

Meeting #20, Hämeenlinna, Finland
09-12 June 2003

Source: TSG SA WG2
Title: CRs on 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 #20.

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.

Tdoc #	Title	Spec	CR #	cat	Version in	REL	WI	S2 meetin
S2-032186	Update to Iu release procedure	23.060	436r2	F	3.14.0	99	TEI	S2-32
S2-032187	Update to Iu release procedure	23.060	437r2	A	4.7.0	4	TEI	S2-32
S2-032188	Update to Iu release procedure	23.060	438r2	A	5.5.0	5	TEI	S2-32
S2-032189	Update to Iu release procedure	23.060	439r2	A	6.0.0	6	TEI	S2-32
S2-032086	CAMEL triggers at SRNS relocation cancel	23.060	447	F	4.7.0	4	TEI4	S2-32
S2-032087	CAMEL triggers at SRNS relocation cancel	23.060	448	A	5.5.0	5	TEI4	S2-32
S2-032088	CAMEL triggers at SRNS relocation cancel	23.060	449	A	6.0.0	6	TEI4	S2-32
S2-031944	Changes for Early UE handling	23.060	443r1	F	5.5.0	5	LATE_UE	S2-32
S2-031945	Changes for Early UE handling	23.060	451	A	6.0.0	6	LATE_UE	S2-32
S2-032201	CR on 23.060: Controlling compression performed at the SGSN.	23.060	442r3	B	6.0.0	6	TEI6	S2-32
S2-032084	GGSN update at SRNS relocation	23.060	431r2	F	5.5.0	5	TEI5	S2-32
S2-032085	GGSN update at SRNS relocation	23.060	446	A	6.0.0	6	TEI5	S2-32
S2-032200	Mapping of PFCs onto LLC SAPIs	23.060	452	F	6.0.0	6	TEI6	S2-32
S2-032081	Max SDU Size and MTU clarification	23.060	432r2	F	5.5.0	5	TEI5	S2-32
S2-032082	Max SDU Size and MTU clarification	23.060	445	A	6.0.0	6	TEI5	S2-32
S2-031595	Preservation procedure for realtime bearers in A/Gb	23.060	435r2	F	5.5.0	5	TEI5	S2-31
S2-032122	RAU in PMM-connected	23.060	433r2	F	6.0.0	6	TEI6	S2-32
S2-032120	User inactivity usage with Iu/RAB release	23.060	440r1	F	6.0.0	6	TEI6	S2-32

CHANGE REQUEST

⌘ **23.060 CR 435** ⌘ rev **2** ⌘ Current version: **5.5.0** ⌘

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Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Preservation procedure for realtime bearers in A/Gb mode		
Source:	⌘ Siemens		
Work item code:	⌘ TEI5 Date: ⌘ 04/02/2003		
Category:	⌘ F Release: ⌘ Rel-5		
	<table border="0"> <tr> <td style="vertical-align: top;"> <p>Use <u>one</u> of the following categories:</p> <p>F (correction)</p> <p>A (corresponds to a correction in an earlier release)</p> <p>B (addition of feature),</p> <p>C (functional modification of feature)</p> <p>D (editorial modification)</p> <p>Detailed explanations of the above categories can be found in 3GPP TR 21.900.</p> </td> <td style="vertical-align: top;"> <p>Use <u>one</u> of the following releases:</p> <p>2 (GSM Phase 2)</p> <p>R96 (Release 1996)</p> <p>R97 (Release 1997)</p> <p>R98 (Release 1998)</p> <p>R99 (Release 1999)</p> <p>Rel-4 (Release 4)</p> <p>Rel-5 (Release 5)</p> <p>Rel-6 (Release 6)</p> </td> </tr> </table>	<p>Use <u>one</u> of the following categories:</p> <p>F (correction)</p> <p>A (corresponds to a correction in an earlier release)</p> <p>B (addition of feature),</p> <p>C (functional modification of feature)</p> <p>D (editorial modification)</p> <p>Detailed explanations of the above categories can be found in 3GPP TR 21.900.</p>	<p>Use <u>one</u> of the following releases:</p> <p>2 (GSM Phase 2)</p> <p>R96 (Release 1996)</p> <p>R97 (Release 1997)</p> <p>R98 (Release 1998)</p> <p>R99 (Release 1999)</p> <p>Rel-4 (Release 4)</p> <p>Rel-5 (Release 5)</p> <p>Rel-6 (Release 6)</p>
<p>Use <u>one</u> of the following categories:</p> <p>F (correction)</p> <p>A (corresponds to a correction in an earlier release)</p> <p>B (addition of feature),</p> <p>C (functional modification of feature)</p> <p>D (editorial modification)</p> <p>Detailed explanations of the above categories can be found in 3GPP TR 21.900.</p>	<p>Use <u>one</u> of the following releases:</p> <p>2 (GSM Phase 2)</p> <p>R96 (Release 1996)</p> <p>R97 (Release 1997)</p> <p>R98 (Release 1998)</p> <p>R99 (Release 1999)</p> <p>Rel-4 (Release 4)</p> <p>Rel-5 (Release 5)</p> <p>Rel-6 (Release 6)</p>		

Reason for change:	⌘ [H1] The preservation procedure for realtime PDP context is only described for lu mode. But realtime PDP contexts, especially of traffic class streaming, are also supported in A/Gb mode. The preservation for realtime PDP context in A/Gb mode is needed for the same reasons as for such contexts in lu mode.
	<p>The triggers for the preservation in A/Gb mode are slightly different but the handling for the preservation is the same as well as the handling to return the bearer provision. The triggers are:</p> <ul style="list-style-type: none"> • Radio Status procedure as defined in 48.018 for the causes "Radio contact lost with MS" and "Radio link quality insufficient to continue communication" (but not "cell-reselection ordered") • Intra- and inter-SGSN Suspend procedure as defined in 48.018 (inter SGSN only in Rel-5)
Summary of change:	⌘ Preservation in A/GB mode can be triggered by Suspend or Radio Status procedures. The return to normal bearer service provision for realtime PDP contexts is done via PDP context modification procedure.
Consequences if not approved:	⌘ No stop of downlink traffic for realtime PDP contexts in A/Gb mode. Incompatible mechanisms for A/Gb and lu modes.

Clauses affected:	⌘ 9.2.3.4, 16.2.1.1				
Other specs	⌘ <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table> Other core specifications ⌘	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Y	N				
<input type="checkbox"/>	<input checked="" type="checkbox"/>				

affected:	<input checked="" type="checkbox"/>	Test specifications
	<input checked="" type="checkbox"/>	O&M Specifications
Other comments:	⌘	

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

*****First Modified Section*****

9.2.3.4 RNC/BSS-Initiated PDP Context Modification Procedure

The RNC can request the release of the Iu connection (see clause "Iu Release Procedure") e.g. due to a break of the radio connection or due to user inactivity. [The BSS may terminate the downlink data transfer to a MS by the Suspend procedure \(which is triggered by the MS\) or by the Radio Status procedure with cause "Radio contact lost with MS" or "Radio link quality insufficient to continue communication" both defined in GSM 08.18 \[21\].](#) After Iu Release [in Iu mode, or after termination of the downlink data transfer in A/Gb mode,](#) the PDP contexts are modified as follows:

- In the SGSN, for a PDP context using background or interactive traffic class, the PDP context is preserved with no modifications.
- In the SGSN, for a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (for both uplink and downlink) ~~when the associated RAB is released~~. The SGSN sends an Update PDP Context Request (TEID, QoS Negotiated) message to the GGSN to set the maximum bit rate to 0 kbit/s in the GGSN. The value of 0 kbit/s for the maximum bit rate indicates to the GGSN to stop sending packets to the SGSN for this PDP context. [For the Iu mode T](#) the value of 0 kbit/s for the maximum bit rate for both uplink and downlink indicates to the SGSN that a RAB shall not be re-established for this PDP Context in subsequent Service Request Procedure. [For the A/Gb mode the value of 0 kbit/s for the maximum bit rate for both uplink and downlink indicates that the SGSN shall not send any downlink data for this PDP Context. In Iu and A/Gb mode](#) CAMEL procedure calls shall be performed, see referenced procedure in 3G TS 23.078: CAMEL_GPRS_Change_Of_QoS. The procedure returns as result "Continue".

[In Iu mode T](#) the following procedures shall be performed in the MS when radio coverage is lost:

- For a PDP context using background or interactive traffic class, the PDP context is preserved even if RRC re-establishment procedures have failed.
- For a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (for both uplink and downlink) when the RRC re-establishment procedure has failed. After coverage is regained and if the MS did not deactivate the PDP Context locally the MS should start MS initiated PDP Context Modification procedure or the PDP Context Deactivation procedure. The MS shall use the PDP Context Modification procedure to re-activate the PDP context and re-establish the RAB

[In A/Gb mode the following procedures shall be performed in the MS when radio coverage is lost, when the radio link quality is insufficient or when the MS suspends GPRS:](#)

- For a PDP context using background or interactive traffic class, the PDP context is preserved.

- For a PDP context using streaming or conversational traffic class, the PDP context is preserved, but the maximum bit rate is downgraded to 0 kbit/s (for both uplink and downlink). After coverage or radio link quality is regained or when GPRS services shall resume and if the MS did not deactivate the PDP Context locally the MS should start MS initiated PDP Context Modification procedure or the PDP Context Deactivation procedure. The MS shall use the PDP Context Modification procedure to re-activate the PDP context.

*******Second Modified Section*******

16.2.1.1 Suspend and Resume procedure (A/Gb mode)

In the following procedures, when a suspended MS is resumed, the MS should either deactivate the PDP context of streaming or conversational traffic class, or the MS should modify the PDP context of streaming or conversational traffic class to reset the maximum bit rate to a proper value (see clause “RNC/BSS-Initiated PDP Context Modification Procedure”).

CHANGE REQUEST

23.060 CR 442 # rev 4 # Current version: 6.0.0

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	#	CR on 23.060: Controlling compression performed at the SGSN.	
Source:	#	Vodafone UK	
Work item code:	#	TEI-6	Date: # 13/05/2003
Category:	#	B	Release: # Rel-6
		Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.	Use <u>one</u> 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) Rel-6 (Release 6)

Reason for change:	#	In section 5.6.2.2 of 3GPP TS 23.060 it is stated: "Unlike in A/Gb mode, user data compression is not supported in lu mode, because the data compression efficiency depends on the type of user data, and because many applications compress data before transmission. It is difficult to check the type of data in the PDCP layer, and compressing all user data requires too much processing." This statement is ambiguous in that it implies that in A/Gb mode it is not difficult to check the type of data in the equivalent SNDCP layer and that compressing all user data doesn't require too much processing. However, it remains difficult to detect data type at the SNDCP layer, and also there are no controls defined in the specification dependent on data type to control compression. In addition, compression of all user data may require too much processing as the SGSN will waste processing time trying to compress user data which is known to have already been compressed especially where the end result is of little or no benefit.
Summary of change:	#	To enable the operator to disable compression at the SGSN on a per APN basis using a new information element that allows the GGSN to tell the SGSN not to compress downlink data in A/Gb mode. The new field will be configured per APN at the GGSN and may override a user request.
Consequences if not approved:	#	There would be unnecessarily high SGSN processor load especially when downlink data is known to be either compressed already or optimised for transmission.

Clauses affected:	#	5.3.2.6, 6.9.1.2.2, 6.9.1.3.2, 6.9.2.1, 6.9.2.2, 6.13.2, 9.2.2.1, 9.2.3.1, 9.2.3.2, 9.2.3.3, 12.3.2, 13.2, 13.3
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Other specs affected:		Y	N		
	⌘	X		Other core specifications	⌘ 29.060
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘	Updated by MCC to have revision marks against original specification			

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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.

***** First Modified Section *****

5.3.2.6 Compression Function

The compression function optimises use of radio path capacity by transmitting as little of the SDU (i.e. the exterior PDP PDU) as possible while at the same time preserving the information contained within it. Only IP header compression is supported in Iu mode. The GGSN may instruct the SGSN to negotiate no data compression for specific PDP contexts.

***** Next Modified Section *****

6.9.1.2.2 Inter SGSN Routeing Area Update

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

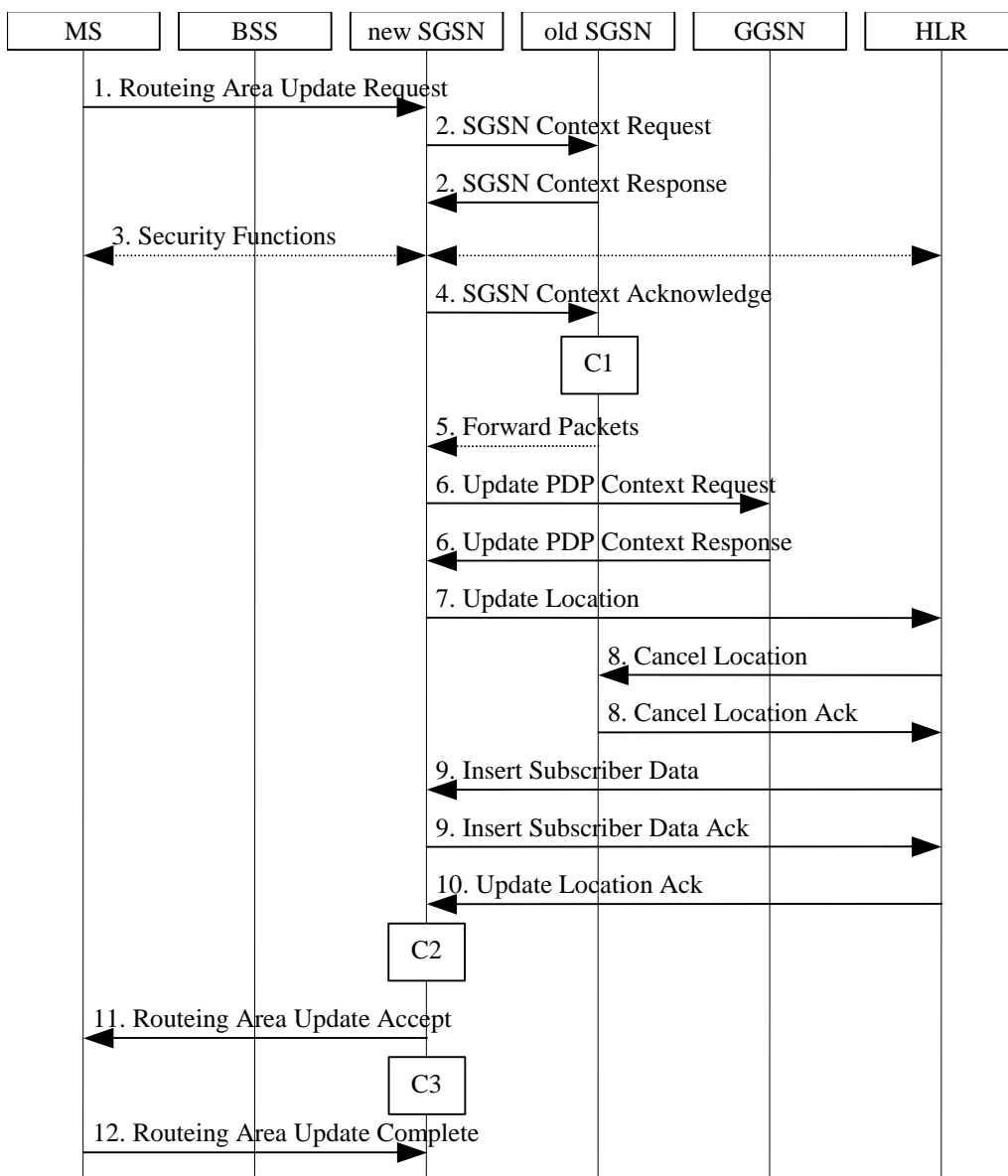


Figure 33: Inter SGSN Routeing Area Update Procedure

- 1) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.
- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI (or TLLI) and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI (or TLLI) and relay the message to that actual old SGSN. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the transmission of N-PDUs to the MS. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routing Area Request.
- 3) Security functions may be executed. These procedures are defined in clause "Security Function". Ciphering mode shall be set if ciphering is supported.

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

- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routing area update procedure back to the old SGSN before completing the ongoing routing area update procedure. If the security functions do not authenticate the MS correctly, then the routing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.
- 5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TEID, Prohibit Payload Compression). The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP

contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter-SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS, is not allowed to be attached in the SGSN, or if subscription checking fails, the new SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 12) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

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

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

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

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

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

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

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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".

- Then the CAMEL_PS_Notification procedure is called once. The procedure return as result "Continue".

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. 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".

***** Next Modified Section *****

6.9.1.3.2 Combined Inter SGSN RA / LA Update

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

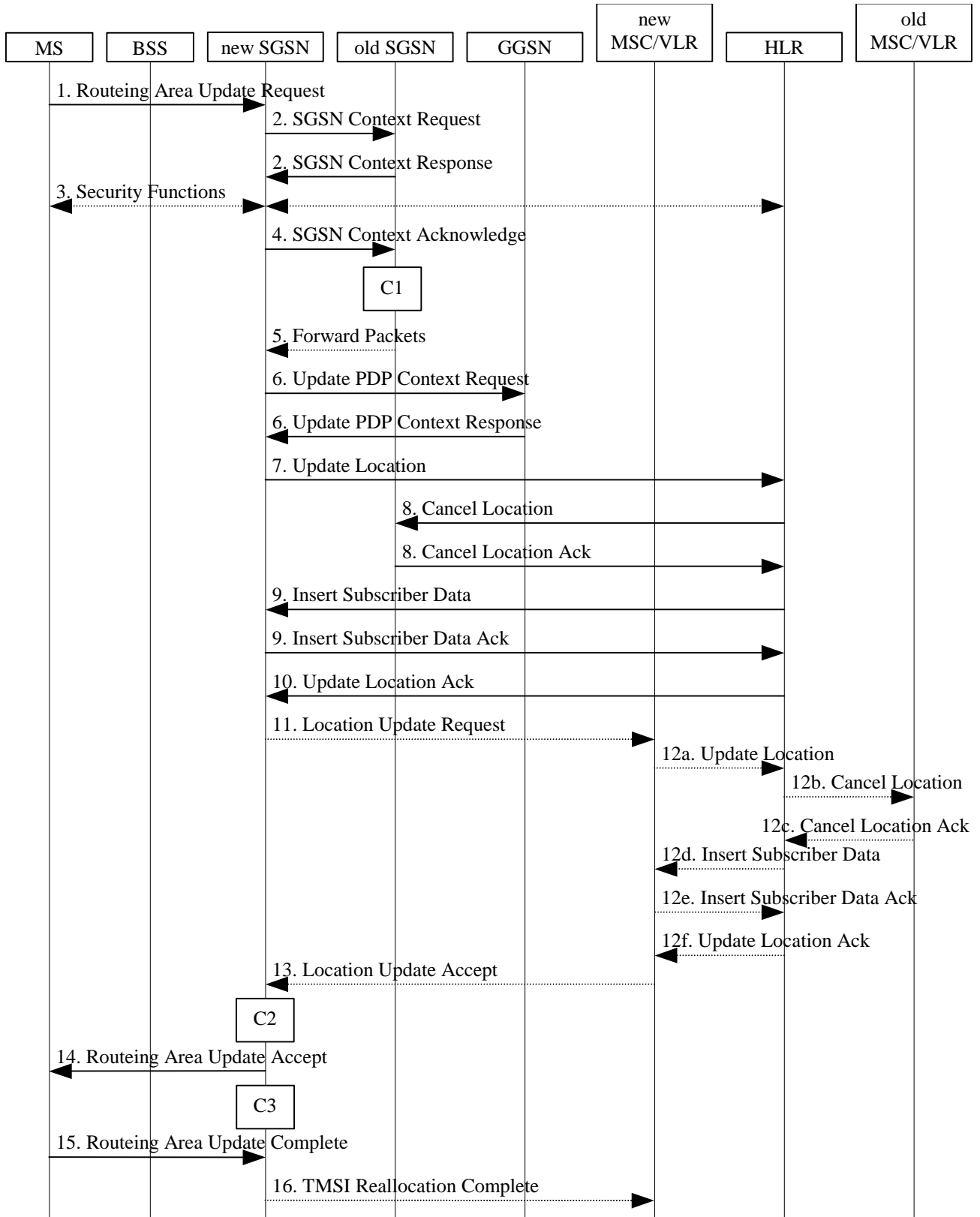


Figure 35: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

- 1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark, DRX parameters and MS Network Capability) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in 3GPP TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous and the DRX cycle length.
- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI (or TLLI) and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI (or TLLI) and relay the message to that actual old SGSN. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN stops assigning SMDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. The old SGSN starts a timer and stops the downlink transfer. The new SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.
- 3) Security functions may be executed. These procedures are defined in clause "Security Function". Ciphering mode shall be set if ciphering is supported. If the security functions fail (e.g. because the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue), the Inter SGSN RAU Update procedure fails. A reject shall be returned to the MS with an appropriate cause.
- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure. If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.
- 5) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SMDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TEID, Prohibit Payload Compression). The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

- 8) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.
- 12) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR:
 - 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, subscriber data) to the new VLR.
 - e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).
 - f) The HLR responds with Update Location Ack (IMSI) to the new VLR.
- 13) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.
- 14) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 15) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete (Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, these N-PDUs shall be discarded by the new SGSN. LLC and SNDSCP in the MS are reset.
- 16) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, or because the SGSN cannot determine the HLR address to establish the locating updating dialogue, the new SGSN shall not

construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

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

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

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routing area update.

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

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

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

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

C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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".

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

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".

- Then the CAMEL_PS_Notification procedure is called. 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".

****** Next Modified Section ******

6.9.2.1 Routing Area Update Procedure

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

The SGSN detects that it is an intra-SGSN routing 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 routing area update. If the network operates in

mode I, an MS that is in CS/PS mode of operation shall perform the Combined RA / LA Update procedures except this CS/PS mode MS is engaged in a CS connection, then it shall perform (non combined) RA Update procedures.

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

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

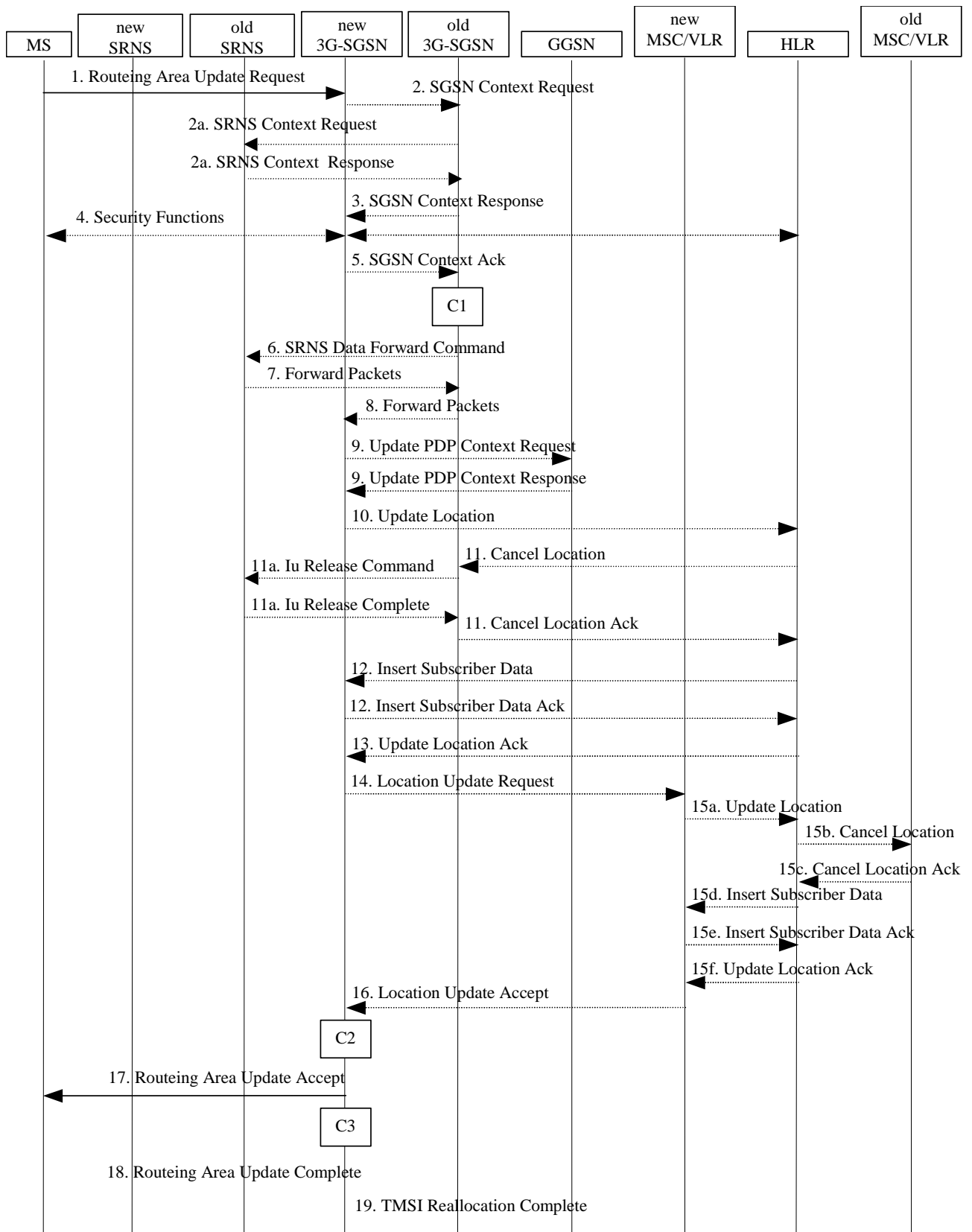


Figure 36: Iu mode RA Update Procedure

- 1) The RRC connection is established, if not already done. The MS sends a Routeing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters, MS Network Capability) to the new SGSN. The MS shall set a follow-on request if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. Update Type shall indicate:
- RA Update if the RA Update is triggered by a change of RA;
 - Periodic RA Update if the RA update is triggered by the expiry of the Periodic RA Update timer;
 - Combined RA / LA Update if the MS is also IMSI-attached and the LA update shall be performed in network operation mode I (see clause "Interactions Between SGSN and MSC/VLR"); or
 - Combined RA / LA Update with IMSI attach requested if the MS wants to perform an IMSI attach in network operation mode I.

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

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

- 2) If the RA update is an Inter-SGSN Routeing area update and if the MS was in PMM-IDLE state, the new SGSN sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN starts a timer.. If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause.
- 2a) If the MS is PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is in the PMM-CONNECTED state and the RAU was received over another Iu connection than the established one, the old SGSN sends an SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message. Upon reception of this message, the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). No conversion of PDCP sequence numbers to SNDPCP sequence numbers shall be done in the 3G-SGSN.
- 3) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next PDU to be sent to the MS. Each PDP Context also includes the PDCP sequence numbers if PDCP sequence numbers are received from the old SRNS. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request. The GTP sequence numbers received from the old 3G-SGSN are only relevant if delivery order is required for the PDP context (QoS profile).
- 4) Security functions may be executed. These procedures are defined in clause "Security Function". If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN

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

- 5) If the RA update is an Inter-SGSN Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.
- 6) If the MS is in PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.
- 7) For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with their related PDCP sequence numbers and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.
- 8) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN. No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.
- 9) If the RA update is an Inter-SGSN RA Update and if the MS was not in PMM-CONNECTED state in the new 3G-SGSN, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, Tunnel Endpoint Identifier,) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier, Prohibit Payload Compression). The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.

Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state in the new 3G-SGSN, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

- 10) If the RA update is an Inter-SGSN RA Update, the new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 11) If the RA update is an Inter-SGSN RA Update, the HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM context. Otherwise, the contexts are removed only when the timer expires. It also ensures that the MM context is kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).
- 11a) On receipt of Cancel Location, if the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNC. When the data-forwarding timer has expired, the SRNS responds with an Iu Release Complete message.
- 12) If the RA update is an 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.
- 13) If the RA update is an Inter-SGSN RA Update, the HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 14) If Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the association has to be established, and the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with ISI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI.

When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 8). The VLR creates or updates the association with the SGSN by storing SGSN Number.

- 15) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR:
 - 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, subscriber data) to the new VLR.
 - e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).
 - f) The HLR responds with Update Location Ack (IMSI) to the new VLR.
- 16) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.
- 17) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).
- 18) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete message to the SGSN.
- 19) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

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

NOTE: The new SGSN may initiate RAB establishment after execution of the security functions (step 4), or wait until completion of the RA update procedure. For the MS, RAB establishment may occur anytime after the RA update request is sent (step 1).

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

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

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

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

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

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

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

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

C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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".

