Technical Specification Group Services and System Aspects ***TSGS#12(01)0330***

Meeting #12, Stockholm, Sweden, 18-21 June 2001

Source: **TSG SA WG2**
Title: **CRs on 03.60 and 23.060**
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 #12.
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.

On 03.60:

CR#	***rev***	***Rel***	***title***	***cat***	***in ver***	***out ver***	***S2#***	***WI***
A205	1	R97	Using RAU procedure for MS RAC IE update	F	6.8.0	6.9.0	S2-011471	GPRS
A206	1	R98	Using RAU procedure for MS RAC IE update	A	7.6.0	7.7.0	S2-011472	GPRS

On 23.060 Rel99 and Rel4:

CR#	***rev***	***Rel***	***title***	***cat***	***in ver***	***out ver***	***S2#***	***WI***
229	1	R99	Clarifications to Handling the user data during the SRNS Relocation Procedure	F	3.7.0	3.8.0	S2-011559	GPRS
231	1	R4	Clarifications to Handling the user data during the SRNS Relocation Procedure	A	4.0.0	4.1.0	S2-011560	TEI4
224	1	R99	Data forwarding during 3G RAU in PMM CONNECTED state	F	3.7.0	3.8.0	S2-011558	GPRS
225		R4	Data forwarding during 3G RAU in PMM CONNECTED state	A	4.0.0	4.1.0	S2-011260	TEI4
222	1	R99	Forbid usage of TFT in case of virtual dial-up access with PPP frame tunneling in GGSN	F	3.7.0	3.8.0	S2-011469	TEI
223	1	R4	Forbid usage of TFT in case of virtual dial-up access with PPP frame tunneling in GGSN	A	4.0.0	4.1.0	S2-011470	TEI4
236		R99	Handling of charging characteristics for roaming users	F	3.7.0	3.8.0	S2-011569rev2	GPRS
237		R4	Handling of charging characteristics for roaming users	A	4.0.0	4.1.0	S2-011570rev2	TEI4
234		R99	Specification of Relocation Cancel procedure	F	3.7.0	3.8.0	S2-011464	TEI
221	1	R4	Specification of Relocation Cancel procedure	A	4.0.0	4.1.0	S2-011554	TEI4

On 23.060 Rel4:

CR#	***rev***	***Rel***	***title***	***cat***	***in ver***	***out ver***	***S2#***	***WI***
230	1	R4	Support of PS realtime relocation in 23.060	B	4.0.0	4.1.0	S2-011561	TEI4
233		R4	Update of Control Plane protocol architecture to align with 29.202	A	4.0.0	4.1.0	S2-011463rev1	TEI4

3GPP TSG-SA2 Meeting #18
14-18 May 2001, Puerto Rico.

Tdoc S2-~~011271~~011471

CR-Form-v3

CHANGE REQUEST

⌘ **03.60** **CR** **A205** ⌘ rev **-1** ⌘ Current version: **6.7.0** ⌘

*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 ☐

Title:	⌘	Using RAU procedure for MS RAC IE update
Source:	⌘	Nokia
Work item code:	⌘	GPRS
Date:	⌘	~~07~~15.05.2001
Category:	⌘	**F**
Release:	⌘	R97

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:	⌘	During the GPRS connection (i.e. when GPRS attached), there might be a need to update the network with new MS Radio Access Capability information e.g. change of multislot class or power class. However there is not defined any MS RAC change procedure for GPRS similar to the circuit-switched classmark change procedure. It is proposed that the MS can use the existing Routing Area Update procedure to send the new MS RAC Information Element to the SGSN also when Routeing Area Update procedure would not be normally needed. SGSN shall convey that information to BSS using already existing procedures i.e including MS RAC into BSSGP DL data PDU or sending the RA_Capability_PDU to the BSS.
Summary of change:	⌘	It is clarified that MS can send a Routeing Area Update when it has new access capabilities to indicate to the network.
Consequences if not approved:	⌘	TSG-CN plenary #11 has already approved the related 04.08 CR (NP-010125).

Clauses affected:	⌘	6.9.1.2, 6.9.1.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.9.1.2 Routeing Area Update Procedure

A routeing area update takes place when a GPRS-attached MS detects that it has entered a new RA, when the periodic RA update timer has expired, or when the MS indicates changed access capabilities to the network, or when a suspended MS is not resumed by the BSS (see subclause "Suspension of GPRS Services"). 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.

An MS in READY state due to anonymous access shall not perform routeing area updates for the AA MM context. If the MS has entered a new routeing area, a new Anonymous Access PDP Context Activation procedure shall be initiated. The old context is implicitly deleted upon expiry of the READY timer.

*** Next modification ***

6.9.1.3 Combined RA / LA Update Procedure

A combined RA / LA update takes place in network operation mode I when the MS enters a new RA or when a GPRS-attached MS performs IMSI attach, or when the MS indicates changed access capabilities to the network. The MS sends a Routeing Area Update Request indicating that an LA update may also need to be performed, in which case the SGSN forwards the LA update to the VLR. This concerns only idle mode (see GSM 03.22), as no combined RA / LA updates are performed during a CS connection.

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Tdoc S2-~~011272~~011472

CR-Form-v3

CHANGE REQUEST

⌘ **03.60** **CR** **A206** ⌘ rev **-1** ⌘ Current version: **7.6.0** ⌘

*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:	⌘	Using RAU procedure for MS RAC IE update
Source:	⌘	Nokia
Work item code:	⌘	GPRS
Date:	⌘	~~07~~15.05.2001
Category:	⌘	**A**
Release:	⌘	R98

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:	⌘	During the GPRS connection (i.e. when GPRS attached), there might be a need to update the network with new MS Radio Access Capability information e.g. change of multislot class or power class. However there is not defined any MS RAC change procedure for GPRS similar to the circuit-switched classmark change procedure. It is proposed that the MS can use the existing Routing Area Update procedure to send the new MS RAC Information Element to the SGSN also when Routeing Area Update procedure would not be normally needed. SGSN shall convey that information to BSS using already existing procedures i.e including MS RAC into BSSGP DL data PDU or sending the RA_Capability_PDU to the BSS.
Summary of change:	⌘	It is clarified that MS can send a Routeing Area Update when it has new access capabilities to indicate to the network.
Consequences if not approved:	⌘	TSG-CN plenary #11 has already approved the related 04.08 CR (NP-010125).

Clauses affected:	⌘	6.9.1.2, 6.9.1.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.9.1.2 Routeing Area Update Procedure

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*** Next modification ***

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S2-011275559

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **229** ⌘ rev **1** ⌘ Current version: **3.7.0** ⌘

*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:	⌘	Clarifications to Handling the user data during the SRNS Relocation Procedure
Source:	⌘	Nokia, Siemens,Ericsson
Work item code:	⌘	GPRS
Date:	⌘	189 May, 2001
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 definition of the SRNS Relocation procedure in 23.060 has the following flaws. The description of the procedure is not sufficiently accurate, and therefore the text may be interpreted in different ways. In fact, neither 23.121, nor 23.060 describes the dynamics of the user traffic flow during the procedure in a sufficiently detailed and clear way.

Besides, there is a number of errors that need to be corrected :

- For instance, Sub clauses 6.9.2.2.1 and 6.9.2.2.2 contain two contradicting statements: "This procedure is only performed for an MS in PMM-CONNECTED state" and "In the case described in figure 37/40 and figure 38/41 the MS is in state MM-IDLE".
- RRC specification 25.331 has changed and the respective text in 23.060 needs update. Indeed both messages RNTI Reallocation/ RNTI Reallocation Complete are now called UTRAN Mobility Information/UTRAN Mobility Information Confirm.

Moreover there are many editorial mistakes that need to be corrected:

- MS instead of UE (MS is used in the figures and in GPRS specs.).
- The steps 7 to 11 for section 1 and 3 and steps 7 to 9 for section 2 are not always handled in a sequential way.
- The letter S for Serving should be used only when one RNC has the Serving role (for example in the first section, steps 1-6 for Source, steps 10 to 14).
- Some layout and syntax mistakes.

Summary of change: ⌘ It is proposed to clarify how the up-link and down-link user data flows for all the cases of relocations, correct all the editorial mistakes (above mentioned ambiguities) and finally align 23.060 with 23.107 and 25.331 as well as the wording between the three sub sections that is to say the three cases of SRNS relocation.

Consequences if ⌘ If the CR is not approved, the SRNS Relocation procedure will still be presented

not approved:		in an ambiguous and confused way.

Clauses affected:	⌘	6.9.2.2		
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.

6.9.2.2 Serving RNS Relocation Procedures

6.9.2.2.1 Serving 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~~MM-IDLE~~.

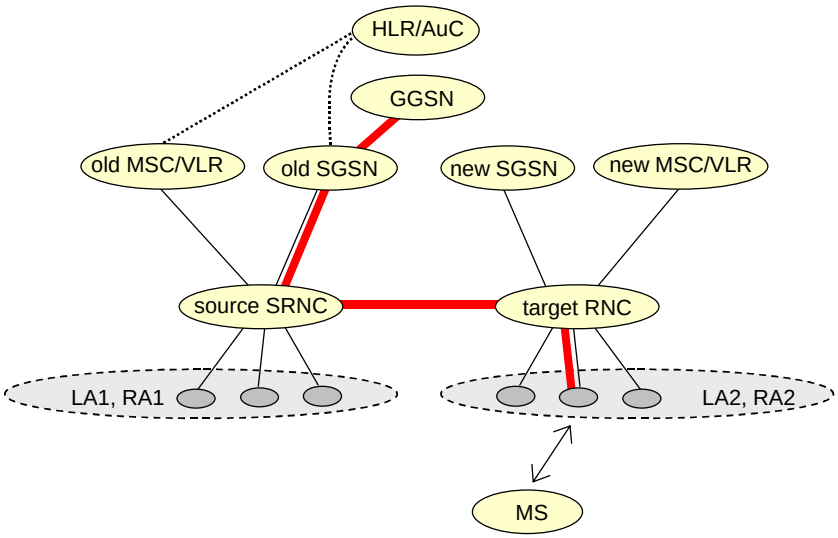


Figure 1: Before SRNS Relocation and Routeing Area Update

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).

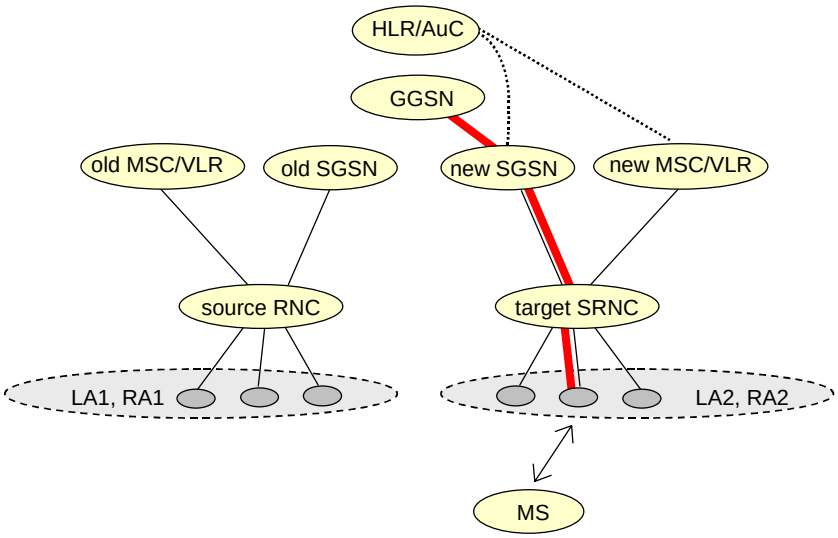
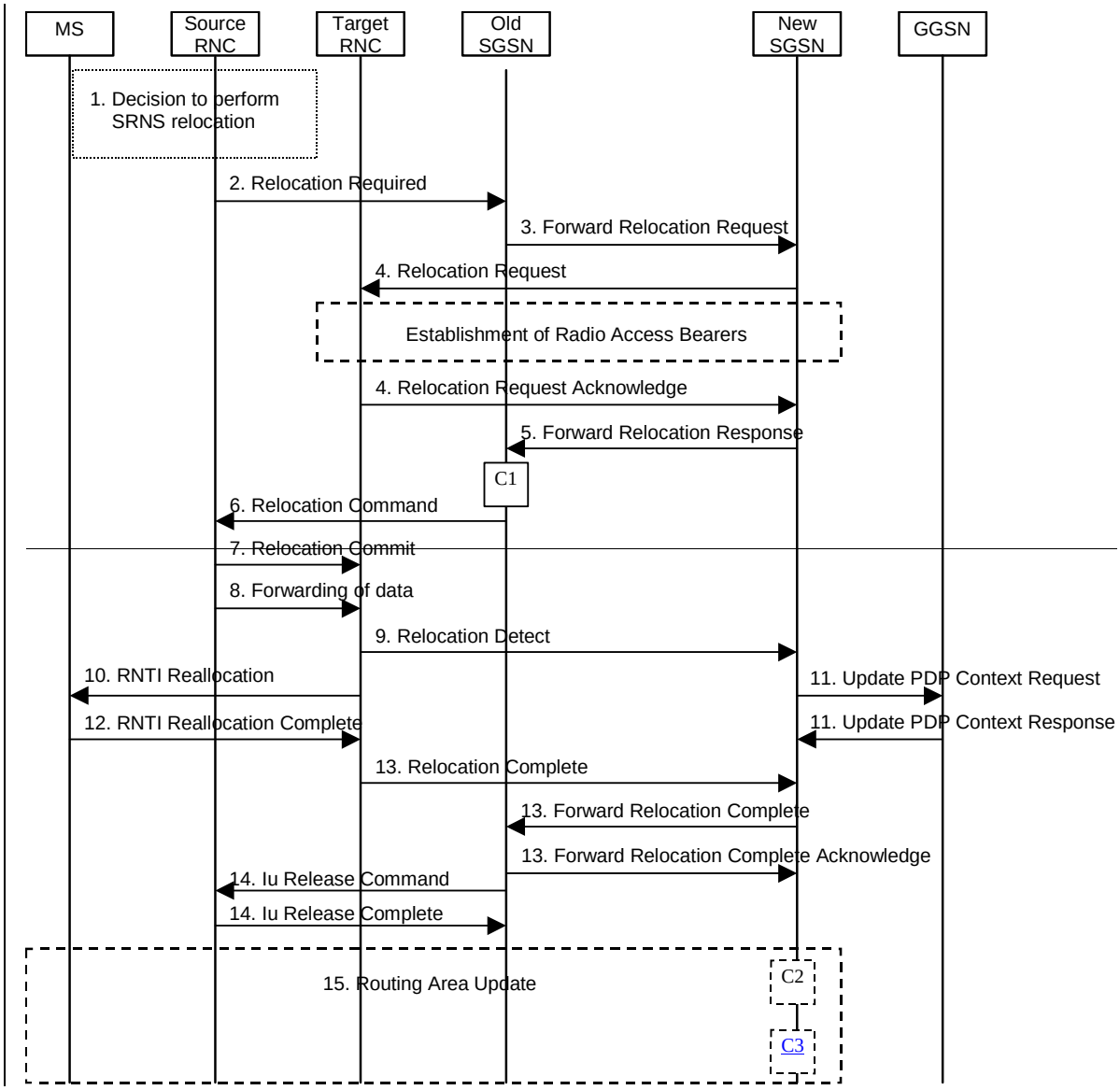


Figure 2: After SRNS Relocation and Routeing Area Update

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS relocation
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation Commit
8. Forwarding of data
9. Relocation Detect
10. RNTI Reallocation
11. Update PDP Context Request
12. RNTI Reallocation Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

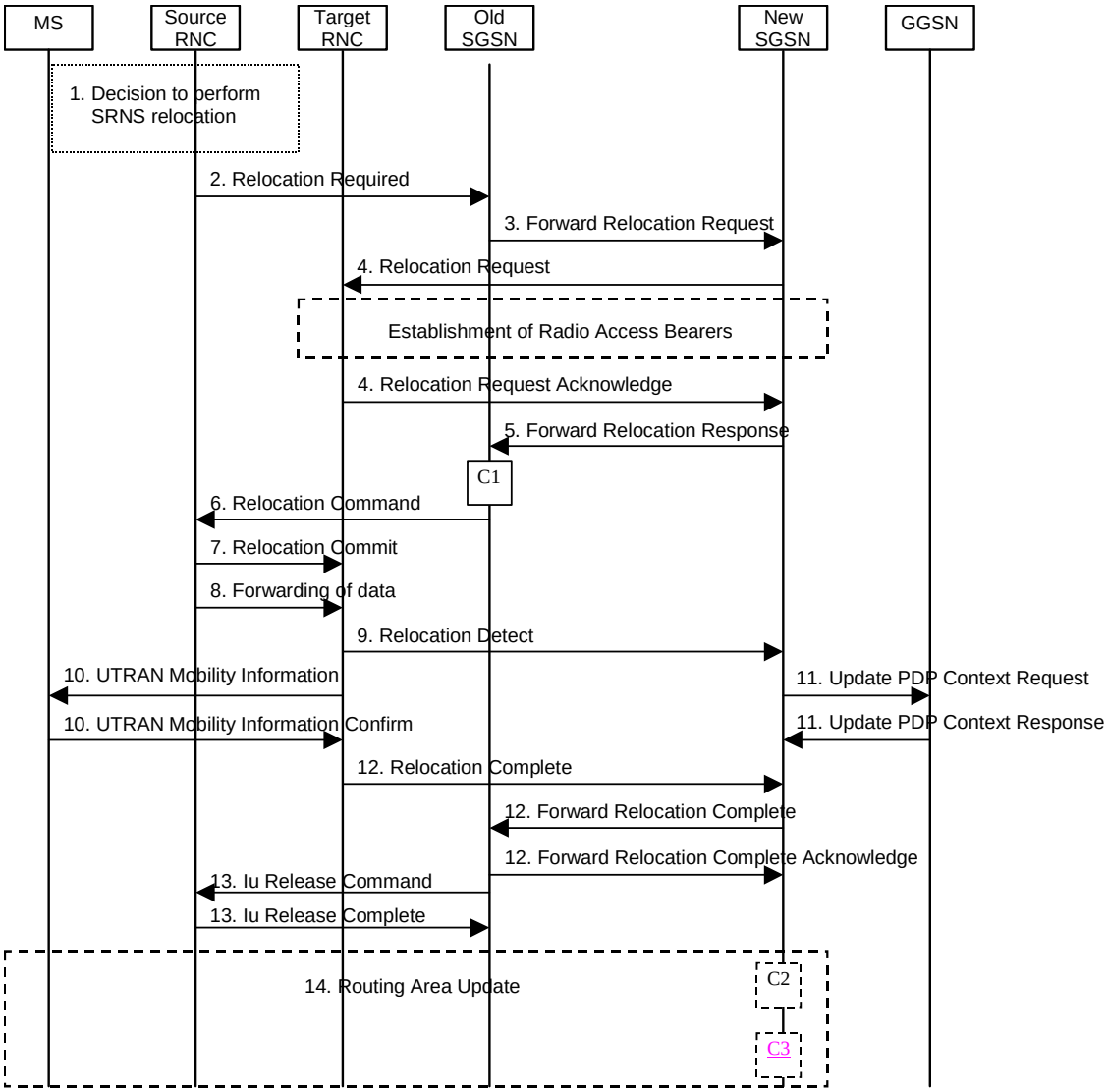


Figure 3: Serving SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate an SRNS relocation. At this point both uplink~~UL~~ and downlink~~DL~~ 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 ~~initiates the relocation preparation procedure by~~ send~~s~~ing 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 ~~UE~~ MS Capabilities). ~~The Relocation Preparation procedure is terminated successfully once source SRNC receives Relocation Command message from the old SGSN (step 6).~~

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. ~~PDP context in old-SGSN contains the GGSN Address for User Plane and the Up-link TEID for Data (at this TEID the GGSN receives up-link packets for given PDP context). old-SGSN sends these IEs to new-SGSN in Forward Relocation Request message.~~

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause ~~(IMSI)~~, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. ~~RAB is made up of a Radio Bearer (RB) and an Iu Bearer. RBs between MS and the source SRNC, and Iu Bearers between the source SRNC and old-SGSN have been established before the source SRNC decides to perform/initiate an SRNS relocation. At this point (step 4) new~~ Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as~~. Later~~ 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 RAB ~~(Iu Bearer)~~ requested to be established, 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 up-link 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. ~~The~~Each RAB to be setup is defined by a Transport Layer Address which is the target RNC Address for user data, and an~~the~~ Iu Transport Association which corresponds to the down-link Tunnel Endpoint Identifier for user data. The target RNC ~~will~~ may for each RAB to be set up ~~(defined by an IP Address and a Tunnel Endpoint Identifier)~~ receive simultaneously downlink~~DL~~ user packets both from the source SRNC and from the new SGSN~~both forwarded downlink PDUs from the source SRNC as well as downlink PDUs from the new SGSN~~.

After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnels are~~have been~~ established between the target RNC and the new-SGSN. ~~At this point, the target RNC shall be able to send/receive UL/DL user data respectively. New-SGSN shall be able to send/receive DL/UL user data respectively to/from target RNC and be able to send UL user data to GGSN. However, target RNC still acts as a drift RNC. That is, new-SGSN does not receive UL user data. GGSN sends DL user data only to old-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 thesey areis used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlinksend DL user data directly to the target RNCse GTP-U tunnels over the Iu interface. Thise forwarding tunnel is performedused for downlink user dataDL transmission only. , and the target RNC cannot send user data to source SRNC.

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

Note: The order of a 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 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 8) is still underway, and before the new SGSN receives Update PDP Context Response message (step 11).

Note: The order of a 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 relocation preparation procedure is terminated successfully and 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 connections using RLC unacknowledged mode PDCP sequence numbers is not used. . 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 used when lossless SRNS relocation is configured for PDCP [57].

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.

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If PDCP does not support lossless relocation, the acknowledged mode SRNS relocation procedures shall be performed as in unacknowledged mode. Hence PDCP sequence numbers shall not be transferred from the old source RNC to the target RNC.

Before sending the Relocation Commit uplink and downlink data transfer in the source, SRNC shall be suspended for RABs which require- loss-less relocation.

8) ~~After having sent the Relocation Commit message, t~~The source ~~S~~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 ~~S~~RNC and the target RNC are duplicated in the source ~~S~~RNC and routed at IP layer towards the target RNC.

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) ~~After having sent the Relocation Detect message, t~~The target SRNC ~~responds to the MS by sending~~ sends ~~an RNTI Reallocation~~a UTRAN Mobility Information message. ~~Both~~ This message~~s~~ 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 acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. 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~~s~~ sending uplink~~UL~~ 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~~DL~~ 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~~UL~~ 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 MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC. From now on the exchange of packets with the MS can start.~~

~~13~~12) When the target SRNC receives the UTRAN Mobility Information Confirm~~RNTI Reallocation Complete~~ message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the ~~UE~~ 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.

~~14~~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.

~~15~~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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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"".

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~~MM IDLE~~ state.

