength measurements.

When the MS camps on a new cell, possibly in a new RA, this indicates one of three possible scenarios:

- a cell update is required;
- a routeing area update is required; or
- a combined routeing area and location area update is required.

In all three scenarios the MS stores the cell identity in its MM context.

If the MS enters a new PLMN, the MS shall ~~either~~ perform a routeing area update, ~~or enter IDLE state.~~unless it is not allowed to do so for the reasons specified in TS 24.008 [13] and TS 23.122 [7b].

In network mode of operation II and III, whenever an MS determines that it shall perform both an LA update and an RA update:

1. It shall initiate the LA update and then initiate the RA update, if the MS is in class A mode of operation.
2. It shall perform the LA update first if the MS is not in class A mode of operation.

Routeing Area Update Request messages shall be sent unciphered, since in the inter-SGSN routeing area update case the new SGSN shall be able to process the request.

Next Change

6.9.2 Location Management Procedures (Iu-mode only)

In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

Refer to 3GPP TS 25.301 for further information on the location management procedures for the UMTS radio.

The PLMN shall provide information for the MS to be able to:

- detect when it has entered a new cell or a new RA; and
- determine when to perform periodic RA updates.

In this specification, only the Location Management procedures related to the CN are described. These procedures are:

- a routeing area update procedure; and
- Serving RNC relocation procedure.

An MS detects entering a new cell by comparing the cell's identity with the cell identity stored in the MS. By comparing the RAI stored in the MS's MM context with the RAI received from the network, the MS detects that an RA update shall be performed. In RRC-CONNECTED mode (PMM-CONNECTED state or CS MM CONNECTED state), the MS is informed of RAI and Cell Identity by the serving RNC via an "MM information" message at the RRC layer. In RRC-IDLE state, the MS is informed of RAI and Cell Identity by the broadcast system information at the RRC layer.

If the MS enters a new PLMN, the MS shall perform a routeing area update, unless it is not allowed to do so for the reasons specified in TS 24.008 [13] and TS 23.122 [7b].

In network mode of operation II, whenever an MS determines that it shall perform both an LA update and an RA update, the MS shall start the LA update first. The MS should start the RA update procedure before the LA update is completed.

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020539***
Sophia Antipolis, France, 18-22 February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **312** ⌘ ev **-** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Correction of CAMEL procedure calls at SRNS relocation
Source:	⌘	Ericsson
Work item code:	⌘	TEI4
Date:	⌘	15 February 2002
Category:	⌘	**A**
Release:	⌘	REL-4

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)

Reason for change: ⌘

In the Routeing Area Update procedures the CAMEL interaction point C1 (PDP context Disconnection) is placed after the SGSN Context Response has been sent by the old SGSN but before it receives the SGSN Context Acknowledge.

If the Security Functions performed by the new SGSN before sending the SGSN Context Acknowledge fail to authenticate the MS, the RAU shall be rejected and the old SGSN shall continue as if the SGSN Context Request was never received. But in this case the PDP Context Disconnection has already been reported to the SCP, hence the PDP context continues without CAMEL control.

The real indication that the PDP context has been successfully handed over to the new SGSN is indeed the SGSN Context Acknowledge.

Note that sections 6.13.2.1 and 6.13.2.2 (inter-SGSN inter-system change) show the correct placement of the CAMEL procedure calls. However some editorial corrections are needed in the corresponding text of section 6.13.2.2.

Other Changes:

In section 6.9.2.1, in addition to the above-mentioned problem, the CAMEL interaction point C2 is placed after the packet forwarding has started. There is no reason to handle this case differently; C2 shall be placed right after the SGSN Context Acknowledge, after C1.

Summary of change: ⌘

In sections 6.9.1.2.2, 6.9.1.3.2 and 6.9.2.1: place the CAMEL procedure calls CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach right after the SGSN Context Acknowledge. A single CAMEL interaction point C1 is used in the figure, which is aligned with the way this is presented in sections 6.13.2.1 and 6.13.2.2.

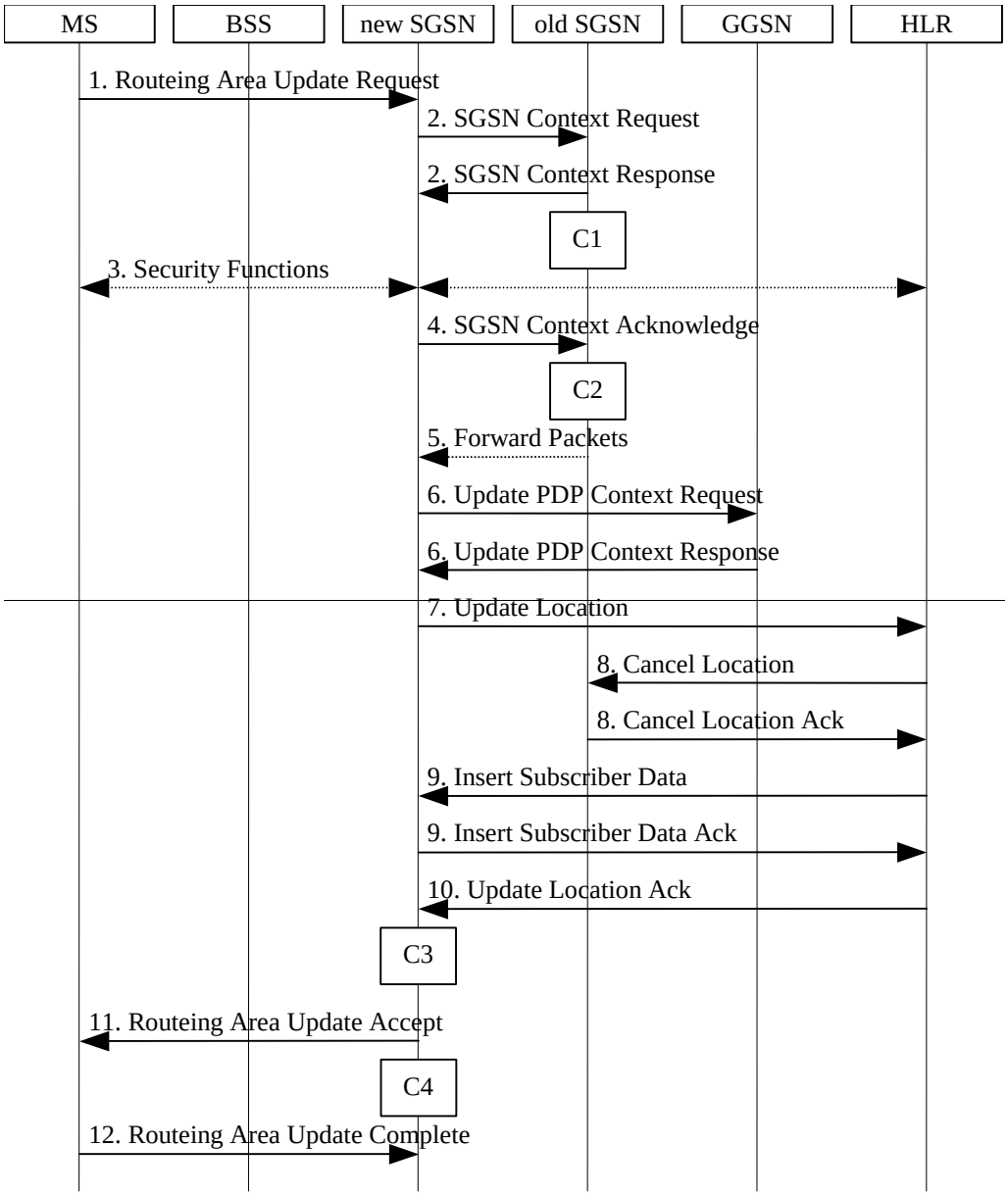
In sections 6.13.2.2: correct some editing problems in the description of the

		CAMEL interaction point C1 in line with section 6.13.2.1.
Consequences if not approved:	⌘	At inter SGSN Routeing Area Update, if the new SGSN fails to authenticate the MS, the PDP context would continue in the old SGSN without CAMEL control.

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2; 6.9.2.1 and 6.13.2.2			
Other specs affected:	⌘	☐	Other core specifications	⌘	
		☐	Test specifications		
		☐	O&M Specifications		
Other comments:	⌘				

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 33.


MS
BSS
new SGSN
old SGSN
GGSN
HLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
C1
3. Security Functions
4. SGSN Context Acknowledge
C2
5. Forward Packets
6. Update PDP Context Request
6. Update PDP Context Response
7. Update Location
8. Cancel Location
8. Cancel Location Ack
9. Insert Subscriber Data
9. Insert Subscriber Data Ack
10. Update Location Ack
C3
11. Routeing Area Update Accept
C4
12. Routeing Area Update Complete

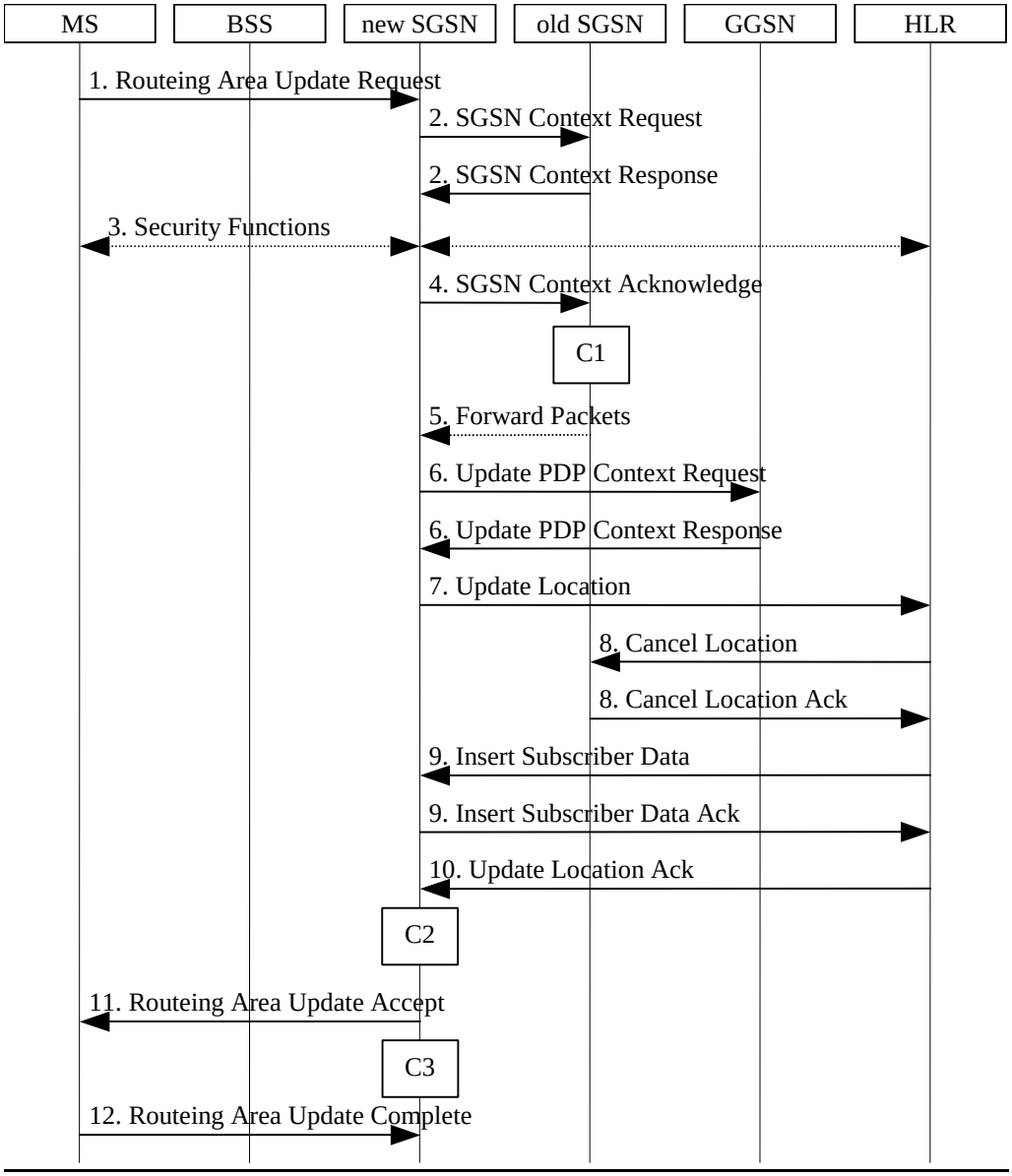


Figure 33: Inter SGSN Routeing Area Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the transmission of N-PDUs to the MS. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

3) Security functions may be executed. These procedures are defined in clause "Security Function". Ciphering mode shall be set if ciphering is supported.

   If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.

4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, then the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.

6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TEID).

7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter-SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

11) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS, is not allowed to be attached in the SGSN, or if subscription checking fails, the new SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

12) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, , or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS does not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, the old SGSN stops forwarding N-PDUs to the new SGSN.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter IDLE state.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as ~~s~~result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

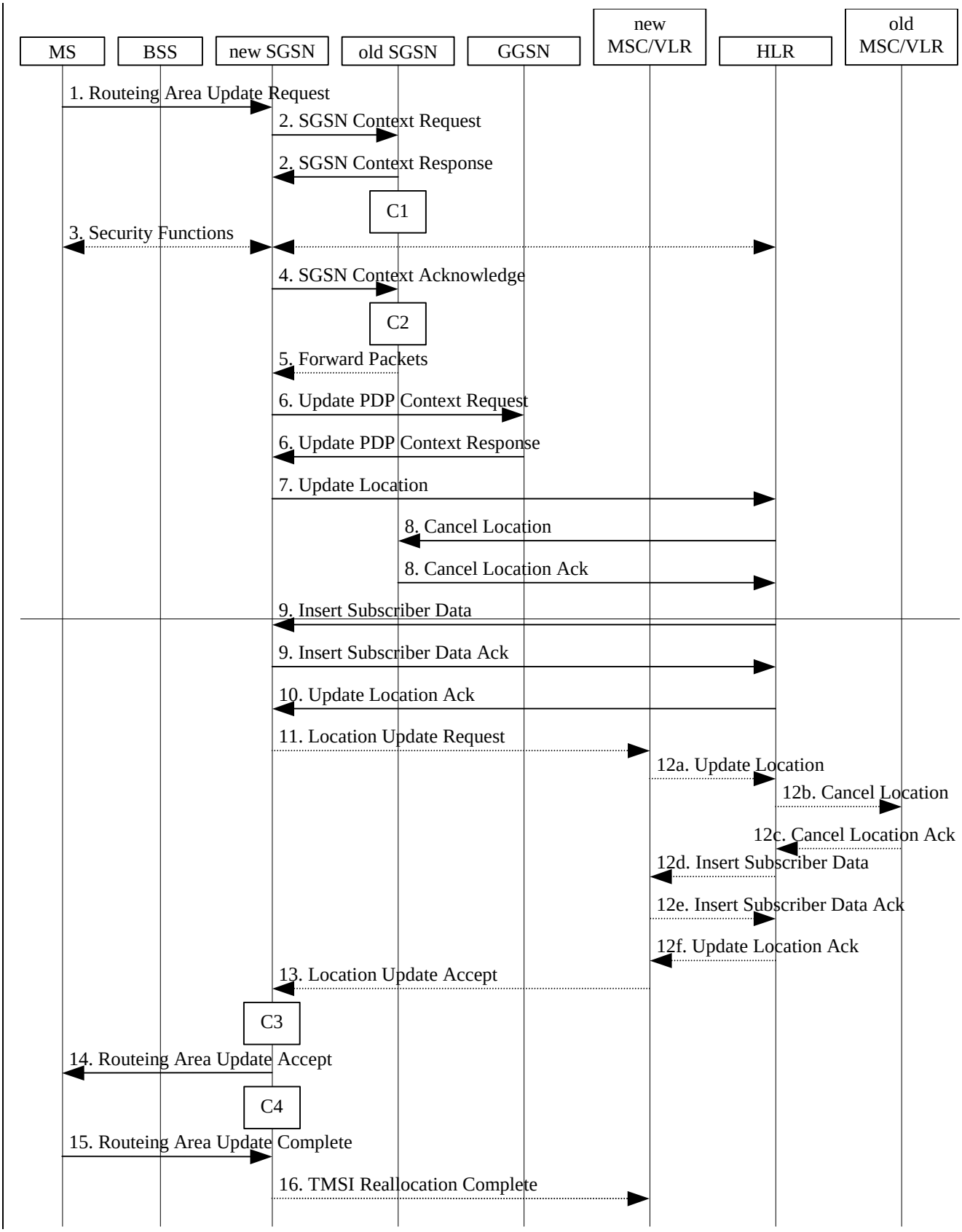
C3~~4~~) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter-SGSN) procedure is illustrated in Figure 35.


MS
BSS
new SGSN
old SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
C1
3. Security Functions
4. SGSN Context Acknowledge
C2
5. Forward Packets
6. Update PDP Context Request
6. Update PDP Context Response
7. Update Location
8. Cancel Location
8. Cancel Location Ack
9. Insert Subscriber Data
9. Insert Subscriber Data Ack
10. Update Location Ack
11. Location Update Request
12a. Update Location
12b. Cancel Location
12c. Cancel Location Ack
12d. Insert Subscriber Data
12e. Insert Subscriber Data Ack
12f. Update Location Ack
13. Location Update Accept
C3
14. Routeing Area Update Accept
C4
15. Routeing Area Update Complete
16. TMSI Reallocation Complete

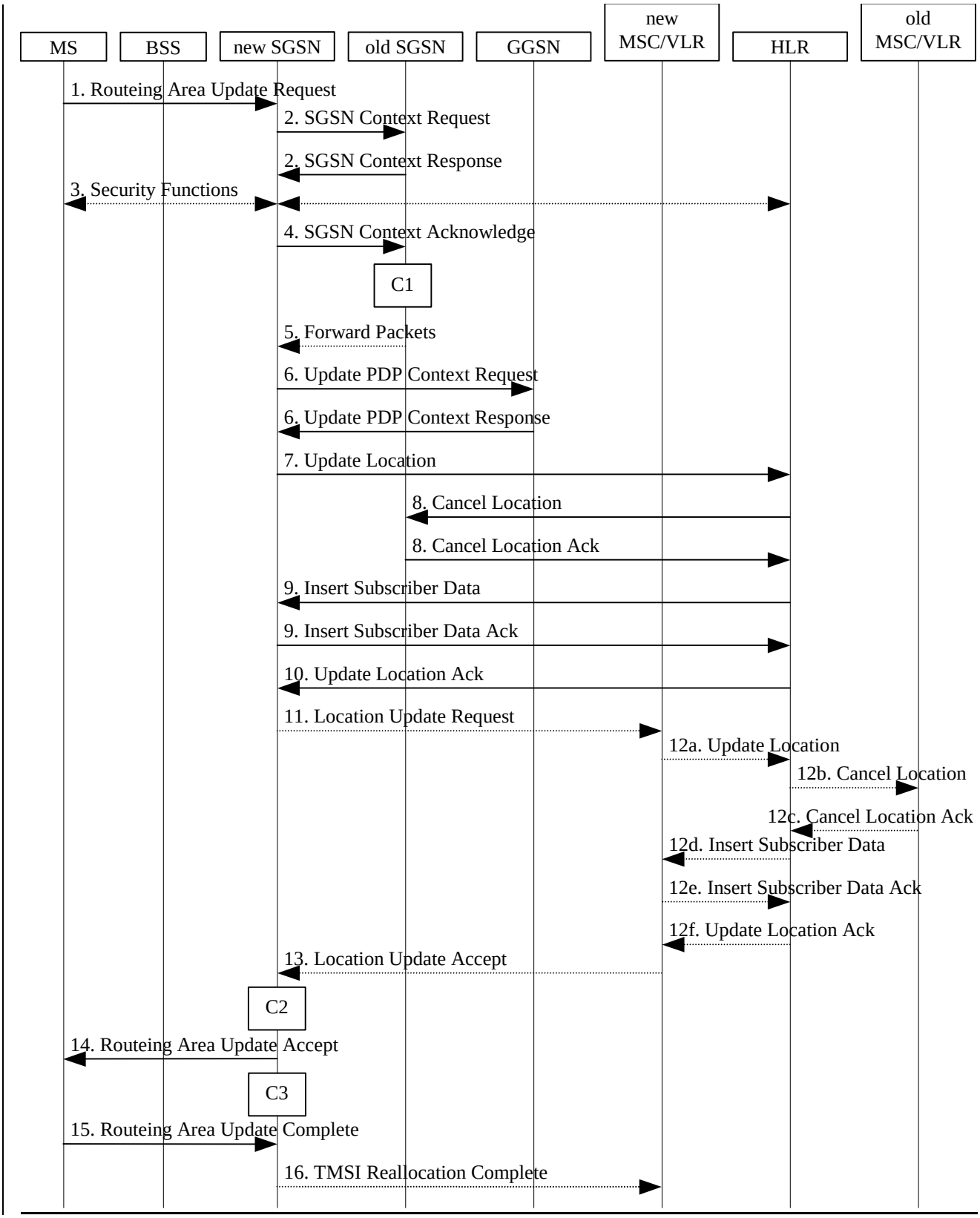


Figure 35: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and

supported GPRS ciphering algorithms as defined in 3GPP TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous and the DRX cycle length.

2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the downlink transfer. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

3) Security functions may be executed. These procedures are defined in clause "Security Function". Ciphering mode shall be set if ciphering is supported. If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.

4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.

6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TEID).

7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

11) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI via a table in the SGSN. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.

12) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

    a) The new VLR sends an Update Location (new VLR) to the HLR.

    b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

    c) The old VLR acknowledges with Cancel Location Ack (IMSI).

    d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

    e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

    f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

13) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

14) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

15) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

16) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter IDLE state.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful location update is performed.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach.~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3~~4~~) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

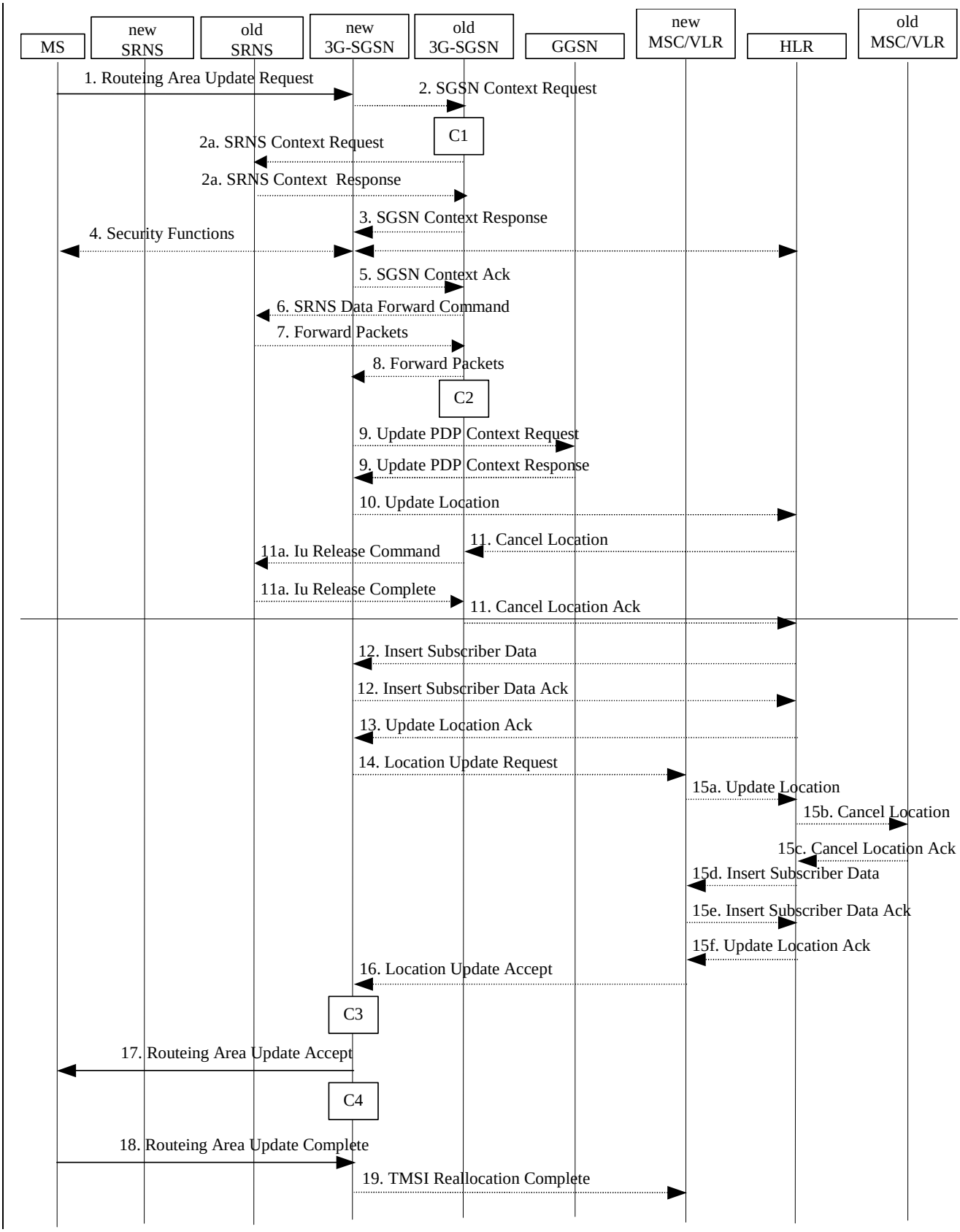
6.9.2.1 Routeing Area Update Procedure

A routeing area update takes place when an attached MS detects that it has entered a new RA or when the periodic RA update timer has expired or when RRC connection is released with cause "Directed Signalling connection re-establishment" or when the MS has to indicate new access capabilities to the network.

The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the GGSNs or the HLR about the new MS location. A periodic RA update is always an intra-SGSN routeing area update. If the network operates in mode I, an MS that is both GPRS-attached and IMSI-attached shall perform the Combined RA / LA Update procedures.

In Iu mode, an RA update is either an intra-SGSN or inter-SGSN RA update, either combined RA / LA update or only RA update, either initiated by an MS in PMM-CONNECTED (only valid after a Serving RNS Relocation Procedure, see clause 6.9.2.2) or in PMM-IDLE state. All the RA update cases are contained in the procedure illustrated in Figure 36.

NOTE 1: The network may receive an RA update from a UE in PMM-CONNECTED state over a new Iu signalling connection. This could happen when the UE enters PMM-IDLE state on receipt of RRC Connection Release with cause "Directed Signalling connection re-establishment" and initiates an RA or Combined RA update procedure (see clause 6.1.2.4.1).


MS
new SRNS
old SRNS
new 3G-SGSN
old 3G-SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
C1
2a. SRNS Context Request
2a. SRNS Context Response
3. SGSN Context Response
4. Security Functions
5. SGSN Context Ack
6. SRNS Data Forward Command
7. Forward Packets
8. Forward Packets
C2
9. Update PDP Context Request
9. Update PDP Context Response
10. Update Location
11. Cancel Location
11a. Iu Release Command
11a. Iu Release Complete
11. Cancel Location Ack
12. Insert Subscriber Data
12. Insert Subscriber Data Ack
13. Update Location Ack
14. Location Update Request
15a. Update Location
15b. Cancel Location
15c. Cancel Location Ack
15d. Insert Subscriber Data
15e. Insert Subscriber Data Ack
15f. Update Location Ack
16. Location Update Accept
C3
17. Routeing Area Update Accept
C4
18. Routeing Area Update Complete
19. TMSI Reallocation Complete

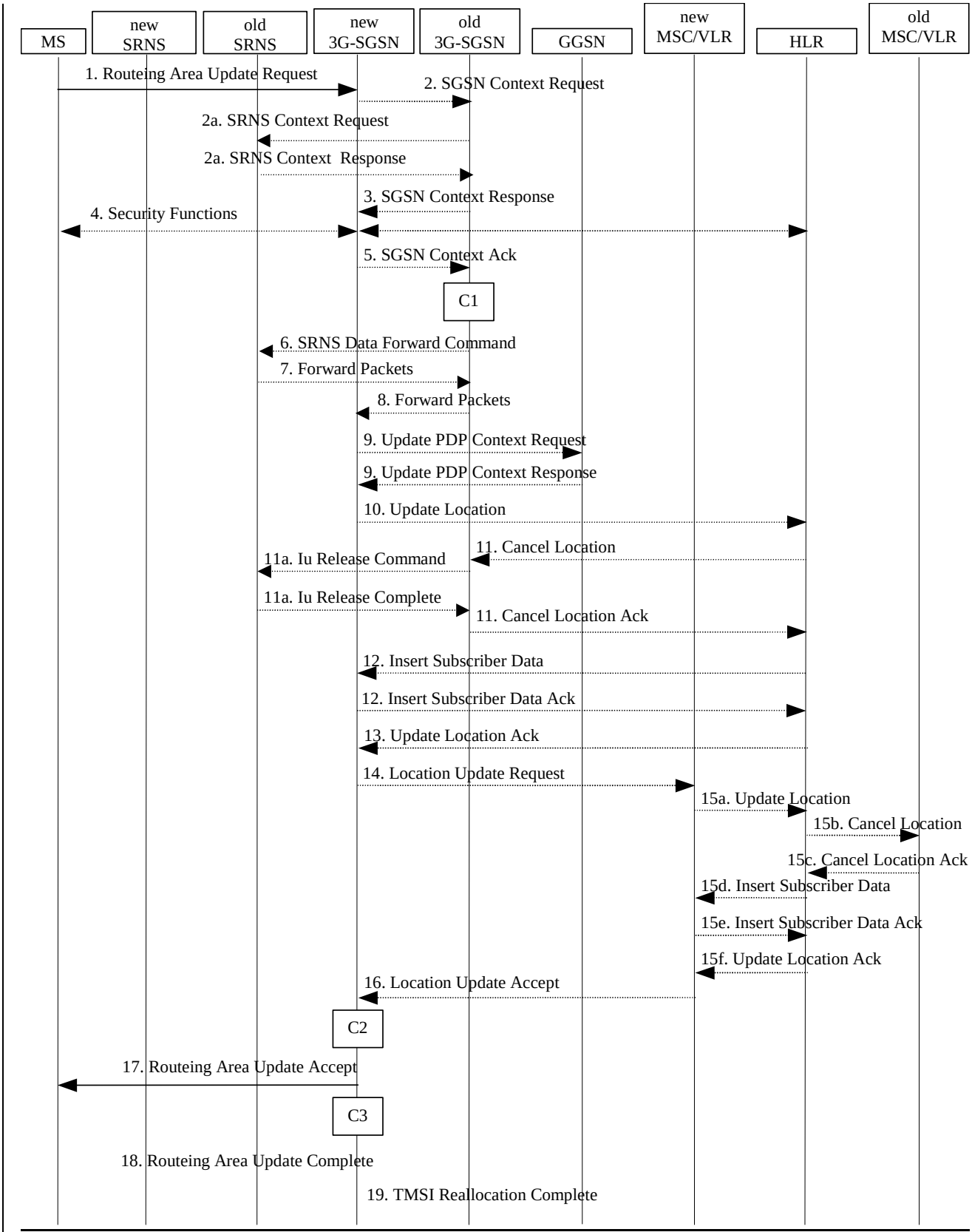


Figure 36: UMTS RA Update Procedure

1) The RRC connection is established, if not already done. The MS sends a Routeing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters, MS Network Capability) to the new SGSN. The MS shall set a follow-on request if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. Update Type shall indicate:

   - RA Update if the RA Update is triggered by a change of RA;
   - Periodic RA Update if the RA update is triggered by the expiry of the Periodic RA Update timer;
   - Combined RA / LA Update if the MS is also IMSI-attached and the LA update shall be performed in network operation mode I (see clause "Interactions Between SGSN and MSC/VLR"); or
   - Combined RA / LA Update with IMSI attach requested if the MS wants to perform an IMSI attach in network operation mode I.

   The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS. Classmark is described in clause "MS Network Capability". DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

NOTE 2: Sending the Routeing Area Update Request message to the SGSN triggers the establishment of a signalling connection between UTRAN and SGSN for the concerned MS.

2) If the RA update is an Inter-SGSN Routeing area update and if the MS was in PMM-IDLE state, the new SGSN sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN starts a timer.. If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause.

2a) If the MS is PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is in the PMM-CONNECTED state and the RAU was received over another Iu connection than the established one, the old SGSN sends an SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message. Upon reception of this message, the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

3) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next PDU to be sent to the MS. Each PDP Context also includes the PDCP sequence numbers if PDCP sequence numbers are received from the old SRNS. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request. The GTP sequence numbers received from the old 3G-SGSN are only relevant if delivery order is required for the PDP context (QoS profile).

4) Security functions may be executed. These procedures are defined in clause "Security Function". If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) If the RA update is an Inter-SGSN Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be

updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

6) If the MS is in PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.

7) For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with their related PDCP sequence numbers and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.

8) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN. No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

9) If the RA update is an Inter-SGSN RA Update and if the MS wasnot in PMM-CONNECTED state in the new 3G-SGSN, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, Tunnel Endpoint Identifier,) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier). Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state in the new 3G-SGSN, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

10) If the RA update is an Inter-SGSN RA Update, the new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

11) If the RA update is an Inter-SGSN RA Update, the HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM context. Otherwise, the contexts are removed only when the timer expires. It also ensures that the MM context is kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

11a) On receipt of Cancel Location, if the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNC. When the data-forwarding timer has expired, the SRNS responds with an Iu Release Complete message.

12) If the RA update is an nter-SGSN RA Update, the HLR sends Insert Subscriber Data (IMSI, subscription data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

13) If the RA update is an Inter-SGSN RA Update, the HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

14) If Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the association has to be established, and the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with ISI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI via a table in the SGSN. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 8). The VLR creates or updates the association with the SGSN by storing SGSN Number.

15) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

c) The old VLR acknowledges with Cancel Location Ack (IMSI).

d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

16) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

17) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).

18) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete message to the SGSN.

19) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

NOTE 3: Steps 15, 16, and 19 are performed only if step 14 is performed.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

NOTE: In case MS was in PMM-CONNECTED state the PDP Contexts are sent already in the Forward Relocation Request message as described in subclause "Serving RNS relocation procedures".

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.

If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-PS services until a successful location update is performed.

The CAMEL procedure call shall~~s~~ be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach.~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C34) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

6.13.2.2 GSM to UMTS Inter-SGSN Change

The inter-system change from GSM to UMTS takes place when a GPRS-attached MS changes from GSM radio access to UTRAN and the UTRAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a UMTS RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update, these RA update cases are illustrated in Figure 55.

If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3GPP TS 23.122), as no combined RA / LA updates are performed during a CS connection.

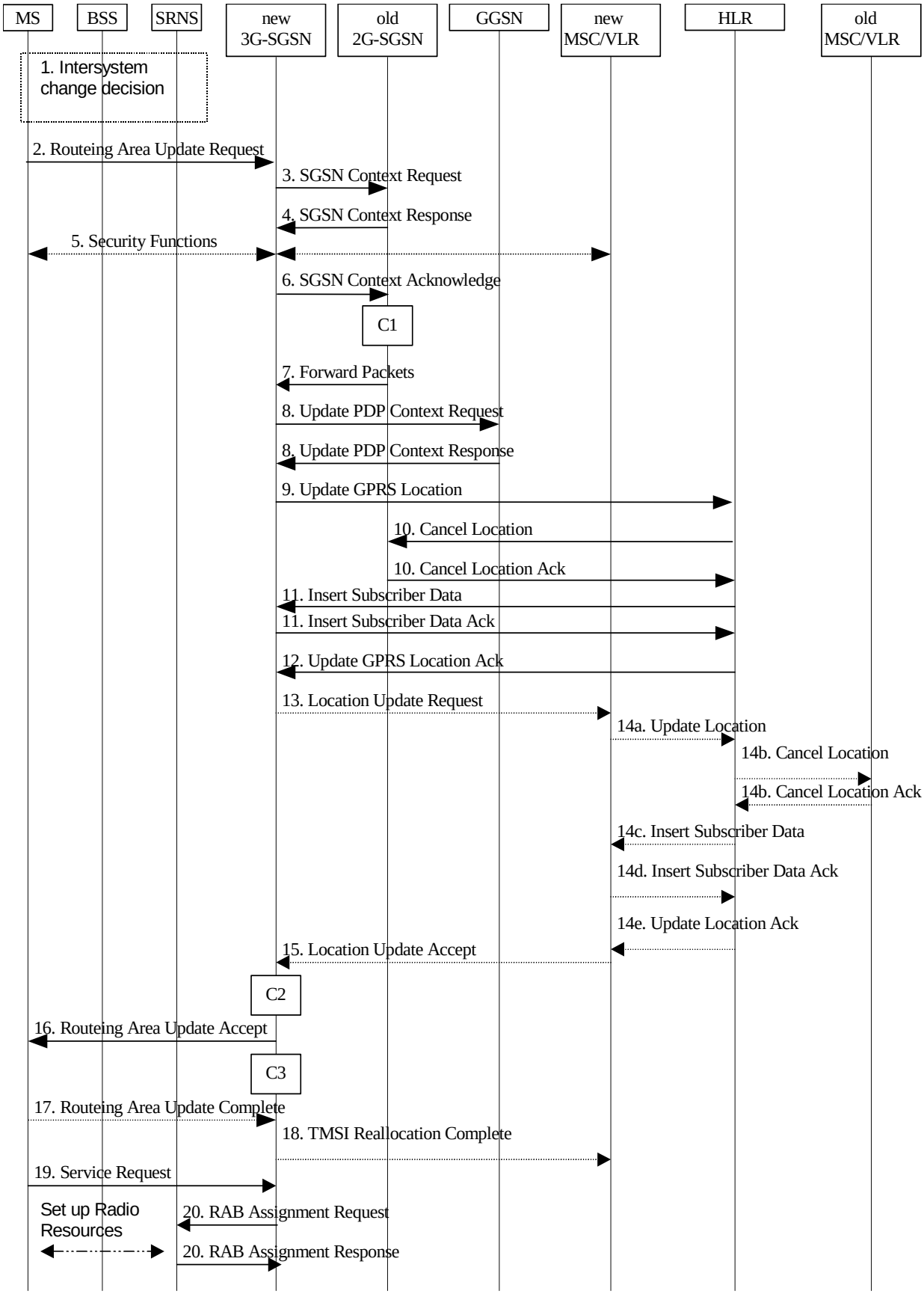


Figure 55: GSM to UMTS Inter SGSN Change

1) The MS or BSS or UTRAN decides to perform an inter-system change, which makes the MS switch to a new cell that supports UMTS radio technology, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

4) The old 2G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. Each PDP Context includes the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode SNDCP to the MS and the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode SNDCP from the MS. The new 3G-SGSN derives the corresponding PDCP sequence numbers from these N-PDU sequence numbers by adding eight most significant bits "1". These PDCP sequence numbers are stored in the 3G-SGSN PDP contexts. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

5) Security functions may be executed.

6) The new 3G-SGSN sends an SGSN Context Acknowledge message to the old 2G-SGSN. This informs the old 2G-SGSN that the new 3G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

7) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. Additional N-PDUs received from the GGSN before the timer described in step 3 expires are also duplicated and tunnelled to the new 3G-SGSN. N-PDUs that were already sent to the MS in acknowledged mode SNDCP and that are not yet acknowledged by the MS are tunnelled together with their related SNDCP N-PDU sequence number. No PDCP sequence numbers shall be indicated for these N-PDUs. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.

8) The new 3G-SGSN sends an Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) message to each GGSN concerned. Each GGSN updates its PDP context fields and returns an Update PDP Context Response (TEID) message.

9) The new 3G-SGSN informs the HLR of the change of SGSN by sending an Update GPRS Location (SGSN Number, SGSN Address, IMSI) message to the HLR.

10) The HLR sends a Cancel Location (IMSI, Cancellation Type) message to the old 2G-SGSN. The old 2G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. If the timer is running, the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with a Cancel Location Ack (IMSI) message.

11) The HLR sends an Insert Subscriber Data (IMSI, GPRS Subscription Data) message to the new 3G-SGSN. The 3G-SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

12) The HLR acknowledges the Update GPRS Location by returning an Update GPRS Location Ack (IMSI) message to the new 3G-SGSN.

13) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI by the 3G-SGSN. The 3G-SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 12). The VLR creates or updates the association with the 3G-SGSN by storing SGSN Number.

14) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

   b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

   c) The old VLR acknowledges with Cancel Location Ack (IMSI).

   d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

   e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

   f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

15) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the 3G-SGSN. VLR TMSI is optional if the VLR has not changed.

16) The new 3G-SGSN validate the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the new 3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new 3G-SGSN constructs MM and PDP contexts for the MS. The new 3G-SGSN responds to the MS with a Routeing Area Update Accept (P-TMSI, P-TMSI signature) message.

17) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete message to the SGSN.

18) The new 3G-SGSN sends TMSI Reallocation Complete message to the new VLR, if the MS confirms the VLR TMSI.

19) If the MS has uplink data or signalling pending it shall send a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.

20) If the MS has sent the Service Request, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request (RAB ID(s), QoS Profile(s), GTP-SNDs, GTP-SNUs, PDCP-SNUs) message to the SRNS. The PDCP sequence numbers are derived from the N-PDU sequence numbers in step 4) and stored in the SGSN PDP contexts. The SRNS sends a Radio Bearer Setup Request (PDCP-SNUs) message to the MS. The MS responds with a Radio Bearer Setup Complete (PDCP-SNDs) message. The MS deducts PDCP-SND from its Receive N-PDU Number by adding eight most significant bits "1". The SRNS responds with a RAB Assignment Response message. The SRNS shall discard all N-PDUs tunnelled from the SGSN with N-PDU sequence numbers older than the eight least significant bits of the PDCP-SNDs received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with SNDCP sequence numbers older than the eight least significant bits of the PDCP-SNUs received from the SRNS. Other N-PDUs shall be transmitted to the SRNS. The SRNS negotiates with the MS for each radio bearer the use of lossless PDCP or not regardless whether the old 2G-SGSN used acknowledged or unacknowledged SNDCP for the related NSAPI or not.

NOTE: The NSAPI value is carried in the RAB ID IE.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as

described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".
- Then the CAMEL_GPRS_Detach procedure is called once. It returns as result "Continue".

C2) CAMEL_GPRS_Routeing_Area_Update_Session

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context

This procedure is called several times: once per PDP context. It returns as result "Continue".

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020540***
Sophia Antipolis, France, 18-22 February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **313** ⌘ ev **-** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Correction of CAMEL procedure calls at SRNS relocation
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	15 February 2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)

Reason for change: ⌘

In the Routeing Area Update procedures the CAMEL interaction point C1 (PDP context Disconnection) is placed after the SGSN Context Response has been sent by the old SGSN but before it receives the SGSN Context Acknowledge.

If the Security Functions performed by the new SGSN before sending the SGSN Context Acknowledge fail to authenticate the MS, the RAU shall be rejected and the old SGSN shall continue as if the SGSN Context Request was never received. But in this case the PDP Context Disconnection has already been reported to the SCP, hence the PDP context continues without CAMEL control.

The real indication that the PDP context has been successfully handed over to the new SGSN is indeed the SGSN Context Acknowledge.

Note that sections 6.13.2.1 and 6.13.2.2 (inter-SGSN inter-system change) show the correct placement of the CAMEL procedure calls. However some editorial corrections are needed in the corresponding text of section 6.13.2.2.

Other Changes:

In section 6.9.2.1, in addition to the above-mentioned problem, the CAMEL interaction point C2 is placed after the packet forwarding has started. There is no reason to handle this case differently; C2 shall be placed right after the SGSN Context Acknowledge, after C1.

Summary of change: ⌘

In sections 6.9.1.2.2, 6.9.1.3.2 and 6.9.2.1: place the CAMEL procedure calls CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach right after the SGSN Context Acknowledge. A single CAMEL interaction point C1 is used in the figure, which is aligned with the way this is presented in sections 6.13.2.1 and 6.13.2.2.

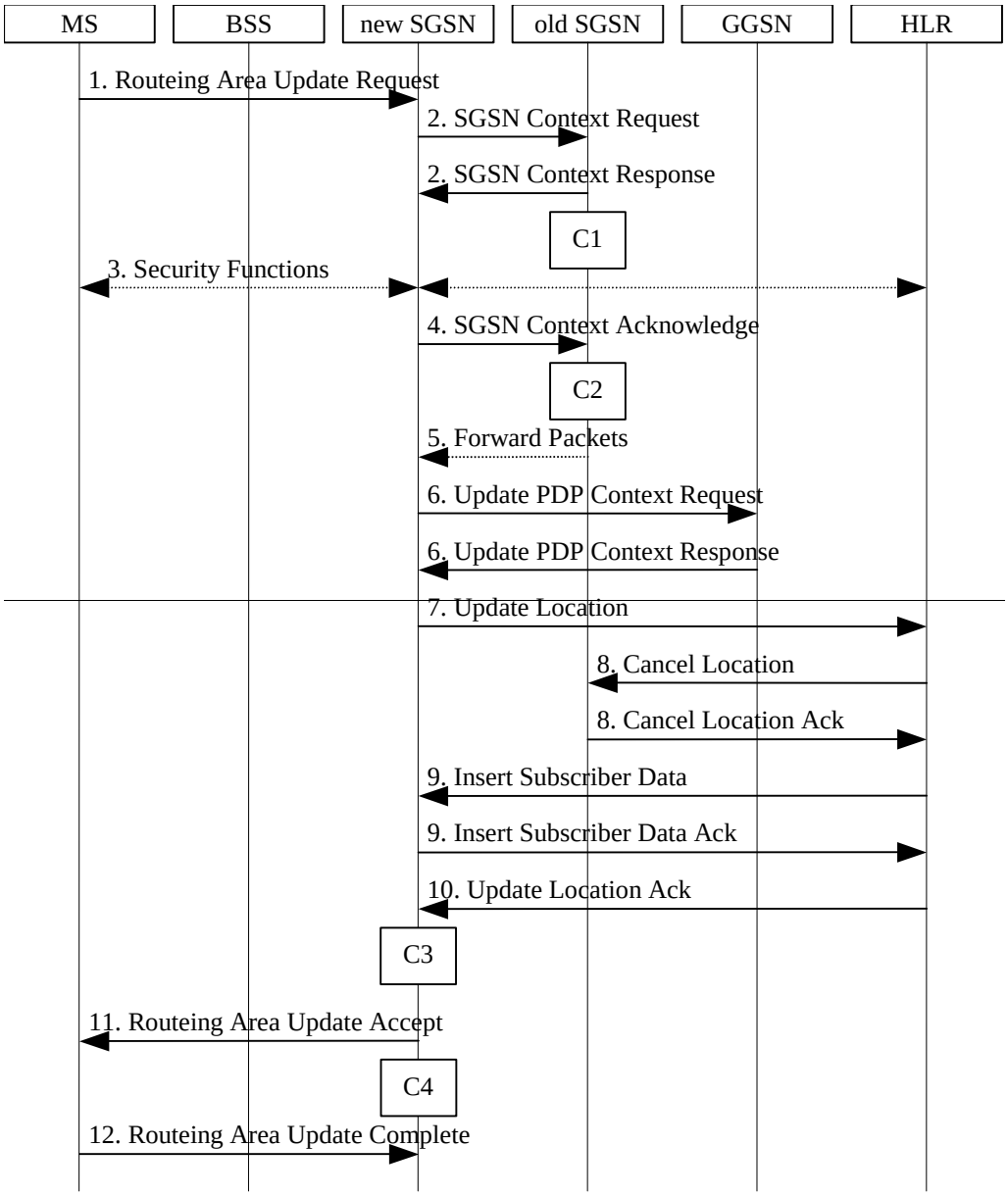
In sections 6.13.2.2: correct some editing problems in the description of the

		CAMEL interaction point C1 in line with section 6.13.2.1.
Consequences if not approved:	⌘	At inter SGSN Routeing Area Update, if the new SGSN fails to authenticate the MS, the PDP context would continue in the old SGSN without CAMEL control.

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2; 6.9.2.1 and 6.13.2.2			
Other specs affected:	⌘	☐	Other core specifications	⌘	
		☐	Test specifications		
		☐	O&M Specifications		
Other comments:	⌘				

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 1.


MS
BSS
new SGSN
old SGSN
GGSN
HLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
C1
3. Security Functions
4. SGSN Context Acknowledge
C2
5. Forward Packets
6. Update PDP Context Request
6. Update PDP Context Response
7. Update Location
8. Cancel Location
8. Cancel Location Ack
9. Insert Subscriber Data
9. Insert Subscriber Data Ack
10. Update Location Ack
C3
11. Routeing Area Update Accept
C4
12. Routeing Area Update Complete

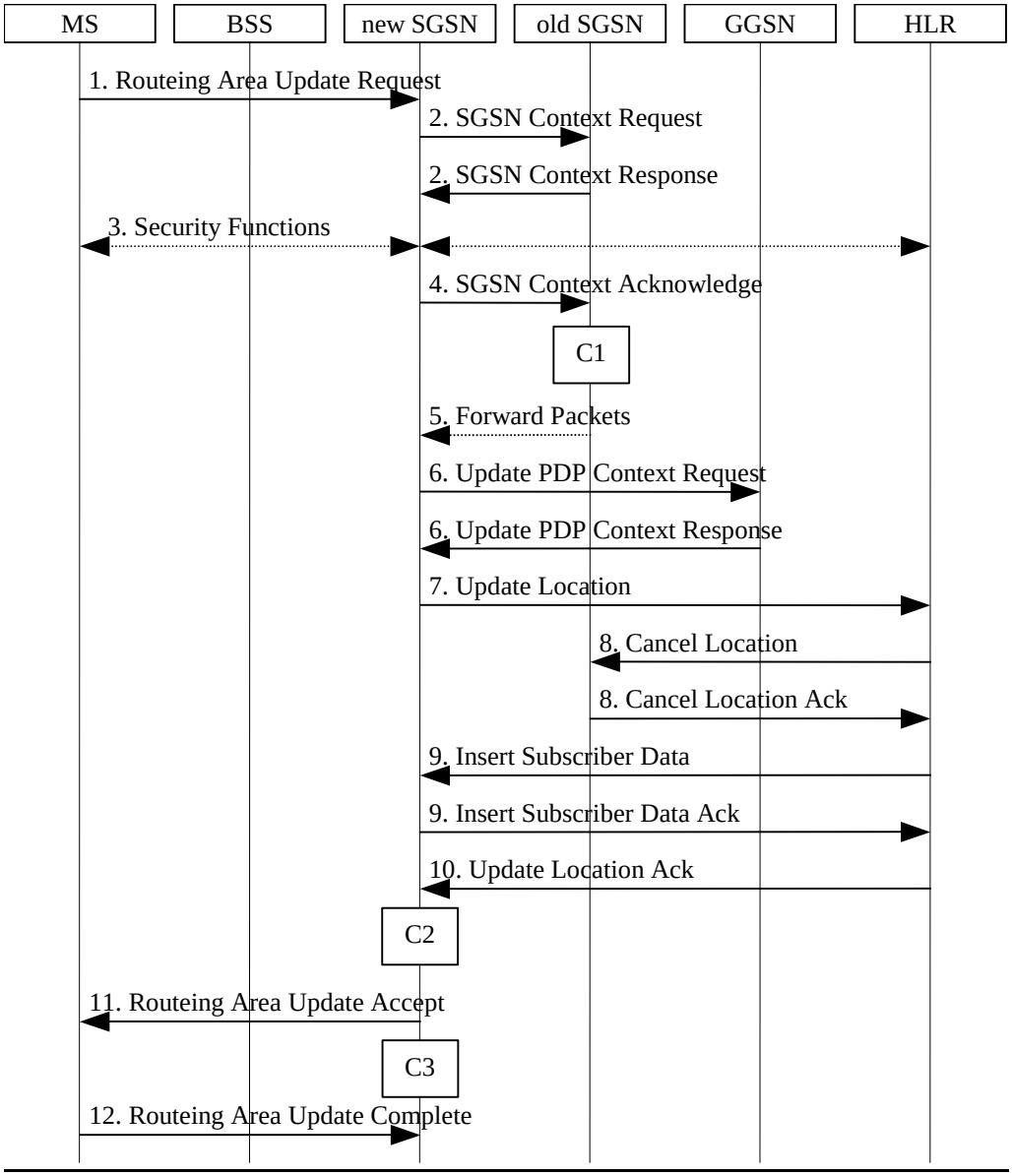


Figure 1: Inter SGSN Routeing Area Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI (or TLLI) and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI (or TLLI) and relay the message to that actual old SGSN.The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the transmission of N-PDUs to the MS. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

3) Security functions may be executed. These procedures are defined in clause "Security Function". Ciphering mode shall be set if ciphering is supported.