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

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".

- Then the CAMEL_PS_Notification procedure is called. 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".

****** Next Modified Section ******

6.9.2.2.1 Serving RNS Relocation Procedure

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

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

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

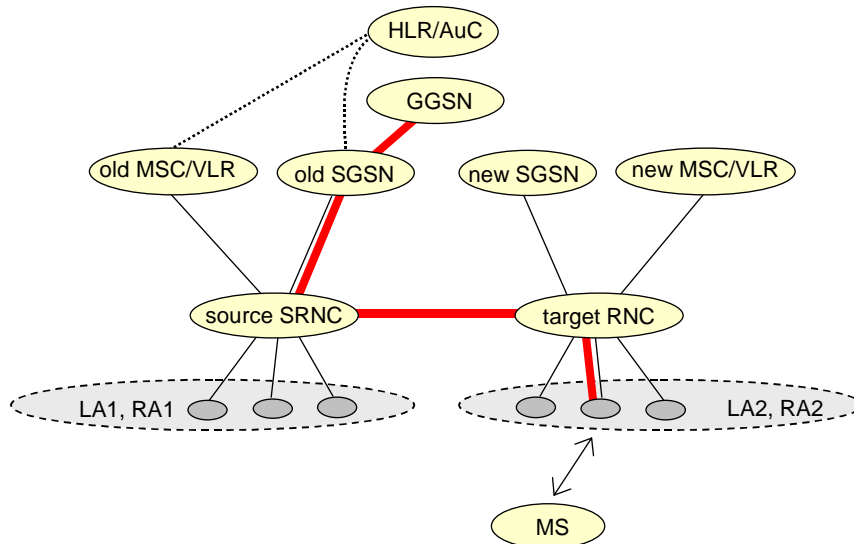


Figure 37: Before SRNS Relocation and Routing Area Update

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

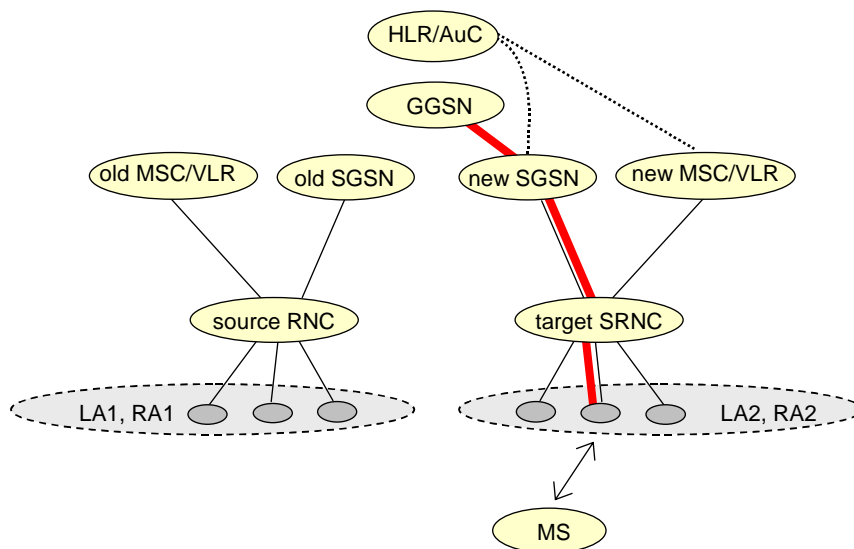


Figure 38: After SRNS Relocation and Routing Area Update

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

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

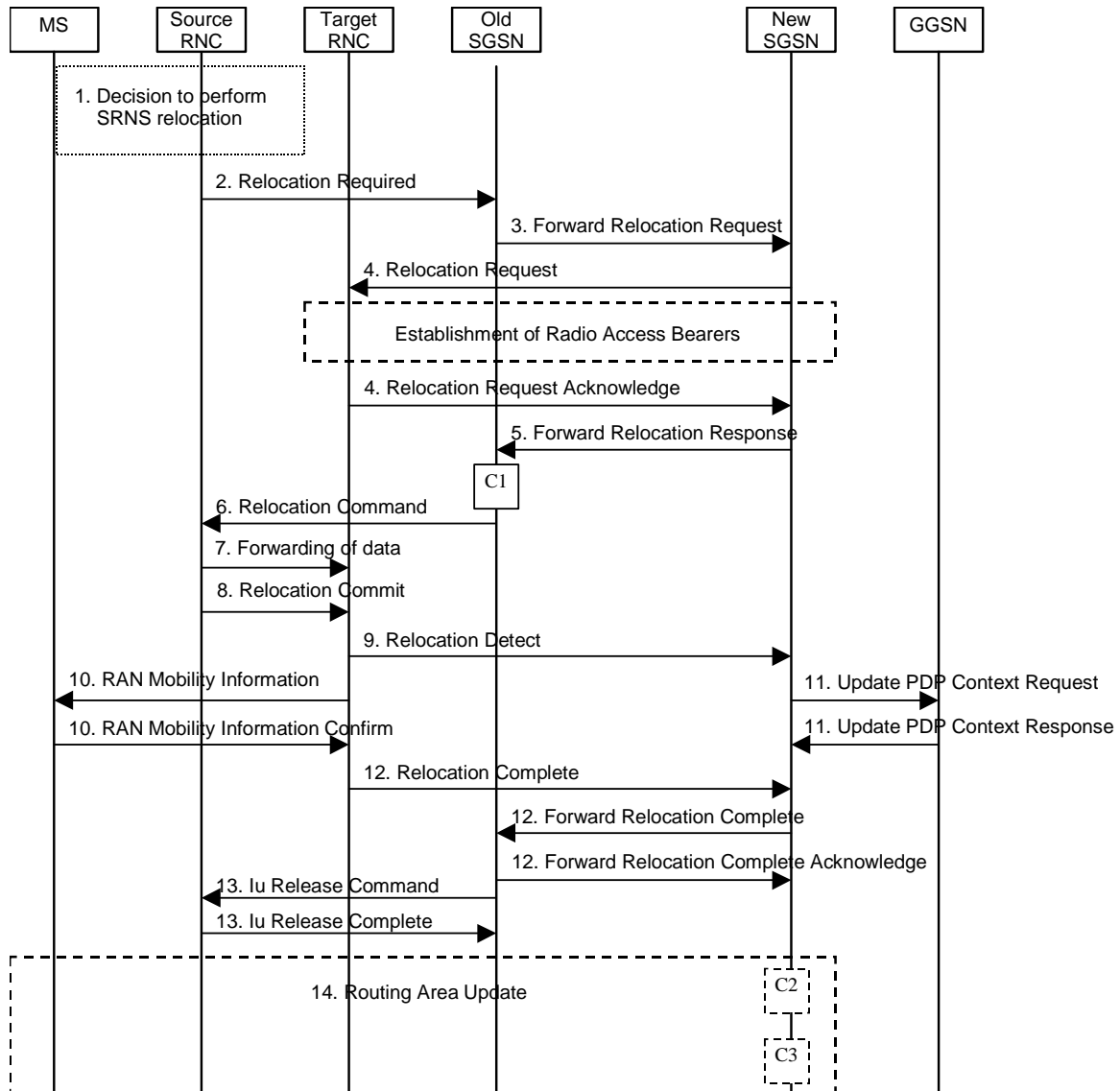


Figure 39: SRNS Relocation Procedure

- 1) The source SRNC decides to perform/initiate SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between MS and source SRNC (data flows via the target RNC, which acts as a drift RNC); GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source SRNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).
- 3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation, the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN transparent container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. The PDP context contains GGSN Address

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

- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source-RNC to target RNC transparent container, RABs to be setup) to the target RNC. Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as the existing Radio Bearers will be reallocated between the MS and the target RNC when the target RNC takes the role of the serving RNC. For each requested RAB, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated; the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.
- 5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from the new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and the RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data. Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

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

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

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

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

- 9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 10) The target SRNC sends a RAN Mobility Information message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

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

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

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

For all RABs, the target RNC should:

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

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

- 11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier, Prohibit Payload Compression). The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 12) When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect and upon reception of Relocation

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

- 13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.
- 14) After the MS has finished the RNTI reallocation procedure and if the new Routing Area Identification is different from the old one, the MS initiates the Routing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then, the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routing_Area_Update_Context.

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

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

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

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

The Combined Hard Handover and SRNS Relocation procedure is used to move the RAN to CN connection point at the RAN side from the source SRNC to the target RNC, while performing a hard handover decided by the RAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra-SGSN SRNS Relocation procedure is performed. If the routing area is changed, this procedure is followed by an Intra-SGSN Routing Area Update procedure. The SGSN detects that it is an intra-SGSN routing 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 Routing Area Update procedure.

Figure 40 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 41 shows the situation after the Combined Hard Handover and

SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 40 and Figure 41 the MS is in PMM-CONNECTED state. Both figures are also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.

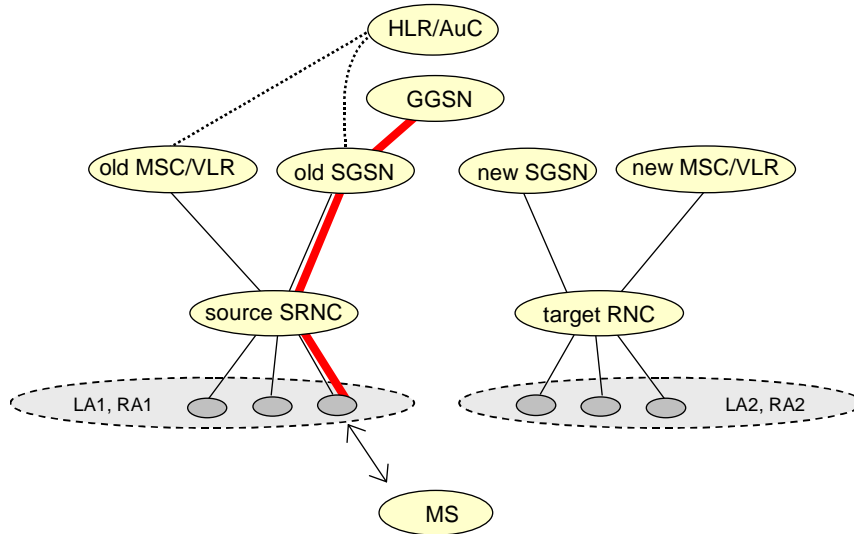


Figure 40: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

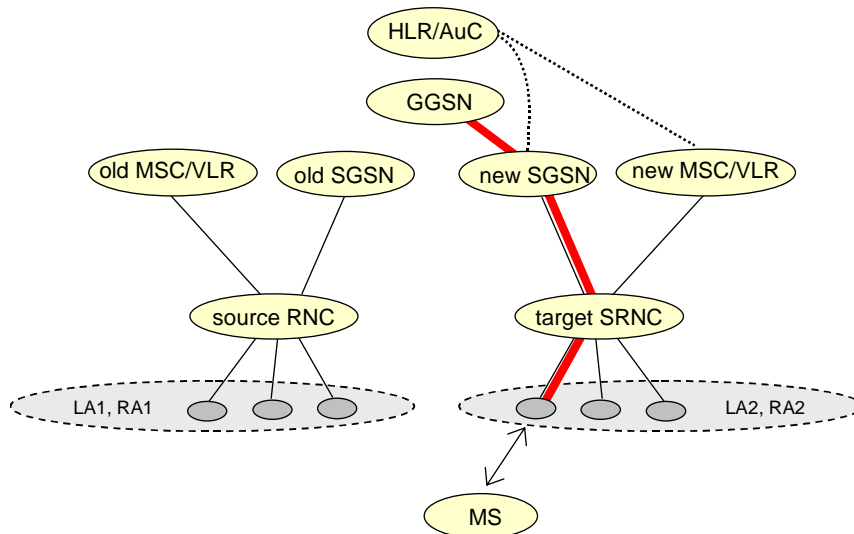


Figure 41: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 42. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. Furthermore, this signalling flow is also applicable for BSS to RNS relocation and vice-versa, as well as BSS to BSS relocation.

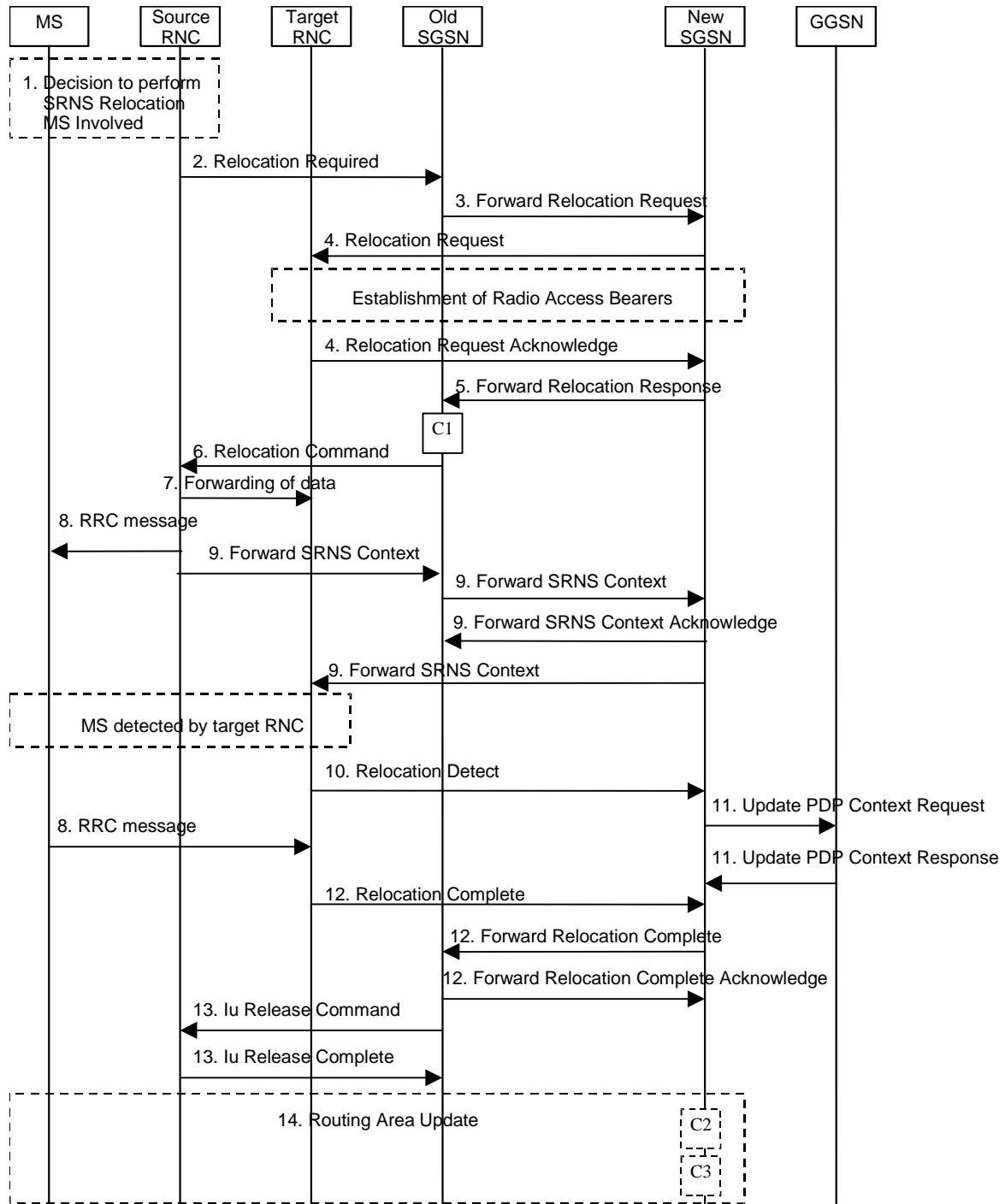


Figure 42: Combined Hard Handover and SRNS Relocation Procedure

- 1) Based on measurement results and knowledge of the RAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between the MS and the source SRNC (no drift RNC available); GTP-U tunnel(s) between the source SRNC and the old SGSN; GTP-U tunnel(s) between the old SGSN and the GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source RNC To Target RNC Transparent Container includes the necessary information for

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

- 3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN Transparent Container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routing Area Update procedure in subclause "Location Management Procedures (Iu mode)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.
- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RAB To Be Setup) to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

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

- 5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, RAN 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. RAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source SRNC. The Target RNC Information, one information element for each RAB to be set up, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begins the forwarding of data for the RABs to be subject for data forwarding.

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

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

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

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

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

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

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

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

- 10) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE Involved", the relocation execution trigger may be received from the Uu interface; i.e., when target RNC detects the MS on the lower layers. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 11) Upon reception of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS relocation is an inter-SGSN SRNS relocation, the new SGSN sends an Update PDP Context Request (New SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) message to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response

(GGSN Tunnel Endpoint Identifier, Prohibit Payload Compression) message. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.

- 12) When the target SRNC receives the appropriate RRC message, e.g. Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message in UTRAN case, or the Handover To UTRAN Complete message or Handover Complete message in GERAN case, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate a Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receiving the Relocation Complete message or, if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired, the source RNC responds with an Iu Release Complete message.
- 14) After the MS has finished the reconfiguration procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. In Figure 42, the procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

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

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

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

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

The Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS relocation procedure for the PS domain is illustrated in Figure 43. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. This signalling flow is also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.

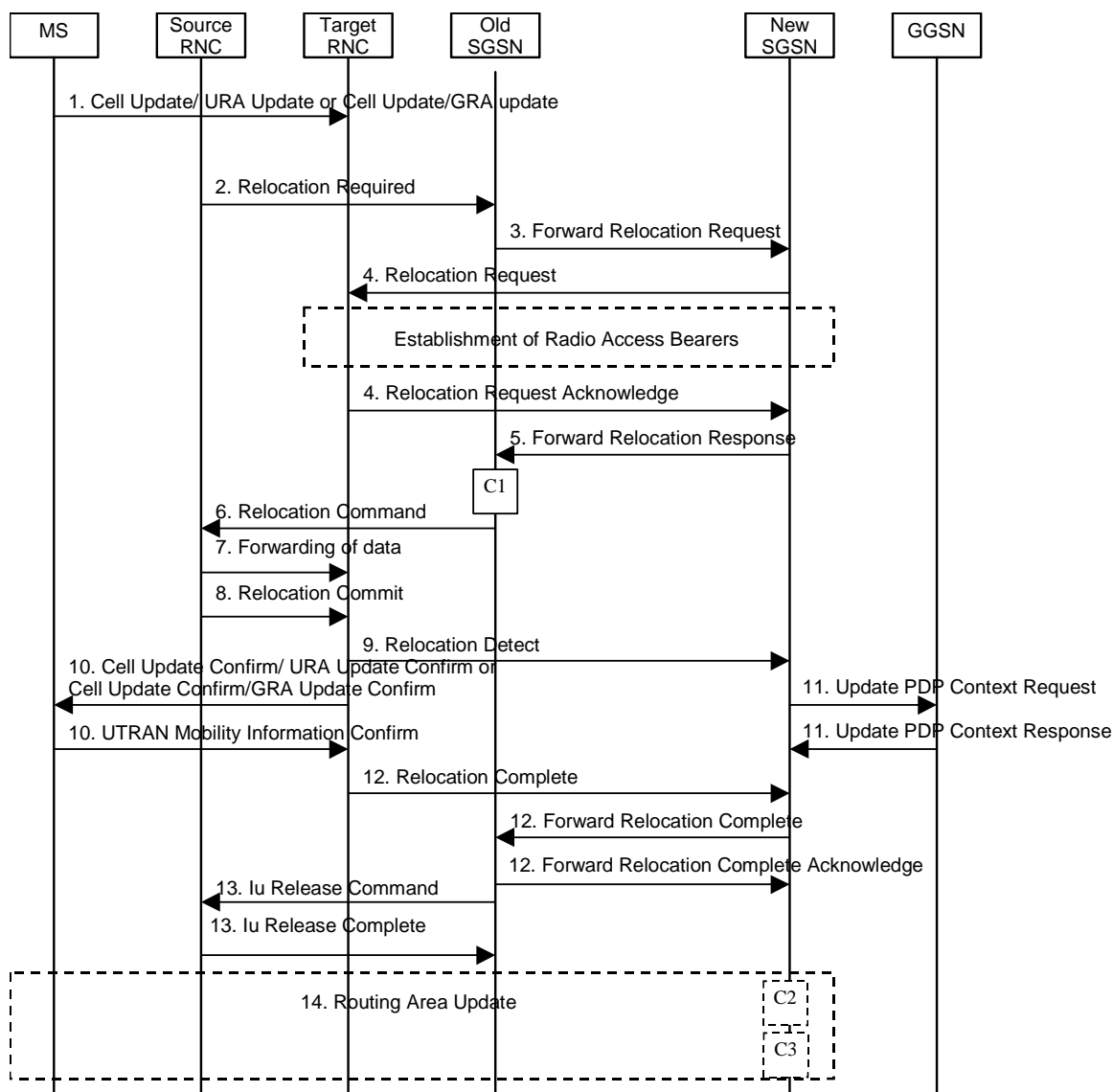


Figure 43: Combined Cell / URA Update and SRNS Relocation Procedure

- 1) The MS sends a Cell Update / URA Update or a Cell Update / GRA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). The source SRNC decides whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this subclause describes the case where a combined cell / URA update and SRNS relocation applies. In this case no radio bearer is established between the source SRNC and the UE. Nonetheless the following tunnel(s) are established: GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including MS Capabilities).
- 3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In the case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN Transparent Container, RANAP Cause) message to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN, see Routing Area Update procedure in subclause "Location Management Procedures (Iu mode)". The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.
- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and a Iu Transport Association which corresponds to the downlink Tunnel Endpoint Identifier for user data.

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

The target-RNC may simultaneously receive for each RAB to be set up downlink user packets both from the source SRNC and from the new SGSN.

- 5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from the source SRNC the forwarded downlink packets, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of

downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.

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

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

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

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

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

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

- 9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 10) The target SRNC sends a Cell Update Confirm / URA Update Confirm or Cell Update Confirm / GRA Update Confirm message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be coordinated in all Iu signalling connections existing for the MS.

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

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

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

- 11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier, Prohibit Payload Compression) message. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 12) When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from the source RNC to the target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation, the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.
- 14) After the MS has finished the Cell / URA update or the Cell / GRA update and RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then, the CAMEL_PS_Notification procedure is called. 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.

****** Next Modified Section ******

6.13.2 Inter-SGSN Inter-system Change

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

An inter-SGSN inter-system change from Iu mode to A/Gb mode takes place when an MS in PMM-IDLE or PMM-CONNECTED state changes from UTRAN or GERAN Iu mode to A/Gb mode and the A/Gb mode radio access node serving the MS is served by a different SGSN. In this case, the RA changes. Therefore, the MS shall initiate a A/Gb mode RA update procedure. The RA update procedure is either combined RA / LA update or only RA update. These RA update cases are illustrated in Figure 54. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

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. The MS sends a Routing 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 3GPP TS 23.122), as no combined RA / LA updates are performed during a CS connection.

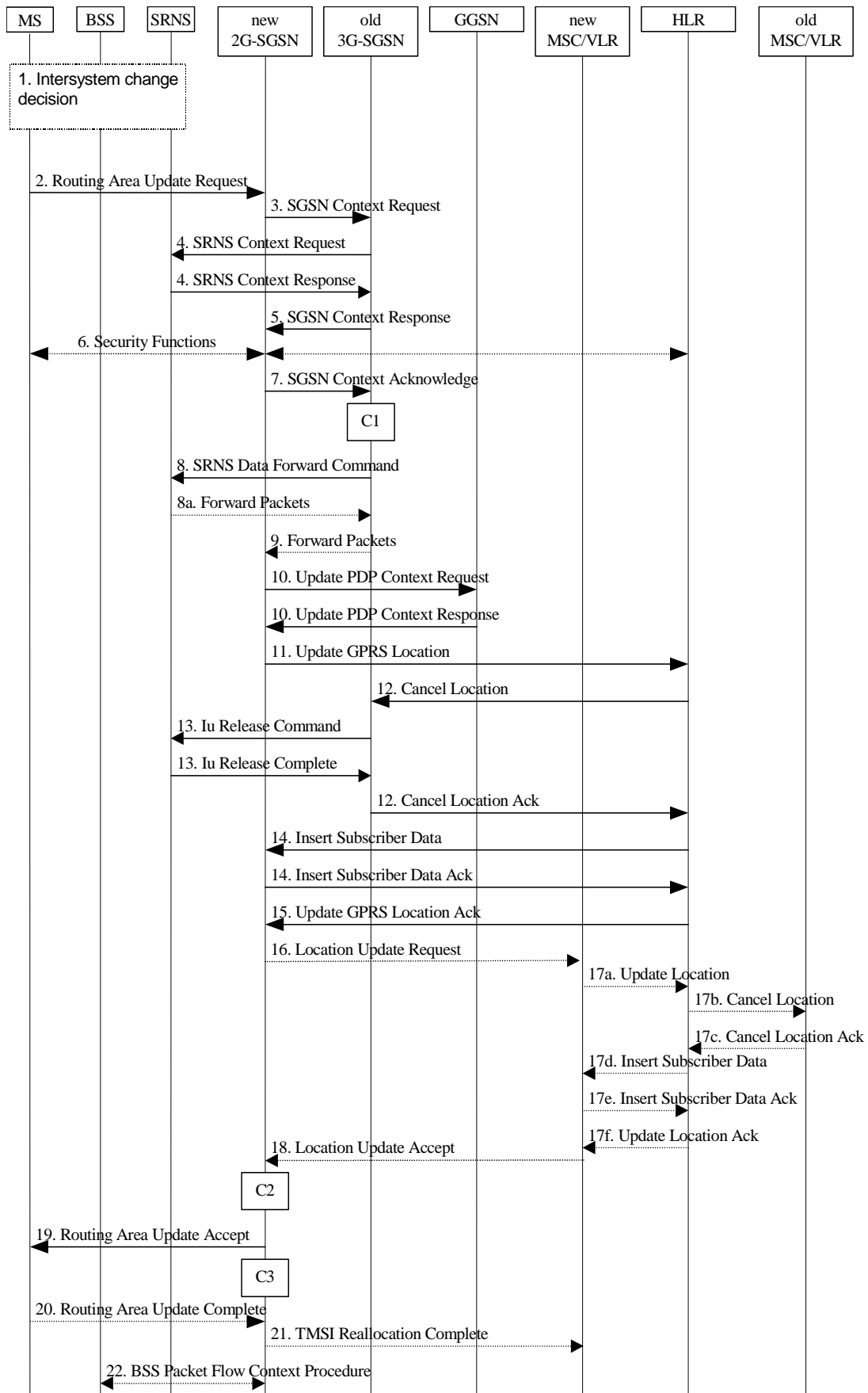


Figure 54: Iu mode to A/Gb mode Inter-SGSN Change

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

- 2) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, MS Network Capability) message to the new 2G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the new 2G-SGSN.
- 3) The new 2G-SGSN sends an SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) message to the old 3G-SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI (or TLLI) and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI (or TLLI) and relay the message to that actual old SGSN. The old 3G-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 3G-SGSN. If the received old P-TMSI Signature does not match the stored value, the security functions in the new 2G-SGSN should be initiated. If the security functions authenticate the MS correctly, the new 2G-SGSN shall send an SGSN Context Request (old RAI, TLLI, MS Validated, New SGSN Address) message to the old 3G-SGSN. MS Validated indicates that the new 2G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 2G-SGSN indicates that it has authenticated the MS correctly, the old 3G-SGSN starts a timer. If the MS is not known in the old 3G-SGSN, the old 3G-SGSN responds with an appropriate error cause.
- 4) If the MS is PMM-CONNECTED the old 3G-SGSN sends an SRNS Context Request (IMSI) message to the SRNS. Upon receipt of this message the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (GTP-SNDs, GTP-SNUs, PDCP-SNDs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context, which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU) downlink PDCP sequence number (PDCP-SND). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS. PDCP-SND is the PDCP sequence number for the first downlink packet for which successful transmission has not been confirmed. The 3G-SGSN shall strip off the eight most significant bits of the passed PDCP sequence numbers, thus converting them to SNDP N-PDU numbers and stores the N-PDU numbers in its PDP contexts..
- 5) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next in-sequence N-PDU to be sent to the MS. Each PDP Context also includes the SNDP Send N-PDU Number (the value is 0) for the next in-sequence downlink N-PDU to be sent in SNDP acknowledged mode to the MS and the SNDP Receive N-PDU Number (= converted PDCP-SNU) for the next in-sequence uplink N-PDU to be received in SNDP acknowledged mode from the MS. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.
- 6) Security functions may be executed.
- 7) The new 2G-SGSN sends an SGSN Context Acknowledge message to the old 3G-SGSN. This informs the old 3G-SGSN that the new 2G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a RA update procedure back to the old SGSN before completing the ongoing RA update procedure.
- 8) If the MS is in the PMM-CONNECTED state, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs to the old 3G-SGSN together with their related downlink PDCP sequence numbers. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.
- 9) The old 3G-SGSN tunnels the GTP PDUs to the new 2G-SGSN. In the case of GTPv1, the conversion of PDCP sequence numbers to SNDP sequence numbers (the eight most significant bits shall be stripped off) shall be done in the new SGSN. No N-PDU sequence numbers shall be indicated for these N-PDUs. If GTPv0 is used

between the SGSNs, the conversion of PDCP sequence numbers to SNDCP numbers shall be done in the old 3G-SGSN (by stripping off the eight most significant bits).