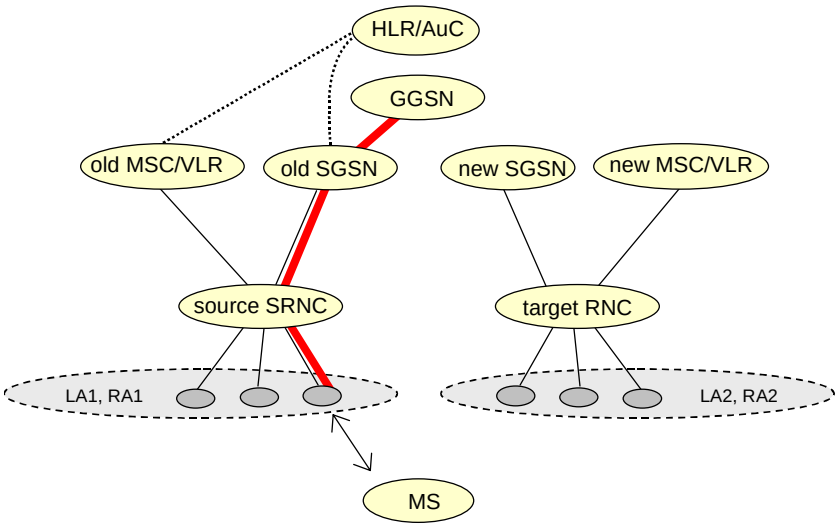


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

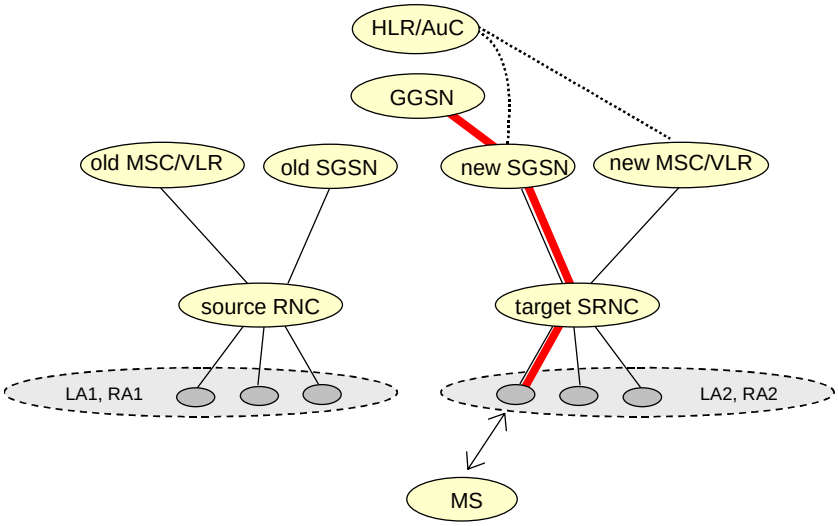
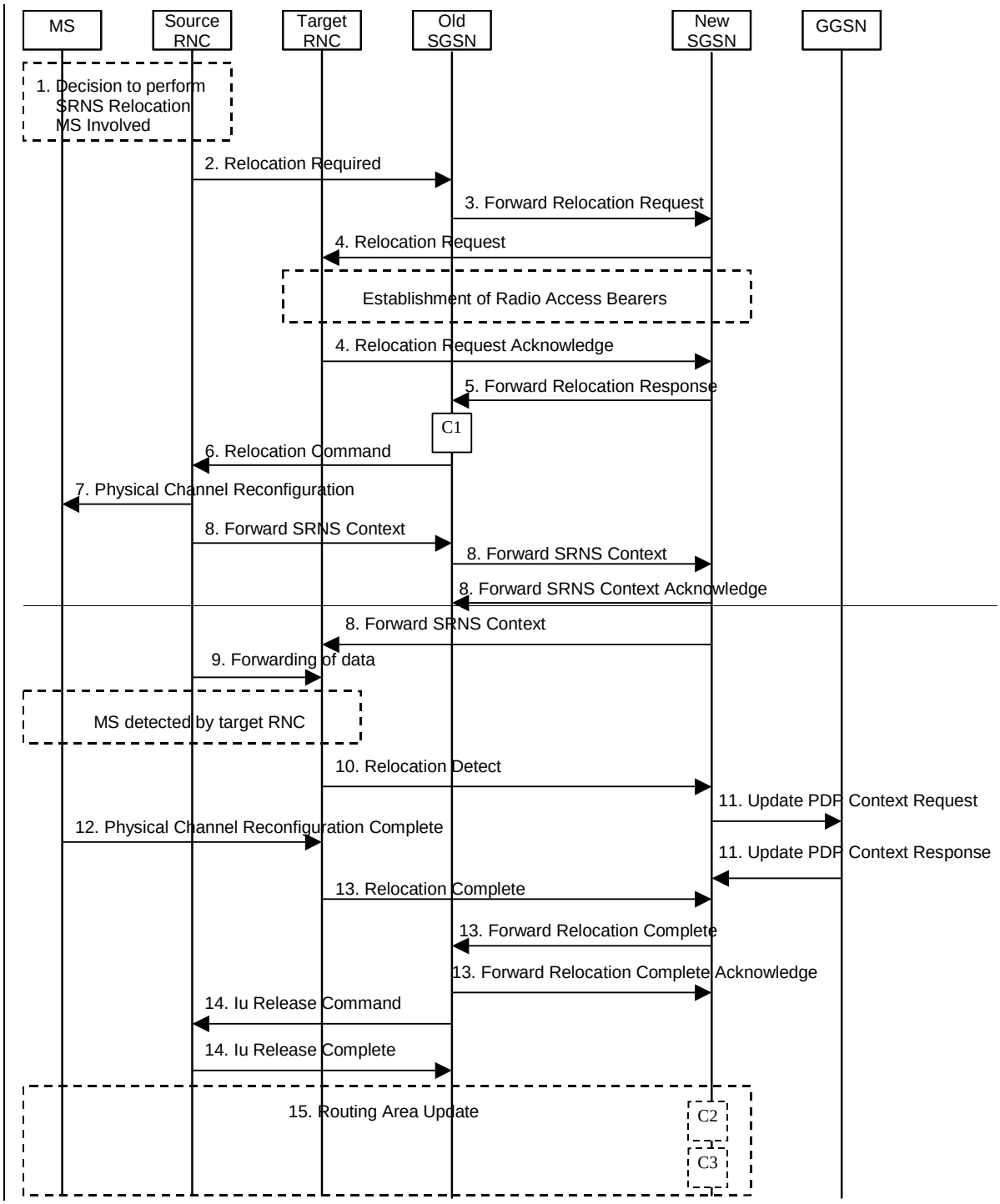


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS Relocation MS Involved
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Physical Channel Reconfiguration
8. Forward SRNS Context
8. Forward SRNS Context
8. Forward SRNS Context Acknowledge
8. Forward SRNS Context
9. Forwarding of data
MS detected by target RNC
10. Relocation Detect
11. Update PDP Context Request
12. Physical Channel Reconfiguration Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

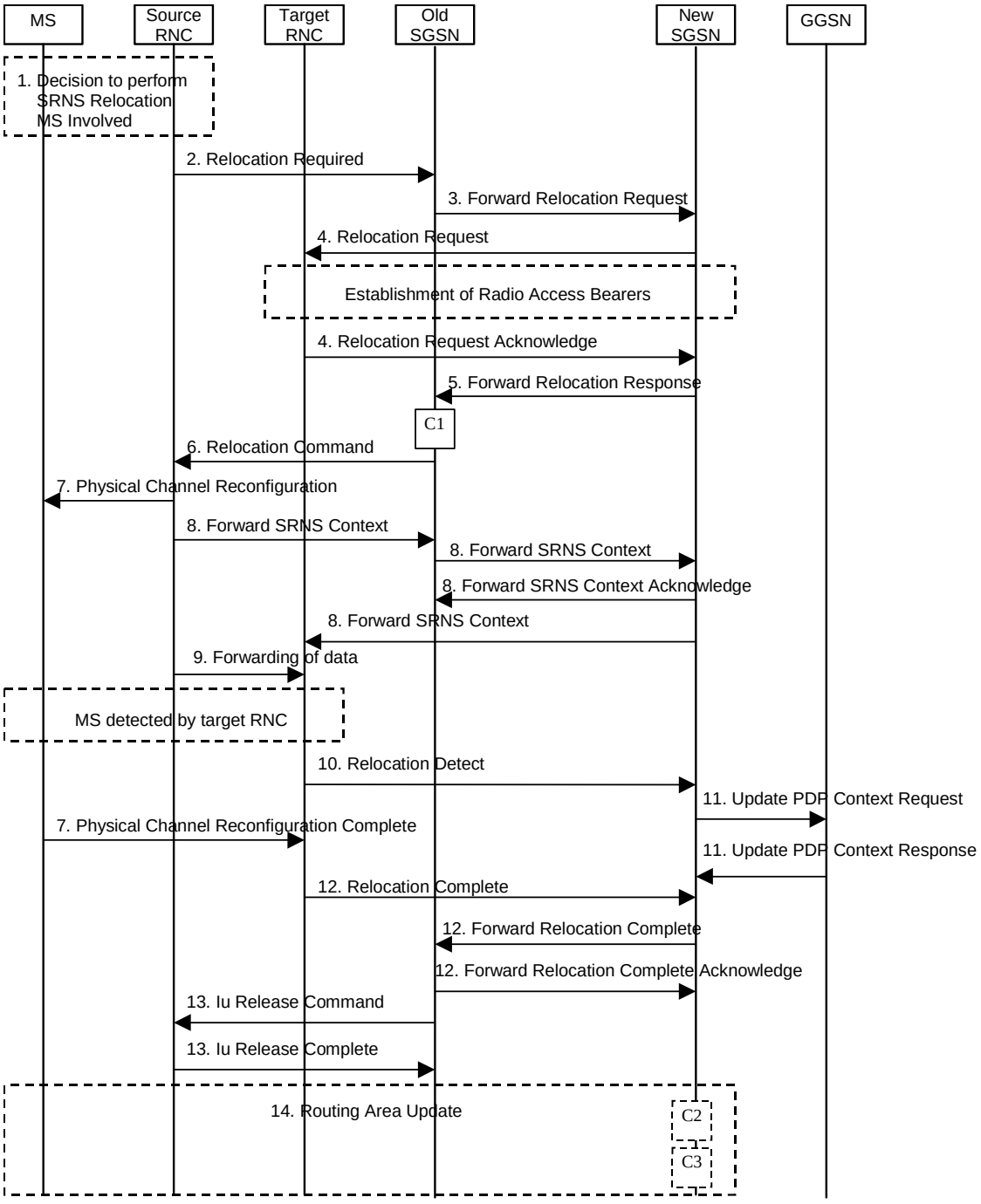


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

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~~UL~~ and downlink~~DL~~ 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 ~~initiates the relocation preparation procedure by~~ send~~s~~ing a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) ~~message~~ 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 ~~UE~~ MS Capabilities). ~~The Relocation Preparation procedure is terminated successfully once source SRNC receives Relocation Command message from the old SGSN (step 6).~~

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) ~~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. ~~PDP context in old-SGSN contains the GGSN Address for User Plane and the Up-link TEID for Data (at this TEID the GGSN receives up-link packets for given PDP context). old-SGSN sends these IEs to new-SGSN in Forward Relocation Request message.~~

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity ~~(IMSI)~~, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RABs To Be Setup) ~~message~~ to the target RNC. ~~RAB is made up of a Radio Bearer (RB) and an Iu Bearer. RBs between MS and the source SRNC, and Iu Bearers between the source SRNC and old-SGSN are already established. At this point (step 4) new Iu Bearers are being setup between the target RNC and new-SGSN. Later new RBs shall be setup between the MS and the target RNC.~~ For each RAB ~~(Iu Bearer)~~ 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 up-link 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) ~~message~~ to the new SGSN. Each RAB to be setup is defined by a~~The~~ 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. The target RNC ~~will~~ may for each RAB to be set up ~~(defined by an IP Address and a Tunnel Endpoint Identifier)~~ receive simultaneously downlink~~DL~~ user packets both from the source SRNC and from the new SGSN~~both forwarded downlink PDUs from the source SRNC as well as downlink PDUs from the new SGSN~~.

After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnel(s) are~~have been~~ 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 ~~setup any RB to~~ 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) ~~message~~ 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 theseey areis used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink~~send DL~~ user data directly to these target RNC~~GTP-U tunnels~~ over the Iu interface. Thise forwarding ~~tunnel~~ is performe~~dused~~ for downlink user data~~DL transmission~~ only.~~, and the target RNC cannot send user data to source SRNC.~~

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 a 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 relocation preparation procedure is terminated successfully and the source SRNC is ready, the source ~~S~~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 ~~S~~RNC shall be suspended for RABs which require- loss-less relocation.

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 only used when lossless SRNS relocation is configured for PDCP [57]. 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 source ~~S~~RNC includes the PDCP sequence number, PDCP-SNU, in the RRC message which is indicated in the Target RNC to Source RNC transparent container to the MS. The MS informs the PDCP sequence number, PDCP-SND, to the target RNC in the corresponding RRC complete message. ~~——~~The target ~~S~~RNC establishes and/or restarts the RLC and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target ~~S~~RNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires loss-less relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then the target ~~S~~RNC shall discard these packets. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source ~~S~~RNC, the MS shall discard these packets.

9) ~~After having sent the Forward SRNS Context message, t~~The source ~~S~~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 ~~S~~RNC and the target RNC are duplicated in the source ~~S~~RNC and routed at the IP layer towards the target RNC.

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 MS has reconfigureditself, 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 SRNC may start the packet transfer for all RABs, which do not require maintaining the delivery order.~~

~~13~~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 ~~UE~~ 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.

~~14~~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.

~~15~~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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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".

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

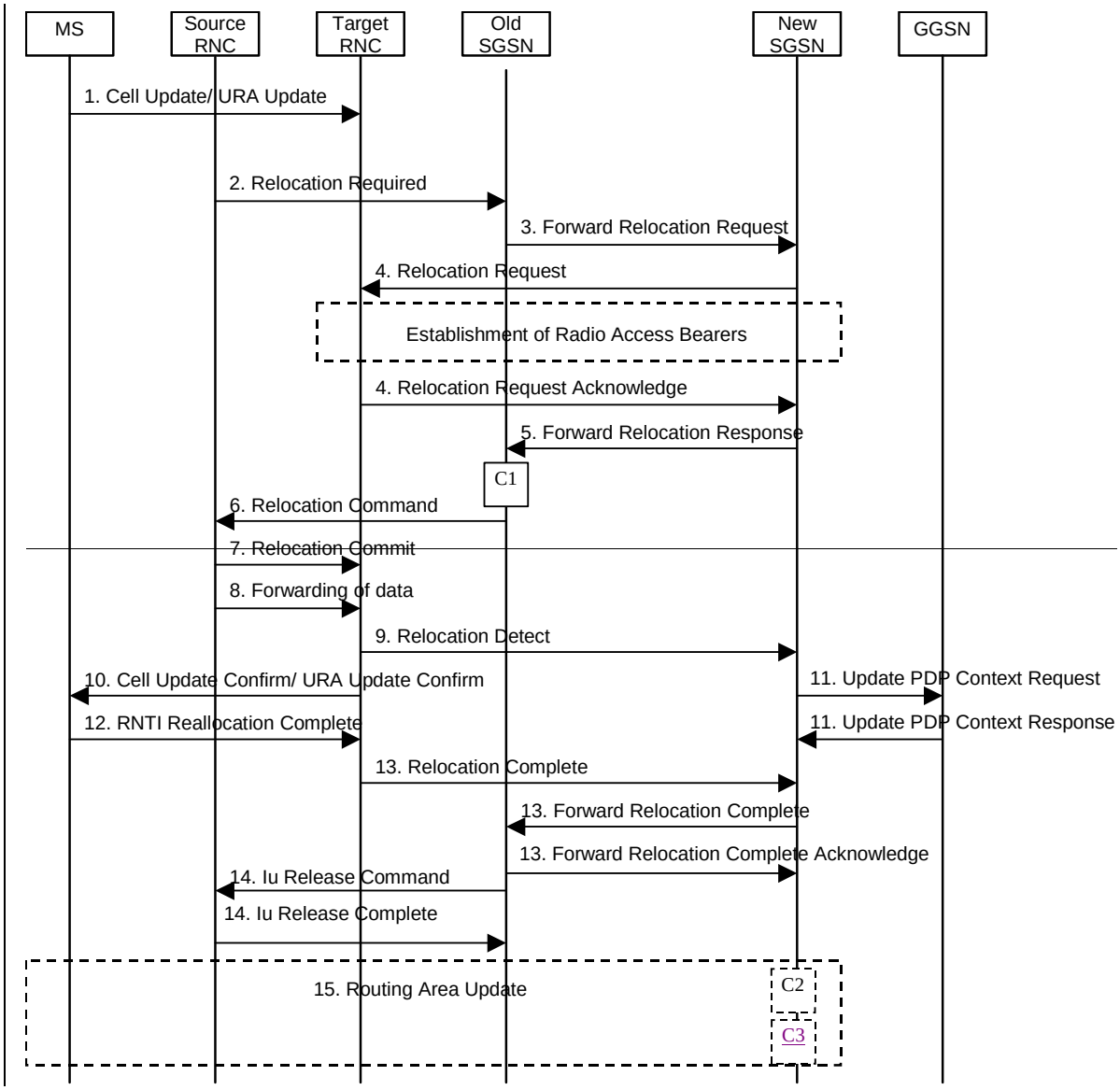
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur interface carries control signalling but no user data.

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Cell Update/ URA Update
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation Commit
8. Forwarding of data
9. Relocation Detect
10. Cell Update Confirm/ URA Update Confirm
11. Update PDP Context Request
12. RNTI Reallocation Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

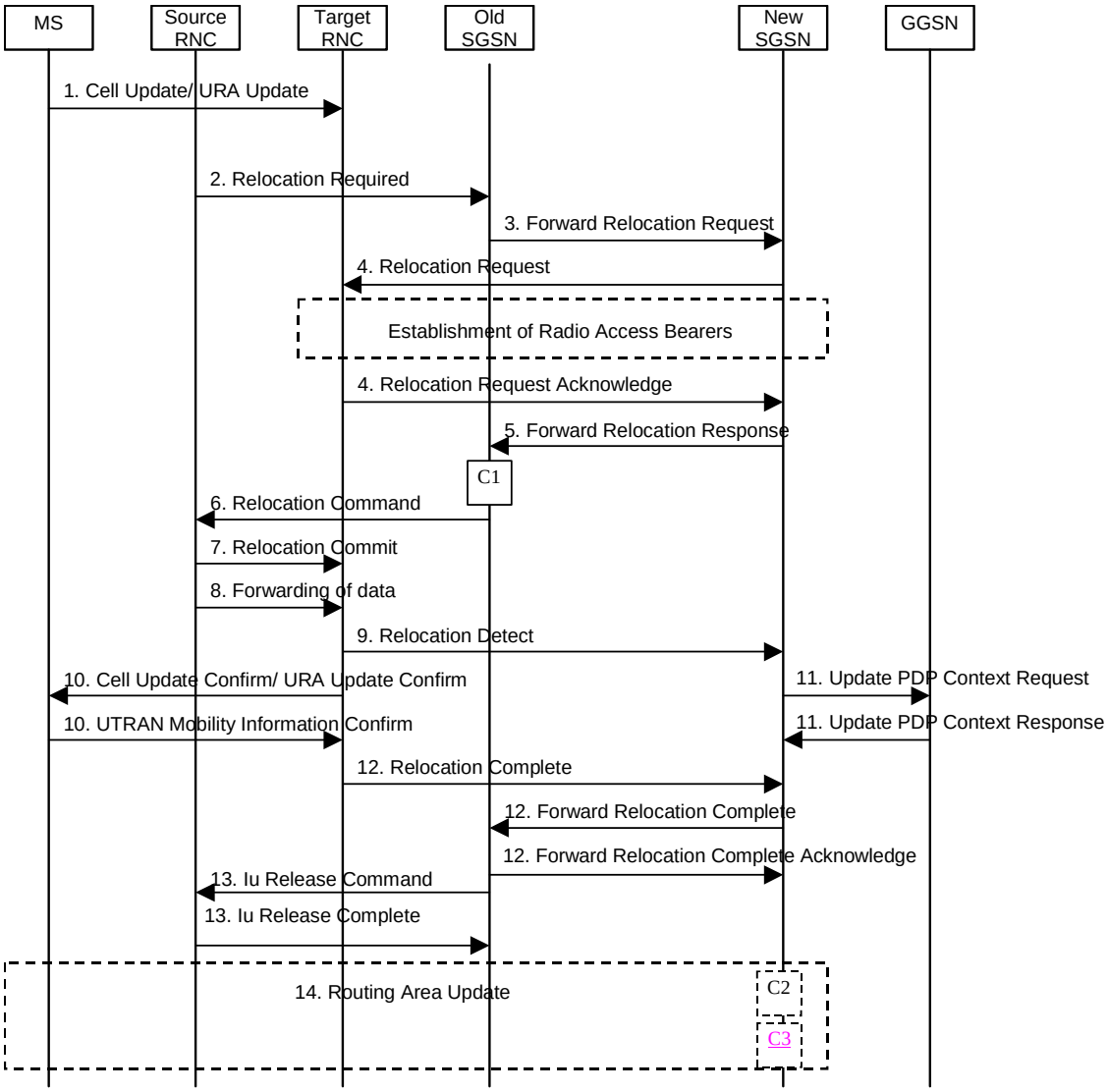


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

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~~user data is send to~~ the source SRNC and the UE. ~~However, at a later stage (step 8) the user data exchange may start/resume.~~ Nonetheless ~~at this point (step 1)~~ the following tunnel(s) are~~have been~~ established: ~~Radio Bearer between MS and source SRNC (logical bearer because in principle data may flow via target RNC, which in such a case 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 ~~initiates the relocation preparation procedure by~~ send~~s~~ing 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 ~~UE~~ MS Capabilities). ~~The Relocation Preparation procedure is terminated successfully once source SRNC receives Relocation Command message from the old SGSN (step 6).~~

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. ~~PDP context in old-SGSN contains the GGSN Address for User Plane and the Up-link TEID for Data (at this TEID the GGSN receives up-link packets for given PDP context). old-SGSN sends these IEs to new-SGSN in Forward Relocation Request message.~~

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity ~~(IMSI)~~, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. ~~RAB is made up of a Radio Bearer (RB) and an Iu Bearer. RBs between MS and the source SRNC, and Iu Bearers between the source SRNC and old-SGSN are already established. At this point (step 4) new Iu Bearers are being setup between the target RNC and new-SGSN. Later the existing RBs will be reallocated between the MS and the target RNC.~~ For each RAB ~~(Iu Bearer)~~ 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 up-link 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) ~~message~~ to the new SGSN. ~~The~~Each RAB to be setup is defined by a Transport Layer Address which is the target RNC Address for user data, and ~~the~~a Iu Transport Association which corresponds to the down-link Tunnel Endpoint Identifier for user data. The target RNC ~~will~~ may for each RAB to be set up ~~(defined by an IP Address and a Tunnel Endpoint Identifier)~~ receive simultaneously downlink~~DL~~ user packets both from the source SRNC and from the new SGSN~~both forwarded downlink PDUs from the source SRNC as well as downlink PDUs from the new SGSN~~.

After the new SGSN receives the Relocation Request Acknowledge message, the GTP-U tunnels are~~have been~~ established between the target RNC and the new-SGSN. ~~At this point, the target RNC shall be able to send/receive UL/DL user data respectively. New-SGSN shall be able to send/receive DL/UL user data respectively to/from target RNC and be able to send UL user data to GGSN. However, target RNC still acts as a drift RNC. That is, new-SGSN does not receive UL user data. GGSN sends DL user data only to old-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 theseey areis used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlinksend DL user data directly to the the target RNCse GTP-U tunnels over the Iu interface. Thise forwarding tunnel is performedused for downlink user dataDL transmission only., and the target RNC cannot send user data to source SRNC.