   If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.

4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, then the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.

6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TEID).

7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter-SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are

successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

11) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS, is not allowed to be attached in the SGSN, or if subscription checking fails, the new SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

12) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS does not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, the old SGSN stops forwarding N-PDUs to the new SGSN.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter IDLE state.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns a sresult "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

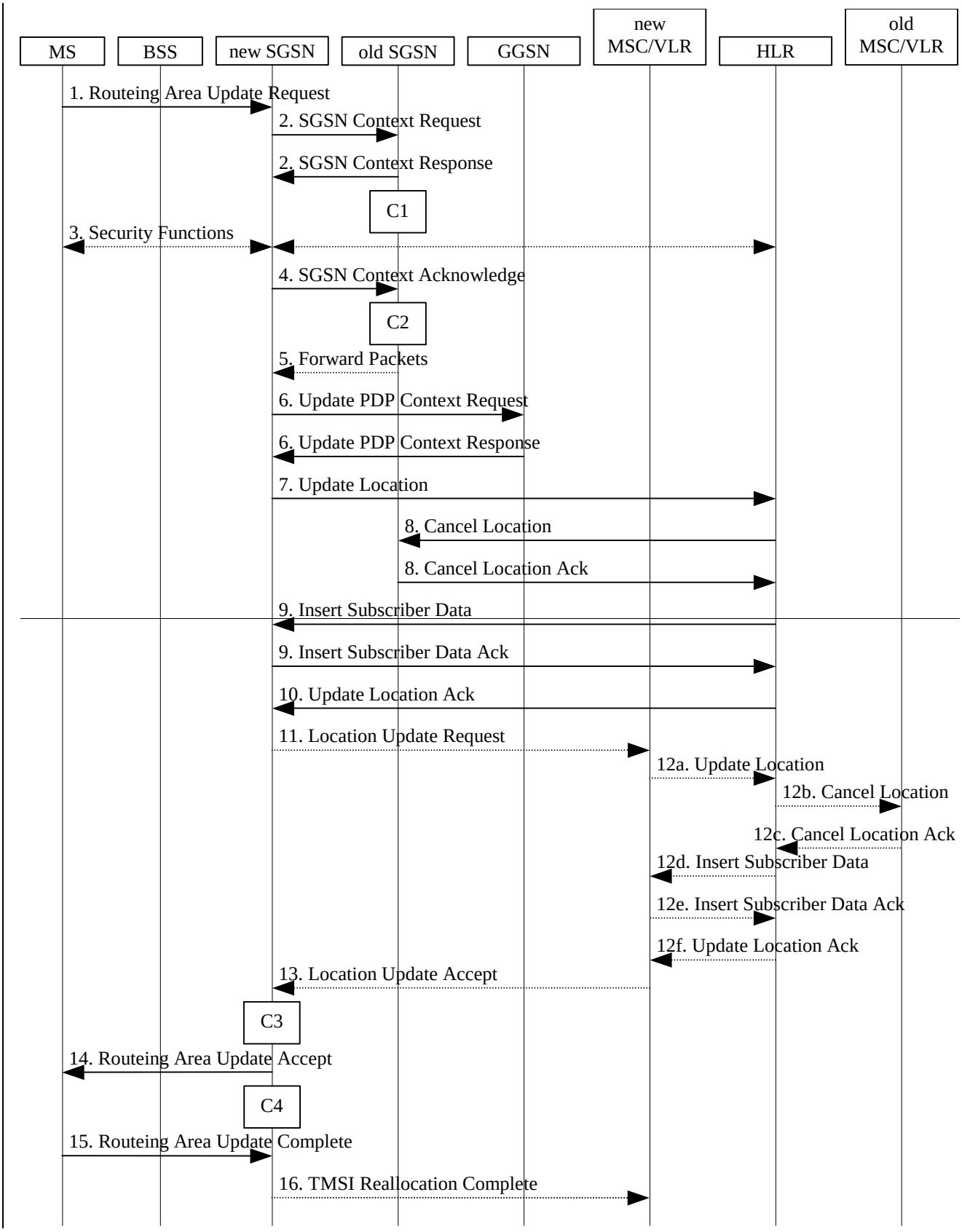
C3~~4~~) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter-SGSN) procedure is illustrated in Figure 2.


MS
BSS
new SGSN
old SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
C1
3. Security Functions
4. SGSN Context Acknowledge
C2
5. Forward Packets
6. Update PDP Context Request
6. Update PDP Context Response
7. Update Location
8. Cancel Location
8. Cancel Location Ack
9. Insert Subscriber Data
9. Insert Subscriber Data Ack
10. Update Location Ack
11. Location Update Request
12a. Update Location
12b. Cancel Location
12c. Cancel Location Ack
12d. Insert Subscriber Data
12e. Insert Subscriber Data Ack
12f. Update Location Ack
13. Location Update Accept
C3
14. Routeing Area Update Accept
C4
15. Routeing Area Update Complete
16. TMSI Reallocation Complete

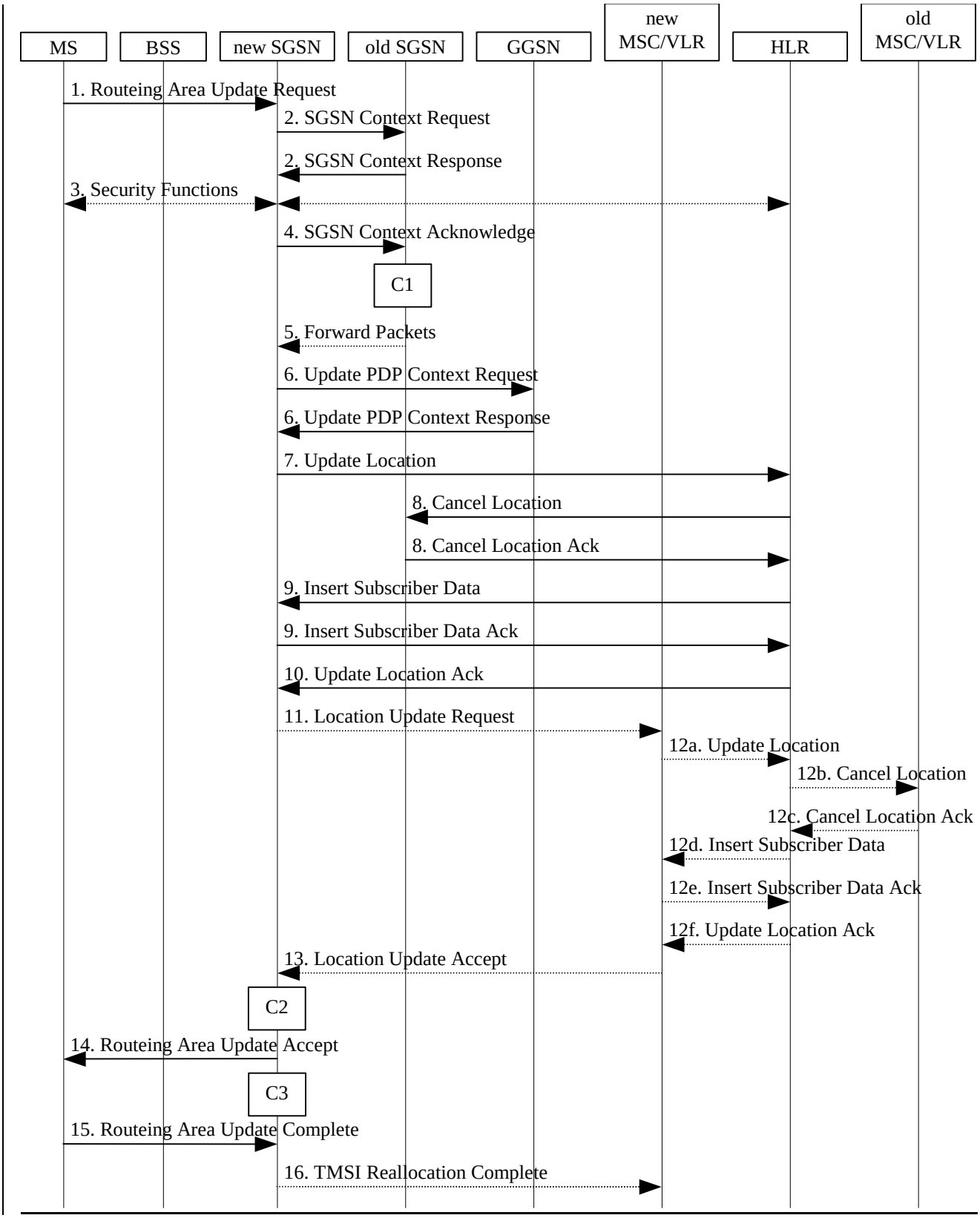


Figure 2: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and

supported GPRS ciphering algorithms as defined in 3GPP TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous and the DRX cycle length.

2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI (or TLLI) and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI (or TLLI) and relay the message to that actual old SGSN. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the downlink transfer. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

3) Security functions may be executed. These procedures are defined in clause "Security Function". Ciphering mode shall be set if ciphering is supported. If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.

4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.

6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TEID).

7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may

return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

11) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.

12) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

    a) The new VLR sends an Update Location (new VLR) to the HLR.

    b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

    c) The old VLR acknowledges with Cancel Location Ack (IMSI).

    d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

    e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

    f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

13) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

14) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

15) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

16) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter IDLE state.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful location update is performed.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach.~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3~~4~~) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

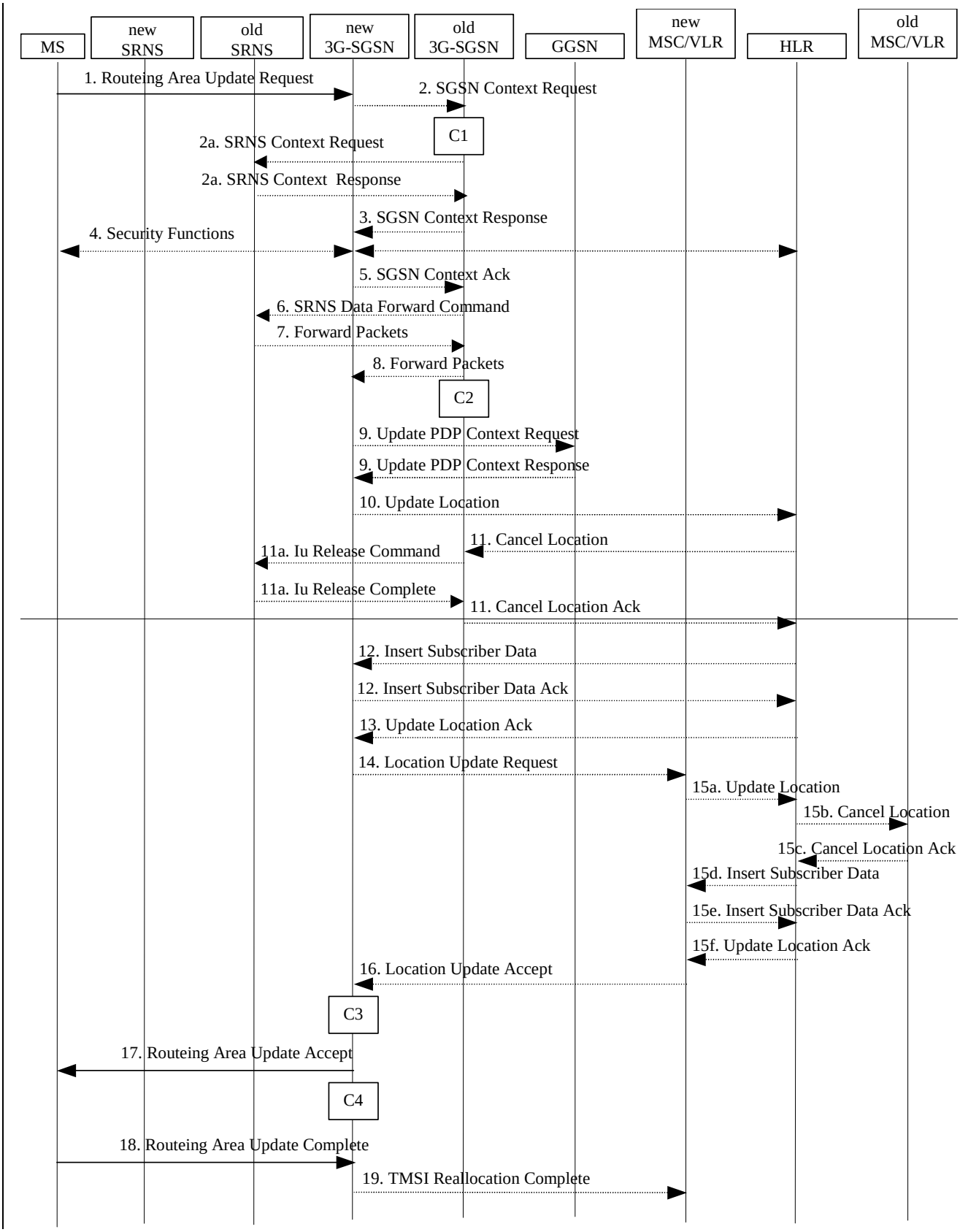
6.9.2.1 Routeing Area Update Procedure

A routeing area update takes place when an attached MS detects that it has entered a new RA or when the periodic RA update timer has expired or when RRC connection is released with cause "Directed Signalling connection re-establishment" or when the MS has to indicate new access capabilities to the network.

The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the GGSNs or the HLR about the new MS location. A periodic RA update is always an intra-SGSN routeing area update. If the network operates in mode I, an MS that is both GPRS-attached and IMSI-attached shall perform the Combined RA / LA Update procedures.

In Iu mode, an RA update is either an intra-SGSN or inter-SGSN RA update, either combined RA / LA update or only RA update, either initiated by an MS in PMM-CONNECTED (only valid after a Serving RNS Relocation Procedure, see clause 6.9.2.2) or in PMM-IDLE state. All the RA update cases are contained in the procedure illustrated in Figure 3.

NOTE 1: The network may receive an RA update from a UE in PMM-CONNECTED state over a new Iu signalling connection. This could happen when the UE enters PMM-IDLE state on receipt of RRC Connection Release with cause "Directed Signalling connection re-establishment" and initiates an RA or Combined RA update procedure (see clause 6.1.2.4.1).


MS
new SRNS
old SRNS
new 3G-SGSN
old 3G-SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
C1
2a. SRNS Context Request
2a. SRNS Context Response
3. SGSN Context Response
4. Security Functions
5. SGSN Context Ack
6. SRNS Data Forward Command
7. Forward Packets
8. Forward Packets
C2
9. Update PDP Context Request
9. Update PDP Context Response
10. Update Location
11. Cancel Location
11a. Iu Release Command
11a. Iu Release Complete
11. Cancel Location Ack
12. Insert Subscriber Data
12. Insert Subscriber Data Ack
13. Update Location Ack
14. Location Update Request
15a. Update Location
15b. Cancel Location
15c. Cancel Location Ack
15d. Insert Subscriber Data
15e. Insert Subscriber Data Ack
15f. Update Location Ack
16. Location Update Accept
C3
17. Routeing Area Update Accept
C4
18. Routeing Area Update Complete
19. TMSI Reallocation Complete

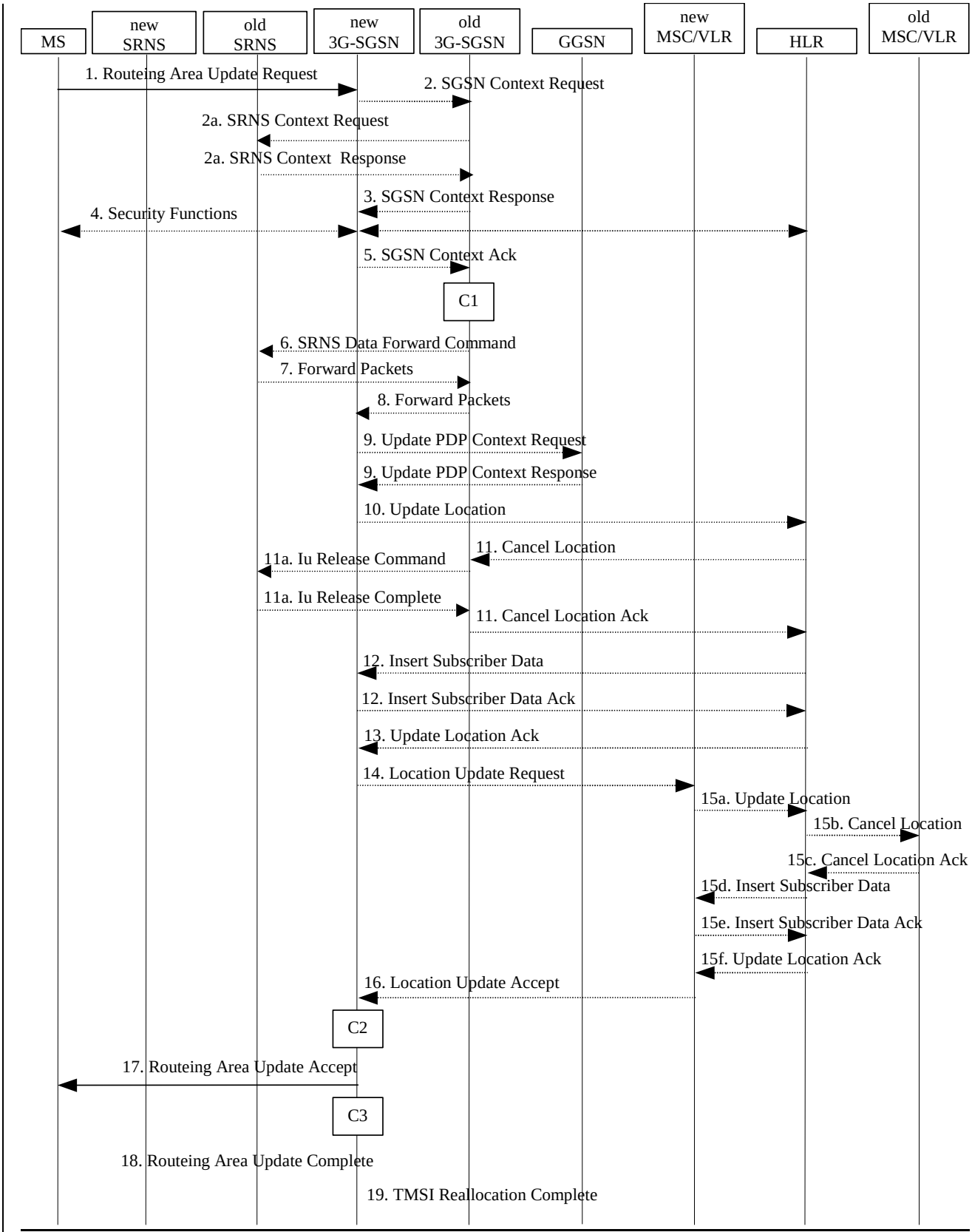


Figure 3: UMTS RA Update Procedure

1) The RRC connection is established, if not already done. The MS sends a Routeing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters, MS Network Capability) to the new SGSN. The MS shall set a follow-on request if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. Update Type shall indicate:

   - RA Update if the RA Update is triggered by a change of RA;
   - Periodic RA Update if the RA update is triggered by the expiry of the Periodic RA Update timer;
   - Combined RA / LA Update if the MS is also IMSI-attached and the LA update shall be performed in network operation mode I (see clause "Interactions Between SGSN and MSC/VLR"); or
   - Combined RA / LA Update with IMSI attach requested if the MS wants to perform an IMSI attach in network operation mode I.

   The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS. Classmark is described in clause "MS Network Capability". DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

NOTE 2: Sending the Routeing Area Update Request message to the SGSN triggers the establishment of a signalling connection between UTRAN and SGSN for the concerned MS.

2) If the RA update is an Inter-SGSN Routeing area update and if the MS was in PMM-IDLE state, the new SGSN sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN starts a timer.. If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause.

2a) If the MS is PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is in the PMM-CONNECTED state and the RAU was received over another Iu connection than the established one, the old SGSN sends an SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message. Upon reception of this message, the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

3) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next PDU to be sent to the MS. Each PDP Context also includes the PDCP sequence numbers if PDCP sequence numbers are received from the old SRNS. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request. The GTP sequence numbers received from the old 3G-SGSN are only relevant if delivery order is required for the PDP context (QoS profile).

4) Security functions may be executed. These procedures are defined in clause "Security Function". If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN

shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) If the RA update is an Inter-SGSN Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

6) If the MS is in PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.

7) For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with their related PDCP sequence numbers and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.

8) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN. No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

9) If the RA update is an Inter-SGSN RA Update and if the MS wasnot in PMM-CONNECTED state in the new 3G-SGSN, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, Tunnel Endpoint Identifier,) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier). Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state in the new 3G-SGSN, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

10) If the RA update is an Inter-SGSN RA Update, the new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

11) If the RA update is an Inter-SGSN RA Update, the HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM context. Otherwise, the contexts are removed only when the timer expires. It also ensures that the MM context is kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

11a) On receipt of Cancel Location, if the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNC. When the data-forwarding timer has expired, the SRNS responds with an Iu Release Complete message.

12) If the RA update is an nter-SGSN RA Update, the HLR sends Insert Subscriber Data (IMSI, subscription data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

13) If the RA update is an Inter-SGSN RA Update, the HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

14) If Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the association has to be established, and the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with ISI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The SGSN starts the location

update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 8). The VLR creates or updates the association with the SGSN by storing SGSN Number.

15) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

   b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

   c) The old VLR acknowledges with Cancel Location Ack (IMSI).

   d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

   e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

   f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

16) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

17) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).

18) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete message to the SGSN.

19) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

NOTE 3: Steps 15, 16, and 19 are performed only if step 14 is performed.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

NOTE: In case MS was in PMM-CONNECTED state the PDP Contexts are sent already in the Forward Relocation Request message as described in subclause "Serving RNS relocation procedures".

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.

If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-PS services until a successful location update is performed.

The CAMEL procedure call shalls be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach.~~

~~The procedure returns as result "Continue".~~

C23) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C34) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

6.13.2.2 A/Gb mode to Iu mode Inter-SGSN Change

The inter-system change from A/Gb mode to Iu mode takes place when a GPRS-attached MS changes from A/Gb mode to UTRAN or GERAN Iu mode and the new RAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a Iu mode RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update, these RA update cases are illustrated in Figure 4. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3GPP TS 23.122), as no combined RA / LA updates are performed during a CS connection.

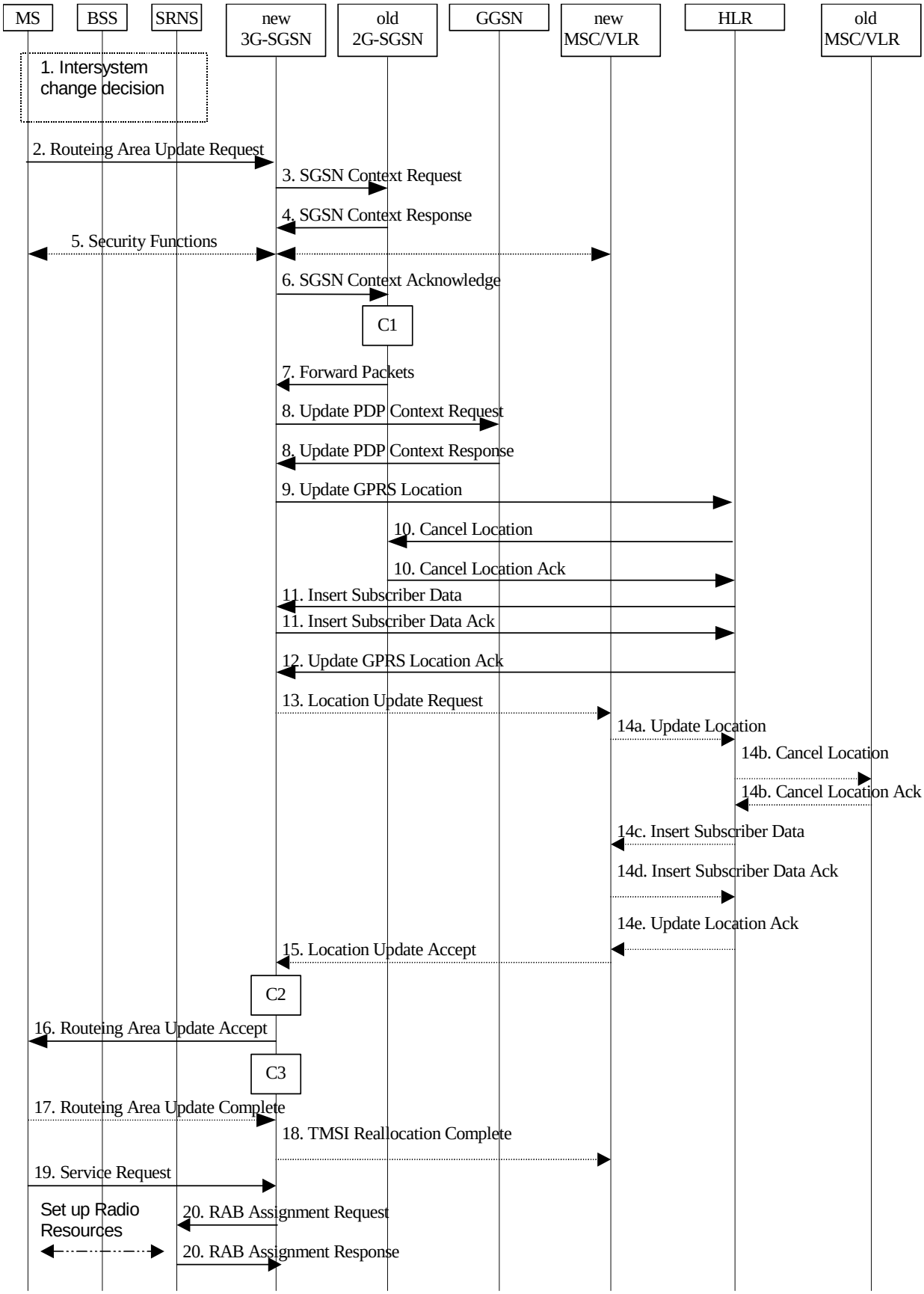


Figure 4: A/Gb mode to Iu mode Inter SGSN Change

1) The MS or RAN decides to perform an inter-system change, which makes the MS switch to a new cell where Iu mode has to be used, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

4) The old 2G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. Each PDP Context includes the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode SNDCP to the MS and the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode SNDCP from the MS. The new 3G-SGSN derives the corresponding PDCP sequence numbers from these N-PDU sequence numbers by adding eight most significant bits "1". These PDCP sequence numbers are stored in the 3G-SGSN PDP contexts. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

5) Security functions may be executed.

6) The new 3G-SGSN sends an SGSN Context Acknowledge message to the old 2G-SGSN. This informs the old 2G-SGSN that the new 3G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

7) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. Additional N-PDUs received from the GGSN before the timer described in step 3 expires are also duplicated and tunnelled to the new 3G-SGSN. N-PDUs that were already sent to the MS in acknowledged mode SNDCP and that are not yet acknowledged by the MS are tunnelled together with their related SNDCP N-PDU sequence number. No PDCP sequence numbers shall be indicated for these N-PDUs. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.

8) The new 3G-SGSN sends an Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) message to each GGSN concerned. Each GGSN updates its PDP context fields and returns an Update PDP Context Response (TEID) message.

9) The new 3G-SGSN informs the HLR of the change of SGSN by sending an Update GPRS Location (SGSN Number, SGSN Address, IMSI) message to the HLR.

10) The HLR sends a Cancel Location (IMSI, Cancellation Type) message to the old 2G-SGSN. The old 2G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. If the timer is running, the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with a Cancel Location Ack (IMSI) message.

11) The HLR sends an Insert Subscriber Data (IMSI, GPRS Subscription Data) message to the new 3G-SGSN. The 3G-SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

12) The HLR acknowledges the Update GPRS Location by returning an Update GPRS Location Ack (IMSI) message to the new 3G-SGSN.

13) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The 3G-SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 12). The VLR creates or updates the association with the 3G-SGSN by storing SGSN Number.

14) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

   b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

   c) The old VLR acknowledges with Cancel Location Ack (IMSI).

   d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

   e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

   f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

15) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the 3G-SGSN. VLR TMSI is optional if the VLR has not changed.

16) The new 3G-SGSN validate the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the new 3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new 3G-SGSN constructs MM and PDP contexts for the MS. The new 3G-SGSN responds to the MS with a Routeing Area Update Accept (P-TMSI, P-TMSI signature) message.

17) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete message to the SGSN.

18) The new 3G-SGSN sends TMSI Reallocation Complete message to the new VLR, if the MS confirms the VLR TMSI.

19) If the MS has uplink data or signalling pending it shall send a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.

20) If the MS has sent the Service Request, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request (RAB ID(s), QoS Profile(s), GTP-SNDs, GTP-SNUs, PDCP-SNUs) message to the SRNS. The PDCP sequence numbers are derived from the N-PDU sequence numbers in step 4) and stored in the SGSN PDP contexts. The SRNS sends a Radio Bearer Setup Request (PDCP-SNUs) message to the MS. The MS responds with a Radio Bearer Setup Complete (PDCP-SNDs) message. The MS deducts PDCP-SND from its Receive N-PDU Number by adding eight most significant bits "1". The SRNS responds with a RAB Assignment Response message. The SRNS shall discard all N-PDUs tunnelled from the SGSN with N-PDU sequence numbers older than the eight least significant bits of the PDCP-SNDs received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with SNDCP sequence numbers older than the eight least significant bits of the PDCP-SNUs received from the SRNS. Other N-PDUs shall be transmitted to the SRNS. The SRNS negotiates with the MS for each radio bearer the use of lossless PDCP or

not regardless whether the old 2G-SGSN used acknowledged or unacknowledged SNDCP for the related NSAPI or not.

NOTE: The NSAPI value is carried in the RAB ID IE.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".
- Then the CAMEL_GPRS_Detach procedure is called once. It returns as result "Continue".

C2) CAMEL_GPRS_Routeing_Area_Update_Session

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context

This procedure is called several times: once per PDP context. It returns as result "Continue".

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18-22 February 2002

Tdoc S2-020541

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **314** ⌘ ev **-** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	CAMEL procedure call irrespective of GPRS-CSI/SMS-CSI
Source:	⌘	Ericsson
Work item code:	⌘	TEI
Date:	⌘	6 February 2002
Category:	⌘	**F**
Release:	⌘	R99

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)

Reason for change:	⌘	Correction of wrongly implemented CR 253r1 (S2-012391) approved in SA2#19. Changes in section 6.6.1 were not implemented in 23.060 v3.9.0.
Summary of change:	⌘	Delete “For an MS with GPRS-CSI defined,” so that the existing procedures in 23.060 call the CAMEL procedures in 23.078 for the MS with/without GPRS-CSI or SMS-CSI.
Consequences if not approved:	⌘	Inconsistent and erroneous behaviour with respect to CAMEL procedure calls.

Clauses affected:	⌘	6.6.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.6.1 MS-Initiated Detach Procedure

The MS-Initiated Detach procedure when initiated by the MS is illustrated in Figure 1.

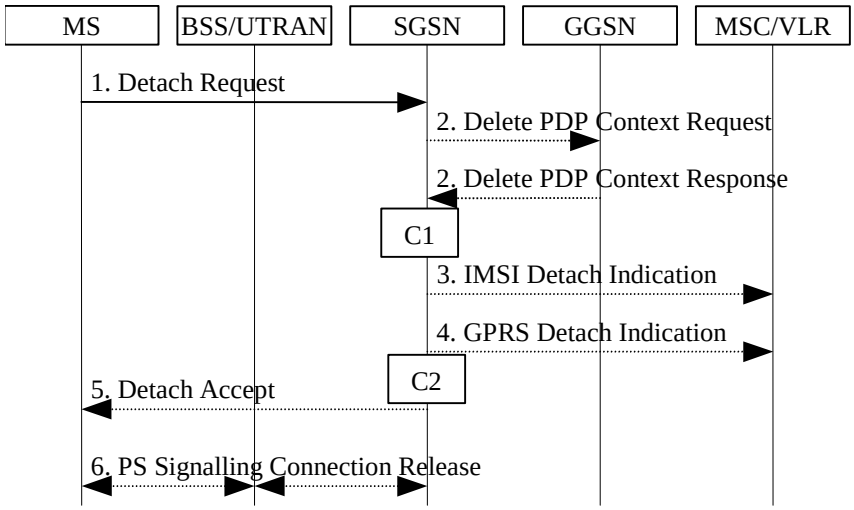


Figure 1: MS-Initiated Combined GPRS / IMSI Detach Procedure

1) The MS detaches by sending Detach Request (Detach Type, P-TMSI, P-TMSI Signature, Switch Off) to the SGSN. Detach Type indicates which type of detach is to be performed, i.e., GPRS Detach only, IMSI Detach only or combined GPRS and IMSI Detach. Switch Off indicates whether detach is due to a switch off situation or not. The Detach Request message includes P-TMSI and P-TMSI Signature. P-TMSI Signature is used to check the validity of the Detach Request message. If P-TMSI Signature is not valid or is not included, the authentication procedure should be performed.

2) If GPRS detach, the active PDP contexts in the GGSNs regarding this particular MS are deactivated by the SGSN sending Delete PDP Context Request (TEID) to the GGSNs. The GGSNs acknowledge with Delete PDP Context Response (TEID).

3) If IMSI detach, the SGSN sends an IMSI Detach Indication (IMSI) message to the VLR.

4) If the MS wants to remain IMSI-attached and is doing a GPRS detach, the SGSN sends a GPRS Detach Indication (IMSI) message to the VLR. The VLR removes the association with the SGSN and handles paging and location update without going via the SGSN.

5) If Switch Off indicates that detach is not due to a switch off situation, the SGSN sends a Detach Accept to the MS.

6) If the MS was GPRS detached, then the 3G-SGSN releases the PS signalling connection.

~~For an MS with GPRS-CSI defined,~~ CAMEL ~~interaction may~~ procedure calls shall be performed~~;~~, see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection.

This procedure is called several times: once per PDP context. The procedure returns as result "Continue".

C2) CAMEL_GPRS_Detach.

The procedure returns as result "Continue".

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18-22 February 2002

Tdoc S2-020543

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CHANGE REQUEST

⌘ **23.060** **CR** **316** ⌘ ev **-** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	CAMEL procedure call irrespective of GPRS-CSI/SMS-CSI
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	15 February 2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)

Reason for change:	⌘	Correction of wrongly implemented CR 254r1 (S2-012392) approved in SA2#19. Changes in section 6.6.1 were not fully implemented in 23.060 v4.2.0, which was the base for 23.060 v5.0.0. The real problem was on the implementation of the corresponding CR 253r1 for R99, so this mirror CR is just for completeness.
Summary of change:	⌘	Grammatical corrections.
Consequences if not approved:	⌘	Nothing serious; just wrong grammar will persist.

Clauses affected:	⌘	6.6.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.6.1 MS-Initiated Detach Procedure

The MS-Initiated Detach procedure when initiated by the MS is illustrated in Figure 23.

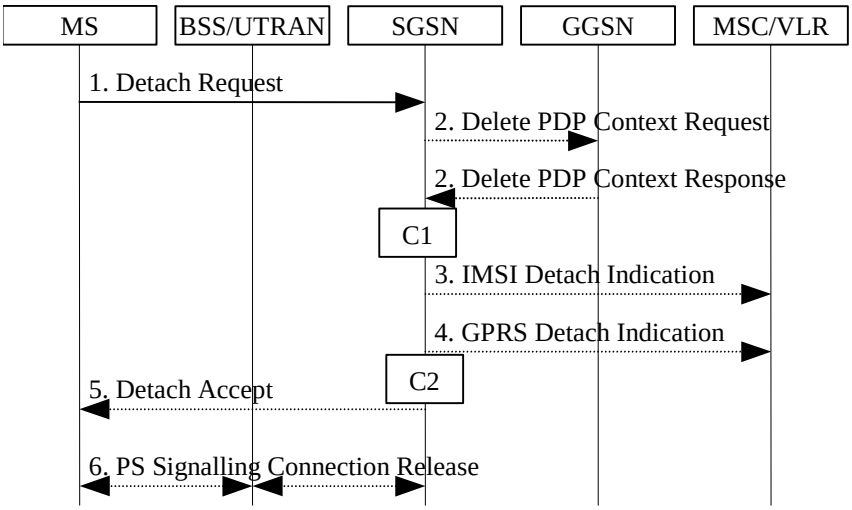

Figure 23: MS-Initiated Combined GPRS / IMSI Detach Procedure

1) The MS detaches by sending Detach Request (Detach Type, P-TMSI, P-TMSI Signature, Switch Off) to the SGSN. Detach Type indicates which type of detach is to be performed, i.e., GPRS Detach only, IMSI Detach only or combined GPRS and IMSI Detach. Switch Off indicates whether detach is due to a switch off situation or not. The Detach Request message includes P-TMSI and P-TMSI Signature. P-TMSI Signature is used to check the validity of the Detach Request message. If P-TMSI Signature is not valid or is not included, the authentication procedure should be performed.

2) If GPRS detach, the active PDP contexts in the GGSNs regarding this particular MS are deactivated by the SGSN sending Delete PDP Context Request (TEID) to the GGSNs. The GGSNs acknowledge with Delete PDP Context Response (TEID).

3) If IMSI detach, the SGSN sends an IMSI Detach Indication (IMSI) message to the VLR.

4) If the MS wants to remain IMSI-attached and is doing a GPRS detach, the SGSN sends a GPRS Detach Indication (IMSI) message to the VLR. The VLR removes the association with the SGSN and handles paging and location update without going via the SGSN.

5) If Switch Off indicates that detach is not due to a switch off situation, the SGSN sends a Detach Accept to the MS.

6) If the MS was GPRS detached, then the 3G-SGSN releases the PS signalling connection.

The CAMEL procedure calls shall be performed; see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection.

This procedure is called several times: once per PDP context. The procedure returns as result "Continue".

C2) CAMEL_GPRS_Detach.

The procedure returns as result "Continue".

3GPP TSG-SA2 Meeting #23 **S2-020544**
Sophia Antipolis, France, 18-22 February 2002

CHANGE REQUEST

⌘ **23.060** **CR** **317** ⌘ **rev** ⌘ Current version: **5.0.0** ⌘

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Introduction of CAMEL control of MT-SMS
Source:	⌘	Ericsson
Work item code:	⌘	CAMEL4
Date:	⌘	13 February 2002
Category:	⌘	B
Release:	⌘	Rel-5

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)*

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)*

Reason for change:	⌘	CAMEL Phase 4 specifies that the SCP shall be able to control the delivery of a Mobile Terminated Short Message to an MS. Refer to the Rel-5 versions of TS 22.078 and TS 23.078. This capability is specified for both the Circuit Switched domain and the Packet Switched domain. The present CR introduces the changes to TS 23.060, for the CAMEL control of MT-SMS in the PS domain.
Summary of change:	⌘	- Modification to Figure 1: "MT SMS Transfer, Successful" (figure and associated text) - Modification to Figure 2: "MT SMS Transfer, Unsuccessful" (figure and associated text) - Editorial alignment of text underneath the figure: "MO SMS Transfer, Successful"
Consequences if not approved:	⌘	CAMEL control of MT-SMS in the PS domain will not work.

Clauses affected:	⌘	16.1.1.1, 16.1.1.1.1 and 16.1.1.2
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

*** First Modification ***

16.1.1.1 Mobile-terminated SMS Transfer

Figure 1 and the description below show an example of a successful delivery of an SM to an MS over a GPRS radio channel.

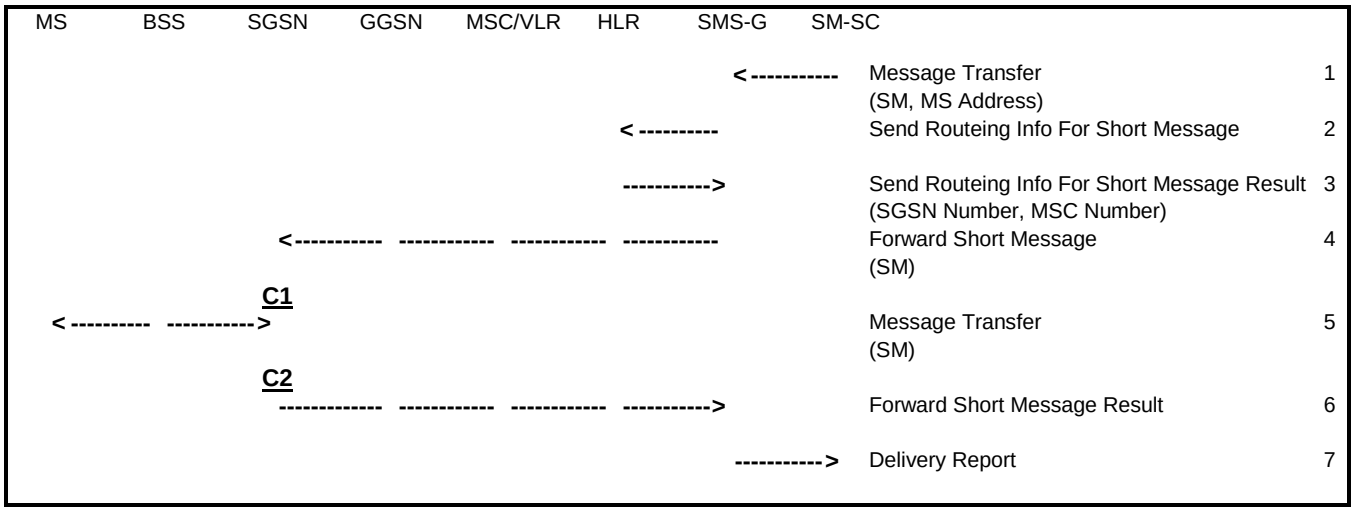

Figure 1: MT SMS Transfer, Successful

1) The short message service centre determines it shall send an SM to an MS. SM-SC forwards the SM to an SMS gateway MSC (SMS-GMSC).

2) SMS-GMSC examines the destination MS Address, and sends a Send Routeing Info For Short Message message to the relevant HLR.

3) HLR returns a Send Routeing Info For Short Message Result message to the SMS-GMSC. The result may contain the MS's current SGSN Number, the MSC Number, or both. If the result does not contain an SGSN Number (i.e., the HLR knows that the MS is not reachable via an SGSN), and if the result does contain an MSC Number, non-GPRS SMS delivery procedures are followed. If the result contains an SGSN Number, the SMS transfer proceeds according to the following events.

NOTE: SMS delivery via the SGSN is normally more radio resource efficient than SMS delivery via the MSC/VLR. The preferred delivery path is selected by SMS-GMSC operator-specific action.

4) SMS-GMSC forwards the SM to the SGSN.

5) SGSN transfers the SM to the MS on the RP, CP, LLC layers, as defined in GSM 04.11 and GSM 04.64.

6) SGSN returns a Forward Short Message Result message to the SMS-GMSC indicating successful delivery of the SM.

7) SMS-GMSC returns a Delivery Report to the SM-SC indicating successful delivery of the SM.

CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL_T_SMS_INIT.

The procedure returns as result "Continue".

C2) CAMEL_T_SMS_DELIVERED.

This procedure does not return a result.

16.1.1.1.1 Unsuccessful Mobile-terminated SMS Transfer

The SGSN may not be able to deliver the SM to the MS. This may for example happen when the MS is not attached to GPRS, or when the radio channel conditions are bad.

When the SGSN cannot deliver the SM to the MS, the SGSN sets the Mobile station Not Reachable for GPRS flag (MNRG), and returns a failure report to the SMS-GMSC. Based on the routeing information received from the HLR, the SMS-GMSC shall do one of the following:

- If an MSC/VLR is available for the MS, the SM is forwarded to the MS via the MSC/VLR. A successful delivery report shall be returned to the SM-SC.
- If an MSC/VLR is not available for the MS, the Message Waiting Indication information in the HLR shall be updated and an unsuccessful delivery report shall be returned to the SM-SC.

Figure 2 illustrates one possible traffic scenario when neither the SGSN nor the MSC is able to deliver the SM.

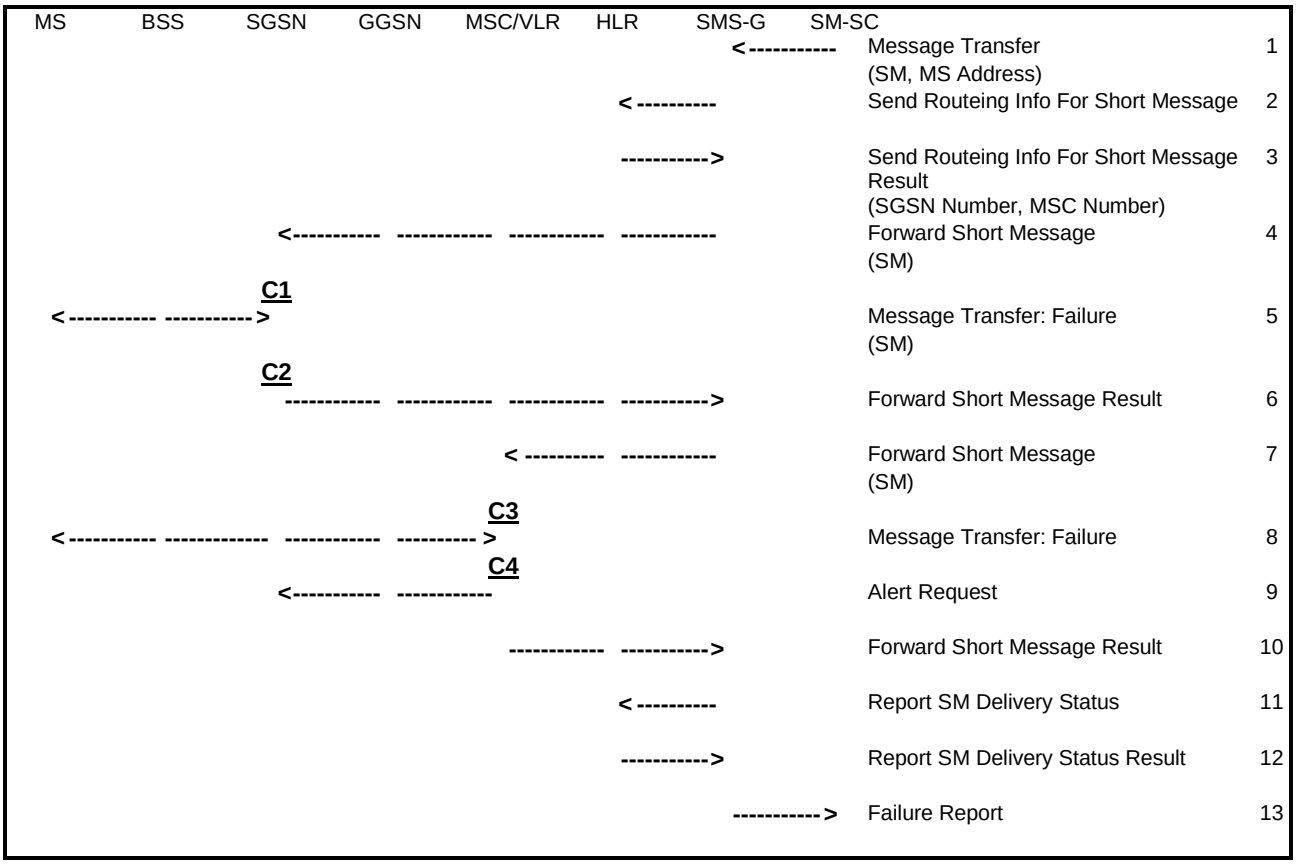

Figure 2: MT SMS Transfer, Unsuccessful

1) The short message service centre determines it shall send an SM to an MS. SM-SC forwards the SM to a SMS-GMSC.
2) SMS-GMSC examines the destination MS Address, and sends a Send Routeing Info For Short Message message to the relevant HLR.
3) HLR returns a Send Routeing Info For Short Message Result message to the SMS-GMSC. The Result contains an SGSN Number and an MSC Number.
4) SMS-GMSC forwards the SM to the SGSN.
5) SGSN attempts to transfer the SM to the MS, but fails.
6) SGSN sets MNRG and returns a Forward Short Message Result message to SMS-GMSC indicating unsuccessful delivery of the SM.

7) SMS-GMSC selects an alternative route for the SMS, and forwards the SM to the MSC/VLR.

8) MSC/VLR attempts to transfer the SM to the MS, but fails.

9) The MSC/VLR requests the setting of the NGAF at the SGSN.

10) VLR sets MNRF and returns a Forward Short Message Result message to the SMS-GMSC indicating unsuccessful delivery of the SM.

11) SMS-GMSC sends a Report SM Delivery message to the HLR.

12) HLR updates its Message Waiting Indication fields and returns a Report SM Delivery Result message to the SMS-GMSC.

13) SMS-GMSC returns a Failure Report to the SM-SC indicating unsuccessful delivery of the SM.

CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL_T_SMS_INIT.

The procedure returns as result "Continue".

C2) CAMEL_T_SMS_FAILURE.

This procedure does not return a result.

C3) CAMEL_T_SMS_INIT.

The procedure returns as result "Continue".

C4) CAMEL_T_SMS_FAILURE.

This procedure does not return a result.

Error! Reference source not found. shows that the SGSN sends a Ready for SM (MS Reachable) message to the HLR when the MS becomes reachable and MNRG is set in the SGSN. The SGSN indicates also to the MSC/VLR when the MS becomes reachable and NGAF is set in the SGSN. If the MNRF is set at the MSC/VLR, the MSC/VLR sends a Ready for SM (MS Reachable) message to the HLR. Reception of a Ready for SM message or Update Location message when MNRG is set in the HLR shall trigger the SMS alert procedure as defined in GSM 03.40.

MNRG remains set in the SGSN independently of whether the MSC/VLR was successful in delivering the SM or not. This means that the SGSN in certain cases sends a Ready for SM message to the HLR when an MS becomes reachable via the SGSN, even if no SM is waiting. This causes a small amount of duplicate signalling between the SGSN and the HLR only.