- 10) The new 2G-SGSN sends an Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) message to each GGSN concerned. Each GGSN updates its PDP context fields and returns an Update PDP Context Response (TEID, Prohibit Payload Compression) message. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 11) The new 2G-SGSN informs the HLR of the change of SGSN by sending an Update GPRS Location (SGSN Number, SGSN Address, IMSI) message to the HLR.
- 12) The HLR sends a Cancel Location (IMSI) message to the old 3G-SGSN. The old 3G-SGSN acknowledges with a Cancel Location Ack (IMSI) message. The old 3G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. If the timer is running, the MM and PDP contexts shall be removed when the timer expires.
- 13) When the MS is PMM-CONNECTED, the old 3G-SGSN sends an Iu Release Command message to the SRNS. When the RNC data-forwarding timer has expired, the SRNS responds with an Iu Release Complete message.
- 14) The HLR sends an Insert Subscriber Data (IMSI, GPRS Subscription Data) message to the new 2G-SGSN. The 2G-SGSN constructs an MM context and PDP contexts for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 15) The HLR acknowledges the Update GPRS Location by returning an Update GPRS Location Ack (IMSI) message to the new 2G-SGSN.
- 16) If the association has to be established i.e. if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routing area update, the new 2G-SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The 2G-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 14). The VLR creates or updates the association with the 2G-SGSN by storing SGSN Number.
- 17) 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:
 - 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, 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.
- 18) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the 2G-SGSN. VLR TMSI is optional if the VLR has not changed.
- 19) The new 2G-SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the new 2G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful, the new 2G-SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 2G-SGSN and the MS. 2G-SGSN initiates the establishment procedure. The new 2G-SGSN responds to the MS with a Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number (= converted PDCP-SNU) message. Receive N-PDU Number contains the acknowledgements for each NSAPI which used lossless PDCP before the start of the update procedure, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the

update procedure. If Receive N-PDU Number confirms the reception of N-PDUs, the MS shall discard these N-PDUs.

20) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete (Receive N-PDU Number (= converted PDCP-SND)) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each lossless PDCP used by the MS before the start of the update procedure, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms the reception of N-PDUs that were forwarded from the old 3G-SGSN, the new 2G-SGSN shall discard these N-PDUs. The MS deducts Receive N-PDU number from PDCP-SND by stripping off the eight most significant bits. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in the MS per radio bearer, which used lossless PDCP. The new 2G-SGSN negotiates with the MS for each NSAPI the use of acknowledged or unacknowledged SNDCP regardless whether the SRNS used lossless PDCP or not.

21) The new 2G-SGSN sends TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

22) The 2G-SGSN and the BSS may execute the BSS Packet Flow Context procedure.

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

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

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routeing area update.

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

C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. 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".

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

The inter-system change from A/Gb mode to Iu mode takes place when a GPRS-attached MS changes from A/Gb mode to UTRAN or GERAN Iu mode and the new RAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a Iu mode RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update,

these RA update cases are illustrated in Figure 55. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

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

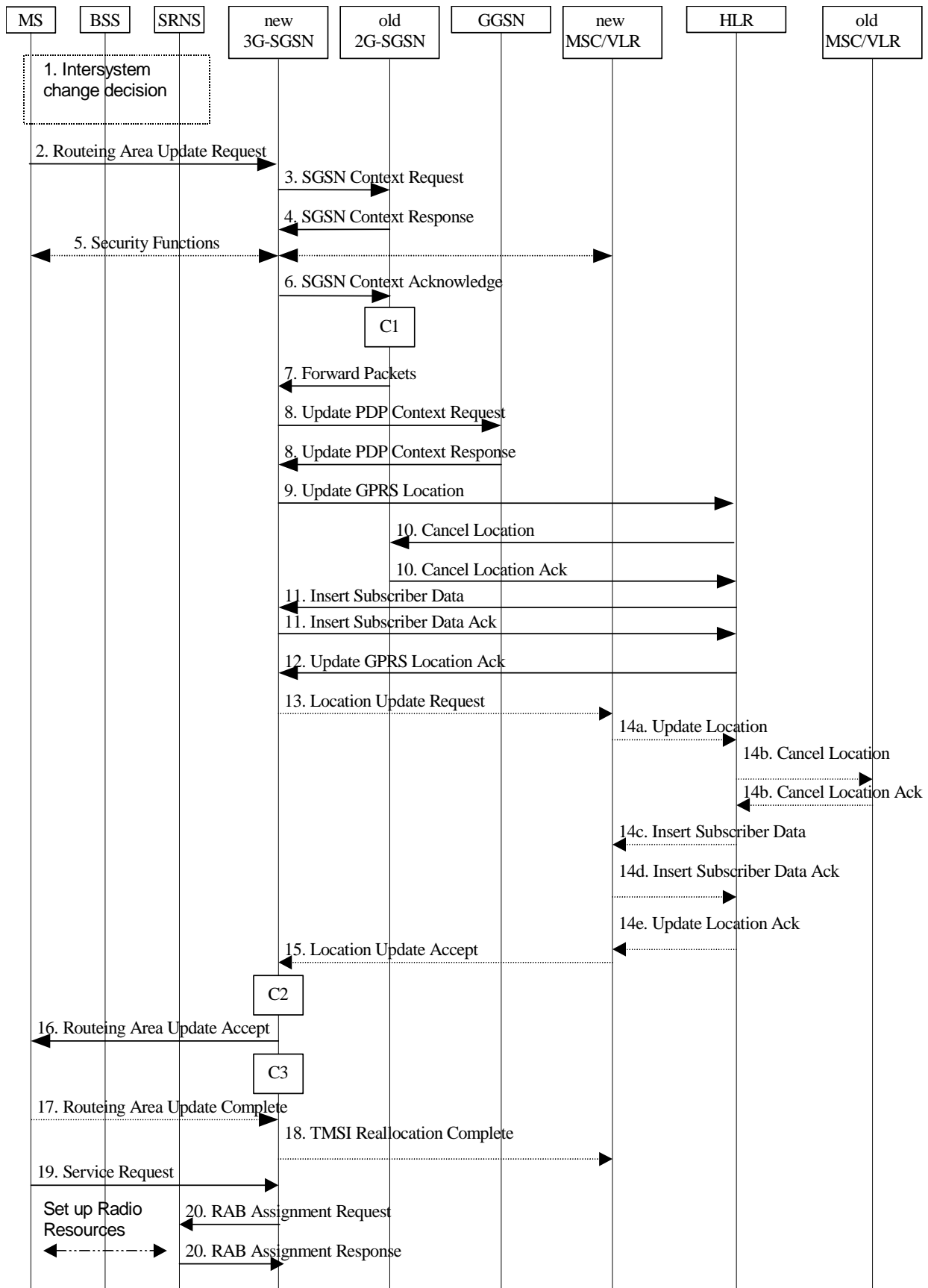


Figure 55: A/Gb mode to Iu mode Inter SGSN Change

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

- 2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.
- 3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, IMSI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.
- 4) The old 2G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. Each PDP Context includes the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode SMDCP to the MS and the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode SMDCP from the MS. The new 3G-SGSN derives the corresponding PDCP sequence numbers from these N-PDU sequence numbers by adding eight most significant bits "1". These PDCP sequence numbers are stored in the 3G-SGSN PDP contexts. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.
- 5) Security functions may be executed.
- 6) The new 3G-SGSN sends an SGSN Context Acknowledge message to the old 2G-SGSN. This informs the old 2G-SGSN that the new 3G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.
- 7) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. Additional N-PDUs received from the GGSN before the timer described in step 3 expires are also duplicated and tunnelled to the new 3G-SGSN. N-PDUs that were already sent to the MS in acknowledged mode SMDCP and that are not yet acknowledged by the MS are tunnelled together with their related SMDCP N-PDU sequence number. No PDCP sequence numbers shall be indicated for these N-PDUs. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.
- 8) The new 3G-SGSN sends an Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) message to each GGSN concerned. Each GGSN updates its PDP context fields and returns an Update PDP Context Response (TEID, Prohibit Payload Compression) message. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 9) The new 3G-SGSN informs the HLR of the change of SGSN by sending an Update GPRS Location (SGSN Number, SGSN Address, IMSI) message to the HLR.
- 10) The HLR sends a Cancel Location (IMSI, Cancellation Type) message to the old 2G-SGSN. The old 2G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. If the timer is running, the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with a Cancel Location Ack (IMSI) message.

- 11) The HLR sends an Insert Subscriber Data (IMSI, GPRS Subscription Data) message to the new 3G-SGSN. The 3G-SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 12) The HLR acknowledges the Update GPRS Location by returning an Update GPRS Location Ack (IMSI) message to the new 3G-SGSN.
- 13) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The 3G-SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 12). The VLR creates or updates the association with the 3G-SGSN by storing SGSN Number.
- 14) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR:
 - 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, subscriber data) to the new VLR.
 - e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).
 - f) The HLR responds with Update Location Ack (IMSI) to the new VLR.
- 15) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the 3G-SGSN. VLR TMSI is optional if the VLR has not changed.
- 16) The new 3G-SGSN validate the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the new 3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful, the new 3G-SGSN constructs MM and PDP contexts for the MS. The new 3G-SGSN responds to the MS with a Routing Area Update Accept (P-TMSI, P-TMSI signature) message.
- 17) The MS acknowledges the new P-TMSI by returning a Routing Area Update Complete message to the SGSN.
- 18) The new 3G-SGSN sends TMSI Reallocation Complete message to the new VLR, if the MS confirms the VLR TMSI.
- 19) If the MS has uplink data or signalling pending it shall send a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.
- 20) If the MS has sent the Service Request, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request (RAB ID(s), QoS Profile(s), GTP-SNDs, GTP-SNUs, PDCP-SNUs) message to the SRNS. The PDCP sequence numbers are derived from the N-PDU sequence numbers in step 4) and stored in the SGSN PDP contexts. The SRNS sends a Radio Bearer Setup Request (PDCP-SNUs) message to the MS. The MS responds with a Radio Bearer Setup Complete (PDCP-SNDs) message. The MS deducts PDCP-SND from its Receive N-PDU Number by adding eight most significant bits "1". The SRNS responds with a RAB Assignment Response message. The SRNS shall discard all N-PDUs tunnelled from the SGSN with N-PDU sequence numbers older than the eight least significant bits of the PDCP-SNDs received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with SNDCP sequence numbers older than the eight least significant bits of the PDCP-SNUs received from the SRNS. Other N-PDUs shall be transmitted to the SRNS. The SRNS negotiates with the MS for each radio bearer the use of lossless PDCP or not regardless whether the old 2G-SGSN used acknowledged or unacknowledged SNDCP for the related NSAPI or not.

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

NOTE: The new SGSN may initiate RAB establishment after execution of the security functions (step 5), or wait until completion of the RA update procedure. For the MS, RAB establishment may occur anytime after the RA update request is sent (step 2).

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

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

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routing area update.

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

C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

They are called in the following order:

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

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. 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".

***** Next Modified Section *****

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 63 and Figure 64.

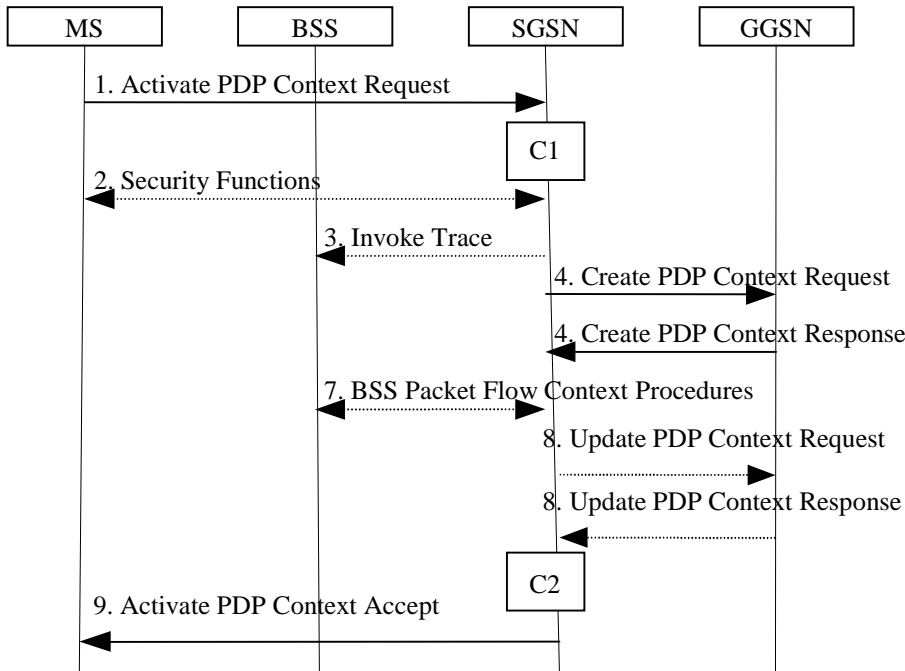


Figure 63: PDP Context Activation Procedure for A/Gb mode

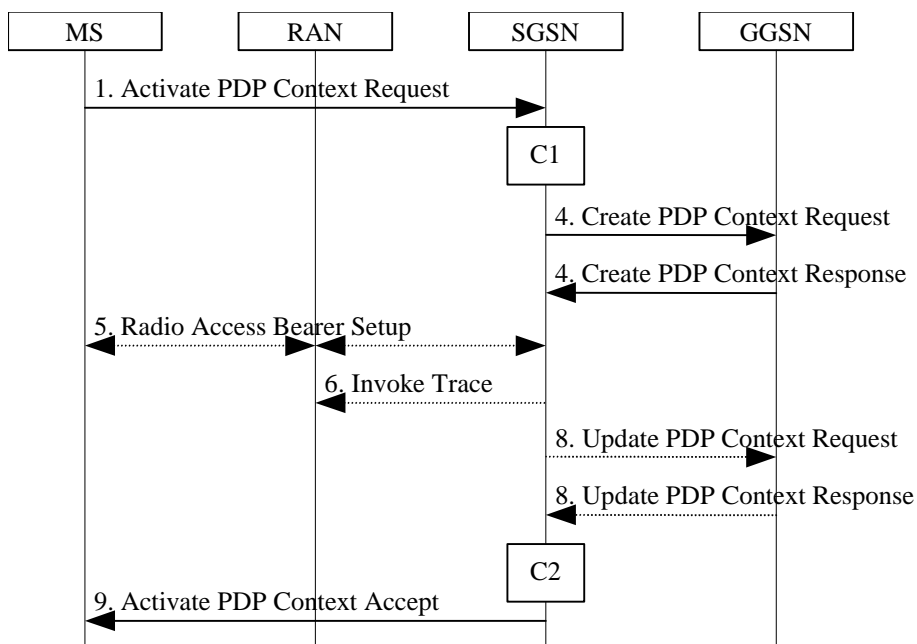


Figure 64: PDP Context Activation Procedure for lu mode

- 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 packet data network and/or to select a service. Access Point Name is a logical name referring to the 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 transfer optional PDP parameters and/or request to the GGSN (see GSM 29.060 [26] and 24.229 [75]). PDP Configuration Options is sent transparently through the SGSN.
- 2) In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".
- 3) In A/Gb mode and if BSS trace is activated, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.
- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

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

If a GGSN address can be derived, the SGSN creates a TEID for the requested PDP context. If the MS requests a dynamic address, the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile.

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, NSAPI, MSISDN, Selection Mode, Charging Characteristics, Trace Reference, Trace Type, Trigger Id, OMC Identity, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in Annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find a packet data network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by an MS or a non-subscribed APN chosen by the SGSN was selected. Selection Mode is set according to Annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode. Charging Characteristics indicates which kind of charging the PDP context is liable for. The charging characteristics on the GPRS subscription and individually subscribed APNs as well as the way the SGSN handles Charging Characteristics and chooses to send them or not to the GGSN is defined in 3GPP TS 32.215 [70]. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the packet data network, and to start charging. The way the GGSN handles Charging Characteristics that it may have received from the SGSN is defined in 3GPP TS 32.215 [70]. The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TEID, PDP Address, PDP Configuration Options, QoS Negotiated, Charging Id, Prohibit Payload Compression, Cause) message to the SGSN. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify and monitor these negotiations as long as the PDP context is in ACTIVE state, and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently used PDP address to the SGSN and the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated, the GGSN rejects the Create PDP Context Request message. The GGSN operator configures the compatible QoS profiles.

- 5) In Iu mode, RAB setup is done by the RAB Assignment procedure, see subclause "RAB Assignment Procedure".
- 6) In Iu mode and if BSS trace is activated, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the RAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.
- 7) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".
- 8) In case the QoS attributes have been downgraded in step 7 for A/Gb mode or in step 5 for Iu mode, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.
- 9) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. PDP Configuration Options may be used to transfer optional PDP parameters to the UE (see GSM 29.060 [26] and 24.229 [75]). PDP Configuration Options is sent transparently through the SGSN. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

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

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

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

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

- C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 63 and Figure 64, procedures return as result "Continue".

- C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 63 and Figure 64, procedures return as result "Continue".

9.2.2.1.1 Secondary PDP Context Activation Procedure

The Secondary PDP Context Activation procedure may be used to activate a PDP context while reusing the PDP address and other PDP context information from an already active PDP context, but with a different QoS profile. Procedures for APN selection and PDP address negotiation are not executed. A unique TI and a unique NSAPI shall identify each PDP context sharing the same PDP address and APN.

The Secondary PDP Context Activation procedure may be executed without providing a Traffic Flow Template (TFT) to the newly activated PDP context if all other active PDP contexts for this PDP address and APN already have an associated TFT. Otherwise a TFT shall be provided. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected packet data network to the newly activated PDP context.

The Secondary PDP Context Activation procedure may only be initiated after a PDP context is already activated for the same PDP address and APN. The procedure is illustrated in Figure 65 and Figure 66.

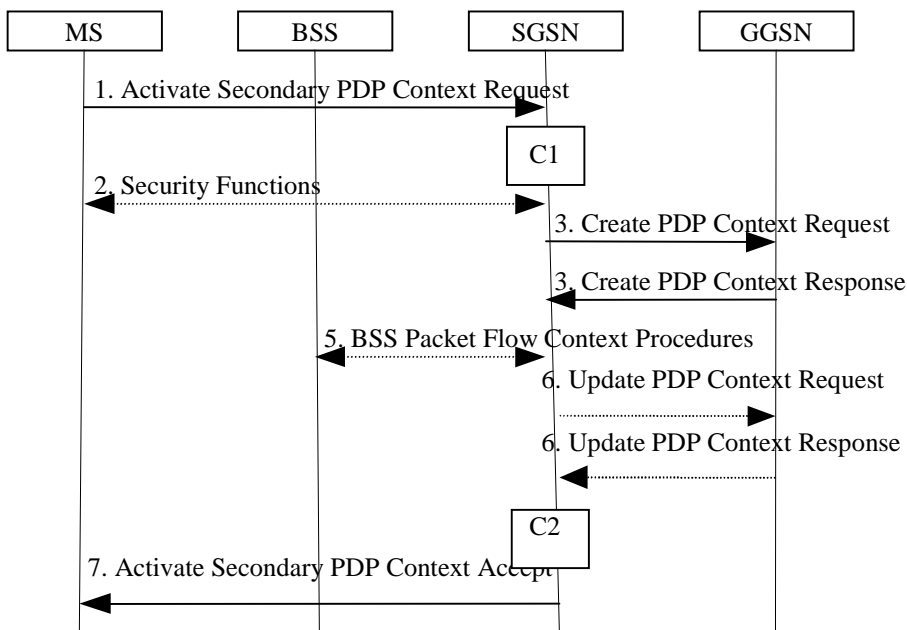


Figure 65: Secondary PDP Context Activation Procedure for A/Gb mode

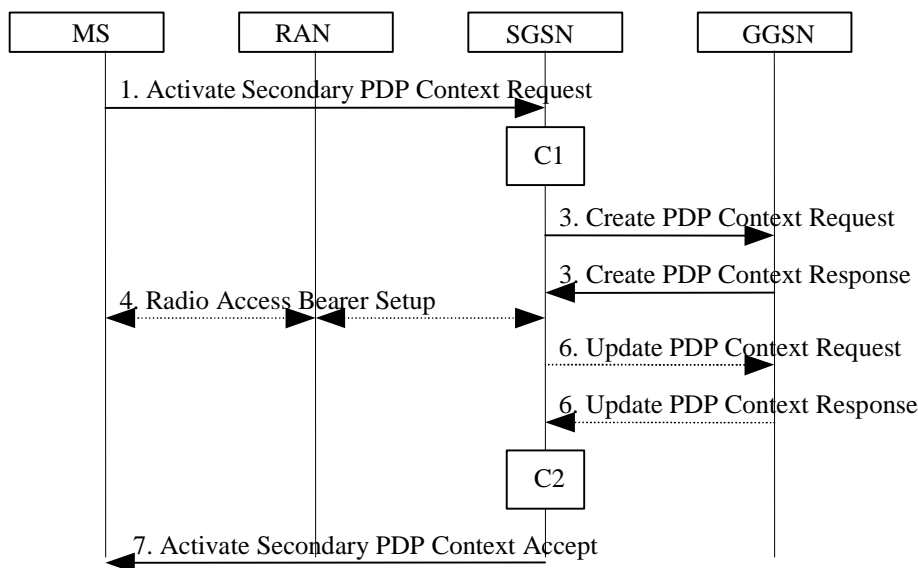


Figure 66: Secondary PDP Context Activation Procedure for Iu mode

- 1) The MS sends an Activate Secondary PDP Context Request (Linked TI, NSAPI, TI, QoS Requested, TFT, PDP Configuration Options) message to the SGSN. Linked TI indicates the TI value assigned to any one of the already activated PDP contexts for this PDP address and APN. QoS Requested indicates the desired QoS profile. TFT is sent transparently through the SGSN to the GGSN to enable packet classification for downlink data transfer. TI and NSAPI contain values not used by any other activated PDP context. PDP Configuration Options may be used to transfer optional PDP parameters and/or requests to the GGSN (see GSM 29.060 [26] and 24.229 [75]). PDP Configuration Options is sent transparently through the SGSN.
- 2) In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".

- 3) The SGSN validates the Activate Secondary PDP Context Request using the TI indicated by Linked TI. The same GGSN address is used by the SGSN as for the already-activated PDP context(s) for that TI and PDP address.

The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile, which represents the maximum QoS per PDP context to the associated APN. The GGSN may restrict and negotiate the requested QoS as specified in clause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TEID, NSAPI, Primary NSAPI, TFT, PDP Configuration Options) message to the affected GGSN. Primary NSAPI indicates the NSAPI value assigned to any one of the already activated PDP contexts for this PDP address and APN. TFT is included only if received in the Activate Secondary PDP Context Request message. PDP Configuration Options is sent transparently through the SGSN if received in the Activate secondary PDP Context Request message.

The GGSN uses the same packet data network as used by the already-activated PDP context(s) for that PDP address, generates a new entry in its PDP context table, and stores the TFT. The new entry allows the GGSN to route PDP PDUs via different GTP tunnels between the SGSN and the packet data network. The GGSN returns a Create PDP Context Response (TEID, QoS Negotiated, Cause, PDP Configuration Options, Prohibit Payload Compression) message to the SGSN. PDP Configuration Options may be used to transfer optional PDP parameters to the UE (see GSM 29.060 [26] and 24.229 [75]). The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.

- 4) In Iu mode, RAB setup is done by the RAB Assignment procedure.
- 5) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".
- 6) In case the QoS attributes have been downgraded in step 5 for A/Gb mode or in step 4 for Iu mode, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.
- 7) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. PDP Configuration Options is sent transparently through the SGSN if received in the Create PDP Context Response message. The SGSN is now able to route PDP PDUs between the GGSN and the MS via different GTP tunnels and possibly different LLC links.

For each additionally activated PDP context a QoS profile and TFT may be requested.

If the secondary PDP context activation procedure fails or if the SGSN returns an Activate Secondary PDP Context Reject (Cause, PDP Configuration Options) message, the MS may attempt another activation with a different TFT, depending on the cause.

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

- C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 65 and in Figure 66, procedures return as result "Continue".

- C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 65 and in Figure 66, procedures return as result "Continue".

***** Next Modified Section *****

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in Figure 70.

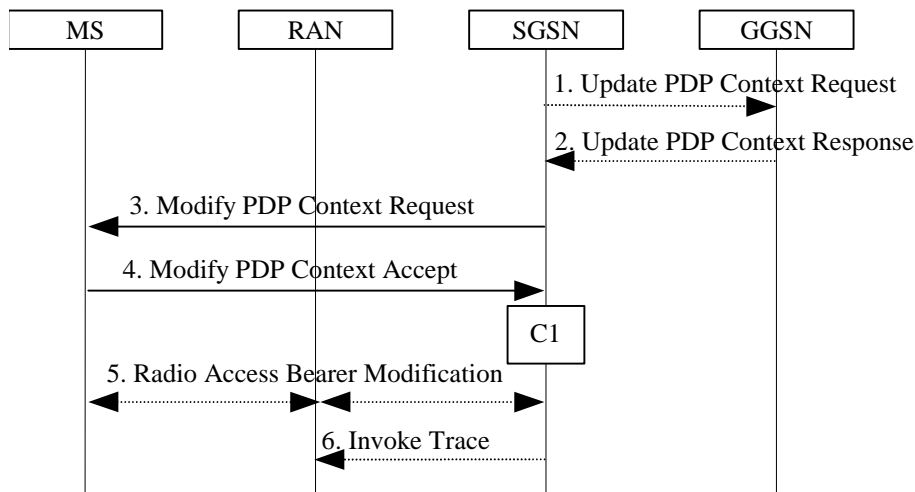


Figure 70: SGSN-Initiated PDP Context Modification Procedure

- 1) The SGSN may send an Update PDP Context Request (TEID, NSAPI, QoS Negotiated, Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified, the GGSN rejects the Update PDP Context Request. The GGSN operator configures the compatible QoS profiles. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity in the message if GGSN trace is activated while the PDP context is active. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.
- 2) The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TEID, QoS Negotiated, Prohibit Payload Compression, Cause) message. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 3) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and may send a Modify PDP Context Request (TI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.
- 4) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by the MS procedure.
- 5) In Iu mode, radio access bearer modification may be performed by the RAB Assignment procedure.
- 6) If BSS trace is activated while the PDP context is active, the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the RAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

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

- C1) CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

9.2.3.2 GGSN-Initiated PDP Context Modification Procedure

The GGSN-Initiated PDP Context Modification procedure is illustrated in Figure 71.

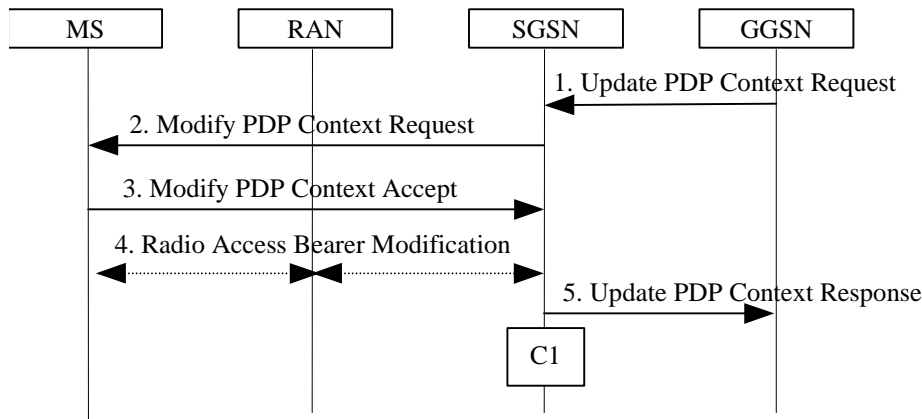


Figure 71: GGSN-Initiated PDP Context Modification Procedure

- 1) The GGSN sends an Update PDP Context Request (TEID, NSAPI, PDP Address, QoS Requested, Prohibit Payload Compression) message to the SGSN. QoS Requested indicates the desired QoS profile. PDP Address is optional. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, the current QoS profile, and the subscribed QoS profile. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, PDP Address, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. PDP Address is optional.
- 3) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 4) In Iu mode, radio access bearer modification may be performed by the RAB Assignment procedure.
- 5) Upon receipt of the Modify PDP Context Accept message, or upon completion of the RAB modification procedure, the SGSN returns an Update PDP Context Response (TEID, QoS Negotiated) message to the GGSN. If the SGSN receives a Deactivate PDP Context Request message, it shall instead follow the PDP Context Deactivation Initiated by MS procedure.