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 a 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 relocation preparation procedure is terminated successfully and 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) message 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 connections using RLC unacknowledged mode PDCP sequence number is not used. PDCP sequence numbers are only used when lossless SRNS relocation is configured for PDCP [57]. 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) ~~After having sent the Relocation Commit message, t~~The source ~~S~~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 data exchanged between the source ~~S~~RNC and the target RNC are duplicated in the source ~~S~~RNC and routed at the IP layer towards the target RNC.

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) ~~After having sent the Relocation Detect message, t~~The target SRNC ~~responds to the MS by send~~sends a Cell Update Confirm / URA Update Confirm message. ~~Both~~ This messages~~s~~ 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~~s~~ sending uplink~~UL~~ 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~~DL~~ 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~~UL~~ 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 requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. 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 MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.~~

~~13~~12) When the target SRNC receives the UTRAN Mobility Information Confirm~~RNTI Reallocation Complete~~ message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the ~~UE~~ 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.

~~14~~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.

~~15~~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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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".

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.

3GPP-SA WG2 Meeting #18 ***S2-011560***
Puerto Rico, 14-18 May 2001 **(revision of S2-011276)**

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **231** ⌘ rev **1** ⌘ Current version: **4.4.0** ⌘

*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:	⌘	Clarifications to Handling the user data during the SRNS Relocation Procedure
Source:	⌘	Nokia, Siemens,Ericsson
Work item code:	⌘	GPRS ***Date:*** ⌘ 23 May, 2001
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 definition of the SRNS Relocation procedure in 23.060 has the following flaws. The description of the procedure is not sufficiently accurate, and therefore the text may be interpreted in different ways. In fact, neither 23.121, nor 23.060 describes the dynamics of the user traffic flow during the procedure in a sufficiently detailed and clear way.

Besides, there is a number of errors that need to be corrected :

- For instance, Sub clauses 6.9.2.2.1 and 6.9.2.2.2 contain two contradicting statements: "This procedure is only performed for an MS in PMM-CONNECTED state" and "In the case described in figure 37/40 and figure 38/41 the MS is in state MM-IDLE".
- RRC specification 25.331 has changed and the respective text in 23.060 needs update. Indeed both messages RNTI Reallocation/ RNTI Reallocation Complete are now called UTRAN Mobility Information/UTRAN Mobility Information Confirm.

Moreover there are many editorial mistakes that need to be corrected:

- MS instead of UE (MS is used in the figures and in GPRS specs.).
- The steps 7 to 11 for section 1 and 3 and steps 7 to 9 for section 2 are not always handled in a sequential way.
- The letter S for Serving should be used only when one RNC has the Serving role (for example in the first section, steps 1-6 for Source, steps 10 to 14).
- Some layout and syntax mistakes.

Summary of change: ⌘ It is proposed to clarify how the up-link and down-link user data flows for all the cases of relocations, correct all the editorial mistakes (above mentioned ambiguities) and finally align 23.060 with 23.107 and 25.331 as well as the wording between the three sub sections that is to say the three cases of SRNS relocation.

Consequences if ⌘ If the CR is not approved, the SRNS Relocation procedure will still be presented

not approved:		in an ambiguous and confused way.

Clauses affected:	⌘	6.9.2.2		
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.

6.9.2.2 Serving RNS Relocation Procedures

6.9.2.2.1 Serving 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~~MM-IDLE~~.

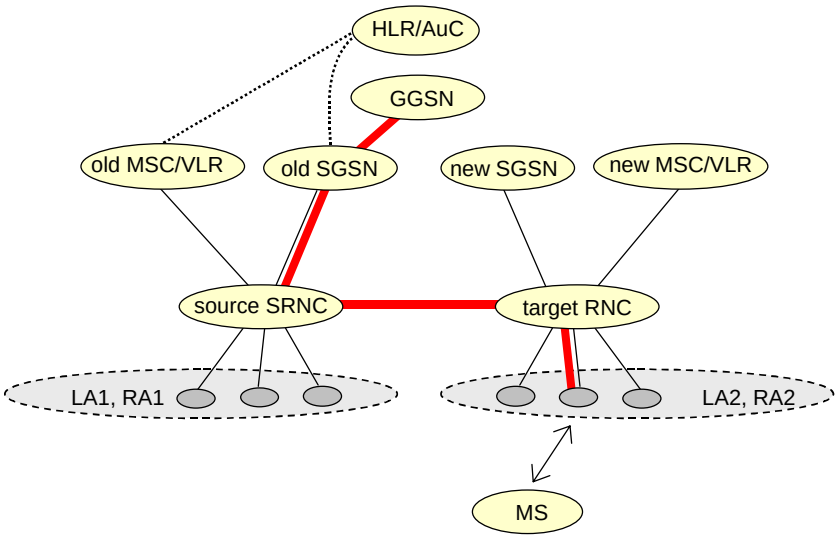


Figure 1: Before SRNS Relocation and Routeing Area Update

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).

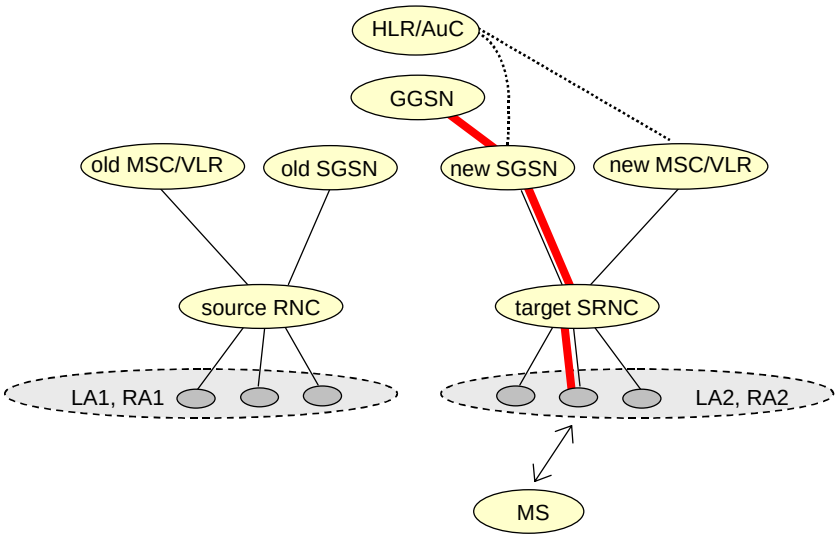
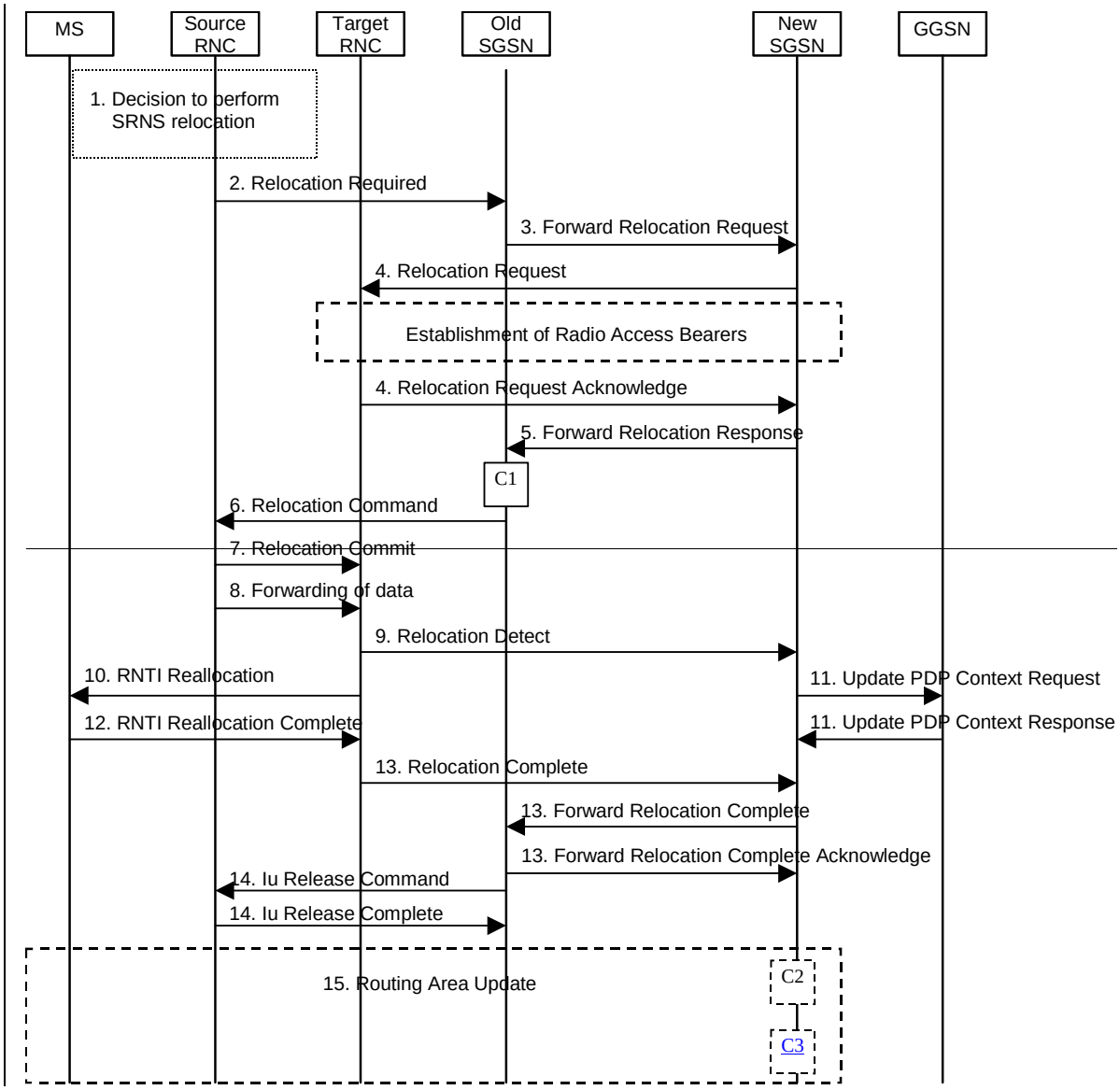


Figure 2: After SRNS Relocation and Routeing Area Update

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS relocation
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation Commit
8. Forwarding of data
9. Relocation Detect
10. RNTI Reallocation
11. Update PDP Context Request
12. RNTI Reallocation Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

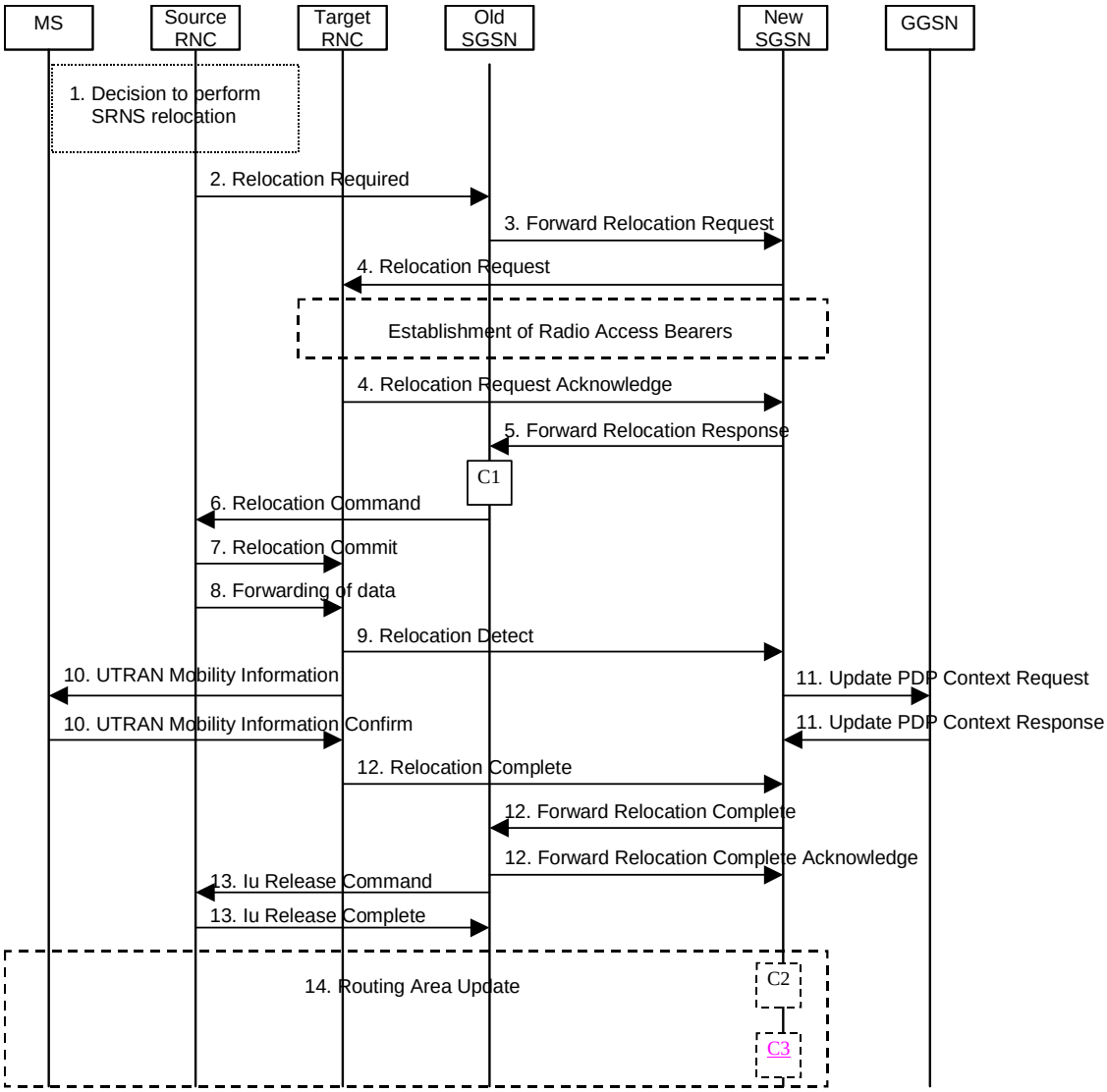


Figure 3: Serving SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate an 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 ~~initiates the relocation preparation procedure by~~ send~~s~~ing 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 ~~UE~~ 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 RAB requested to be established, 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. The target RNC ~~will~~ may for each RAB to be set up ~~(defined by an IP Address and a Tunnel Endpoint Identifier)~~ receive simultaneously downlink user packets both from the source SRNC and from the new SGSN~~both forwarded downlink PDUs from the source SRNC as well as downlink PDUs 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~~is~~ 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 a 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).

W~~hen the relocation preparation procedure is terminated successfully and w~~hen 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 connections using RLC unacknowledged mode PDCP sequence numbers is not used. . 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 used when lossless SRNS relocation is configured for PDCP [57].

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.

~~.~~

~~—~~If PDCP does not support lossless relocation, the acknowledged mode SRNS relocation procedures shall be performed as in unacknowledged mode. Hence PDCP sequence numbers shall not be transferred from the ~~old~~ source RNC to the target RNC.

Before sending the Relocation Commit uplink and downlink data transfer in the source, SRNC shall be suspended for RABs which require- loss-less relocation.

8) ~~After having sent the Relocation Commit message, t~~The source ~~S~~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 ~~S~~RNC and the target RNC are duplicated in the source ~~S~~RNC and routed at IP layer towards the target RNC.

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) ~~After having sent the Relocation Detect message, t~~The target SRNC ~~responds to the MS by sending~~ sends ~~an RNTI Reallocation~~a UTRAN Mobility Information message. ~~Both~~ This message~~s~~ 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 acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. 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.

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 MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC. From now on the exchange of packets with the MS can start.~~

~~13~~12) When the target SRNC receives the UTRAN Mobility Information Confirm~~RNTI Reallocation Complete~~ message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the ~~UE~~ 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.

~~14~~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.

~~15~~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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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"".

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~~MM IDLE~~ state.

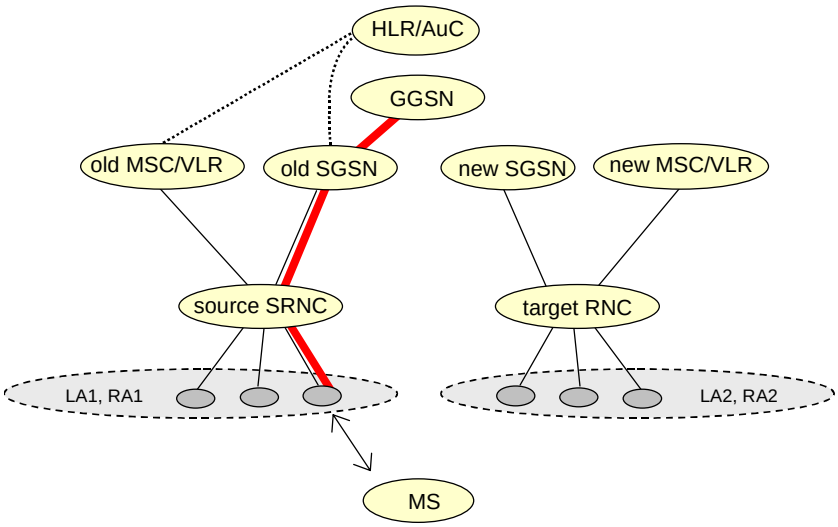


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

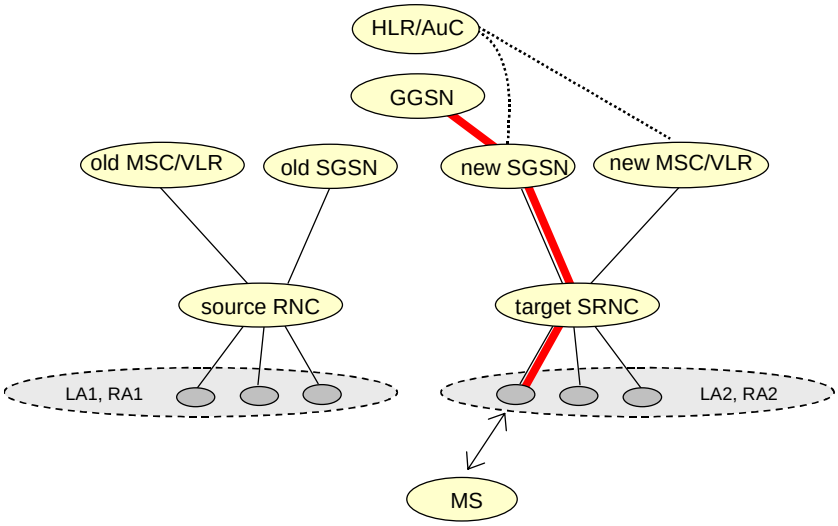
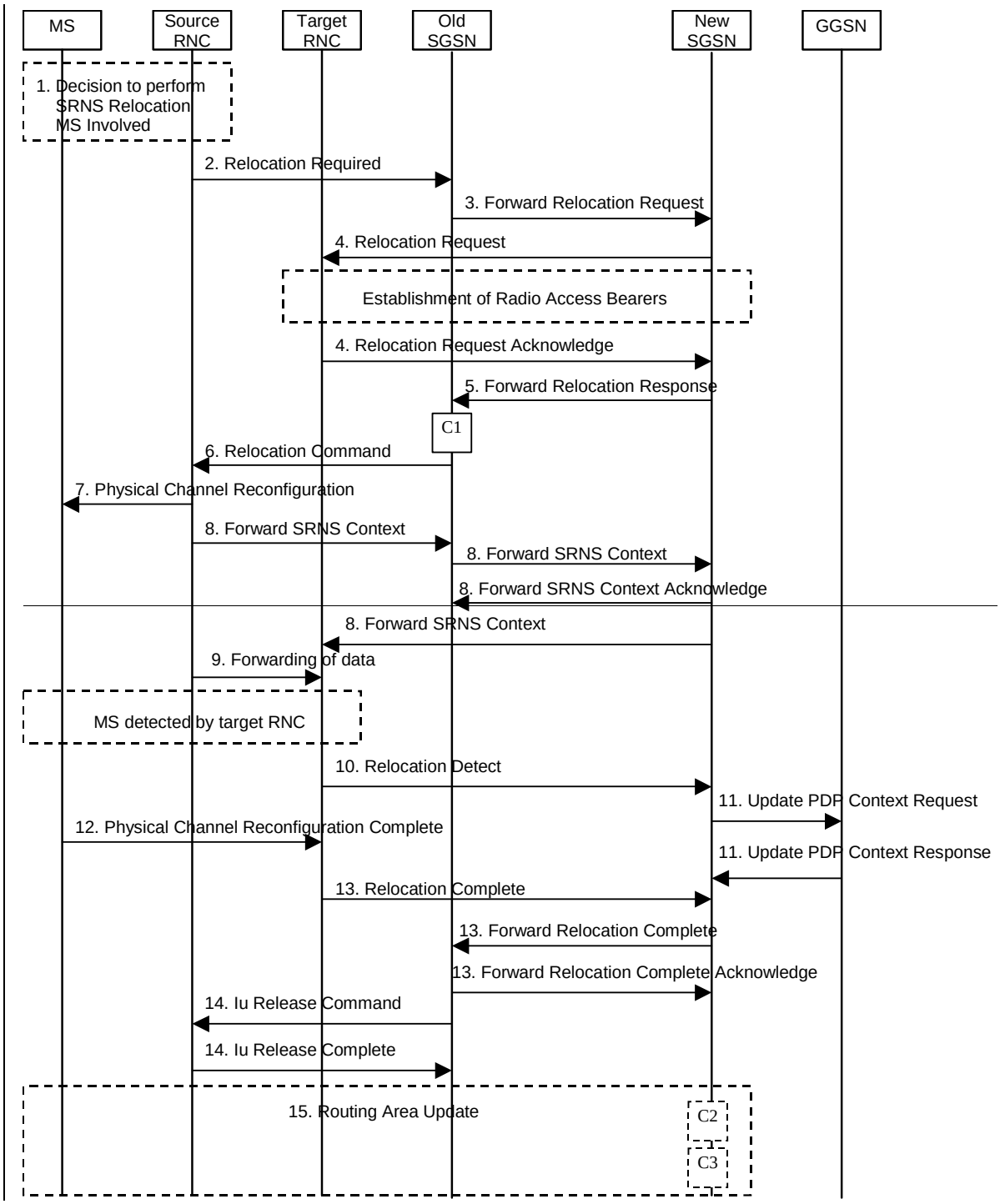


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS Relocation MS Involved
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Physical Channel Reconfiguration
8. Forward SRNS Context
8. Forward SRNS Context
8. Forward SRNS Context Acknowledge
8. Forward SRNS Context
9. Forwarding of data
MS detected by target RNC
10. Relocation Detect
11. Update PDP Context Request
12. Physical Channel Reconfiguration Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