16.1.1.2 Mobile-originated SMS Transfer

Figure 3 and the description below explain the steps involved in sending an SM from an MS over a GPRS radio channel.

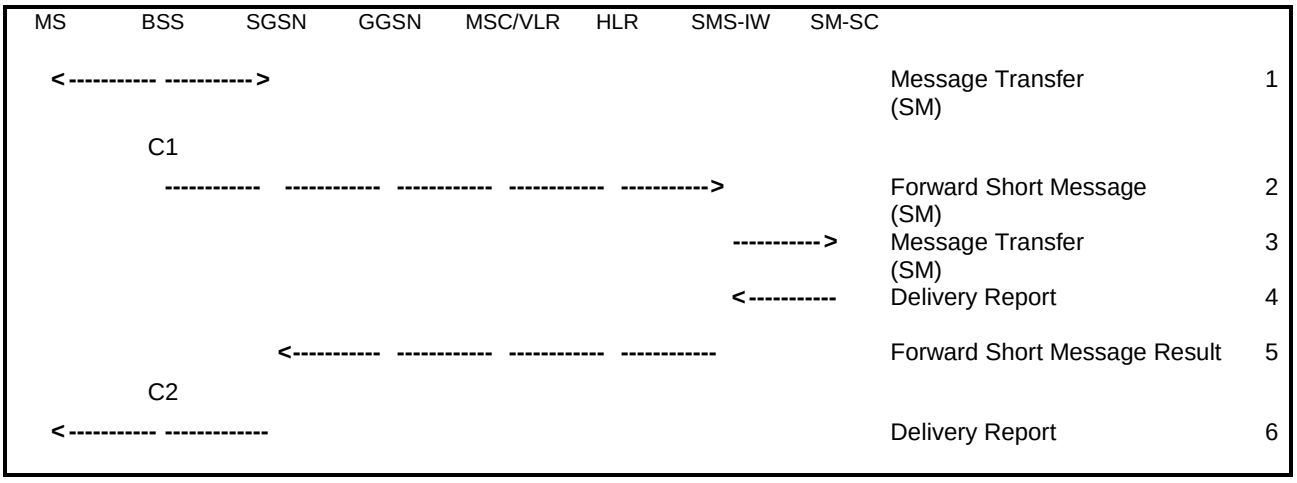

Figure 3: MO SMS Transfer, Successful

1) The MS has an SM to send, and transfers the SM to the SGSN via RP, CP, and LLC.

2) SGSN checks the MS subscription data, and determines that the MS is allowed to originate the SMS. SGSN forwards the SM to a SMS interworking MSC (SMS-IWMSC).

3) SMS-IWMSC passes the SM to the addressed SM-SC.

4) SM-SC returns a Delivery Report to the SMS-IWMSC indicating successful delivery of the SM.

5) SMS-IWMSC returns a Forward Short Message Result message to the SGSN indicating successful delivery of the SM.

6) SGSN returns a Delivery Report to the MS indicating successful delivery of the SM.

~~For an MS with SMS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3GPP TS 23.078:~~CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078.

C1) CAMEL_O_SMS_INIT.

The procedure returns as result "Continue".

C2) CAMEL_O_SMS_SUBMITTED

This procedure does not return a result.

****** End of Document ******

3GPP TSG SA WG2 #23 **S2-020590**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **321** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☐

Title:	⌘	Correction of arbitrary editorial changes
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	13.2.2002
Category:	⌘	**D**
Release:	⌘	REL-5

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)

Reason for change:	⌘	With the creation of version 5.0.0 for some information flows the text describing the steps of procedures is moved above the title of the related figures and looks like notes for the figure. This is inconsistent with the description style for all other information flows and confuses the reader. A complete paragraph is formatted as a header. From page 11 onwards the page header indicates "release 4"
Summary of change:	⌘	Restoration of original description style.
Consequences if not approved:	⌘	Inconsistent description style and confusion for the reader.

Clauses affected:	⌘	6.7, 6.8, 6.9.2.2, and potentially others
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	The requested changes are not shown by this CR as these are purely editorial. Furthermore, change of formatting should be avoided to allow for a useful version comparison by MS word. This is the only means for keeping track of changes as draft versions of the specs are not used.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3GPP TSG SA WG2 #23 **S2-020592**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **323** ⌘ **rev** **-** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	No encrypted IMSI for identity check
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	12.2.2002
Category:	⌘	**F**
Release:	⌘	R99

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:
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R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The mechanism was never introduced but is still FFS in 23.060.
Summary of change:	⌘	Removal of the description for sending the IMSI encrypted.
Consequences if not approved:	⌘	Description of non-existing functionality.

Clauses affected:	⌘	6.8.4
Other specs affected:	⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications
Other comments:	⌘	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.8.4 Identity Check Procedures

The Identity Check procedure is illustrated in Figure 1.

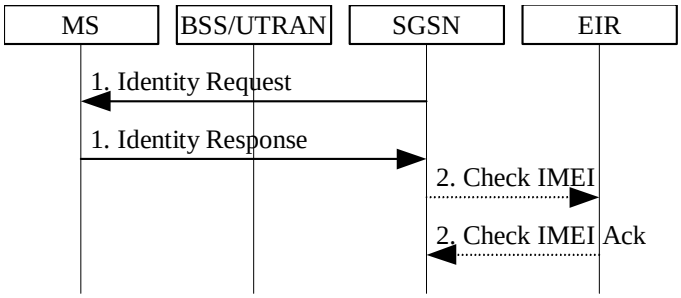

Figure 1: Identity Check Procedure

1) The SGSN sends Identity Request (Identity Type) to the MS. The MS responds with Identity Response (Mobile Identity). ~~In Iu mode, the MS may choose to send its IMSI encrypted (FFS).~~

2) If the SGSN decides to check the IMEI against the EIR, it sends Check IMEI (IMEI) to EIR. The EIR responds with Check IMEI Ack (IMEI).

3GPP TSG SA WG2 #23 **S2-020593**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **324** ⌘ **rev** **-** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	No encrypted IMSI for identity check
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	12.2.2002
Category:	⌘	**A**
Release:	⌘	REL-4

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)

Reason for change:	⌘	The mechanism was never introduced but is still FFS in 23.060.
Summary of change:	⌘	Removal of the description for sending the IMSI encrypted.
Consequences if not approved:	⌘	Description of non-existing functionality.

Clauses affected:	⌘	6.8.4
Other specs affected:	⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications
Other comments:	⌘	

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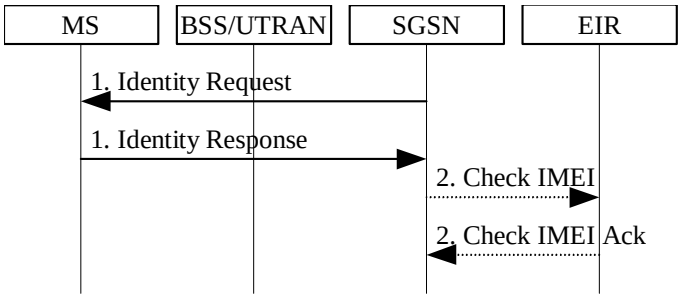

Figure 1: Identity Check Procedure

1) The SGSN sends Identity Request (Identity Type) to the MS. The MS responds with Identity Response (Mobile Identity). ~~In Iu mode, the MS may choose to send its IMSI encrypted (FFS).~~

2) If the SGSN decides to check the IMEI against the EIR, it sends Check IMEI (IMEI) to EIR. The EIR responds with Check IMEI Ack (IMEI).

3GPP TSG SA WG2 #23 **S2-020594**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **325** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	No encrypted IMSI for identity check
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	12.2.2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)

Reason for change:	⌘	The mechanism was never introduced but is still FFS in 23.060.
Summary of change:	⌘	Removal of the description for sending the IMSI encrypted.
Consequences if not approved:	⌘	Description of non-existing functionality.

Clauses affected:	⌘	6.8.4
Other specs affected:	⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications
Other comments:	⌘	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.8.4 Identity Check Procedures

The Identity Check procedure is illustrated in Figure 1.

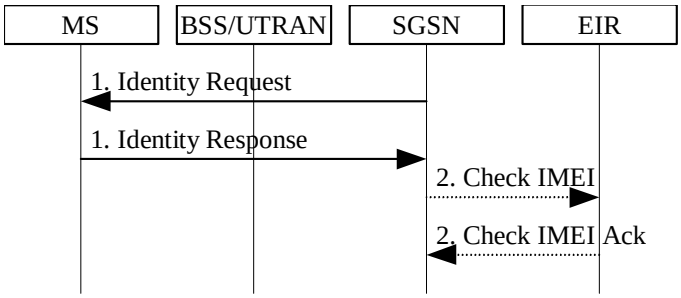

Figure 1: Identity Check Procedure

1) The SGSN sends Identity Request (Identity Type) to the MS. The MS responds with Identity Response (Mobile Identity). ~~In Iu mode, the MS may choose to send its IMSI encrypted (FFS).~~

2) If the SGSN decides to check the IMEI against the EIR, it sends Check IMEI (IMEI) to EIR. The EIR responds with Check IMEI Ack (IMEI).

3GPP TSG-SA WG2 #23 **Tdoc *S2-020606***
Sophia Antipolis, France. 18 – 22 February 2002

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **326** ⌘ rev **-** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Parameter correction in GSM to UMTS inter system RA update
Source:	⌘	Nokia
Work item code:	⌘	GPRS
Date:	⌘	12.02.2002
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(essential 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)

Reason for change: ⌘ A clear (copy and paste) error was made in section 6.13.2.2, "GSM to UMTS Inter-SGSN Change" as it reads that in the following case a 3G SGSN sends TLLI to a 2G SGSN:

> "If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, **TLLI**, MS Validated, New SGSN Address) message to the old 2G-SGSN."

This is not possible because, when sending the SGSN Context Request message the new 3G SGSN **has no means to know** if the old SGSN is 2G or 3G. Besides, section 6.9.2.1, "Routeing Area Update Procedure reads:

> "If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (**IMSI**, old RAI, MS Validated) message to the old SGSN."

Therefore, the existing text in section 6.13.2.2 makes the procedure impossible to implement.

Clearly, during the RAU the new 3G SGSN should always use IMSI and not TLLI.

Summary of change: ⌘ Replacing TLLI by IMSI in SGSN Context Request with MS Validated

Consequences if not approved: ⌘ Not possible to implement the specification as it stands

Clauses affected: ⌘ 6.13.2.2

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

Other comments:	⌘	This comment offers to consider correcting another minor editorial error by possible future CR. Some sections of 23.060 indicate that 'New SGSN address' IE is present in 'SGSN Context Request' message, and some do not. This is only an editorial error, because 29.060 clearly indicates that this parameter is mandatory. On the other hand, such a detailed description of a message is not absolutely necessary in a stage 2 specification.

6.13.2.2 GSM to UMTS Inter-SGSN Change

The inter-system change from GSM to UMTS takes place when a GPRS-attached MS changes from GSM radio access to UTRAN and the UTRAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a UMTS RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update, these RA update cases are illustrated in Figure 1.

If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.

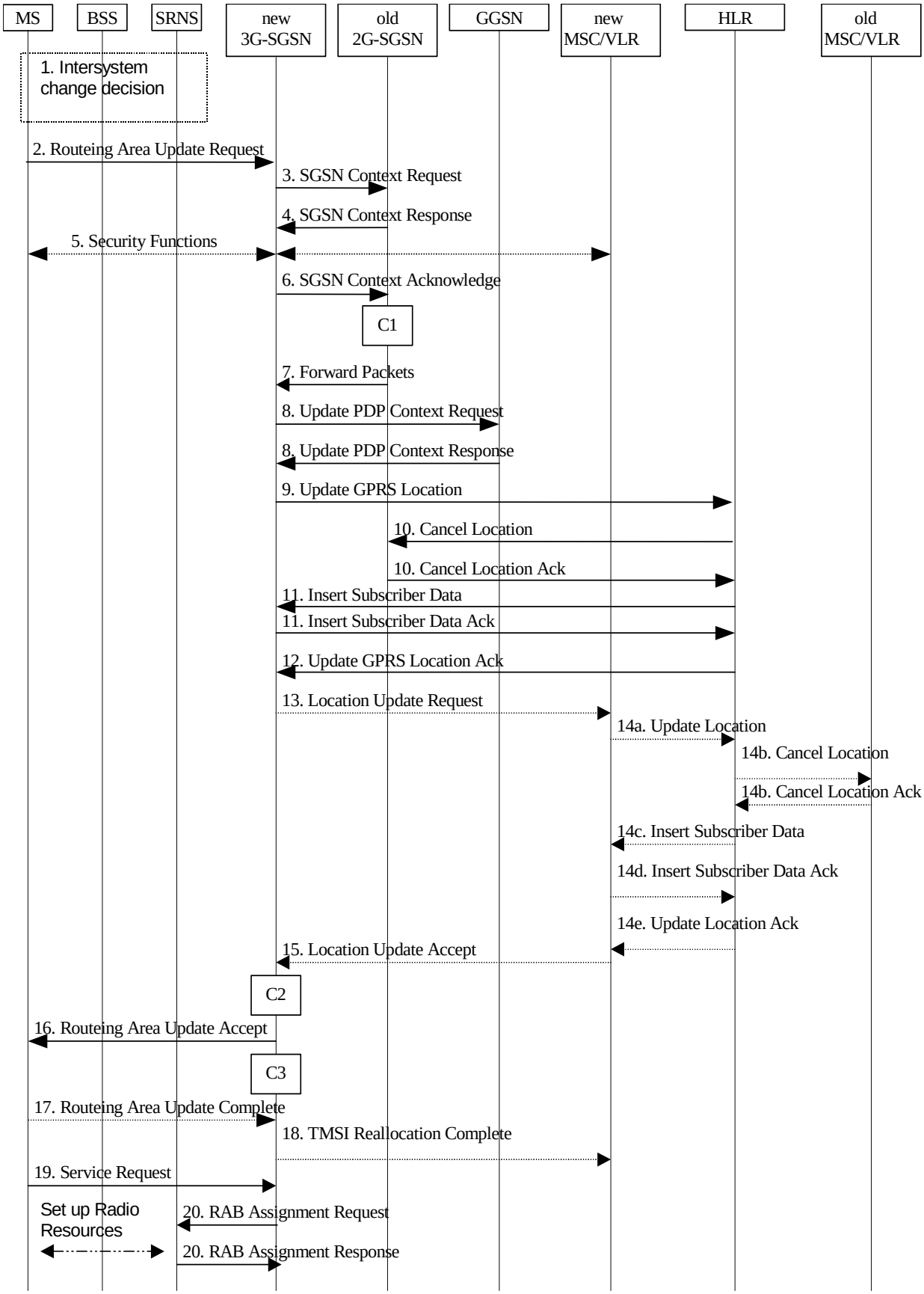

Figure 1: GSM to UMTS Inter SGSN Change

1) The MS or BSS or UTRAN decides to perform an inter-system change, which makes the MS switch to a new cell that supports UMTS radio technology, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, IMSI~~TLLI~~, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

3GPP TSG-SA WG2 #23 **Tdoc *S2-020607***
Sophia Antipolis, France. 18 – 22 February 2002

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **327** ⌘ rev **-** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Parameter correction in GSM to UMTS inter system RA update
Source:	⌘	Nokia
Work item code:	⌘	TEI4 ***Date:*** ⌘ 12.02.2002
Category:	⌘	**A** ***Release:*** ⌘ REL-4

Use one of the following categories:
F *(essential 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:
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R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘ A clear (copy and paste) error was made in section 6.13.2.2, "GSM to UMTS Inter-SGSN Change" as it reads that in the following case a 3G SGSN sends TLLI to a 2G SGSN:

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Therefore, the existing text in section 6.13.2.2 makes the procedure impossible to implement.

Clearly, during the RAU the new 3G SGSN should always use IMSI and not TLLI.

Summary of change: ⌘ Replacing TLLI by IMSI in SGSN Context Request with MS Validated

Consequences if not approved: ⌘ Not possible to implement the specification as it stands

Clauses affected: ⌘ 6.13.2.2

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

Other comments:	⌘	This comment offers to consider correcting another minor editorial error by possible future CR. Some sections of 23.060 indicate that 'New SGSN address' IE is present in 'SGSN Context Request' message, and some do not. This is only an editorial error, because 29.060 clearly indicates that this parameter is mandatory. On the other hand, such a detailed description of a message is not absolutely necessary in a stage 2 specification.

6.13.2.2 GSM to UMTS Inter-SGSN Change

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If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3GPP TS 23.122), as no combined RA / LA updates are performed during a CS connection.

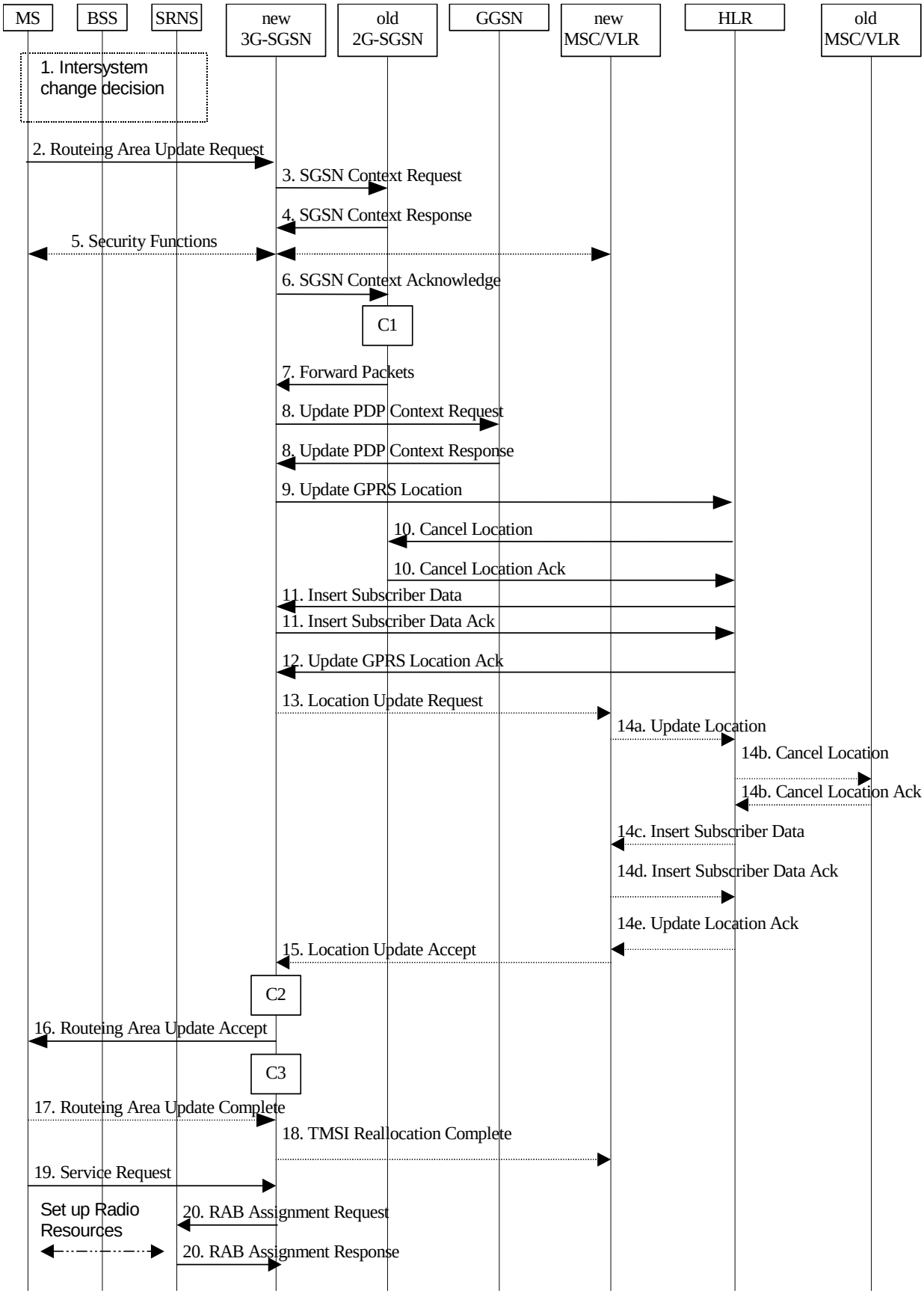

Figure 55: GSM to UMTS Inter SGSN Change

1) The MS or BSS or UTRAN decides to perform an inter-system change, which makes the MS switch to a new cell that supports UMTS radio technology, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, ~~TLLI~~IMSI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

3GPP TSG-SA WG2 #23 **Tdoc *S2-020608***
Sophia Antipolis, France. 18 – 22 February 2002

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **328** ⌘ rev **-** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Parameter correction in GSM to UMTS inter system RA update
Source:	⌘	Nokia
Work item code:	⌘	TEI5 ***Date:*** ⌘ 12.02.2002
Category:	⌘	**A** ***Release:*** ⌘ REL-5

Use one of the following categories:
F *(essential 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)

Reason for change: ⌘ A clear (copy and paste) error was made in section 6.13.2.2, "A/Gb mode to Iu mode Inter-SGSN Change" as it reads that in the following case a 3G SGSN sends TLLI to a 2G SGSN:

> "If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, **TLLI**, MS Validated, New SGSN Address) message to the old 2G-SGSN."

This is not possible because, when sending the SGSN Context Request message the new 3G SGSN **has no means to know** if the old SGSN is 2G or 3G. Besides, section 6.9.2.1, "Routeing Area Update Procedure reads:

> "If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (**IMSI**, old RAI, MS Validated) message to the old SGSN."

Therefore, the existing text in section 6.13.2.2 makes the procedure impossible to implement.

Clearly, during the RAU the new 3G SGSN should always use IMSI and not TLLI.

Summary of change: ⌘ Replacing TLLI by IMSI in SGSN Context Request with MS Validated

Consequences if not approved: ⌘ Not possible to implement the specification as it stands

Clauses affected: ⌘ 6.13.2.2

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

Other comments:	⌘	This comment offers to consider correcting another minor editorial error by possible future CR. Some sections of 23.060 indicate that 'New SGSN address' IE is present in 'SGSN Context Request' message, and some do not. This is only an editorial error, because 29.060 clearly indicates that this parameter is mandatory. On the other hand, such a detailed description of a message is not absolutely necessary in a stage 2 specification.

6.13.2.2 A/Gb mode to Iu mode Inter-SGSN Change

The inter-system change from A/Gb mode to Iu mode takes place when a GPRS-attached MS changes from A/Gb mode to UTRAN or GERAN Iu mode and the new RAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a Iu mode RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update, these RA update cases are illustrated in Figure 1. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3GPP TS 23.122), as no combined RA / LA updates are performed during a CS connection.

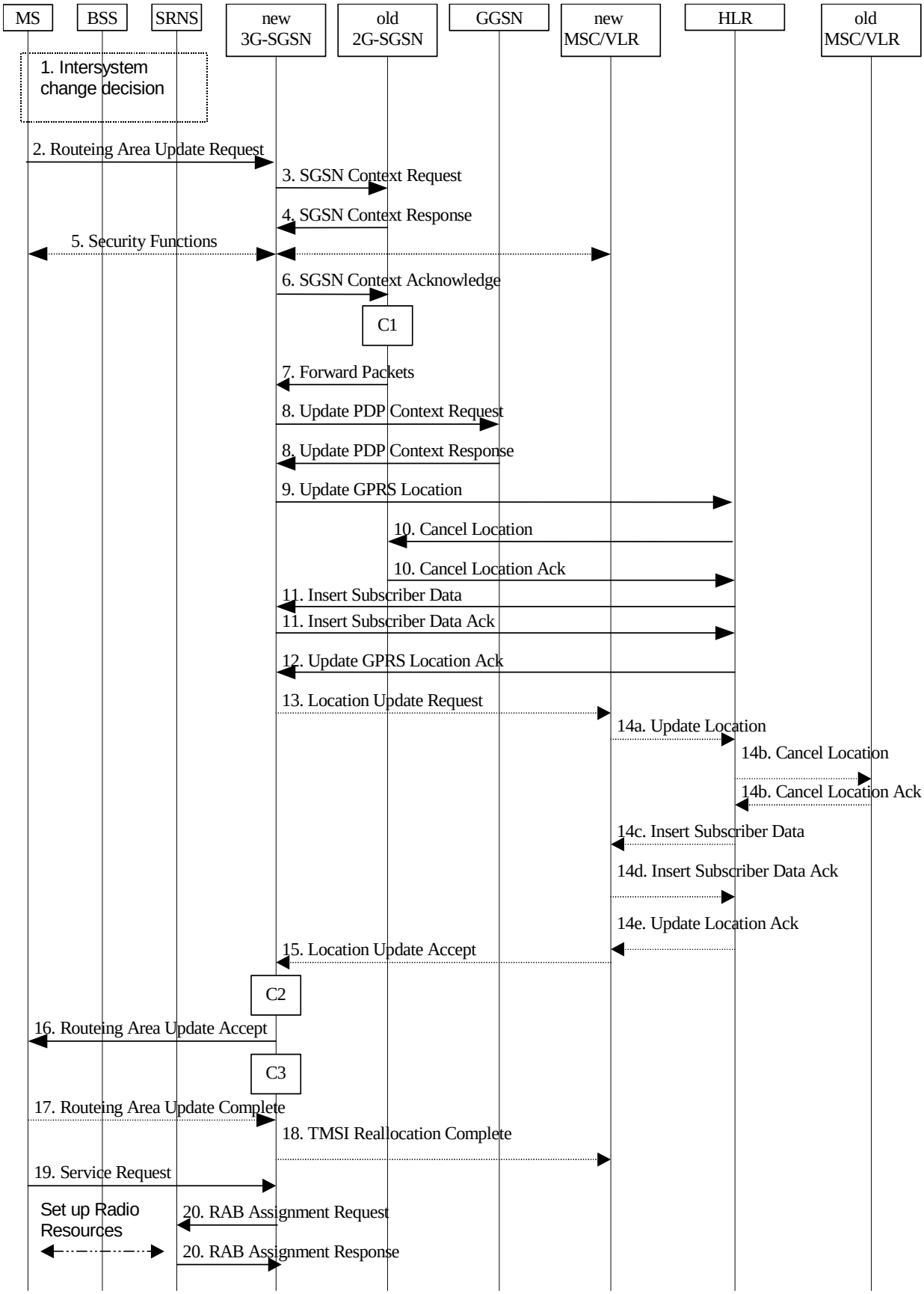

Figure 1: A/Gb mode to Iu mode Inter SGSN Change

1) The MS or RAN decides to perform an inter-system change, which makes the MS switch to a new cell where Iu mode has to be used, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, ~~TLLI~~IMSI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020644***
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **336** ⌘ ev ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network **X**

Title:	⌘	Corrections on Clarification of handling of real-time PDP contexts due to incorrect implementation of CR 250
Source:	⌘	Siemens
Work item code:	⌘	TEI4
Date:	⌘	13th February 2002
Category:	⌘	**F**
Release:	⌘	REL-4

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)

Reason for change:	⌘	CR 250 is wrongly implemented.
Summary of change:	⌘	Correction of wrongly implemented CR. Additionally an editorial correction is done in chapter 9.2.5.2.
Consequences if not approved:	⌘	Incorrect TS

Clauses affected:	⌘	6.12.1; 9.2.5.2		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.12.1 MS Initiated Service Request Procedure

The MS in PMM-IDLE state sends the Service Request message to the 3G-SGSN in order to establish the PS signalling connection for the upper layer signalling or for the resource reservation for active PDP context(s). After receiving the Service Request message, the 3G-SGSN may perform authentication, and it shall perform the security mode procedure. After the establishment of the secure PS signalling connection to a 3G-SGSN, the MS may send signalling messages, e.g. Activate PDP Context Request, to the 3G-SGSN, or the 3G-SGSN may start the resource reservation for the active PDP contexts depending on the requested service in the Service Request message. An MS in PMM-CONNECTED state also requests the resource reservation for the active PDP contexts through this procedure.

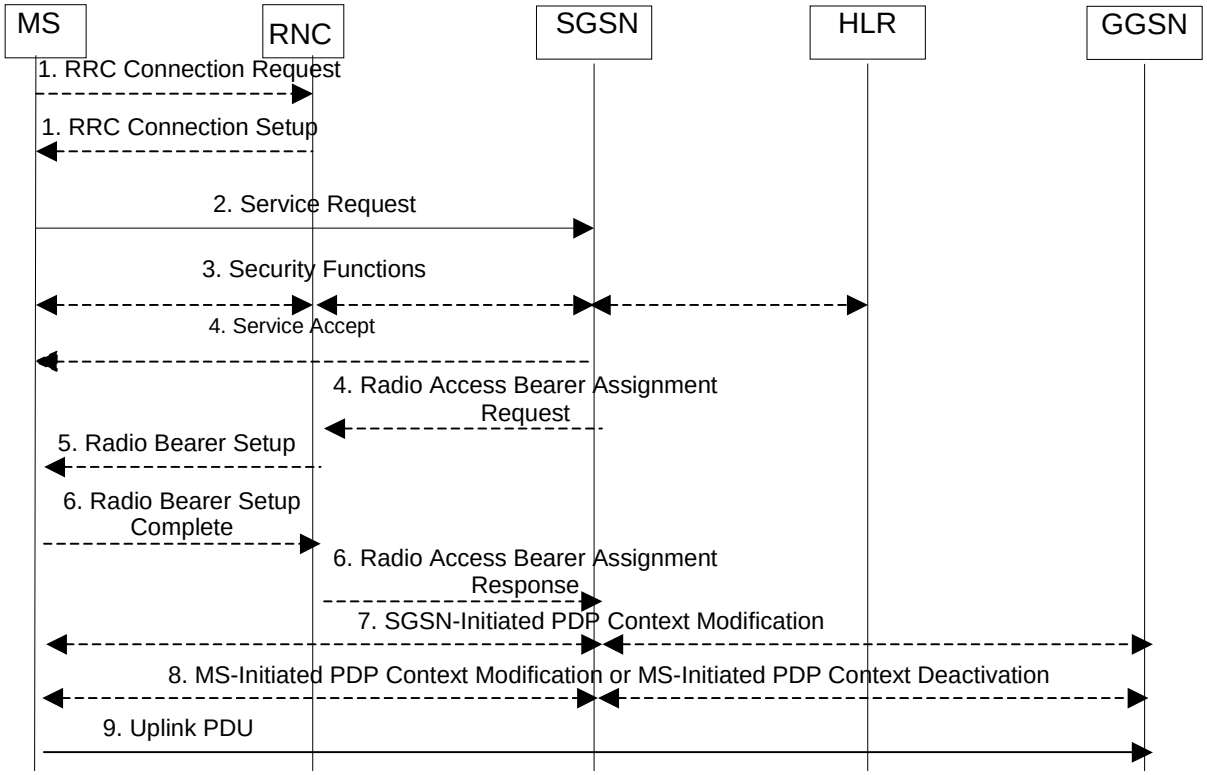

Figure 50: MS Initiated Service Request Procedure

1) The MS establishes an RRC connection, if none exists for CS traffic.

2) The MS sends a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling. At this point, the SGSN may perform the authentication procedure.

   If Service Type indicates Data, a signalling connection is established between the MS and the SGSN, and resources for active PDP context(s) are allocated, i.e. RAB establishment for the activated PDP context(s).

   If Service Type indicates Signalling, the signalling connection is established between the MS and the SGSN for sending upper-layer signalling messages, e.g. Activate PDP Context Request. The resources for active PDP context(s) are not allocated.

3) The SGSN shall perform the security functions if the MS in PMM-IDLE state initiated the service request.

4) If the network is in PMM-CONNECTED state and the Service Type indicates Data, the SGSN shall respond with a Service Accept message towards the MS, in case the service request can be accepted. In case Service Type indicates Data, the SGSN sends a Radio Access Bearer Assignment Request (NSAPIRAB ID(s), TEID(s), QoS Profile(s), SGSN IP Address(es)) message to re-establish radio access bearer for every activated PDP context.

5) The RNC indicates to the MS the new Radio Bearer Identity established and the corresponding RAB ID with the RRC radio bearer setup procedure.

6) SRNC responds with the Radio Access Bearer Assignment Response (RAB ID(s), TEID(s), QoS Profile(s), RNC IP Address(es)) message. The GTP tunnel(s) are established on the Iu interface. If the RNC returns a Radio Access Bearer Assignment Response message with a cause indicating that the requested QoS profile(s) can not be provided, e.g. "Requested Maximum Bit Rate not Available", the SGSN may send a new Radio Access Bearer Assignment Request message with different QoS profile(s). The number of re-attempts, if any, as well as how the new QoS profile(s) values are determined is implementation dependent.

~~7) For each RAB using streaming or conversational traffic class with maximum bitrate of 0 kbit/s (e.g. after "RNC-Initiated PDP Context Modification Procedure") the MS starts the MS-Initiated PDP Context Modification procedure or the PDP Context Deactivation Initiated by MS procedure to inform the CN whether to re-activate or to delete the PDP contexts.~~

7~~8~~) For each RAB re-established with a modified QoS profile, the SGSN initiates a PDP Context Modification procedure to inform the MS and the GGSN of the new negotiated QoS profile for the corresponding PDP context.

8) For each RAB using streaming or conversational traffic class with maximum bitrate of 0 kbit/s (e.g. after "RNC-Initiated PDP Context Modification Procedure") the MS starts the MS-Initiated PDP Context Modification procedure or the PDP Context Deactivation Initiated by MS procedure to inform the CN whether to re-activate or to delete the PDP contexts.

9) The MS sends the uplink packet.

For Service Type = Signalling, the MS knows that the Service Request message was successfully received in the SGSN when the MS receives the RRC Security Mode Control Command message.

For Service Type = Data, in PMM-IDLE, the MS knows that the Service Request was successfully received when the MS receives the RRC Security Mode Control Command message from the RNC; in PMM-CONNECTED state, the MS knows that the Service Request was successfully received when the MS receives the Service Accept message.

NOTE: The reception of the Service Accept message does not imply the successful re-establishment of the RAB(s).

For any Service Type, in case the service request cannot be accepted, the network returns a Service Reject message to the MS with an appropriate cause value.

For Service Type = Data, in case the SGSN fails to re-establish RAB(s) for the PDP context(s), the SGSN determines if an SM procedure, such as SGSN-Initiated PDP Context Modification or PDP Context Deactivation, should be initiated. The appropriate action depends on the QoS profile of the PDP context and is an operator choice.

NEXT MODIFICATION

9.2.5.2 Re-establishment of RABs

The procedure for re-establishment of RABs allows the SGSN to re-establish RABs for active PDP contexts that don't have an associated RAB.

The MS initiates the re-establishment of RABs by using the Service Request (Service Type = Data) message. This is described in the sub-clause "MS Initiated Service Request Procedure" ~~describes this~~.

When RABs for an MS that has no RRC connection needs to be re-established, the CN must first page the MS. The clause "Network Initiated Service Request Procedure" describes this.

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020645***
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **337** ⌘ ev ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network **X**

Title:	⌘	Corrections on Clarification of handling of real-time PDP contexts due to incorrect implementation of CR 250
Source:	⌘	Siemens
Work item code:	⌘	TEI5
Date:	⌘	13th February 2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)

Reason for change:	⌘	CR 250 is wrongly implemented.
Summary of change:	⌘	Correction of wrongly implemented CR. Additionally an editorial correction is done in chapter 9.2.5.2.
Consequences if not approved:	⌘	Incorrect TS

Clauses affected:	⌘	6.12.1; 9.2.5.2		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

How to create CRs using this form:
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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.12.1 MS Initiated Service Request Procedure

The MS in PMM-IDLE state sends the Service Request message to the 3G-SGSN in order to establish the PS signalling connection for the upper layer signalling or for the resource reservation for active PDP context(s). After receiving the Service Request message, the 3G-SGSN may perform authentication, and it shall perform the security mode procedure. After the establishment of the secure PS signalling connection to a 3G-SGSN, the MS may send signalling messages, e.g. Activate PDP Context Request, to the 3G-SGSN, or the 3G-SGSN may start the resource reservation for the active PDP contexts depending on the requested service in the Service Request message. An MS in PMM-CONNECTED state also requests the resource reservation for the active PDP contexts through this procedure.

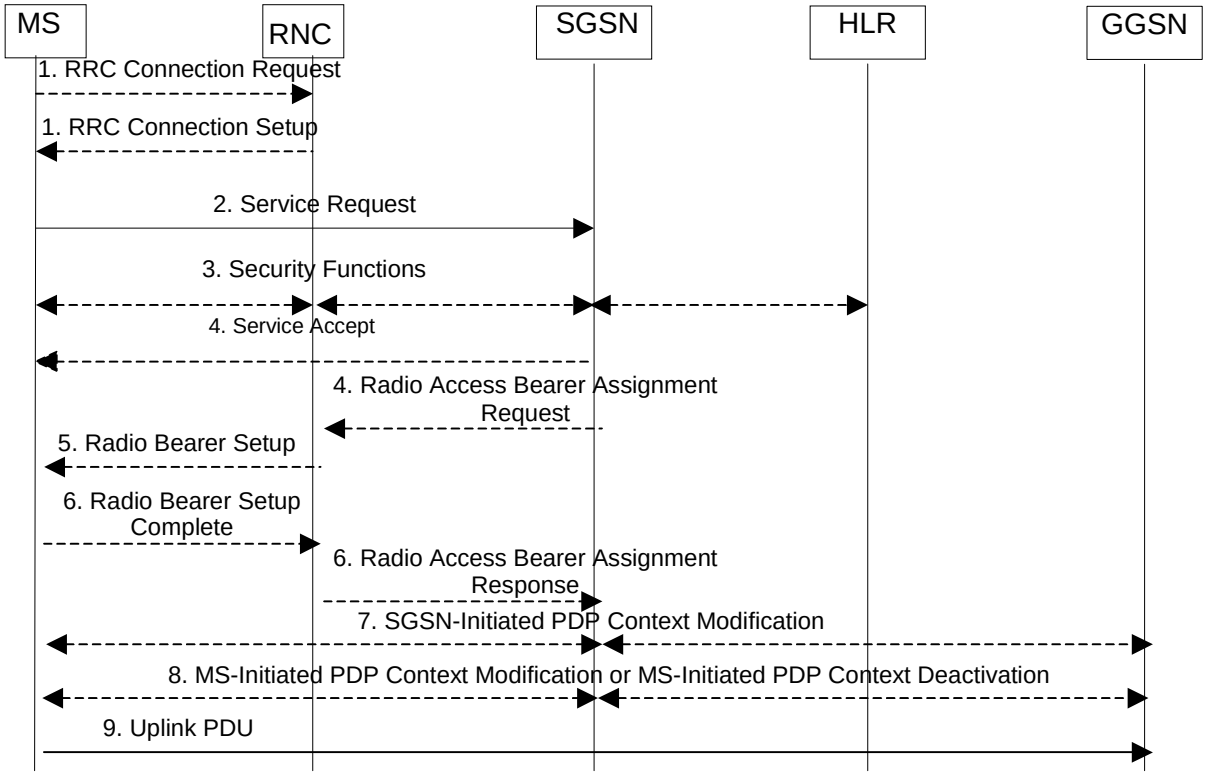


Figure 50: MS Initiated Service Request Procedure

1) The MS establishes an RRC connection, if none exists for CS traffic.

2) The MS sends a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling. At this point, the SGSN may perform the authentication procedure.

   If Service Type indicates Data, a signalling connection is established between the MS and the SGSN, and resources for active PDP context(s) are allocated, i.e. RAB establishment for the activated PDP context(s).

   If Service Type indicates Signalling, the signalling connection is established between the MS and the SGSN for sending upper-layer signalling messages, e.g. Activate PDP Context Request. The resources for active PDP context(s) are not allocated.

3) The SGSN shall perform the security functions if the MS in PMM-IDLE state initiated the service request.

4) If the network is in PMM-CONNECTED state and the Service Type indicates Data, the SGSN shall respond with a Service Accept message towards the MS, in case the service request can be accepted. In case Service Type indicates Data, the SGSN sends a Radio Access Bearer Assignment Request (NSAPIRAB ID(s), TEID(s), QoS Profile(s), SGSN IP Address(es)) message to re-establish radio access bearer for every activated PDP context.

5) The RNC indicates to the MS the new Radio Bearer Identity established and the corresponding RAB ID with the RRC radio bearer setup procedure.

6) SRNC responds with the Radio Access Bearer Assignment Response (RAB ID(s), TEID(s), QoS Profile(s), RNC IP Address(es)) message. The GTP tunnel(s) are established on the Iu interface. If the RNC returns a Radio Access Bearer Assignment Response message with a cause indicating that the requested QoS profile(s) can not be provided, e.g. "Requested Maximum Bit Rate not Available", the SGSN may send a new Radio Access Bearer Assignment Request message with different QoS profile(s). The number of re-attempts, if any, as well as how the new QoS profile(s) values are determined is implementation dependent.

~~7) For each RAB using streaming or conversational traffic class with maximum bitrate of 0 kbit/s (e.g. after "RNC-Initiated PDP Context Modification Procedure") the MS starts the MS-Initiated PDP Context Modification procedure or the PDP Context Deactivation Initiated by MS procedure to inform the CN whether to re-activate or to delete the PDP contexts.~~

7~~8~~) For each RAB re-established with a modified QoS profile, the SGSN initiates a PDP Context Modification procedure to inform the MS and the GGSN of the new negotiated QoS profile for the corresponding PDP context.

8) For each RAB using streaming or conversational traffic class with maximum bitrate of 0 kbit/s (e.g. after "RNC-Initiated PDP Context Modification Procedure") the MS starts the MS-Initiated PDP Context Modification procedure or the PDP Context Deactivation Initiated by MS procedure to inform the CN whether to re-activate or to delete the PDP contexts.

9) The MS sends the uplink packet.

For Service Type = Signalling, the MS knows that the Service Request message was successfully received in the SGSN when the MS receives the RRC Security Mode Control Command message.

For Service Type = Data, in PMM-IDLE, the MS knows that the Service Request was successfully received when the MS receives the RRC Security Mode Control Command message from the RNC; in PMM-CONNECTED state, the MS knows that the Service Request was successfully received when the MS receives the Service Accept message.

NOTE: The reception of the Service Accept message does not imply the successful re-establishment of the RAB(s).

For any Service Type, in case the service request cannot be accepted, the network returns a Service Reject message to the MS with an appropriate cause value.

For Service Type = Data, in case the SGSN fails to re-establish RAB(s) for the PDP context(s), the SGSN determines if an SM procedure, such as SGSN-Initiated PDP Context Modification or PDP Context Deactivation, should be initiated. The appropriate action depends on the QoS profile of the PDP context and is an operator choice.

NEXT MODIFICATION

9.2.5.2 Re-establishment of RABs

The procedure for re-establishment of RABs allows the SGSN to re-establish RABs for active PDP contexts that don't have an associated RAB.

The MS initiates the re-establishment of RABs by using the Service Request (Service Type = Data) message. This is described in the sub-clause "MS Initiated Service Request Procedure" ~~describes this~~.

When RABs for an MS that has no RRC connection needs to be re-established, the CN must first page the MS. The clause "Network Initiated Service Request Procedure" describes this.

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020712***
Sophia Antipolis, France, 18-22 February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **311** ⌘ ev **1** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Correction of CAMEL procedure calls at SRNS relocation
Source:	⌘	Ericsson
Work item code:	⌘	TEI
Date:	⌘	18 February 2002
Category:	⌘	**F**
Release:	⌘	R99

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)

Reason for change: ⌘

In the Routeing Area Update procedures the CAMEL interaction point C1 (PDP context Disconnection) is placed after the SGSN Context Response has been sent by the old SGSN but before it receives the SGSN Context Acknowledge.

If the Security Functions performed by the new SGSN before sending the SGSN Context Acknowledge fail to authenticate the MS, the RAU shall be rejected and the old SGSN shall continue as if the SGSN Context Request was never received. But in this case the PDP Context Disconnection has already been reported to the SCP, hence the PDP context continues without CAMEL control.

The real indication that the PDP context has been successfully handed over to the new SGSN is indeed the SGSN Context Acknowledge.

Note that sections 6.13.2.1 and 6.13.2.2 (inter-SGSN inter-system change) show the correct placement of the CAMEL procedure calls. However some editorial corrections are needed in the corresponding text of section 6.13.2.2.

Other Changes:

In section 6.9.2.1, in addition to the above-mentioned problem, the CAMEL interaction point C2 is placed after the packet forwarding has started. There is no reason to handle this case differently; C2 shall be placed right after the SGSN Context Acknowledge, after C1.

Summary of change: ⌘

In sections 6.9.1.2.2, 6.9.1.3.2 and 6.9.2.1: place the CAMEL procedure calls CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach right after the SGSN Context Acknowledge. A single CAMEL interaction point C1 is used in the figure, which is aligned with the way this is presented in sections 6.13.2.1 and 6.13.2.2.

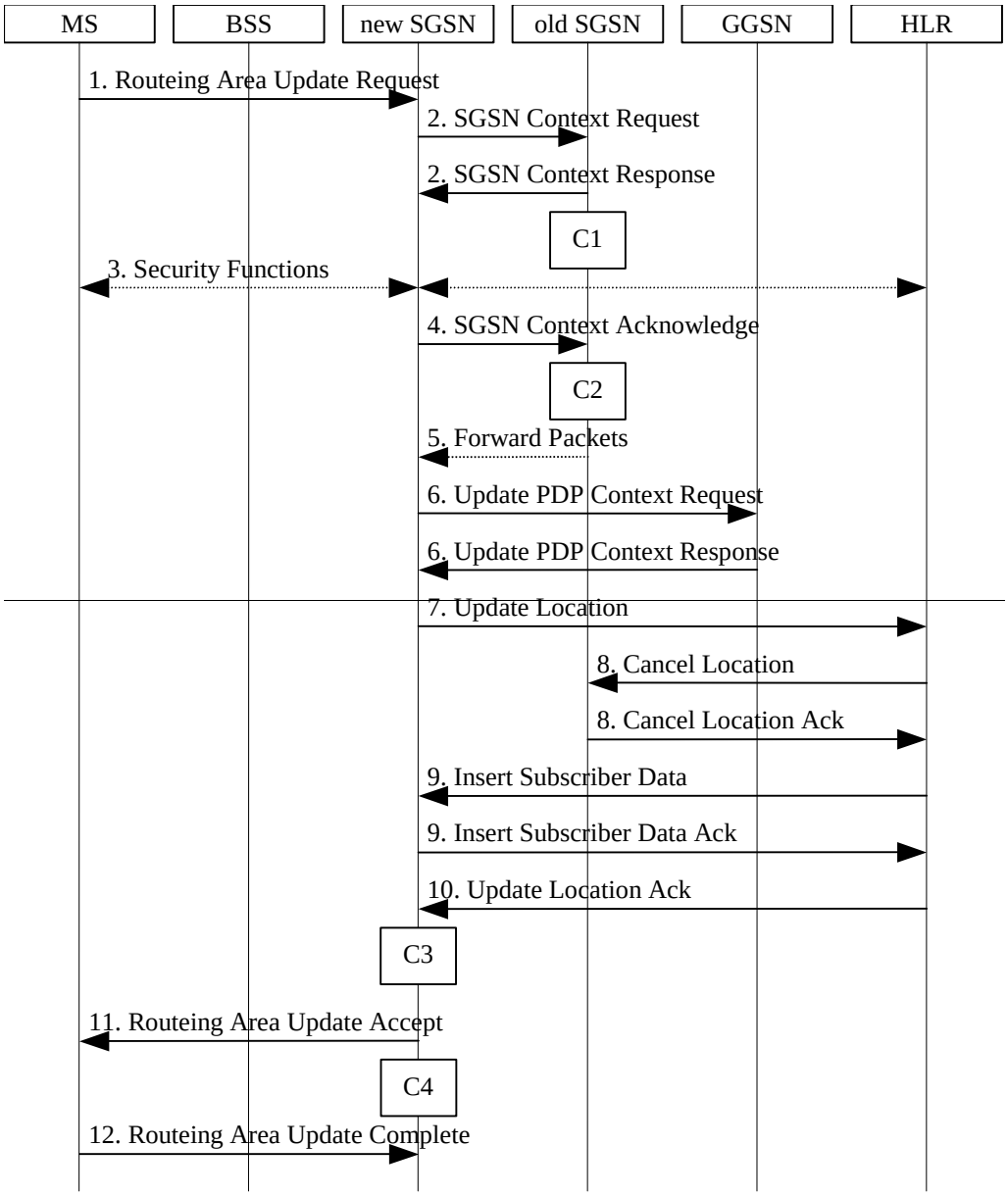
In sections 6.13.2.2: correct some editing problems in the description of the

		CAMEL interaction point C1 in line with section 6.13.2.1.
Consequences if not approved:	⌘	At inter SGSN Routeing Area Update, if the new SGSN fails to authenticate the MS, the PDP context would continue in the old SGSN without CAMEL control.

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2; 6.9.2.1 and 6.13.2.2			
Other specs affected:	⌘	☐	Other core specifications	⌘	
		☐	Test specifications		
		☐	O&M Specifications		
Other comments:	⌘				

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 1.


MS
BSS
new SGSN
old SGSN
GGSN
HLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
C1
3. Security Functions
4. SGSN Context Acknowledge
C2
5. Forward Packets
6. Update PDP Context Request
6. Update PDP Context Response
7. Update Location
8. Cancel Location
8. Cancel Location Ack
9. Insert Subscriber Data
9. Insert Subscriber Data Ack
10. Update Location Ack
C3
11. Routeing Area Update Accept
C4
12. Routeing Area Update Complete

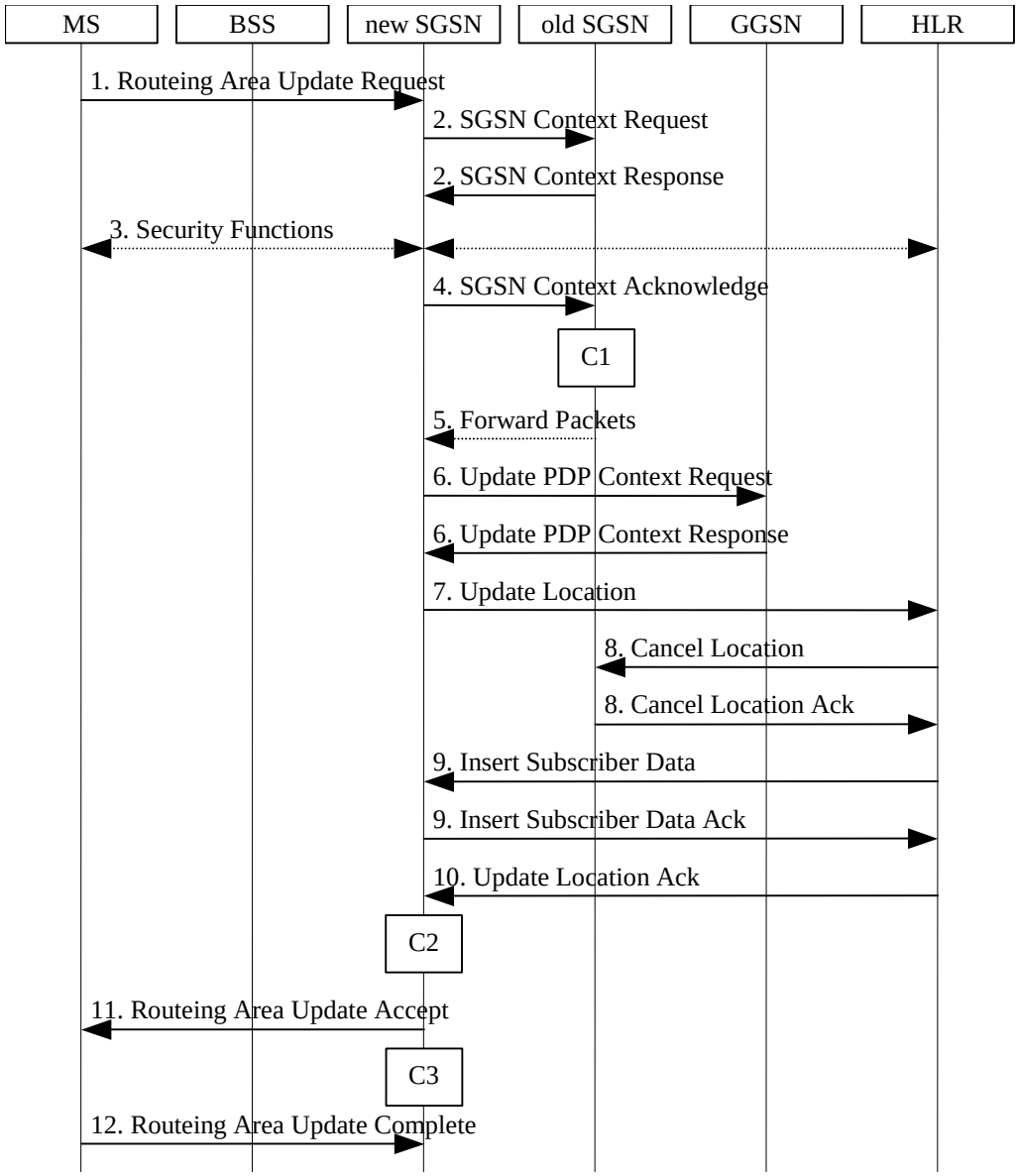


Figure 1: Inter SGSN Routeing Area Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old

SGSN starts a timer and stops the transmission of N-PDUs to the MS. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.