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

C1) CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in Figure 72.

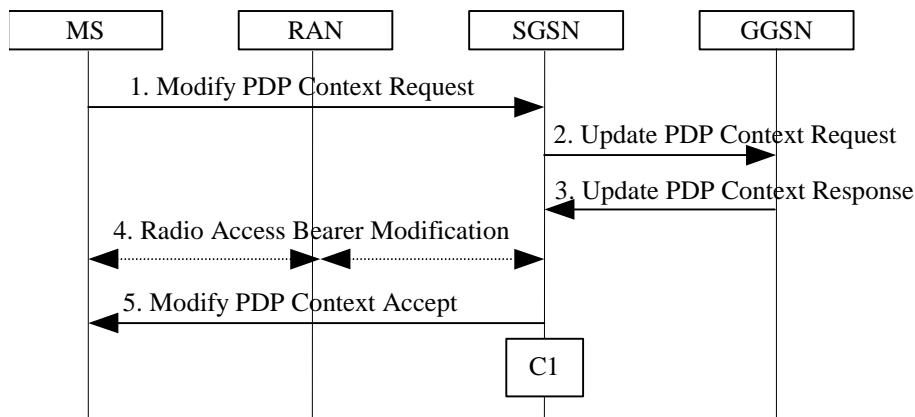


Figure 72: MS-Initiated PDP Context Modification Procedure

- 1) The MS sends a Modify PDP Context Request (TI, QoS Requested, TFT, PDP Configuration Options) message to the SGSN. Either QoS Requested or TFT or both may be included. QoS Requested indicates the desired QoS profile, while TFT indicates the TFT that is to be added or modified or deleted from the PDP context. PDP Configuration Options may be used to transfer optional PDP parameters and/or requests to the GGSN.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, and the subscribed QoS profile. The SGSN sends an Update PDP Context Request (TEID, NSAPI, QoS Negotiated, TFT, PDP Configuration Options) message to the GGSN. If QoS Negotiated and/or TFT received from the SGSN is incompatible with the PDP context being modified (e.g., TFT contains inconsistent packet filters), the GGSN rejects the Update PDP Context Request. The GGSN operator configures the compatible QoS profile. PDP Configuration Options is sent transparently through the SGSN if received in Modify PDP Context Request message.
- 3) The GGSN may further restrict QoS Negotiated given its capabilities, operator policies and the current load. The GGSN stores QoS Negotiated, stores, modifies, or deletes TFT of that PDP context as indicated in TFT, and returns an Update PDP Context Response (TEID, QoS Negotiated, PDP Configuration Options, Prohibit Payload Compression) message. PDP Configuration Options may be used to transfer optional PDP parameters to the UE. The Prohibit Payload Compression indicates that the SGSN should negotiate no data compression for this PDP context.
- 4) In Iu mode, radio access bearer modification may be performed by the RAB Assignment procedure. In case the radio access bearer does not exist the RAB setup is done by the RAB Assignment procedure.
- 5) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns a Modify PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. PDP Configuration Options is sent transparently through the SGSN if received in Modify PDP Context Response message.

NOTE1: If the SGSN does not accept QoS Requested, then steps 2 and 3 of this procedure are skipped, and the existing QoS Negotiated is returned to the MS in step 4.

NOTE2: In this release of the standards no procedure is defined that uses the Protocol Configuration Options in the PDP context modification procedure.

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

C1) CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

****** Next Modified Section ******

12.3.2 Subfunctions

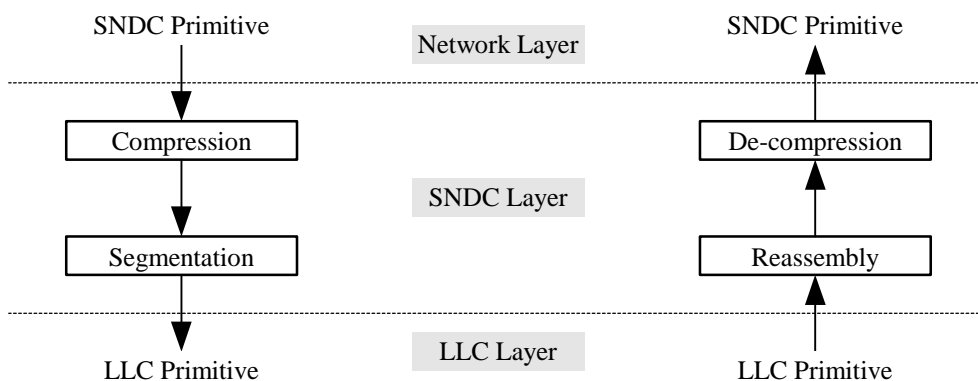


Figure 81: Sequential Invocation of SNDC Functionality

SNDCP performs the following subfunctions:

- Mapping of SNDC primitives received from the network layer into corresponding LLC primitives to be passed to the LLC layer, and vice versa.
- Multiplexing of N-PDUs from one or several NSAPIs onto one LLC SAPI. NSAPIs that are multiplexed onto the same SAPI shall use the same radio priority level, QoS traffic handling priority, and traffic class.
- Compression of redundant protocol control information and user data. This may include e.g. TCP/IP header compression and V.42 bis [32] data compression. Compression may be performed independently for each QoS traffic handling priority and traffic class. If several network layers use the same QoS traffic handling priority and traffic class, one common compressor may be used for these network layers. The relationship between NSAPIs, compressors, and SAPIs is defined in GSM 04.65. Compression parameters are negotiated between the MS and the SGSN. Compression is an optional SNDC function. The GGSN may indicate to the SGSN during PDP Context Activation and during Update PDP Context to negotiate no data compression for the PDP context.
- Segmentation and reassembly. The output of the compression subfunctions are segmented to maximum-length LLC frames.

****** Next Modified Section ******

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA does not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

Table 6: SGSN MM and PDP Contexts

Field	Description	A/Gb mode	Iu mode
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
Authentication Vectors	Authentication and ciphering parameters (authentication triplets or quintets)..	X	X
Kc	Currently used A/Gb mode ciphering key.	X	2)
CKSN	Ciphering key sequence number of Kc.	X	2)
Ciphering algorithm	Selected ciphering algorithm.	X	X
CK	Currently used Iu mode ciphering key.	1)	X
IK	Currently used Iu mode integrity key.	1)	X
KSI	Key Set Identifier.	1)	X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	X
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g. normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g. operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3GPP TS 23.016	X	X
MG-CSI	Optional Mobility Management for GPRS CAMEL subscription information, see 3GPP TS 23.016.	X	X
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g. PPP or IP.	X	X
PDP Address	PDP address, e.g. an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used. This APN shall be composed of the APN Network Identifier and the APN Operator Identifier.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the	X	X

Field	Description	A/Gb mode	Iu mode
	VPLMN.		
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC/BSC currently used.		X
<u>Prohibit Payload Compression</u>	<u>Indicates that the SGSN should negotiate no data compression for this PDP context.</u>	<u>X</u>	

The information marked with a "1)" in table 6 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 6 may be maintained if authentication is performed by the GSM authentication procedure.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 7 shows the PDP context fields for one PDP Address.

Table 7: GGSN PDP Context

Field	Description
IMSI	International Mobile Subscriber Identity.
NSAPI	Network layer Service Access Point Identifier.
MSISDN	The basic MSISDN of the MS.
PDP Type	PDP type; e.g. PPP or IP.
PDP Address	PDP address; e.g. an IP address.
Dynamic Address	Indicates whether PDP Address is static or dynamic.
APN in Use	The APN Network Identifier currently used.
TEID	Tunnel Endpoint Identifier.
TFT	Traffic flow template.
QoS Profile Negotiated	The quality of service profile negotiated.
SGSN Address	The IP address of the SGSN currently serving this MS.
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.
Recovery	Indicates if the SGSN is performing database recovery.
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the SGSN.
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Charging Characteristics	The charging characteristics for this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.
Trace Reference	Identifies a record or a collection of records for a particular trace.
Trace Type	Indicates the type of trace.
Trigger Id	Identifies the entity that initiated the trace.
OMC Identity	Identifies the OMC that shall receive the trace record(s).
Prohibit Payload Compression	Indicates that the SGSN should negotiate no data compression for this PDP context.

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

CHANGE REQUEST

⌘ **23.060 CR 452** ⌘ rev ⌘ Current version: **6.0.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Mapping of PFCs onto LLC SAPIs		
Source:	⌘ Siemens AG		
Work item code:	⌘ TEI-6	Date:	⌘ 15.05.2003
Category:	⌘ F	Release:	⌘ Rel-6
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
	F (correction)		2 (GSM Phase 2)
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)
	B (addition of feature),		R97 (Release 1997)
	C (functional modification of feature)		R98 (Release 1998)
	D (editorial modification)		R99 (Release 1999)
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		Rel-4 (Release 4)
			Rel-5 (Release 5)
			Rel-6 (Release 6)

Reason for change:	⌘ The LLC protocol is based on the assumption of the in-sequence delivery of the LLC PDUs of the same SAPI by the lower layers. If this principle is violated, the LLC protocol will not work properly any longer, e.g. in ADM there will be the risk that the de-ciphering will fail due to the asynchronous incrementation of the overflow counter and in ABM it will cause unnecessary retransmission and thus a waste of radio resources. It must be ensured that the QoS parameters which have impact on the scheduling of the LLC PDUs by the RLC layer are identical for those PDP contexts which are sharing the same LLC SAPI. If the PFC concept is used, the PFC will be the scheduling criteria. Thus it must be ensured that all NSAPIs mapped onto one LLC SAPI share the same PFC.
Summary of change:	⌘ It is clarified that all NSAPIs mapped onto one LLC SAPI must share the same PFC.
Consequences if not approved:	⌘ The LLC protocol will not work properly and in consequence this would lead to the risk of lost PDUs and inefficient use of the radio resources.

Clauses affected:	⌘ 12.3.2						
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px;">Y</td> <td style="width: 20px;">N</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table>	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Other core specifications	⌘
Y	N						
<input type="checkbox"/>	<input checked="" type="checkbox"/>						
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px;">Y</td> <td style="width: 20px;">N</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table>	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Test specifications	⌘
Y	N						
<input type="checkbox"/>	<input checked="" type="checkbox"/>						
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px;">Y</td> <td style="width: 20px;">N</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table>	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>	O&M Specifications	⌘
Y	N						
<input type="checkbox"/>	<input checked="" type="checkbox"/>						
Other comments:	⌘						

12.3.2 Subfunctions

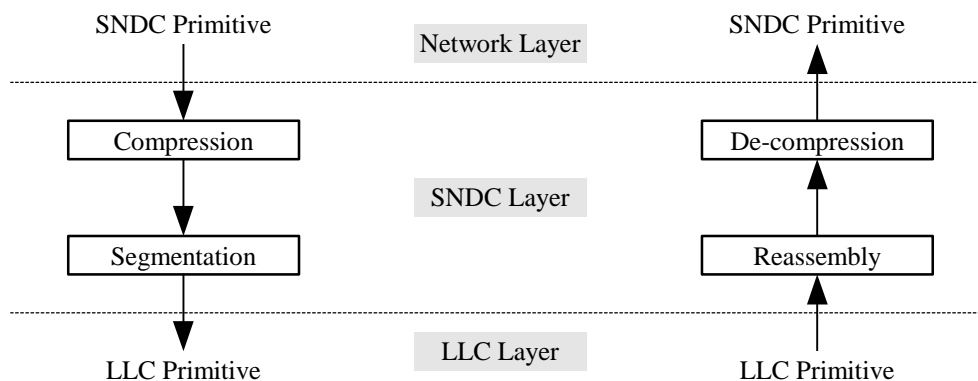


Figure 81: Sequential Invocation of SNDC Functionality

SNDCP performs the following subfunctions:

- Mapping of SNDC primitives received from the network layer into corresponding LLC primitives to be passed to the LLC layer, and vice versa.
- Multiplexing of N-PDUs from one or several NSAPIs onto one LLC SAPI. NSAPIs that are multiplexed onto the same SAPI shall use the same radio priority level, QoS traffic handling priority, and traffic class. [In case BSS packet flow contexts are created all NSAPIs that are multiplexed onto the same LLC SAPI shall share the same BSS packet flow context.](#)
- Compression of redundant protocol control information and user data. This may include e.g. TCP/IP header compression and V.42 bis [32] data compression. Compression may be performed independently for each QoS traffic handling priority and traffic class. If several network layers use the same QoS traffic handling priority and traffic class, one common compressor may be used for these network layers. The relationship between NSAPIs, compressors, and SAPIs is defined in GSM 04.65. Compression parameters are negotiated between the MS and the SGSN. Compression is an optional SNDC function.
- Segmentation and reassembly. The output of the compression subfunctions are segmented to maximum-length LLC frames.

12.6.3.5 BSS Context

The SGSN may provide a BSS with information related to ongoing user data transmission in A/Gb mode. The information is given as BSS packet flow contexts, which describe QoS characteristics for the data transmission. All BSS packet flow contexts related to one MS are stored in an MS specific BSS context. The BSS may contain BSS contexts for several MSs. Within a BSS context the BSS packet flow contexts are identified by a packet flow identifier, which is assigned by the SGSN. A BSS packet flow context is shared by one or more [LLC SAPIs](#) ~~activated PDP contexts~~ of the same MS with identical or similar negotiated QoS profiles. The data transfers related to [LLC SAPIs](#) ~~PDP contexts~~ that share the same BSS packet flow context constitute one packet flow.

CHANGE REQUEST

⌘ **23.060 CR 439** ⌘ rev **2** ⌘ Current version: **6.0.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘	Update to lu Release Procedure	
Source:	⌘	3	
Work item code:	⌘	TEI6	Date: ⌘ 15/05/2003
Category:	⌘	A	Release: ⌘ Rel-6
		Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	Use <u>one</u> 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) Rel-6 (Release 6)

Reason for change: ⌘ Within the current specifications, it is stated that an RNC may request to the core network to initiate the release an lu connection for a variety of reasons, e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure etc). Furthermore, the SGSN may initiate the release of the lu signalling connection based on either an lu Release Request message, or by another SGSN event (e.g., authentication failure, detach).

In the scenario where a UE which has failed to successfully activate a PDP context either through the procedure failing or through explicit rejection it is valid as per the specification for the UE to retry the activation (or not!). Due to this possibility it is valid for the core network to maintain the lu signalling connection to cater for the subsequent attempts. In this scenario, it is not specified anywhere which entity should monitor and release the lu signalling connection.

Furthermore, a UE that deactivates its' last PDP context will still have a lu signalling connection established but no RABs, once the deactivation procedure has been successfully executed. In this scenario, it is again not stated in any specification which entity should monitor and release the lu signalling connection.

Two possibilities exist;

1. The RNC may request release of the lu with cause value "User Inactivity" if there is a connection established without any activity. However, User inactivity has been defined in the specifications as when "...the RNC decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired". This means that there is no requirement for the RAN to monitor the lu signalling connection for activity, and decide to release.
2. The core network could request the lu signalling connection to be released

		In the absence of any clear definition in the specification, it is clear that the possibility exists that none of the entities takes responsibility for initiating the release of lu connection leading to hanging RRC connection and hence wasting radio resources.									
Summary of change:	⌘	It is proposed that the SGSN shall trigger the lu Release Command after a period of signalling inactivity in the lu connection. The period shall be determined by an implementation dependent timer.									
Consequences if not approved:	⌘	The specifications as currently written are incomplete and result in hanging RRC/lu connections and interoperability issues within multi-vendor networks.									
Clauses affected:	⌘	12.7.3									
Other specs affected:	⌘	<table border="1"> <thead> <tr> <th>Y</th> <th>N</th> </tr> </thead> <tbody> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> </tbody> </table>	Y	N		X		X		X	Other core specifications ⌘ Test specifications O&M Specifications
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Other comments:	⌘										

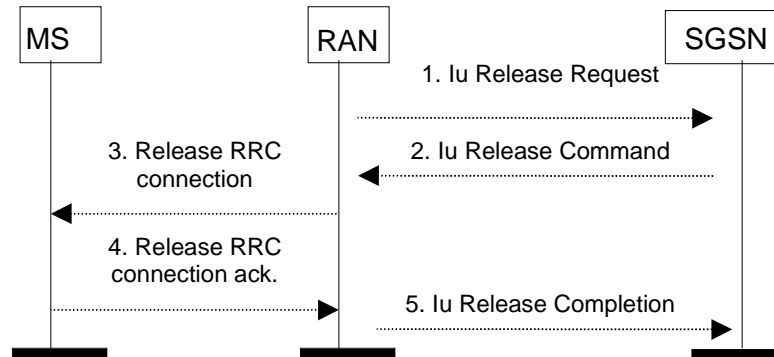
How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at <http://www.3gpp.org/specs/CR.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.
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12.7.3 Iu Release Procedure

This procedure is used to release the Iu interface. This procedure also triggers the release of all the Iu connections and changes the 3G-SGSN PMM state to PMM-IDLE. Both RAN-initiated and SGSN-initiated Iu release procedures are shown in Figure 89.



NOTE 1: Message 1 is only sent when the RAN-initiated Iu release procedure is considered.

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- 1) The RAN notices that the RRC connection has been released or detects a need to release the radio resources. It sends an Iu Release Request (Cause) message to the SGSN. Cause indicates the reason for the release (e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure, or Release due to UE generated signalling connection release). User Inactivity means that the RAN decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired.
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- 3) If the RRC connection is not already released (Cause = User Inactivity), the RAN sends a Release RRC Connection message to the MS.
- 4) The MS returns a Release RRC Connection Acknowledge message to the RAN.
- 5) The RAN confirms the Iu release by returning an Iu Release Completion message to the SGSN.

If the RNC does not receive the Release RRC Connection Acknowledge message and if Cause is different from Authentication Failure or Detach, it should send a failure message to the SGSN, and the SGSN should stay in the MM-CONNECTED state.

CHANGE REQUEST

⌘ **23.060 CR 438** ⌘ rev **2** ⌘ Current version: **5.5.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Update to lu Release Procedure				
Source:	⌘ 3				
Work item code:	⌘ TEI	Date:	⌘ 15/05/2003		
Category:	⌘ A	Release:	⌘ Rel-5		
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:		
	F (correction)		2 (GSM Phase 2)		
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)		
	B (addition of feature),		R97 (Release 1997)		
	C (functional modification of feature)		R98 (Release 1998)		
	D (editorial modification)		R99 (Release 1999)		
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		Rel-4 (Release 4)		
			Rel-5 (Release 5)		
			Rel-6 (Release 6)		

Reason for change: ⌘ Within the current specifications, it is stated that an RNC may request to the core network to initiate the release an lu connection for a variety of reasons, e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure etc). Furthermore, the SGSN may initiate the release of the lu signalling connection based on either an lu Release Request message, or by another SGSN event (e.g., authentication failure, detach).

In the scenario where a UE which has failed to successfully activate a PDP context either through the procedure failing or through explicit rejection it is valid as per the specification for the UE to retry the activation (or not!). Due to this possibility it is valid for the core network to maintain the lu signalling connection to cater for the subsequent attempts. In this scenario, it is not specified anywhere which entity should monitor and release the lu signalling connection.

Furthermore, a UE that deactivates its' last PDP context will still have a lu signalling connection established but no RABs, once the deactivation procedure has been successfully executed. In this scenario, it is again not stated in any specification which entity should monitor and release the lu signalling connection.

Two possibilities exist;

1. The RNC may request release of the lu with cause value "User Inactivity" if there is a connection established without any activity. However, User inactivity has been defined in the specifications as when "...the RNC decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired". This means that there is no requirement for the RAN to monitor the lu signalling connection for activity, and decide to release.
2. The core network could request the lu signalling connection to be released

		In the absence of any clear definition in the specification, it is clear that the possibility exists that none of the entities takes responsibility for initiating the release of lu connection leading to hanging RRC connection and hence wasting radio resources.															
Summary of change:	⌘	It is proposed that the SGSN shall trigger the lu Release Command after a period of signalling inactivity in the lu connection. The period shall be determined by an implementation dependent timer.															
Consequences if not approved:	⌘	The specifications as currently written are incomplete and result in hanging RRC/lu connections and interoperability issues within multi-vendor networks.															
Clauses affected:	⌘	12.7.3															
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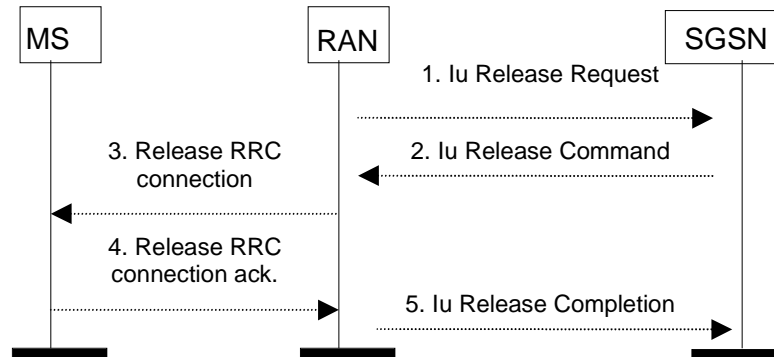
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This procedure is used to release the Iu interface. This procedure also triggers the release of all the Iu connections and changes the 3G-SGSN PMM state to PMM-IDLE. Both RAN-initiated and SGSN-initiated Iu release procedures are shown in Figure 89.



NOTE 1: Message 1 is only sent when the RAN-initiated Iu release procedure is considered.

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Figure 89: Iu Release Procedure

- 1) The RAN notices that the RRC connection has been released or detects a need to release the radio resources. It sends an Iu Release Request (Cause) message to the SGSN. Cause indicates the reason for the release (e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure, or Release due to UE generated signalling connection release). User Inactivity means that the RAN decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired.
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- 5) The RAN confirms the Iu release by returning an Iu Release Completion message to the SGSN.

If the RNC does not receive the Release RRC Connection Acknowledge message and if Cause is different from Authentication Failure or Detach, it should send a failure message to the SGSN, and the SGSN should stay in the MM-CONNECTED state.

CHANGE REQUEST

⌘ **23.060 CR 437** ⌘ rev **2** ⌘ Current version: **4.7.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Update to lu Release Procedure				
Source:	⌘ 3				
Work item code:	⌘ TEI	Date:	⌘ 15/05/2003		
Category:	⌘ A	Release:	⌘ Rel-4		
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:		
	F (correction)		2 (GSM Phase 2)		
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)		
	B (addition of feature),		R97 (Release 1997)		
	C (functional modification of feature)		R98 (Release 1998)		
	D (editorial modification)		R99 (Release 1999)		
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		Rel-4 (Release 4)		
			Rel-5 (Release 5)		
			Rel-6 (Release 6)		

Reason for change: ⌘ Within the current specifications, it is stated that an RNC may request to the core network to initiate the release an lu connection for a variety of reasons, e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure etc). Furthermore, the SGSN may initiate the release of the lu signalling connection based on either an lu Release Request message, or by another SGSN event (e.g., authentication failure, detach).

In the scenario where a UE which has failed to successfully activate a PDP context either through the procedure failing or through explicit rejection it is valid as per the specification for the UE to retry the activation (or not!). Due to this possibility it is valid for the core network to maintain the lu signalling connection to cater for the subsequent attempts. In this scenario, it is not specified anywhere which entity should monitor and release the lu signalling connection.

Furthermore, a UE that deactivates its' last PDP context will still have a lu signalling connection established but no RABs, once the deactivation procedure has been successfully executed. In this scenario, it is again not stated in any specification which entity should monitor and release the lu signalling connection.

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Summary of change:	⌘	It is proposed that the SGSN shall trigger the lu Release Command after a period of signalling inactivity in the lu connection. The period shall be determined by an implementation dependent timer.									
Consequences if not approved:	⌘	The specifications as currently written are incomplete and result in hanging RRC/lu connections and interoperability issues within multi-vendor networks.									
Clauses affected:	⌘	12.7.3									
Other specs affected:	⌘	<table border="1"> <thead> <tr> <th>Y</th> <th>N</th> </tr> </thead> <tbody> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> </tbody> </table>	Y	N		X		X		X	Other core specifications ⌘ Test specifications ⌘ O&M Specifications ⌘
Y	N										
	X										
	X										
	X										
Other comments:	⌘										

How to create CRs using this form:

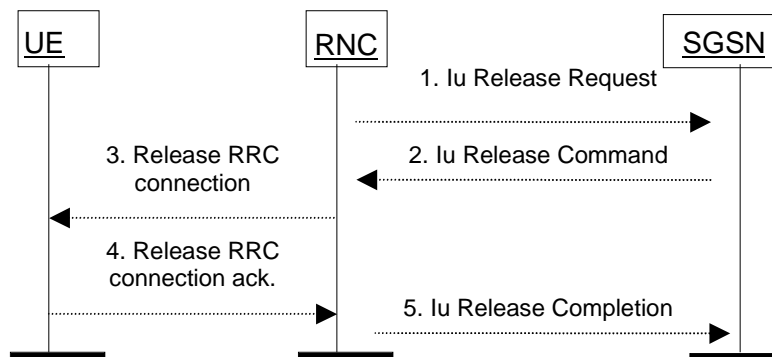
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This procedure is used to release the Iu interface. This procedure also triggers the release of all the Iu connections and changes the 3G-SGSN PMM state to PMM-IDLE. Both RNC-initiated and SGSN-initiated Iu release procedures are shown in Figure 89.



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- 4) The MS returns a Release RRC Connection Acknowledge message to the RNC.
- 5) The RNC confirms the Iu release by returning an Iu Release Completion message to the SGSN.

If the RNC does not receive the Release RRC Connection Acknowledge message and if Cause is different from Authentication Failure or Detach, it should send a failure message to the SGSN, and the SGSN should stay in the MM-CONNECTED state.

After Iu release, the MS and the SGSN shall modify PDP context(s) that use streaming or conversational traffic class according to the rules in clause "RNC-Initiated PDP Context Modification Procedure".

CHANGE REQUEST

⌘ **23.060 CR 436** ⌘ rev **2** ⌘ Current version: **3.14.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Update to lu Release Procedure				
Source:	⌘ 3				
Work item code:	⌘ TEI	Date:	⌘ 15/05/2003		
Category:	⌘ F	Release:	⌘ R99		
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:		
	F (correction)		2 (GSM Phase 2)		
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)		
	B (addition of feature),		R97 (Release 1997)		
	C (functional modification of feature)		R98 (Release 1998)		
	D (editorial modification)		R99 (Release 1999)		
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		Rel-4 (Release 4)		
			Rel-5 (Release 5)		
			Rel-6 (Release 6)		

Reason for change: ⌘ Within the current specifications, it is stated that an RNC may request to the core network to initiate the release an lu connection for a variety of reasons, e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure etc). Furthermore, the SGSN may initiate the release of the lu signalling connection based on either an lu Release Request message, or by another SGSN event (e.g., authentication failure, detach).

In the scenario where a UE which has failed to successfully activate a PDP context either through the procedure failing or through explicit rejection it is valid as per the specification for the UE to retry the activation (or not!). Due to this possibility it is valid for the core network to maintain the lu signalling connection to cater for the subsequent attempts. In this scenario, it is not specified anywhere which entity should monitor and release the lu signalling connection.

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		In the absence of any clear definition in the specification, it is clear that the possibility exists that none of the entities takes responsibility for initiating the release of lu connection leading to hanging RRC connection and hence wasting radio resources.															
Summary of change:	⌘	It is proposed that the SGSN shall trigger the lu Release Command after a period of signalling inactivity in the lu connection. The period shall be determined by an implementation dependent timer.															
Consequences if not approved:	⌘	The specifications as currently written are incomplete and result in hanging RRC/lu connections and interoperability issues within multi-vendor networks.															
Clauses affected:	⌘	12.7.3															
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12.7.3 Iu Release Procedure

This procedure is used to release the Iu interface. This procedure also triggers the release of all the Iu connections and changes the 3G-SGSN PMM state to PMM-IDLE. Both RNC-initiated and SGSN-initiated Iu release procedures are shown in Figure 1.