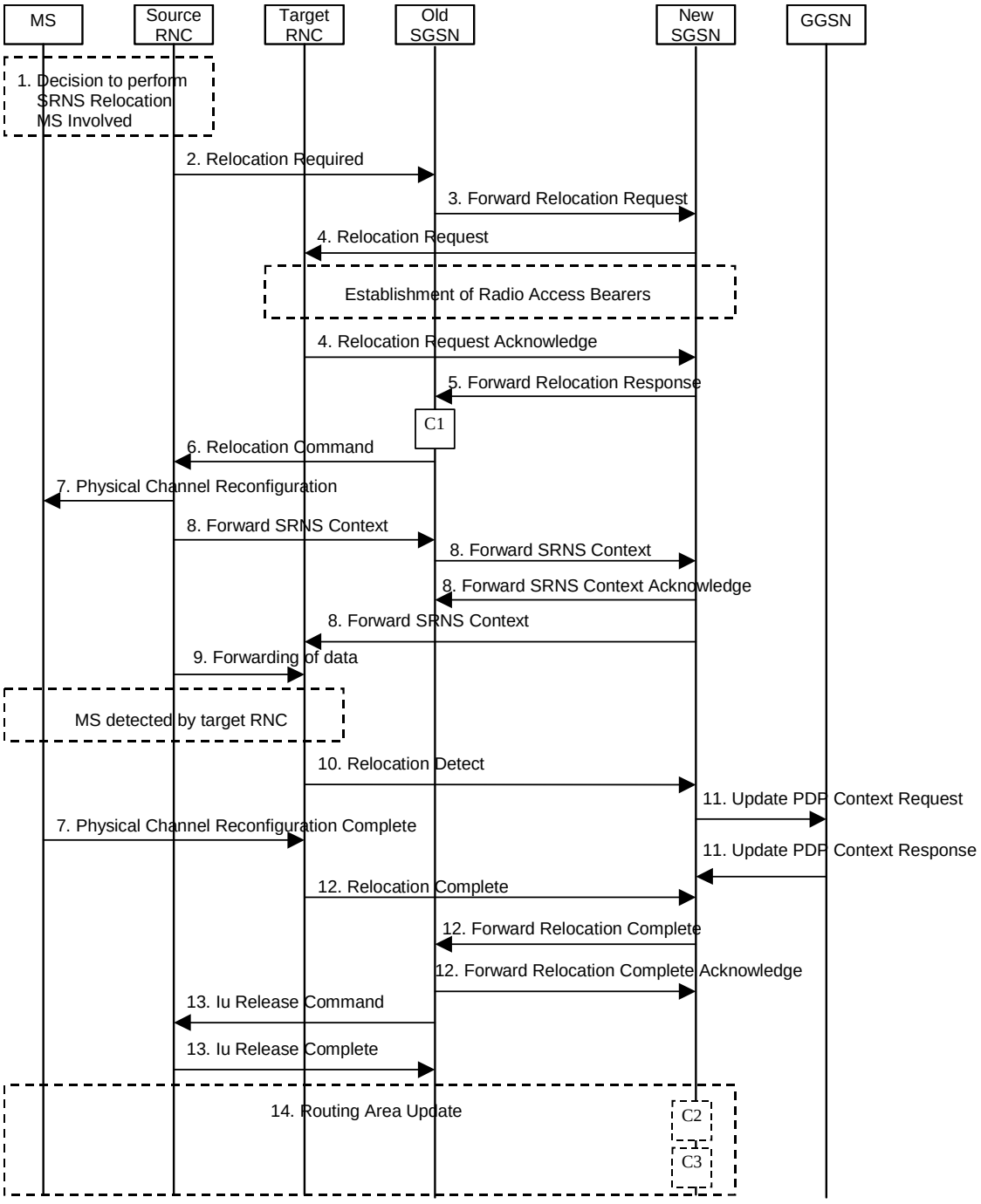


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

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 ~~initiates the relocation preparation procedure by~~ send~~s~~ing a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) ~~message~~ 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 ~~UE~~ 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) ~~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) ~~message~~ 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) ~~message~~ 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. The target RNC ~~will~~ may for each RAB to be set up ~~(defined by an IP Address and a Tunnel Endpoint Identifier)~~ receive simultaneously downlink user packets both from the source SRNC and from the new SGSN~~both forwarded downlink PDUs from the source SRNC as well as downlink PDUs 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) ~~message~~ 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~~is~~ 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 a 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 relocation preparation procedure is terminated successfully and the source SRNC is ready, the source ~~S~~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 ~~S~~RNC shall be suspended for RABs which require- loss-less relocation.

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 only used when lossless SRNS relocation is configured for PDCP [57]. 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 source ~~S~~RNC includes the PDCP sequence number, PDCP-SNU, in the RRC message which is indicated in the Target RNC to Source RNC transparent container to the MS. The MS informs the PDCP sequence number, PDCP-SND, to the target RNC in the corresponding RRC complete message. ~~——~~The target ~~S~~RNC establishes and/or restarts the RLC and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target ~~S~~RNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires loss-less relocation. PDCP-SND

confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then the target ~~S~~RNC shall discard these packets. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source ~~S~~RNC, the MS shall discard these packets.

9) ~~After having sent the Forward SRNS Context message, t~~The source ~~S~~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 ~~S~~RNC and the target RNC are duplicated in the source ~~S~~RNC and routed at the IP layer towards the target RNC.

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 MS has reconfigureditself, 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 SRNC may start the packet transfer for all RABs, which do not require maintaining the delivery order.~~

~~13~~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 ~~UE~~ 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.

~~14~~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.

~~15~~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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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".

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

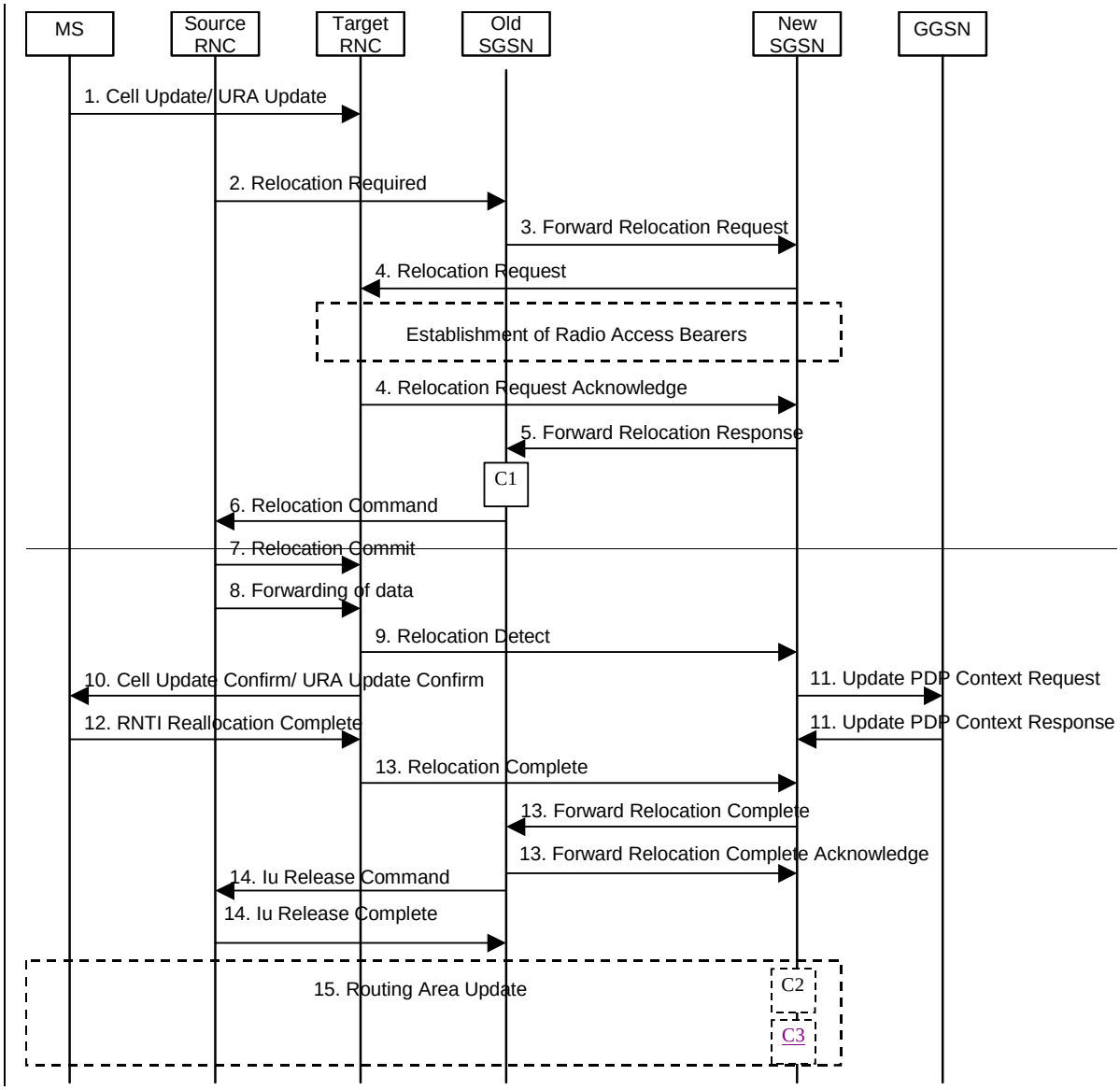
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur interface carries control signalling but no user data.

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Cell Update/ URA Update
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation Commit
8. Forwarding of data
9. Relocation Detect
10. Cell Update Confirm/ URA Update Confirm
11. Update PDP Context Request
12. RNTI Reallocation Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

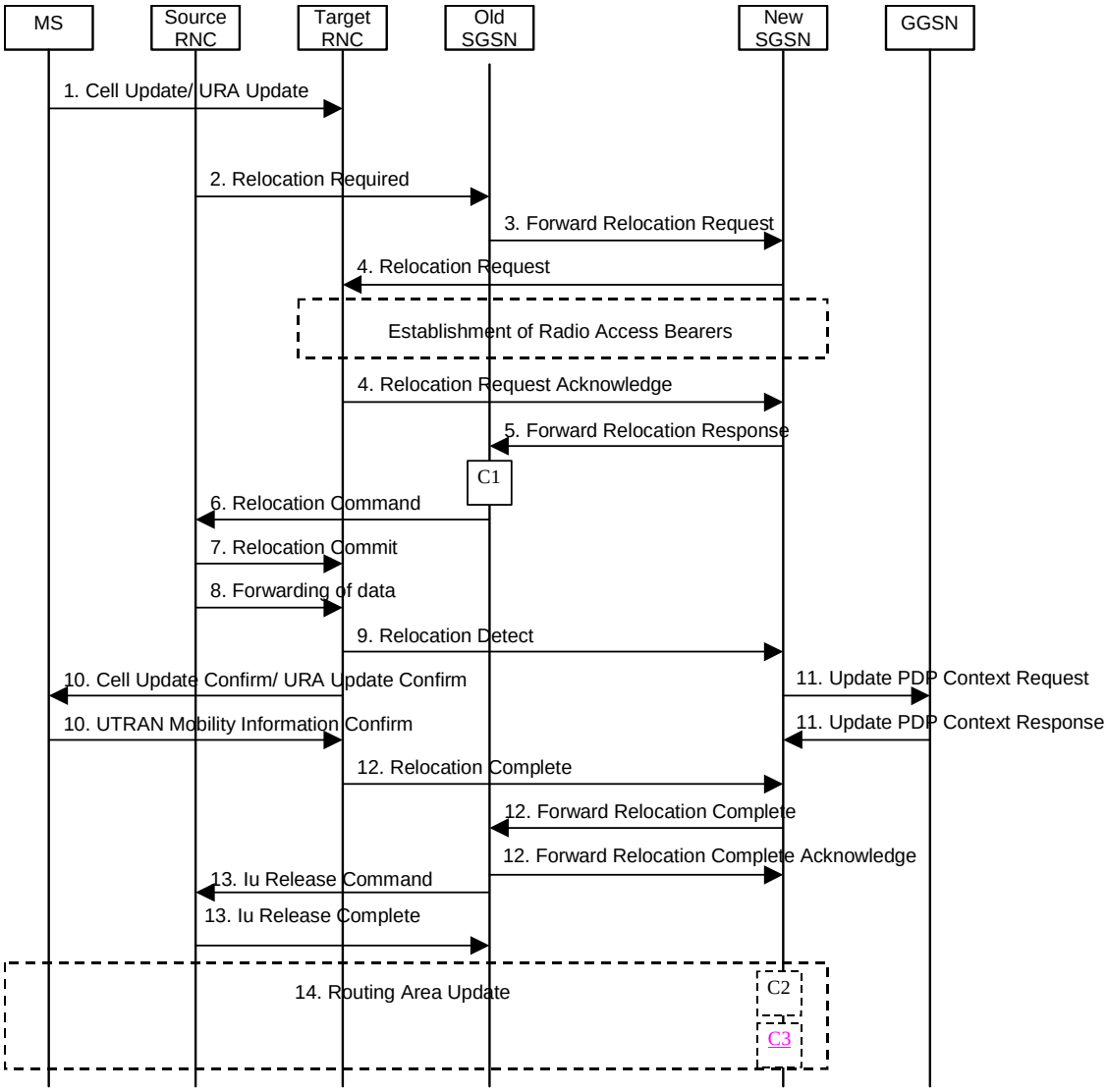


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

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 ~~initiates the relocation preparation procedure by~~ sends~~ing~~ 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 ~~UE~~ 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 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 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) ~~message~~ 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 ~~will~~ may for each RAB to be set up ~~(defined by an IP Address and a Tunnel Endpoint Identifier)~~ receive simultaneously downlink user packets both from the source SRNC and from the new SGSN~~both forwarded downlink PDUs from the source SRNC as well as downlink PDUs 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~~is~~ 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 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 a 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 relocation preparation procedure is terminated successfully and 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) ~~message~~ 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 connections using RLC unacknowledged mode PDCP sequence number is not used. PDCP sequence numbers are only used when lossless SRNS relocation is configured for PDCP [57]. 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) ~~After having sent the Relocation Commit message, t~~The source ~~S~~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 data exchanged between the source ~~S~~RNC and the target RNC are duplicated in the source ~~S~~RNC and routed at the IP layer towards the target RNC.

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) ~~After having sent the Relocation Detect message, t~~The target SRNC ~~responds to the MS by~~ send~~s~~ing a Cell Update Confirm / URA Update Confirm message. ~~Both~~ This message~~s~~ contain~~s~~ 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 requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, the target SRNC shall discard these packets. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. 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 MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.~~

~~13~~12) When the target SRNC receives the UTRAN Mobility Information Confirm~~RNTI Reallocation Complete~~ message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the ~~UE~~ 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.

~~14~~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.

~~15~~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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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".

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.

3GPP TSG-SA2 Meeting #18 **S2-011558**
Rio Grande, Puerto Rico, 14 May - 18 May 2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **224** ⌘ rev **1** ⌘ Current version: **3.7.0** ⌘

*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:	⌘	Data forwarding during 3G RAU in PMM CONNECTED state
Source:	⌘	Siemens AG
Work item code:	⌘	GPRS
Date:	⌘	2001-05-18
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:	⌘	CR 209 already discussed the scenario where a MS performing a 3G RAU is still PMM-CONNECTED in the old SGSN with an Iu-ps connection to the old RNC due to lack of Iur support . Further description is necessary for that case because the old SGSN, when receiving the acknowledge after successful context transfer to the new SGSN will start the SRNS Data Forward Command procedure towards the old RNC. This is due to the fact that the old SGSN has no means to distinguish between an intersystem change to 2G and a 3G RAU when it receives SGSN Context Request. But this distinction is not needed, as forwarding user data is necessary for a 3G RAU as pending user data may be buffered in the old RNC if the UE was in the CELL-FACH state before it has performed a cell reselection towards the new RNC.
Summary of change:	⌘	Clarification of data forwarding during 3G-RAU.
Consequences if not approved:	⌘	Missing stage 2 description may cause insufficient support of PDP Contexts with high reliability QoS attributes.

Clauses affected:	⌘	6.9.2.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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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://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.

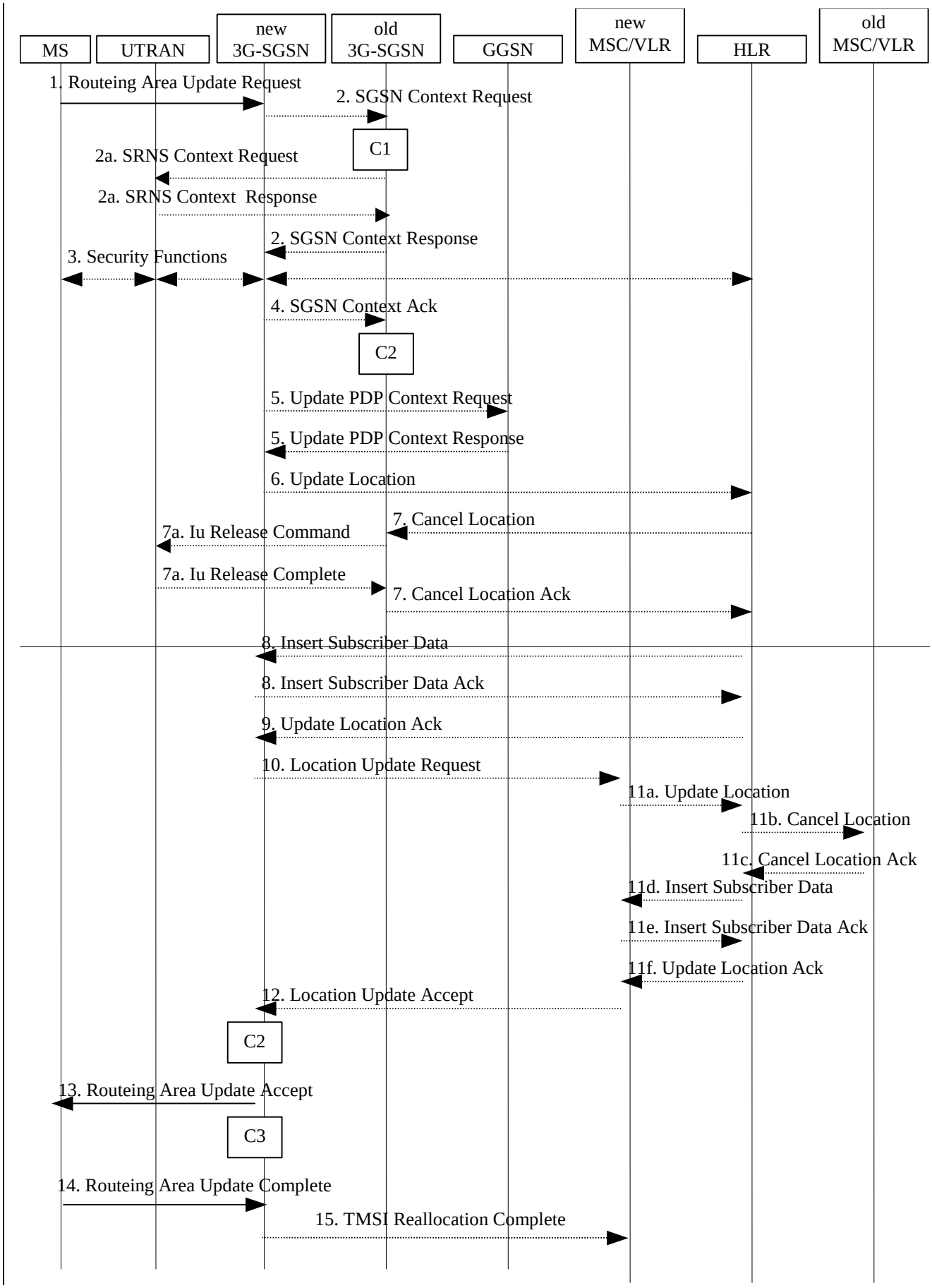
6.9.2.1 Routeing Area Update Procedure

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".

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 36.

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
UTRAN
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
2. SGSN Context Response
3. Security Functions
4. SGSN Context Ack
C2
5. Update PDP Context Request
5. Update PDP Context Response
6. Update Location
7. Cancel Location
7a. Iu Release Command
7a. Iu Release Complete
7. Cancel Location Ack
8. Insert Subscriber Data
8. Insert Subscriber Data Ack
9. Update Location Ack
10. Location Update Request
11a. Update Location
11b. Cancel Location
11c. Cancel Location Ack
11d. Insert Subscriber Data
11e. Insert Subscriber Data Ack
11f. Update Location Ack
12. Location Update Accept
C2
13. Routeing Area Update Accept
C3
14. Routeing Area Update Complete
15. TMSI Reallocation Complete

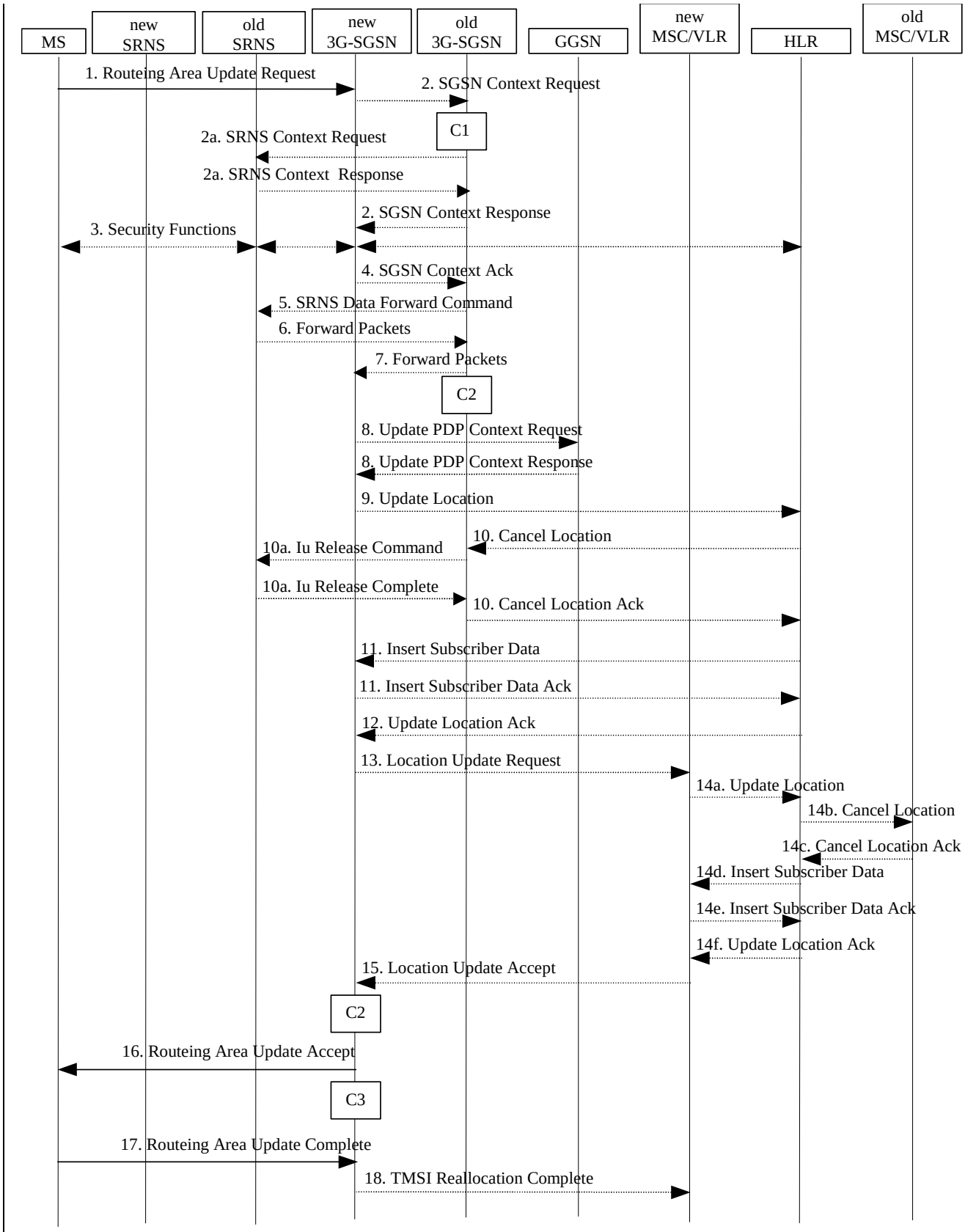


Figure 36: UMTS RA Update Procedure

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. A follow-on request shall be set by the MS 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 responds with SGSN Context Response (Cause, IMSI, 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 starts a timer. 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.