   If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.

4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, then the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.

6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TEID).

7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter-SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

11) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS, is not allowed to be attached in the SGSN, or if subscription checking fails, the new SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

12) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, , or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS does not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, the old SGSN stops forwarding N-PDUs to the new SGSN.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter IDLE state.

CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

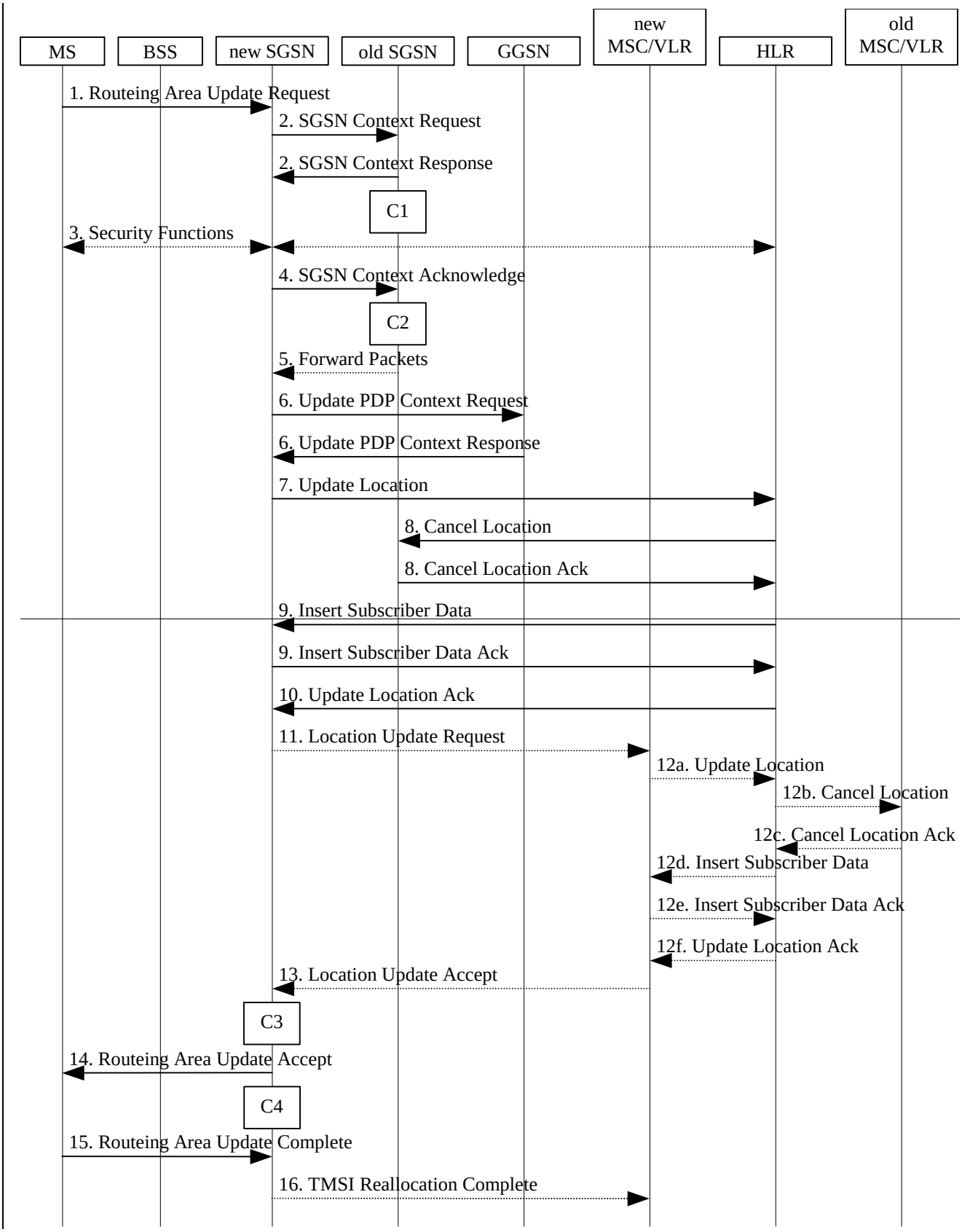
C3~~4~~) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter-SGSN) procedure is illustrated in Figure 2.


MS
BSS
new SGSN
old SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
C1
3. Security Functions
4. SGSN Context Acknowledge
C2
5. Forward Packets
6. Update PDP Context Request
6. Update PDP Context Response
7. Update Location
8. Cancel Location
8. Cancel Location Ack
9. Insert Subscriber Data
9. Insert Subscriber Data Ack
10. Update Location Ack
11. Location Update Request
12a. Update Location
12b. Cancel Location
12c. Cancel Location Ack
12d. Insert Subscriber Data
12e. Insert Subscriber Data Ack
12f. Update Location Ack
13. Location Update Accept
C3
14. Routeing Area Update Accept
C4
15. Routeing Area Update Complete
16. TMSI Reallocation Complete

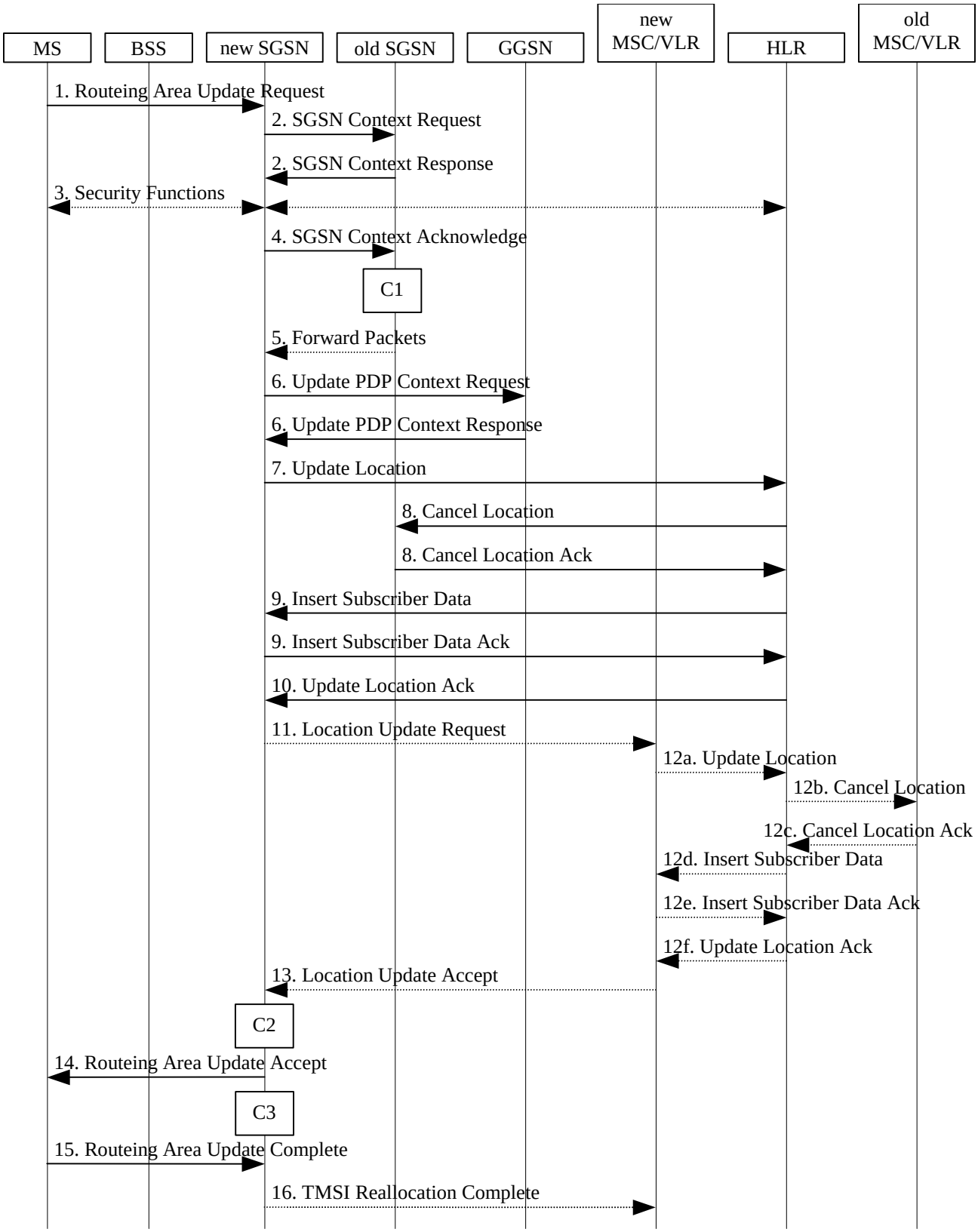


Figure 2: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and

supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous and the DRX cycle length.

2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the downlink transfer. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported. If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.

4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.

6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TEID).

7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

11) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI via a table in the SGSN. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.

12) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

    a) The new VLR sends an Update Location (new VLR) to the HLR.

    b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

    c) The old VLR acknowledges with Cancel Location Ack (IMSI).

    d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

    e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

    f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

13) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

14) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

15) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

16) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter IDLE state.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful location update is performed.

CAMEL procedure calls shall be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach.~~

~~The procedure returns as result "Continue".~~

C2~~3~~) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3~~4~~) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

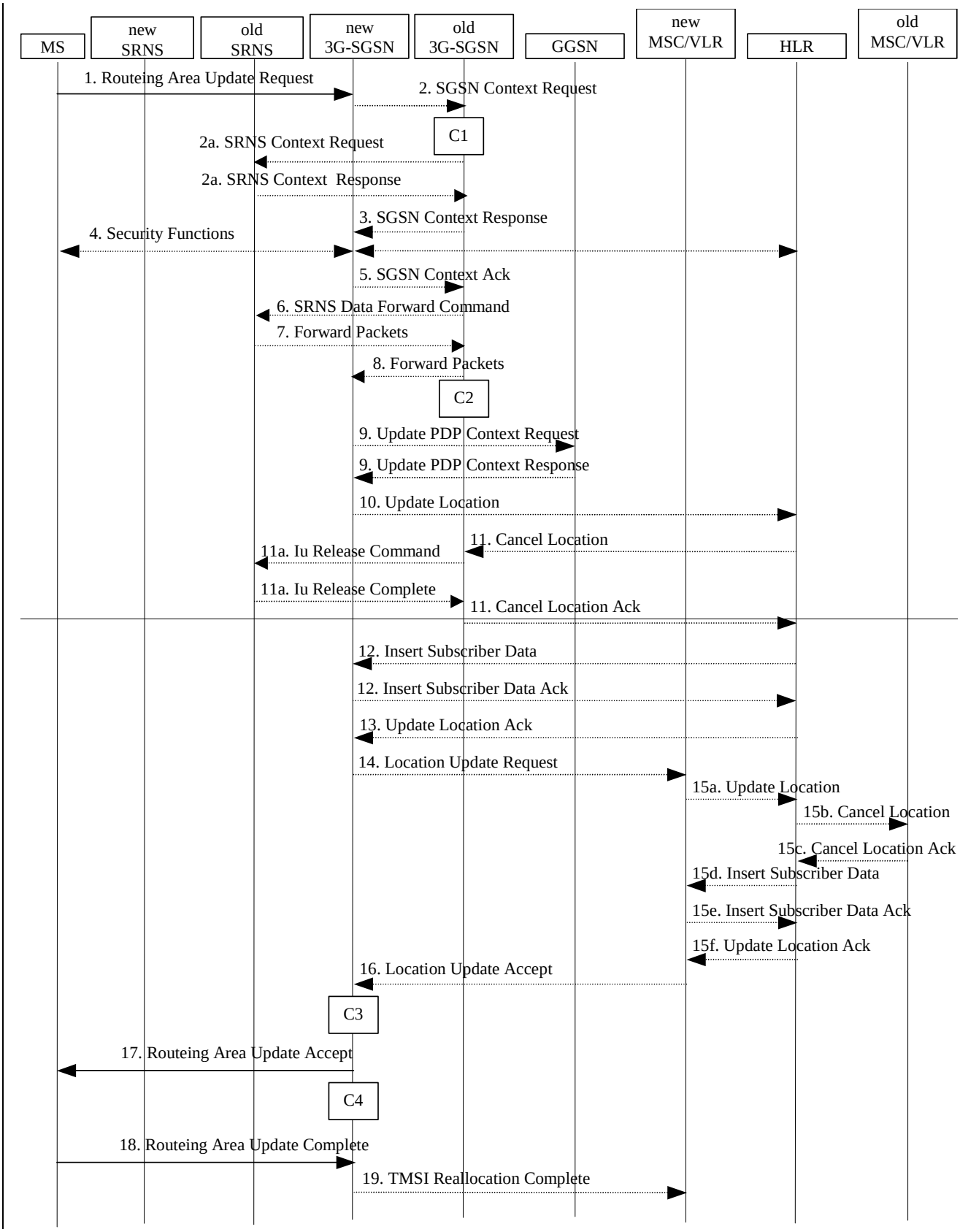
6.9.2.1 Routeing Area Update Procedure

A routeing area update takes place when an attached MS detects that it has entered a new RA or when the periodic RA update timer has expired or when RRC connection is released with cause "Directed Signalling connection re-establishment", or when the MS has to indicate new access capabilities to the network.

The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the GGSNs or the HLR about the new MS location. A periodic RA update is always an intra-SGSN routeing area update. If the network operates in mode I, an MS that is both GPRS-attached and IMSI-attached shall perform the Combined RA / LA Update procedures.

In Iu mode, an RA update is either an intra-SGSN or inter-SGSN RA update, either combined RA / LA update or only RA update, either initiated by an MS in PMM-CONNECTED (only valid after a Serving RNS Relocation Procedure, see sub-clause 6.9.2.2) or in PMM-IDLE state. All the RA update cases are contained in the procedure illustrated in Figure 3.

Note: The network may receive an RA update from a UE in PMM-CONNECTED state over a new Iu signalling connection. This could happen when the UE enters PMM-IDLE state on receipt of RRC Connection Release with cause "Directed Signalling connection re-establishment" and initiates an RA or Combined RA update procedure (see sub-clause 6.1.2.4.1).


MS
new SRNS
old SRNS
new 3G-SGSN
old 3G-SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
C1
2a. SRNS Context Request
2a. SRNS Context Response
3. SGSN Context Response
4. Security Functions
5. SGSN Context Ack
6. SRNS Data Forward Command
7. Forward Packets
8. Forward Packets
C2
9. Update PDP Context Request
9. Update PDP Context Response
10. Update Location
11. Cancel Location
11a. Iu Release Command
11a. Iu Release Complete
11. Cancel Location Ack
12. Insert Subscriber Data
12. Insert Subscriber Data Ack
13. Update Location Ack
14. Location Update Request
15a. Update Location
15b. Cancel Location
15c. Cancel Location Ack
15d. Insert Subscriber Data
15e. Insert Subscriber Data Ack
15f. Update Location Ack
16. Location Update Accept
C3
17. Routeing Area Update Accept
C4
18. Routeing Area Update Complete
19. TMSI Reallocation Complete

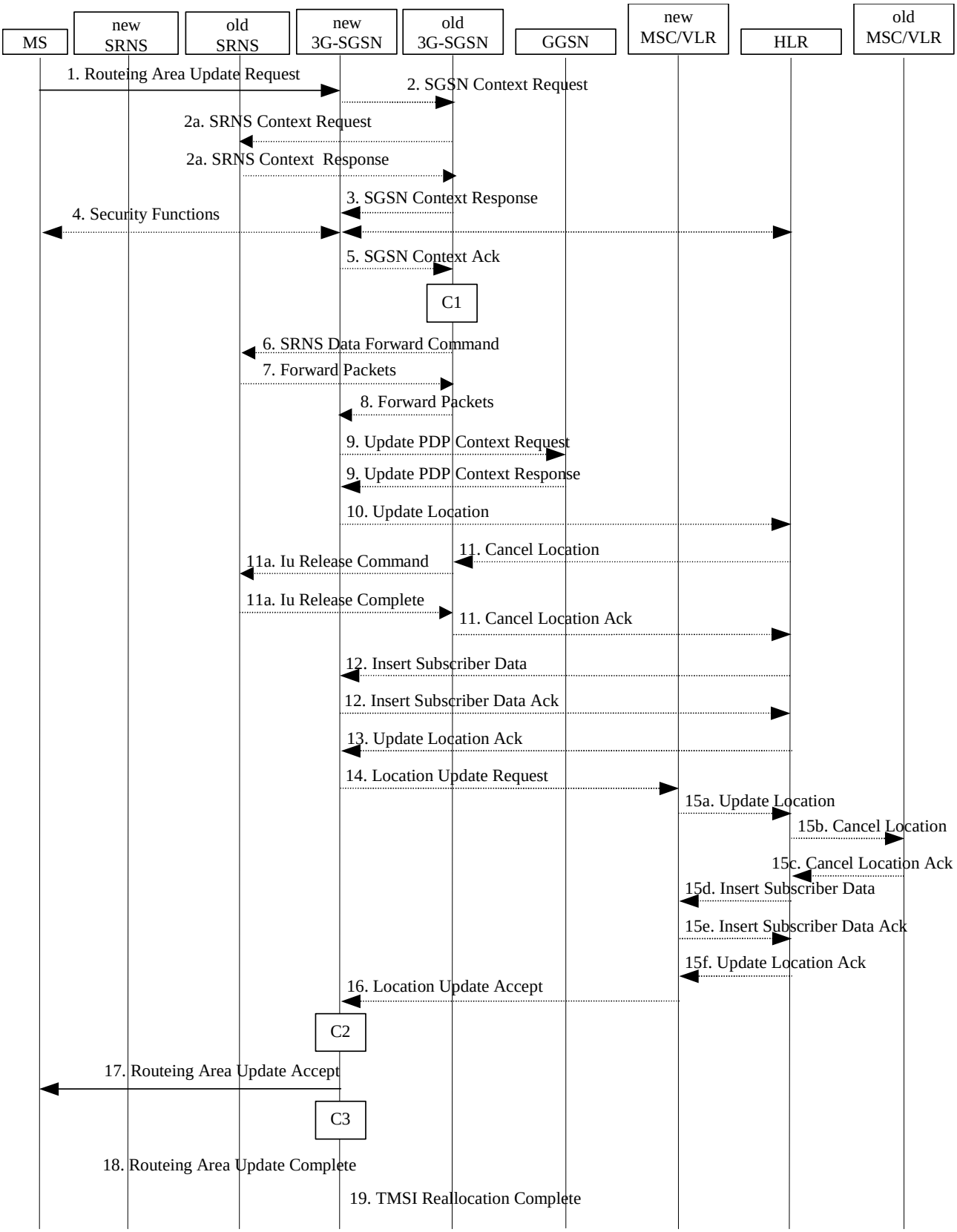


Figure 3: UMTS RA Update Procedure

1) The RRC connection is established, if not already done. The MS sends a Routeing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters, MS Network Capability) to the new SGSN. The MS shall set a follow-on request if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. Update Type shall indicate:

   - RA Update if the RA Update is triggered by a change of RA;
   - Periodic RA Update if the RA update is triggered by the expiry of the Periodic RA Update timer;
   - Combined RA / LA Update if the MS is also IMSI-attached and the LA update shall be performed in network operation mode I (see subclause "Interactions Between SGSN and MSC/VLR"); or
   - Combined RA / LA Update with IMSI attach requested if the MS wants to perform an IMSI attach in network operation mode I.

   The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS. Classmark is described in subclause "MS Network Capability". DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

NOTE: Sending the Routeing Area Update Request message to the SGSN triggers the establishment of a signalling connection between UTRAN and SGSN for the concerned MS.

2) If the RA update is an Inter-SGSN Routeing area update and if the MS was in PMM-IDLE state, the new SGSN sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN starts a timer. If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause.

2a) If the MS is PMM-CONNECTED in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old SGSN shall sends SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message. Upon reception of this message, the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

3) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next PDU to be sent to the MS. Each PDP Context also includes PDCP sequence numbers if PDCP sequence numbers are received from the old SRNS. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request. The GTP sequence numbers received from the old 3G-SGSN are only relevant if delivery order is required for the PDP context (QoS profile).

4) Security functions may be executed. These procedures are defined in subclause "Security Function". If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) If the RA update is an Inter-SGSN Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be

updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

6) If the MS is in PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.

7) For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with their related PDCP downlink sequence number, and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon receipt of the SRNS Data Forward Command message from the 3G SGSN, the SRNS shall start the data-forwarding timer.

8) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN. No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

9) If the RA update is an Inter-SGSN RA Update and if the MS was not in PMM-CONNECTED state in the new 3G-SGSN, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, Tunnel Endpoint Identifier,) to the GGSNs. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier). Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state in the new 3G-SGSN, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

10) If the RA update is an Inter-SGSN RA Update, the new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

11) If the RA update is an Inter-SGSN RA Update, the HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM context. Otherwise, the contexts are removed only when the timer expires. It also ensures that the MM context is kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

11a) On receipt of Cancel Location, if the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNC. When the data-forwarding timer expires, the SRNS responds with an Iu Release Complete message.

12) If the RA update is an nter-SGSN RA Update, the HLR sends Insert Subscriber Data (IMSI, subscription data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

13) If the RA update is an Inter-SGSN RA Update, the HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

14) If Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the association has to be established, and the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with ISI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI via a table in the SGSN. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 8). The VLR creates or updates the association with the SGSN by storing SGSN Number.

15) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

c) The old VLR acknowledges with Cancel Location Ack (IMSI).

d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

16) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

17) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).

18) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete message to the SGSN.

19) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

NOTE: Steps 15, 16, and 19 are performed only if step 14 is performed.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

NOTE: In case MS was in PMM-CONNECTED state the PDP Contexts are sent already in the Forward Relocation Request message as described in subclause “Serving RNS relocation procedures”.

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.

If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-PS services until a successful location update is performed.

CAMEL procedure calls shall be performed; see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- ~~This~~ The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

~~C2) CAMEL_GPRS_Detach.~~

~~The procedure returns as result "Continue".~~

C3) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C4) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

Next modified section

6.13.2.2 GSM to UMTS Inter-SGSN Change

The inter-system change from GSM to UMTS takes place when a GPRS-attached MS changes from GSM radio access to UTRAN and the UTRAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a UMTS RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update, these RA update cases are illustrated in Figure 4.

If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.

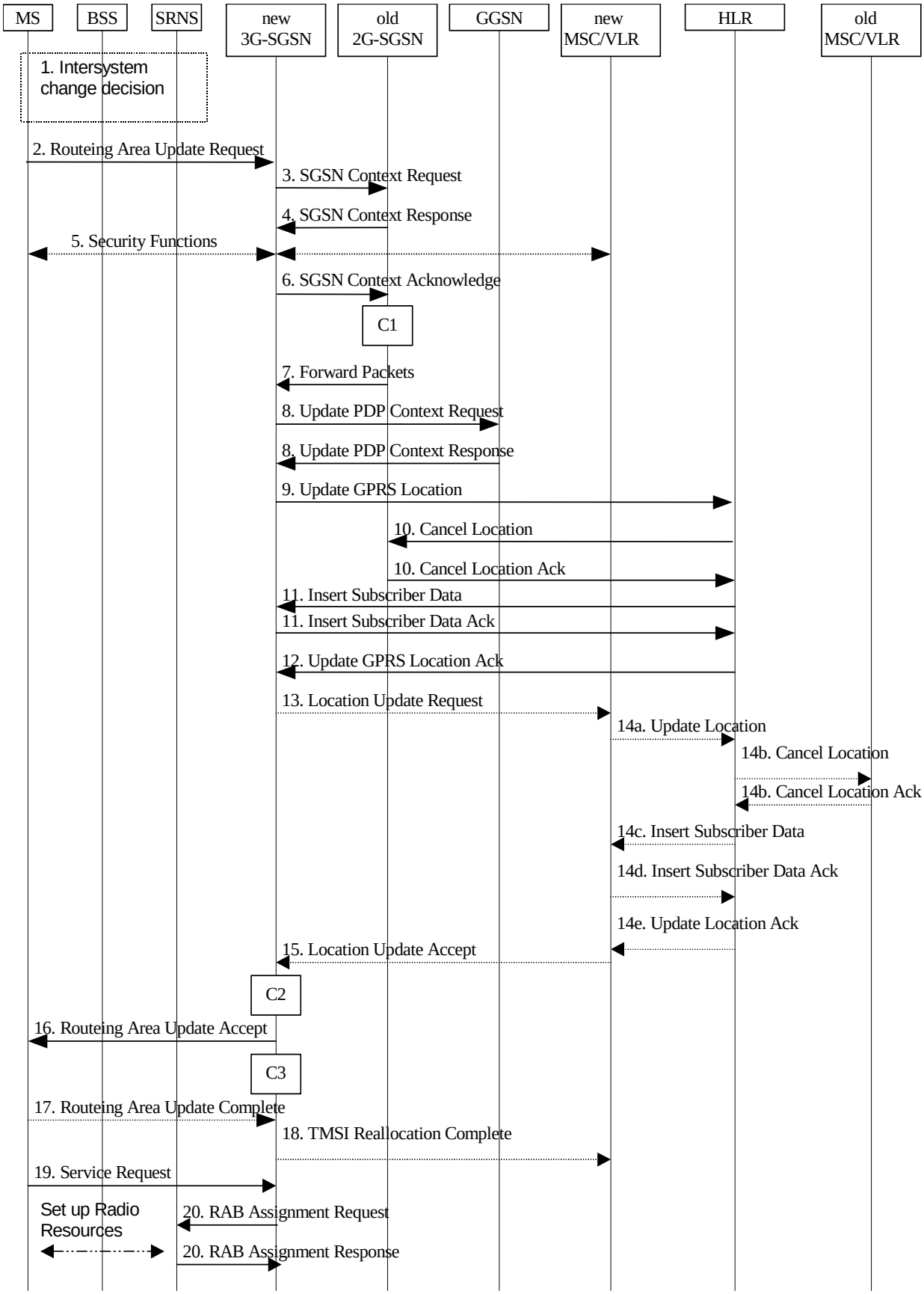


Figure 4: GSM to UMTS Inter SGSN Change

1) The MS or BSS or UTRAN decides to perform an inter-system change, which makes the MS switch to a new cell that supports UMTS radio technology, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

4) The old 2G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. Each PDP Context includes the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode SNDCP to the MS and the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode SNDCP from the MS. The new 3G-SGSN derives the corresponding PDCP sequence numbers from these N-PDU sequence numbers by adding eight most significant bits "1". These PDCP sequence numbers are stored in the 3G-SGSN PDP contexts. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

5) Security functions may be executed.

6) The new 3G-SGSN sends an SGSN Context Acknowledge message to the old 2G-SGSN. This informs the old 2G-SGSN that the new 3G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

7) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. Additional N-PDUs received from the GGSN before the timer described in step 3 expires are also duplicated and tunnelled to the new 3G-SGSN. N-PDUs that were already sent to the MS in acknowledged mode SNDCP and that are not yet acknowledged by the MS are tunnelled together with the corresponding SNDCP N-PDU sequence numbers. No PDCP sequence numbers shall be indicated for these N-PDUs. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.

8) The new 3G-SGSN sends an Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) message to each GGSN concerned. Each GGSN updates its PDP context fields and returns an Update PDP Context Response (TEID) message.

9) The new 3G-SGSN informs the HLR of the change of SGSN by sending an Update GPRS Location (SGSN Number, SGSN Address, IMSI) message to the HLR.

10) The HLR sends a Cancel Location (IMSI, Cancellation Type) message to the old 2G-SGSN. The old 2G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. If the timer is running, the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with a Cancel Location Ack (IMSI) message.

11) The HLR sends an Insert Subscriber Data (IMSI, GPRS Subscription Data) message to the new 3G-SGSN. The 3G-SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

12) The HLR acknowledges the Update GPRS Location by returning an Update GPRS Location Ack (IMSI) message to the new 3G-SGSN.

13) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI by the 3G-SGSN. The 3G-SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 12). The VLR creates or updates the association with the 3G-SGSN by storing SGSN Number.

14) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

   b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

   c) The old VLR acknowledges with Cancel Location Ack (IMSI).

   d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

   e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

   f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

15) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the 3G-SGSN. VLR TMSI is optional if the VLR has not changed.

16) The new 3G-SGSN validate the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the new 3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new 3G-SGSN constructs MM and PDP contexts for the MS. The new 3G-SGSN responds to the MS with a Routeing Area Update Accept (P-TMSI, P-TMSI signature) message.

17) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete message to the SGSN.

18) The new 3G-SGSN sends TMSI Reallocation Complete message to the new VLR, if the MS confirms the VLR TMSI.

19) If the MS has uplink data or signalling pending it shall send a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.

20) If the MS sent the Service Request, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request (RAB ID(s), QoS Profile(s), GTP-SNDs, GTP-SNUs, PDCP-SNUs) message to the SRNS. The PDCP sequence numbers are derived from the N-PDU sequence numbers in step 4 and are stored in the SGSN PDP context. The SRNS sends a Radio Bearer Setup Request (PDCP-SNUs) message to the MS. The MS responds with a Radio Bearer Setup Complete (PDCP-SNDs) message. The MS deducts PDCP-SND from its Receive N-PDU Number by adding eight most significant bits "1". The SRNS responds with a RAB Assignment Response message. The SRNS shall discard all N-PDUs tunnelled from the SGSN with N-PDU sequence numbers older than the eight least significant bits of the PDCP-SNDs received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with SNDCP sequence numbers older than the eight least significant bits of the PDCP-SNUs received from the SRNS. Other N-PDUs shall be transmitted to the SRNS. The SRNS negotiates with the MS for each radio bearer the use of lossless PDCP or not regardless whether the old 2G-SGSN used acknowledged or unacknowledged SNDCP for the related NSAPI or not.

NOTE: The NSAPI value is carried in the RAB ID IE.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as

described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

CAMEL procedure calls shall be performed, see referenced procedure in 3G TS 23.078: ~~performed, see referenced procedures in 3G TS 23.078.~~

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

These procedures are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. It returns as result "Continue".

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18-22 February 2002

Tdoc S2-020713

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **315** ⌘ ev **1** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	CAMEL procedure call irrespective of GPRS-CSI/SMS-CSI
Source:	⌘	Ericsson
Work item code:	⌘	TEI4
Date:	⌘	18 February 2002
Category:	⌘	**F**
Release:	⌘	REL-4

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)

Reason for change:	⌘	Correction of wrongly implemented CR 254r1 (S2-012392) approved in SA2#19. Changes in section 6.6.1 were not fully implemented in 23.060 v4.2.0. The real problem was on the implementation of the corresponding CR 253r1 for R99, so this mirror CR is just for completeness.
Summary of change:	⌘	Grammatical corrections.
Consequences if not approved:	⌘	Nothing serious; just wrong grammar will persist.

Clauses affected:	⌘	6.6.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.6.1 MS-Initiated Detach Procedure

The MS-Initiated Detach procedure when initiated by the MS is illustrated in Figure 23.

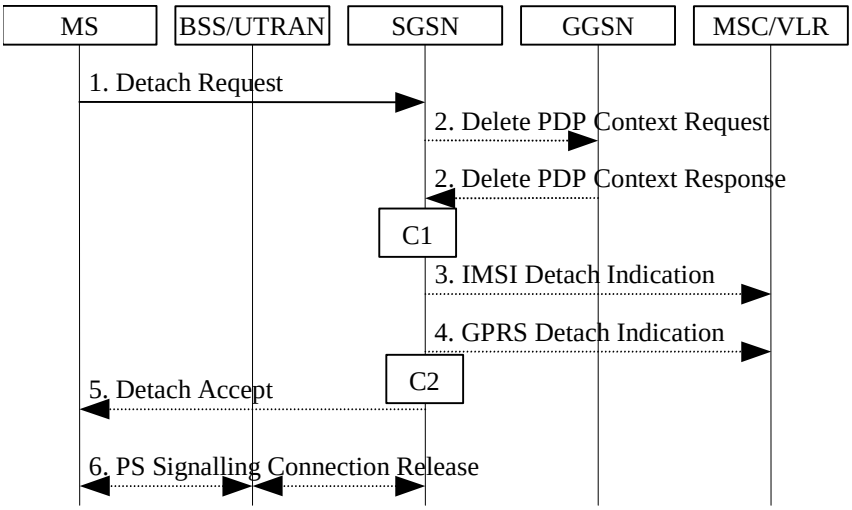


Figure 23: MS-Initiated Combined GPRS / IMSI Detach Procedure

1) The MS detaches by sending Detach Request (Detach Type, P-TMSI, P-TMSI Signature, Switch Off) to the SGSN. Detach Type indicates which type of detach is to be performed, i.e., GPRS Detach only, IMSI Detach only or combined GPRS and IMSI Detach. Switch Off indicates whether detach is due to a switch off situation or not. The Detach Request message includes P-TMSI and P-TMSI Signature. P-TMSI Signature is used to check the validity of the Detach Request message. If P-TMSI Signature is not valid or is not included, the authentication procedure should be performed.

2) If GPRS detach, the active PDP contexts in the GGSNs regarding this particular MS are deactivated by the SGSN sending Delete PDP Context Request (TEID) to the GGSNs. The GGSNs acknowledge with Delete PDP Context Response (TEID).

3) If IMSI detach, the SGSN sends an IMSI Detach Indication (IMSI) message to the VLR.

4) If the MS wants to remain IMSI-attached and is doing a GPRS detach, the SGSN sends a GPRS Detach Indication (IMSI) message to the VLR. The VLR removes the association with the SGSN and handles paging and location update without going via the SGSN.

5) If Switch Off indicates that detach is not due to a switch off situation, the SGSN sends a Detach Accept to the MS.

6) If the MS was GPRS detached, then the 3G-SGSN releases the PS signalling connection.

The CAMEL procedure calls shall be performed; see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection.

This procedure is called several times: once per PDP context. The procedure returns as result "Continue".

C2) CAMEL_GPRS_Detach.

The procedure returns as result "Continue".

3GPP TSG SA WG2 #23 **S2-020717**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **333** ⌘ **rev** **1** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Clarification on the significance of packet flow contexts
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	12.2.2002
Category:	⌘	**F**
Release:	⌘	R99

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)

Reason for change:	⌘	It is not clear from the description of the BSS contexts within which scope the packet flow contexts and the related identities are significant. There are reserved values which indicate QoS profiles which may be used for data transfers of MSs without a BSS context. And, there are non-reserved values and releated packet flow contexts which are obviously only significant for an MS if explicitely signalled by the SGSN. It is not described what an BSS packet flow context is.
Summary of change:	⌘	It is clarified, that BSS packet flow contexts with non-reserved identifier values are only significant within the BSS context of the MS for which the information was sent by SGSN. Description added for the BSS packet flow context.
Consequences if not approved:	⌘	Different non interoperable implementations.

Clauses affected:	⌘	12.6.3.5		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

How to create CRs using this form:
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2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

12.6.3.5 BSS Context

The SGSN may ~~can~~ provide a BSS with information related to ongoing user data transmission in A/Gb mode. The information is given as BSS packet flow contexts, which describe QoS characteristics for the data transmission. All BSS packet flow contexts related to one MS are~~is~~ stored in an MS specific BSS context. The BSS may contain BSS contexts for several MSs. ~~A BSS context contains a number of BSS packet flow contexts.~~ Within a BSS context the~~Each~~ BSS packet flow contexts are~~is~~ identified by a packet flow identifier, which is assigned by the SGSN. A BSS packet flow context is shared by one or more activated PDP contexts of the same MS with identical or similar negotiated QoS profiles. The data transfers related to PDP contexts that share the same BSS packet flow context constitute one packet flow.

Three packet flows are pre-defined, and identified by three reserved packet flow identifier values. The BSS shall not negotiate BSS packet flow contexts for these pre-defined packet flows with the SGSN. One pre-defined packet flow is used for best-effort service, one is used for SMS, and one is used for signalling. The SGSN can assign the best-effort or SMS packet flow identifier to any PDP context. In the SMS case, the BSS shall handle the packet flow for the PDP context with the same QoS with which it handles SMS. A non-reserved packet flow identifier value is only significant for an MS when the SGSN provided the BSS with a packet flow context for this packet flow identifier value for this MS.

The combined BSS QoS profile for the PDP contexts that share the same packet flow is called the aggregate BSS QoS profile. The aggregate BSS QoS profile is considered to be a single parameter with multiple data transfer attributes as defined in clause "Quality of Service Profile". It defines the QoS that must be provided by the BSS for a given packet flow between the MS and the SGSN, i.e. for the Um and Gb interfaces combined. The aggregate BSS QoS profile is negotiated between the SGSN and the BSS.

A BSS packet flow timer indicates the maximum time that the BSS may store the BSS packet flow context. The BSS packet flow timer shall not exceed the value of the READY timer for this MS. The BSS packet flow timer is started when the BSS packet flow context is stored in the BSS and when an LLC frame is received from the MS. When the BSS packet flow timer expires, the BSS shall delete the BSS packet flow context.

When a PDP context is activated, modified or deactivated, the SGSN may create, modify, or delete BSS packet flow contexts.

3GPP TSG SA WG2 #23 **S2-020718~~642~~**

Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **334** ⌘ **rev** **1** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Clarification on the significance of packet flow contexts
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	12.2.2002
Category:	⌘	**A**
Release:	⌘	REL-4

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)

Reason for change:	⌘	It is not clear from the description of the BSS contexts within which scope the packet flow contexts and the related identities are significant. There are reserved values which indicate QoS profiles which may be used for data transfers of MSs without a BSS context. And, there are non-reserved values and releated packet flow contexts which are obviously only significant for an MS if explicitely signalled by the SGSN. It is not described what an BSS packet flow context is.
Summary of change:	⌘	It is clarified, that BSS packet flow contexts with non-reserved identifier values are only significant within the BSS context of the MS for which the information was sent by SGSN. Description added for the BSS packet flow context.
Consequences if not approved:	⌘	Different non interoperable implementations.

Clauses affected:	⌘	12.6.3.5
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

12.6.3.5 BSS Context

The SGSN may ~~can~~ provide a BSS with information related to ongoing user data transmission in A/Gb mode. The information is given as BSS packet flow contexts, which describe QoS characteristics for the data transmission. All BSS packet flow contexts related to one MS are~~is~~ stored in an MS specific BSS context. The BSS may contain BSS contexts for several MSs. ~~A BSS context contains a number of BSS packet flow contexts.~~ Within a BSS context the~~Each~~ BSS packet flow contexts are~~is~~ identified by a packet flow identifier, which is assigned by the SGSN. A BSS packet flow context is shared by one or more activated PDP contexts of the same MS with identical or similar negotiated QoS profiles. The data transfers related to PDP contexts that share the same BSS packet flow context constitute one packet flow.

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The combined BSS QoS profile for the PDP contexts that share the same packet flow is called the aggregate BSS QoS profile. The aggregate BSS QoS profile is considered to be a single parameter with multiple data transfer attributes as defined in clause "Quality of Service Profile". It defines the QoS that must be provided by the BSS for a given packet flow between the MS and the SGSN, i.e. for the Um and Gb interfaces combined. The aggregate BSS QoS profile is negotiated between the SGSN and the BSS.

A BSS packet flow timer indicates the maximum time that the BSS may store the BSS packet flow context. The BSS packet flow timer shall not exceed the value of the READY timer for this MS. The BSS packet flow timer is started when the BSS packet flow context is stored in the BSS and when an LLC frame is received from the MS. When the BSS packet flow timer expires, the BSS shall delete the BSS packet flow context.

When a PDP context is activated, modified or deactivated, the SGSN may create, modify, or delete BSS packet flow contexts.

3GPP TSG SA WG2 #23 **S2-020719~~643~~**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **335** ⌘ **rev** **1** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Clarification on the significance of packet flow contexts
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	12.2.2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)*
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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)

Reason for change:	⌘	It is not clear from the description of the BSS contexts within which scope the packet flow contexts and the related identities are significant. There are reserved values which indicate QoS profiles which may be used for data transfers of MSs without a BSS context. And, there are non-reserved values and releated packet flow contexts which are obviously only significant for an MS if explicitely signalled by the SGSN. It is not described what an BSS packet flow context is.
Summary of change:	⌘	It is clarified, that BSS packet flow contexts with non-reserved identifier values are only significant within the BSS context of the MS for which the information was sent by SGSN. Description added for the BSS packet flow context.
Consequences if not approved:	⌘	Different non interoperable implementations.

Clauses affected:	⌘	12.6.3.5
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

12.6.3.5 BSS Context

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When a PDP context is activated, modified or deactivated, the SGSN may create, modify, or delete BSS packet flow contexts.

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18th-22nd February 2002

Tdoc S2-020726
(S2-020582)

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **320** ⌘ **rev** **1** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	PDP context handling at Inter SGSN RA Update
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	2002-02-21
Category:	⌘	**F**
Release:	⌘	*REL-5*

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)*

Reason for change: ⌘ The following two CR's, S2-013051 and S2-013047 were both approved at SA2#20. Unfortunately they were introducing new text on the same topics, and on the merging of the two CR's into 23.060, one sentence of the S2-013051 CR has not been included.

In S2-013051, the following text were approved (new text in blue, *missing sentence in italic*):

> The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.) *In case the new SGSN is not able to maintain active all the PDP Contexts received from old SGSN, it should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete.*
>
> If the SGSN is unable to update the PDP context in one or more GGSNs, the SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

In S2-013047, the following text were approved (new text in blue):

> If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.
>
> If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

Summary of change:	⌘	*The missing sentence is proposed included as shown below (*in blue*):* If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update. The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.) If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.
Consequences if not approved:	⌘	Inconcistency between the approved CR 281r2 and the current 23.060 text,

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2; 6.9.2.1; 6.13.2.1; 6.13.2.2		
Other specs Affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

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6.9.1.2.2 Inter SGSN Routeing Area Update

Text not changed

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS does not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ NEXT MODIFICATION ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤

6.9.1.3.2 Combined Inter SGSN RA / LA Update

Text not changed

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in clause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ NEXT MODIFICATION ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤

6.9.2.1 Routeing Area Update Procedure

Text not changed

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered up.

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ NEXT MODIFICATION ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤

6.13.2 Inter-SGSN Inter-system Change

6.13.2.1 Iu mode to A/Gb mode Inter-SGSN Change

Text not changed

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤ NEXT MODIFICATION ¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤¤

6.13.2.2 A/Gb mode to Iu mode Inter-SGSN Change

Text not changed

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

The PDP Contexts shall be sent from old to new SGSN in a prioritized order, i.e. the most important PDP Context first in the SGSN Context Response message. (The prioritization method is implementation dependent, but should be based on the current activity.)

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18-22 February 2002

Tdoc S2-020729

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **310** ⌘ ev **1** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Dual-stack IPv4/IPv6 GSNs
Source:	⌘	Ericsson
Work item code:	⌘	TEI-5
Date:	⌘	21 February 2002
Category:	⌘	**C**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
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R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	In SA2#22 it was agreed (see approved tdoc S2-020161) that when a GSN supports IPv6 for addressing in the transport plane, then it shall also support IPv4, i.e. GSNs supporting only IPv6 in the backbone are not allowed, at least for release 5. This CR introduces the necessary changes to reflect this principle in 23.060.
Summary of change:	⌘	Added text in sections 5.6.1.1 and 14.11.1 stating that when IPv6 is used in the backbone, then IPv4 must also be supported. Plus some editorial corrections. RFC 2460 (IPv6) is also added to the references and is referenced in the text of section 5.6.1.1.
Consequences if not approved:	⌘	

Clauses affected:	⌘	2, 5.6.1.1 and 14.11.1
Other specs affected:	⌘	☒ Other core specifications ⌘ 29.060 ☐ Test specifications ☐ O&M Specifications
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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS ciphering algorithm requirements".

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

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

[5] 3GPP TS 23.007: "Restoration procedures".

[5b] 3GPP TS 23.016: "Subscriber data management; Stage 2".

[6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[7] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".

[7b] 3GPP TS 23.122: "Non-Access Stratum functions related to Mobile Station (MS) in idle mode".

[8] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".

[8b] 3GPP TS 23.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 - Stage 2".

[9] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications", (Release 4).

[10] Void.

[11] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".

[12] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[13] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".

[14] GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol".

[15] GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station – Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".

[16] GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[16b] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[17] 3GPP TS 27.060: "Packet Domain; Mobile Station (MS) supporting Packet Switched services".

[18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile-services Switching Centre - Base Station System (MSC-BSS) interface; Layer 3 specification".

[19] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".

[20] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".

[21] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[22] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); In-band control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

[23] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[24] 3GPP TS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".

[25] 3GPP TS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".

[26] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[27] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting Packet Based services and Packet Data Networks (PDN)".

[27b] 3GPP TS 29.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3; CAMEL Application Part (CAP) Specification".

[28] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface".

[29] ITU-T Recommendations I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".

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

[31] ITU-T Recommendation Q.65: "The unified functional methodology for the characterization of services and network capabilities".

[32] ITU-T Recommendation V.42bis: "Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".

[33] ITU-T Recommendation X.3: "Packet assembly/disassembly facility (PAD) in a public data network".

[34] 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".

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

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

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

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

[43] RFC 1034 (1987): "Domain names – concepts and facilities" (STD 13).

[44] RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

[45] RFC 1542 (1993): "Clarifications and Extensions for the Bootstrap Protocol".

[46] RFC 2002 (1996): "IP Mobility Support".

[47] RFC 2131 (1997): "Dynamic Host Configuration Protocol".

[48] RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification".

[49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.

[50] 3GPP TS 25.301: "Radio Interface Protocol Architecture".

[51] 3GPP TS 25.303: "Interlayer procedures in Connected Mode".

[51b] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Call Reselection in Connected Mode".

[52] 3GPP TS 25.331: "RRC Protocol Specification".

[53] 3GPP TS 25.401: "UTRAN Overall Description".

[54] 3GPP TS 23.121: "Architectural Requirements for Release 1999".

[55] 3GPP TS 25.322: "RLC protocol specification".

[56] 3GPP TS 25.412: "UTRAN Iu Interface Signalling Transport".

[56b] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[57] 3GPP TS 25.323: "Packet Data Convergence Protocol (PDCP) specification".

[58] 3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".

[59] ITU-T Recommendation I.361: "B-ISDN ATM layer specification".

[60] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification".

[61] 3GPP TS 33.102: "3G Security; Security architecture".

[62] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".

[63] 3GPP TS 25.411: "UTRAN Iu interface Layer 1".

[64] 3GPP TS 25.414: "UTRAN Iu interface data transport & transport signalling".

[65] 3GPP TS 23.171: "Functional stage 2 description of location services in UMTS".

[66] 3GPP TS 23.015: "Technical realization of Operator Determined Barring (ODB)".

[67] ITU-T Recommendation I.363.5: "B-ISDN ATM Adaptation Layer (AAL) specification: Type 5 AAL".

[68] RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[69] RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[70] 3GPP TS 32.215: "3G Telecom Management; Charging management; Charging data description for the Packet Switched (PS) domain".

[71] RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)".

[72] 3GPP TS 29.202: "Signalling System No. 7 (SS7) signalling transport in core network; Stage 3".

[73] 3GPP TS 23.236: "Intra Domain Connection of RAN Nodes to Multiple CN Nodes".

Next modified section

5.6.1.1 MS – GGSN

The user plane consists of a layered protocol structure providing user information transfer, along with associated information transfer control procedures (e.g. flow control, error detection, error correction and error recovery). The user plane independence of the Network Subsystem (NSS) platform from the underlying radio interface is preserved via the Gb interface. The following user plane is used in A/Gb mode.

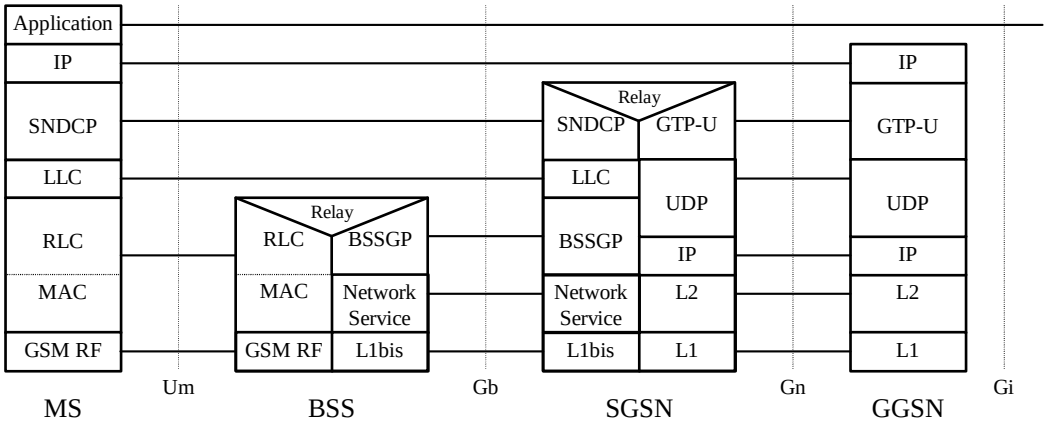

Figure 1: User Plane for GSM

Legend:

- GPRS Tunnelling Protocol for the user plane (GTP-U): This protocol tunnels user data between GPRS Support Nodes in the backbone network. The GPRS Tunnelling Protocol shall encapsulate all PDP PDUs. GTP is specified in 3GPP TS 29.060 [26].