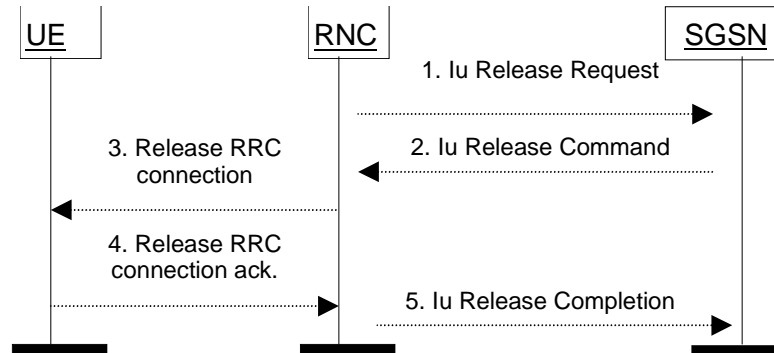


Figure 1: Iu Release Procedure

NOTE 1: Message 1 is only sent when the RNC-initiated Iu release procedure is considered.

NOTE 2: Message 1 is not sent but message 2 is sent when the SGSN-initiated Iu release procedure is considered.

- 1) The RNC notices that the RRC connection has been released or detects a need to release the radio resources. It sends an Iu Release Request (Cause) message to the SGSN. Cause indicates the reason for the release (e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure, or Release due to UE generated signalling connection release). User Inactivity means that the RNC decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired.
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If the RNC does not receive the Release RRC Connection Acknowledge message and if Cause is different from Authentication Failure or Detach, it should send a failure message to the SGSN, and the SGSN should stay in the MM-CONNECTED state.

After Iu release, the MS and the SGSN shall modify PDP context(s) that use streaming or conversational traffic class according to the rules in subclause "RNC-Initiated PDP Context Modification Procedure".

CHANGE REQUEST

⌘ **23.060 CR 433** ⌘ rev **2** ⌘ Current version: **6.0.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ RAU in PMM-connected		
Source:	⌘ Nortel Networks		
Work item code:	⌘ TEI6	Date:	⌘ 12/05/2003
Category:	⌘ F	Release:	⌘ Rel-6
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
	F (correction)		2 (GSM Phase 2)
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)
	B (addition of feature),		R97 (Release 1997)
	C (functional modification of feature)		R98 (Release 1998)
	D (editorial modification)		R99 (Release 1999)
	Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		Rel-4 (Release 4)
			Rel-5 (Release 5)
			Rel-6 (Release 6)

Reason for change:	⌘ 23.060 says that RAU in PMM-connected is "only valid" after an SRNS relocation. In fact from a UE perspective the RAU in PMM-connected happens whenever MM information is given to the UE when new RAI. The possible restriction is on the RNC, which gives (or not) new RAI information to the mobile.
Summary of change:	⌘ State that in PMM connected, if there is a change of RAI, then the SRNC sends it to the UE only in case of SRNS relocation
Consequences if not approved:	⌘ Unclear why the RAU in PMM-connected is only valid after relocation, and what this means for the MS, the RNC and the SGSN behaviour

Clauses affected:	⌘ 6.9.2.1										
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> </table>	Y	N	X	X	X	X	X	X	Other core specifications	⌘
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X	X										
X	X										
X	X										
		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/specs/CR.htm>. Below is a brief summary:

- 1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
- 2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under <ftp://ftp.3gpp.org/specs/>. For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

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

6.9.2.1 Routing Area Update Procedure

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

The SGSN detects that it is an intra-SGSN routing 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 routing area update. If the network operates in mode I, an MS that is in CS/PS mode of operation shall perform the Combined RA / LA Update procedures except this CS/PS mode MS is engaged in a CS connection, then it shall perform (non combined) RA Update procedures.

In Iu mode, an RA update is either an intra-SGSN or inter-SGSN RA update, either combined RA / LA update or only RA update, either initiated by an MS in PMM-CONNECTED (~~only valid after a Serving RNS Relocation Procedure, see clause 6.9.2.2~~) or in PMM-IDLE state. The SRNC may provide a PMM-CONNECTED state MS with MM information like RAI by dedicated signalling. Typically, the SRNC should not provide a RAI to an MS in PMM-CONNECTED state. An exception is after an SRNS relocation, in which case the new SRNC shall indicate the RAI to the MS.

All the RA update cases are contained in the procedure illustrated in Figure 36.

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

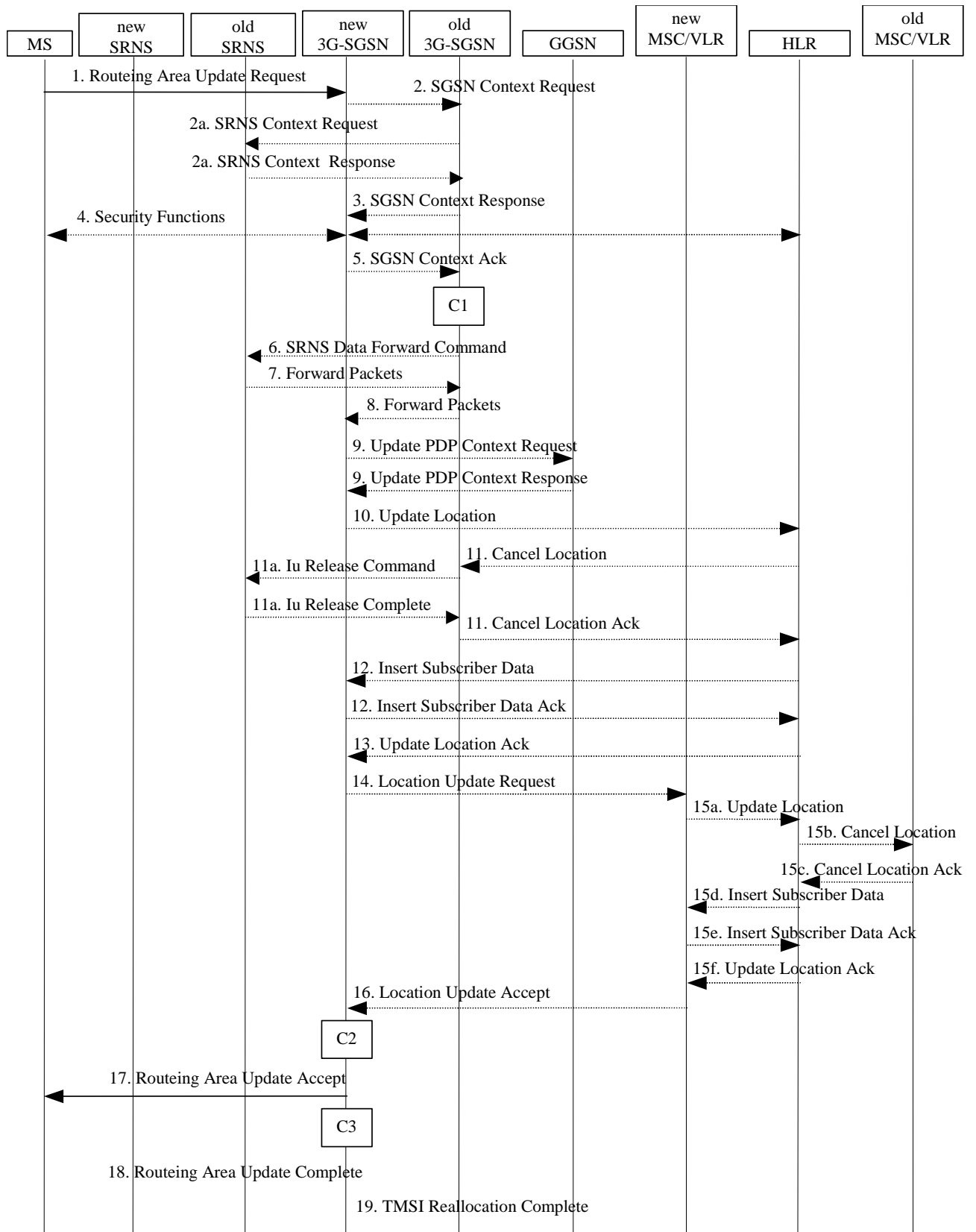


Figure 36: Iu mode RA Update Procedure

- 1) The RRC connection is established, if not already done. The MS sends a Routing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters, MS Network Capability) to the new SGSN. The MS shall set a follow-on request if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. Update Type shall indicate:
 - RA Update if the RA Update is triggered by a change of RA;
 - Periodic RA Update if the RA update is triggered by the expiry of the Periodic RA Update timer;
 - Combined RA / LA Update if the MS is also IMSI-attached and the LA update shall be performed in network operation mode I (see clause "Interactions Between SGSN and MSC/VLR"); or
 - Combined RA / LA Update with IMSI attach requested if the MS wants to perform an IMSI attach in network operation mode I.

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

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

- 2) If the RA update is an Inter-SGSN Routing area update and if the MS was in PMM-IDLE state, the new SGSN sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the SGSN Context Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN starts a timer.. If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause.
- 2a) If the MS is PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is in the PMM-CONNECTED state and the RAU was received over another Iu connection than the established one, the old SGSN sends an SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message. Upon reception of this message, the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). No conversion of PDCP sequence numbers to SDCP sequence numbers shall be done in the 3G-SGSN.
- 3) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for

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

- 4) Security functions may be executed. These procedures are defined in clause "Security Function". If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.
- 5) If the RA update is an Inter-SGSN Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.
- 6) If the MS is in PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.
- 7) For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with their related PDCP sequence numbers and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.
- 8) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN. No conversion of PDCP sequence numbers to SMDCP sequence numbers shall be done in the 3G-SGSN.
- 9) If the RA update is an Inter-SGSN RA Update and if the MS was not in PMM-CONNECTED state in the new 3G-SGSN, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, Tunnel Endpoint Identifier,) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier). Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state in the new 3G-SGSN, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".
- 10) If the RA update is an Inter-SGSN RA Update, the new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 11) If the RA update is an Inter-SGSN RA Update, the HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM context. Otherwise, the contexts are removed only when the timer expires. It also ensures that the MM context is kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).
- 11a) On receipt of Cancel Location, if the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNS. When the data-forwarding timer has expired, the SRNS responds with an Iu Release Complete message.

- 12) 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 Routing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 13) If the RA update is an Inter-SGSN RA Update, the HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 14) If Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routing area update, the association has to be established, and the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with ISI attach requested. Otherwise, Location Update Type shall indicate normal location update. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 8). The VLR creates or updates the association with the SGSN by storing SGSN Number.
- 15) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR:
 - 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, subscriber data) to the new VLR.
 - e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).
 - f) The HLR responds with Update Location Ack (IMSI) to the new VLR.
- 16) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.
- 17) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routing 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 Routing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).
- 18) The MS confirms the reallocation of the TMSIs by returning a Routing Area Update Complete message to the SGSN.
- 19) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

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

NOTE: The new SGSN may initiate RAB establishment after execution of the security functions (step 4), or wait until completion of the RA update procedure. For the MS, RAB establishment may occur anytime after the RA update request is sent (step 1).

In the case of a rejected routing 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 routing area update to that RA. The RAI value shall be deleted when the MS is powered up.

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

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

If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN should use the prioritisation sent by old SGSN as input when deciding which PDP contexts to maintain active and which ones to delete. In any case, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "SGSN-initiated PDP Context Deactivation Procedure". This shall not cause the SGSN to reject the routing area update.

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

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

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

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

C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

C2) CAMEL_GPRS_Routing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routing_Area_Update_Context.

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

CHANGE REQUEST

23.060 CR 440 rev 1 Current version: 6.0.0

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title: User inactivity usage with lu/RAB release

Source: Nortel Networks, AWS

Work item code: TEI6

Date: 12/05/2003

Category: F

Release: Rel-6

Use one of the following categories:

Use one of the following releases:

F (correction)

2 (GSM Phase 2)

A (corresponds to a correction in an earlier release)

R96 (Release 1996)

B (addition of feature),

R97 (Release 1997)

C (functional modification of feature)

R98 (Release 1998)

D (editorial modification)

R99 (Release 1999)

Detailed explanations of the above categories can be found in 3GPP [TR 21.900](#).

Rel-4 (Release 4)

Rel-5 (Release 5)

Rel-6 (Release 6)

Reason for change: The text from 23.060 in the "lu release procedure" chapter currently reads:

User Inactivity means that the RAN decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired.

Although the text is not very well worded, we assume that it means lu release (and therefore also RAB release), is only released for user inactivity when the QoS is background or interactive.

If we assumed that the RAB or the lu can be released for user inactivity in the case of real-time QoS, then the preservation procedure would be used and the PDP contexts would be set to 0 bandwidth: the GGSN would block any downlink traffic which would not reach the mobile, even though the mobile could have been reached.

So, if a cause value of user inactivity

1. can be used for background and interactive only, we have no issue
2. can be used for streaming and conversational, then either:
 - o we need to enable the GGSN to contact the UE in case it needs to send downlink traffic to the UE, or
 - o we need to disable the preservation procedure in this case so that traffic is not blocked by the GGSN

We assume we are in the case of 1 and that the text quoted above needs to be clarified.

Summary of change: Clarify that the lu (or RAB) release due to user inactivity will only be requested by the RAN in the case of RABs with background and interactive traffic classes.

Consequences if not approved: ☼ Packets could be blocked at the GGSN even though the user is reachable (simply it had been inactive)

Clauses affected: ☼ 12.7.3

	Y	N		☼
Other specs affected:		X	Other core specifications	
		X	Test specifications	
		X	O&M Specifications	

Other comments: ☼

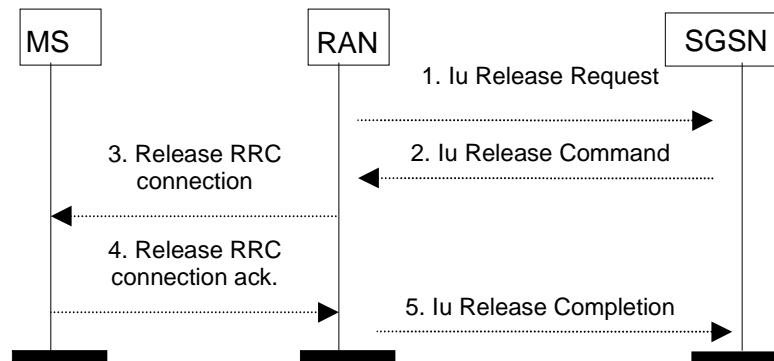
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- 2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under <ftp://ftp.3gpp.org/specs/>. For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
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12.7.3 Iu Release Procedure

This procedure is used to release the Iu interface. This procedure also triggers the release of all the Iu connections and changes the 3G-SGSN PMM state to PMM-IDLE. Both RAN-initiated and SGSN-initiated Iu release procedures are shown in Figure 89.



NOTE 1: Message 1 is only sent when the RAN-initiated Iu release procedure is considered.

NOTE 2: Message 1 is not sent but message 2 is sent when the SGSN-initiated Iu release procedure is considered.

Figure 89: Iu Release Procedure

- 1) The RAN notices that the RRC connection has been released or detects a need to release the radio resources. It sends an Iu Release Request (Cause) message to the SGSN. Cause indicates the reason for the release (e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure, or Release due to UE generated signalling connection release). User Inactivity means that the RAN decided to release an MS [that shows no more activity, in the case where the MS has with only a non real-time bearer RABs established, in order to optimise the radio usage after the RRC-Connection-Release timer expired.](#)
- 2) The SGSN releases the Iu by sending the Iu Release Command (Cause) message to the RAN. This message may be triggered either by an Iu Release Request message, or by another SGSN event (e.g., authentication failure or detach). It is optional for the SGSN to send the Iu Release Command message after an Iu Release Request message with Cause set to User Inactivity is received from the RAN.
- 3) If the RRC connection is not already released (Cause = User Inactivity), the RAN sends a Release RRC Connection message to the MS.
- 4) The MS returns a Release RRC Connection Acknowledge message to the RAN.
- 5) The RAN confirms the Iu release by returning an Iu Release Completion message to the SGSN.

If the RNC does not receive the Release RRC Connection Acknowledge message and if Cause is different from Authentication Failure or Detach, it should send a failure message to the SGSN, and the SGSN should stay in the MM-CONNECTED state. After Iu release, the MS and the SGSN shall modify PDP context(s) that use streaming or conversational traffic class according to the rules in clause "RNC-Initiated PDP Context Modification Procedure".

CHANGE REQUEST

23.060 CR 449 rev Current version: 6.0.0

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	CAMEL triggers at SRNS relocation cancel		
Source:	Nortel Networks, Ericsson		
Work item code:	TEI4	Date:	12/05/2003
Category:	A	Release:	Rel-6
	Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Use <u>one</u> 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) Rel-6 (Release 6)

Reason for change:	CRs 284 and 285 (approved at SA#14) added CAMEL procedure calls to the Relocation Cancel procedure for R99 and Rel-4 respectively. However, CR 285 (Rel-4) wrongly added the CAMEL procedure calls before reception of the Relocation Cancel message instead of after, as correctly shown in CR 284 (R99). This set of CRs aligns Rel-4, Rel-5 and Rel-6 of 23.060 with the correct procedure in R99.
Summary of change:	Move the C2 and C3 triggers to after the old SGSN gets the relocation cancel.
Consequences if not approved:	Misalignment of 23.060 between releases.

Clauses affected:	6.9.2.2.4										
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> </table> Other core specifications Test specifications O&M Specifications	Y	N	X	X	X	X	X	X		
Y	N										
X	X										
X	X										
X	X										
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.

6.9.2.2.4 SRNS Relocation Cancel Procedure

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

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

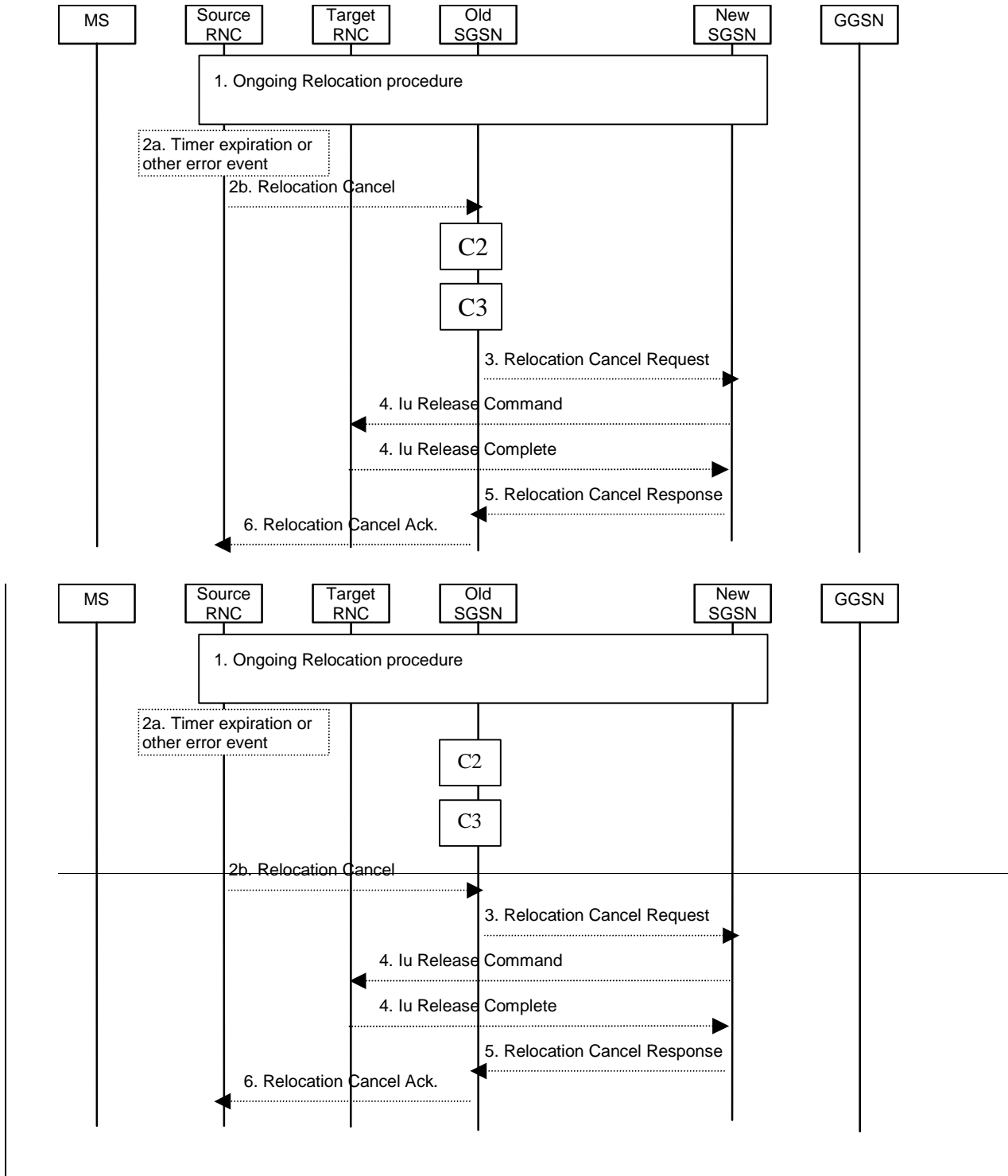


Figure 44: SRNS Cancel Relocation Procedure

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

- 2a) The SRNS Cancel Relocation may be initiated by a timer expiry or by an error event in the source RNC.
- 2b) When one of conditions in 2a is satisfied, the source RNC sends a Relocation Cancel (Cause) to the old SGSN. Cause indicates the reason for cancelling the ongoing SRNS relocation.
- 3) The old SGSN sends a Relocation Cancel Request (IMSI, RANAP Cause) to the new SGSN to indicate that the ongoing SRNS relocation should be cancelled. RANAP Cause contains the cause value received by the source RNC in the Relocation Cancel message.
- 4) The new SGSN sends an Iu Release Command (Cause) to request from the target RNC to release the Iu resources already allocated for the SRNS relocation, or to cancel the ongoing allocation of Iu resources for the SRNS relocation. Cause is set equal to RANAP Cause, i.e. to whatever cause value was included in the Relocation Cancel Request received from old SGSN. The target RNC releases the requested Iu resources and responds with an Iu Release Complete.
- 5) The new SGSN acknowledges the cancellation of the ongoing SRNS Relocation by sending a Relocation Cancel Response to the old SGSN.
- 6) The old SGSN responds to the source RNC with a Relocation Cancel Ack message.

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

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The procedure CAMEL_GPRS_Routeing_Area_Update_Session is called. The procedure returns as result "Continue".
- Then the procedure CAMEL_PS_Notification is called. The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

CHANGE REQUEST

23.060 CR 448 rev Current version: 5.5.0

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	CAMEL triggers at SRNS relocation cancel		
Source:	Nortel Networks, Ericsson		
Work item code:	TEI4	Date:	12/05/2003
Category:	A	Release:	Rel-5
	Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Use <u>one</u> 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) Rel-6 (Release 6)

Reason for change:	CRs 284 and 285 (approved at SA#14) added CAMEL procedure calls to the Relocation Cancel procedure for R99 and Rel-4 respectively. However, CR 285 (Rel-4) wrongly added the CAMEL procedure calls before reception of the Relocation Cancel message instead of after, as correctly shown in CR 284 (R99). This set of CRs aligns Rel-4, Rel-5 and Rel-6 of 23.060 with the correct procedure in R99.
Summary of change:	Move the C2 and C3 triggers to after the old SGSN gets the relocation cancel.
Consequences if not approved:	Misalignment of 23.060 between releases.

Clauses affected:	6.9.2.2.4										
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> </table> Other core specifications Test specifications O&M Specifications	Y	N	X	X	X	X	X	X		
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X	X										
X	X										
X	X										
Other comments:											

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downloaded from the 3GPP server under <ftp://ftp.3gpp.org/specs/> For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

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

6.9.2.2.4 SRNS Relocation Cancel Procedure

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

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

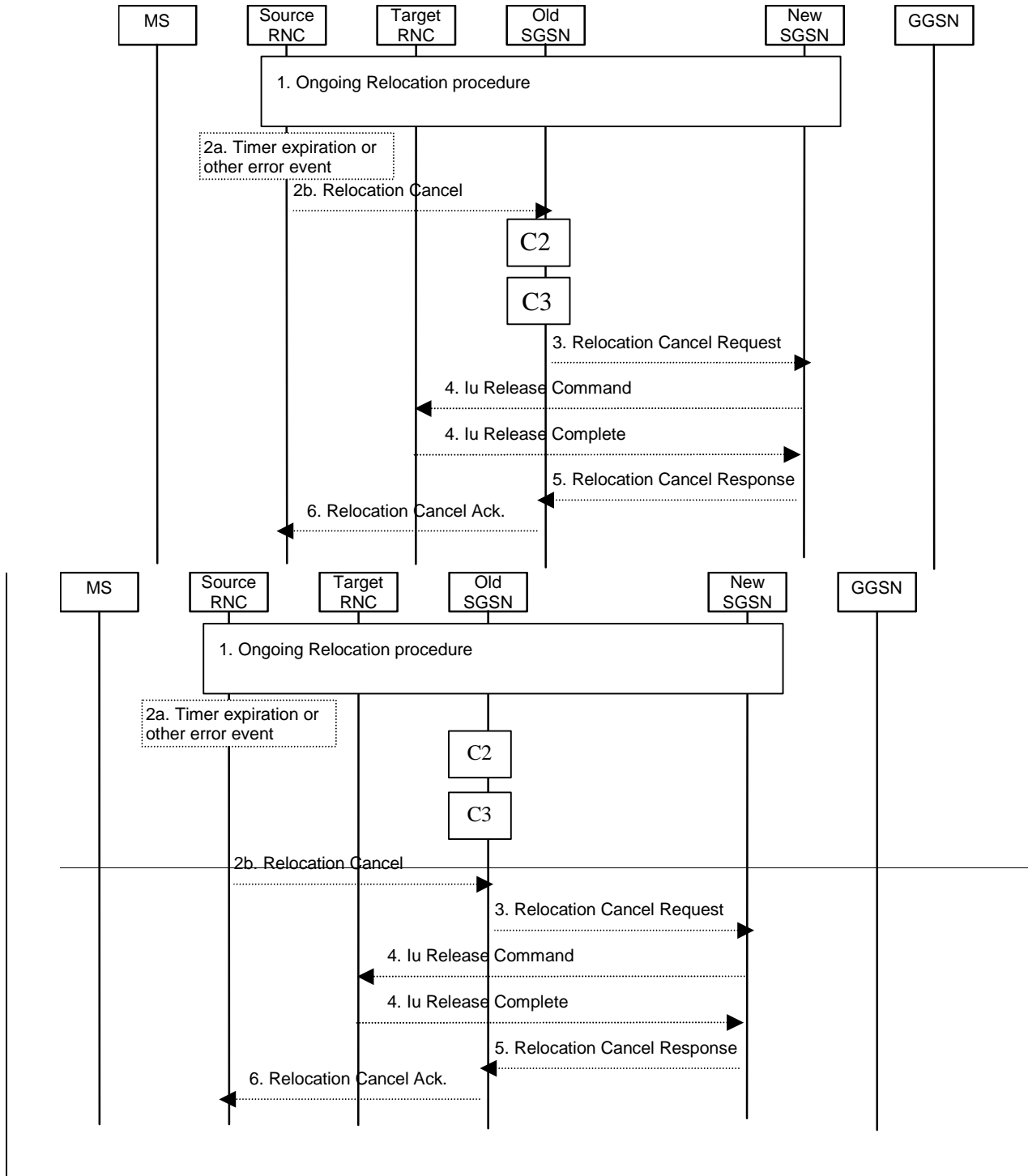


Figure 44: SRNS Cancel Relocation Procedure

- 1) An SRNS Relocation procedure has started, as specified in section 6.9.2.2.1.
- 2a) The SRNS Cancel Relocation may be initiated by a timer expiry or by an error event in the source RNC.

- 2b) When one of conditions in 2a is satisfied, the source RNC sends a Relocation Cancel (Cause) to the old SGSN. Cause indicates the reason for cancelling the ongoing SRNS relocation.
- 3) The old SGSN sends a Relocation Cancel Request (IMSI, RANAP Cause) to the new SGSN to indicate that the ongoing SRNS relocation should be cancelled. RANAP Cause contains the cause value received by the source RNC in the Relocation Cancel message.
- 4) The new SGSN sends an Iu Release Command (Cause) to request from the target RNC to release the Iu resources already allocated for the SRNS relocation, or to cancel the ongoing allocation of Iu resources for the SRNS relocation. Cause is set equal to RANAP Cause, i.e. to whatever cause value was included in the Relocation Cancel Request received from old SGSN. The target RNC releases the requested Iu resources and responds with an Iu Release Complete.
- 5) The new SGSN acknowledges the cancellation of the ongoing SRNS Relocation by sending a Relocation Cancel Response to the old SGSN.
- 6) The old SGSN responds to the source RNC with a Relocation Cancel Ack message.