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 a new Iu connection, the old SGSN ~~shall~~ 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 from the SRNS. 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 using acknowledged mode, 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).

3) 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.

4) 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.

5) 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 a new Iu connection, 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.

6) The SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with the PDCP downlink sequence number, and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN.

7) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN.

8) ~~5)~~ If the RA update is an Inter-SGSN RA Update and if the MS was in PMM-IDLE state, 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, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

9) ~~6)~~ 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.

~~7)~~10) 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).

~~7a~~10a) On receipt of Cancel Location, ~~I~~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~~The SRNC responds with an Iu Release Complete message~~.

11) ~~8)~~ If the RA update is an inter-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.

12)~~9)~~ 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.

13)~~10)~~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~~11). The VLR creates or updates the association with the SGSN by storing SGSN Number.

14)~~11)~~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) ~~12)~~ 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.

16) ~~13)~~ 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 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).

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

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

~~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.~~

~~If the MS has sent the Service Request with service type 'data' or the 3G-SGSN has pending DL data, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request.~~

NOTE: Steps 1~~1~~4, 1~~2~~5, and 1~~5~~8 are performed only if step 12~~9~~ 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 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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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"".

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"".

3GPP TSG-SA2 Meeting #18 ***S2-011260***
Rio Grande, Puerto Rico, 14 May - 18 May 2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **225** ⌘ rev ⌘ Current version: **4.0.0** ⌘

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

Title:	⌘	Data forwarding during 3G RAU in PMM CONNECTED state
Source:	⌘	Siemens AG
Work item code:	⌘	TEI4
Date:	⌘	2001-05-18
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.

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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 209 already discussed the scenario where a MS performing a 3G RAU is still PMM-CONNECTED in the old SGSN with an Iu-ps connection to the old RNC due to lack of Iur support . Further description is necessary for that case because the old SGSN, when receiving the acknowledge after successful context transfer to the new SGSN will start the SRNS Data Forward Command procedure towards the old RNC. This is due to the fact that the old SGSN has no means to distinguish between an intersystem change to 2G and a 3G RAU when it receives SGSN Context Request. But this distinction is not needed, as forwarding user data is necessary for a 3G RAU as pending user data may be buffered in the old RNC if the UE was in the CELL-FACH state before it has performed a cell reselection towards the new RNC.
Summary of change:	⌘	Clarification of data forwarding during 3G-RAU.
Consequences if not approved:	⌘	Missing stage 2 description may cause insufficient support of PDP Contexts with high reliability QoS attributes.

Clauses affected:	⌘	6.9.2.1
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.

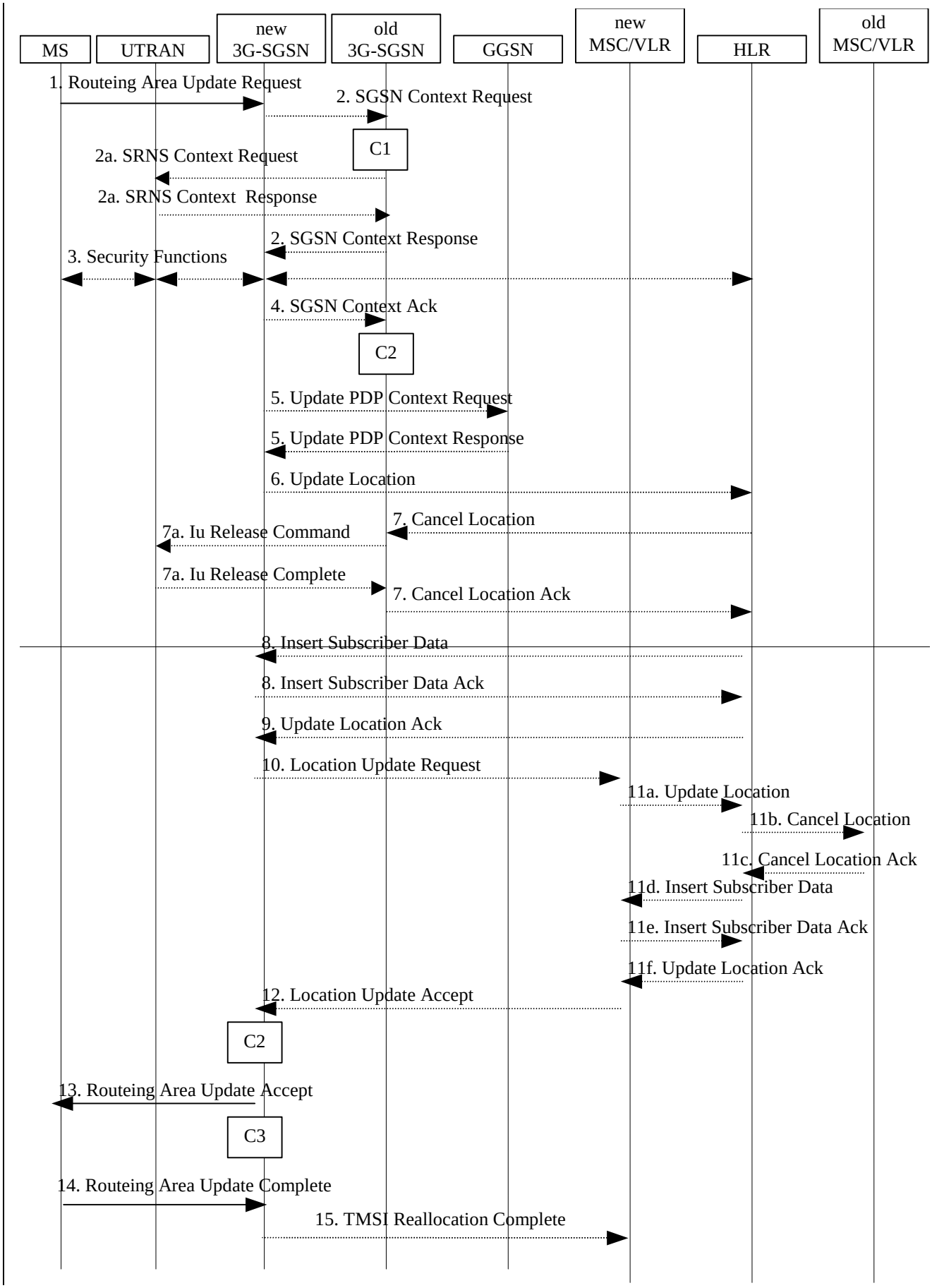
6.9.2.1 Routeing Area Update Procedure

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".

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 36.

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
UTRAN
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
2. SGSN Context Response
3. Security Functions
4. SGSN Context Ack
C2
5. Update PDP Context Request
5. Update PDP Context Response
6. Update Location
7. Cancel Location
7a. Iu Release Command
7a. Iu Release Complete
7. Cancel Location Ack
8. Insert Subscriber Data
8. Insert Subscriber Data Ack
9. Update Location Ack
10. Location Update Request
11a. Update Location
11b. Cancel Location
11c. Cancel Location Ack
11d. Insert Subscriber Data
11e. Insert Subscriber Data Ack
11f. Update Location Ack
12. Location Update Accept
C2
13. Routeing Area Update Accept
C3
14. Routeing Area Update Complete
15. TMSI Reallocation Complete

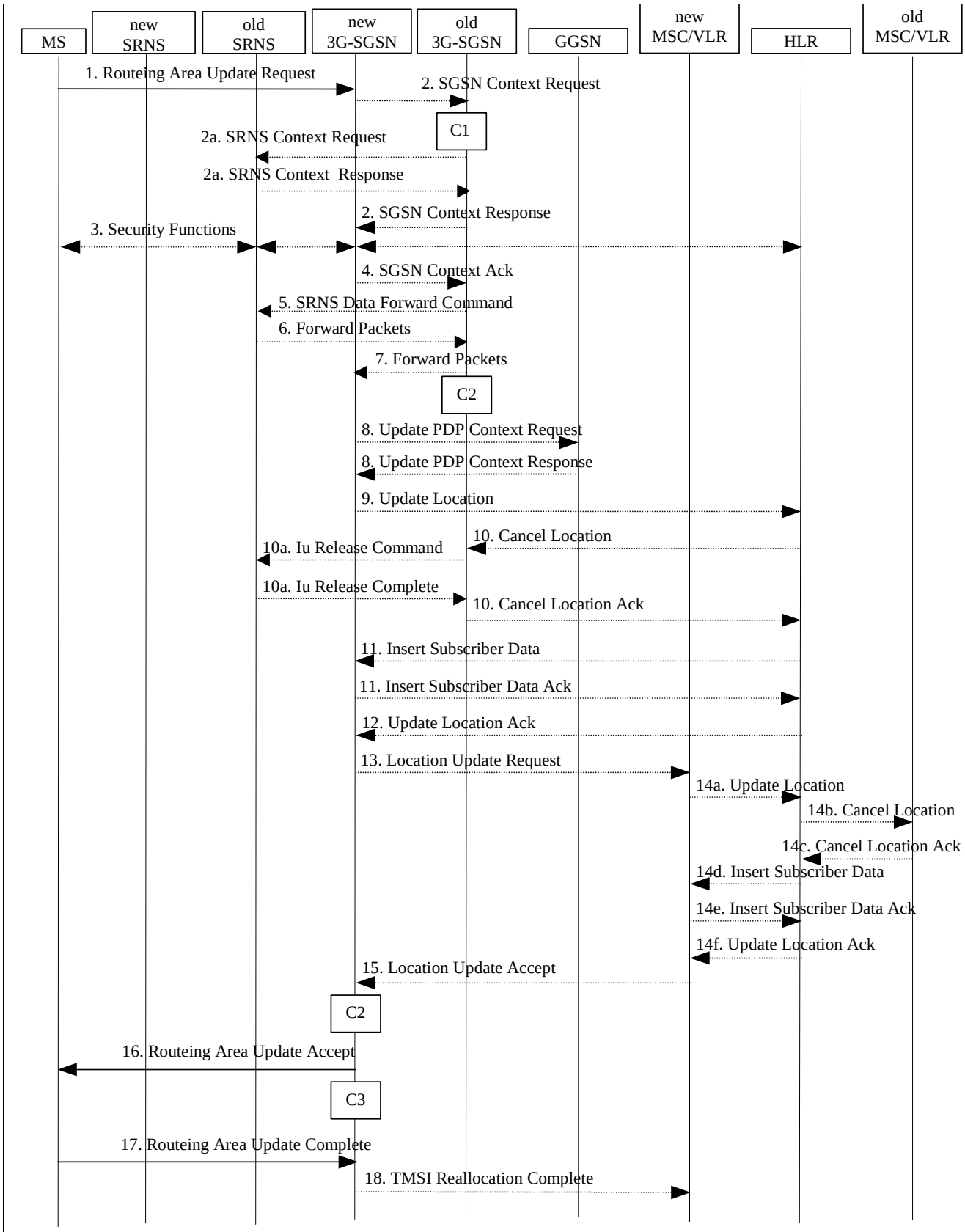


Figure 36: UMTS RA Update Procedure

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. A follow-on request shall be set by the MS 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 responds with SGSN Context Response (Cause, IMSI, 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 starts a timer. 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.

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 a new Iu connection, the old SGSN ~~shall~~ 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 from the SRNS. 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 using acknowledged mode, 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).

3) 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.

4) 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.

5) 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 a new Iu connection, 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.

6) The SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with the PDCP downlink sequence number, and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN.

7) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN.

8) ~~5)~~ If the RA update is an Inter-SGSN RA Update and if the MS was in PMM-IDLE state, 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, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

9) ~~6)~~ 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.

~~7)~~10) 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).

~~7a~~10a) On receipt of Cancel Location, ~~I~~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~~The SRNC responds with an Iu Release Complete message~~.

11) ~~8)~~ If the RA update is an inter-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.

12)~~9)~~ 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.

13)~~10)~~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~~11). The VLR creates or updates the association with the SGSN by storing SGSN Number.

14)~~11)~~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) ~~12)~~ 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.

16) ~~13)~~ 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 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).

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

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

~~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.~~

~~If the MS has sent the Service Request with service type 'data' or the 3G-SGSN has pending DL data, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request.~~

NOTE: Steps 1~~1~~4, 1~~2~~5, and 1~~5~~8 are performed only if step 12~~9~~ 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 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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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"".

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"".

3GPP TSG-SA WG2 Meeting #18
Puerto Rico, 14th - 18th May 2001

Tdoc S2-011469 ***(revision of S2-011225)***

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **222** ⌘ rev **1** ⌘ Current version: **3.7.0** ⌘

*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:	⌘	Forbid usage of TFT in case of virtual dial-up access with PPP frame tunneling in GGSN
Source:	⌘	Alcatel
Work item code:	⌘	TEI
Date:	⌘	May 14th
Category:	⌘	**F**
Release:	⌘	R99~~EL-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:	⌘	Current 23.060 allows usage of PPP PDP type even if GGSN is carrying out PPP relaying ("virtual dial-up access with PPP frame tunneling in GGSN" using e.g. L2TP). As in this case GGSN is only ensuring layer 2 switching, GGSN cannot handle layer 3 parameters required by TFT settings. Furthermore the sentence " If PPP carries header-compressed IP packets, then a TFT cannot be used" should not apply to the case where PPP (compression) is terminated in GGSN
Summary of change:	⌘	Forbid usage of TFT in that case
Consequences if not approved:	⌘	If GGSN is only ensuring layer 2 tunneling and either no IP traffic is carried on the PPP session or the PPP session is ciphered/compressed (without GGSN knowing it) then Unpredictable behaviour can happen.

Clauses affected:	⌘	9.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:
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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.

9.3 Packet Routeing and Transfer Function

The packet routeing and transfer function:

- routes and transfers packets between a mobile TE and an external 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 is identified by a tunnel endpoint identifier (TEID) and a GSN address.

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. ~~If PPP carries header-compressed IP packets, then a TFT cannot be used.~~

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.

3GPP TSG-SA WG2 Meeting #18
Puerto Rico, 14th - 18th May 2001

Tdoc S2-011470 ***(revision of S2-011226)***

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **223** ⌘ rev **1** ⌘ Current version: **4.0.0** ⌘

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Clauses affected:	⌘	9.3		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

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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. ~~If PPP carries header-compressed IP packets, then a TFT cannot be used.~~

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.

3GPP TSG-SA2 Meeting #18
Puerto Rico, USA, 14-18 May 2001

S2-011569rev21

CR-Form-v3

CHANGE REQUEST

⌘ **23.060er** **CR** **236** ⌘ rev **Rev 21** ⌘ Current version: **3.7.0** ⌘

*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:	⌘	Handling of Charging Characterictics for roaming users
Source:	⌘	Alcatel
Work item code:	⌘	TEI
Date:	⌘	23~~18~~ May 2001
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 current description of the handling of Charging Characteristics in section 9.2.2.1 "PDP Context Activation Procedure" has lead to a number of misunderstandings among TSG WGs (as seen from the LSs received by SA2), and seems to not fulfil operator's requirements regarding charging of roaming users.
Summary of change:	⌘	~~It is clarified in sub-clause 9.2.2.1 "PDP Context Activation Procedure" that: When the MS is roaming into a VPLMN and the GGSN is located in the HPLMN, the SGSN may ignore any HLR supplied Charging Characteristics for its own usage but shall transfer the HLR supplied Charging Characteristics to the GGSN. The sentence "Charging characteristics shall be ignored for roaming subscribers" in section 15.1 is also proposed to be removed.~~ 23.060 should not be too explicit on the handling of Charging Characteritics and only refer to 32.015 where an accurate description of these items should be given This would avoid the duplication of information that can only lead to inconsistencies and implementation mismatch
Consequences if not approved:	⌘	If this CR is not approved, potential misinterpretations could lead to implementations that incompletely fulfil operator's charging requirements.

Clauses affected:	⌘	9.2.2.1, 15.1		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1~~Figure 1~~Figure 1 and Figure 2~~Figure 3~~Figure 2.

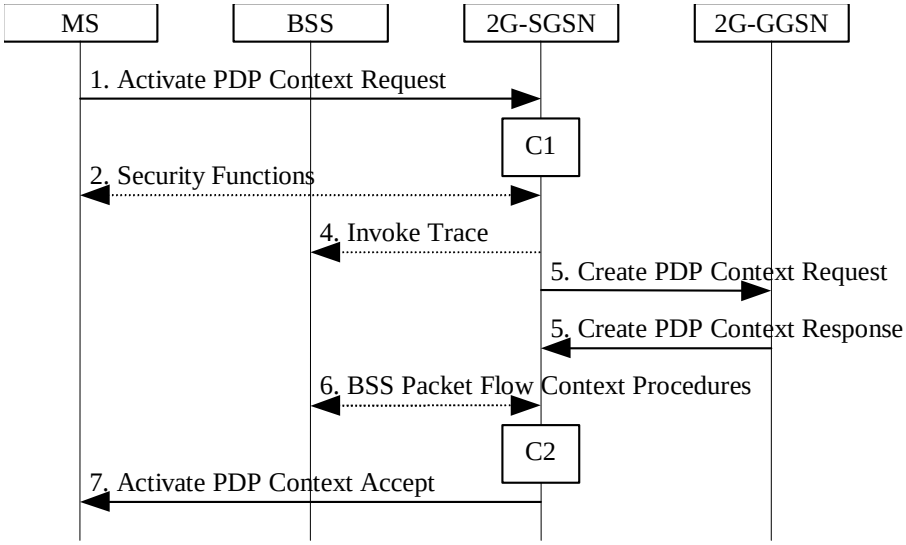

Figure 11: PDP Context Activation Procedure for GSM

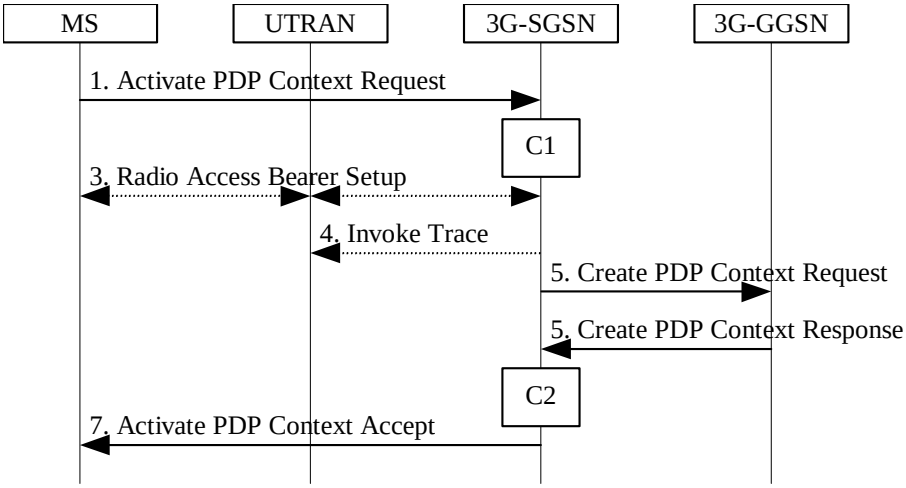

Figure 232: PDP Context Activation Procedure for UMTS

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

2) In A/Gb mode, security functions may be executed. These procedures are defined in subclause "Security Function".

3) In Iu mode, RAB setup is done by the RAB Assignment procedure, see subclause "RAB Assignment Procedure".

4) If BSS trace is activated, 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.

5) 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 SGSN shall derive Charging Characteristics from Subscribed Charging Characteristics and/or PDP context Charging Characteristics if received from the HLR as follows: if a "PDP context Charging Characteristics" is present for this PDP context, it shall be sent; otherwise if a "Subscribed Charging Characteristics" is present for this subscriber it shall be sent. If neither "PDP context Charging Characteristics" nor a "Subscribed Charging Characteristics" is present, the SGSN may choose a default Charging Characteristics which would be sent to the GGSN, and used there as well. The Charging Characteristics sent to the GGSN shall also include an indication whether it was retrieved from subscription data received from the HLR or is a default profile determined by the SGSN~~ 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 3G TS 32.015 [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 3G TS 32.015 [70].~~. When the Charging Characteristics sent by the SGSN have been determined by the SGSN (not retrieved from HLR subscription data), the GGSN may choose to ignore this. The charging characteristics on the GPRS subscription and individually subscribed APNs are specified in 3G TS 32.015 [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.

6) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

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

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

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

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

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 1~~Figure 1~~~~Figure 1~~ and Figure 2~~Figure 3~~~~Figure 2~~, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 1~~Figure 1~~~~Figure 1~~ and Figure 2~~Figure 3~~~~Figure 2~~, procedures return as result "Continue".

*** Next Modification ***

15.1 Charging

Charging information for the packet domain is collected for each MS by SGSNs and GGSNs that are serving the MS. The operator can control whether charging shall be collected in the SGSN and the GGSN on an individual MS and/or PDP context basis by appropriately setting the Subscribed Charging Characteristics and/or PDP context Charging Characteristics in the HLR. ~~Charging characteristics shall be ignored for roaming subscribers.~~ The charging characteristics on the GPRS subscription and individually subscribed APNs are specified in 3G TS 32.015 [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 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 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 3G TS 23.078.

3GPP TSG-SA2 Meeting #18
Puerto Rico, USA, 14-18 May 2001

S2-011569rev21

CR-Form-v3

CHANGE REQUEST

⌘ **23.060er** **CR** **237** ⌘ rev **Rev 21** ⌘ Current version: **4.0.0** ⌘

*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:	⌘	Handling of Charging Characterictics for roaming users
Source:	⌘	Alcatel
Work item code:	⌘	TEI4
Date:	⌘	23~~18~~ May 2001
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 current description of the handling of Charging Characteristics in section 9.2.2.1 "PDP Context Activation Procedure" has lead to a number of misunderstandings among TSG WGs (as seen from the LSs received by SA2), and seems to not fulfil operator's requirements regarding charging of roaming users.
Summary of change:	⌘	~~It is clarified in sub-clause 9.2.2.1 "PDP Context Activation Procedure" that: When the MS is roaming into a VPLMN and the GGSN is located in the HPLMN, the SGSN may ignore any HLR supplied Charging Characteristics for its own usage but shall transfer the HLR supplied Charging Characteristics to the GGSN. The sentence "Charging characteristics shall be ignored for roaming subscribers" in section 15.1 is also proposed to be removed.~~ 23.060 should not be too explicit on the handling of Charging Characteritics and only refer to 32.215 where an accurate description of these items should be given This would avoid the duplication of information that can only lead to inconsistencies and implementation mismatch The reference to 32.215 forf release 4, instead of 32.015, is also updated.
Consequences if not approved:	⌘	If this CR is not approved, potential misinterpretations could lead to implementations that incompletely fulfil operator's charging requirements.