- UDP carries GTP PDUs for protocols that do not need a reliable data link (e.g. IP), and provides protection against corrupted GTP PDUs. UDP is defined in RFC 768 [39].

- IP: This is the backbone network protocol used for routeing user data and control signalling. The backbone network may initially be based on the IPv4. Ultimately, IPv6 shall be used. When IPv6 is used in the backbone, then IPv4 shall also be supported. IPv4 is defined in RFC 791 [40] and IPv6 is defined in RFC 2460 [48].

- Subnetwork Dependent Convergence Protocol (SNDCP): This transmission functionality maps network-level characteristics onto the characteristics of the underlying network. SNDCP is specified in GSM 04.65 [16].

- Logical Link Control (LLC): This layer provides a highly reliable ciphered logical link. LLC shall be independent of the underlying radio interface protocols in order to allow introduction of alternative GPRS radio solutions with minimum changes to the NSS. LLC is specified in GSM 04.64 [15].

- Relay: In the BSS, this function relays LLC PDUs between the Um and Gb interfaces. In the SGSN, this function relays PDP PDUs between the Gb and Gn interfaces.

- Base Station System GPRS Protocol (BSSGP): This layer conveys routeing- and QoS-related information between the BSS and the SGSN. BSSGP does not perform error correction. BSSGP is specified in GSM 08.18 [21].

- Network Service (NS): This layer transports BSSGP PDUs. NS is based on the Frame Relay connection between the BSS and the SGSN, and may - multi-hop and traverse a network of Frame Relay switching nodes. NS is specified in GSM 08.16 [20].

- RLC/MAC: This layer contains two functions: The Radio Link Control function provides a radio-solution-dependent reliable link. The Medium Access Control function controls the access signalling (request and grant) procedures for the radio channel, and the mapping of LLC frames onto the GSM physical channel. RLC/MAC is defined in GSM 04.60 [14].

- GSM RF: As defined in GSM 05 series.

Next modified section

14.11.1 GSN Address

Each SGSN and GGSN shall have ~~an~~ one or more IP addresses of type IPv4, and optionally of type IPv6, for inter-communication over the backbone network. When an SGSN or a GGSN supports IPv6 in the backbone network, then it shall also support IPv4. The IP addresses of GSNs and other backbone nodes of all PLMNs build a private address space that is not accessible from the public Internet. For the GGSN and the SGSN, ~~this~~ each of these IP addresses may also correspond to one or more DNS-type logical GSN names.

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020760***
Sophia Antipolis, France, 18-22 February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **305** ⌘ ev **2** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network **X**

Title:	⌘	Allocation of unique prefixes to IPv6 terminals
Source:	⌘	Ericsson
Work item code:	⌘	TEI
Date:	⌘	20 February 2002
Category:	⌘	**F**
Release:	⌘	R99

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)

Reason for change: ⌘

The current mechanism for IPv6 stateless address autoconfiguration defined in 23.060 is not aligned with the standard IETF mechanism and as such is prone to incompatibilities with future developments of IPv6. Already some features of IPv6 have been identified that do not work properly with the current mechanism (e.g. privacy extensions for IPv6 defined in RFC 3041). In order to avoid such incompatibilities, today and in the future, it is therefore essential to align the support of IPv6 in GPRS/UMTS with the mechanisms defined in the IETF.

This CR corrects the current shortcomings of the IPv6 stateless address autoconfiguration in 23.060, mainly by specifying that a different prefix shall be allocated to each PDP context that uses stateless address autoconfiguration.

This principle is recommended in the Internet-Draft “draft-wasserman-3gpp-advice-00.txt”, which has been produced by a design team composed of IETF IPng experts that have investigated the use of IPv6 in the 3GPP architecture. It shall be noted that these experts do not believe that this principle could lead to an over-consumption of the vast IPv6 addressing space, as indicated in the Internet-Draft.

Note that the IETF IPng working group has adopted this Internet-Draft as working group item in the last IETF meeting (Dec 2001), with the intention to quickly progress it to the status of informational RFC.

Summary of change: ⌘

The IPv6 stateless address autoconfiguration procedure is modified to support allocation of a distinct prefix to each PDP context.

Consequences if not approved: ⌘

The support of IPv6 stateless address autoconfiguration in GPRS will not be aligned with the standard IETF mechanism and therefore risks not being compatible with future developments of IPv6 in IETF.

Clauses affected:	⌘	9.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	It shall be noted that only the UE and the GGSN are impacted by these changes. The SGSN remains untouched.

9.2.1.1 Dynamic IPv6 Address Allocation

IPv6 address allocation is somewhat different from the IPv4 address allocation procedure. There are two possibilities to allocate the address for an IPv6 node – stateless and stateful autoconfiguration. The stateful address allocation mechanism needs a DHCP server to allocate the address for the IPv6 node. In the stateless autoconfiguration, the IPv6 node is more involved in the allocation of the address. In addition, the stateless autoconfiguration procedure does not need any external entity involved in the address autoconfiguration.

IPv6 stateful address autoconfiguration uses the standard External PDN Address Allocation procedure, as described in 3GPP TS 29.061 [27]. The GGSN informs the MS that it shall perform ~~requests~~ stateful address autoconfiguration by means of the Router Advertisements, as defined in RFC 2461[71]. For this purpose, the GGSN shall automatically and periodically send Router Advertisement messages towards the MS after a PDP context of type IPv6 is activated. The use of stateless or stateful address autoconfiguration is configured per APN.~~using an Access Point Name referring to that service.~~

In order to support the standard IPv6 stateless address autoconfiguration mechanism, as defined by the IETF, within the particular context of UMTS (point-to-point connections, radio resource efficiency, etc), the GGSN shall assign a prefix that is unique within its scope to each PDP context applying IPv6 stateless address autoconfiguration. The size of the prefix is according to the maximum prefix length for a global IPv6 address. This avoids the necessity to perform duplicate address detection at the network level for every address built by the MS. The GGSN shall not use the prefix advertised to the MS to configure an address on any of its interfaces.

To ensure that the link-local address generated by the MS does not collide with the link-local address of the GGSN, ~~support dynamic IPv6 address allocation by the PLMN operator,~~ the GGSN shall provide~~s a unique~~ an interface identifier (see RFC 2462 [69]) to the MS and the MS shall use this interface identifier to configure its link-local address. This is applicable for both stateful and stateless IPv6 address autoconfiguration. ~~This enables the MS to perform the IPv6 stateless autoconfiguration procedures to generate its full IPv6 address.~~ In case of stateless address autoconfiguration however, the MS can choose any interface identifier to generate addresses other than link-local, without involving the network. In particular, the SGSN and the GGSN are not updated with the actual address used by the MS, as the prefix alone identifies the PDP context.

Figure 1 illustrates the IPv6 stateless autoconfiguration procedure~~s for this case~~. The figure and its description show only the messages and actions specific to the IPv6 stateless address autoconfiguration procedure. For a complete description of the PDP Context Activation Procedure, refer to the corresponding clause.

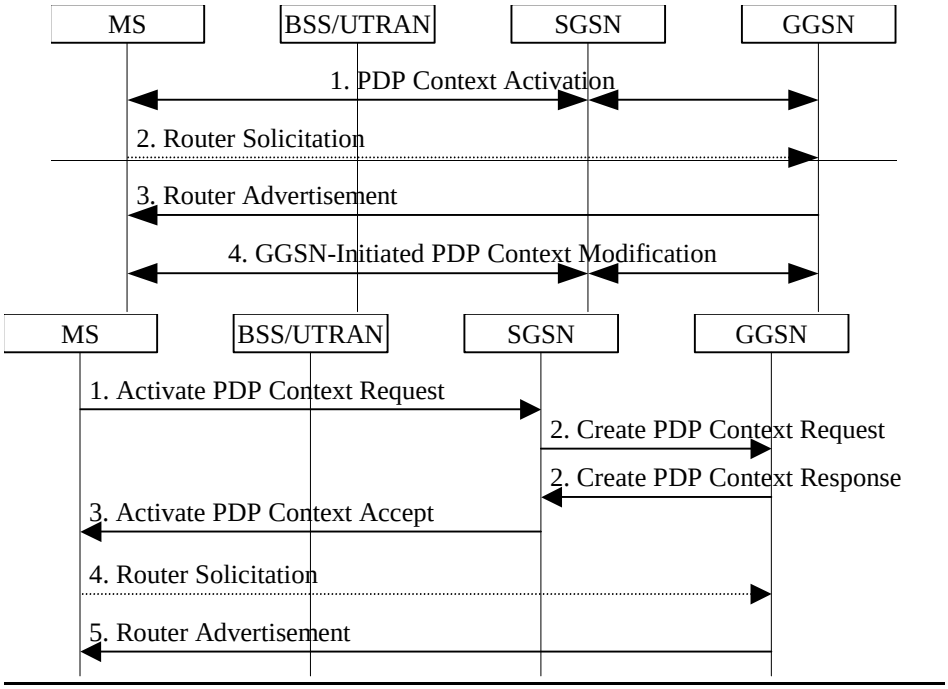

Figure 1: IPv6 Stateless Address Autoconfiguration Procedure

1) The MS sends an Activate PDP Context Request message to the SGSN~~. The procedure follows that~~ as defined in clause "PDP Context Activation Procedure"~~ with exceptions described below~~. The MS shall leave PDP Address empty and set PDP Type to IPv6.

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2) Upon reception of the Create PDP Context Request, ~~T~~the GGSN ~~shall~~ create~~s the unique link-local~~ an IPv6 address composed of the prefix allocated to the PDP context and an interface identifier generated by the GGSN. ~~for the MS and send it~~ This address is then returned in the PDP Address information element in the Create PDP Context Response message. The processing of the Create PDP Context Request and Create PDP Context Response, in both the SGSN and the GGSN, is otherwise as specified in clause "PDP Context Activation Procedure".~~The link local address consists of a fixed 10-bit prefix (IPv6 well-known link-local prefix), zero or more 0 bits, and the interface identifier.~~

NOTE: Since the MS is considered to be alone on its link towards the GGSN, the interface identifier does not need to be unique across all PDP contexts on any APN.

3) The MS receives the IPv6 address produced by the GGSN in the Activate PDP Context Accept. The MS extracts the interface identifier from the address received and stores it. The MS shall use this interface identifier to build its link-local address and may also use it for building its full IPv6 address, as describe in step 5. The MS shall ignore the prefix contained in the address received in the Activate PDP Context Accept. The processing of the Activate PDP Context Accept is otherwise as specified in clause "PDP Context Activation Procedure".

4~~2~~) The MS may send a Router Solicitation message to the GGSN to activate the sending of the Router Advertisement message.

5~~3~~) The GGSN ~~should automatically~~ send~~s the~~ a Router Advertisement message~~ after the PDP context is activated~~. The Router Advertisement messages shall contain the same prefix as the one provided in step 2. A given prefix shall not be advertised on more than one PDP context on a given APN, or set of APNs, within the same addressing scope. ~~In release 99 t~~The GGSN shall be configured to advertise only one ~~network~~ prefix per ~~APN~~PDP context.

After the MS has received the Router Advertisement message, it constructs its full IPv6 address by concatenating the interface identifier received in step 3~~ contained in the link-local address provided in the Create PDP Context Response Message in step 1~~, or a locally generated interface identifier, and the ~~network~~ prefix ~~of the selected APN~~ received in the Router Advertisement. If the Router Advertisement contains more than one prefix option, the MS shall only consider the first one and silently discard the others.~~Subsequently, the MS is ready to start communicating to the Internet.~~

NOTE: The MS can at any time change the interface identifier used to generate full IPv6 addresses, without involving the network, i.e. without updating the PDP context in the SGSN and the GGSN.

Because any prefix that the GGSN advertises in a PDP context is unique within the scope of the prefix (i.e. site-local or global)~~ provides a unique interface identifier during the PDP context activation procedure~~, there is no need for the MS to perform Duplicate Address Detection for this IPv6 address. Therefore, the GGSN shall ~~intercept and~~ silently discard Neighbor Solicitation messages that the MS may send to perform Duplicate Address Detection. It is possible for the MS to perform Neighbor Unreachability Detection towards the GGSN, as defined in RFC 2461[71]; therefore if the GGSN receives a Neighbor Solicitation as part of this procedure, the GGSN shall provide a Neighbor Advertisement as described in RFC 2461.

~~4) The GGSN updates the PDP context in the SGSN and MS with the full IPv6 address, see clause "GGSN-Initiated PDP Context Modification Procedure".~~

3GPP TSG-SA2 Meeting #23 ***Tdoc S2-020761***
Sophia Antipolis, France, 18-22 February 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **306** ⌘ ev **2** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network **X**

Title:	⌘	Allocation of unique prefixes to IPv6 terminals
Source:	⌘	Ericsson
Work item code:	⌘	TEI4
Date:	⌘	20 February 2002
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
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Clauses affected:	⌘	9.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	It shall be noted that only the UE and the GGSN are impacted by these changes. The SGSN remains untouched.

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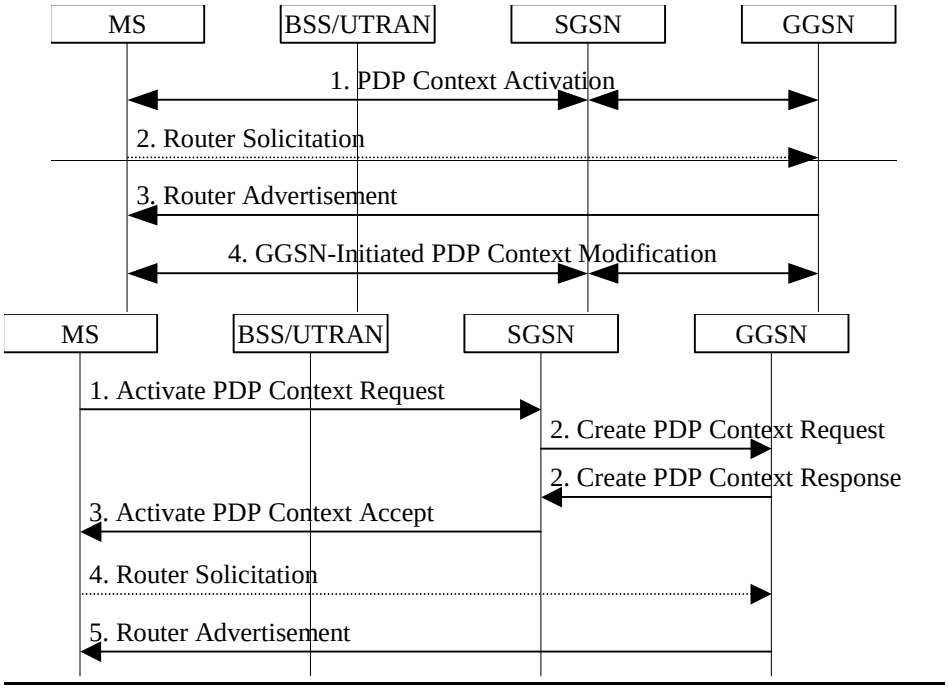

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2) Upon reception of the Create PDP Context Request, ~~T~~the GGSN ~~shall~~ create~~s~~ ~~the unique link-local~~ an IPv6 address composed of the prefix allocated to the PDP context and an interface identifier generated by the GGSN. ~~for the MS and send it~~ This address is then returned in the PDP Address information element in the Create PDP Context Response message. The processing of the Create PDP Context Request and Create PDP Context Response, in both the SGSN and the GGSN, is otherwise as specified in clause "PDP Context Activation Procedure".~~The link local address consists of a fixed 10-bit prefix (IPv6 well-known link-local prefix), zero or more 0 bits, and the interface identifier.~~

NOTE: Since the MS is considered to be alone on its link towards the GGSN, the interface identifier does not need to be unique across all PDP contexts on any APN.

3) The MS receives the IPv6 address produced by the GGSN in the Activate PDP Context Accept. The MS extracts the interface identifier from the address received and stores it. The MS shall use this interface identifier to build its link-local address and may also use it for building its full IPv6 address, as describe in step 5. The MS shall ignore the prefix contained in the address received in the Activate PDP Context Accept. The processing of the Activate PDP Context Accept is otherwise as specified in clause "PDP Context Activation Procedure".

4~~2~~) The MS may send a Router Solicitation message to the GGSN to activate the sending of the Router Advertisement message.

5~~3~~) The GGSN ~~should automatically~~ send~~s~~ ~~the~~ a Router Advertisement message~~ after the PDP context is activated~~. The Router Advertisement messages shall contain the same prefix as the one provided in step 2. A given prefix shall not be advertised on more than one PDP context on a given APN, or set of APNs, within the same addressing scope. ~~In release 99 t~~The GGSN shall be configured to advertise only one ~~network~~ prefix per ~~APN~~PDP context.

After the MS has received the Router Advertisement message, it constructs its full IPv6 address by concatenating the interface identifier received in step 3~~ contained in the link-local address provided in the Create PDP Context Response Message in step 1~~, or a locally generated interface identifier, and the ~~network~~ prefix ~~of the selected APN~~ received in the Router Advertisement. If the Router Advertisement contains more than one prefix option, the MS shall only consider the first one and silently discard the others.~~Subsequently, the MS is ready to start communicating to the Internet.~~

NOTE: The MS can at any time change the interface identifier used to generate full IPv6 addresses, without involving the network, i.e. without updating the PDP context in the SGSN and the GGSN.

Because any prefix that the GGSN advertises in a PDP context is unique within the scope of the prefix (i.e. site-local or global)~~ provides a unique interface identifier during the PDP context activation procedure~~, there is no need for the MS to perform Duplicate Address Detection for this IPv6 address. Therefore, the GGSN shall ~~intercept and~~ silently discard Neighbor Solicitation messages that the MS may send to perform Duplicate Address Detection. It is possible for the MS to perform Neighbor Unreachability Detection towards the GGSN, as defined in RFC 2461[71]; therefore if the GGSN receives a Neighbor Solicitation as part of this procedure, the GGSN shall provide a Neighbor Advertisement as described in RFC 2461.

~~4) The GGSN updates the PDP context in the SGSN and MS with the full IPv6 address, see clause "GGSN-Initiated PDP Context Modification Procedure".~~

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18-22 February 2002

Tdoc S2-020762

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **286** ⌘ ev **4** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network **X**

Title:	⌘	Allocation of unique prefixes to IPv6 terminals
Source:	⌘	Ericsson
Work item code:	⌘	IMS-CCR
Date:	⌘	20 February 2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)

Reason for change: ⌘

The current mechanism for IPv6 stateless address autoconfiguration defined in 23.060 is not aligned with the standard IETF mechanism and as such is prone to incompatibilities with future developments of IPv6. Already some features of IPv6 have been identified that do not work properly with the current mechanism (e.g. privacy extensions for IPv6 defined in RFC 3041). In order to avoid such incompatibilities, today and in the future, it is therefore essential to align the support of IPv6 in GPRS/UMTS with the mechanisms defined in the IETF.

Since IMS mandates the use of IPv6 in Release 5 and addressing is an essential aspect of the architecture, such alignment has to be considered in the same timeframe, i.e. in Release 5, so as to avoid backward compatibility problems, with terminals in particular, if these changes were to be introduced later.

This CR corrects the current shortcomings of the IPv6 stateless address autoconfiguration in 23.060, mainly by specifying that a different prefix shall be allocated to each PDP context that uses stateless address autoconfiguration.

This principle is recommended in the Internet-Draft “draft-wasserman-3gpp-advice-00.txt”, which has been produced by a design team composed of IETF IPng experts that have investigated the use of IPv6 in the 3GPP architecture. It shall be noted that these experts do not believe that this principle could lead to an over-consumption of the vast IPv6 addressing space, as indicated in the Internet-Draft.

Note that the IETF IPng working group has adopted this Internet-Draft as working group item in the last IETF meeting (Dec 2001), with the intention to quickly progress it to the status of informational RFC.

Summary of change: ⌘

The IPv6 stateless address autoconfiguration procedure is modified to support allocation of a distinct prefix to each PDP context.

Consequences if not approved:	⌘	The support of IPv6 stateless address autoconfiguration in GPRS will not be aligned with the standard IETF mechanism and therefore risks not being compatible with future developments of IPv6 in IETF.

Clauses affected:	⌘	9.2.1.1		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘	It shall be noted that only the UE and the GGSN are impacted by these changes. The SGSN remains untouched.		

9.2.1.1 Dynamic IPv6 Address Allocation

IPv6 address allocation is somewhat different from the IPv4 address allocation procedure. There are two possibilities to allocate the address for an IPv6 node – stateless and stateful autoconfiguration. The stateful address allocation mechanism needs a DHCP server to allocate the address for the IPv6 node. In the stateless autoconfiguration, the IPv6 node is more involved in the allocation of the address. In addition, the stateless autoconfiguration procedure does not need any external entity involved in the address autoconfiguration.

IPv6 stateful address autoconfiguration uses the standard External PDN Address Allocation procedure, as described in 3GPP TS 29.061 [27]. The GGSN informs the MS that it shall perform ~~requests~~ stateful address autoconfiguration by means of the Router Advertisements, as defined in RFC 2461[71]. For this purpose, the GGSN shall automatically and periodically send Router Advertisement messages towards the MS after a PDP context of type IPv6 is activated. The use of stateless or stateful address autoconfiguration is configured per APN.~~using an Access Point Name referring to that service.~~

In order to support the standard IPv6 stateless address autoconfiguration mechanism, as defined by the IETF, within the particular context of UMTS (point-to-point connections, radio resource efficiency, etc), the GGSN shall assign a prefix that is unique within its scope to each PDP context applying IPv6 stateless address autoconfiguration. The size of the prefix is according to the maximum prefix length for a global IPv6 address. This avoids the necessity to perform duplicate address detection at the network level for every address built by the MS. The GGSN shall not use the prefix advertised to the MS to configure an address on any of its interfaces.

To ensure that the link-local address generated by the MS does not collide with the link-local address of the GGSN, ~~support dynamic IPv6 address allocation by the PLMN operator,~~ the GGSN shall provide~~s a unique~~ an interface identifier (see RFC 2462 [69]) to the MS and the MS shall use this interface identifier to configure its link-local address. This is applicable for both stateful and stateless IPv6 address autoconfiguration. ~~This enables the MS to perform the IPv6 stateless autoconfiguration procedures to generate its full IPv6 address.~~ In case of stateless address autoconfiguration however, the MS can choose any interface identifier to generate addresses other than link-local, without involving the network. In particular, the SGSN and the GGSN are not updated with the actual address used by the MS, as the prefix alone identifies the PDP context.

Figure 1 illustrates the IPv6 stateless autoconfiguration procedure~~s for this case~~. The figure and its description show only the messages and actions specific to the IPv6 stateless address autoconfiguration procedure. For a complete description of the PDP Context Activation Procedure, refer to the corresponding clause.

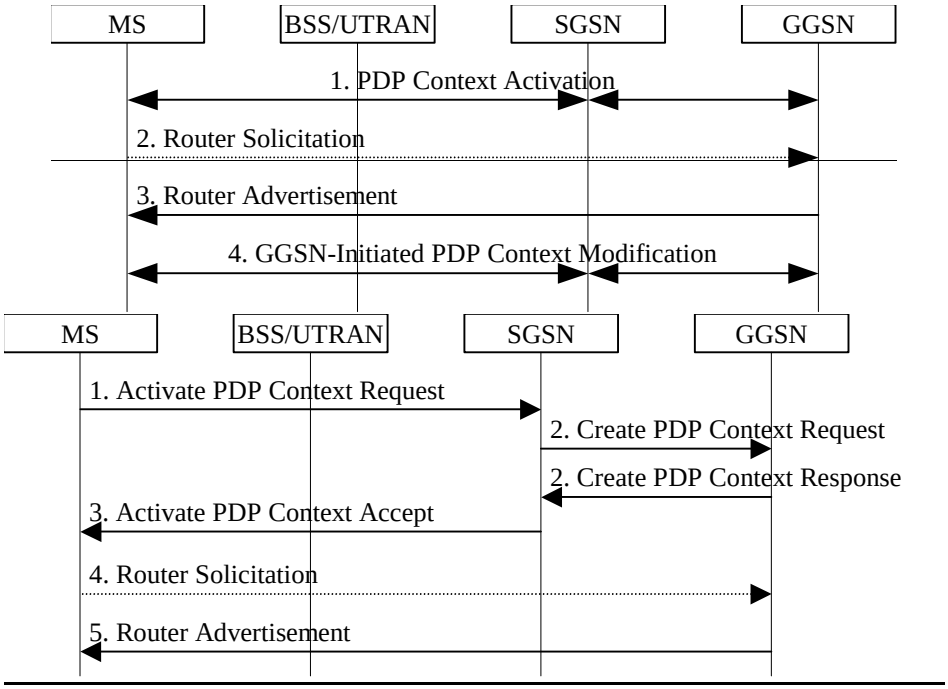

Figure 1: IPv6 Stateless Address Autoconfiguration Procedure

1) The MS sends an Activate PDP Context Request message to the SGSN~~. The procedure follows that~~ as defined in clause "PDP Context Activation Procedure"~~ with exceptions described below~~. The MS shall leave PDP Address empty and set PDP Type to IPv6.

~~The MS shall leave PDP Address empty and set PDP Type to IPv6.~~

2) Upon reception of the Create PDP Context Request, ~~T~~the GGSN ~~shall~~ create~~s~~ ~~the unique link-local~~ an IPv6 address composed of the prefix allocated to the PDP context and an interface identifier generated by the GGSN. ~~for the MS and send it~~ This address is then returned in the PDP Address information element in the Create PDP Context Response message. The processing of the Create PDP Context Request and Create PDP Context Response, in both the SGSN and the GGSN, is otherwise as specified in clause "PDP Context Activation Procedure".~~The link local address consists of a fixed 10-bit prefix (IPv6 well-known link-local prefix), zero or more 0 bits, and the interface identifier.~~

NOTE: Since the MS is considered to be alone on its link towards the GGSN, the interface identifier does not need to be unique across all PDP contexts on any APN.

3) The MS receives the IPv6 address produced by the GGSN in the Activate PDP Context Accept. The MS extracts the interface identifier from the address received and stores it. The MS shall use this interface identifier to build its link-local address and may also use it for building its full IPv6 address, as describe in step 5. The MS shall ignore the prefix contained in the address received in the Activate PDP Context Accept. The processing of the Activate PDP Context Accept is otherwise as specified in clause "PDP Context Activation Procedure".

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5~~3~~) The GGSN ~~should automatically~~ send~~s~~ ~~the~~ a Router Advertisement message~~ after the PDP context is activated~~. The Router Advertisement messages shall contain the same prefix as the one provided in step 2. A given prefix shall not be advertised on more than one PDP context on a given APN, or set of APNs, within the same addressing scope. ~~In release 99 t~~The GGSN shall be configured to advertise only one ~~network~~ prefix per ~~APN~~PDP context.

After the MS has received the Router Advertisement message, it constructs its full IPv6 address by concatenating the interface identifier received in step 3~~ contained in the link-local address provided in the Create PDP Context Response Message in step 1~~, or a locally generated interface identifier, and the ~~network~~ prefix ~~of the selected APN~~ received in the Router Advertisement. If the Router Advertisement contains more than one prefix option, the MS shall only consider the first one and silently discard the others.~~Subsequently, the MS is ready to start communicating to the Internet.~~

NOTE: The MS can at any time change the interface identifier used to generate full IPv6 addresses, without involving the network, i.e. without updating the PDP context in the SGSN and the GGSN.

Because any prefix that the GGSN advertises in a PDP context is unique within the scope of the prefix (i.e. site-local or global)~~ provides a unique interface identifier during the PDP context activation procedure~~, there is no need for the MS to perform Duplicate Address Detection for this IPv6 address. Therefore, the GGSN shall ~~intercept and~~ silently discard Neighbor Solicitation messages that the MS may send to perform Duplicate Address Detection. It is possible for the MS to perform Neighbor Unreachability Detection towards the GGSN, as defined in RFC 2461[71]; therefore if the GGSN receives a Neighbor Solicitation as part of this procedure, the GGSN shall provide a Neighbor Advertisement as described in RFC 2461.

~~4) The GGSN updates the PDP context in the SGSN and MS with the full IPv6 address, see clause "GGSN-Initiated PDP Context Modification Procedure".~~

3GPP TSG SA WG2 #23 **S2-020789**
Sophia Antipolis, France, 18th – 22nd February 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **322** ⌘ **rev** **1** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	IMS related adaptations
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	8.2.2002
Category:	⌘	**F**
Release:	⌘	REL-5

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)

Reason for change: ⌘

The Gi reference point is clarified in 23.002 REL-5 as the reference point between the GGSN and a packet data network. It may be an operator external public or private packet data network or an intra operator packet data network, e.g. for provisioning of IMS services.

23.060 REL-5 needs an alignment.

Chapter 5 header and many text passages use the term “packet domain”. But this is defined nowhere. And chapter 5 describes the overall architecture to provide GPRS services. A similar term “PS domain” somehow defined in 23.002 lists just SGSN, GGSN and BG as elements of the PS domain. Chapter 5 and other changed from “packet domain” to “GPRS” as describes all entities involved in GPRS.

Chapter 6.11 uses “PS subscriber” and “PS subscription”. And, chapter 13 uses “packet domain subscription”. Both chapters aligned to “GPRS subscription” as used in chapters 9 and 15.

The about ten occurences of “PS domain” are unchanged.

Summary of change: ⌘ Removal of "external" from the packet data networks for which GPRS provides bearer services and change to consistent wording "packet data network". Replacement of packet domain by GPRS.

Consequences if not approved: ⌘ Inconsistent terminology, use of not defined terms, and inconsistent specifications.

Clauses affected: ⌘ 3.3, 5, 6.2.2, 6.11, 7, 9, 12.7, 13, 14.13, 15.1, 15.2, 15.13.3, 16.3

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

Other comments: ⌘ chapter 4 "main concept" not touched, to be changed because of GERAN

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3.3 Symbols

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

Ga	Charging data collection interface between a CDR transmitting unit (e.g. an SGSN or a GGSN) and a CDR receiving functionality (a CGF).
Gb	Interface between an SGSN and a BSS.
Gc	Interface between a GGSN and an HLR.
Gd	Interface between an SMS-GMSC and an SGSN, and between an SMS-IWMSC and an SGSN.
Gf	Interface between an SGSN and an EIR.
Gi	Reference point between GPRS and a~~n 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.
Iu	Interface between the RNS and the core network. It is also considered as a reference point.
kbit/s	Kilobits per second.
Mbit/s	Megabits per second. 1 Mbit/s = 1 million bits per second.
R	Reference point between a non-ISDN compatible TE and MT. Typically this reference point supports a standard serial interface.
Reporting Area	The service area for which the location of an MS is reported.
Service Area	The location accuracy level needed for service management purposes in the 3G-SGSN, e.g. a routeing area or a cell. The 3G-SGSN can request the SRNC to report: i) the MS's current service area; ii) when the MS moves into a given service area; or iii) when the MS moves out of a given service area.
Um	Interface between the mobile station (MS) and the GSM fixed network part. The Um interface is the GSM network interface for providing GPRS services over the radio to the MS. The MT part of the MS is used to access the GPRS services in A/Gb mode through this interface.
Uu	Interface between the mobile station (MS) and the UMTS fixed network part. The Uu interface is the UMTS network interface for providing GPRS services over the radio to the MS. The MT part of the MS is used to access the GPRS services in Iu mode through this interface.

5 General GPRS~~Packet Domain~~ Architecture and Transmission Mechanism

5.1 GPRS~~Packet Domain~~ Access Interfaces and Reference Points

Each PLMN has two access points to GPRS services, the radio interface (labelled Um in A/Gb mode and Uu in Iu mode) used for mobile access and the R reference point used for origination or reception of messages. The R reference point for the MSs is defined in 3GPP TS 27.060 [17].

An interface differs from a reference point in that an interface is defined where specific information is exchanged and needs to be fully recognised.

There is an interPLMN interface called Gp that connects two independent GPRS packet domain networks for message exchange.

There is also a PLMN to ~~fixed network (typically a~~ packet data network~~)~~ reference point called Gi. Gi is defined in 3GPP TS 29.061 [27].

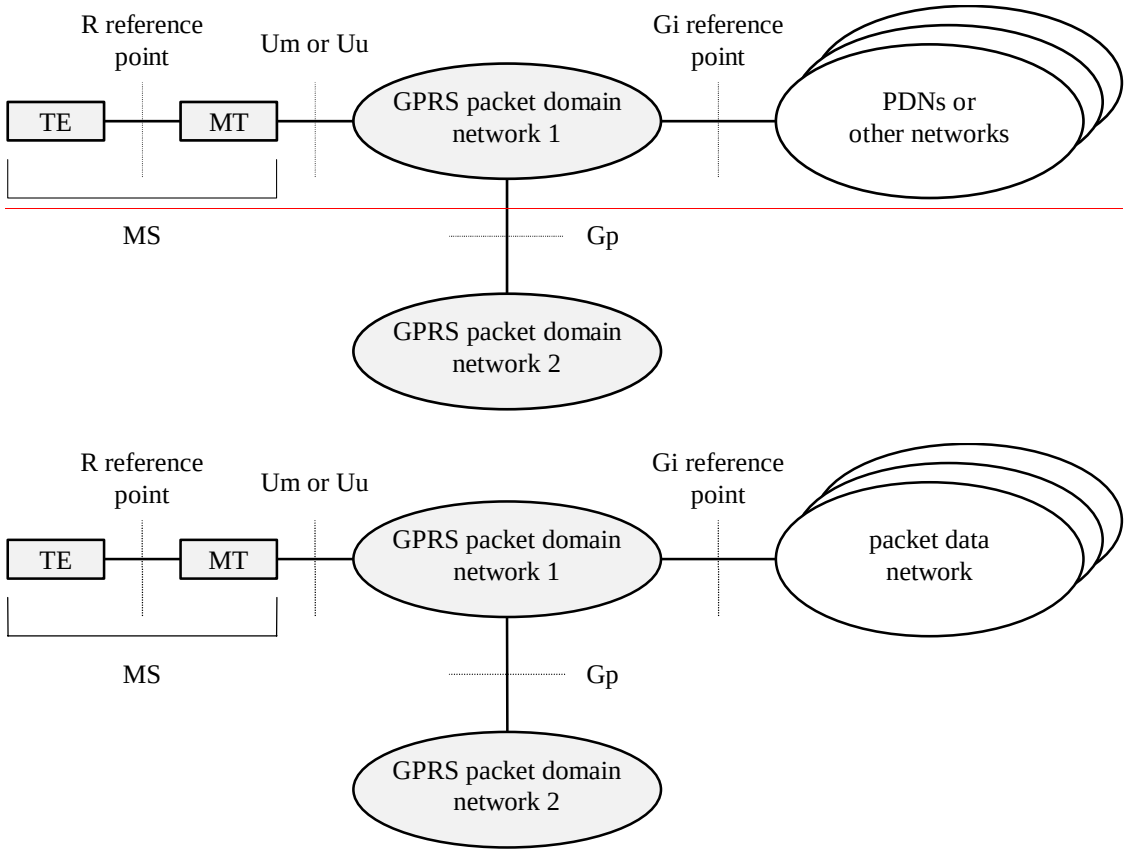

Figure 1: GPRS~~Packet Domain~~ Access Interfaces and Reference Points

There may be more than a single network interface to several different packet data ~~(or other)~~ networks. These networks may both differ in ownership as well as in communications protocol (e.g. TCP/IP etc.). The network operator ~~should~~ defines and negotiates interconnection with each interconnected packet data network~~external (PDN or other) network~~.

5.2 Network Interworking

Network interworking is required whenever a packet domain PLMN and any other network are involved in the execution of a service request. With reference to Figure 1, interworking takes place through the Gi reference point and the Gp interface.

The internal mechanism for conveying the PDP PDU through the PLMN is managed by the PLMN network operator and is not apparent to the data user. The use of the GPRS~~packet domain data~~ service may have an impact on and increase the transfer time normally found for a message when communicated through a fixed packet data network.

5.2.1 Internet (IP) Interworking

GPRS~~The packet domain~~ shall support interworking with networks based on the Internet protocol (IP). IP is defined in RFC 791 [40]. The packet domain may provide compression of the TCP/IP header when an IP datagram is used within the context of a TCP connection.

~~The packet domain PLMN service is an IP domain, and m~~Mobile terminals offered service by a service provider may be globally addressable through the network operator's addressing scheme.

5.3 High-Level Functions

The following list gives the logical functions performed within the packet domain network for GPRS. Several functional groupings (meta functions) are defined and each encompasses a number of individual functions:

- Network Access Control Functions.
- Packet Routeing and Transfer Functions.

- Mobility Management Functions.
- Logical Link Management Functions (GSM only).
- Radio Resource Management Functions.
- Network Management Functions.

5.3.1 Network Access Control Functions

Network access is the means by which a user is connected to a telecommunication network in order to use the services and/or facilities of that network. An access protocol is a defined set of procedures that enables the user to employ the services and/or facilities of the network.

User network access may occur from either the mobile side or the fixed side of the network. The fixed network interface may support multiple access protocols to ~~external~~ packet data networks, for example IP. The set of access protocols to be supported is determined by the PLMN operator.

Individual PLMN administrations may require specific access-control procedures in order to limit the set of users permitted to access the network, or to restrict the capabilities of individual users, for example by limiting the type of service available to an individual subscriber. Such access control procedures are beyond the scope of the specifications.

5.3.1.1 Registration Function

Registration is the means by which a user's Mobile Id is associated with the user's packet data protocol(s) and address (es) within the PLMN, and with the user's access point(s) to the packet data~~external PDP~~ network. The association can be static, i.e. stored in an HLR, or dynamic, i.e. allocated on a per need basis.

5.3.1.2 Authentication and Authorisation Function

This function performs the identification and authentication of the service requester, and the validation of the service request type to ensure that the user is authorised to use the particular network services. The authentication function is performed in association with the Mobility Management functions.

5.3.1.3 Admission Control Function

The purpose of admission control is to calculate which network resources are required to provide the quality of service (QoS) requested, determine if those resources are available, and then reserve those resources. Admission control is performed in association with the Radio Resource Management functions in order to estimate the radio resource requirements within each cell.

5.3.1.4 Message Screening Function

A screening function concerned with filtering out unauthorised or unsolicited messages is required. This should be supported through packet filtering functions. All types of message screening are left to the operators' control, e.g. by use of Internet firewalls.

5.3.1.5 Packet Terminal Adaptation Function

This function adapts data packets received / transmitted from/to terminal equipment to a form suitable for transmission by GPRS across the packet domain network.

5.3.1.6 Charging Data Collection Function

This function collects data necessary to support subscription and/or traffic fees.

5.3.1.7 Operator Determined Barring Function

The purpose of this function is to limit the service provider's financial risk with respect to new subscribers or to those who have not promptly paid their bills by restricting a particular packet switched service.

The functionality of ODB is described in the 3GPP TS 23.015 [66].

5.3.2 Packet Routeing and Transfer Functions

A route is an ordered list of nodes used for the transfer of messages within and between the PLMN(s). Each route consists of the originating node, zero or more relay nodes and the destination node. Routeing is the process of determining and using, in accordance with a set of rules, the route for transmission of a message within and between the PLMN(s).

5.3.2.1 Relay Function

The relay function is the means by which a node forwards data received from one node to the next node in the route.

5.3.2.2 Routeing Function

The routeing function determines the network node to which a message should be forwarded and the underlying service(s) used to reach that GPRS Support Node (GSN), using the destination address of the message. The routeing function selects the transmission path for the "next hop" in the route.

Data transmission between GSNs may occur across ~~external~~ packet data networks that provide their own internal routeing functions, for example ITU-T Recommendation X.25 [34], Frame Relay or ATM networks.

5.3.2.3 Address Translation and Mapping Function

Address translation is the conversion of one address to another address of a different type. Address translation may be used to convert an ~~external~~ packet data network protocol address into an internal network address that can be used for routeing packets within and between the PLMN(s).

Address mapping is used to map a network address to another network address of the same type for the routeing and relaying of messages within and between the PLMN(s), for example to forward packets from one network node to another.

5.3.2.4 Encapsulation Function

Encapsulation is the addition of address and control information to a data unit for routeing packets within and between the PLMN(s). Decapsulation is the removal of the addressing and control information from a packet to reveal the original data unit.

Encapsulation and decapsulation are performed between the GPRS support nodes ~~of the packet domain PLMN(s)~~, and between the GPRS serving support node and the MS.

5.3.2.5 Tunnelling Function

Tunnelling is the transfer of encapsulated data units within and between the PLMN(s) from the point of encapsulation to the point of decapsulation. A tunnel is a two-way point-to-point path. Only the tunnel endpoints are identified.

5.3.2.6 Compression Function

The compression function optimises use of radio path capacity by transmitting as little of the SDU (i.e. the exterior PDP PDU) as possible while at the same time preserving the information contained within it. Only IP header compression is supported in Iu mode.

5.3.2.7 Ciphering Function

The ciphering function preserves the confidentiality of user data and signalling across the radio channels and inherently protects the PLMN from intruders.

5.3.2.8 Domain Name Server Function

The Domain Name Server function resolves logical GSN names to GSN addresses. This function is standard Internet functionality according to RFC 1034 [43], which allows resolution of any name for GSNs and other nodes within the GPRS packet domain PLMN backbone networks.

5.3.3 Mobility Management Functions

The mobility management functions are used to keep track of the current location of an MS within the PLMN or within another PLMN.

5.3.4 Logical Link Management Functions (GSM only)

Logical link management functions are concerned with the maintenance of a communication channel between an individual MS and the PLMN across the radio interface. These functions involve the co-ordination of link state information between the MS and the PLMN as well as the supervision of data transfer activity over the logical link.

Refer to GSM 04.64 [15] for further information.

5.3.4.1 Logical Link Establishment Function

Logical link establishment is performed when the MS attaches to the PS services.

5.3.4.2 Logical Link Maintenance Functions

Logical link maintenance functions supervise the logical link status and control link state changes.

5.3.4.3 Logical Link Release Function

The logical link release function is used to de-allocate resources associated with the logical link connection.

5.3.5 Radio Resource Management Functions

Radio resource management functions are concerned with the allocation and maintenance of radio communication paths, and are performed by the Access Network. Refer to GSM 03.64 [11] for further information on the GSM radio. Refer to 3GPP TS 25.301 [50] for further information on the UMTS radio.

5.3.6 Network Management Functions

Network management functions provide mechanisms to support O&M functions related to GPRS~~the packet domain~~.

5.4 Logical Architecture

The ~~packet domain~~GPRS Core Network functionality is logically implemented on two network nodes, the Serving GPRS Support Node and the Gateway GPRS Support Node. It is necessary to name a number of new interfaces. No inference should be drawn about the physical configuration on an interface from Figure 2.

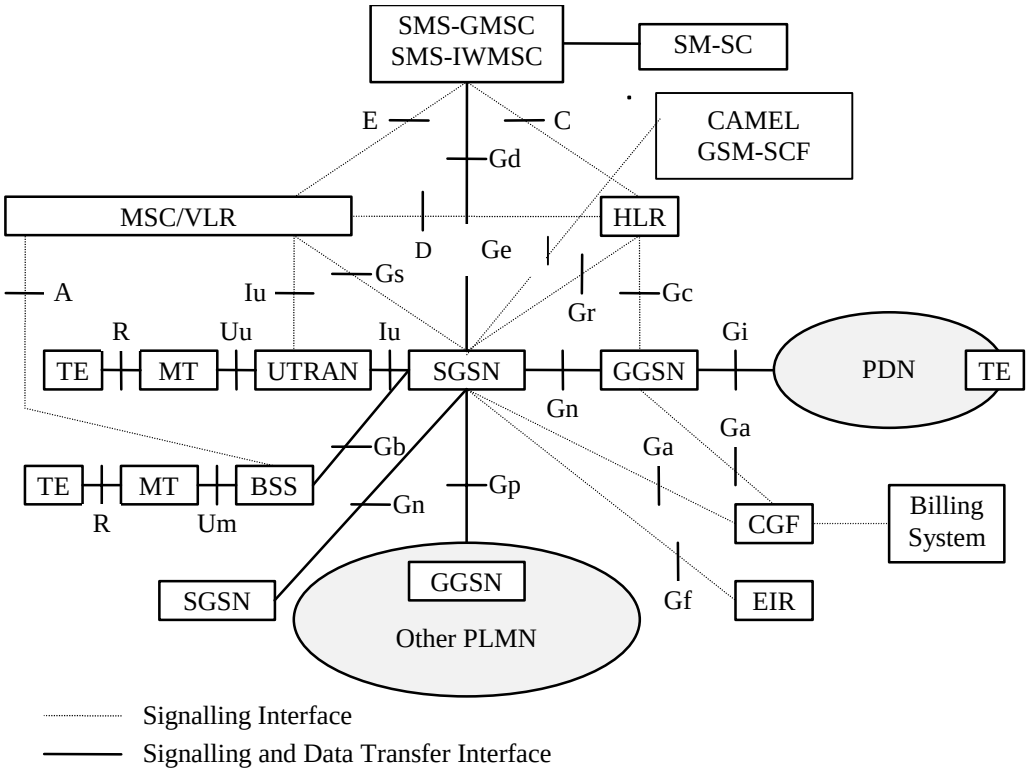

Figure 2: Overview of the ~~Packet Domain~~GPRS Logical Architecture

5.4.1 GPRS~~Packet Domain~~ Core Network Nodes

A GPRS Support Node (GSN) contains functionality required to support GPRS functionality for GSM and/or UMTS. In one PLMN, there may be more than one GSN.

The Gateway GPRS Support Node (GGSN) is the node that is accessed by the packet data network due to evaluation of the PDP address. It contains routeing information for PS-attached users. The routeing information is used to tunnel N-PDUs to the MS's current point of attachment, i.e. the Serving GPRS Support Node. The GGSN may request location information from the HLR via the optional Gc interface. The GGSN is the first point of PDN interconnection with a GSM PLMN supporting GPRS (i.e. the Gi reference point is supported by the GGSN). GGSN functionality is common for GSM and UMTS.

The Serving GPRS Support Node (SGSN) is the node that is serving the MS. The SGSN supports GPRS for GSM (i.e. the Gb interface is supported by the SGSN) and/or UMTS (i.e. the Iu interface is supported by the SGSN). At PS attach, the SGSN establishes a mobility management context containing information pertaining to e.g. mobility and security for the MS. At PDP Context Activation, the SGSN establishes a PDP context, to be used for routeing purposes, with the GGSN that the subscriber will be using.

The SGSN and GGSN functionalities may be combined in the same physical node, or they may reside in different physical nodes. The SGSN and the GGSN contain IP or other (operator's selection, e.g. ATM-SVC) routeing functionality, and they may be interconnected with IP routers. In Iu mode, the SGSN and RNC may be interconnected with one or more IP routers. When the SGSN and the GGSN are in different PLMNs, they are interconnected via the Gp interface. The Gp interface provides the functionality of the Gn interface, plus security functionality required for inter-PLMN communication. The security functionality is based on mutual agreements between operators.

The SGSN may send location information to the MSC/VLR via the optional Gs interface. The SGSN may receive paging requests from the MSC/VLR via the Gs interface.

The SGSN interfaces with the GSM-SCF for optional CAMEL control using Ge reference point. Depending on the result from the CAMEL interaction, the session and packet data transfer may proceed normally. Otherwise, interaction with the GSM-SCF continues as described in 3GPP TS 23.078 [8b]. Only the GSM-SCF interworking points are indicated in the signalling procedures in this specification.

5.4.2 GPRS Packet Domain PLMN Backbone Networks

There are two kinds of backbone networks. These are called:

- intra-PLMN backbone network; and
- inter-PLMN backbone network.

The intra-PLMN backbone network is the IP network interconnecting GSNs within the same PLMN.

The inter-PLMN backbone network is the IP network interconnecting GSNs and intra-PLMN backbone networks in different PLMNs.

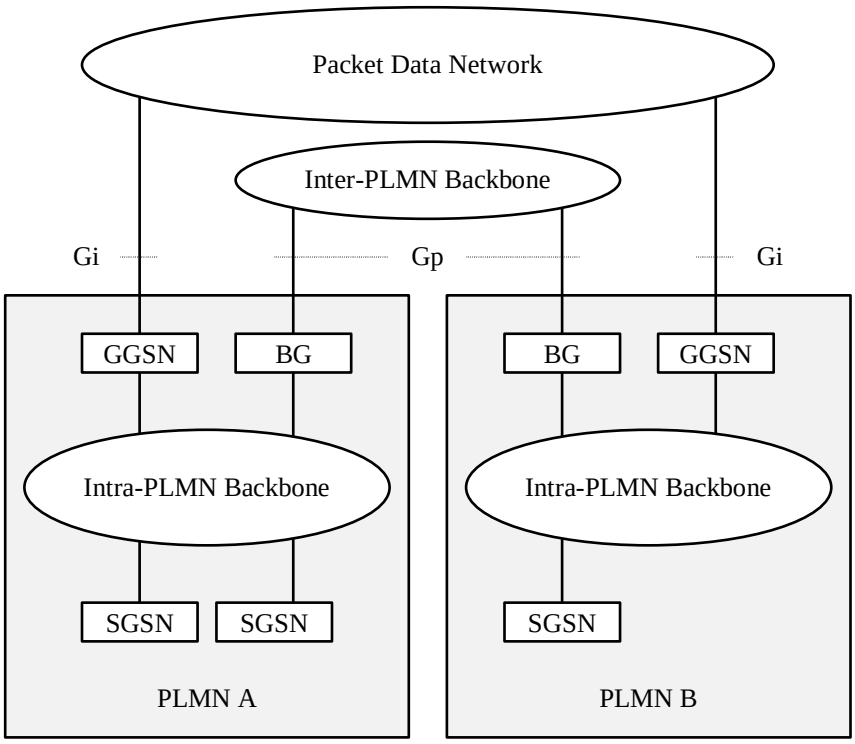

Figure 3: Intra- and Inter-PLMN Backbone Networks

Every intra-PLMN backbone network is a private IP network intended for GPRS packet domain data and signalling only. A private IP network is an IP network to which some access control mechanism is applied in order to achieve a required level of security. Two intra-PLMN backbone networks are connected via the Gp interface using Border Gateways (BGs) and an inter-PLMN backbone network. The inter-PLMN backbone network is selected by a roaming agreement that includes the BG security functionality. The BG is not defined within the scope of ~~the~~ GPRS~~packet domain~~. The inter-PLMN backbone can be a Packet Data Network, e.g. the public Internet or a leased line.

5.4.3 HLR

The HLR contains ~~packet domain~~GPRS subscription data and routeing information. The HLR is accessible from the SGSN via the Gr interface and from the GGSN via the Gc interface. For roaming MSs, the HLR may be in a different PLMN than the current SGSN.

5.4.4 SMS-GMSC and SMS-IWMSC

The SMS-GMSC and SMS-IWMSC are connected to the SGSN via the Gd interface to enable the SGSN to support SMS.

5.4.5 Mobile Stations (GSM only)

A GSM GPRS MS can operate in one of three modes of operation. The mode of operation depends on the services that the MS is attached to, i.e. only GPRS or both GPRS and other GSM services, and upon the MS's capabilities to operate GPRS and other GSM services simultaneously.

- Class-A mode of operation: The MS is attached to both GPRS and other GSM services, and the MS supports simultaneous operation of GPRS and other GSM services.