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

C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The procedure CAMEL_GPRS_Routeing_Area_Update_Session is called. The procedure returns as result "Continue".
- Then the procedure CAMEL_PS_Notification is called. The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

CHANGE REQUEST

¶ **23.060 CR 447** ¶ rev ¶ Current version: **4.7.0** ¶

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

Proposed change affects: UICC apps¶ ME Radio Access Network Core Network

Title:	¶ CAMEL triggers at SRNS relocation cancel		
Source:	¶ Nortel Networks, Ericsson		
Work item code:	¶ TEI4	Date:	¶ 12/05/2003
Category:	¶ F	Release:	¶ Rel-4
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
	F (correction)		2 (GSM Phase 2)
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)
	B (addition of feature),		R97 (Release 1997)
	C (functional modification of feature)		R98 (Release 1998)
	D (editorial modification)		R99 (Release 1999)
	Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Rel-4 (Release 4)
			Rel-5 (Release 5)
			Rel-6 (Release 6)

Reason for change:	¶ CRs 284 and 285 (approved at SA#14) added CAMEL procedure calls to the Relocation Cancel procedure for R99 and Rel-4 respectively. However, CR 285 (Rel-4) wrongly added the CAMEL procedure calls before reception of the Relocation Cancel message instead of after, as correctly shown in CR 284 (R99). This set of CRs aligns Rel-4, Rel-5 and Rel-6 of 23.060 with the correct procedure in R99.
Summary of change:	¶ Move the C2 and C3 triggers to after the old SGSN gets the relocation cancel.
Consequences if not approved:	¶ Misalignment of 23.060 between releases.

Clauses affected:	¶ 6.9.2.2.4										
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">¶</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">¶</td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;">¶</td> <td style="text-align: center;">X</td> </tr> </table>	Y	N	¶	X	¶	X	¶	X	Other core specifications	¶
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		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.

6.9.2.2.4 SRNS Relocation Cancel Procedure

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

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

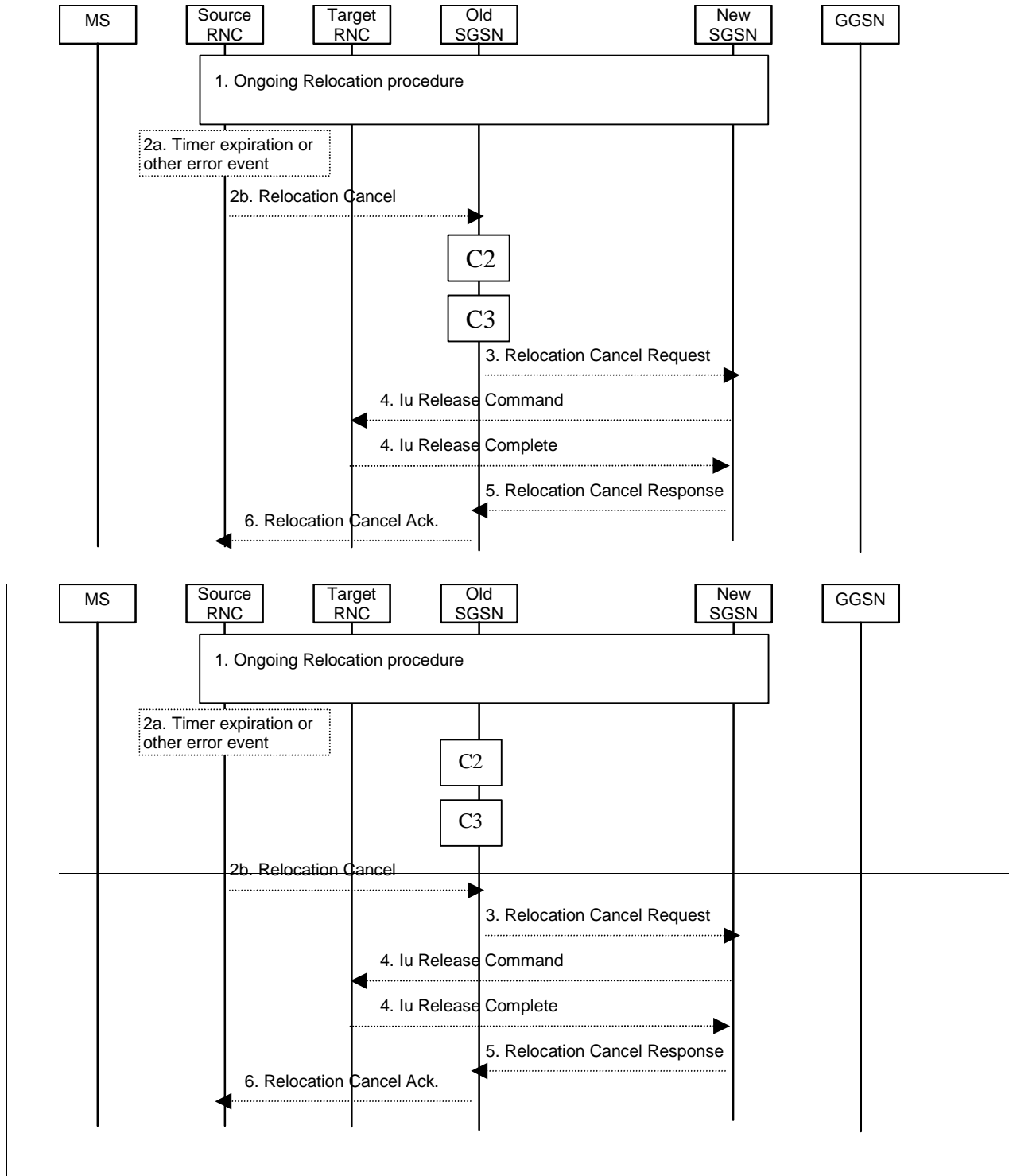


Figure 44: SRNS Cancel Relocation Procedure

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

- 2a) The SRNS Cancel Relocation may be initiated by a timer expiry or by an error event in the source RNC.
- 2b) When one of conditions in 2a is satisfied, the source RNC sends a Relocation Cancel (Cause) to the old SGSN. Cause indicates the reason for cancelling the ongoing SRNS relocation.
- 3) The old SGSN sends a Relocation Cancel Request (IMSI, RANAP Cause) to the new SGSN to indicate that the ongoing SRNS relocation should be cancelled. RANAP Cause contains the cause value received by the source RNC in the Relocation Cancel message.
- 4) The new SGSN sends an Iu Release Command (Cause) to request from the target RNC to release the Iu resources already allocated for the SRNS relocation, or to cancel the ongoing allocation of Iu resources for the SRNS relocation. Cause is set equal to RANAP Cause, i.e. to whatever cause value was included in the Relocation Cancel Request received from old SGSN. The target RNC releases the requested Iu resources and responds with an Iu Release Complete.
- 5) The new SGSN acknowledges the cancellation of the ongoing SRNS Relocation by sending a Relocation Cancel Response to the old SGSN.
- 6) The old SGSN responds to the source RNC with a Relocation Cancel Ack message.

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

- C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

CHANGE REQUEST

23.060 CR 446 rev - Current version: 6.0.0

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	GGSN update at SRNS relocation		
Source:	Nortel Networks, Ericsson		
Work item code:	TEI5	Date:	12/05/2003
Category:	A	Release:	Rel-6
	Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Use <u>one</u> 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) Rel-6 (Release 6)

Reason for change:	The procedure for cancelling on ongoing SRNS relocation is described in 23.060 paragraph 6.9.2.2.4. This cancellation can happen at different points of the relocation. Depending on the time when this occurs, the new SGSN may or not have updated the user plane to the GGSN. If it has and the relocation is subsequently cancelled, all traffic will be lost. The solution to the issue is that the new SGSN should delay switching the user plane until the RANAP Relocation Complete is received from the target RNC.
Summary of change:	In the SRNS relocation flows, move the GTP Update PDP context from the old SGSN to the GGSN, to when the relocation complete is received over the lu.
Consequences if not approved:	In some cases the relocation may be cancelled but the user plane set up as if the relocation was successful, resulting in all traffic being lost.

Clauses affected:	6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3										
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">Y</td> <td style="padding: 2px;">N</td> </tr> <tr> <td style="padding: 2px;"> </td> <td style="padding: 2px;">X</td> </tr> <tr> <td style="padding: 2px;"> </td> <td style="padding: 2px;">X</td> </tr> <tr> <td style="padding: 2px;"> </td> <td style="padding: 2px;">X</td> </tr> </table> Other core specifications Test specifications O&M Specifications	Y	N		X		X		X		
Y	N										
	X										
	X										
	X										
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.

6.9.2.2.1 Serving RNS Relocation Procedure

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

The Serving SRNS Relocation procedure is used to move the RAN to CN connection point at the RAN 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 routing area is changed, this procedure is followed by an Intra-SGSN Routing Area Update procedure. The SGSN detects an Intra-SGSN routing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about new location of the MS.

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

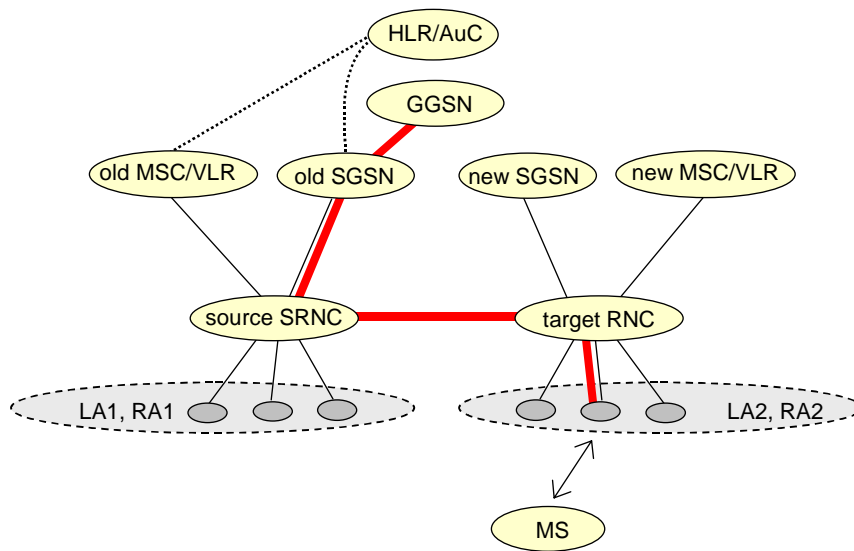


Figure 37: Before SRNS Relocation and Routing Area Update

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

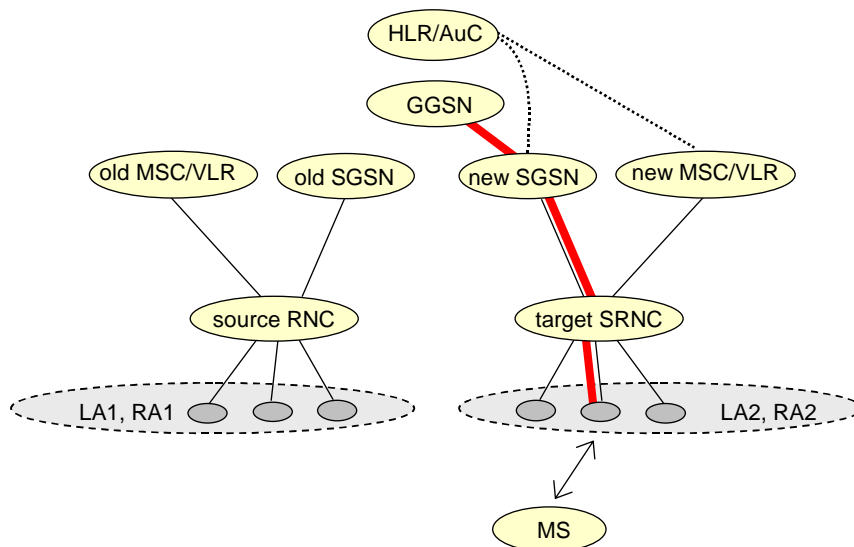
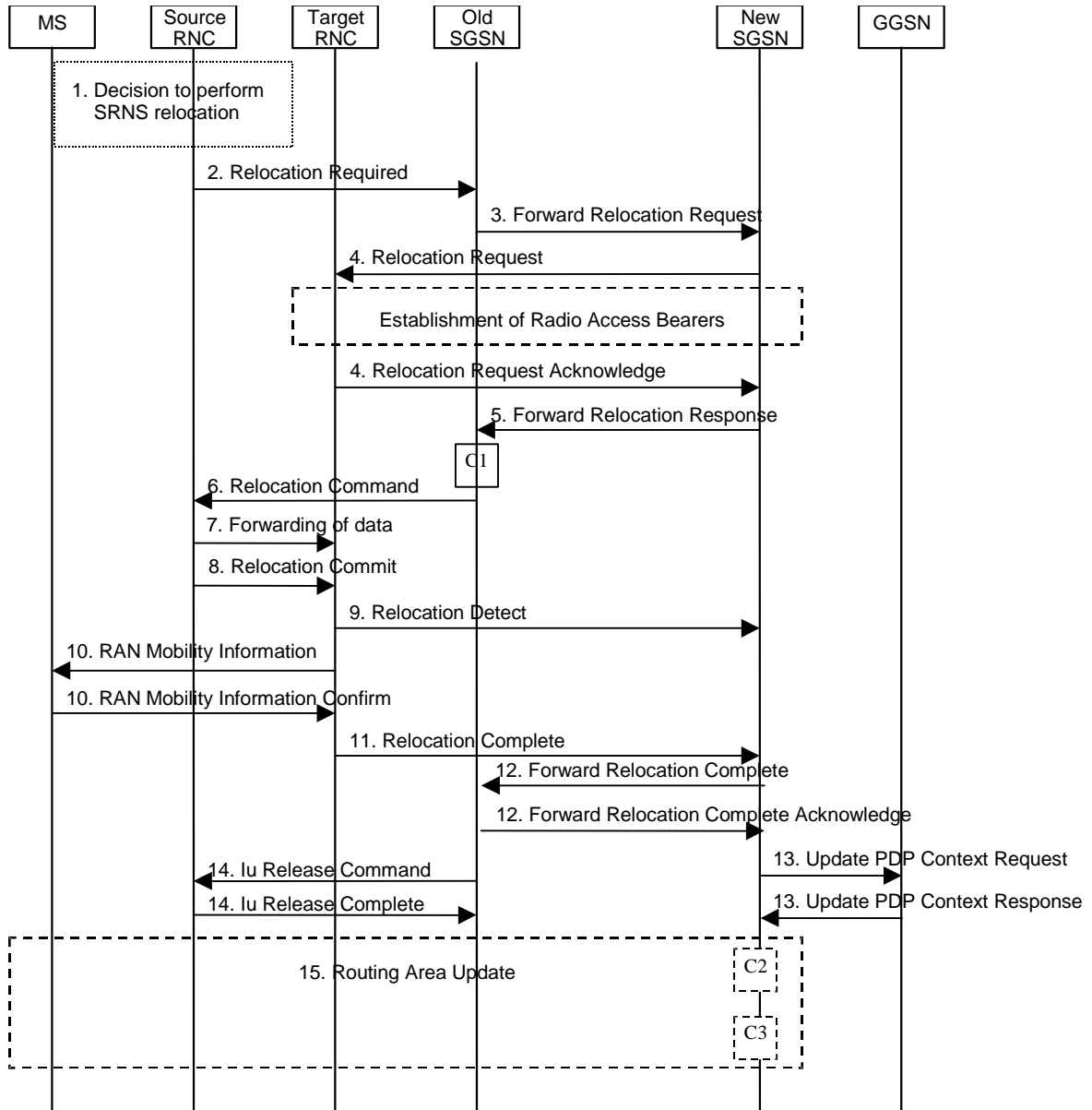


Figure 38: After SRNS Relocation and Routing Area Update

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

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



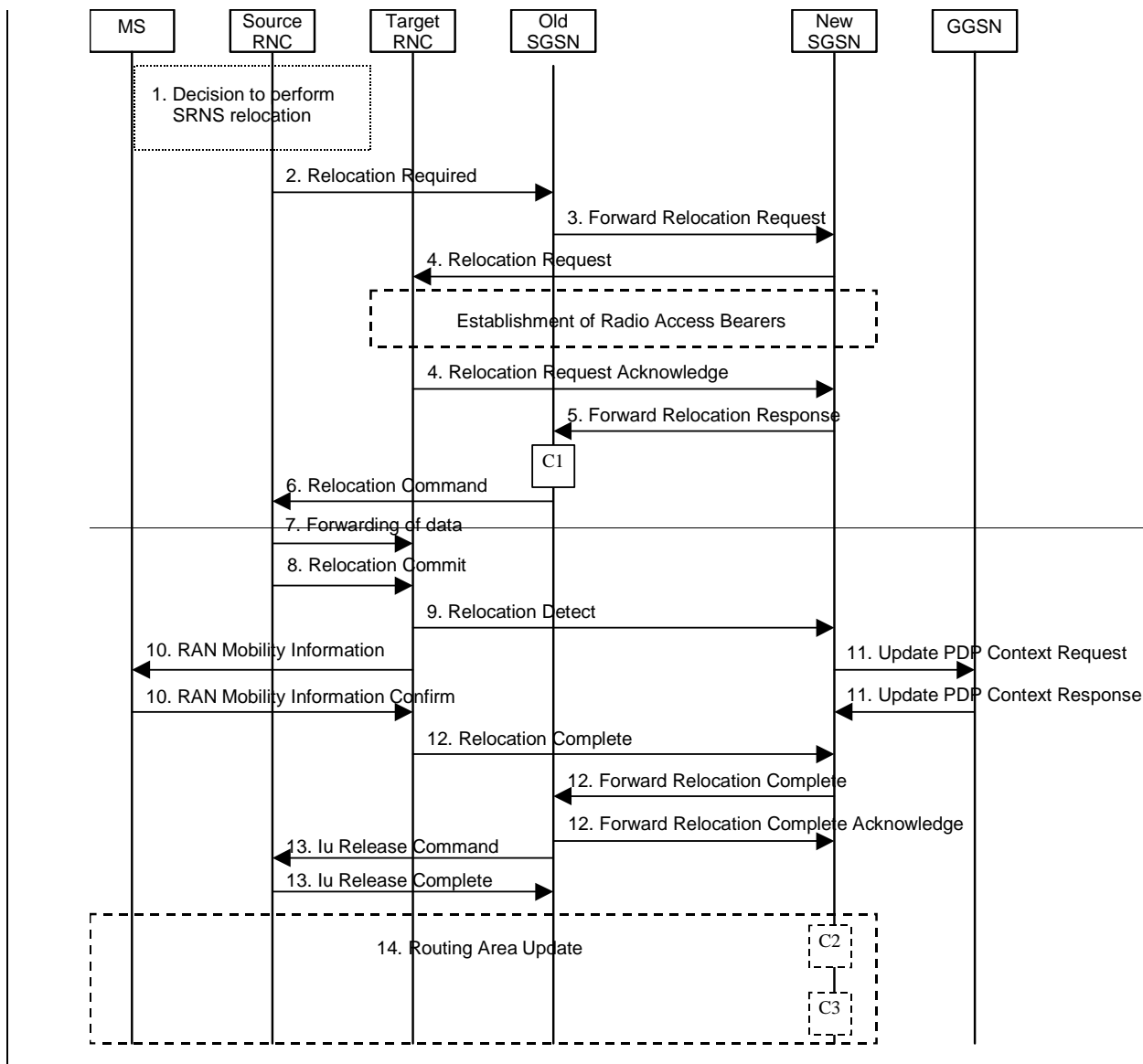


Figure 39: SRNS Relocation Procedure

- 1) The source SRNC decides to perform/initiate SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between MS and source SRNC (data flows via the target RNC, which acts as a drift RNC); GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source SRNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).
- 3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation, the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN transparent container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. The PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old

SGSN (see the Routing Area Update procedure in subclause "Location Management Procedures (Iu mode)"). The Forward Relocation Request message is applicable only in the case of inter-SGSN SRNS relocation.

- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source-RNC to target RNC transparent container, RABs to be setup) to the target RNC. Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as the existing Radio Bearers will be reallocated between the MS and the target RNC when the target RNC takes the role of the serving RNC. For each requested RAB, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated; the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.
- 5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from the new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and the RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data. Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

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

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

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

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

- 9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 10) The target SRNC sends a RAN Mobility Information message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

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

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

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

For all RABs, the target RNC should:

- start uplink reception of data and start transmission of uplink GTP-PDUs towards the new SGSN;
- start processing the already buffered and the arriving downlink GTP-PDUs and start downlink transmission towards the MS.

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

~~112) When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect 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.~~

- 12) Upon receipt of Relocation Complete message, if the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receipt of the Relocation Complete message, the CN shall 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.
- 143) 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.
- 154) After the MS has finished the RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then, the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

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

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

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

Figure 40 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 41 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 40 and Figure 41 the MS is in PMM-CONNECTED state. Both figures are also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.

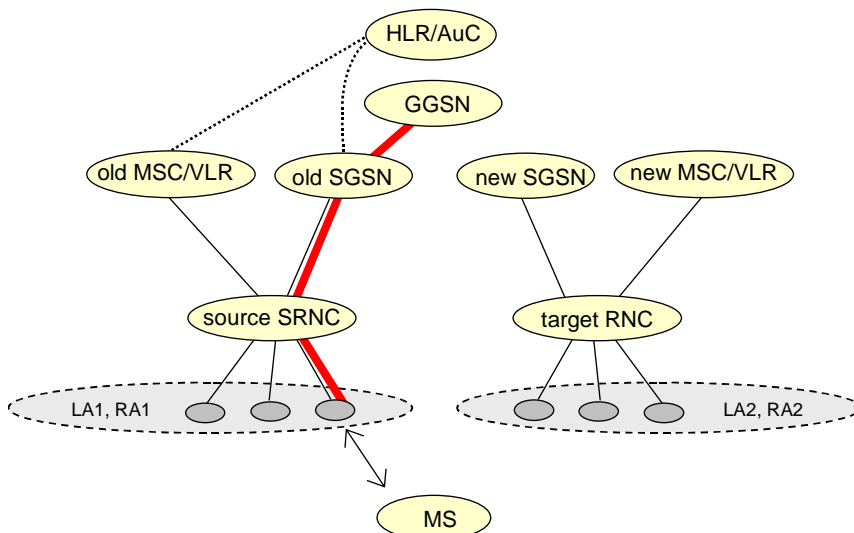


Figure 40: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

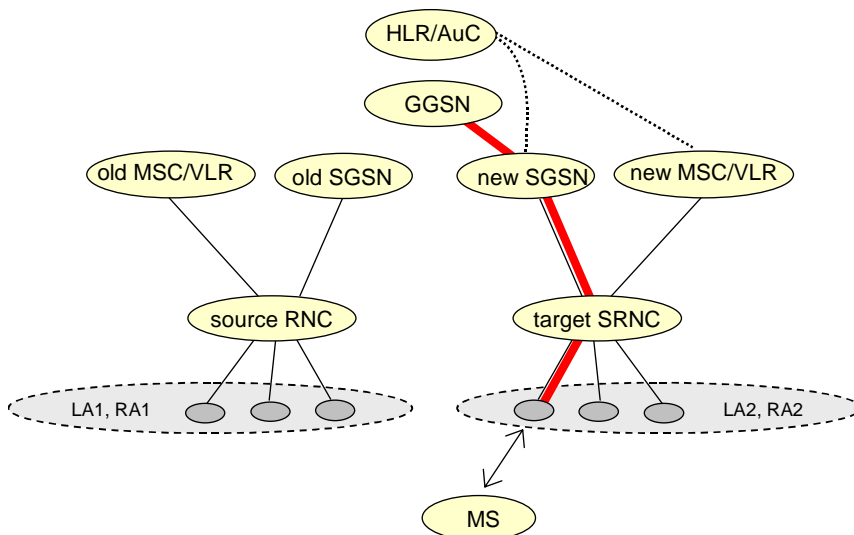
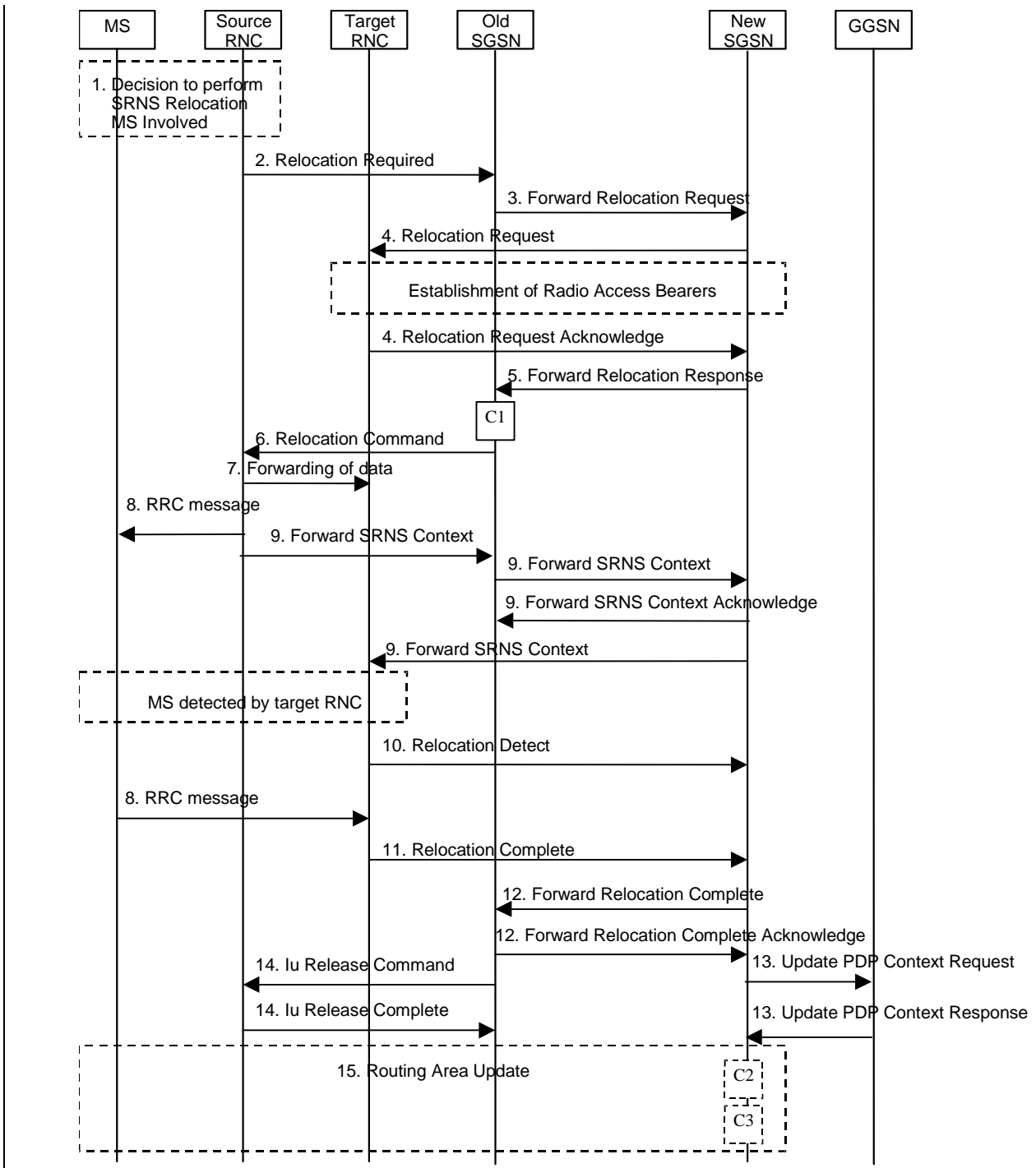


Figure 41: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 42. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. Furthermore, this signalling flow is also applicable for BSS to RNS relocation and vice-versa, as well as BSS to BSS relocation.