Clauses affected:	⌘	2, 9.2.2.1, 15.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	The title of TS 32.215 is still provisional in SA5 at the time of writing.

2 References

The following documents contain provisions, which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); GPRS ciphering algorithm requirements".

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

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

[5] 3G TS 23.007: "Restoration procedures".

[5b] 3G 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: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

[7b] 3G TS 23.122: "Non Access Stratum functions related to Mobile Station (MS) in idle mode".

[8] 3G TS 23.040: "Technical realisation of the Short Message Service (SMS); Point-to-Point (PP)".

[8b] 3G TS 23.078: "Customised Applications for Mobile Network Enhanced Logic (CAMEL) Phase 3 – Stage 2".

[11] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); Overall description of the General Packet Radio Service (GPRS) Radio interface; Stage 2".

[12] 3G TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[13] 3G 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] 3G TS 27.060: "General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS".

[18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile 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+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

[23] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[24] 3G TS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".

[25] 3G TS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".

[26] 3G TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[27] 3G TS 29.061: "General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".

[27b] 3G TS 29.078: "3rd Generation Partnership Project; 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] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

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

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

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

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

[34] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

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

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

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

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

[43] IETF RFC 1034 (1987): "Domain Names – Concepts and Facilities" (STD 7).

[44] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

[45] IETF RFC 1542 (1993): "Clarification and Extensions for the Bootstrap Protocol".

[46] IETF RFC 2002 (1996): "IPv4 Mobility Support".

[47] IETF RFC 2131 (1997): "Dynamic Host Configuration Protocol".

[49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.

[50] 3G TS 25.301: "Radio Interface Protocol Architecture".

[51] 3G TS 25.303: "UE Functions and Interlayer Procedures in Connected Mode".

[51b] 3G TS 25.304: "UE Procedures in Idle Mode and Procedures for Call Reselection in Connected Mode".

[52] 3G TS 25.331: "RRC Protocol Specification".

[53] 3G TS 25.401: "UTRAN Overall Description".

[54] 3G TS 23.121: "Architectural Requirements for Release 1999".

[55] 3G TS 25.322: "RLC Protocol Specification".

[56] 3G TS 25.412: "UTRAN Iu Interface Signalling Transport".

[56b] 3G TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[57] 3G TS 25.323: "Packet Data Convergence Protocol (PDCP) protocol".

[58] 3G TS 23.107: "Quality of Service, Concept and Architecture".

[59] ITU-T Recommendation I.361: "B-ISDN ATM Layer Specification".

[60] 3G TS 25.321: "Medium Access Control (MAC) Protocol Specification".

[61] 3G TS 33.102: "Security Architecture".

[62] 3G TS 22.002: "Circuit Bearer Services Supported by a PLMN".

[63] 3G TS 25.411: "UTRAN Iu interface Layer 1".

[64] 3G TS 25.414: "UTRAN Iu interface data transport & transport signalling".

[65] 3G TS 23.171: "Functional stage 2 description of location services in UMTS".

[66] 3G TS 23.015: "Technical realization of operator determined barring (ODB)".

[67] ITU-T Recommendation I.363.5: "B-ISDN ATM Adaptation Layer Specification: Type 5 AAL".

[68] IETF RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[69] IETF RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[70] 3G TS 32.0215: "~~GSM call and event~~Charging data description for the packet switched domain".

[71] IETF RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)".

*** Next Modification ***

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1~~Figure 1~~Figure 1 and Figure 2~~Figure 3~~Figure 2.

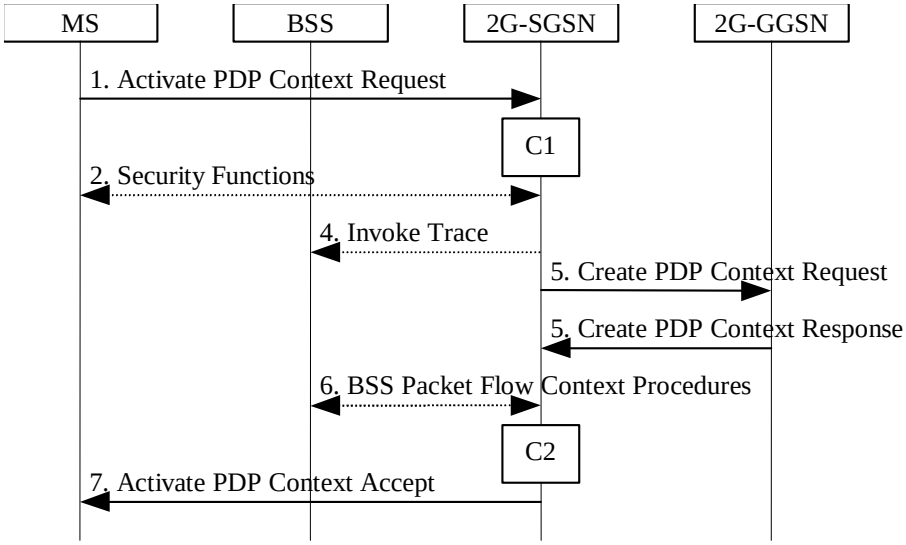

Figure 1~~1~~: PDP Context Activation Procedure for GSM

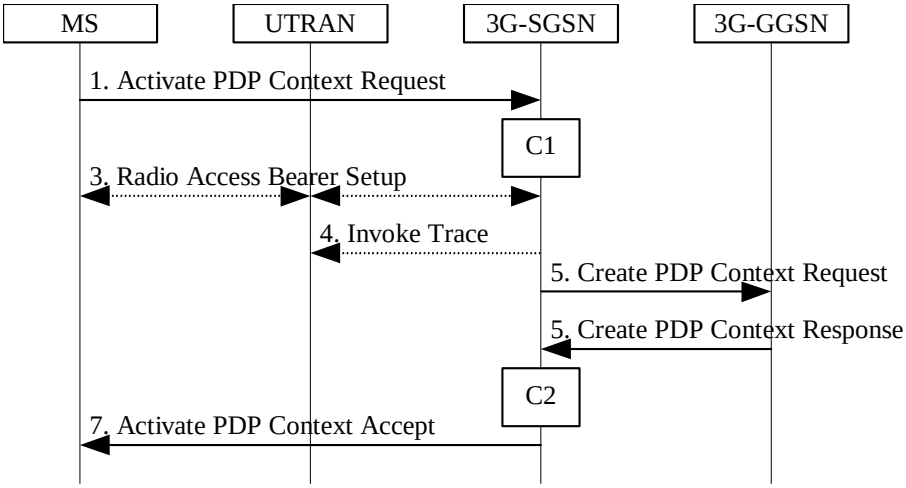

Figure 2~~3~~2: PDP Context Activation Procedure for UMTS

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

2) In A/Gb mode, security functions may be executed. These procedures are defined in subclause "Security Function".

3) In Iu mode, RAB setup is done by the RAB Assignment procedure, see subclause "RAB Assignment Procedure".

4) If BSS trace is activated, 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.

5) 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 SGSN shall derive Charging Characteristics from Subscribed Charging Characteristics and/or PDP context Charging Characteristics if received from the HLR as follows: if a "PDP context Charging Characteristics" is present for this PDP context, it shall be sent; otherwise if a "Subscribed Charging Characteristics" is present for this subscriber it shall be sent. If neither "PDP context Charging Characteristics" nor a "Subscribed Charging Characteristics" is present, the SGSN may choose a default Charging Characteristics which would be sent to the GGSN, and used there as well. The Charging Characteristics sent to the GGSN shall also include an indication whether it was retrieved from subscription data received from the HLR or is a default profile determined by the SGSN~~ 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 3G 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 3G TS 32.215 [70].~~. When the Charging Characteristics sent by the SGSN have been determined by the SGSN (not retrieved from HLR subscription data), the GGSN may choose to ignore this. The charging characteristics on the GPRS subscription and individually subscribed APNs are specified in 3G TS 32.015 [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.

6) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

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

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

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

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

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 1~~Figure 1~~Figure 1 and Figure 2~~Figure 3~~~~Figure 2~~, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 1~~Figure 1~~Figure 1 and Figure 2~~Figure 3~~~~Figure 2~~, procedures return as result "Continue".

*** Next Modification ***

15.1 Charging

Charging information for the packet domain is collected for each MS by SGSNs and GGSNs that are serving the MS. The operator can control whether charging shall be collected in the SGSN and the GGSN on an individual MS and/or PDP context basis by appropriately setting the Subscribed Charging Characteristics and/or PDP context Charging Characteristics in the HLR. ~~Charging characteristics shall be ignored for roaming subscribers.~~ The charging characteristics on the GPRS subscription and individually subscribed APNs are specified in 3G 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 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 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 3G TS 23.078.

3GPP TSG-SA WG2 Meeting #08 ***Tdoc S2-011464***
Rio Grande, Puerto Rico, 14-18 May 2001

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CHANGE REQUEST

⌘ **23.060** **CR** **234** ⌘ rev **-** ⌘ Current version: **3.7.0** ⌘

*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:	⌘	Specification of Relocation Cancel procedure
Source:	⌘	Motorola
Work item code:	⌘	TEI
Date:	⌘	May 08, 2001
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 SRNS Relocation Cancel procedure is not specified in stage 2 and this creates confusion and misalignment of stage 3 specifications. Also, it is not clear how this procedure can be triggered and how it should be carried out.
Summary of change:	⌘	A new section, 6.9.2.2.4 is created to specify the SRNS Relocation Cancel procedure.
Consequences if not approved:	⌘	If SRNS Relocation Cancel procedure is not specified in stage 2 there will be no common baseline for stage 3 specifications. This can create misunderstanding and can lead to different implementations.

Clauses affected:	⌘	6.9.2.2.4 (new section)
Other specs affected:	⌘	☐ Other core specifications ⌘ TS 29.060 ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	One additional parameter (RANAP Cause) is added to the Relocation Cancel Request message specified in TS 29.060. The CR in N4-010568, which is submitted to N4 for approval, proposes the addition of RANAP Cause in the Relocation Cancel Request. TS 25.413 specifies 2 timers (TRELOCcomplete and TRELOCprep), which should trigger the Relocation Cancel procedure when one of them expires at the source RNC. Liaison statement to RAN3 has been drafted in S2-011459.

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.

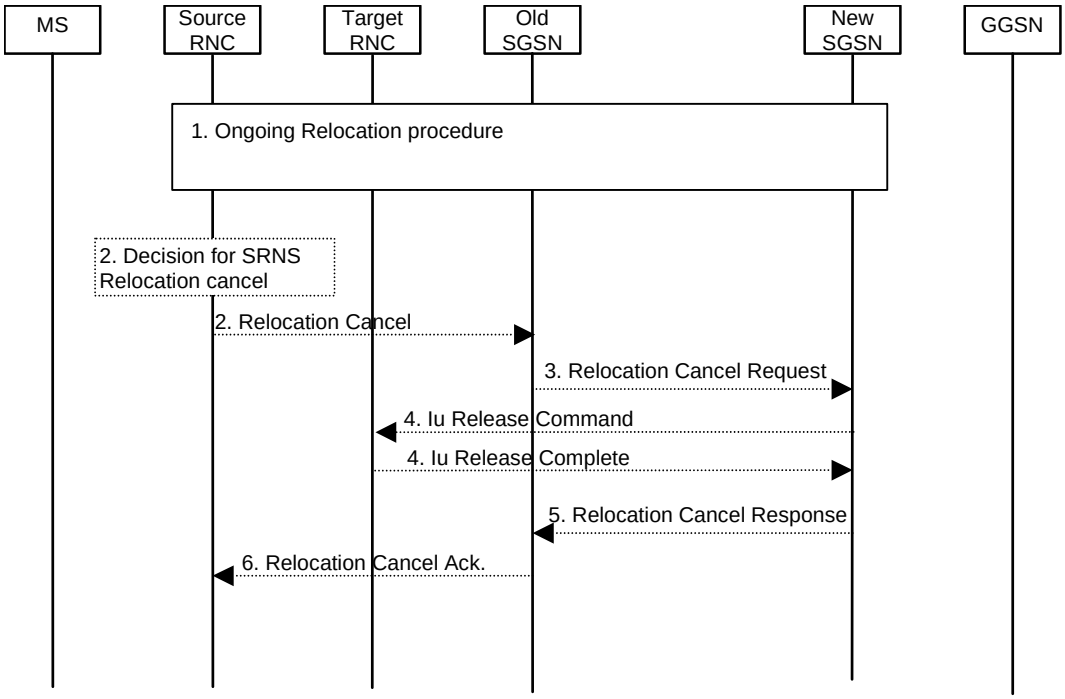

Figure 43a: SRNS Relocation Cancel Procedure

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 decides 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, where 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 SRNS relocation for the MS specified by IMSI should be cancelled at the target RNC. 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) Finally, the old SGSN responds to the source RNC with a Relocation Cancel Ack message.

3GPP TSG-SA WG2 Meeting #08
Rio Grande, Puerto Rico, 14-18 May 2001

Tdoc S2-011489~~213~~

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **221r1** ⌘ rev **-** ⌘ Current version: **4.0.0** ⌘

*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:	⌘	Specification of Relocation Cancel procedure
Source:	⌘	Motorola
Work item code:	⌘	~~GPRS~~TEI
Date:	⌘	May 08, 2001
Category:	⌘	~~**B**~~ **F**
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 SRNS Relocation Cancel procedure is not specified in stage 2 and this creates confusion and misalignment of stage 3 specifications. Also, it is not clear how this procedure can be triggered and how it should be carried out.
Summary of change:	⌘	A new section, 6.9.2.2.4 is created to specify the SRNS Relocation Cancel procedure.
Consequences if not approved:	⌘	If SRNS Relocation Cancel procedure is not specified in stage 2 there will be no common baseline for stage 3 specifications. This can create misunderstanding and can lead to different implementations due to race conditions created by existence of 2 decisions points with respect to initiation of Relocation Cancel procedure ~~.~~

Clauses affected:	⌘	6.9.2.2.4 (new section)		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	TS 25.413
Other comments:	⌘	Two additional parameters are added to the Relocation Cancel Request message specified in TS 29.060. The corresponding CR for 29.060 is in N4-010568. TS 25.413 specifies 2 timers (TRELOCcomplete and TRELOCprep), which should trigger the Relocation Cancel procedure when one of them expires at the SRNC. Liaison statement to RAN3 has been drafted in S2-011459.		

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 ~~either~~ by the source RNC. ~~or by the old SGSN (in case of an inter-SGSN SRNS Relocation).~~

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.

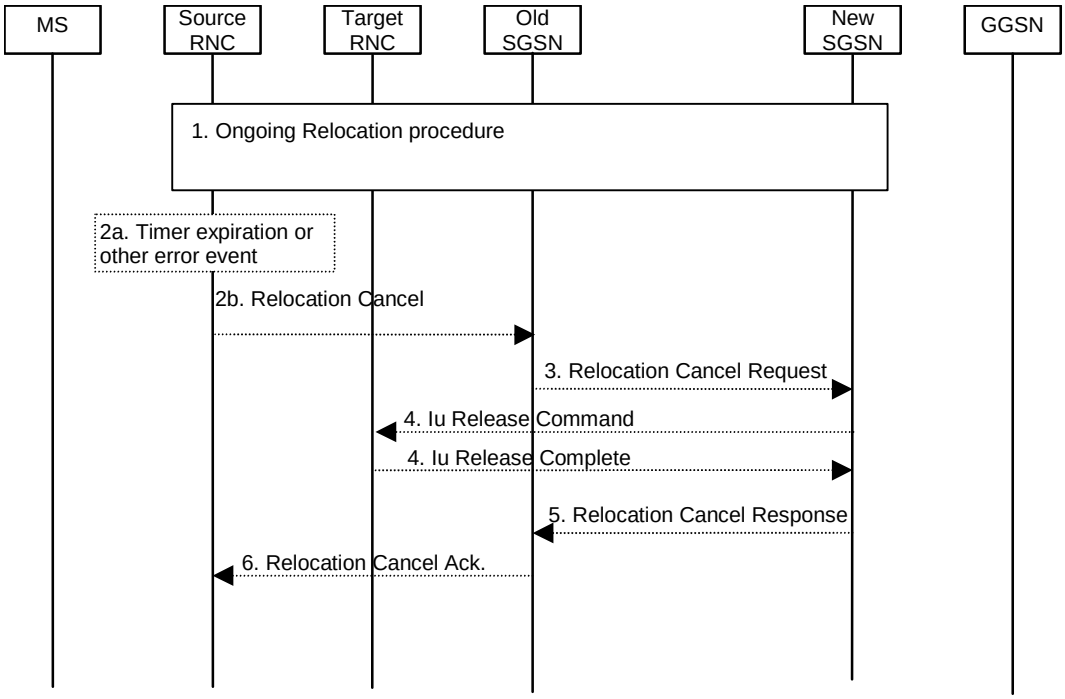

Figure 43a: SRNS Cancel Relocation Procedure

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

2a) ~~If the source RNC decides to cancel the ongoing SRNS relocation, it sends a Relocation Cancel (Cause) to the old SGSN. Cause indicates the reason for cancelling the ongoing SRNS relocation.~~ The SRNS Cancel Relocation may be initiated by a timer expiry or by an error event in the source RNC.

2b) ~~Alternatively, the SRNS Cancel Relocation may be initiated by an error event (e.g. expriry of a timer) in the old SGSN.~~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, ~~Tunnel Endpoint Identifier, Cause~~, RANAP Cause) to the new SGSN to indicate that the ongoing SRSN relocation should be cancelled. ~~Cause is included when the SRNS Cancel Relocation was initiated by the old SGSN (in step 2b) and it contains the cause that initiated the relocation cancel.~~ RANAP Cause ~~is included when the SRNS Cancel Relocation was initiated by the source RNC (in step 2a) and it~~ 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 ~~either Cause or~~ 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)~~a) If the SRNS Cancel Relocation was initiated by the source RNC (in step 2a), then~~ Tthe old SGSN responds to the source RNC with a Relocation Cancel Ack message.

~~6b) If the SRNS Cancel Relocation was initiated by an error event (e.g. expriry of a timer) in the old SGSN (in step 2b), then the old SGSN sends a Relocation Preparation Failure (Cause) to the source RNC. This message indicates that the old SGSN has cancelled the requested SRNS Relocation and specifies the reason in the Cause value.~~

3GPP-SA WG2 Meeting #18
Puerto Rico, 14-18 May 2001 ***Tdoc S2-011561***

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **230** ⌘ rev **1** ⌘ Current version: **4.0.0** ⌘

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

Title:	⌘	Support of PS real-time relocation in 23.060
Source:	⌘	Nokia, Siemens, Ericsson, Motorola
Work item code:	⌘	QoSPS-PSdoRTS
Date:	⌘	18 May, 2001
Category:	⌘	**B**
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:	⌘	According to 23.107 QoS Concept and Architecture, in Packet Switch Domain side, the Conversational and the Streaming QoS classes require real-time relocation. According to TR 25.936 Handover for real-time services from PS domain and RANAP Release 4 improved PS relocation procedure are required. This clearly implies changes to 23.060 for the user plane handling of that real-time relocation.
Summary of change:	⌘	Describe the improved user plane handling for this SRNS relocation for realtime bearer.
Consequences if not approved:	⌘	

Clauses affected:	⌘	6.9.2.2
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.

6.9.2.2 Serving RNS Relocation Procedures

~~The requirement for handling the user plane during the relocation is set by the SGSN at the set-up of the PDP context. The SGSN may require the user plane to be handled during relocation in one of the following two ways:~~

~~- real-time relocation: Packet loss or duplication is not detected, but the break in User Plane communication during relocation is minimized. This is achieved by forwarding DL data from source RNC to target RNC, therefore RABs requiring real-time handling should be set subject to data forwarding. There is no need to use PDCP counters (sequence numbers), and RLC may be used either in acknowledged mode or in unacknowledged mode.~~

~~- none: The way to handle RLC, PDCP, GTP-U counters (sequence numbers) and data forwarding is not defined. They may be handled as real-time relocation or in another way, e.g. the RABs with relocation requirement set to none may be set to be subject to data forwarding or not subject to data forwarding. The handling is decided by the SRNC based on information that is available to it.~~

6.9.2.2.1 Serving SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state.

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 MM-IDLE.

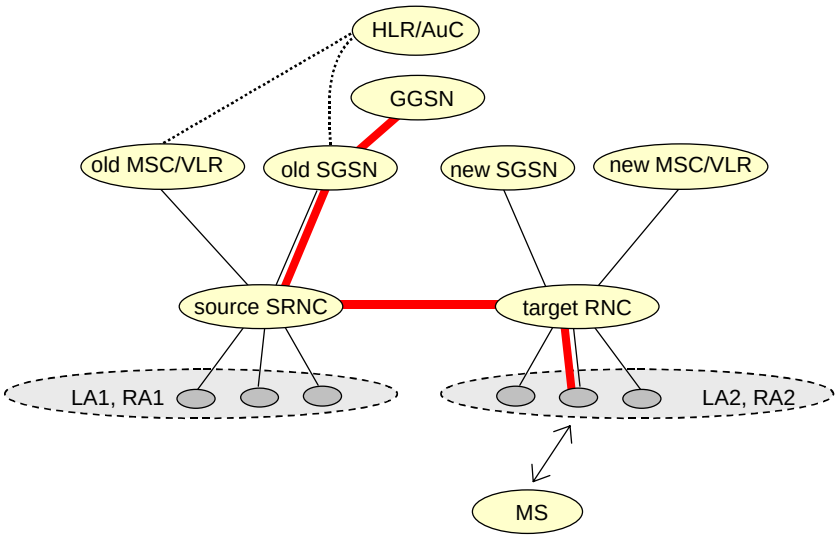


Figure 1: Before SRNS Relocation and Routeing Area Update

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).