- Class-B mode of operation: The MS is attached to both GPRS and other GSM services, but the MS can only operate one set of services at a time.

- Class-C mode of operation: The MS is exclusively attached to GPRS services.

The three modes of operation are defined in 3GPP TS 22.060 [3].

NOTE: Other GSM technical specifications may refer to the MS modes of operation as GPRS class-A MS, GPRS class-B MS, and GPRS class-C MS.

5.4.6 Mobile Stations (UMTS only)

A UMTS mobile station can operate in one of three modes of operation. However, these operation modes are different from the ones in A/Gb mode GPRS due to the capabilities of UTRAN to multiplex CS and PS connections, due to paging co-ordination for PS services and CS services that are offered by the CN or the UTRAN, etc. The different UMTS mobile station operation modes are defined as follows:

- PS/CS mode of operation: The MS is attached to both the PS domain and CS domain, and the MS is capable of simultaneously operating PS services and CS services. This mode of operation is equivalent to the GSM GPRS class-A mode of operation.

- PS mode of operation: The MS is attached to the PS domain only and may only operate services of the PS domain. However, this does not prevent CS-like services to be offered over the PS domain (e.g. VoIP). This mode of operation is equivalent to the GSM GPRS class-C mode of operation.

- CS mode of operation: The MS is attached to the CS domain only and may only operate services of the CS domain. However, this does not prevent PS-like service to be offered over the CS domain. The CS mode of operation is outside the scope of this specification.

All combinations of different operation modes as described for GSM and UMTS MSs shall be allowed for GSM and UMTS multisystem terminals.

5.4.7 Charging Gateway Functionality

The Charging Gateway Functionality (CGF) is described in 3GPP TS 32.215 [70].

5.5 Assignment of Functions to General Logical Architecture

The functions identified in the functional model are assigned to the logical architecture.

Table 1: Mapping of Functions to Logical Architecture

Function	2G-MS	3G-MS	BSS	UTRAN	2G-SGSN	3G-SGSN	GGSN	HLR
Network Access Control:								
Registration								X
Authentication and Authorisation	X	X			X	X		X
Admission Control	X	X	X	X	X	X		
Message Screening							X	
Packet Terminal Adaptation	X	X						
Charging Data Collection					X	X	X	
Operator Determined Barring					X	X		X
Packet Routeing & Transfer:								
Relay	X	X	X	X	X	X	X	
Routeing	X	X	X	X	X	X	X	
Address Translation and Mapping	X	X		X	X	X	X	
Encapsulation	X	X		X	X	X	X	
Tunnelling				X	X	X	X	
Compression	X	X		X	X			
Ciphering	X	X		X	X			X
Mobility Management:	X	X			X	X	X	X
Logical Link Management:								
Logical Link Establishment	X				X			
Logical Link Maintenance	X				X			
Logical Link Release	X				X			
Radio Resource Management:	X	X	X	X	X			

5.6 User and Control Planes

5.6.1 User Plane (GSM only)

5.6.1.1 MS – GGSN

The user plane consists of a layered protocol structure providing user information transfer, along with associated information transfer control procedures (e.g. flow control, error detection, error correction and error recovery). The user plane independence of the Network Subsystem (NSS) platform from the underlying radio interface is preserved via the Gb interface. The following user plane is used in A/Gb mode.

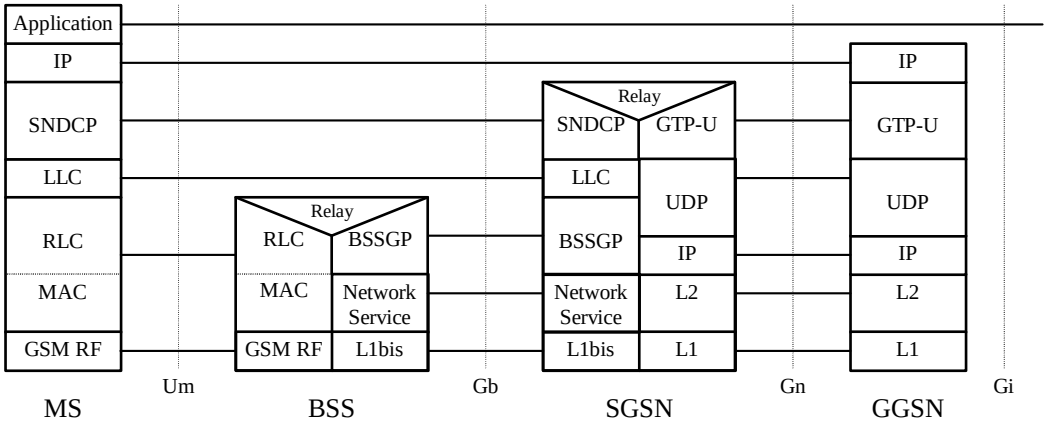

Figure 4: User Plane for GSM

Legend:

- GPRS Tunnelling Protocol for the user plane (GTP-U): This protocol tunnels user data between GPRS Support Nodes in the backbone network. The GPRS Tunnelling Protocol shall encapsulate all PDP PDUs. GTP is specified in 3GPP TS 29.060 [26].

- UDP carries GTP PDUs for protocols that do not need a reliable data link (e.g. IP), and provides protection against corrupted GTP PDUs. UDP is defined in RFC 768 [39].

- IP: This is the backbone network protocol used for routeing user data and control signalling. The backbone network may initially be based on the IPv4. Ultimately, IPv6 shall be used. IPv4 is defined in RFC 791[40].

- Subnetwork Dependent Convergence Protocol (SNDCP): This transmission functionality maps network-level characteristics onto the characteristics of the underlying network. SNDCP is specified in GSM 04.65 [16].

- Logical Link Control (LLC): This layer provides a highly reliable ciphered logical link. LLC shall be independent of the underlying radio interface protocols in order to allow introduction of alternative GPRS radio solutions with minimum changes to the NSS. LLC is specified in GSM 04.64 [15].

- Relay: In the BSS, this function relays LLC PDUs between the Um and Gb interfaces. In the SGSN, this function relays PDP PDUs between the Gb and Gn interfaces.

- Base Station System GPRS Protocol (BSSGP): This layer conveys routeing- and QoS-related information between the BSS and the SGSN. BSSGP does not perform error correction. BSSGP is specified in GSM 08.18 [21].

- Network Service (NS): This layer transports BSSGP PDUs. NS is based on the Frame Relay connection between the BSS and the SGSN, and may - multi-hop and traverse a network of Frame Relay switching nodes. NS is specified in GSM 08.16 [20].

- RLC/MAC: This layer contains two functions: The Radio Link Control function provides a radio-solution-dependent reliable link. The Medium Access Control function controls the access signalling (request and grant) procedures for the radio channel, and the mapping of LLC frames onto the GSM physical channel. RLC/MAC is defined in GSM 04.60 [14].

- GSM RF: As defined in GSM 05 series.

5.6.1.2 GSN – GSN

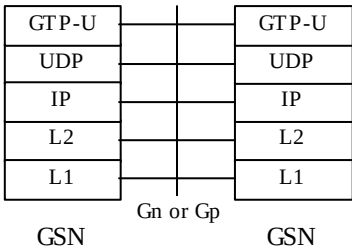

Figure 5: User Plane for SGSN – GGSN and SGSN – SGSN Interfaces

Legend:

- GPRS Tunnelling Protocol for the user plane (GTP-U): This protocol tunnels user data between SGSNs and GGSNs (Gn), and between SGSNs in the backbone network (Gp).

- User Datagram Protocol (UDP): This protocol transfers user data between GSNs. UDP is defined in RFC 768.

5.6.2 User Plane (UMTS only)

5.6.2.1 MS – GGSN

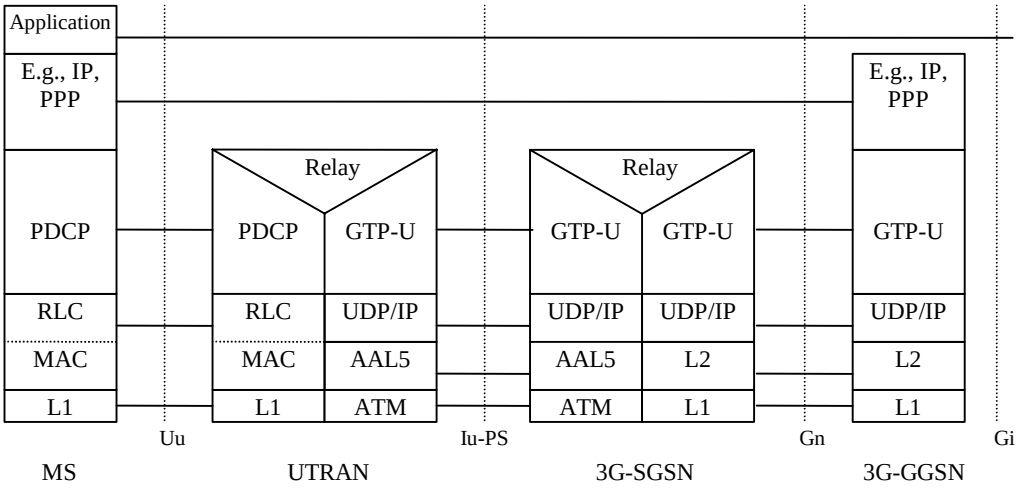

Figure 6: User Plane for UMTS

Legend:

- Packet Data Convergence Protocol (PDCP): This transmission functionality maps higher-level characteristics onto the characteristics of the underlying radio-interface protocols. PDCP provides protocol transparency for higher-layer protocols. PDCP supports e.g. IPv4, PPP and IPv6. Introduction of new higher-layer protocols shall be possible without any changes to the radio-interface protocols. PDCP provides protocol control information compression. PDCP is specified in 3GPP TS 25.323.

NOTE: Unlike in A/Gb mode, user data compression is not supported in Iu mode, because the data compression efficiency depends on the type of user data, and because many applications compress data before transmission. It is difficult to check the type of data in the PDCP layer, and compressing all user data requires too much processing.

- GPRS Tunnelling Protocol for the user plane (GTP-U): This protocol tunnels user data between UTRAN and the 3G-SGSN, and between the GSNs in the backbone network. GTP shall encapsulate all PDP PDUs. GTP is specified in 3GPP TS 29.060.

- UDP/IP: These are the backbone network protocols used for routeing user data and control signalling.

- Asynchronous Transfer Mode (ATM): The information to be transmitted is divided into fixed-size cells (53 octets), multiplexed, and transmitted. ATM is specified in ITU-T Recommendation I.361 [59].
- ATM Adaptation Layer 5 (AAL5): This adaptation layer protocol provides support for variable-bitrate connection-oriented or connectionless data services. AAL5 is specified in ITU-T Recommendation I.363.5 [67].
- Radio Link Control (RLC): The RLC protocol provides logical link control over the radio interface. There may be several simultaneous RLC links per MS. Each link is identified by a Bearer Id. RLC is defined in 3GPP TS 25.322.
- Medium Access Control (MAC): The MAC protocol controls the access signalling (request and grant) procedures for the radio channel. MAC is specified in 3GPP TS 25.321.

5.6.2.2 GSN – GSN

This user plane is the same as for GSM, see clause "GSN – GSN" above.

5.6.3 Control Plane

The control plane consists of protocols for control and support of the user plane functions:

- controlling the GPRS~~packet domain~~ network access connections, such as attaching to and detaching from GPRS~~the packet domain network~~;
- controlling the attributes of an established network access connection, such as activation of a PDP address;
- controlling the routeing path of an established network connection in order to support user mobility; and
- controlling the assignment of network resources to meet changing user demands.

The following control planes are used in both GSM and UMTS unless specifically indicated.

5.6.3.1 MS – SGSN (GSM only)

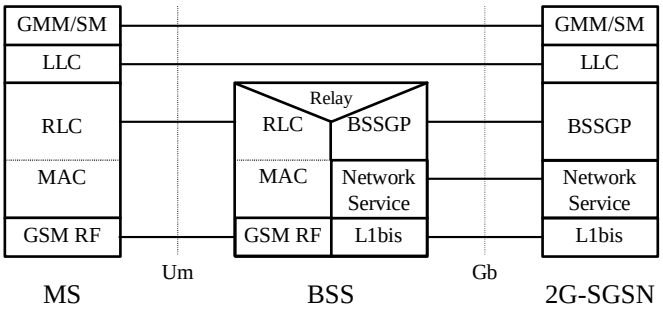

Figure 7: Control Plane MS - 2G-SGSN

Legend:

- GPRS Mobility Management and Session Management (GMM/SM): This protocol supports mobility management functionality such as GPRS attach, GPRS detach, security, routeing area update, location update, PDP context activation, and PDP context deactivation, as described in clauses "Mobility Management Functionality" and "PDP Context Activation, Modification, Deactivation, and Preservation Functions".

5.6.3.2 MS – SGSN (UMTS only)

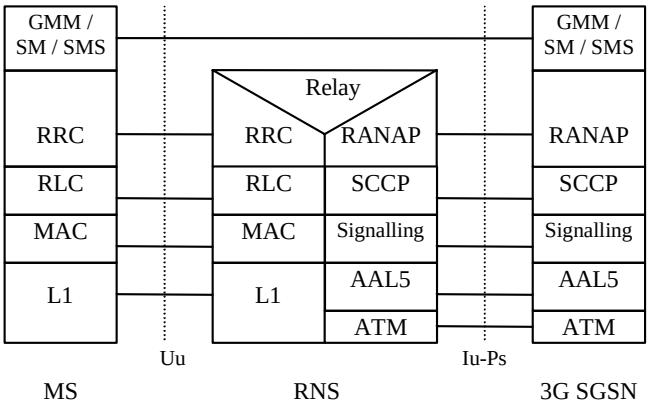

Figure 8: Control Plane MS - 3G-SGSN

Legend:

- UMTS Mobility Management and Session Management (GMM/SM): GMM supports mobility management functionality such as attach, detach, security, and routeing area update, as described in clause "Mobility Management Functionality". SM supports PDP context activation and PDP context deactivation, as described in clause "PDP Context Activation, Modification, Deactivation, and Preservation Functions".

- SMS supports the mobile-originated and mobile-terminated short message service described in 3GPP TS 23.040.

- Radio Access Network Application Protocol (RANAP): This protocol encapsulates and carries higher-layer signalling, handles signalling between the 3G-SGSN and UTRAN, and manages the GTP connections on the Iu interface. RANAP is specified in 3GPP TS 25.413. The layers below RANAP are defined in 3GPP TS 23.121.

- Radio Link Control (RLC): The RLC protocol offers logical link control over the radio interface for the transmission of higher layer-signalling messages and SMS. RLC is defined in 3GPP TS 25.322.

5.6.3.3 SGSN - HLR

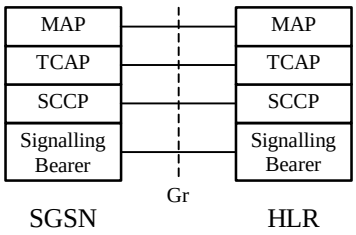

Figure 9: Control Plane SGSN - HLR

Legend:

- Mobile Application Part (MAP): This protocol supports signalling exchange with the HLR, as defined in 3GPP TS 29.002 [23], with enhancements for GPRS as described in the present document.

- TCAP and SCCP are the same protocols as used to support MAP in CS PLMNs.

- The Signalling Bearer is one of the signalling bearers specified in 3GPP TS 29.202 [72].

5.6.3.4 SGSN - MSC/VLR

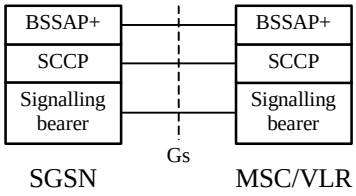

Figure 10: Control Plane SGSN - MSC/VLR

Legend:

- Base Station System Application Part + (BSSAP+): A subset of BSSAP procedures supports signalling between the SGSN and MSC/VLR, as described in clause "Mobility Management Functionality" and in 3GPP TS 29.018 [25]. The requirements for the lower layers are specified in 3GPP TS 29.016 [24].

5.6.3.5 SGSN - EIR

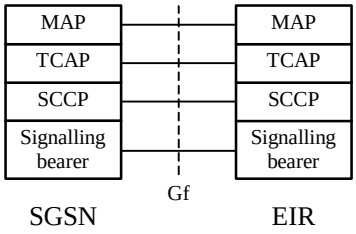

Figure 11: Control Plane SGSN - EIR

Legend:

- Mobile Application Part (MAP): This protocol supports signalling between the SGSN and the EIR, as described in clause "Identity Check Procedures".

5.6.3.6 SGSN - SMS-GMSC or SMS-IWMSC

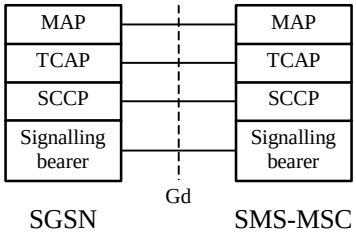

Figure 12: Control Plane SGSN - SMS-GMSC and SGSN - SMS-IWMSC

Legend:

- Mobile Application Part (MAP): This protocol supports signalling between the SGSN and SMS-GMSC or SMS-IWMSC, as described in clause "Point-to-point Short Message Service".

5.6.3.7 GSN - GSN

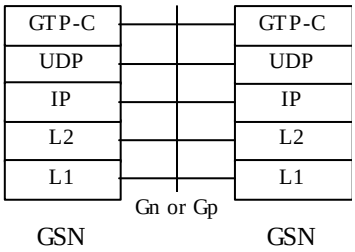

Figure 13: Control Plane for SGSN – GGSN and SGSN – SGSN Interfaces

Legend:

- GPRS Tunnelling Protocol for the control plane (GTP-C): This protocol tunnels signalling messages between SGSNs and GGSNs (Gn), and between SGSNs in the backbone network (Gp).
- User Datagram Protocol (UDP): This protocol transfers signalling messages between GSNs. UDP is defined in RFC 768.

5.6.3.8 GGSN - HLR

This optional signalling path allows a GGSN to exchange signalling information with an HLR. There are two alternative ways to implement this signalling path:

- If an SS7 interface is installed in the GGSN, the MAP protocol can be used between the GGSN and an HLR.
- If an SS7 interface is not installed in the GGSN, any GSN with an SS7 interface installed in the same PLMN as the GGSN can be used as a GTP-to-MAP protocol converter to allow signalling between the GGSN and an HLR.

5.6.3.8.1 MAP-based GGSN - HLR Signalling

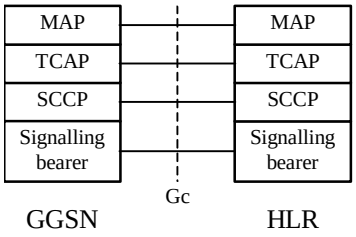

Figure 14: Control Plane GGSN - HLR Using MAP

Legend:

- Mobile Application Part (MAP): This protocol supports signalling exchange with the HLR, as described in clause "Network-Requested PDP Context Activation Procedure".

5.6.3.8.2 GTP and MAP-based GGSN - HLR Signalling

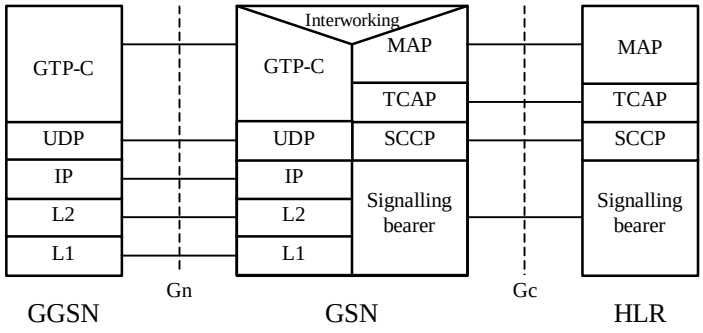

Figure 15: Control Plane GGSN - HLR Using GTP and MAP

Legend:

- GPRS Tunnelling Protocol for the control plane (GTP-C): This protocol tunnels signalling messages between the GGSN and the protocol-converting GSN in the backbone network.

- Interworking: This function provides interworking between GTP and MAP for GGSN - HLR signalling.

5.7 Functionality Needed for Mobile IP Using IPv4

To support the optional Mobile IP services, see 3GPP TS 23.121 [54], efficiently by GPRS~~in the packet domain~~, Foreign Agent (FA) functionality needs to be provided in the GGSN. The interface between the GGSN and FA, including the mapping between the care of IP address and the GTP tunnel in the PLMN is not standardized as the GGSN and FA are considered to be one integrated node.

Mobile IP services need a Home Agent (HA). The HA is a router that tunnels datagrams to an FA. The FA de-tunnels the datagrams and sends them towards the MS that is in a PLMN. The HA maintains current location information for each of the departed users. The location of the HA is outside the scope of the 3GPP specifications.

The FA and HA functionality is specified in RFC 2002 [46].

6.2.2 Periodic RA Update Timer Function

The Periodic RA Update Timer function monitors the periodic RA update procedure in the MS. The length of the periodic RA update timer is sent in the Routeing Area Update Accept or Attach Accept message. The periodic RA update timer is unique within an RA. Upon expiry of the periodic RA update timer, the MS shall start a periodic routeing area update procedure.

NOTE: An MS is said to be in ~~packet domain~~GPRS coverage if it can access ~~packet domain~~GPRS services. These services may be provided in A/Gb mode or in Iu mode.

If the MS is in coverage but out of ~~packet domain~~GPRS coverage when the periodic RA update timer expires, then, if the MS is IMSI-attached to a network in network operation mode I, the periodic location update procedure (or other appropriate location update procedure) shall be started immediately. In addition, and irrespective of whether or not the MS was IMSI-attached, regardless of the network operation mode, the periodic RA update procedure (or other appropriate update procedure) shall be started as soon as the MS returns to ~~packet domain~~GPRS coverage.

If the MS is out of coverage when the periodic RA update timer expires then:

- if the MS is both IMSI- and GPRS-attached and returns to coverage in a cell that supports packet-domain services in network operation mode I, then the combined RA / LA update procedure with IMSI attach requested shall be started as soon as the MS returns to coverage;

- if the MS is both IMSI- and GPRS-attached and returns to coverage in a cell that supports packet-domain services in network operation mode II or III, or if a GPRS only-attached MS returns to coverage in a cell that

supports packet-domain services, then the periodic RA update procedure shall be started as soon as the MS returns to coverage; or

- if the MS returns to coverage in a cell that does not support packet-domain services, and if the MS is IMSI-attached, then the periodic location update procedure (or other appropriate location update procedure) shall be started as soon as the MS returns to coverage in that cell. In addition, and irrespective of whether or not the MS was IMSI-attached, the periodic RA update procedure (or other appropriate update procedure) shall be started as soon as the MS returns to packet-domain coverage.

If the MS lost packet-domain coverage but the periodic RA update timer did not expire while out of packet-domain coverage, then the MS shall not perform the periodic RA update procedure because of the MS's return to packet-domain coverage.

If the MS lost coverage but the periodic RA update timer did not expire while out of coverage, the MS shall not perform the periodic RA update procedure because of the MS's return to coverage.

6.11 Subscriber Management Function

The Subscriber Management function provides a mechanism to inform the nodes about changes of the GPRSPS subscription data for a specific GPRSPS subscriber.

6.11.1 Subscriber Management Procedures

Whenever the GPRSPS subscription data is changed for a GPRSPS subscriber in the HLR, and the changes affect the GPRSPS subscription data stored in the SGSN, the SGSN node shall be informed about these changes by means of the following procedures:

- Insert Subscriber Data procedure, used to add or modify GPRSPS subscription data in the SGSN; or
- Delete Subscriber Data procedure, used to remove GPRSPS subscription data fromin the SGSN.

.

6.11.1.1 Insert Subscriber Data Procedure

In addition to the insertion and modification of general GPRSPS subscription data for a GPRSPS subscriber, see GSM 09.02, the HLR may request the insertion or modification of one or several new or existing PDP contexts in the SGSN. It should be noted that the modification may trigger a PDP Context Modification procedure as described in clause "Modification Procedures". In particular, the following PDP context parameters may be modified by the HLR:

- QoS Profile Subscribed; and
- VPLMN Address Allowed.

The Insert Subscriber Data procedure is illustrated in Figure 16.

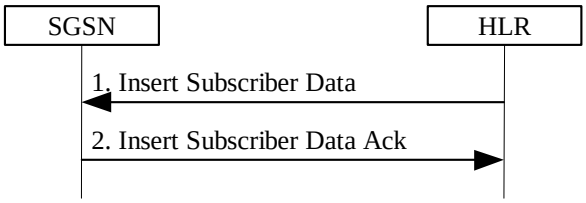

Figure 16: Insert Subscriber Data Procedure

1) The HLR sends an Insert Subscriber Data (IMSI, GPRSPS Subscription Data) message to the SGSN.

2) The SGSN updates its GPRS~~PS~~ subscription data and acknowledges the Insert Subscriber Data message by returning an Insert Subscriber Data Ack (IMSI) message. For each PDP context that is included in GPRS~~PS~~ Subscription Data the SGSN shall check whether it is a new, an active, or an inactive PDP context:

   - For a new or inactive PDP context, no further action is required except storage in the SGSN.

   - For an active PDP context, the SGSN shall in addition compare the new QoS Subscribed with QoS Negotiated and shall, if necessary, initiate a PDP Context Modification procedure as described in subclause "Modification Procedures". Furthermore, if VPLMN Address Allowed is changed, the SGSN shall, if necessary (e.g., if the PDP context is currently routed via a GGSN in the VPLMN and VPLMN Address Allowed is changed to not allowed), initiate a PDP Context Deactivation procedure as explained in subclause 6.11.1.2 Delete Subscriber Data Procedure

In addition to the deletion of general GPRS~~PS~~ subscription data for a subscriber, see GSM 09.02, the HLR may request the deletion of one or several PDP contexts from the SGSN.

The Delete Subscriber Data procedure is illustrated in Figure 17.

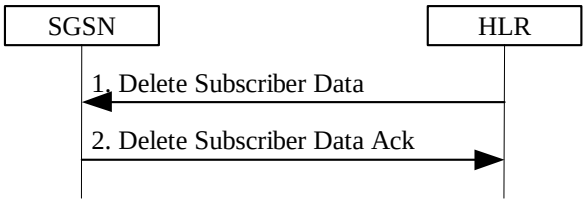

Figure 17: Delete Subscriber Data Procedure

1) The HLR sends a Delete Subscriber Data (IMSI, PDP Context Identifiers List) message to the SGSN.

2) The SGSN acknowledges the Delete Subscriber Data message by returning a Delete Subscriber Data Ack (IMSI) message. For each PDP context identifier included in PDP Context Identifiers List, the SGSN shall check whether it belongs to an active or an inactive PDP context:

   - For an inactive PDP context no further action is required except deletion of the PDP context.

   - For an active PDP context, the SGSN shall initiate the PDP Context Deactivation Initiated by the SGSN procedure as explained in subclause "Deactivation Procedures" before the PDP context is deleted.

7 Network Management Functionality

The Network Management function provides mechanisms to support O&M functions related to ~~the packet domain~~GPRS.

9 Packet Routeing and Transfer Functionality

9.1 Definition of Packet Data Protocol States

A GPRS subscription contains the subscription of one or more PDP addresses. Each PDP address is described by one or more PDP contexts in the MS, the SGSN, and the GGSN. Each PDP context may be associated with a TFT. At most one PDP context associated with the same PDP address may exist at any time with no TFT assigned to it. Every PDP context exists independently in one of two PDP states. The PDP state indicates whether data transfer is enabled for that PDP address and TFT or not. In case all PDP contexts associated with the same PDP address are deactivated, data transfer for that PDP address is disabled. Activation and deactivation are described in clause "PDP Context Activation,

Modification, Deactivation, and Preservation Functions". All PDP contexts of a subscriber are associated with the same MM context for the IMSI of that subscriber.

9.1.1 INACTIVE State

The INACTIVE state characterises the data service for a certain PDP address of the subscriber as not activated. The PDP context contains no routeing or mapping information to process PDP PDUs related to that PDP address. No data can be transferred. A changing location of a subscriber causes no update for the PDP context in INACTIVE state even if the subscriber is GPRS-attached.

Mobile-terminated PDP PDUs received in INACTIVE state by the GGSN may initiate the Network-Requested PDP Context Activation procedure if the GGSN is allowed to initiate the activation of the PDP context for that PDP address. Otherwise, mobile-terminated PDP PDUs received in INACTIVE state invoke error procedures in the GGSN relevant to the ~~external~~ packet data network protocol, for example, an IP packet is discarded and an ICMP (see RFC 792 [41]) packet (error notification) is returned to the source of the received packet. Other error procedures may be introduced on the application level, but this is outside the scope of the present document.

The MS initiates the movement from INACTIVE to ACTIVE state by initiating the PDP Context Activation procedure.

9.1.2 ACTIVE State

In ACTIVE state, the PDP context for the PDP address in use is activated in the MS, SGSN and GGSN. The PDP context contains mapping and routeing information for transferring PDP PDUs for that particular PDP address between the MS and the GGSN. The PDP state ACTIVE is permitted only when the mobility management state of the subscriber is STANDBY, READY, PMM-IDLE, or PMM-CONNECTED. The Iu interface radio access bearer may or may not be established for an active PDP context.

An active PDP context for an MS is moved to INACTIVE state when the deactivation procedure is initiated.

All active PDP contexts for an MS are moved to INACTIVE state when the MM state changes to IDLE or PMM-DETACHED.

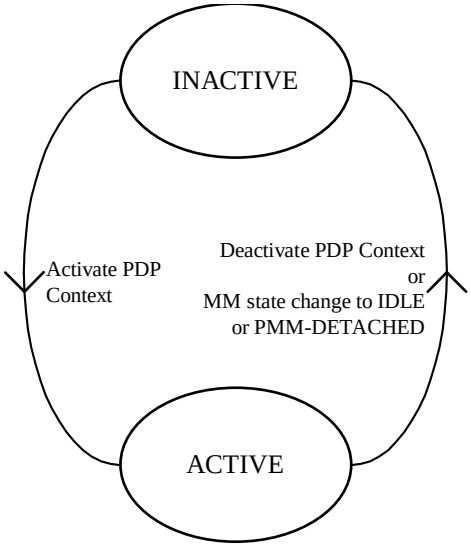

Figure 18: Functional PDP State Model

9.2 PDP Context Activation, Modification, Deactivation, and Preservation Functions

A GPRS-attached MS can initiate the activation, modification, and deactivation functions at any time for a PDP context in the MS, the SGSN, and the GGSN. A GGSN may request the activation of a PDP context to a GPRS-attached subscriber. A GGSN may initiate the deactivation of a PDP context.

NOTE: If the MS is in PMM-IDLE state, it needs to perform a service request procedure to enter the PMM-CONNECTED state before initiating these procedures.

Upon receiving an Activate PDP Context Request message or an Activate Secondary PDP Context Request message, the SGSN shall initiate procedures to set up PDP contexts. The first procedure includes subscription checking, APN selection, and host configuration, while the latter procedure excludes these functions and reuses PDP context parameters including the PDP address but except the QoS parameters. Once activated, all PDP contexts that share the same PDP address and APN shall be managed equally. At least one PDP context shall be activated for a PDP address before a Secondary PDP Context Activation procedure may be initiated. When the MS performs an RA update procedure to change from a release 99 to a release 97 or 98 system, only one active PDP context per PDP address and APN shall be preserved. This PDP context is selected taking the QoS profile and NSAPI value into account.

Upon receiving a Deactivate PDP Context Request message, the SGSN shall initiate procedures to deactivate the PDP context. When the last PDP context associated with a PDP address is deactivated, N-PDU transfer for this PDP address is disabled.

An MS does not have to receive the (De-) Activate PDP Context Accept message before issuing another (De-)Activate PDP Context Request. However, only one request can be outstanding for every TI.

By sending a RAB Release Request or Iu Release Request message to the SGSN, UTRAN initiates the release of one or more RABs. The preservation function allows the active PDP contexts associated with the released RABs to be preserved without modification in the CN, and the RABs can then be re-established at a later stage.

9.2.1 Static and Dynamic PDP Addresses

PDP addresses can be allocated to an MS in four different ways:

- the HPLMN operator assigns a PDP address permanently to the MS (static PDP address);
- the HPLMN operator assigns a PDP address to the MS when a PDP context is activated (dynamic HPLMN PDP address);
- the VPLMN operator assigns a PDP address to the MS when a PDP context is activated (dynamic VPLMN PDP address); or
- the PDN operator or administrator assigns a permanent or dynamic IP address to the MS (External PDN Address Allocation).

It is the HPLMN operator that defines in the subscription whether a dynamic HPLMN or VPLMN PDP address can be used.

For every IMSI, zero, one, or more dynamic PDP addresses per PDP type can be assigned. For every IMSI, zero, one, or more static PDP addresses per PDP type can be subscribed to.

When dynamic addressing from the HPLMN or the VPLMN is used, it is the responsibility of the GGSN to allocate and release the dynamic PDP address. When External PDN Address Allocation is used, the PLMN may obtain a PDP address from the PDN and provide it to the MS during PDP context activation, or the MS may directly negotiate a PDP address with the PDN after the PDP context activation procedure is executed. If the PLMN provides the address during PDP context activation in case of External PDN Address Allocation, then it is the responsibility of the GGSN and PDN to allocate and release the dynamic PDP address by means of protocols such as DHCP or RADIUS. If DHCP is used, the GGSN provides the function of a DHCP Client. If RADIUS is used, the GGSN provides the function of a RADIUS Client. If the MS negotiates a PDP address with the PDN after PDP context activation in case of External PDN Address Allocation, it is the responsibility of the MS and the PDN to allocate and release the PDP address by means of protocols such as DHCP or MIP. In case of DHCP, the GGSN provides the function of a DHCP Relay Agent as defined in RFC 2131 [47] and RFC 1542 [45]. In case of MIP, the GGSN provides the function of a Foreign Agent as defined in RFC 2002 [46].

Only static PDP addressing is applicable in the network-requested PDP context activation case.

9.2.1.1 Dynamic IPv6 Address Allocation

IPv6 address allocation is somewhat different from the IPv4 address allocation procedure. There are two possibilities to allocate the address for an IPv6 node – stateless and stateful autoconfiguration. The stateful address allocation mechanism needs a DHCP server to allocate the address for the IPv6 node. In the stateless autoconfiguration, the IPv6 node is more involved in the allocation of the address. In addition, the stateless autoconfiguration procedure does not need any external entity involved in the address autoconfiguration.

IPv6 stateful address autoconfiguration uses the standard External PDN Address Allocation procedure, as described in 3GPP TS 29.061 [27]. The MS requests stateful address autoconfiguration by using an Access Point Name referring to that service.

To support dynamic IPv6 address allocation by the PLMN operator, the GGSN provides a unique interface identifier (see RFC 2462 [69]) to the MS. This enables the MS to perform the IPv6 stateless autoconfiguration procedures to generate its full IPv6 address. Figure 19 illustrates the IPv6 stateless autoconfiguration procedures for this case.

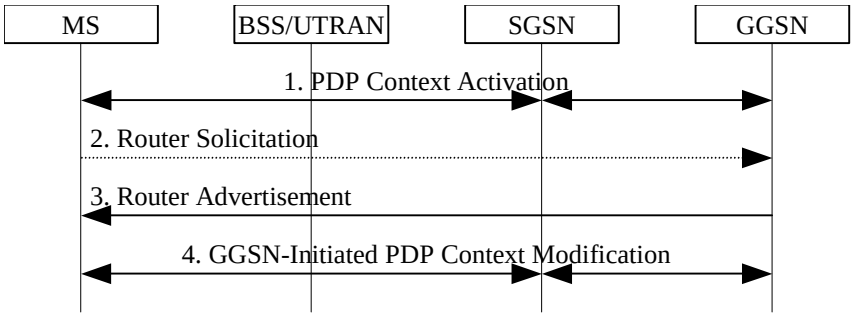

Figure 19: IPv6 Stateless Address Autoconfiguration Procedure

1) The MS sends an Activate PDP Context Request message to the SGSN. The procedure follows that defined in clause "PDP Context Activation Procedure" with exceptions described below.

   The MS shall leave PDP Address empty and set PDP Type to IPv6. The GGSN shall create the unique link-local address for the MS and send it in the PDP Address information element in the Create PDP Context Response message. The link local address consists of a fixed 10-bit prefix (IPv6 well-known link-local prefix), zero or more 0 bits, and the interface identifier.

2) The MS may send a Router Solicitation message to the GGSN to activate the sending of the Router Advertisement message.

3) The GGSN should automatically send the Router Advertisement message after the PDP context is activated. In release 99 the GGSN shall be configured to advertise only one network prefix per APN.

   After the MS has received the Router Advertisement message, it constructs its full IPv6 address by concatenating the interface identifier contained in the link-local address provided in the Create PDP Context Response Message in step 1 and the network prefix of the selected APN received in the Router Advertisement. Subsequently, the MS is ready to start communicating to the Internet.

   Because the GGSN provides a unique interface identifier during the PDP context activation procedure, there is no need for the MS to perform Duplicate Address Detection for this IPv6 address. Therefore, the GGSN shall intercept and discard Neighbor Solicitation messages that the MS may send to perform Duplicate Address Detection. It is possible for the MS to perform Neighbor Unreachability Detection, as defined in RFC 2461[71]; therefore if the GGSN receives a Neighbor Solicitation as part of this procedure, the GGSN shall provide a Neighbor Advertisement as described in RFC 2461.

4) The GGSN updates the PDP context in the SGSN and MS with the full IPv6 address, see clause "GGSN-Initiated PDP Context Modification Procedure".

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 20 and Figure 21.

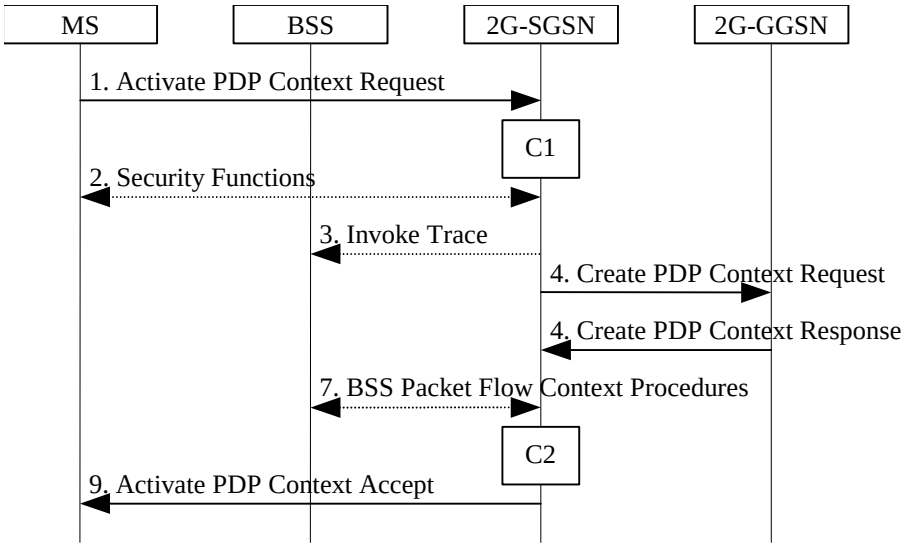

Figure 20: PDP Context Activation Procedure for GSM

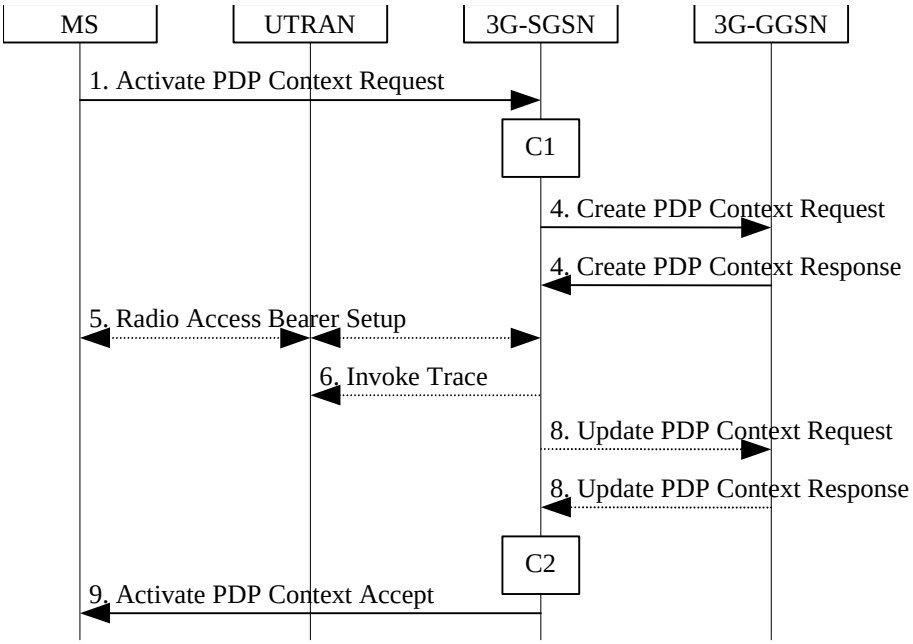

Figure 21: PDP Context Activation Procedure for UMTS

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~~ packet data 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) In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".

3) In A/Gb mode and if BSS trace is activated, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

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, the SGSN rejects the PDP context activation request.

   If a GGSN address can be derived, the SGSN creates a TEID for the requested PDP context. If the MS requests a dynamic address, the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile.

   The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, NSAPI, MSISDN, Selection Mode, Charging Characteristics, Trace Reference, Trace Type, Trigger Id, OMC Identity, PDP Configuration Options) 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 a~~n external~~ packet data 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 an MS or a non-subscribed APN chosen by the 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, 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 charging characteristics on the GPRS subscription and individually subscribed APNs as well as the way the SGSN handles Charging Characteritics and chooses to send them or not to the GGSN is defined in 3GPP TS 32.215 [70]. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.

   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~~packet data network, and to start charging. The way the GGSN handles Charging Characteritics that it may have received from the SGSN is defined in 3GPP TS 32.215 [70]. The GGSN then returns a Create PDP Context Response (TEID, PDP Address, 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, 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. 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, the GGSN rejects the Create PDP Context Request message. The GGSN operator configures the compatible QoS profiles.

5) In Iu mode, RAB setup is done by the RAB Assignment procedure, see subclause "RAB Assignment Procedure".

6) In Iu mode and if BSS trace is activated, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the UTRAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

7) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".

8) In Iu mode and in case the QoS attributes have been downgraded in step 5, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.

9) 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 clause "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, the MS may attempt another activation to the same APN up to a maximum number of attempts.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 20 and Figure 21, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 20 and Figure 21, procedures return as result "Continue".

9.2.2.1.1 Secondary PDP Context Activation Procedure

The Secondary PDP Context Activation procedure may be used to activate a PDP context while reusing the PDP address and other PDP context information from an already active PDP context, but with a different QoS profile. Procedures for APN selection and PDP address negotiation are not executed. A unique TI and a unique NSAPI shall identify each PDP context sharing the same PDP address and APN.

The Secondary PDP Context Activation procedure may be executed without providing a Traffic Flow Template (TFT) to the newly activated PDP context if all other active PDP contexts for this PDP address and APN already have an associated TFT.Otherwise a TFT shall be provided. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected ~~external~~ packet data network to the newly activated PDP context.

The Secondary PDP Context Activation procedure may only be initiated after a PDP context is already activated for the same PDP address and APN. The procedure is illustrated in Figure 22 and Figure 23.

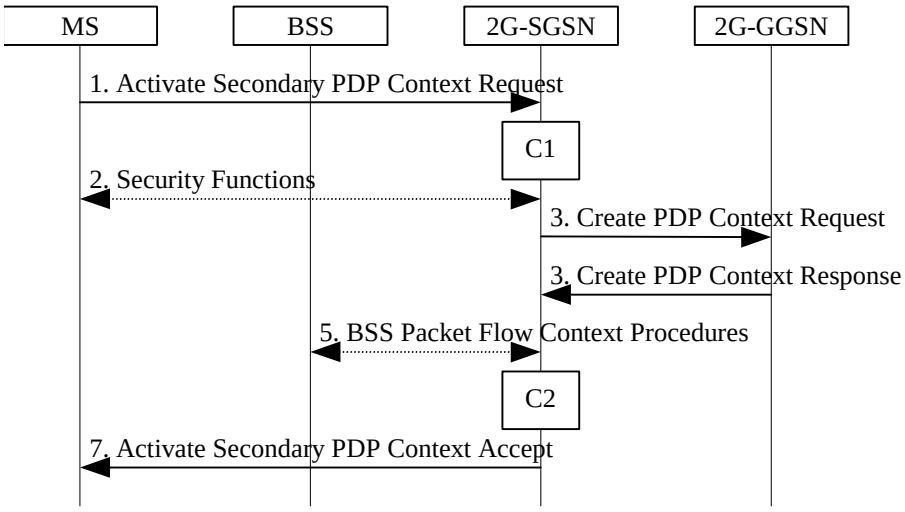

Figure 22: Secondary PDP Context Activation Procedure for GSM

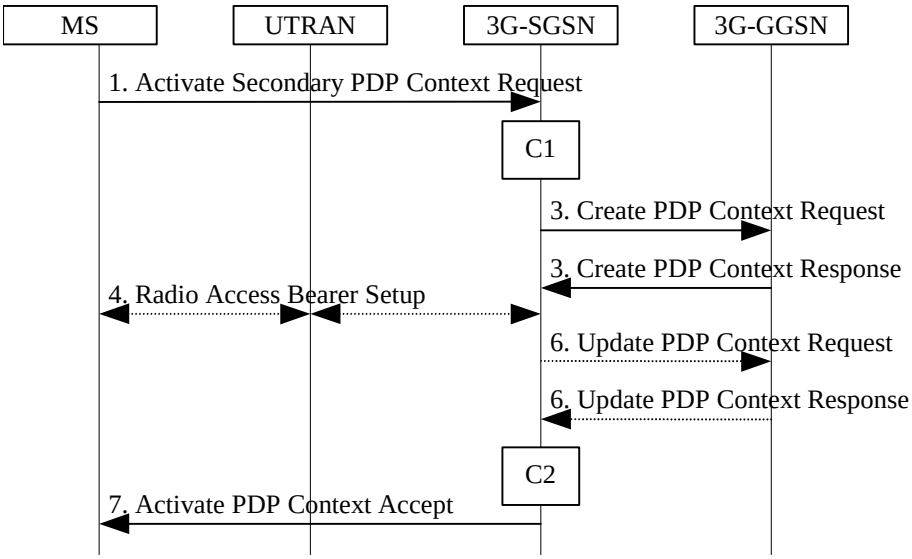

Figure 23: Secondary PDP Context Activation Procedure for UMTS

1) The MS sends an Activate Secondary PDP Context Request (Linked TI, NSAPI, TI, QoS Requested, TFT) message to the SGSN. Linked TI indicates the TI value assigned to any one of the already activated PDP contexts for this PDP address and APN. QoS Requested indicates the desired QoS profile. TFT is sent transparently through the SGSN to the GGSN to enable packet classification for downlink data transfer. TI and NSAPI contain values not used by any other activated PDP context.

2) In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".

3) The SGSN validates the Activate Secondary PDP Context Request using the TI indicated by Linked TI. The same GGSN address is used by the SGSN as for the already-activated PDP context(s) for that TI and PDP address.

   The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile, which represents the maximum QoS per PDP context to the associated APN. The GGSN may restrict and negotiate the requested QoS as specified in clause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TEID, NSAPI, Primary NSAPI, TFT) message to the affected GGSN. Primary NSAPI indicates the NSAPI value assigned to any one of the already activated PDP contexts for this PDP address and APN. TFT is included only if received in the Activate Secondary PDP Context Request message. The GGSN uses the same ~~external~~ packet data network as used by the already-activated PDP context(s) for that PDP address, generates a new entry in its PDP context table, and stores the TFT. The new entry allows the GGSN to route PDP PDUs via different GTP tunnels between the SGSN and the ~~external PDP~~packet data network. The GGSN returns a Create PDP Context Response (TEID, QoS Negotiated, Cause) message to the SGSN.

4) In Iu mode, RAB setup is done by the RAB Assignment procedure.

5) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".

6) In Iu mode and in case the QoS attributes have been downgraded in step 4, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.

7) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS via different GTP tunnels and possibly different LLC links.

For each additionally activated PDP context a QoS profile and TFT may be requested.

If the secondary PDP context activation procedure fails or if the SGSN returns an Activate Secondary PDP Context Reject (Cause) message, the MS may attempt another activation with a different TFT, depending on the cause.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 22 and in Figure 23, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 22 and in Figure 23, procedures return as result "Continue".

9.2.2.2 Network-Requested PDP Context Activation Procedure

The Network-Requested PDP Context Activation procedure allows the GGSN to initiate the activation of a PDP context. When receiving a PDP PDU the GGSN checks if a PDP context is established for that PDP address. If no PDP context has been previously established, the GGSN may try to deliver the PDP PDU by initiating the Network-Requested PDP Context Activation procedure. The criteria used by the GGSN to determine whether trying to deliver the PDP PDU to the MS may be based on subscription information are outside the scope of GPRS standardisation.

To support Network-Requested PDP Context Activation, the GGSN has to have static PDP information about the PDP address. To determine whether Network-Requested PDP Context Activation is supported for a PDP address, the GGSN checks if there is static PDP information for that PDP address.

Once these checks have been performed the GGSN may initiate the Network-Requested PDP Context Activation procedure.

The network operator may implement the following techniques to prevent unnecessary enquires to the HLR:

- Implementation of the Mobile station Not Reachable for GPRS flag (MNRG) technique in GGSN, SGSN, and HLR (see clause "Unsuccessful Network-Requested PDP Context Activation Procedure").
- The GGSN may reject or discard PDP PDUs after a previous unsuccessful delivery attempt. This systematic rejection of PDP PDUs would be performed during a certain time after the unsuccessful delivery.
- The GGSN may store the address of the SGSN with which the GGSN established the last PDP context. This would prevent an enquiry to the HLR. This SGSN address would be considered as valid during a certain time.

9.2.2.2.1 Successful Network-Requested PDP Context Activation Procedure

The Successful Network-Requested PDP Context Activation procedure is illustrated in Figure 24.

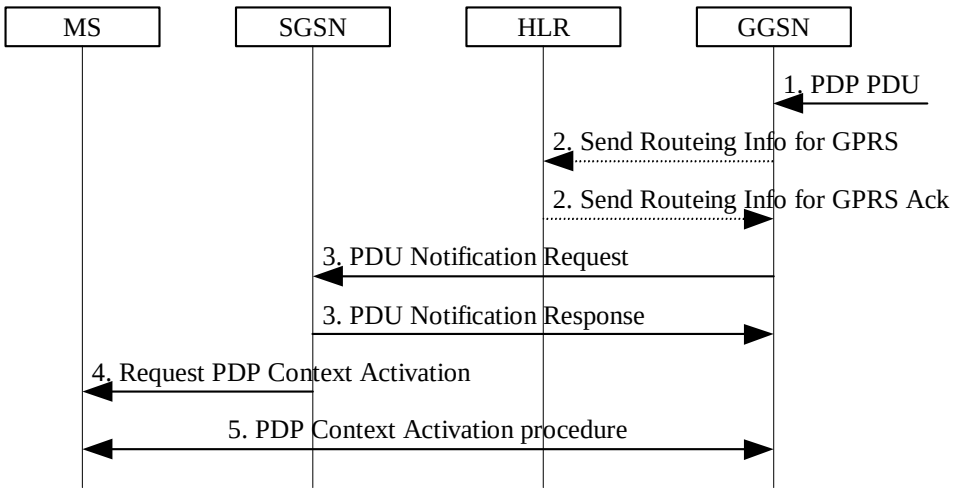

Figure 24: Successful Network-Requested PDP Context Activation Procedure

1) When receiving a PDP PDU the GGSN determines if the Network-Requested PDP Context Activation procedure has to be initiated. The GGSN may store subsequent PDP PDUs received for the same PDP address.