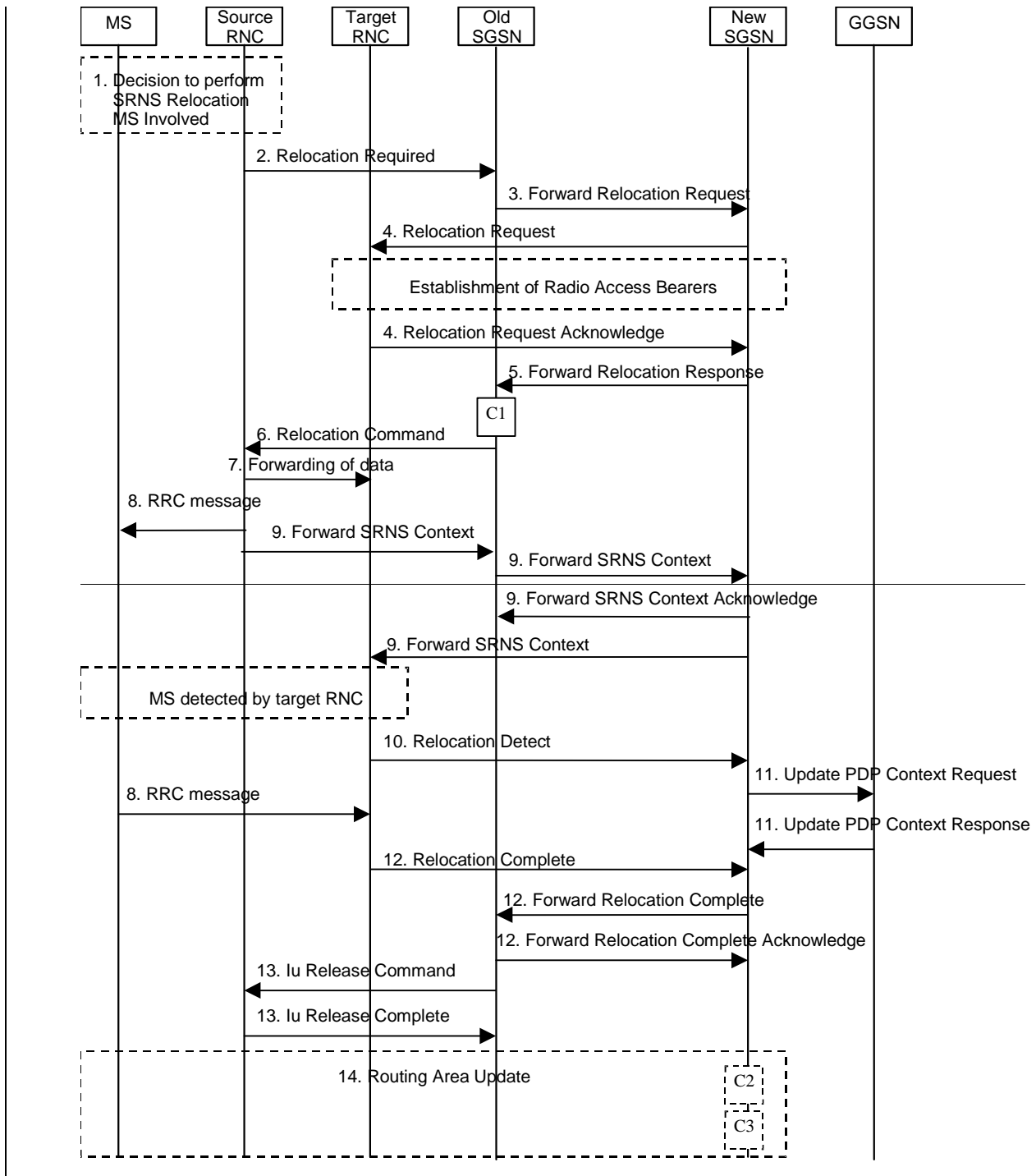


Figure 42: Combined Hard Handover and SRNS Relocation Procedure

- 1) Based on measurement results and knowledge of the RAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between the MS and the source SRNC (no drift RNC available); GTP-U tunnel(s) between the source SRNC and the old SGSN; GTP-U tunnel(s) between the old SGSN and the GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source RNC To Target RNC Transparent Container includes the necessary information for relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

- 3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN Transparent Container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routing Area Update procedure in subclause "Location Management Procedures (Iu mode)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.
- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RAB To Be Setup) to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

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

- 5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, RAN 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. RAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source SRNC. The Target RNC Information, one information element for each RAB to be set up, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begins the forwarding of data for the RABs to be subject for data forwarding.

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

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

together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

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

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

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

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

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

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

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

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

- 11) 42) —When the target SRNC receives the appropriate RRC message, e.g. Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message in UTRAN case, or the Handover To

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

- 12) Upon receipt of Relocation Complete message, if the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receipt of the Relocation Complete message, the CN shall 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.
- 143) 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.
- 154) After the MS has finished the reconfiguration procedure and if the new Routing Area Identification is different from the old one, the MS initiates the Routing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. In Figure 42, the procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

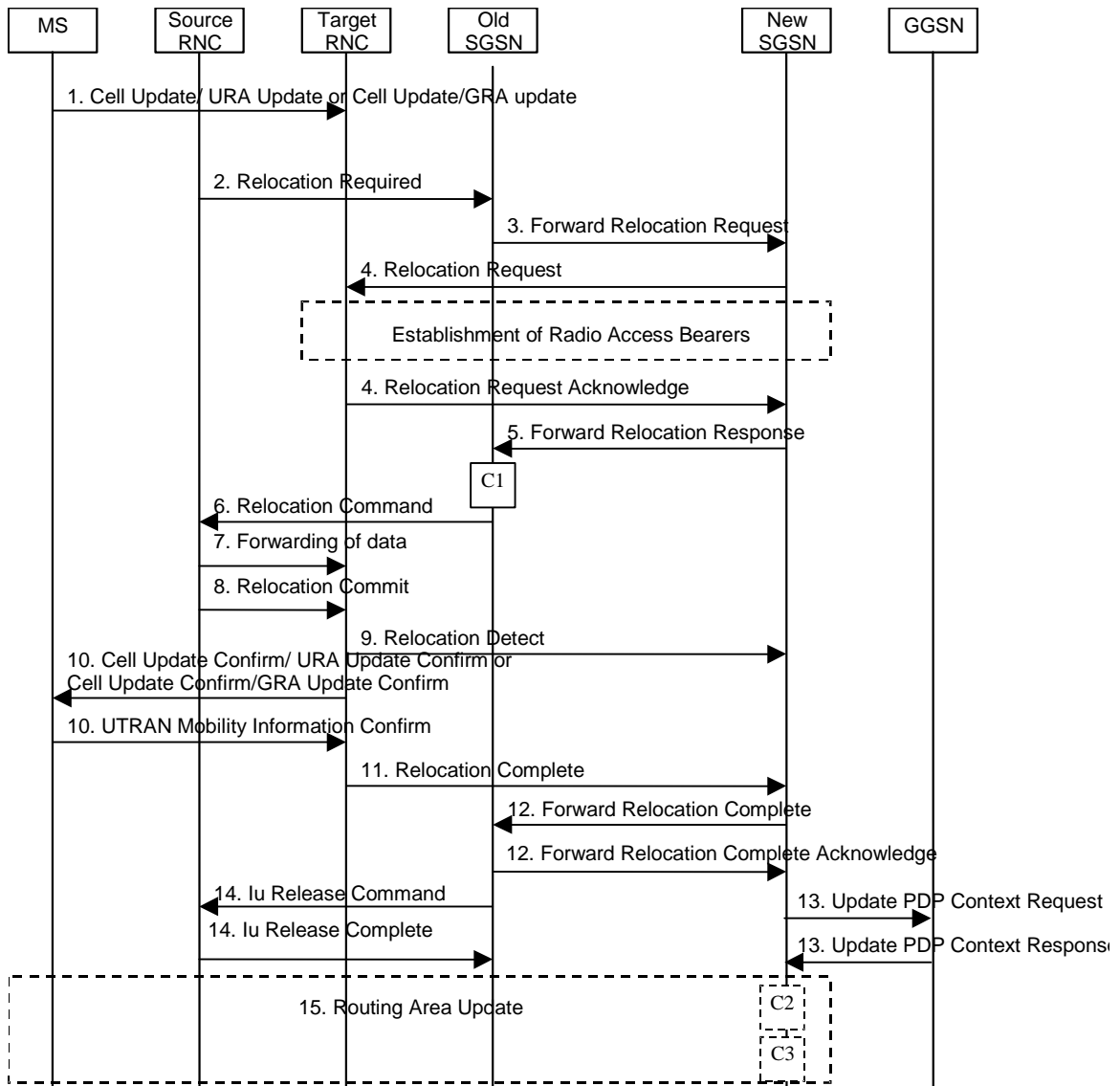
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur/Iur-g interface carries control signalling but no user data. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

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

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

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

The Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS relocation procedure for the PS domain is illustrated in Figure 43. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. This signalling flow is also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.



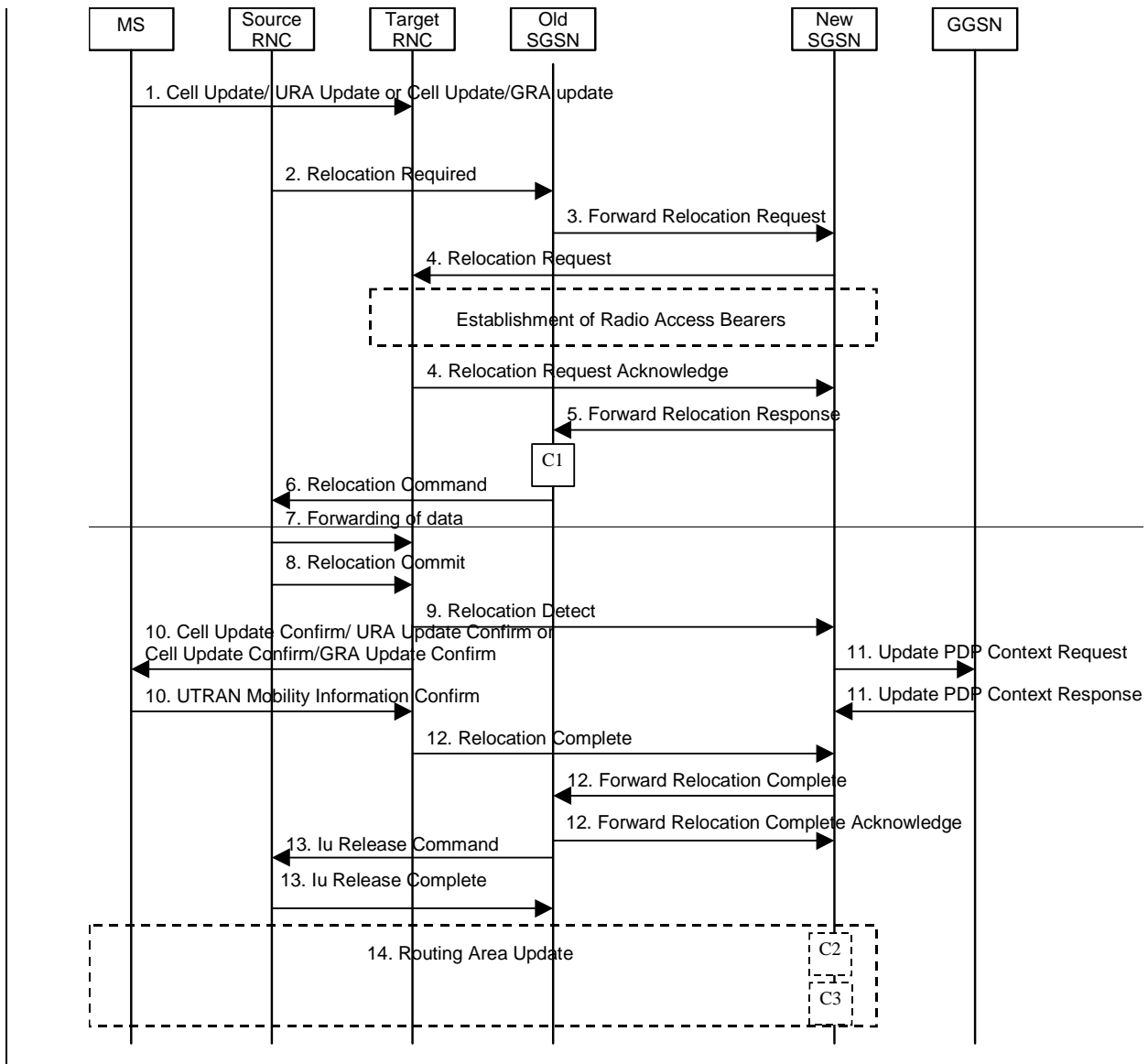


Figure 43: Combined Cell / URA Update and SRNS Relocation Procedure

- 1) The MS sends a Cell Update / URA Update or a Cell Update / GRA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). The source SRNC decides whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this subclause describes the case where a combined cell / URA update and SRNS relocation applies. In this case no radio bearer is established between the source SRNC and the UE. Nonetheless the following tunnel(s) are established: GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including MS Capabilities).
- 3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In the case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN Transparent Container, RANAP Cause) message to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN

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

- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and a Iu Transport Association which corresponds to the downlink Tunnel Endpoint Identifier for user data.

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

The target-RNC may simultaneously receive for each RAB to be set up downlink user packets both from the source SRNC and from the new SGSN.

- 5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from the source SRNC the forwarded downlink packets, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs subject to data forwarding and starts the data-forwarding timer. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

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

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

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

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

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

- 9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 10) The target SRNC sends a Cell Update Confirm / URA Update Confirm or Cell Update Confirm / GRA Update Confirm message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

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

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

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

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

- ~~11) 12) —When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from the source RNC to the target SRNC. If the~~

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

- 12) Upon receipt of Relocation Complete message, if the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receipt of the Relocation Complete message, the CN shall 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.
- 143) 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.
- 154) After the MS has finished the Cell / URA update or the Cell / GRA update and RNTI reallocation procedure and if the new Routing Area Identification is different from the old one, the MS initiates the Routing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then, the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routing_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.

CHANGE REQUEST

23.060 CR 431 rev 2 Current version: 5.5.0

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	GGSN update at SRNS relocation		
Source:	Nortel Networks, Ericsson		
Work item code:	TEI5	Date:	12/05/2003
Category:	F	Release:	Rel-5
	Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Use <u>one</u> 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) Rel-6 (Release 6)

Reason for change:	The procedure for cancelling on ongoing SRNS relocation is described in 23.060 paragraph 6.9.2.2.4. This cancellation can happen at different points of the relocation. Depending on the time when this occurs, the new SGSN may or not have updated the user plane to the GGSN. If it has and the relocation is subsequently cancelled, all traffic will be lost. The solution to the issue is that the new SGSN should delay switching the user plane until the RANAP Relocation Complete is received from the target RNC.
Summary of change:	In the SRNS relocation flows, move the GTP Update PDP context from the old SGSN to the GGSN, to when the relocation complete is received over the lu.
Consequences if not approved:	In some cases the relocation may be cancelled but the user plane set up as if the relocation was successful, resulting in all traffic being lost. While this CR could also be reflected for R99 and Rel4, it is proposed for rel5 onwards since this is an essential change of lesser impact.

Clauses affected:	6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3						
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table> Other core specifications	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Y	N						
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<input checked="" type="checkbox"/>	<input type="checkbox"/>						
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table> O&M Specifications	<input checked="" type="checkbox"/>	<input type="checkbox"/>				
<input checked="" type="checkbox"/>	<input type="checkbox"/>						
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/specs/CR.htm>. Below is a brief summary:

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

6.9.2.2.1 Serving RNS Relocation Procedure

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

The Serving SRNS Relocation procedure is used to move the RAN to CN connection point at the RAN 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 routing area is changed, this procedure is followed by an Intra-SGSN Routing Area Update procedure. The SGSN detects an Intra-SGSN routing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about new location of the MS.

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

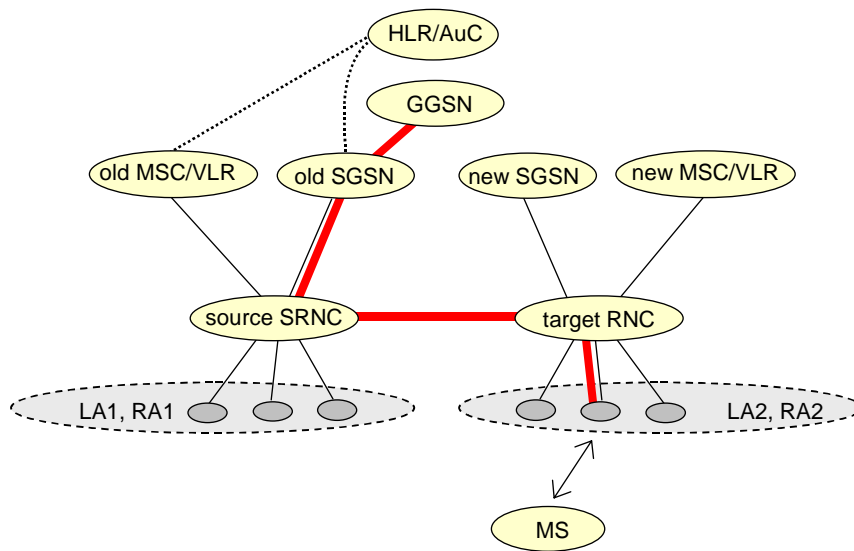


Figure 37: Before SRNS Relocation and Routing Area Update

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

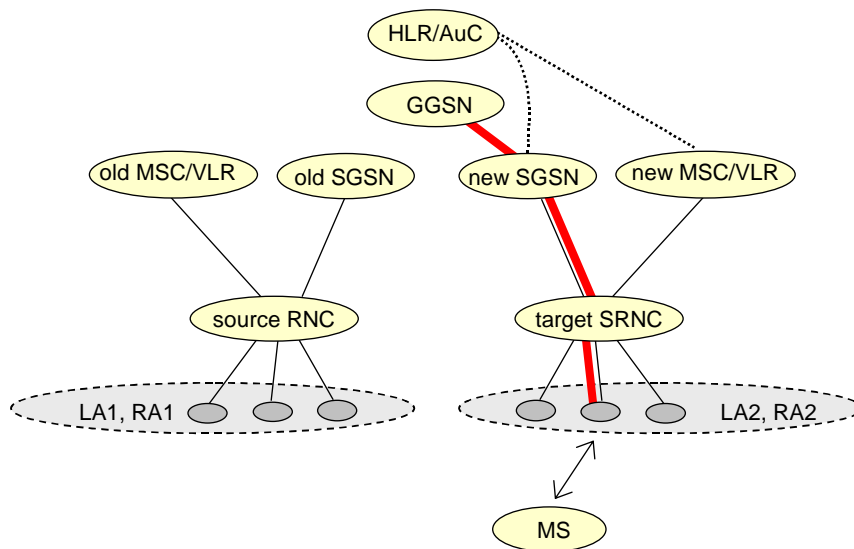
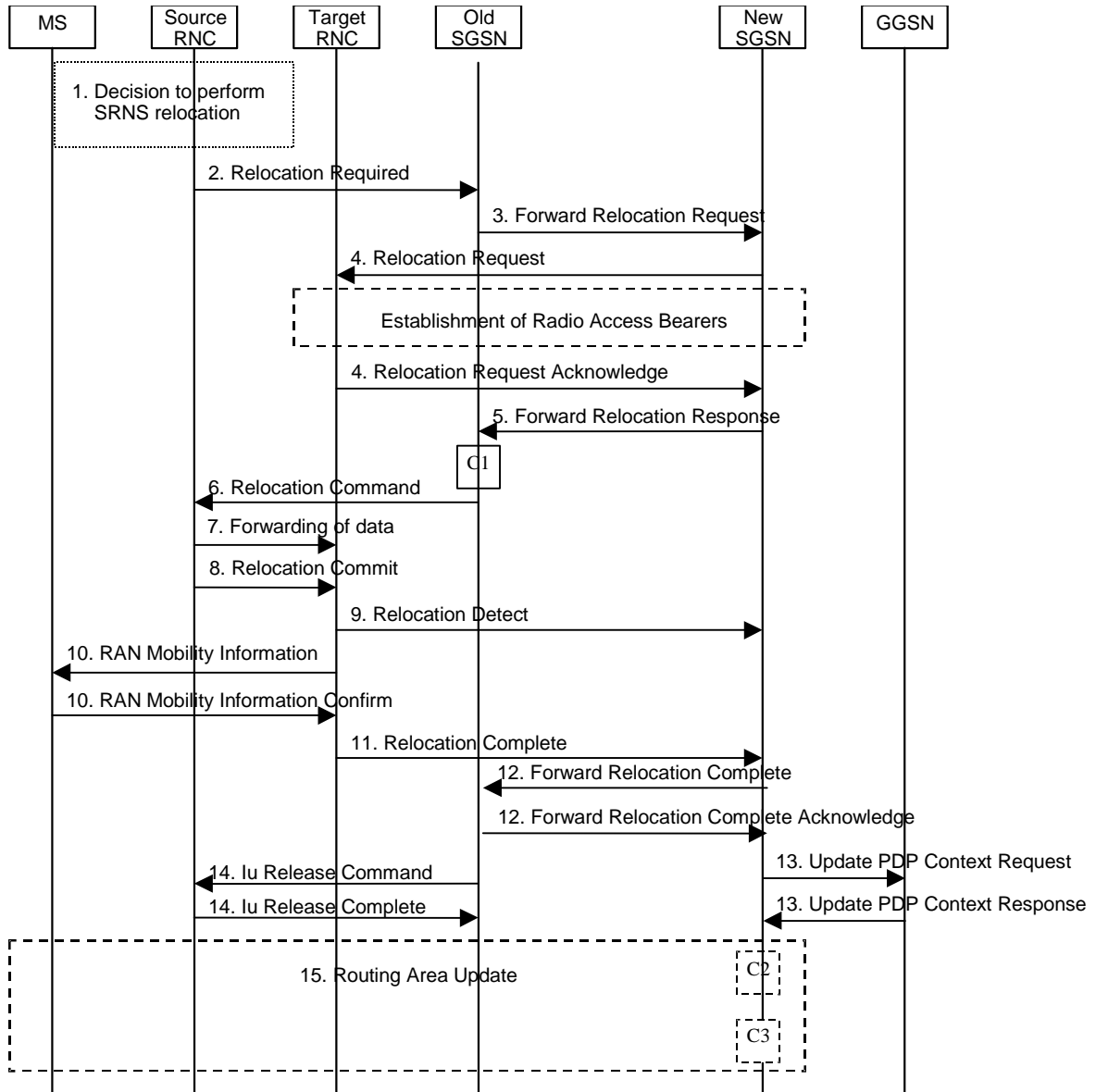


Figure 38: After SRNS Relocation and Routing Area Update

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

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



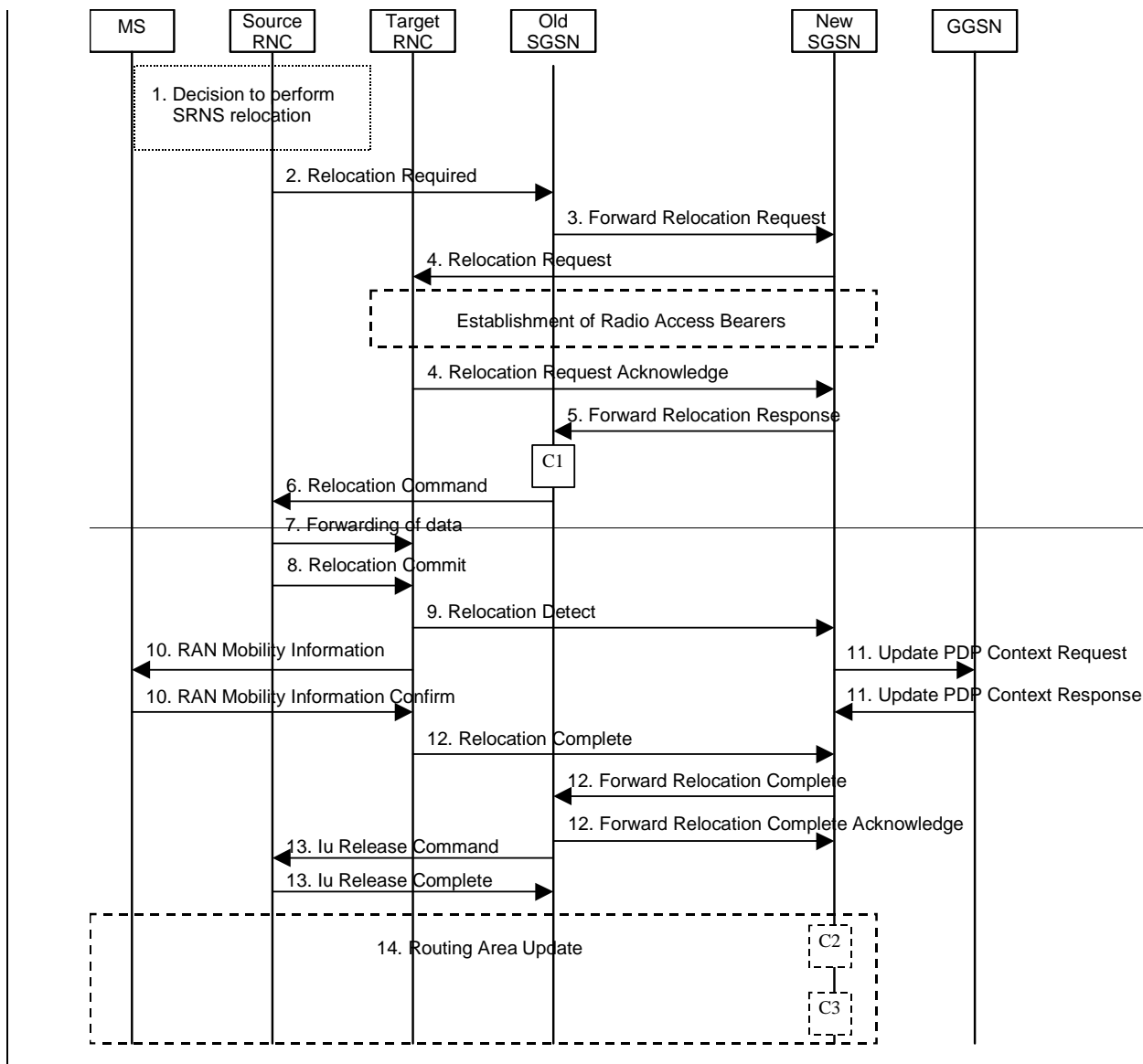


Figure 39: SRNS Relocation Procedure

- 1) The source SRNC decides to perform/initiate SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between MS and source SRNC (data flows via the target RNC, which acts as a drift RNC); GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source SRNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).
- 3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation, the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN transparent container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. The PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old

SGSN (see the Routing Area Update procedure in subclause "Location Management Procedures (Iu mode)"). The Forward Relocation Request message is applicable only in the case of inter-SGSN SRNS relocation.

- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source-RNC to target RNC transparent container, RABs to be setup) to the target RNC. Only the Iu Bearers of the RABs are setup between the target RNC and the new-SGSN as the existing Radio Bearers will be reallocated between the MS and the target RNC when the target RNC takes the role of the serving RNC. For each requested RAB, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated; the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and an Iu Transport Association, which corresponds to the downlink Tunnel Endpoint Identifier for user data. For each RAB to be set up, the target RNC may receive simultaneously downlink user packets both from the source SRNC and from the new SGSN.
- 5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from the new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the forwarded downlink PDUs, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and the RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from source SRNC to target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data. Before the serving RNC role is not yet taken over by target RNC and when downlink user plane data starts to arrive to target RNC, the target RNC may buffer or discard arriving downlink GTP-PDUs according to the related QoS profile.

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

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

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

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

- 9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 10) The target SRNC sends a RAN Mobility Information message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

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

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

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

For all RABs, the target RNC should:

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

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

- 11) Upon receipt of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).
- 11) ~~12)~~—When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. ~~If the user plane has not been switched at Relocation Detect 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.~~
- 12) Upon receipt of the Relocation complete message, if the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN shall signal to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receiving the Relocation Complete message, 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 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).
- 13) 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) 4) After the MS has finished the RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routeing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then, the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routeing_Area_Update_Context.

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

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

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

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

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

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

Figure 40 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 41 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 40 and Figure 41 the MS is in PMM-CONNECTED state. Both figures are also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.