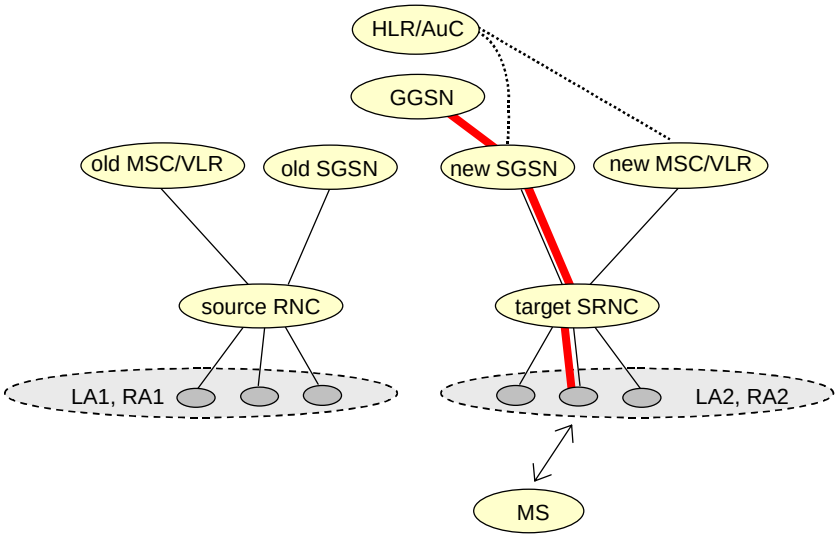
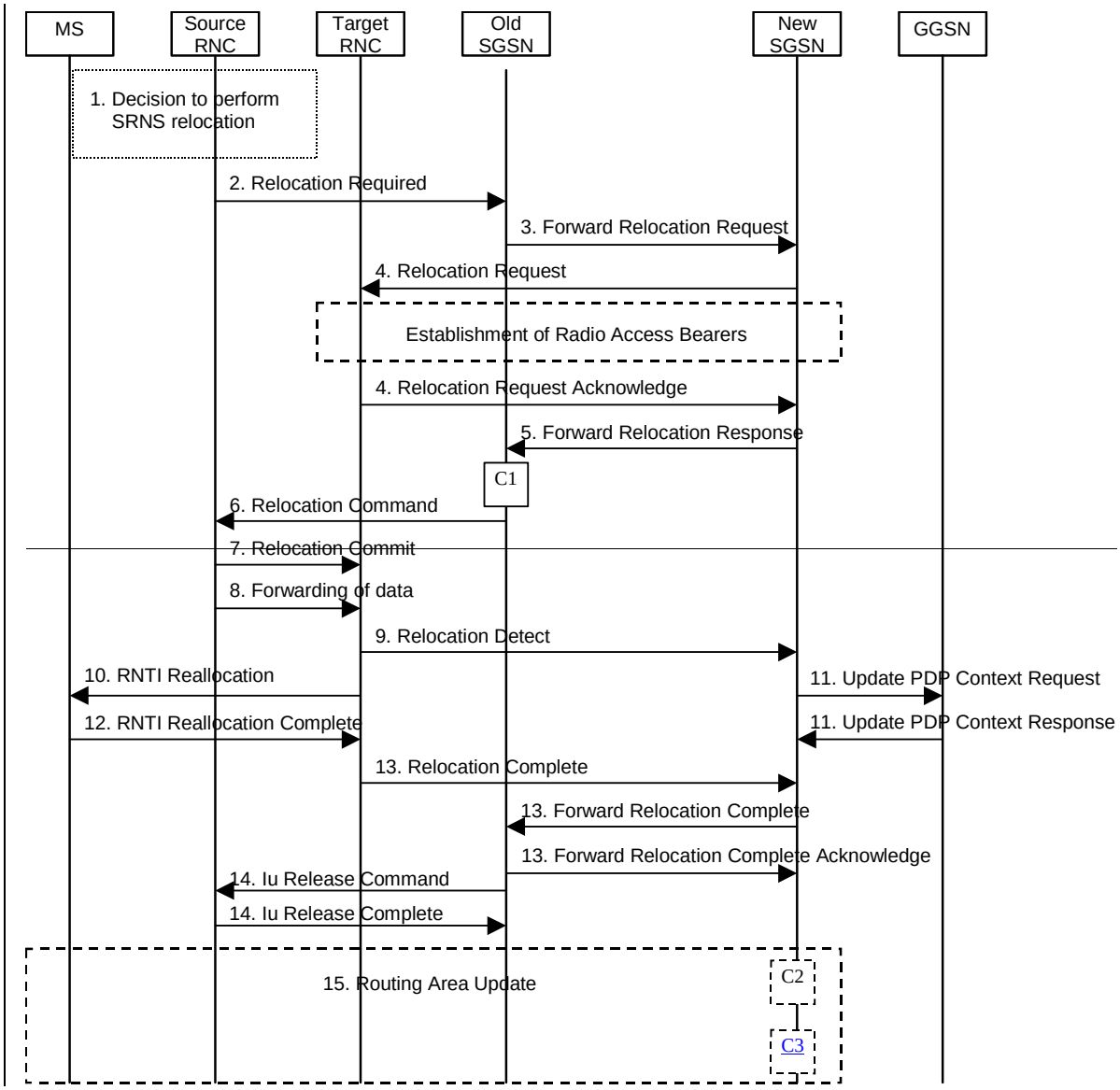


Figure 2: After SRNS Relocation and Routeing Area Update

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS relocation
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation Commit
8. Forwarding of data
9. Relocation Detect
10. RNTI Reallocation
11. Update PDP Context Request
12. RNTI Reallocation Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

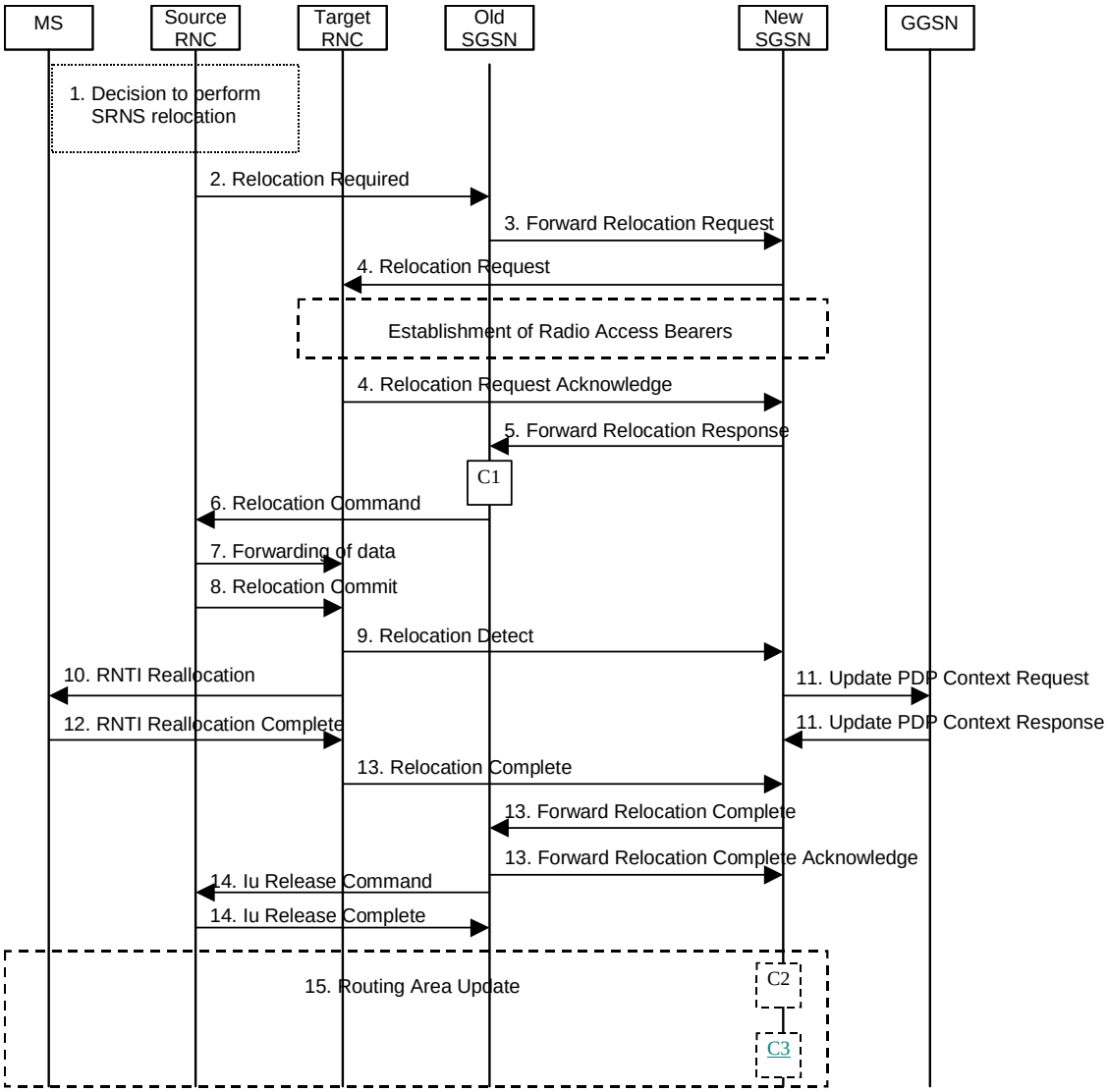


Figure 3: Serving SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate an SRNS relocation.

2) The source SRNC initiates the relocation preparation procedure by sending 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 to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including UE 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. For each RAB requested to be established, 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 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. The target RNC will for each RAB to be set up (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downlink PDUs from the source SRNC as well as downlink PDUs from the new SGSN.

~~After Relocation Resource Allocation procedure is successfully terminated but the Relocation Commit has not been received by the target RNC (serving RNC role is not yet taken over by target RNC) and when DL user plane data starts to arrive to target RNC, the target RNC all arriving DL GTP-PDUs for RABs requiring real-time relocation.~~

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 RNC. 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 RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) ~~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. The Transport Layer Address and Iu Transport Association is used for forwarding of downlink N-PDU from source RNC to target RNC.

7) The source SRNC may, according to the QoS profile, 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 SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC. 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 ro 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.~~Upon reception of the~~

~~Relocation Command message from the PS domain, t~~The source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and 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. The purpose of this procedure is to transfer SRNS contexts 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 connections using RLC unacknowledged mode PDCP sequence numbers is not used. . 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 used when lossless SRNS relocation is configured for PDCP [57].

If delivery order is required (QoS profile), consecutive GTP-PDU sequence numberingshall 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.

.

If PDCP does not support lossless relocation, the acknowledged mode SRNS relocation procedures shall be performed as in unacknowledged mode. Hence PDCP sequence numbers shall not be transferred from the old RNC to the target RNC.

~~Before sending the Relocation Commit uplink and downlink data transfer in the source, SRNC shall be suspended for RABs which require- loss-less relocation.~~

8) ~~After having sent the Relocation Commit message, the source SRNC 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 SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.~~

   ~~During the forwarding, the source RNC should for RABs requiring real-time relocation:~~

   ~~-continue to process and transmit DL data normally towards the MS.~~

   ~~- start duplicating all arrived and not acknowledged & arriving DL GTP-PDUs towards target RNC.~~

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) After having sent the Relocation Detect message, the target SRNC responds to the MS by sending an RNTI Reallocation message. Both messages contain 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 acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets .

The target RNC should for all RABs. ~~requiring real-time relocation:~~

- start uplink~~UL~~ reception of data and start transmission of uplink~~UL~~ GTP-PDUs towards the new SGSN.

- start processing the already buffered and the arriving downlink~~DL~~ GTP-PDUs and start downlink~~DL~~ 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 MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

13) When the target SRNC receives the RNTI Reallocation Complete message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the UE 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.

14) 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.

15) 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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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"".

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.

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 MM IDLE state.

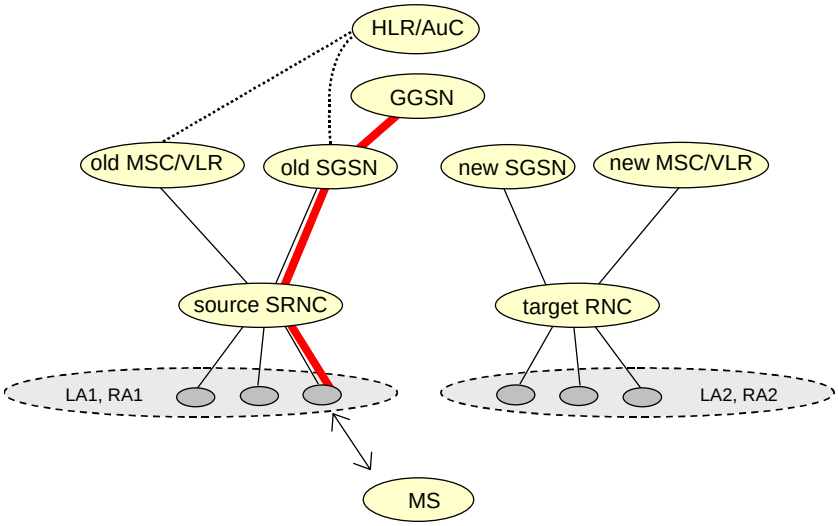


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

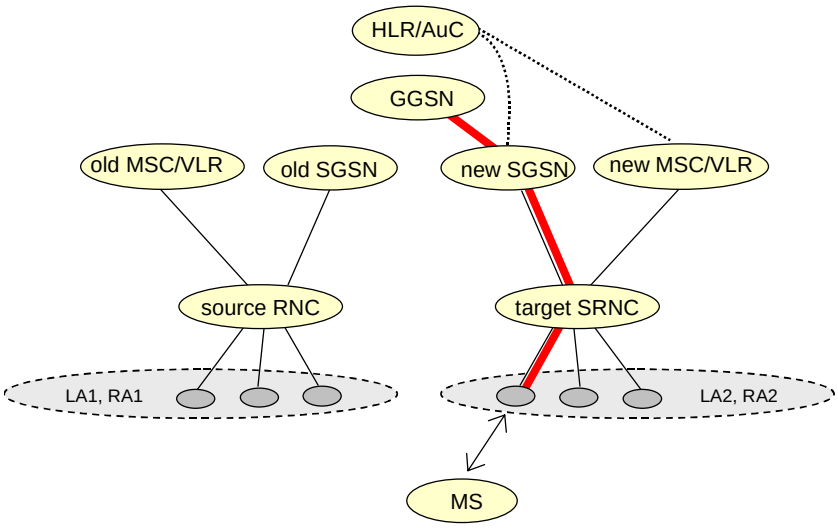
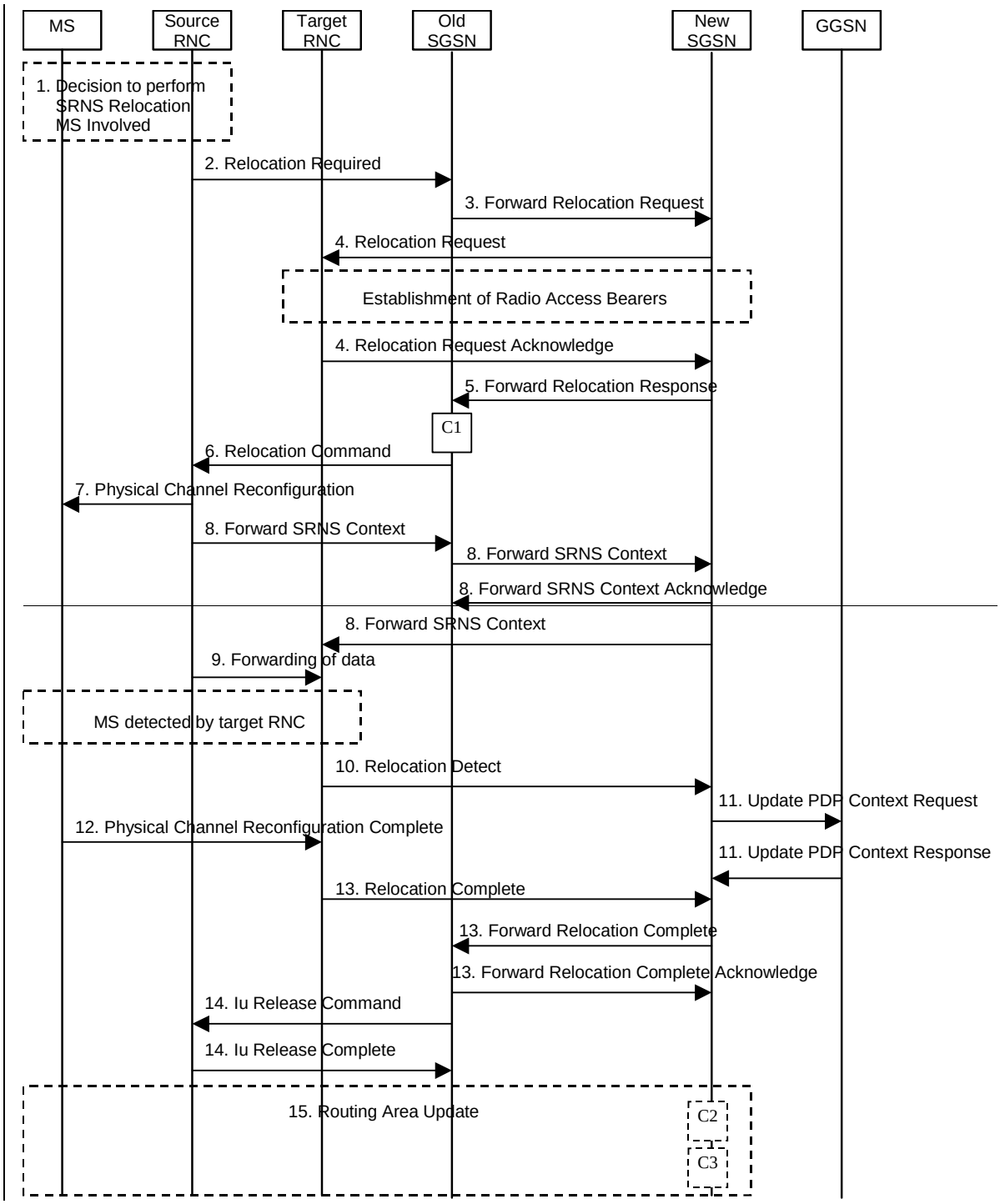


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS Relocation MS Involved
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Physical Channel Reconfiguration
8. Forward SRNS Context
8. Forward SRNS Context
8. Forward SRNS Context Acknowledge
8. Forward SRNS Context
9. Forwarding of data
MS detected by target RNC
10. Relocation Detect
11. Update PDP Context Request
12. Physical Channel Reconfiguration Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

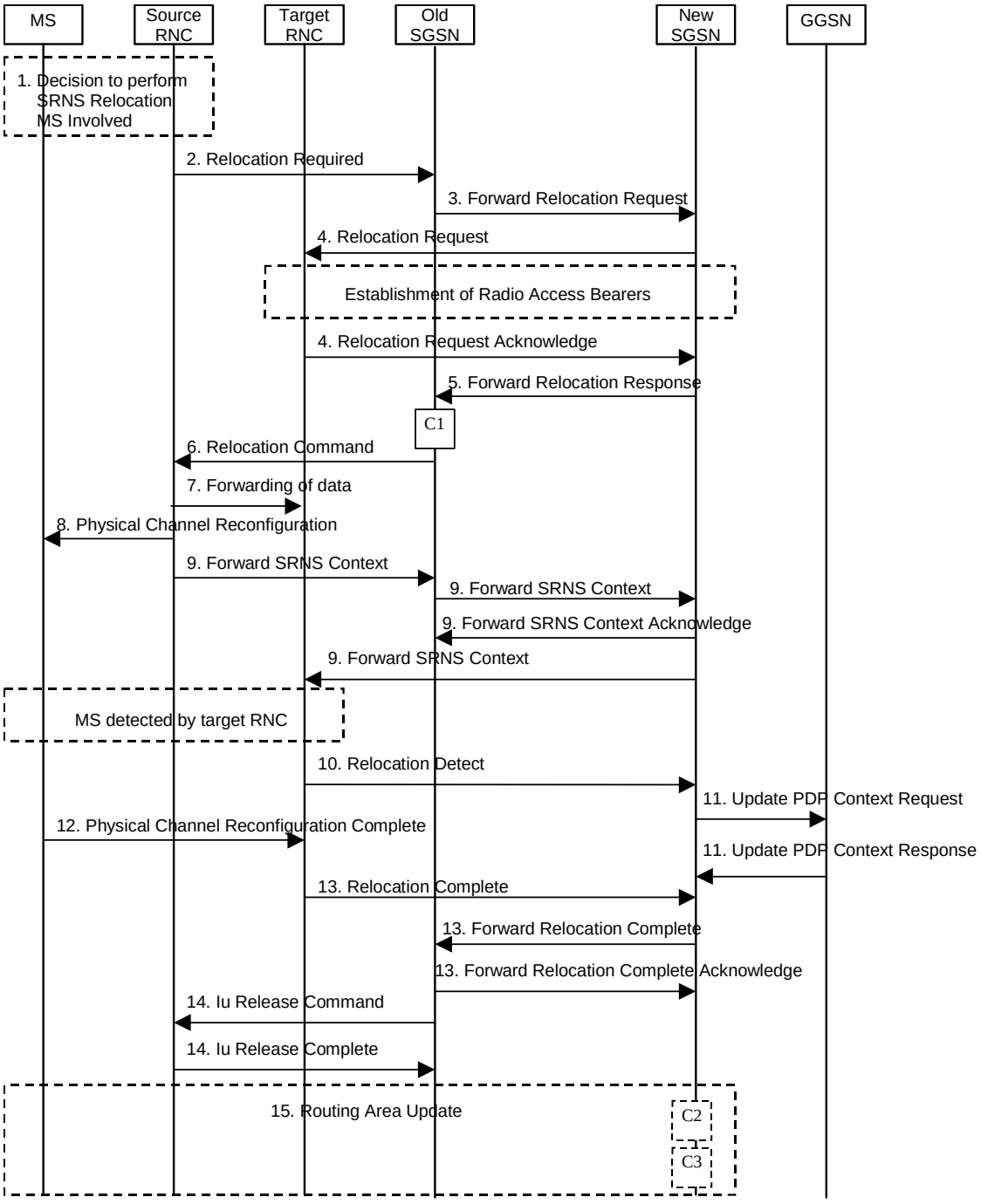


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

1) Based on measurement results and knowledge of the UTRAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation.

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

co-ordination, security functionality and RRC protocol context information (including UE 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 (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 (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RABs To Be Setup) message 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 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 (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. 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. The target RNC will for each RAB to be set up (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downlink PDUs from the source SRNC as well as downlink PDUs from the new SGSN.

   ~~After Relocation Resource Allocation procedure is successfully terminated but the Forward SRNS Context has not been received by the target RNC (serving RNC role is not yet taken over by target RNC) and when DL user plane data starts to arrive to target RNC, the target RNC should discard all arriving DL GTP-PDUs for RABs requiring real-time relocation.~~

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 RNC. 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 (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message 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. Transport Layer Address and Iu Transport Association is used for forwarding of downlink N-PDU from the source RNC to the target RNC.

7) The source SRNC may, according to the QoS profile, 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 SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. 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 ro the related QoS profile,

7)8) Before sending the Physical Channel Reconfiguration the uplink and downlink data transfer in the source, SRNC shall be suspended for RABs which require delivery order.Upon reception of the Relocation Command message from the PS domain, t The source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and the source SRNC is ready, the source SRNC 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 SRNC shall be suspended for RABs which require- loss-less relocation.

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. 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 used when lossless SRNS relocation is configured for PDCP [57]. 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 uplinkand downlink, respectively.

The source SRNC includes the PDCP sequence number, PDCP-SNU, in the RRC message which is indicated in the Target RNC to Source RNC transparent container to the MS. The MS informs the PDCP sequence number, PDCP-SND, to the target RNC in the corresponding RRC complete message. 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 acknowledged mode in the MS per radio bearer, which requires loss-less relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then the target SRNC shall discard these packets. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, the MS shall discard these packets.

9) After having sent the Forward SRNS Context message, the source SRNC 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 SRNC

~~and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC.~~

~~During the forwarding, the source RNC should for RABs requiring real-time relocation:~~

~~-continue to process and transmit DL data normally towards the MS.~~

~~start duplicating all arrived and not acknowledged & arriving DL GTP-PDUs towards target RNC.~~

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 MS has reconfigureditself, 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 SRNC may start the packet transfer for all RABs, which do not require maintaining the delivery order.

13) 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 UE 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.

14) 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.

15) 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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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".