2) The GGSN may send Send Routeing Information for GPRS (IMSI) message to the HLR. If the HLR determines that the request can be served, it returns Send Routeing Information for GPRS Ack (IMSI, SGSN Address, Mobile Station Not Reachable Reason) message to the GGSN. The Mobile Station Not Reachable Reason

parameter is included if the MNRG flag is set in the HLR. The Mobile Station Not Reachable Reason parameter indicates the reason for the setting of the MNRG flag as stored in the MNRR record (see GSM 03.40). If the MNRR record indicates a reason other than "No Paging Response", the HLR shall include the GGSN number in the GGSN-list of the subscriber.

If the HLR determines that the request cannot be served (e.g. IMSI unknown in HLR), the HLR shall send a Send Routeing Information for GPRS Ack (IMSI, MAP Error Cause) message. Map Error Cause indicates the reason for the negative response.

3) If the SGSN address is present and either Mobile Station Not Reachable Reason is not present or Mobile Station Not Reachable Reason indicates "No Paging Response", the GGSN shall send a PDU Notification Request (IMSI, PDP Type, PDP Address, APN) message to the SGSN indicated by the HLR. Otherwise, the GGSN shall set the MNRG flag for that MS. The SGSN returns a PDU Notification Response (Cause) message to the GGSN in order to acknowledge that it shall request the MS to activate the PDP context indicated with PDP Address.

4) The SGSN sends a Request PDP Context Activation (TI, PDP Type, PDP Address, APN) message to request the MS to activate the indicated PDP context.

5) The PDP context is activated with the PDP Context Activation procedure (see clause "PDP Context Activation Procedure").

9.2.2.2.2 Unsuccessful Network-Requested PDP Context Activation Procedure

If the PDP context requested by the GGSN cannot be established, the SGSN sends a PDU Notification Response (Cause) or a PDU Notification Reject Request (IMSI, PDP Type, PDP Address, Cause) message to the GGSN depending on if the context activation fails before or after the SGSN has sent a Request PDP Context Activation message to the MS. Cause indicates the reason why the PDP context could not be established:

- "IMSI Not Known". The SGSN has no MM context for that IMSI (Cause in PDU Notification Response).

- "MS GPRS Detached". The MM state of the MS is IDLE (Cause in PDU Notification Response).

- "MS Not GPRS Responding". The MS is GPRS-attached to the SGSN but the MS does not respond. This may be due to the lack of a response to a GPRS Paging Request, due to an Abnormal RLC condition, or due to no Activate PDP Context Request message received within a certain time after the Request PDP Context Activation message was delivered to the MS (Cause in PDU Notification Reject Request).

- "MS Refuses". The MS refuses explicitly the network-requested PDP context (Cause in PDU Notification Reject Request).

When receiving the PDU Notification Response or the PDU Notification Reject Request message, the GGSN may reject or discard the PDP PDU depending on the PDP type.

After an unsuccessful Network-Requested PDP Context Activation procedure the network may perform some actions to prevent unnecessary enquires to the HLR. The actions taken depend on the cause of the delivery failure.

- If the MS is not reachable or if the MS refuses the PDP PDU (Cause value "MS Not GPRS Responding" or "MS Refuses"), the SGSN shall not change the setting of MNRG for this MS. The GGSN may refuse any PDP PDU for that PDP address during a certain period. The GGSN may store the SGSN address during a certain period and send subsequent PDU Notification Request messages to that SGSN.

- If the MS is GPRS-detached or if the IMSI is not known in the SGSN (Cause value "MS GPRS Detached" or "IMSI Not Known"), the SGSN, the GGSN, and the HLR may perform the Protection and Mobile User Activity procedures.

The Protection procedure is illustrated in Figure 25.

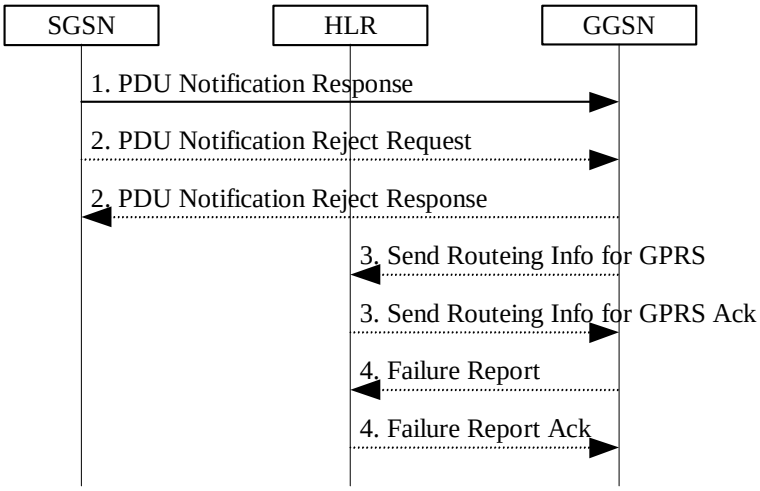

Figure 25: Protection Procedure

1) If the MM context of the mobile is IDLE or if the SGSN has no information about that user, the SGSN returns a PDU Notification Response (Cause) message to the GGSN with Cause equal to "MS GPRS Detached" or "IMSI Not Known". Otherwise, the Cause shall be "Activation Proceeds". If the Cause is "MS GPRS Detached" or "IMSI Not Known" and if the SGSN has an MM context for that user, the SGSN sets MNRG to indicate the need to report to the HLR when the next contact with that MS is performed.

2) If the MS does not respond or refuses the activation request, the SGSN sends a PDU Notification Reject Request (IMSI, PDP Type, PDP Address, Cause) message to the GGSN with Cause equal to "MS Not GPRS Responding" or "MS Refuses". The GGSN returns a PDU Notification Reject Response message to the SGSN.

3) If Cause equals "IMSI Not Known", the GGSN may send Send Routeing Information for GPRS (IMSI) message to the HLR. The HLR returns Send Routeing Information for GPRS Ack (IMSI, SGSN Address, Cause) message to the GGSN indicating the address of the SGSN that currently serves the MS. If SGSN Address is different from the one previously stored by the GGSN, then steps 3, 4, and 5 in Figure 24 are followed.

4) If SGSN Address is the same as the one previously stored in the GGSN, or if the Cause value returned in step 1 equals "MS GPRS Detached", then the GGSN sets MNRG for that PDP address and sends a Failure Report (IMSI, GGSN Number, GGSN Address) message to the HLR to request MNRG to be set in the HLR. The HLR sets (if not already set) MNRG for the IMSI and adds GGSN Number and GGSN Address to the list of GGSNs to report to when activity from that IMSI is detected. GGSN Number is either the number of the GGSN, or, if a protocol-converting GSN is used as an intermediate node, the number of the protocol-converting GSN. GGSN Address is an optional parameter that shall be included if a protocol-converting GSN is used.

The Mobile User Activity procedure is illustrated in Figure 26.

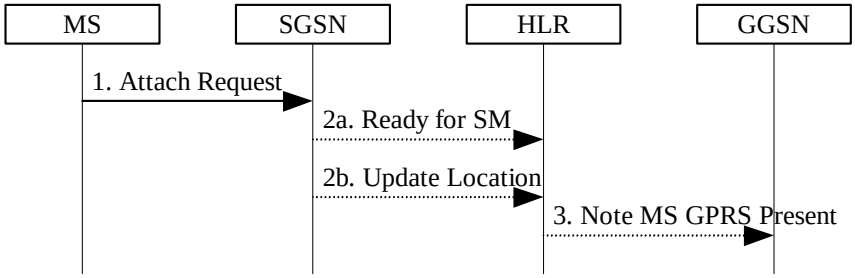

Figure 26: Mobile User Activity Procedure

1) The SGSN receives an indication that an MS is reachable, e.g., an Attach Request message from the MS.

2a) If the SGSN contains an MM context of the MS and MNRG for that MS is set, the SGSN shall send a Ready for SM (IMSI, MS Reachable) message to the HLR and clears MNRG for that MS.

2b) If the SGSN does not keep the MM context of the MS, the SGSN shall send an Update Location message (see subclause "GPRS Attach Function") to the HLR.

3) When the HLR receives the Ready for SM message or the Update Location message for an MS that has MNRG set, it clears MNRG for that MS and sends a Note MS GPRS Present (IMSI, SGSN Address) message to all the GGSNs in the list of the subscriber. (The Ready for SM message also triggers the SMS alert procedure as described in subclause "Unsuccessful Mobile-terminated SMS Transfer".) SGSN Address field is the address of the SGSN that currently serves the MS. Upon reception of Note MS Present each GGSN shall clear MNRG.

9.2.3 Modification Procedures

Modification procedures modify parameters that were negotiated during an activation procedure for one or several PDP contexts. An MS, a GGSN, an SGSN, or an RNC can request a modification procedure. The Modification procedures may possibly be triggered by the HLR as explained in subclause "Insert Subscriber Data Procedure" or by an RNC in a RAB Release or an RNC-initiated RAB Modification procedure. An MS and SGSN can also decide about modification procedures after an RNC-initiated Iu release.

The following parameters can be modified:

- QoS Negotiated;
- Radio Priority;
- Packet Flow Id;
- PDP Address (in case of the GGSN-initiated modification procedure); and
- TFT (in case of MS-initiated modification procedure).

The SGSN can request the modification of parameters by sending a Modify PDP Context Request message to the MS.

A GGSN can request the modification of parameters by sending an Update PDP Context Request message to the SGSN.

An MS can request the modification of parameters by sending a Modify PDP Context Request message to the SGSN.

An RNC can request an Iu release by sending an Iu Release Request message to the SGSN. After Iu release the MS and SGSN shall modify the PDP contexts according to the rules defined in clause "RNC-Initiated PDP Context Modification Procedure".

An RNC can request the release of a radio access bearer. After RAB release the MS and the SGSN shall locally modify the corresponding PDP context according to rules defined in the clause "RAB Release-Initiated Local PDP Context Modification Procedure".

A trace may be activated while a PDP context is active. To enable trace activation in a GGSN, the SGSN shall send an Update PDP Context Request message to the GGSN. If PDP context modification is performed only to activate a trace, the SGSN shall not send a Modify PDP Context Request message to the MS.

An RNC may request the modification of some negotiated RAB related QoS parameters by sending a RAB Modify Request.

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in Figure 27.

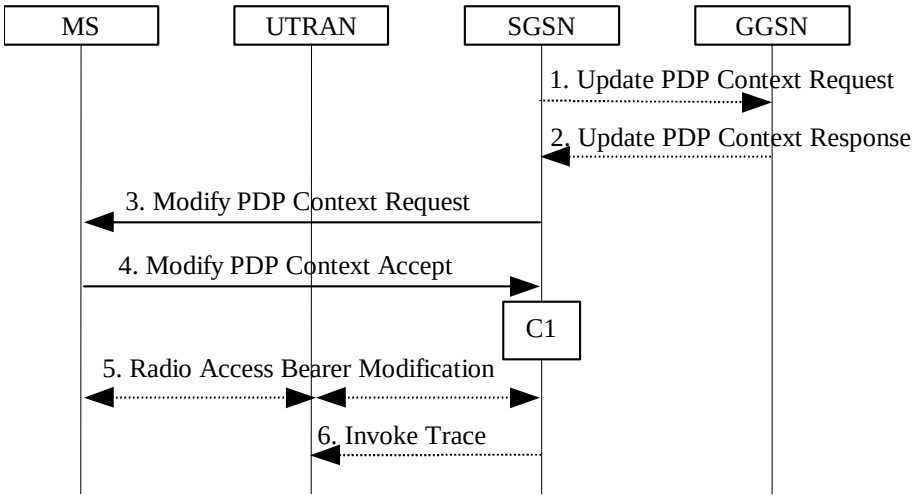

Figure 27: SGSN-Initiated PDP Context Modification Procedure

1) The SGSN may send an Update PDP Context Request (TEID, NSAPI, QoS Negotiated, Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified, the GGSN rejects the Update PDP Context Request. The GGSN operator configures the compatible QoS profiles. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity in the message if GGSN trace is activated while the PDP context is active. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.

2) The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TEID, QoS Negotiated, Cause) message.

3) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and may send a Modify PDP Context Request (TI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.

4) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by the MS procedure.

5) In Iu mode, radio access bearer modification may be performed by the RAB Assignment procedure.

6) If BSS trace is activated while the PDP context is active, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS or UTRAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

The CAMEL procedure calls shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

9.2.3.2 GGSN-Initiated PDP Context Modification Procedure

The GGSN-Initiated PDP Context Modification procedure is illustrated in Figure 28.

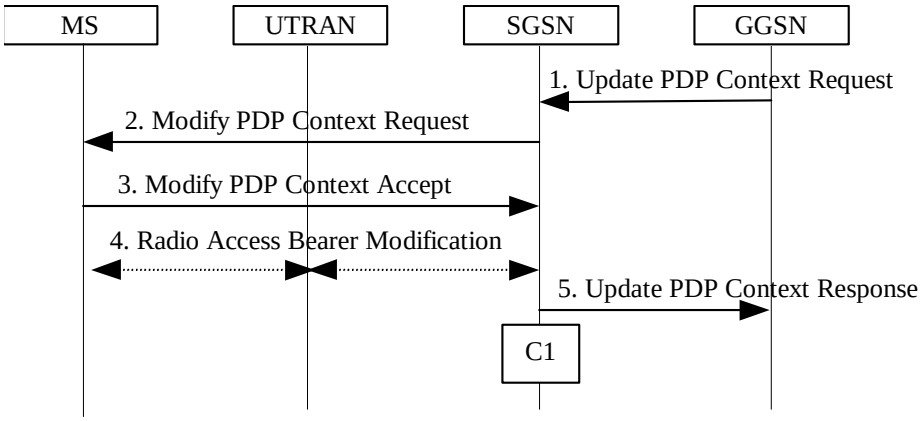

Figure 28: GGSN-Initiated PDP Context Modification Procedure

1) The GGSN sends an Update PDP Context Request (TEID, NSAPI, PDP Address, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile. PDP Address is optional.

2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, the current QoS profile, and the subscribed QoS profile. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, PDP Address, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. PDP Address is optional.

3) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.

4) In Iu mode, radio access bearer modification may be performed by the RAB Assignment procedure.

5) Upon receipt of the Modify PDP Context Accept message, or upon completion of the RAB modification procedure, the SGSN returns an Update PDP Context Response (TEID, QoS Negotiated) message to the GGSN. If the SGSN receives a Deactivate PDP Context Request message, it shall instead follow the PDP Context Deactivation Initiated by MS procedure.

The CAMEL procedure calls shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in Figure 29.

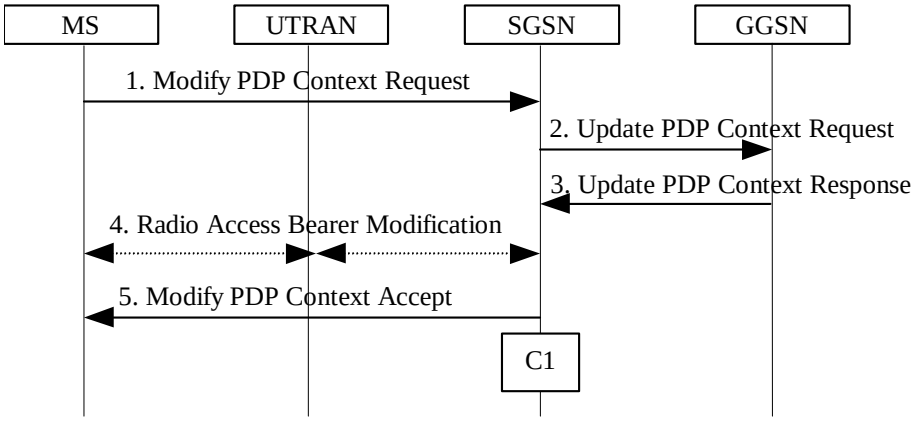

Figure 29: MS-Initiated PDP Context Modification Procedure

1) The MS sends a Modify PDP Context Request (TI, QoS Requested, TFT) message to the SGSN. Either QoS Requested or TFT or both may be included. QoS Requested indicates the desired QoS profile, while TFT indicates the TFT that is to be added or modified or deleted from the PDP context.

2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, and the subscribed QoS profile. The SGSN sends an Update PDP Context Request (TEID, NSAPI, QoS Negotiated, TFT) message to the GGSN. If QoS Negotiated and/or TFT received from the SGSN is incompatible with the PDP context being modified (e.g., TFT contains inconsistent packet filters), the GGSN rejects the Update PDP Context Request. The GGSN operator configures the compatible QoS profile.

3) The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated, stores, modifies, or deletes TFT of that PDP context as indicated in TFT, and returns an Update PDP Context Response (TEID, QoS Negotiated) message.

4) In Iu mode, radio access bearer modification may be performed by the RAB Assignment procedure.

5) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns a Modify PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.

NOTE: If the SGSN does not accept QoS Requested, then steps 2 and 3 of this procedure are skipped, and the existing QoS Negotiated is returned to the MS in step 4.

The CAMEL procedure calls shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

9.2.3.4 RNC-Initiated PDP Context Modification Procedure

The RNC can request the release of the Iu connection (see clause "Iu Release Procedure") e.g. due to a break of the radio connection or due to user inactivity. After Iu Release the PDP contexts are modified as follows:

- In the SGSN, for a PDP context using background or interactive traffic class, the PDP context is preserved with no modifications.

- In the SGSN, for a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (for both uplink and downlink) when the associated RAB is released. The SGSN sends an Update PDP Context Request (TEID, QoS Negotiated) message to the GGSN to set the maximum bit rate to 0 kbit/s in the GGSN. The value of 0 kbit/s for the guaranteed bit rate indicates to the GGSN to stop sending packets to the SGSN for this PDP context. CAMEL procedure calls shall be performed, see referenced procedure in 3G TS 23.078: CAMEL_GPRS_Change_Of_QoS. The procedure returns as result "Continue".

The following procedures shall be performed in the MS when radio coverage is lost:

- For a PDP context using background or interactive traffic class, the PDP context is preserved even if RRC re-establishment procedures have failed.

- For a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (for both uplink and downlink) when the RRC re-establishment procedure has failed. After coverage is regained the MS should re-activate the PDP context and re-establish the RAB (refer to section "Re-establishment of RABs").

9.2.3.5 RAB Release-Initiated Local PDP Context Modification Procedure

The RNC can request a RAB to be released through the RAB Release procedure on the streaming or conversational traffic class bearers without releasing the Iu connection when there is a break in the radio connection.

After the RAB(s) release the SGSN shall modify the PDP context as follows:

- In the SGSN, for a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (both for uplink and downlink) when the associated RAB is released. The SGSN sends an Update PDP Context Request (TEID, QoS Negotiated) message to the GGSN to set the maximum bit rate to 0 kbit/s in the GGSN. The value of 0 kbit/s for the guaranteed bit rate indicates to the GGSN to stop sending downlink packets corresponding to this PDP context. CAMEL procedure calls shall be

performed, see referenced procedure in 3G TS 23.078: CAMEL_GPRS_Change_Of_QoS. The procedure returns as result "Continue".

The following procedures shall be performed in the MS when radio coverage is lost:

- For a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (for both uplink and downlink) when the RRC re-establishment procedure has failed. After coverage is regained the MS should start the MS-Initiated PDP Context Modification procedure or the PDP Context Deactivation Initiated by MS procedure. The MS shall use the PDP context modification procedure to re-activate the PDP context and to re-establish the RAB.

The radio access bearer shall be released by the RNC only when RRC re-establishment is not any longer possible. Therefore the change happens simultaneously in the MS and in the SGSN.

9.2.3.6 RNC-initiated RAB Modification Procedure (UTRAN only)

The RNC-initiated RAB Modification procedure permits RNC to propose modifications to any negotiable RAB parameter for an MS after RAB establishment, 3G 25.413 [56a]. RAB parameters are equivalent to RAB attributes as defined in TS 23.107 [58] for each QoS class. The procedure is depicted in **Error! Reference source not found.**.

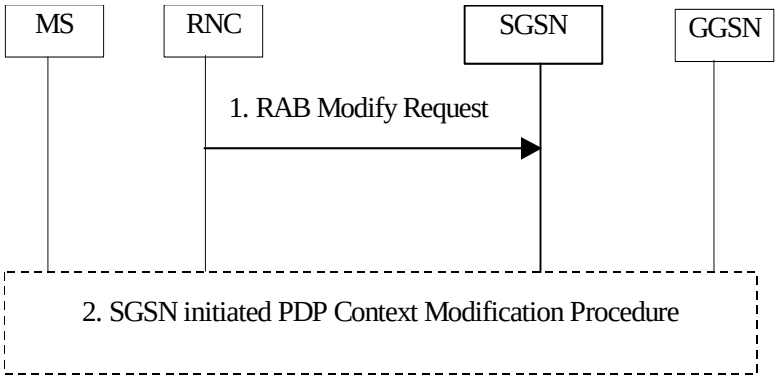

Figure 30: RNC-initiated RAB Modification Procedure.

1) The RNC sends a RAB Modify Request (RAB ID, RAB Parameter Values) message to the SGSN.
2) The SGSN may decide to ignore the message or to invoke the PDP Context Modification procedure as described in subclause 9.2.3.1, which includes the SGSN RAB Modification procedure.

9.2.4 Deactivation Procedures

9.2.4.1 MS Initiated PDP Context Deactivation Procedure

The PDP Context Deactivation Initiated by MS procedures for GSM and UMTS are illustrated in Figure 31 andFigure 32, respectively.

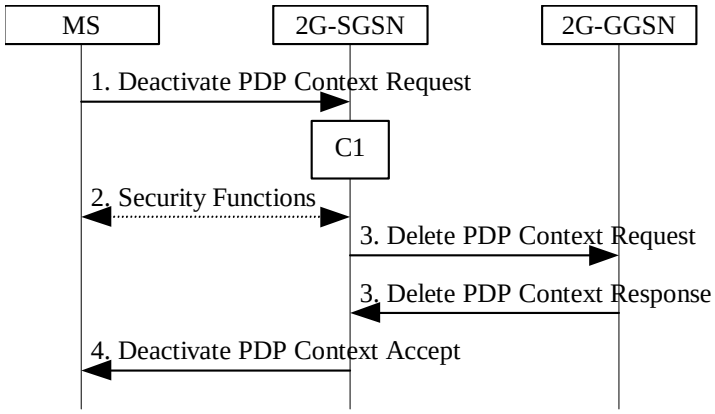

Figure 31: MS Initiated PDP Context Deactivation Procedure for GSM

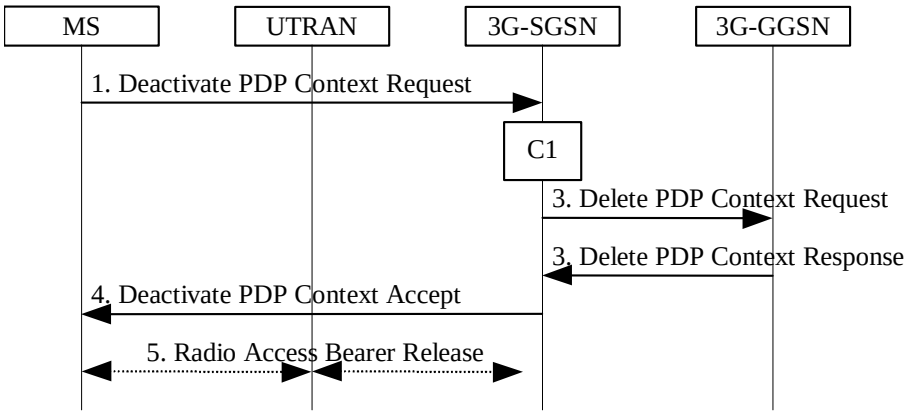

Figure 32: MS Initiated PDP Context Deactivation Procedure for UMTS

1) The MS sends a Deactivate PDP Context Request (TI, Teardown Ind) message to the SGSN.

2) In A/Gb mode security functions may be executed. These procedures are defined in clause "Security Function".

3) The SGSN sends a Delete PDP Context Request (TEID, NSAPI, Teardown Ind) message to the GGSN. If the MS in the Deactivate PDP Context Request message included Teardown Ind, then the SGSN deactivates all PDP contexts associated with this PDP address by including Teardown Ind in the Delete PDP Context Request message. The GGSN removes the PDP context(s) and returns a Delete PDP Context Response (TEID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network.

4) The SGSN returns a Deactivate PDP Context Accept (TI) message to the MS.

5) In Iu mode, radio access bearer release is done by the RAB Assignment procedure.

At GPRS detach, all PDP contexts for the MS are implicitly deactivated.

If the SGSN receives a Deactivate PDP Context Request (TI) message for a PDP context that is currently being activated, the SGSN shall stop the PDP Context Activation procedure without responding to the MS, and continue with the PDP Context Deactivation initiated by MS procedure.

The CAMEL procedure call shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection.

The procedure returns as result "Continue".

9.2.4.2 SGSN-initiated PDP Context Deactivation Procedure

The PDP Context Deactivation Initiated by SGSN procedure is illustrated in Figure 33.

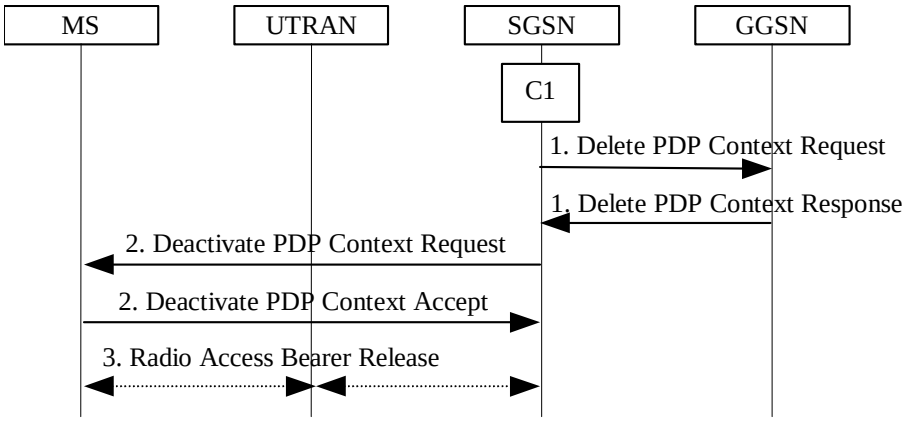

Figure 33: SGSN-initiated PDP Context Deactivation Procedure

1) The SGSN sends a Delete PDP Context Request (TEID, NSAPI, Teardown Ind) message to the GGSN. If Teardown Ind is included by the SGSN, the GGSN deactivates all PDP contexts associated with this PDP address. The GGSN removes the PDP context and returns a Delete PDP Context Response (TEID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the GGSN before sending the Deactivate PDP Context Request message.

2) The SGSN sends a Deactivate PDP Context Request (TI, Teardown Ind) message to the MS. If Teardown Ind is included, all PDP contexts associated with this PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, Teardown Ind) message to the SGSN. Teardown Ind is included if received from the SGSN.

3) In Iu mode, radio access bearer release is done by the RAB Assignment procedure.

The CAMEL procedure call shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection

The procedure returns as result "Continue".

9.2.4.3 GGSN-initiated PDP Context Deactivation Procedure

The PDP Context Deactivation Initiated by GGSN procedure is illustrated in Figure 34.

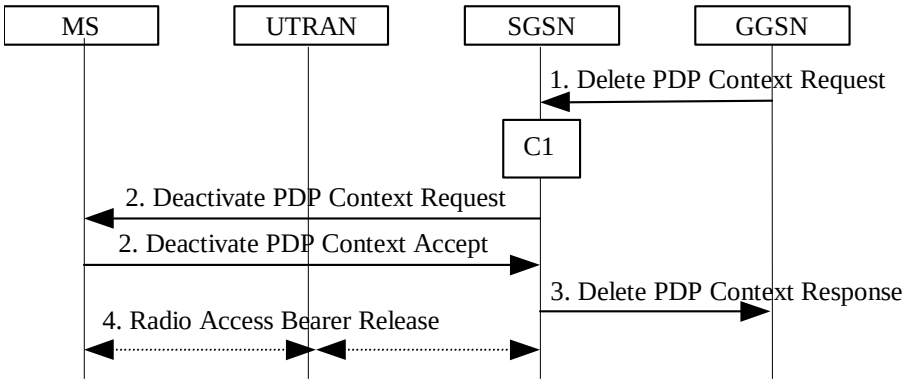

Figure 34: GGSN-initiated PDP Context Deactivation Procedure

1) The GGSN sends a Delete PDP Context Request (TEID, NSAPI, Teardown Ind) message to the SGSN. Teardown Ind indicates whether or not all PDP contexts associated with this PDP address shall be deactivated.

2) The SGSN sends a Deactivate PDP Context Request (TI, Teardown Ind) message to the MS. If Teardown Ind was included by the SGSN, then all PDP contexts associated with this PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, Teardown Ind) message to the SGSN. Teardown Ind is included if received from the SGSN.

3) The SGSN returns a Delete PDP Context Response (TEID) message to the GGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the MS before sending the Delete PDP Context Response message.

4) In Iu mode, radio access bearer release is done by the RAB Assignment procedure.

The CAMEL procedure call shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection.

The procedure returns as result "Continue".

9.2.5 Preservation Procedures

By sending a RAB Release Request or Iu Release Request message to the SGSN, UTRAN initiates the release of one or more RABs. The preservation procedure allows the active PDP contexts associated with the released RABs to be preserved without modification in the CN, and the RABs can then be re-established at a later stage.

UTRAN uses the Iu Release Request to request release of all RABs of an MS, and the RAB Release Request in other cases.

9.2.5.1 Release of RABs Triggered by UTRAN

9.2.5.1.1 RAB Release Procedure

UTRAN initiates a RAB release procedure to release one or several RABs. The RAB Release procedure is illustrated in Figure 35.

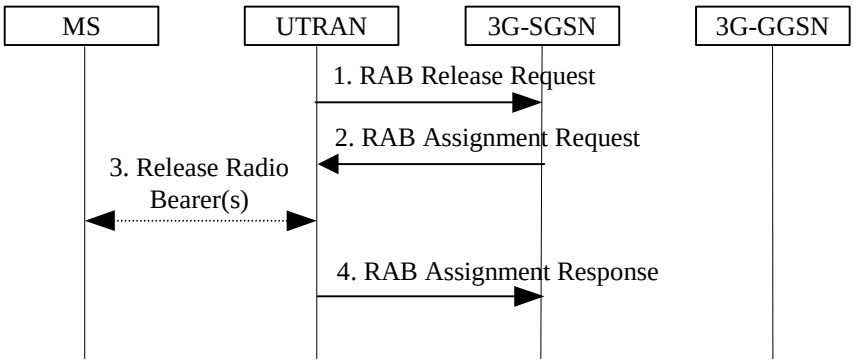

Figure 35: RAB Release Procedure

1) UTRAN initiates the procedure by sending a RAB Release Request (For each RAB to be released: RAB ID, Cause) message to the SGSN.

2) The SGSN sends a RAB Assignment Request (For each RAB to be released: RAB ID, Cause) to the UTRAN.

3) The Radio Bearer(s) are released if still existing.

4) UTRAN sends a RAB Assignment Response (For each released RAB: RAB ID, GTP SND, GTP SNU) to the SGSN. GTP SND and GTP SNU enable the SGSN to restore the values in case the PDP context is maintained and the RAB is re-established at a later stage.

9.2.5.1.2 Iu Release Procedure

UTRAN initiates an Iu release procedure to release all RABs of an MS and the Iu connection. The Iu Release procedure is illustrated in Figure 36.

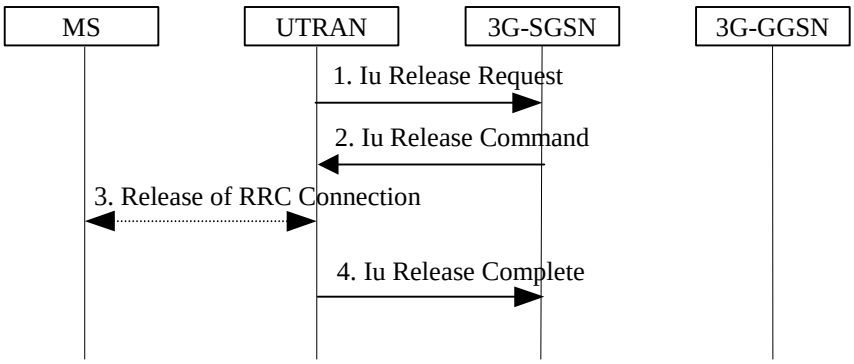

Figure 36: Iu Release Procedure

1) UTRAN sends an Iu Release Request (Cause) message to the SGSN.

2) The SGSN sends an Iu Release Command (Cause) message to the UTRAN.

3) The RRC connection is released if still existing.

4) UTRAN confirms the Iu release by sending an Iu Release Complete (For each released RAB: RAB ID, GTP SND, GTP SNU) message to the SGSN. GTP SND and GTP SNU enable the SGSN to restore the values in case the PDP context is maintained and the RAB is re-established at a later stage.

9.2.5.2 Re-establishment of RABs

The procedure for re-establishment of RABs allows the SGSN to re-establish RABs for active PDP contexts that don't have an associated RAB.

The MS initiates the re-establishment of RABs by using the Service Request (Service Type = Data) message. in the sub-clause "MS Initiated Service Request Procedure" describes this.

When RABs for an MS that has no RRC connection needs to be re-established, the CN must first page the MS. The clause "Network Initiated Service Request Procedure" describes this.

9.3 Packet Routeing and Transfer Function

The packet routeing and transfer function:

- routes and transfers packets between a mobile TE and a~~n external~~ packet data network, i.e. between reference point R and reference point Gi;
- routes and transfers packets between mobile TE and other GPRS PLMN, i.e. between reference point R and reference point Gi via interface Gp;
- routes and transfers packets between TEs, i.e. between the R reference point in different MSs; and
- optionally supports IP Multicast routeing of packets via a relay function in the GGSN.

The PDP PDUs shall be routed and transferred between the MS and the GGSN as N-PDUs. In case of PDP type PPP, the maximum size of each N-PDU shall be 1 502 octets. In other cases, the maximum size of each N-PDU shall be 1 500 octets. When the MS or the GGSN receives a PDP PDU that results in an N-PDU that is not larger than the maximum N-PDU size, the PDP PDU shall be routed and transferred as one N-PDU. When the MS or the GGSN receives a PDP PDU that results in an N-PDU that is larger than the maximum N-PDU size, the PDP PDU shall be segmented, discarded or rejected, depending on the PDP type and the implementation. The packet data protocol in the MS may limit the maximum size of the PDP PDUs that are routed and transferred, e.g. due to MS memory limitations.

Between the 2G-SGSN and the MS, PDP PDUs are transferred with SNDCP. Between the 3G-SGSN and the MS, PDP PDUs are transferred with GTP-U and PDCP.

Between the SGSN and the GGSN, PDP PDUs are routed and transferred with the UDP/IP protocols. The GPRS Tunnelling Protocol transfers data through tunnels. A tunnel endpoint identifier (TEID) and a GSN address identify a tunnel.

When multiple PDP contexts exist for the same PDP address of an MS, the GGSN routes downlink N-PDUs to the different GTP tunnels based on the TFTs assigned to the PDP contexts. Upon reception of a PDP PDU, the GGSN evaluates for a match, first the packet filter amongst all TFTs that has the smallest evaluation precedence index and, in case no match is found, proceeds with the evaluation of packet filters in increasing order of their evaluation precedence index. This procedure shall be executed until a match is found, in which case the N-PDU is tunnelled to the SGSN via the PDP context that is associated with the TFT of the matching packet filter. If no match is found, the N-PDU shall be sent via the PDP context that does not have a TFT assigned to it; if all PDP contexts have a TFT assigned, the GGSN shall silently discard the PDP PDU.

The MS is responsible for creating or modifying PDP contexts and their QoS. The MS should define TFTs in such a way that downlink PDP PDUs are routed to a PDP context that best matches the QoS requested by the receiver of this PDU (e.g. an application supporting QoS).

For each uplink PDP PDU, the MS should choose the PDP context that best matches the QoS requested by the sender of this PDP PDU (e.g. an application supporting QoS). Packet classification and routeing within the MS is an MS-local matter. The GGSN shall not match uplink N-PDUs against TFTs.

TFTs are used for PDP types IP and PPP only. For PDP type PPP a TFT is applicable only when PPP is terminated in the GGSN (i.e. GGSN does not provide PDN interworking by means of tunnelled PPP, e.g. by the Layer Two Tunnelling Protocol (L2TP)) and IP traffic is carried over PPP. To support roaming subscribers, and for forward compatibility, the SGSN is not required to know the tunnelled PDP. Every SGSN shall have the capability to transfer PDUs belonging to PDPs not supported in the PLMN of the SGSN.

The GGSN could also optionally support IP Multicast: this allows the MSs to join multicast groups and start receiving multicast packets. The GGSN duplicates the incoming multicast packets and relays them to the already active TEIDs. These TEIDs are those of MSs that have joined a multicast group.

9.4 Relay Function

The relay function of a network node transfers the PDP PDUs received from the incoming link to the appropriate outgoing link. At the RNC, the SGSN, and the GGSN the relay function stores all valid PDP PDUs until they are forwarded to the next network node or until the maximum holding time of the PDP PDUs is reached. The PDP PDUs are discarded when buffering is longer than their maximum holding time. This maximum holding time is implementation dependent and can be influenced by the PDP type, the QoS of the PDP PDU, the resource load status, and by buffer conditions. The discarding protects resources from useless transfer attempts, especially the radio resource. Impacts on user protocol operation by too short holding time shall be avoided.

In A/Gb mode, the SGSN and GGSN relay functions add sequence numbers to PDP PDUs received from SNDCP and from the Gi reference point, respectively. In Iu mode, the RNC and GGSN relay functions add sequence numbers to PDP PDUs received from PDCP and from the Gi reference point, respectively.

PDP PDUs may be re-sequenced in the RNC, the SGSN, and/or in the GGSN depending on the setting of the delivery order attribute in the QoS profile. In A/Gb mode, the SGSN relay function may perform re-sequencing of PDP PDUs before passing the PDP PDUs to SNDCP. In Iu mode, the SGSN relay function may optionally perform re-sequencing of PDP PDUs before passing the PDP PDUs to Iu GTP-U and before passing the PDP PDUs to Gn GTP-U. The GGSN relay function may perform re-sequencing of PDP PDUs before passing the PDP PDUs to the Gi reference point. The RNC may perform re-sequencing of PDP PDUs before passing the PDP PDUs to PDCP.

9.5 Packet Terminal Adaptation Function

The Packet Terminal Adaptation function adapts packets received from and transmitted to the Terminal Equipment to a form suitable for transmission within the PLMN.

A range of MT versions providing different standard interfaces towards the TE can be used, e.g.:

- MT with asynchronous serial interface and PAD (Packet Assembly / Disassembly) support. In the case when the PAD function does not exist in the MT, it exists in the TE.
- "Embedded MT" integrated with the TE, possibly via an industry-standard application program interface.
- MT with synchronous serial interface.

9.6 Encapsulation Function

GPRS~~The packet domain~~ transparently transports PDP PDUs between ~~external~~ packet data networks and MSs. All PDP PDUs are encapsulated and decapsulated for routeing purposes. Encapsulation functionality exists at the MS, at the RNC, at the SGSN, and at the GGSN. Encapsulation allows PDP PDUs to be delivered to and associated with the correct PDP context in the MS, the SGSN, or the GGSN. Two different encapsulation schemes are used; one for the backbone network between two GSNs and between an SGSN and an RNC, and one for the GSM connection between the SGSN and the MS or for the UMTS RRC connection between the RNC and the MS.

Encapsulation requires that the MS is attached to GPRS, and that the PDP Context Activation procedure has been executed. If the GPRS Attach or PDP Context Activation procedures cannot be successfully executed, then uplink PDP PDUs are discarded in the MS. If these procedures have not been executed when a downlink PDP PDU arrives in the GGSN, then the downlink PDP PDU shall be discarded, rejected, or the Network-Requested PDP Context Activation procedure shall be initiated.

9.6.1 Encapsulation Between GSNs

The GPRS packet domain PLMN backbone network encapsulates a PDP PDU with a GPRS Tunnelling Protocol header, and inserts this GTP PDU in a UDP PDU that again is inserted in an IP PDU. The IP and GTP PDU headers contain the GSN addresses and tunnel endpoint identifier necessary to uniquely address a GSN PDP context.

10 Message Screening Functionality

This screening mechanism may be performed by routers and firewalls, and performs the selection of which packets to allow and which to deny.

Only network-controlled message screening shall be supported. Network-controlled screening is used to protect the GPRS packet domain PLMN from known security problems, and the screening provided by a certain PLMN is applied independently of the MS user. Network-controlled screening is outside the scope of this specification.

12.7 Iu Interface (UMTS only)

The Iu interface connects the UTRAN or GERAN and the Core Network ~~packet domains~~. allowing the exchange of signalling information and user data. The user plane of the Iu interface shall allow user data from many users to be multiplexed over the same physical resource. Resources are given to a user upon activity (when data is sent or received) and are reallocated immediately thereafter.

In UMTS only user data is transmitted on this shared physical medium. Signalling data is transferred via an SCCP connection. A reference configuration for the Iu interface user plane is given in **Error! Reference source not found.**.

13 Information Storage

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

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~~GPRS subscription data per IMSI. This is illustrated in Figure 37.

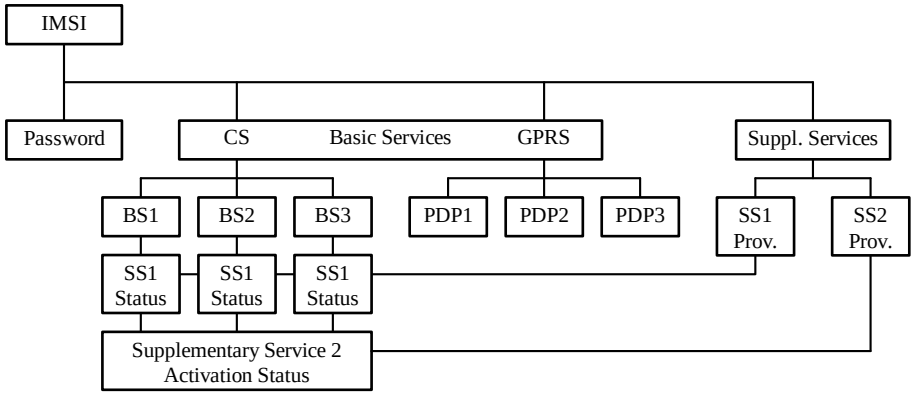

Figure 37: ~~Packet Domain~~ Subscription Data

As Figure 37 indicates, the ~~packet domain~~GPRS 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 5 shows the ~~packet domain~~GPRS subscription data contained in the HLR.

Table 2: HLR ~~Packet Domain~~GPRS Subscription Data

Field	Description	GSM	UMTS
IMSI	IMSI is the main reference key.	X	X
MSISDN	The basic MSISDN of the MS.	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
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g. normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace, e.g. MSC/BSS trace, HLR trace, and/or SGSN/GGSN/BSS trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g. operator-determined barring.	X	X
MS PS Purged for GPRS	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 clauses "MAP-based GGSN - HLR Signalling" and "GTP and MAP-based GGSN - HLR Signalling".	X	X
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3GPP TS 23.016	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. PPP or IP.	X	X
PDP Address	PDP address, e.g., an IP 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. . QoS Profile Subscribed is also the maximum QoS per PDP context to the associated APN.	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
PDP context Charging Characteristics	The charging characteristics of this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	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 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA des not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

NOTE: 2G-SGSN and 3G-SGSN refer to R99 SGSNs with either GSM or UMTS access.

Table 3: SGSN MM and PDP Contexts

Field	Description	GSM	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
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
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	X
Kc	Currently used ciphering key.	X	X
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm (GEA).	X	X
CK	Currently used ciphering key.	X	X
IK	Currently used integrity key.	X	X
KSI	Key Set Identifier.		X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	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
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g. normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	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	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3GPP TS 23.016	X	X
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	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. PPP or IP.	X	X
PDP Address	PDP address, e.g. an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used. This APN shall be composed of the APNNetwork Identifier and the APN Operator Identifier.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		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
Radio Priority	The RLC/MAC radio priority level for uplink user data	X	

Field	Description	GSM	UMTS
	transmission.		
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

13.3 GGSN

GGSN maintains activated PDP contexts. Table 7 shows the PDP context fields for one PDP Address.

Table 4: GGSN PDP Context

Field	Description	GSM	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. PPP or IP.	X	X
PDP Address	PDP address; e.g. an IP 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
TEID	Tunnel Endpoint Identifier.	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
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the SGSN.	X	X
GTP-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 for this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	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.

13.4 MS

Each MS supporting GPRS ~~packet domain MS~~ maintains MM and PDP context information in IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, and PMM-CONNECTED states. The information may be contained in the MS and the TE. Table 8 shows the MS context fields.

Table 5: MS MM and PDP Contexts

Field	SIM	Description	GSM	UMTS
IMSI	G, U	International Mobile Subscriber Identity.	X	X
MM State		Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	G, U	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	G, U	A signature used for identification checking purposes.	X	X
Routeing Area	G, U	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	G	Current GPRS ciphering key.	X	
CKSN / KSI	G, U	Key Set Identifier for IK Next, CK Next, and Kc.	X	X
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK		Currently used ciphering key.		X
CK Next	U	UMTS ciphering key to be used after the next security mode command.		X
IK		Currently used integrity key.		X
IK Next	U	Integrity key to be used after the next security mode command.		X
MS Radio Access Capability		MS radio access capabilities.	X	X
UE Capability		UE radio capabilities.		X
MS Network Capability		MS network capabilities.	X	X
DRX Parameters		Discontinuous reception parameters.	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 Type		PDP type, e.g. PPP or IP.	X	X
PDP Address		PDP address; e.g. an IP address.	X	X
PDP State		Packet data protocol state, INACTIVE or ACTIVE.	X	X
Dynamic Address Allowed		Specifies whether the MS is allowed to use a dynamic address.	X	X
APN Requested		The APN requested.	X	X
NSAPI		Network layer Service Access Point Identifier.	X	X
TI		Transaction Identifier.	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		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 uplink N-PDU to be sent to the SGSN.	X	X
Receive N-PDU Number		SNDCP sequence number of the next downlink N-PDU expected from the SGSN.	X	X
PDCP-SND		Sequence number of the next downlink in-sequence PDCP-PDU expected from the RNC.		X
PDCP-SNU		Sequence number of the next uplink in-sequence PDCP-PDU to be sent to the RNC.		X

The information marked with a "U" in table 8 shall be stored in the USIM.

The information marked with a "G" in table 8:

- shall be stored in the GSIM if the connected SIM is GPRS-aware; and
- may be stored in the ME after GPRS detach if the connected GSIM is not GPRS-aware.

If the GSIM is ~~packet domain~~GPRS service-aware, then the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the GSIM shall be used for ~~packet domain~~GPRS services.

If the GSIM is not ~~packet domain~~GPRS service-aware, the P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the ME shall be used if and only if the IMSI stored in the GSIM is identical to the IMSI image maintained in the ME. If the IMSI stored in the GSIM is different from the IMSI image in the ME, the IMSI image in the ME shall not be used, and the MS shall identify itself with the IMSI stored in the SIM when performing a GPRS attach. IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN may be stored in the ME after the GPRS attach has been successfully performed.

When using a USIM, the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK Next, IK Next, and CKSN / KSI stored in the USIM, and the CK and IK stored in the ME, shall be used for ~~packet domain~~GPRS services.

14.13 Access Point Name

In the backbone, Access Point Name is a reference to the GGSN to be used. In addition, Access Point Name may, in the GGSN, identify the ~~external~~ packet data network and optionally a service to be offered. Access Point Name is composed of two parts as defined in 3GPP TS 23.003:

- The APN Network Identifier is mandatory and is a label (for example "corporation" or "service") or a set of labels separated by dots, which is a fully qualified domain name according to the DNS naming conventions (for example "company.com" or "service.company.com"). In order to guarantee the uniqueness of the APN, the packet-domain PLMN should allocate, to an ISP or corporation, an APN Network Identifier identical to their domain name in the public Internet. The APN Network Identifier shall not end with ".gprs". An APN Network Identifier that consists of 3 or more labels and that starts with a Reserved Service Label, or an APN Network Identifier that consists of a Reserved Service Label alone, shall indicate that for this APN the GGSN supports additional services such as external PDN address allocation or Mobile IP support. Reserved Service Labels, e.g. "dhcp" or "MIPv4FA", and the corresponding services that they stand for, e.g. external PDN address allocation via DHCP, or Mobile IP Foreign Agent support, are to be agreed upon among operators.

- The APN Operator Identifier is optional. It is a fully qualified domain name according to the DNS naming conventions, and consists of three labels. The APN Operator Identifier shall end in ".gprs". For example, it may be "MNCyyyy.MCCzzzz.gprs". The exact format is defined in 3GPP TS 29.060.

The APN stored in the HLR shall not contain the APN Operator Identifier. A wild card may be stored in the HLR instead of the APN. This wild card indicates that the user may select an APN that is not stored in the HLR. The use of the wild card is described in Annex A.

15 Operational Aspects

15.1 Charging

GPRS ~~C~~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 information shall be collected in the SGSN and the GGSN on an individual MS and/or PDP context basis by appropriately setting the Subscribed Charging Characteristics and/or PDP context Charging Characteristics in the HLR. The charging characteristics on the GPRS subscription and individually subscribed APNs are specified in 3GPP TS 32.215 [70].

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~~GPRS operator collects and processes his own charging information.

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

Charging may be also realised by a CAMEL server using CAMEL interaction procedures, see referenced procedures in 3GPP TS 23.078.

15.1.1 Charging Information

Charging information is collected for the GPRS subscriber.

As a minimum, the SGSN shall collect the following charging information for MSs and/or individual PDP contexts that are subject to 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~~GPRS resources: the charging information shall describe the usage of other ~~packet domain~~GPRS-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 and/or individual PDP contexts that are subject to 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~~GPRS operator;
- usage of the ~~external~~ packet data networks: the charging information shall describe the amount of data sent and received to and from the ~~external~~ packet data network; and
- usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the PDP addresses.

The RNC shall collect the following charging information for an MS's RABs when instructed by the 3G-SGSN:

- amount of not transferred downlink data, i.e. data that the RNC has either discarded or forwarded to a 2G-SGSN. Partially transferred packets shall be handled as not transferred. The collected charging information shall be sent by the RNC to the 3G-SGSN when a RAB is released, or when explicitly requested by the 3G-SGSN. The 3G-SGSN shall indicate at RAB setup whether data volume collection and reporting for the particular RAB is required or not.

15.1.2 Reverse Charging

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

15.2 Quality of Service Profile

A QoS profile is associated with each PDP context. The QoS profile is considered to be a single parameter with multiple data transfer attributes. The definition of the QoS attributes for GPRS~~the packet domain~~ can be found in 3GPP TS 23.107, which also defines the mapping between the release 99~~packet domain~~ QoS attributes and the QoS attributes for GPRS releases 97 and 98.

At any given time, there should be a maximum of one PDP context, for a particular PDP address, that is not associated with a TFT.

During the QoS profile negotiation defined in clause "Activation Procedures", it shall be possible for the MS to request a value for each of the QoS attributes, including the HLR-stored subscribed default values. When the MS requests a

QoS, the HLR-stored subscribed default values shall be interpreted as the maximum QoS per PDP context to the associated APN.

The network shall negotiate each attribute to a level that is in accordance with the available GPRS resources. The network shall always attempt to provide adequate resources to support the negotiated QoS profiles.

15.3.3 Example Usage of Packet Filters

Based on the type of traffic or the ~~external~~packet data~~-~~ network QoS capabilities, different types of packet filters can be used to classify a given PDP PDU in order to determine the right PDP context. Some examples are given below.

16.3 Supplementary Services

No supplementary services are defined for GPRS~~the packet domain~~. Supplementary services may be available in the~~when~~ interworked packet data~~-with~~ networks, but this is outside the scope of this specification.

3GPP TSG-SA WG2 #23
Sophia Antipolis, France. 18 – 22 February 2002

Tdoc *S2-020836~~714~~*
rev of Tdoc S2-020609

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **329** ⌘ rev **2~~1~~** ⌘ Current version: **3.10.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Clarification to the interactions between GTPv0 and GTPv1
Source:	⌘	Nokia
Work item code:	⌘	GPRS
Date:	⌘	2~~1~~9.02.2002
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(essential 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)*

Reason for change: ⌘

The sub section 11.1.1, "Interactions Between GTP v0 (R97) and GTP v1 (R99)" defines the inter SGSN RAU cases, when the following conditions are simultaneously met:

- At lease one of the GSNs involved support only GTPv0, and not GTPv1;
- At lease one of the GSNs involved support both GTPv0 and GTPv1.

Obviously only four possible cases could be identified:

1. New SGSN support only GTPv0. Old SGSN and GGSN support both;
2. Old SGSN support only GTPv0; New SGSN and GGSN support both;
3. Old SGSN and GGSN support only GTPv0; New SGSN supports both;
4. GGSN support only GTPv0; Both new and old SGSNs support GTPv0/1.

First tree cases are unambiguously defined in the sub section. However, the following paragraph is rather ambiguous:

> "In case of an SGSN change between an SGSN that supports GTP v1 with a GTP v0 tunnel between the old SGSN and the GGSN, the respective uplink Flow Label signalling shall be inserted in the two lower octets of the TEID field; the upper two octets shall be set to all zeros."

Apparently, the paragraph refers to the fourth case, when both SGSNs support GTPv0 and GTPv1 but GGSN supports only GTPv0.

The CR proposes the required clarifications to the matter. In addition, it also offers an explicit definition on which TEID field should be used in which message.

Summary of change: ⌘ Clarifying the case where and inter SGSN changes takes place between two R99+ SGSNs and a R97/98 GGSN.

Consequences if not approved:	⌘	Specification text has unclear meaning

Clauses affected:	⌘	11.1.1		
Other specs affected:	⌘	Other core specifications Test specifications O&M Specifications	⌘	
Other comments:	⌘			

11.1.1 Interactions Between GTP v0 (R97) and GTP v1 (R99)

When a first GSN receives a GTP PDU from a second GSN using a version not supported, then the first GSN shall return a "version not supported" error message to the second GSN. The second GSN shall then fall back to the most-recent version supported by the first GSN. A GSN shall use its most-recent GTP version when initiating GTP PDU transmission to a new GSN.

When an SGSN that supports GTP v1 establishes a GTP tunnel to a GGSN that supports GTP v0, the SGSN shall convert a release 99 QoS profile to a release 97 QoS profile before transmitting the QoS profile to the GGSN. If the MS supports the R99 QoS profile, the SGSN shall convert the negotiated R97 QoS profile to an R99 QoS profile before transmitting the QoS profile to the MS.

A GGSN shall be able to fall back to GTP v0 during an Update PDP Context procedure. That is, the GGSN shall accept an Update PDP Context Request of GTP v0 even if the established GTP tunnel is of GTP v1.

When an inter-SGSN RA update procedure is performed from a first SGSN that supports GTP v1 to a second SGSN that supports GTP v0, the first SGSN shall convert the R99 QoS profile to an R97 QoS profile before sending the SGSN Context Response message. Furthermore, it fills the Uplink Flow Label Signalling field in the PDP Context information element of the SGSN Context Response message with the lower two octets of the Uplink TEID Control Plane. If several PDP contexts have been activated for the same APN and PDP address in the first SGSN (secondary PDP context activation), then all PDP contexts except the PDP context with the highest-quality QoS profile are deleted in the MS and in the first SGSN, and the first SGSN shall initiate deletion of these PDP contexts in the GGSN.

MS detects that the new SGSN is supporting only GTPv0 from the Release Indication broadcasted on the GSM radio.

3G TS 23.107 [58] specifies how to determine the highest-quality QoS profile. The second SGSN shall be responsible for updating the remaining PDP context in the GGSN, and the GGSN shall remove the TFT if present when it receives the GTP v0 Update PDP Context Request message.

NOTE: The conversion between an R99 QoS profile and an R97 QoS profile is defined in 3G TS 23.107.

When an inter-SGSN RA update procedure is performed from a first SGSN that supports GTP v0 to a second SGSN that supports GTP v1, the second SGSN shall convert the R97 QoS profile to the R99 QoS profile, ignore the delivered Uplink Flow Label Signalling and use GTP v1 to send the Update PDP Context Request message to the GGSN. The Update PDP Context Request message shall be sent with a header containing a TEID set to all zeros and with an additional IE containing the IMSI for the PDP context.

A GGSN shall be able to change to GTP v1 during an Update PDP Context procedure. That is, the GGSN shall accept an Update PDP Context Request of GTP v1 with a TEID set to all zeros and containing the IMSI in addition to the NSAPI, even if the established GTP tunnel is of GTP v0.

When ~~In case of an SGSN change between an SGSN that supports GTP v1 with~~ a GTP v0 tunnel was established between the old SGSN and the GGSN, and both old and new SGSNs support GTPv1, the respective uplink Flow Label signalling shall be inserted in the two lower octets of the Uplink TEID Control Plane field of the SGSN Context Response message; the upper two octets shall be set to all zeros.

3GPP TSG-SA WG2 #23
Sophia Antipolis, France. 18 – 22 February 2002

Tdoc *S2-020837~~715~~*
rev of Tdoc S2-020610

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **330** ⌘ rev **2~~1~~** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Clarification to the interactions between GTPv0 and GTPv1
Source:	⌘	Nokia
Work item code:	⌘	TEI4
Date:	⌘	2~~1~~9.02.2002
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
F *(essential 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)*

Reason for change: ⌘ The sub section 11.1.1, "Interactions Between GTP v0 (R97) and GTP v1 (R99)" defines the inter SGSN RAU cases, when the following conditions are simultaneously met:

- At lease one of the GSNs involved support only GTPv0, and not GTPv1;
- At lease one of the GSNs involved support both GTPv0 and GTPv1.

Obviously only four possible cases could be identified:

1. New SGSN support only GTPv0. Old SGSN and GGSN support both;
2. Old SGSN support only GTPv0; New SGSN and GGSN support both;
3. Old SGSN and GGSN support only GTPv0; New SGSN supports both;
4. GGSN support only GTPv0; Both new and old SGSNs support GTPv0/1.

First tree cases are unambiguously defined in the sub section. However, the following paragraph is rather ambiguous:

> "In case of an SGSN change between an SGSN that supports GTP v1 with a GTP v0 tunnel between the old SGSN and the GGSN, the respective uplink Flow Label signalling shall be inserted in the two lower octets of the TEID field; the upper two octets shall be set to all zeros."

Apparently, the paragraph refers to the fourth case, when both SGSNs support GTPv0 and GTPv1 but GGSN supports only GTPv0.

The CR proposes the required clarifications to the matter. In addition, it also offers an explicit definition on which TEID field should be used in which message.

Summary of change: ⌘ Clarifying the case where and inter SGSN changes takes place between two R99+ SGSNs and a R97/98 GGSN.

Consequences if not approved:	⌘	Specification text has unclear meaning

Clauses affected:	⌘	11.1.1		
Other specs affected:	⌘	Other core specifications Test specifications O&M Specifications	⌘	
Other comments:	⌘			

11.1.1 Interactions Between GTP v0 (R97) and GTP v1 (R99)

When a first GSN receives a GTP PDU from a second GSN using a version not supported, then the first GSN shall return a "version not supported" error message to the second GSN. The second GSN shall then fall back to the most-recent version supported by the first GSN. A GSN shall use its most-recent GTP version when initiating GTP PDU transmission to a new GSN.

When an SGSN that supports GTP v1 establishes a GTP tunnel to a GGSN that supports GTP v0, the SGSN shall convert a release 99 QoS profile to a release 97 QoS profile before transmitting the QoS profile to the GGSN. If the MS supports the R99 QoS profile, the SGSN shall convert the negotiated R97 QoS profile to an R99 QoS profile before transmitting the QoS profile to the MS.

A GGSN shall be able to fall back to GTP v0 during an Update PDP Context procedure. That is, the GGSN shall accept an Update PDP Context Request of GTP v0 even if the established GTP tunnel is of GTP v1.

When an inter-SGSN RA update procedure is performed from a first SGSN that supports GTP v1 to a second SGSN that supports GTP v0, the first SGSN shall convert the R99 QoS profile to an R97 QoS profile before sending the SGSN Context Response message. Furthermore, it fills the Uplink Flow Label Signalling field in the PDP Context information element of the SGSN Context Response message with the lower two octets of the Uplink TEID Control Plane. If several PDP contexts have been activated for the same APN and PDP address in the first SGSN (secondary PDP context activation), then all PDP contexts except the PDP context with the highest-quality QoS profile are deleted in the MS and in the first SGSN, and the first SGSN shall initiate deletion of these PDP contexts in the GGSN.

The MS detects that the new SGSN is supporting only GTPv0 from the Release Indication broadcasted on the GSM radio.

3GPP TS 23.107 [58] specifies how to determine the highest-quality QoS profile. The second SGSN shall be responsible for updating the remaining PDP context in the GGSN, and the GGSN shall remove the TFT if present when it receives the GTP v0 Update PDP Context Request message.

NOTE: The conversion between an R99 QoS profile and an R97 QoS profile is defined in 3GPP TS 23.107.

When an inter-SGSN RA update procedure is performed from a first SGSN that supports GTP v0 to a second SGSN that supports GTP v1, the second SGSN shall convert the R97 QoS profile to the R99 QoS profile, ignore the delivered Uplink Flow Label Signalling and use GTP v1 to send the Update PDP Context Request message to the GGSN. The Update PDP Context Request message shall be sent with a header containing a TEID set to all zeros and with an additional IE containing the IMSI for the PDP context.

A GGSN shall be able to change to GTP v1 during an Update PDP Context procedure. That is, the GGSN shall accept an Update PDP Context Request of GTP v1 with a TEID set to all zeros and containing the IMSI in addition to the NSAPI, even if the established GTP tunnel is of GTP v0.

When ~~In case of an SGSN change between an SGSN that supports GTP v1 with~~ a GTP v0 tunnel was established between the old SGSN and the GGSN, and both old and new SGSNs support GTPv1, the respective uplink Flow Label signalling shall be inserted in the two lower octets of the Uplink TEID Control Plane field of the SGSN Context Response message; the upper two octets shall be set to all zeros.

3GPP TSG-SA WG2 #23
Sophia Antipolis, France. 18 – 22 February 2002

Tdoc *S2-020838~~716~~*
rev of Tdoc S2-020611

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **331** ⌘ rev **2~~1~~** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Clarification to the interactions between GTPv0 and GTPv1
Source:	⌘	Nokia
Work item code:	⌘	TEI5
Date:	⌘	2~~1~~9.02.2002
Category:	⌘	**A**
Release:	⌘	REL-5

Use one of the following categories:
F *(essential 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)*

Reason for change: ⌘ The sub section 11.1.1, "Interactions Between GTP v0 (R97) and GTP v1 (R99)" defines the inter SGSN RAU cases, when the following conditions are simultaneously met:

- At lease one of the GSNs involved support only GTPv0, and not GTPv1;
- At lease one of the GSNs involved support both GTPv0 and GTPv1.

Obviously only four possible cases could be identified:

1. New SGSN support only GTPv0. Old SGSN and GGSN support both;
2. Old SGSN support only GTPv0; New SGSN and GGSN support both;
3. Old SGSN and GGSN support only GTPv0; New SGSN supports both;
4. GGSN support only GTPv0; Both new and old SGSNs support GTPv0/1.

First tree cases are unambiguously defined in the sub section. However, the following paragraph is rather ambiguous:

> "In case of an SGSN change between an SGSN that supports GTP v1 with a GTP v0 tunnel between the old SGSN and the GGSN, the respective uplink Flow Label signalling shall be inserted in the two lower octets of the TEID field; the upper two octets shall be set to all zeros."

Apparently, the paragraph refers to the fourth case, when both SGSNs support GTPv0 and GTPv1 but GGSN supports only GTPv0.

The CR proposes the required clarifications to the matter. In addition, it also offers an explicit definition on which TEID field should be used in which message.

Summary of change: ⌘ Clarifying the case where and inter SGSN changes takes place between two R99+ SGSNs and a R97/98 GGSN.

Consequences if not approved:	⌘	Specification text has unclear meaning

Clauses affected:	⌘	11.1.1		
Other specs affected:	⌘	Other core specifications Test specifications O&M Specifications	⌘	
Other comments:	⌘			

11.1.1 Interactions Between GTP v0 (R97) and GTP v1 (R99)

When a first GSN receives a GTP PDU from a second GSN using a version not supported, then the first GSN shall return a "version not supported" error message to the second GSN. The second GSN shall then fall back to the most-recent version supported by the first GSN. A GSN shall use its most-recent GTP version when initiating GTP PDU transmission to a new GSN.

When an SGSN that supports GTP v1 establishes a GTP tunnel to a GGSN that supports GTP v0, the SGSN shall convert a release 99 QoS profile to a release 97 QoS profile before transmitting the QoS profile to the GGSN. If the MS supports the R99 QoS profile, the SGSN shall convert the negotiated R97 QoS profile to an R99 QoS profile before transmitting the QoS profile to the MS.

A GGSN shall be able to fall back to GTP v0 during an Update PDP Context procedure. That is, the GGSN shall accept an Update PDP Context Request of GTP v0 even if the established GTP tunnel is of GTP v1.

When an inter-SGSN RA update procedure is performed from a first SGSN that supports GTP v1 to a second SGSN that supports GTP v0, the first SGSN shall convert the R99 QoS profile to an R97 QoS profile before sending the SGSN Context Response message. Furthermore, it fills the Uplink Flow Label Signalling field in the PDP Context information element of the SGSN Context Response message with the lower two octets of the Uplink TEID Control Plane. If several PDP contexts have been activated for the same APN and PDP address in the first SGSN (secondary PDP context activation), then all PDP contexts except the PDP context with the highest-quality QoS profile are deleted in the MS and in the first SGSN, and the first SGSN shall initiate deletion of these PDP contexts in the GGSN.

The MS detects that the new SGSN is supporting only GTPv0 from the Release Indication broadcasted on the GSM radio.

3GPP TS 23.107 [58] specifies how to determine the highest-quality QoS profile. The second SGSN shall be responsible for updating the remaining PDP context in the GGSN, and the GGSN shall remove the TFT if present when it receives the GTP v0 Update PDP Context Request message.

NOTE: The conversion between an R99 QoS profile and an R97 QoS profile is defined in 3GPP TS 23.107.

When an inter-SGSN RA update procedure is performed from a first SGSN that supports GTP v0 to a second SGSN that supports GTP v1, the second SGSN shall convert the R97 QoS profile to the R99 QoS profile, ignore the delivered Uplink Flow Label Signalling and use GTP v1 to send the Update PDP Context Request message to the GGSN. The Update PDP Context Request message shall be sent with a header containing a TEID set to all zeros and with an additional IE containing the IMSI for the PDP context.

A GGSN shall be able to change to GTP v1 during an Update PDP Context procedure. That is, the GGSN shall accept an Update PDP Context Request of GTP v1 with a TEID set to all zeros and containing the IMSI in addition to the NSAPI, even if the established GTP tunnel is of GTP v0.

When ~~In case of an SGSN change between an SGSN that supports GTP v1 with~~ a GTP v0 tunnel was established between the old SGSN and the GGSN, and both old and new SGSNs support GTPv1, the respective uplink Flow Label signalling shall be inserted in the two lower octets of the Uplink TEID Control Plane field of the SGSN Context Response message; the upper two octets shall be set to all zeros.

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France,18-22 Feb. 2002

Tdoc S2-020882rev21
rev of S2-020567

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **318** Rev⌘ **1** ⌘ Current version: **4.3.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Restoration of R'96 Any Time Interrogation functionality
Source:	⌘	Vodafone
Work item code:	⌘	TEI
Date:	⌘	~~22 February~~6 March 2002
Category:	⌘	**A**
Release:	⌘	REL-4

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)

Reason for change: ⌘

In R'96, R'97 and R'98 it is possible to build many services based on the mobile's cell identity. This is either the cell where the mobile currently is, or, the cell where the mobile was last known to be. In the latter case, accurate information is supplied on "how long it has been since the mobile was last in contact with the network".

In R'99, the accuracy of the 'age of location' information has been lost in the case where the mobile is out of coverage but has an RRC connection to the SGSN, eg the mobile is in the URA_PCH state. Note that the periodic URA update timer (T305) can take values from the set {5, 10, 30, 60, 120, 360, 720 or infinity} minutes, so this 'loss of coverage while an RRC connection is active' is a real possibility.

Further information and example message flows are given in the document inserted into the 'other comments' field below. But it can be summarised as follows:

An Any Time Interrogate command can be sent from a CAMEL platform to an HLR in order to obtain the mobile's last known location. This triggers a Provide Subscriber information message to the MSC which, if the Gs interface is in use, triggers an MS Information Request message to the SGSN. If the mobile has an Iu interface connection to the SGSN, then a Location Report Control message is sent to the RNC. If the mobile is in URA-PCH state but is out of coverage, then the RNC should return its most accurate location information to the SGSN. This would be the last known cell ID (mapped one to one to a Service Area ID). Currently the Iu interface Location Report message cannot carry any 'age of location information' and so the SGSN will (because it has an active Iu connection for that mobile) assume that the mobile is currently in coverage in that cell and insert "age=zero" information onto the Gs interface. This "age=zero" information will be incorrectly transported all the way back to the application.

This behaviour is incorrect and this CR attempts to correct the stage 2 description.

This CR is one of a set of CRs that aims to restore the R'96 capability to the R'99

		system.
Summary of change:	⌘	When the LOCATION REPORT message is sent as an aswer to a request for ~~direct~~ report of current Service Area and the current Service Area of the mobile cannot be determined by the RNC ~~cannot determine the current Cell Id of the mobile~~, the RNC ~~shall~~ may report last known Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area~~cell~~.
Consequences if not approved:	⌘	Services based on Cell ID/SAI will randomly and unpredictably fail by indicating that the 'mobile is active in a specific cell' while, in reality, the mobile might have been switched off while out of coverage (or had the battery removed) hours ago in that cell. Note that this might be particularly problematic for law enforcement functions. For other services, note that changes in configuration of the VPLMN (eg URA timer, installation of Gs interface) could unpredictably alter the perfomance of HPLMN functions.

Clauses affected:	⌘	6.3.6, 12.7.5 and 13.7		
Other specs Affected:	⌘	X Other core specifications Test specifications O&M Specifications	⌘	25.413
Other comments:	⌘	For release '4, 29.002 and 23.271 may also need to be modified to describe the interworking between the Iu interface and the MAP interface to the GMLC. The related document S2-020252 is attached below.  S2-020252.zip		

6.3.6 MS Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MS Information procedure via the SGSN. If the information requested by the VLR in the MS Information procedure is known by the SGSN, then the SGSN shall return this information to the VLR without interrogating the MS.

If the information requested is MS identity information (e.g. IMEI) that is not known by the SGSN but is known by the MS, then the SGSN shall interrogate the MS in a similar manner to that described in clause "Identity Check Procedures".

In A/Gb mode, if the information requested is MS location information, then this indicates a request for Cell Global Identity and Cell Identity Age. In Iu mode, if the information requested is MS location information, then this indicates a request for Service Area Identity and Service Area Identity~~Code~~ Age, and in this case if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure (see clause "Location Reporting Procedure") in order to ~~derive~~retrieve the Service Area Identity ~~and Service Area Identity Age information~~.

The MS Information procedure is illustrated in Figure 20. Procedure steps are explained in the following list.

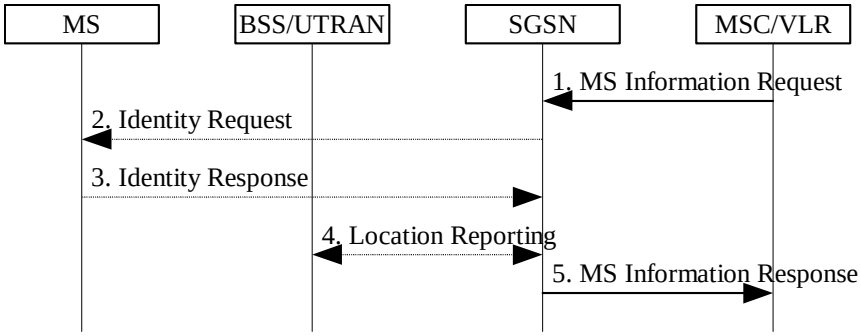

Figure 20: MS Information Procedure

1) The MSC/VLR sends an MS Information Request (IMSI, Information Type) message to the SGSN. Information Type indicates the information that the MSC/VLR is requesting for that IMSI.

2) If the information requested is not known by the SGSN but should be known by the MS, then the SGSN interrogates the MS in a similar manner to that described in the subclause "Identity Check Procedures". The SGSN sends an Identity Request (Identity Type) message to the MS.

3) The MS responds with an Identity Response (Mobile Identity) message to the SGSN.

4) In Iu mode, if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure to retrieve the ~~current or last known~~ Service Area Identity. If UTRAN node cannot determine current Service Area of the mobile, it may report last known Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area~~cell~~. ~~and the Service Area Identity Age~~.

5) The SGSN sends an MS Information Response (IMSI, Information) message to the MSC/VLR. Information contains the information requested by the MSC/VLR.

12.7.5 Location Reporting Procedure

This procedure is used by a 3G-SGSN to request the SRNC to report ~~directly~~ where the MS is currently located, or to report when the MS moves into or out of a given service area. This procedure relates to location services (LCS) and other services (e.g. CAMEL and emergency calls) in Iu mode. The overall LCS procedure is to be described in the LCS stage-2 specification, see 3GPP TS 23.171.

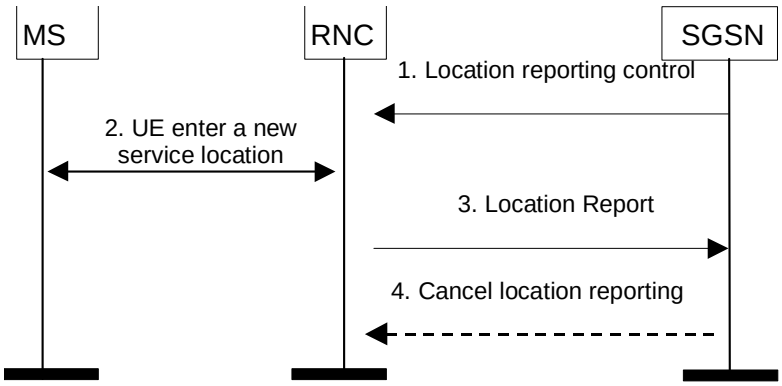

Figure 91: Location Reporting Procedure

1) The SGSN detects from the subscriber data the need to monitor in which service area an MS in the PMM-CONNECTED state with an Iu interface connection is located. The SGSN sends a Location Reporting Control (Service Area Code(s), Reporting Type) message to the SRNC. The SRNC stores the Service Area Code(s) as reporting area(s) for this MS. For example, a service area may be a location area with restricted access. Reporting Type indicates whether the message is intended to start a reporting period or trigger a stand-alone report about the current location of the MS.

2) The SRNC detects that the MS moves into or out of a reporting area. Alternatively, the SRNC derives the ~~current or last known~~ location of the MS if this was requested by the SGSN.

3) The SRNC sends a Location Report (location information~~, location information age~~~~Service Area Code~~) message informing the 3G-SGSN about where the MS is ~~now (or was)~~ located. If no Service Area Code is included, it indicates that the MS is outside the requested service area. When the SGSN has requested ~~direct report of~~ the ~~current~~ location of the MS, the SRNC shall include the requested location information in the Location Report message, e.g. in the format of a cell id, if the SRNC cannot determine current Service Area of the mobile, it may report last known Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area~~cell~~. The SGSN may then perform specific actions (e.g. detach an MS entering a forbidden location area or route an emergency call to the nearest local emergency number).

4) The SGSN can send a Cancel Location Reporting message to inform the SRNC that it should terminate location reporting for a given MS. This message is needed only when the reporting was requested for a reporting period.

The procedure is implicitly cancelled at SRNC relocation. If the service is still required in the new SRNC or new SGSN, a new Location Reporting Control message shall be sent.

13.7 RNC for UMTS

RNC maintains RNC Context for CN-related information in PMM-CONNECTED state. RNC also contains RNC RAB contexts for activated RABs. Table 11 shows the context fields for one MS.

Table 11: RNC Context

Field	Description
IMSI	IMSI is the main reference key.
UE Capability	UE radio capabilities.
SAI	Current or last known SAI
SAI age	Time elapsed since the RNC last established the UE's last known~~current~~ SAI
Trace Reference	Identifies a record or a collection of records for a particular trace.
Trace Type	Indicates the type of trace.
Trigger Id	Identifies the entity that initiated the trace.
OMC Identity	Identifies the OMC that shall receive the trace record(s).
Each RNC context contains zero or more RNC RAB contexts:	
RAB ID	Radio Access Bearer Identifier.
PDP Type	PDP type, e.g. PPP or IP.
TEID	Tunnel Endpoint Identifier.
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
GTP-SND	GTP-U sequence number of the next downlink in-sequence N-PDU to be sent to the MS.
GTP-SNU	GTP-U sequence number of the next uplink in-sequence N-PDU to be sent to the GGSN.
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.
PDCP-SNU	Sequence Number of the next uplink in-sequence PDCP-PDU expected from the MS.

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France,18-22 Feb. 2002

Tdoc S2-020883rev21
Rev of S2-020568

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **319** Rev⌘ **1** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Restoration of R'96 Any Time Interrogation functionality
Source:	⌘	Vodafone
Work item code:	⌘	TEI
Date:	⌘	~~22 February~~6 March 2002
Category:	⌘	**A**
Release:	⌘	REL-5

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)

Reason for change: ⌘

In R'96, R'97 and R'98 it is possible to build many services based on the mobile's cell identity. This is either the cell where the mobile currently is, or, the cell where the mobile was last known to be. In the latter case, accurate information is supplied on "how long it has been since the mobile was last in contact with the network".

In R'99, the accuracy of the 'age of location' information has been lost in the case where the mobile is out of coverage but has an RRC connection to the SGSN, eg the mobile is in the URA_PCH state. Note that the periodic URA update timer (T305) can take values from the set {5, 10, 30, 60, 120, 360, 720 or infinity} minutes, so this 'loss of coverage while an RRC connection is active' is a real possibility.

Further information and example message flows are given in the document inserted into the 'other comments' field below. But it can be summarised as follows:

An Any Time Interrogate command can be sent from a CAMEL platform to an HLR in order to obtain the mobile's last known location. This triggers a Provide Subscriber information message to the MSC which, if the Gs interface is in use, triggers an MS Information Request message to the SGSN. If the mobile has an Iu interface connection to the SGSN, then a Location Report Control message is sent to the RNC. If the mobile is in URA-PCH state but is out of coverage, then the RNC should return its most accurate location information to the SGSN. This would be the last known cell ID (mapped one to one to a Service Area ID). Currently the Iu interface Location Report message cannot carry any 'age of location information' and so the SGSN will (because it has an active Iu connection for that mobile) assume that the mobile is currently in coverage in that cell and insert "age=zero" information onto the Gs interface. This "age=zero" information will be incorrectly transported all the way back to the application.

This behaviour is incorrect and this CR attempts to correct the stage 2 description.

This CR is one of a set of CRs that aims to restore the R'96 capability to the R'99

		system.
Summary of change:	⌘	When the LOCATION REPORT message is sent as an aswer to a request for ~~direct~~ report of current Service Area and the current Service Area of the mobile cannot be determined by the RNC ~~cannot determine the current Cell Id of the mobile~~, the RNC ~~shall~~ may report last known Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area~~cell~~.
Consequences if not approved:	⌘	Services based on Cell ID/SAI will randomly and unpredictably fail by indicating that the 'mobile is active in a specific cell' while, in reality, the mobile might have been switched off while out of coverage (or had the battery removed) hours ago in that cell. Note that this might be particularly problematic for law enforcement functions. For other services, note that changes in configuration of the VPLMN (eg URA timer, installation of Gs interface) could unpredictably alter the perfomance of HPLMN functions.

Clauses affected:	⌘	6.3.6, 12.7.5 and 13.7		
Other specs Affected:	⌘	X Other core specifications Test specifications O&M Specifications	⌘	25.413
Other comments:	⌘	29.002 and 23.271 may also need to be modified to correctly describe the interworking between the Iu interface and the MAP interface to the GMLC. The related document S2-020252 is attached below.  S2-020252.zip		

6.3.6 MS Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MS Information procedure via the SGSN. If the information requested by the VLR in the MS Information procedure is known by the SGSN, then the SGSN shall return this information to the VLR without interrogating the MS.

If the information requested is MS identity information (e.g. IMEI) that is not known by the SGSN but is known by the MS, then the SGSN shall interrogate the MS in a similar manner to that described in clause "Identity Check Procedures".

In A/Gb mode, if the information requested is MS location information, then this indicates a request for Cell Global Identity and Cell Identity Age. In Iu mode, if the information requested is MS location information, then this indicates a request for Service Area Identity and Service Area Identity~~Code~~ Age, and in this case if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure (see clause "Location Reporting Procedure") in order to ~~derive~~retrieve the Service Area Identity ~~and Service Area Identity Age information~~.

The MS Information procedure is illustrated in **Error! Reference source not found.**. Procedure steps are explained in the following list.

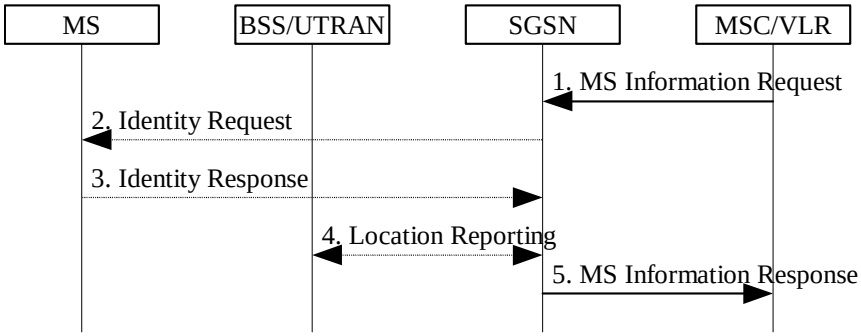

Figure 1: MS Information Procedure

1) The MSC/VLR sends an MS Information Request (IMSI, Information Type) message to the SGSN. Information Type indicates the information that the MSC/VLR is requesting for that IMSI.

2) If the information requested is not known by the SGSN but should be known by the MS, then the SGSN interrogates the MS in a similar manner to that described in the subclause "Identity Check Procedures". The SGSN sends an Identity Request (Identity Type) message to the MS.

3) The MS responds with an Identity Response (Mobile Identity) message to the SGSN.

4) In Iu mode, if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure to retrieve the ~~current or last known~~ Service Area Identity. If UTRAN node cannot determine current Service Area of the mobile, it may report last known Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area~~cell and the Service Area Identity Age~~.

5) The SGSN sends an MS Information Response (IMSI, Information) message to the MSC/VLR. Information contains the information requested by the MSC/VLR.

12.7.5 Location Reporting Procedure

This procedure is used by a 3G-SGSN to request the SRNC to report ~~directly~~ where the MS is currently located, or to report when the MS moves into or out of a given service area. This procedure relates to location services (LCS) and other services (e.g. CAMEL and emergency calls) in Iu mode. The overall LCS procedure is to be described in the LCS stage-2 specification, see 3GPP TS 23.171.

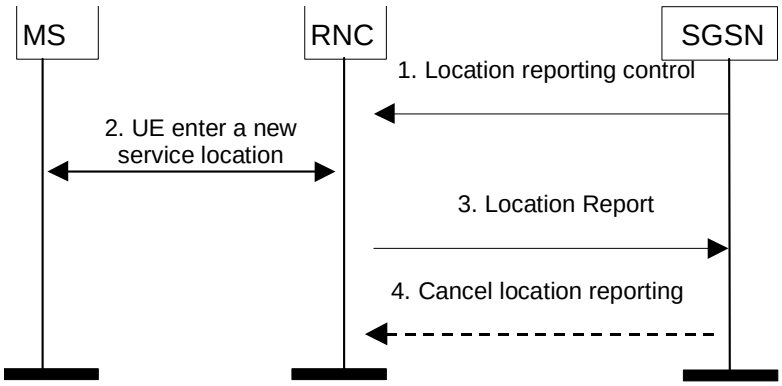

Figure 2: Location Reporting Procedure

1) The SGSN detects from the subscriber data the need to monitor in which service area an MS in the PMM-CONNECTED state with an Iu interface connection is located. The SGSN sends a Location Reporting Control (Service Area Code(s), Reporting Type) message to the SRNC. The SRNC stores the Service Area Code(s) as reporting area(s) for this MS. For example, a service area may be a location area with restricted access. Reporting Type indicates whether the message is intended to start a reporting period or trigger a stand-alone report about the current location of the MS.

2) The SRNC detects that the MS moves into or out of a reporting area. Alternatively, the SRNC derives the current ~~or last known~~ location of the MS if this was requested by the SGSN.

3) The SRNC sends a Location Report (location information~~, location information age~~~~Service Area Code~~) message informing the 3G-SGSN about where the MS is now ~~(or was)~~ located. If no Service Area Code is included, it indicates that the MS is outside the requested service area. When the SGSN has requested ~~direct report of~~ the ~~current~~ location of the MS, the SRNC shall include the requested location information in the Location Report message, e.g. in the format of a cell id, if the SRNC cannot determine current Service Area of the mobile, it may report last known Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area~~cell~~. The SGSN may then perform specific actions (e.g. detach an MS entering a forbidden location area or route an emergency call to the nearest local emergency number).

4) The SGSN can send a Cancel Location Reporting message to inform the SRNC that it should terminate location reporting for a given MS. This message is needed only when the reporting was requested for a reporting period.

The procedure is implicitly cancelled at SRNC relocation. If the service is still required in the new SRNC or new SGSN, a new Location Reporting Control message shall be sent.

13.7 RNC for UMTS

RNC maintains RNC Context for CN-related information in PMM-CONNECTED state. RNC also contains RNC RAB contexts for activated RABs. Table 11 shows the context fields for one MS.

Table 1: RNC Context

Field	Description
IMSI	IMSI is the main reference key.
UE Capability	UE radio capabilities.
SAI	Current or last known SAI
SAI age	Time elapsed since the RNC last established the UE's last known ~~current~~ SAI
Trace Reference	Identifies a record or a collection of records for a particular trace.
Trace Type	Indicates the type of trace.
Trigger Id	Identifies the entity that initiated the trace.
OMC Identity	Identifies the OMC that shall receive the trace record(s).
Each RNC context contains zero or more RNC RAB contexts:	
RAB ID	Radio Access Bearer Identifier.
PDP Type	PDP type, e.g. PPP or IP.
TEID	Tunnel Endpoint Identifier.
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
GTP-SND	GTP-U sequence number of the next downlink in-sequence N-PDU to be sent to the MS.
GTP-SNU	GTP-U sequence number of the next uplink in-sequence N-PDU to be sent to the GGSN.
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.
PDCP-SNU	Sequence Number of the next uplink in-sequence PDCP-PDU expected from the MS.

3GPP TSG-SA2 Meeting #23
Sophia Antipolis, France, 18-22.2.2002

S2-~~020489~~020901

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **308** ⌘ **rev** **-1** ⌘ Current version: **5.0.0** ⌘

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

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	IMS Enhancements(PCO in Secondary PDP context)
Source:	⌘	Nokia
Work item code:	⌘	IMS-CCR
Date:	⌘	13.02.2002
Category:	⌘	**F**
Release:	⌘	REL-5

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)

Reason for change:	⌘	During SA#22 we sent an LS (S2-020328) to CN1 and CN4 on the transparent transfer via SGSN of application level information between UE and GGSN. Regarding to the requirement of providing a mechanism for GPRS P-CSCF discovery CN1 has developed the following changes to release 5 (TS 24.008) ; 1) The Protocol Configuration Options (PCO) field, available in a Primary PDP Context messages is used to convey the P-CSCF address request. 2) The PCO field available in Primary PDP Context response messages is used to convey the P-CSCF address(es) from GGSN to the UE. The PCO field (including the above capabilities) has been added to Secondary PDP Context messages for release 5.
Summary of change:	⌘	This contribution proposes to the usage of Protocol Configuration Options IE at secondary PDP context activation procedure.
Consequences if not approved:	⌘	Non-working solutions.

Clauses affected:	⌘			
Other specs affected:	⌘	**X** Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	24.229, 24.008, 23.228, 29.060
Other comments:	⌘	CN1 have approved related 24.008 CR556 (N1-020456) and CN4 approved 29.060 CR309 (N4-020294)		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST MODIFICATION

2 References

……..

[74] 3GPP TS 24.229: IP Multimedia Call Control Protocol based on SIP and SDP

[75] 3GPP TS 23.221: "Architectural Requirements"

NEXT MODIFICATION

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 63 and Figure 64.

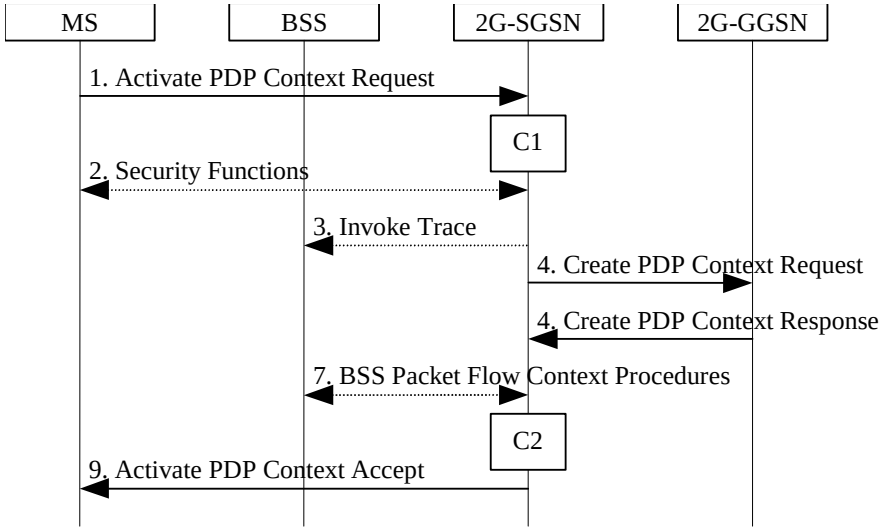

Figure 63: PDP Context Activation Procedure for GSM

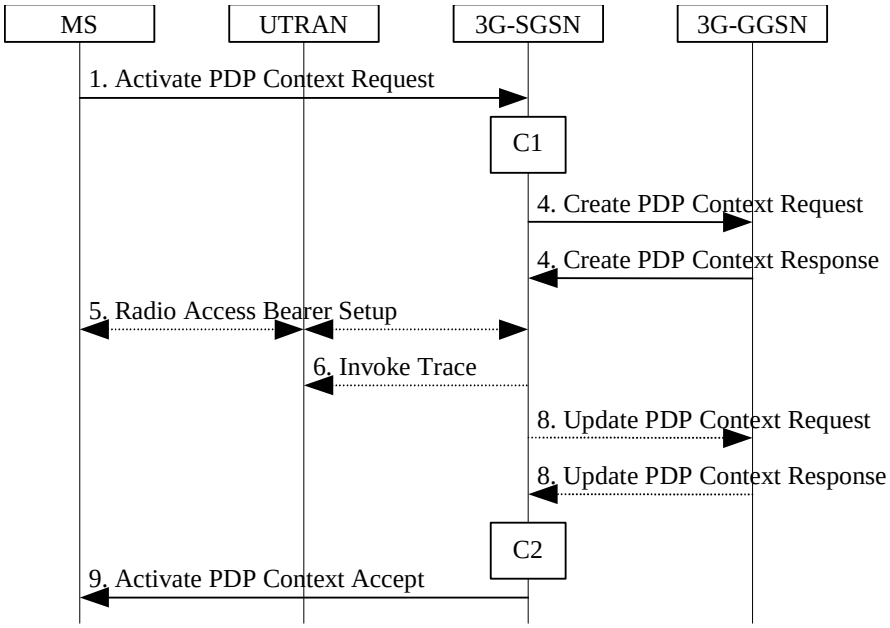

Figure 64: PDP Context Activation Procedure for UMTS

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~~ transfer optional PDP parameters and/or request to ~~from~~ the GGSN (see GSM ~~0~~29.0~~6~~0 [26] and 24.229 [74]). PDP Configuration Options is sent transparently through the SGSN.

   In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".

3) In A/Gb mode and if BSS trace is activated, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

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, the SGSN rejects the PDP context activation request.

   If a GGSN address can be derived, the SGSN creates a TEID for the requested PDP context. If the MS requests a dynamic address, the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile.

   The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, NSAPI, MSISDN, Selection Mode, Charging Characteristics, Trace

Reference, Trace Type, Trigger Id, OMC Identity, PDP Configuration Options) 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 an MS or a non-subscribed APN chosen by the 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, 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 charging characteristics on the GPRS subscription and individually subscribed APNs as well as the way the SGSN handles Charging Characteritics and chooses to send them or not to the GGSN is defined in 3GPP TS 32.215 [70]. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.

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 way the GGSN handles Charging Characteritics that it may have received from the SGSN is defined in 3GPP TS 32.215 [70]. The GGSN then returns a Create PDP Context Response (TEID, PDP Address, 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, 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. 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.

5) In Iu mode, RAB setup is done by the RAB Assignment procedure, see subclause "RAB Assignment Procedure".

6) In Iu mode and if BSS trace is activated, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the UTRAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

7) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".

8) In Iu mode and in case the QoS attributes have been downgraded in step 5, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.

9) 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. PDP Configuration Options may be used to transfer optional PDP parameters to the UE (see GSM 29.060 [26] and 24.229 [74]). PDP Configuration Options is sent transparently through the SGSN.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 clause "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, the MS may attempt another activation to the same APN up to a maximum number of attempts.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 63 and Figure 64, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 63 and Figure 64, procedures return as result "Continue".

NEXT MODIFICATION

9.2.2.1.1 Secondary PDP Context Activation Procedure

The Secondary PDP Context Activation procedure may be used to activate a PDP context while reusing the PDP address and other PDP context information from an already active PDP context, but with a different QoS profile. Procedures for APN selection and PDP address negotiation are not executed. A unique TI and a unique NSAPI shall identify each PDP context sharing the same PDP address and APN.

The Secondary PDP Context Activation procedure may be executed without providing a Traffic Flow Template (TFT) to the newly activated PDP context if all other active PDP contexts for this PDP address and APN already have an associated TFT.Otherwise a TFT shall be provided. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external packet data network to the newly activated PDP context.

The Secondary PDP Context Activation procedure may only be initiated after a PDP context is already activated for the same PDP address and APN. The procedure is illustrated in Figure 65 and Figure 66.

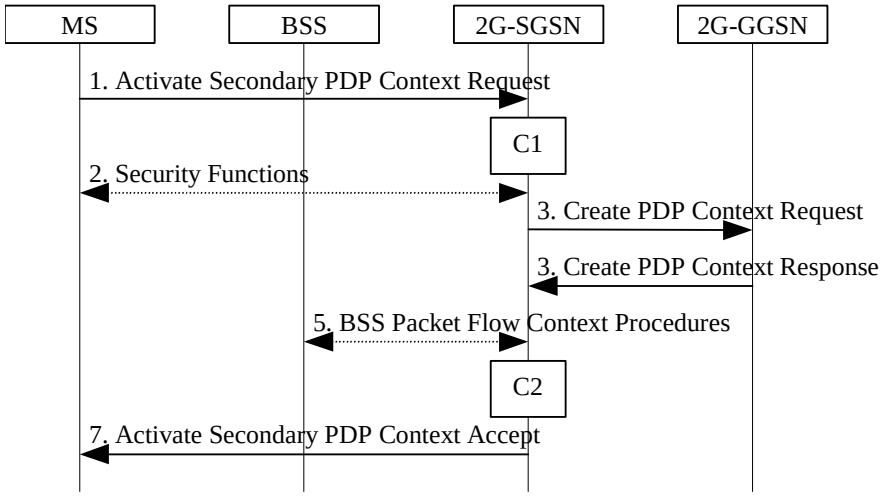

Figure 65: Secondary PDP Context Activation Procedure for GSM

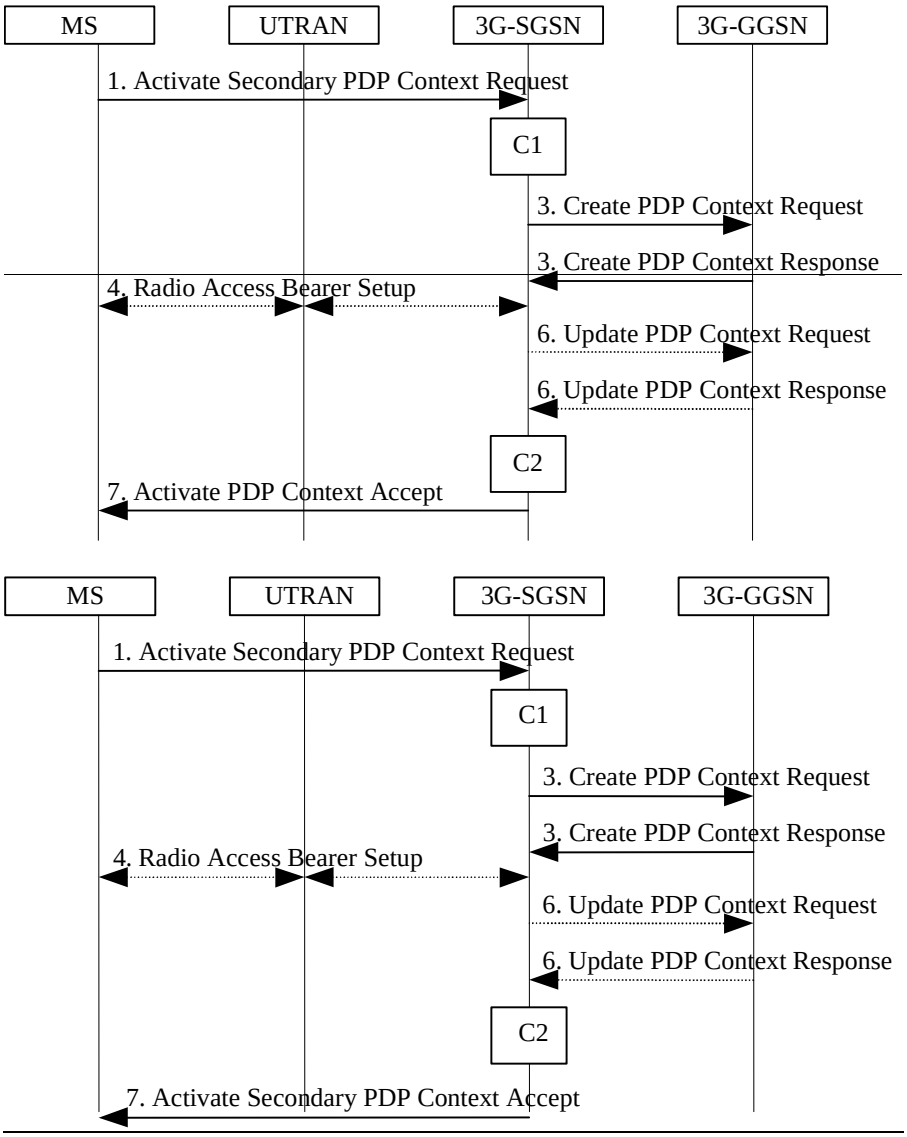

Figure 66: Secondary PDP Context Activation Procedure for UMTS

1) The MS sends an Activate Secondary PDP Context Request (Linked TI, NSAPI, TI, QoS Requested, TFT, PDP Configuration Options) message to the SGSN. Linked TI indicates the TI value assigned to any one of the already activated PDP contexts for this PDP address and APN. QoS Requested indicates the desired QoS profile. TFT is sent transparently through the SGSN to the GGSN to enable packet classification for downlink data transfer. TI and NSAPI contain values not used by any other activated PDP context PDP Configuration Options may be used to transfer optional PDP parameters and/or requests to~~/from~~ the GGSN (see GSM 29.060 [26] and 24.229 [74]). PDP Configuration Options is sent transparently through the SGSN.

2) In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".

3) The SGSN validates the Activate Secondary PDP Context Request using the TI indicated by Linked TI. The same GGSN address is used by the SGSN as for the already-activated PDP context(s) for that TI and PDP address.

   The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile, which represents the maximum QoS per PDP context to the associated APN. The GGSN may restrict and negotiate the requested QoS as specified in clause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TEID, NSAPI, Primary NSAPI, TFT) message to the affected GGSN. Primary NSAPI indicates the NSAPI value assigned to any one of the already activated PDP contexts for this PDP address and APN. TFT is included only if received in the Activate Secondary PDP Context Request message. The GGSN uses the same external network as used by the already-activated PDP context(s) for that PDP address, generates a new entry in its PDP context table, and stores the TFT. The new entry allows the GGSN to route PDP PDUs via different GTP tunnels between the SGSN and the external PDP network. The GGSN returns a Create PDP Context Response (TEID, QoS Negotiated, Cause) message to the SGSN.

4) In Iu mode, RAB setup is done by the RAB Assignment procedure.

5) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".

6) In Iu mode and in case the QoS attributes have been downgraded in step 4, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.

7) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. PDP Configuration Options may be used to transfer optional PDP parameters to the UE (see GSM 29.060 [26] and 24.229 [74]). PDP Configuration Options is sent transparently through the SGSN.The SGSN is now able to route PDP PDUs between the GGSN and the MS via different GTP tunnels and possibly different LLC links.

For each additionally activated PDP context a QoS profile and TFT may be requested.

If the secondary PDP context activation procedure fails or if the SGSN returns an Activate Secondary PDP Context Reject (Cause) message, the MS may attempt another activation with a different TFT, depending on the cause.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 65 and in Figure 66, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 65 and in Figure 66, procedures return as result "Continue".