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

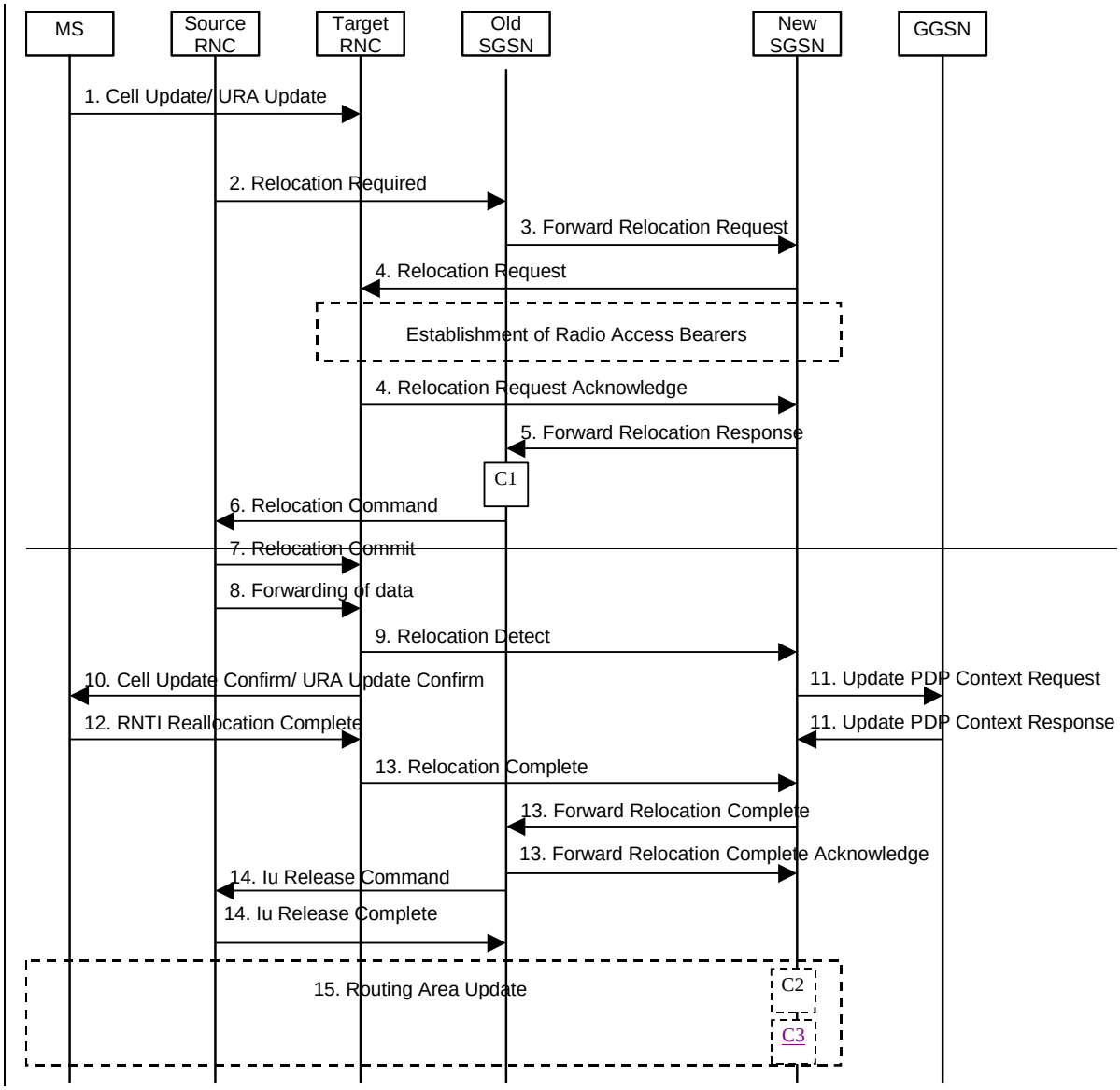
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur carries control signalling but no user data.

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.


MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Cell Update/ URA Update
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation Commit
8. Forwarding of data
9. Relocation Detect
10. Cell Update Confirm/ URA Update Confirm
11. Update PDP Context Request
12. RNTI Reallocation Complete
11. Update PDP Context Response
13. Relocation Complete
13. Forward Relocation Complete
13. Forward Relocation Complete Acknowledge
14. Iu Release Command
14. Iu Release Complete
15. Routing Area Update
C2
C3

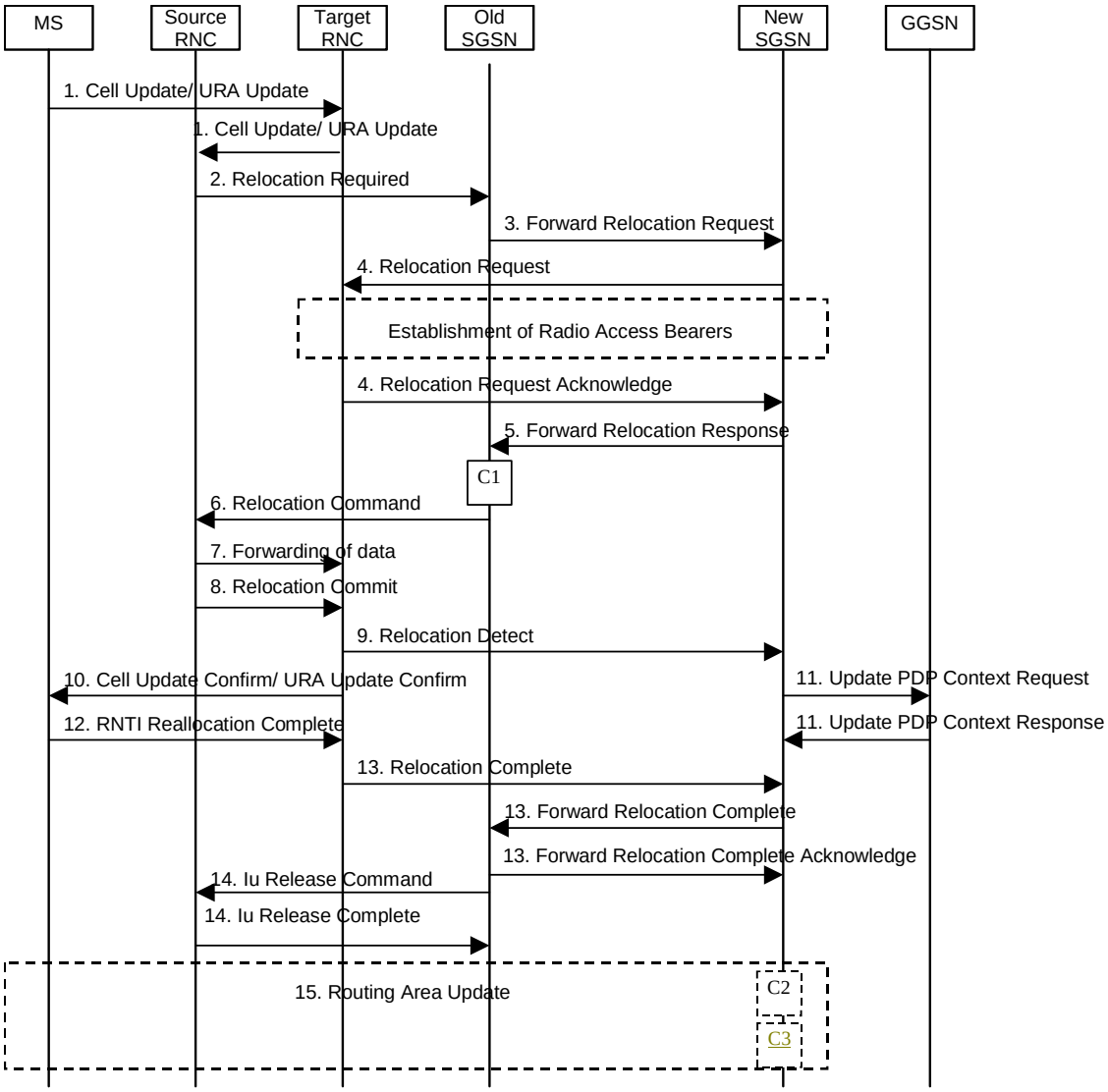


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

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.

2) The source SRNC initiates the relocation preparation procedure by sending 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 UE 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 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 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 (RABs setup, RABs failed to setup) message to the new SGSN. The target RNC will for each RAB to be set up (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downlink PDUs from the source SRNC as well as downlink PDUs from the new SGSN.

   ~~After Relocation Resource Allocation procedure is successfully terminated but the Relocation Commit has not been received by the target RNC (serving RNC role is not yet taken over by target RNC) and when DL user plane data starts to arrive to target RNC, the target RNC should discard all arriving DL GTP-PDUs for RABs requiring real-time relocation.~~

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 RNC. 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 RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) ~~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. The Transport Layer Address and Iu Transport Association is used for forwarding of downlink N-PDU from the source RNC to the target RNC.

7) The source SRNC may, according to the QoS profile, 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 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.

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 ro the related QoS profile.

8) ~~7) Upon reception of the Relocation Command message from the PS domain, t~~[Before sending the Relocation Commit the uplink and downlink data transfer in the source, SRNC shall be suspended for RABs which require delivery order.Note: to be checked if this needed] The source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit (SRNS Contexts) message to the target RNC. The purpose of this procedure is to transfer SRNS contexts 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 connections using RLC unacknowledged mode PDCP sequence number is not used. PDCP sequence numbers are only used when lossless SRNS relocation is configured for PDCP [57]. 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) ~~After having sent the Relocation Commit message, the source SRNC 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 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.~~

~~During the forwarding, the source RNC should for RABs requiring real-time relocation:~~

~~-continue to process and transmit DL data normally towards the MS.~~

~~- start duplicating all arrived and not acknowledged & arriving DL GTP-PDUs towards target RNC.~~

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) After having sent the Relocation Detect message, the target SRNC responds to the MS by sending a Cell Update Confirm / URA Update Confirm message. Both messages contain 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 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 requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC,the target SRNC shall discard these packets. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. 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 MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.

13) When the target SRNC receives the RNTI Reallocation Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the UE 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.

14) 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.

15) 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.

For an MS with GPRS-CSI defined, CAMEL interaction may 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".

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.

3GPP TSG-SA WG2 Meeting #08
Rio Grande, Puerto Rico, 14-18 May 2001

Tdoc S2-011463rev1

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **233** ⌘ rev **1-** ⌘ Current version: **4.0.0** ⌘

*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:	⌘	Update of Control Plane protocol architecture to align with 29.202
Source:	⌘	Motorola
Work item code:	⌘	TEI
Date:	⌘	May 05, 2001
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 protocol stacks used for the Gf, Gs and Gr interfacies, the SCCP is identified as an MTP3-user and the transport of SCCP messages between two entities shall be accomplished according to the 3GPP TS 29.202. However, it has been identified that the signalling bearer can be also other than MTP3/MTP2.
Summary of change:	⌘	MTP2 and MTP3 have been replaced in protocol stacks with more general signalling bearer.
Consequences if not approved:	⌘	There will be misalignment between stage 2 TS 23.060 and stage 3 TS 29.202 for Release 4.

Clauses affected:	⌘			
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	none
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.

2 References

The following documents contain provisions, which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); GPRS ciphering algorithm requirements".

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

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

[5] 3G TS 23.007: "Restoration procedures".

[5b] 3G 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: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

[7b] 3G TS 23.122: "Non Access Stratum functions related to Mobile Station (MS) in idle mode".

[8] 3G TS 23.040: "Technical realisation of the Short Message Service (SMS); Point-to-Point (PP)".

[8b] 3G TS 23.078: "Customised Applications for Mobile Network Enhanced Logic (CAMEL) Phase 3 – Stage 2".

[11] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); Overall description of the General Packet Radio Service (GPRS) Radio interface; Stage 2".

[12] 3G TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[13] 3G 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] 3G TS 27.060: "General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS".

[18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile 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+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

[23] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[24] 3G TS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".

[25] 3G TS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".

[26] 3G TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[27] 3G TS 29.061: "General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".

[27b] 3G TS 29.078: "3rd Generation Partnership Project; 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] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

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

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

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

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

[34] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

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

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

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

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

[43] IETF RFC 1034 (1987): "Domain Names – Concepts and Facilities" (STD 7).

[44] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

[45] IETF RFC 1542 (1993): "Clarification and Extensions for the Bootstrap Protocol".

[46] IETF RFC 2002 (1996): "IPv4 Mobility Support".

[47] IETF RFC 2131 (1997): "Dynamic Host Configuration Protocol".

[49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.

[50] 3G TS 25.301: "Radio Interface Protocol Architecture".

[51] 3G TS 25.303: "UE Functions and Interlayer Procedures in Connected Mode".

[51b] 3G TS 25.304: "UE Procedures in Idle Mode and Procedures for Call Reselection in Connected Mode".

[52] 3G TS 25.331: "RRC Protocol Specification".

[53] 3G TS 25.401: "UTRAN Overall Description".

[54] 3G TS 23.121: "Architectural Requirements for Release 1999".

[55] 3G TS 25.322: "RLC Protocol Specification".

[56] 3G TS 25.412: "UTRAN Iu Interface Signalling Transport".

[56b] 3G TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[57] 3G TS 25.323: "Packet Data Convergence Protocol (PDCP) protocol".

[58] 3G TS 23.107: "Quality of Service, Concept and Architecture".

[59] ITU-T Recommendation I.361: "B-ISDN ATM Layer Specification".

[60] 3G TS 25.321: "Medium Access Control (MAC) Protocol Specification".

[61] 3G TS 33.102: "Security Architecture".

[62] 3G TS 22.002: "Circuit Bearer Services Supported by a PLMN".

[63] 3G TS 25.411: "UTRAN Iu interface Layer 1".

[64] 3G TS 25.414: "UTRAN Iu interface data transport & transport signalling".

[65] 3G TS 23.171: "Functional stage 2 description of location services in UMTS".

[66] 3G TS 23.015: "Technical realization of operator determined barring (ODB)".

[67] ITU-T Recommendation I.363.5: "B-ISDN ATM Adaptation Layer Specification: Type 5 AAL".

[68] IETF RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[69] IETF RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[70] 3G TS 32.015: "GSM call and event data for the packet switched domain".

[71] IETF RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)".

[72] 3G TS 29.202: “SS7 signalling transport in Core Network; stage 3”.

NEXT MODIFICATION

5.6.3 Control Plane

The control plane consists of protocols for control and support of the user plane functions:

- controlling the packet domain network access connections, such as attaching to and detaching from 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)

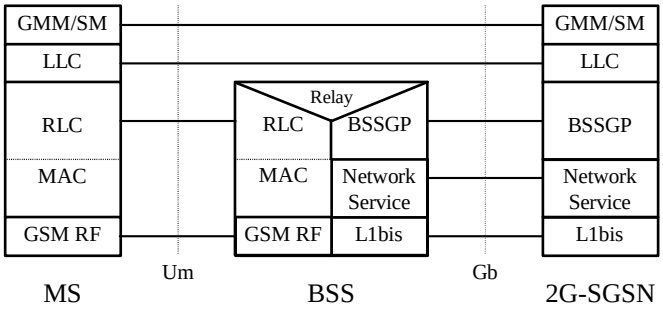


Figure 1: Control Plane MS - 2G-SGSN

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)

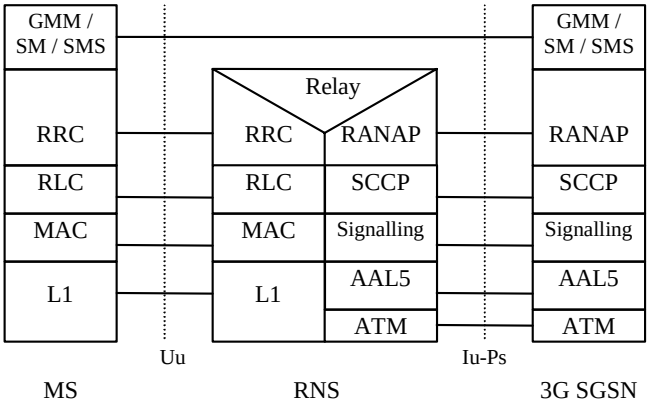


Figure 2: Control Plane MS - 3G-SGSN

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 subclause "PDP Context Activation, Modification, Deactivation, and Preservation Functions".

- SMS supports the mobile-originated and mobile-terminated short message service described in 3G 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 3G TS 25.413. The layers below RANAP are defined in 3G 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 3G TS 25.322.

5.6.3.3 SGSN - HLR

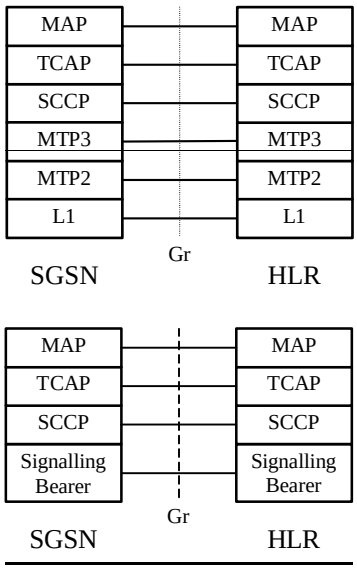


Figure 3: Control Plane SGSN - HLR

Legend:

- Mobile Application Part (MAP): This protocol supports signalling exchange with the HLR, as defined in 3G TS 29.002 [23], with enhancements for GPRS as described in the present document.
- TCAP~~,~~ and SCCP~~, MTP3, and MTP2~~ are the same protocols as used to support MAP in CS PLMNs.
- The Signalling Bearer is one of the signalling bearers specified in 3G TS 29.202 [72].

5.6.3.4 SGSN - MSC/VLR

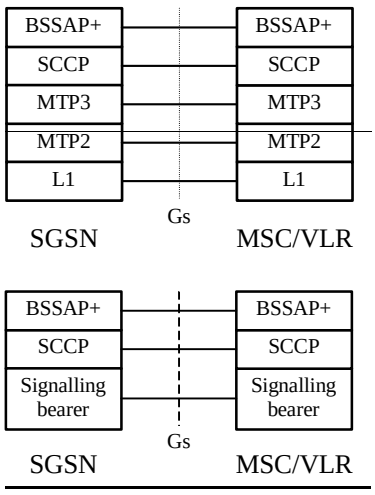


Figure 4: Control Plane SGSN - MSC/VLR

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 3G TS 29.018 [25]. The requirements for the lower layers are specified in 3G TS 29.016 [24].

5.6.3.5 SGSN - EIR

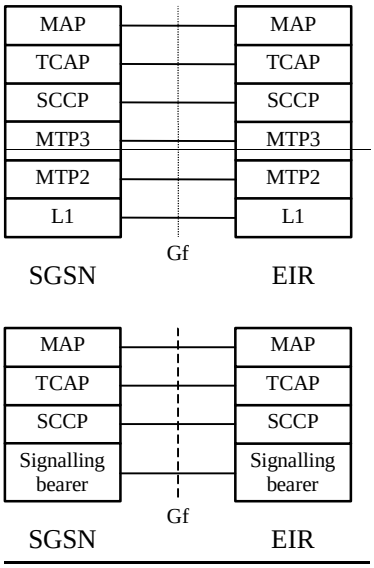


Figure 5: Control Plane SGSN - EIR

Legend:

- Mobile Application Part (MAP): This protocol supports signalling between the SGSN and the EIR, as described in subclause "Identity Check Procedures".

5.6.3.6 SGSN - SMS-GMSC or SMS-IWMSC

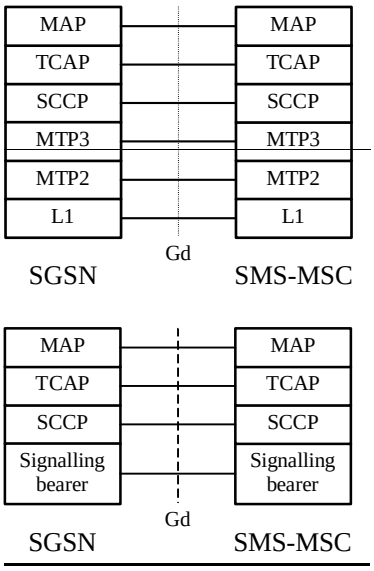


Figure 6: Control Plane SGSN - SMS-GMSC and SGSN - SMS-IWMSC

Legend:

- Mobile Application Part (MAP): This protocol supports signalling between the SGSN and SMS-GMSC or SMS-IWMSC, as described in subclause "Point-to-point Short Message Service".

5.6.3.7 GSN - GSN

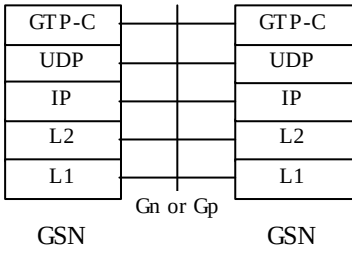


Figure 7: Control Plane for SGSN – GGSN and SGSN – SGSN Interfaces

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

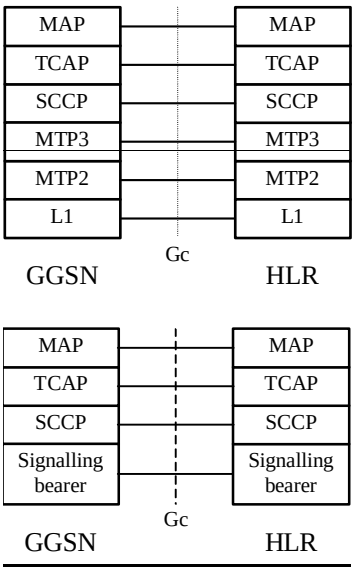


Figure 8: Control Plane GGSN - HLR Using MAP

Legend:

- Mobile Application Part (MAP): This protocol supports signalling exchange with the HLR, as described in subclause "Network-Requested PDP Context Activation Procedure".

5.6.3.8.2 GTP and MAP-based GGSN - HLR Signalling

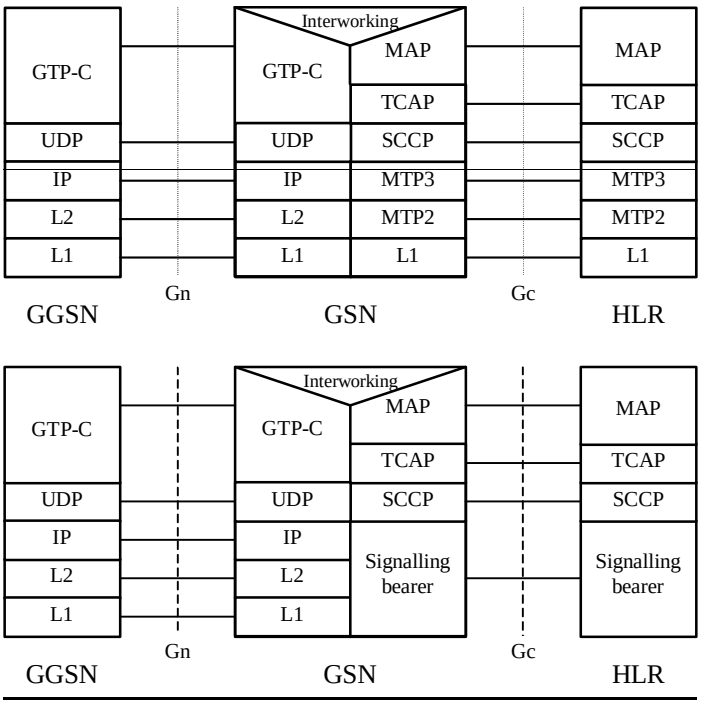


Figure 9: Control Plane GGSN - HLR Using GTP and MAP

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.