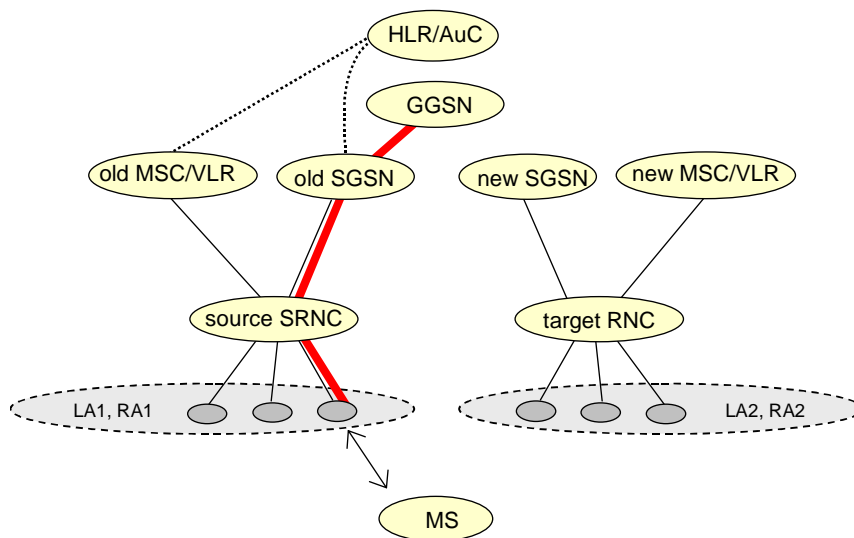


Figure 40: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

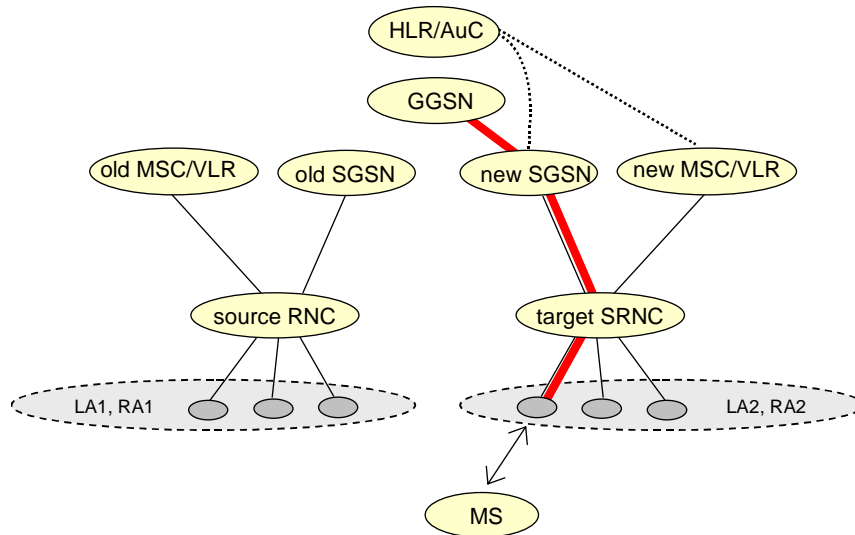
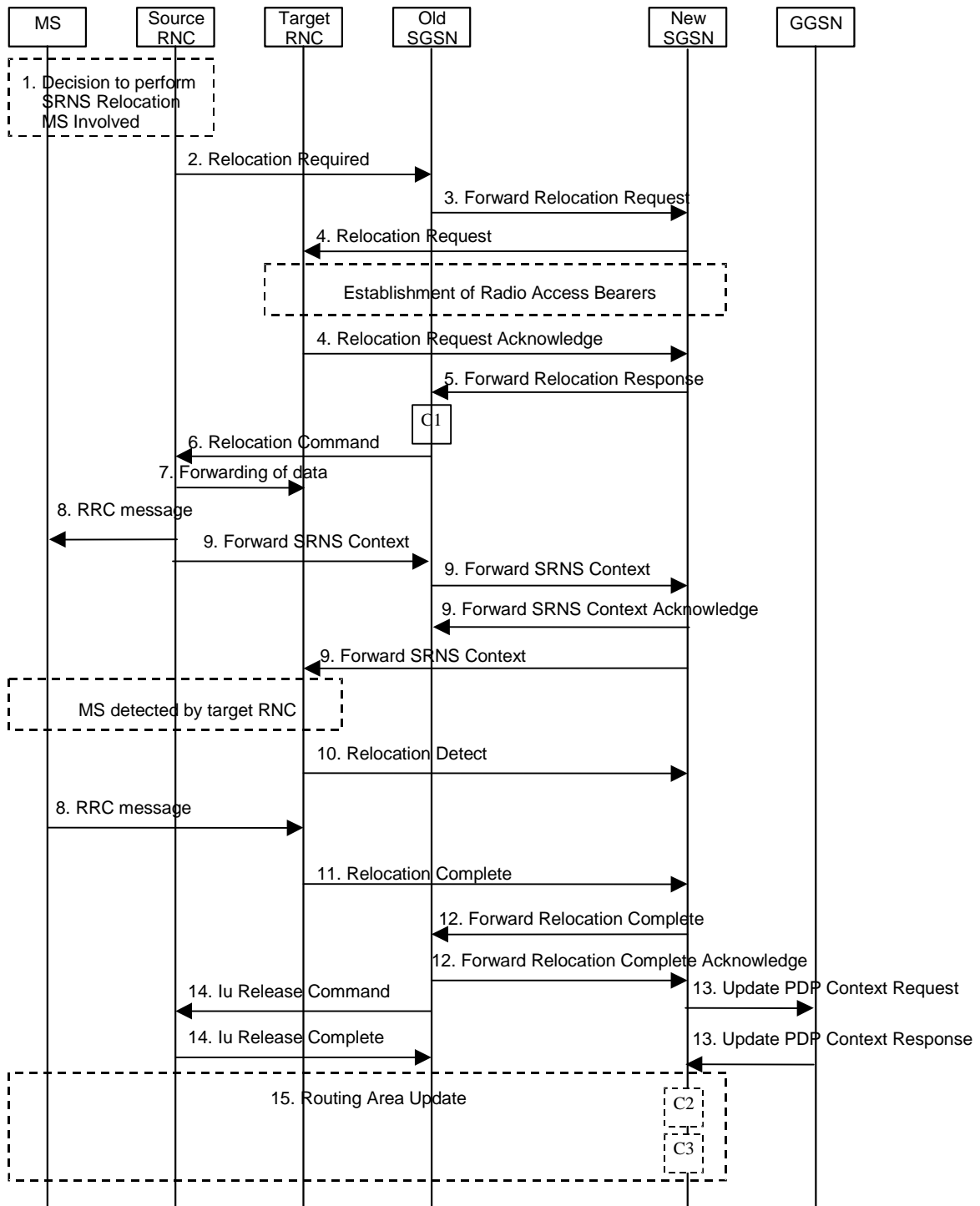


Figure 41: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 42. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. Furthermore, this signalling flow is also applicable for BSS to RNS relocation and vice-versa, as well as BSS to BSS relocation.



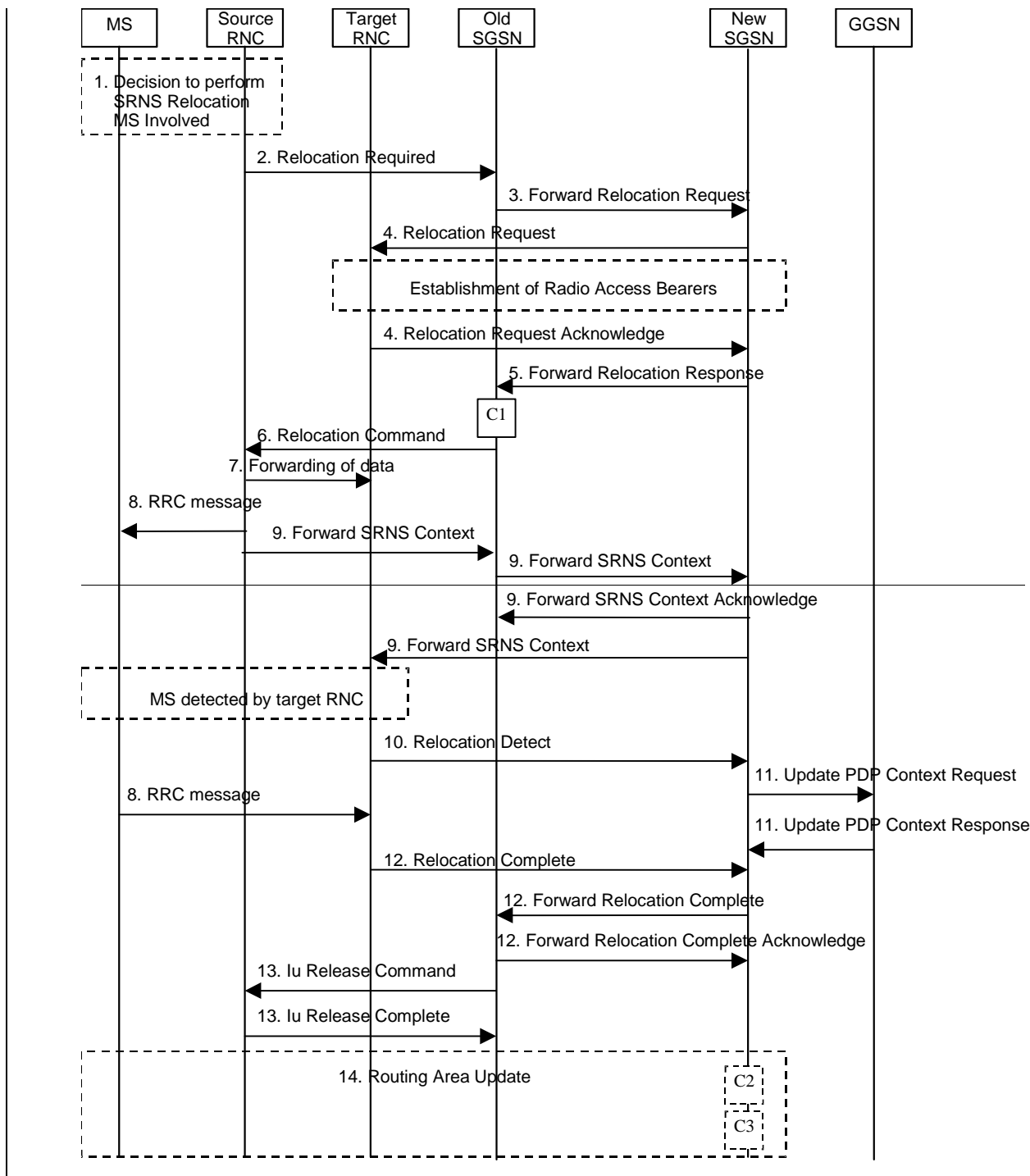


Figure 42: Combined Hard Handover and SRNS Relocation Procedure

- 1) Based on measurement results and knowledge of the RAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation. At this point both uplink and downlink user data flows via the following tunnel(s): Radio Bearer between the MS and the source SRNC (no drift RNC available); GTP-U tunnel(s) between the source SRNC and the old SGSN; GTP-U tunnel(s) between the old SGSN and the GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source RNC To Target RNC Transparent Container includes the necessary information for relocation co-ordination, security functionality and RRC protocol context information (including MS Capabilities).

- 3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN Transparent Container, RANAP Cause) to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routing Area Update procedure in subclause "Location Management Procedures (Iu mode)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.
- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RAB To Be Setup) to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

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

- 5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, RAN 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. RAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source SRNC. The Target RNC Information, one information element for each RAB to be set up, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink user data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begins the forwarding of data for the RABs to be subject for data forwarding.

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

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

together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

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

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

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

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

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

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

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

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

- 11) 42) —When the target SRNC receives the appropriate RRC message, e.g. Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message in UTRAN case, or the Handover To

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

- 12) Upon reception of Relocation Complete message, if the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon reception of Relocation Complete message, the CN shall 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.
- 143) 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.
- 154) After the MS has finished the reconfiguration procedure and if the new Routing Area Identification is different from the old one, the MS initiates the Routing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routing_Area_Update_Session procedure is called. In Figure 42, the procedure returns as result "Continue".
- Then the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routing_Area_Update_Context.

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

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

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

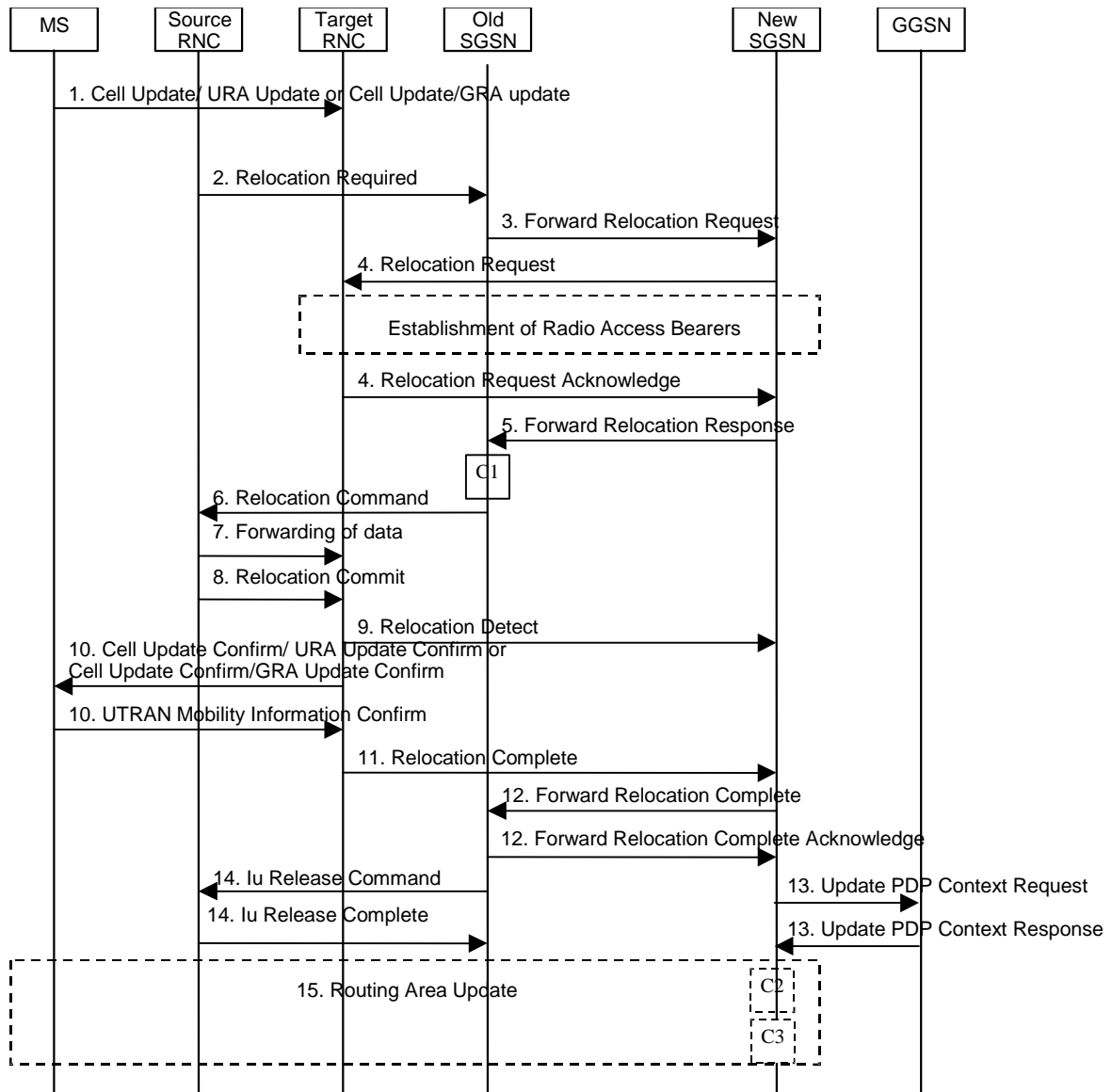
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur/Iur-g interface carries control signalling but no user data. In the context of this specification, the terms RNS or RNC refer also to a GERAN BSS or BSC (respectively) when serving an MS in Iu mode.

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

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

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

The Combined Cell / URA Update and SRNS Relocation or Combined Cell/GRA Update and SBSS relocation procedure for the PS domain is illustrated in Figure 43. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation. This signalling flow is also applicable to BSS to RNS relocation and vice-versa, as well as for BSS to BSS relocation.



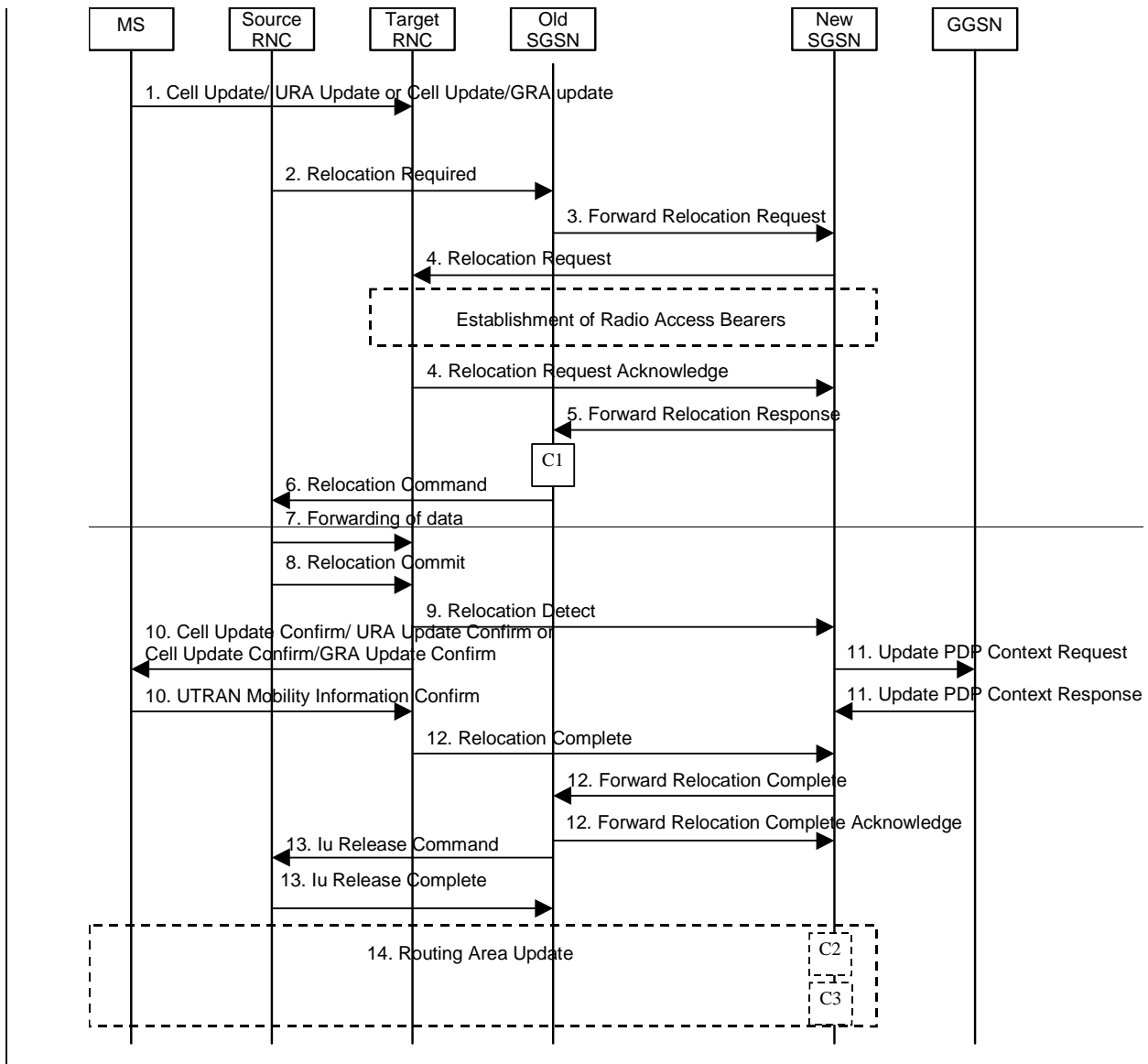


Figure 43: Combined Cell / URA Update and SRNS Relocation Procedure

- 1) The MS sends a Cell Update / URA Update or a Cell Update / GRA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). The source SRNC decides whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this subclause describes the case where a combined cell / URA update and SRNS relocation applies. In this case no radio bearer is established between the source SRNC and the UE. Nonetheless the following tunnel(s) are established: GTP-U tunnel(s) between source SRNC and old-SGSN; GTP-U tunnel(s) between old-SGSN and GGSN.
- 2) The source SRNC sends a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including MS Capabilities).
- 3) The old SGSN determines from the Target ID if the SRNS Relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In the case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, RAN Transparent Container, RANAP Cause) message to the new SGSN. For relocation to an area where Intra Domain Connection of RAN Nodes to Multiple CN Nodes is used, the old SGSN may – if it provides Intra Domain Connection of RAN Nodes to Multiple CN Nodes -have multiple target SGSNs for each relocation target in a pool area, in which case the old SGSN will select one of them to become the new SGSN, as specified in 3GPP TS 23.236 [73]. PDP context contains GGSN

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

- 4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each requested RAB, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. SGSN shall not establish RABs for PDP contexts with maximum bitrate for uplink and downlink of 0 kbit/s. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to the uplink Tunnel Endpoint Identifier Data.

After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Each RAB to be setup is defined by a Transport Layer Address, which is the target RNC Address for user data, and a Iu Transport Association which corresponds to the downlink Tunnel Endpoint Identifier for user data.

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

The target-RNC may simultaneously receive for each RAB to be set up downlink user packets both from the source SRNC and from the new SGSN.

- 5) When resources for the transmission of user data between the target RNC and the new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from the source SRNC the forwarded downlink packets, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source SRNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from the source SRNC to the target RNC. If the target RNC or the new SGSN failed to allocate resources, the RAB Setup Information element contains only NSAPI indicating that the source SRNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.
- 6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. These are the same Transport Layer Address and Iu Transport Association that the target RNC had sent to new SGSN in Relocation Request Acknowledge message, and these are used for forwarding of downlink N-PDU from the source SRNC to the target RNC. The source SRNC is now ready to forward downlink data directly to the target RNC over the Iu interface. This forwarding is performed for downlink user data only.
- 7) The source SRNC may, according to the QoS profile, begin the forwarding of data for the RABs subject to data forwarding and starts the data-forwarding timer. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between the source SRNC and the target RNC are duplicated in the source SRNC and routed at the IP layer towards the target RNC. For each radio bearer which uses lossless PDCP the GTP-PDUs related to transmitted but not yet acknowledged PDCP-PDUs are duplicated and routed at IP layer towards the target RNC together with their related downlink PDCP sequence numbers. The source RNC continues transmitting duplicates of downlink data and receiving uplink data.

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

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

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

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

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

- 9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.
- 10) The target SRNC sends a Cell Update Confirm / URA Update Confirm or Cell Update Confirm / GRA Update Confirm message. This message contains UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

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

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

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

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

- ~~11) 12) —When the target SRNC receives the RAN Mobility Information Confirm message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the MS by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from the source RNC to the target SRNC. If the~~

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

- 12) Upon receipt of Relocation Complete message, if the SRNS Relocation is an inter-SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.
- 13) Upon receipt of the Relocation Complete message, the CN shall 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.
- 134) 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.
- 154) After the MS has finished the Cell / URA update or the Cell / GRA update and RNTI reallocation procedure and if the new Routing Area Identification is different from the old one, the MS initiates the Routing Area Update procedure. See subclause "Location Management Procedures (Iu mode)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

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

- C1) CAMEL_GPRS_PDP_Context_Disconnection, CAMEL_GPRS_Detach and CAMEL_PS_Notification.

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

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

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

- C2) CAMEL_GPRS_Routing_Area_Update_Session and CAMEL_PS_Notification.

They are called in the following order:

- The CAMEL_GPRS_Routing_Area_Update_Session procedure is called. The procedure returns as result "Continue".
- Then, the CAMEL_PS_Notification procedure is called. The procedure returns as result "Continue".

- C3) CAMEL_GPRS_Routing_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.

CHANGE REQUEST

23.060 CR 445 # rev **-** # Current version: **6.0.0**

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

Proposed change affects: UICC apps# ME Radio Access Network Core Network

Title:	# Max SDU Size and MTU clarification		
Source:	# Ericsson		
Work item code:	# TEI5	Date:	# 15/05/2003
Category:	# A	Release:	# Rel-6
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:
	F (correction)		2 (GSM Phase 2)
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)
	B (addition of feature),		R97 (Release 1997)
	C (functional modification of feature)		R98 (Release 1998)
	D (editorial modification)		R99 (Release 1999)
	Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Rel-4 (Release 4)
			Rel-5 (Release 5)
			Rel-6 (Release 6)

Reason for change:	# Subclause 9.3 "Packet Routeing and Transfer Function" clearly states the maximum size of each N-PDU (1 502 octets for PDP type PPP and 1500 octets for all other PDP Types) and clearly states that PDP PDUs that are not larger than the maximum N-PDU size shall be routed and transferred as one N-PDU. Later in the same subclause there is a sentence that may be interpreted as giving the MS the possibility to restrict the maximum N-PDU PDU size due to MS limitations. But the MS has no means to communicate this restriction to the GGSN
Summary of change:	# The contentious sentence is removed.
Consequences if not approved:	# Significant ambiguity as to whether the MS can restrict the maximum N-PDU size to less than 1500/1502 octets . The contentious sentence may also be misinterpreted that the standard allow application control of the MTU between GGSN and UE.

Clauses affected:	# 9.3								
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">X</td> </tr> </table> Other core specifications # 23.107 (CR 135r2) Test specifications O&M Specifications	Y	N	X			X		X
Y	N								
X									
	X								
	X								
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 Routing and Transfer Function

The packet routing and transfer function:

- routes and transfers packets between a mobile TE and a packet data network, i.e. between reference point R and reference point Gi;
- routes and transfers packets between mobile TE and other GPRS PLMN, i.e. between reference point R and reference point Gi via interface Gp;
- routes and transfers packets between TEs, i.e. between the R reference point in different MSs; and
- optionally supports IP Multicast routing of packets via a relay function in the GGSN.

The PDP PDUs shall be routed and transferred between the MS and the GGSN as N-PDUs. In case of PDP type PPP, the maximum size of each N-PDU shall be 1 502 octets. In other cases, the maximum size of each N-PDU shall be 1 500 octets. When the MS or the GGSN receives a PDP PDU that results in an N-PDU that is not larger than the maximum N-PDU size, the PDP PDU shall be routed and transferred as one N-PDU. When the MS or the GGSN receives a PDP PDU that results in an N-PDU that is larger than the maximum N-PDU size, the PDP PDU shall be segmented, discarded or rejected, depending on the PDP type and the implementation. ~~The packet data protocol in the MS may limit the maximum size of the PDP PDUs that are routed and transferred, e.g. due to MS memory limitations.~~

Between the 2G-SGSN and the MS, PDP PDUs are transferred with SNDCP. Between the 3G-SGSN and the MS, PDP PDUs are transferred with GTP-U and PDCP.

Between the SGSN and the GGSN, PDP PDUs are routed and transferred with the UDP/IP protocols. The GPRS Tunnelling Protocol transfers data through tunnels. A tunnel endpoint identifier (TEID) and a GSN address identify a tunnel.

When multiple PDP contexts exist for the same PDP address of an MS, the GGSN routes downlink N-PDUs to the different GTP tunnels based on the TFTs assigned to the PDP contexts. Upon reception of a PDP PDU, the GGSN evaluates for a match, first the packet filter amongst all TFTs that has the smallest evaluation precedence index and, in case no match is found, proceeds with the evaluation of packet filters in increasing order of their evaluation precedence index. This procedure shall be executed until a match is found, in which case the N-PDU is tunnelled to the SGSN via the PDP context that is associated with the TFT of the matching packet filter. If no match is found, the N-PDU shall be sent via the PDP context that does not have a TFT assigned to it; if all PDP contexts have a TFT assigned, the GGSN shall silently discard the PDP PDU.

The MS is responsible for creating or modifying PDP contexts and their QoS. The MS should define TFTs in such a way that downlink PDP PDUs are routed to a PDP context that best matches the QoS requested by the receiver of this PDU (e.g. an application supporting QoS).

For each uplink PDP PDU, the MS should choose the PDP context that best matches the QoS requested by the sender of this PDP PDU (e.g. an application supporting QoS). Packet classification and routing within the MS is an MS-local matter. The GGSN shall not match uplink N-PDUs against TFTs.

TFTs are used for PDP types IP and PPP only. For PDP type PPP a TFT is applicable only when PPP is terminated in the GGSN (i.e. GGSN does not provide PDN interworking by means of tunnelled PPP, e.g. by the Layer Two Tunnelling Protocol (L2TP)) and IP traffic is carried over PPP. To support roaming subscribers, and for forward compatibility, the SGSN is not required to know the tunnelled PDP. Every SGSN shall have the capability to transfer PDUs belonging to PDPs not supported in the PLMN of the SGSN.

The GGSN could also optionally support IP Multicast: this allows the MSs to join multicast groups and start receiving multicast packets. The GGSN duplicates the incoming multicast packets and relays them to the already active TEIDs. These TEIDs are those of MSs that have joined a multicast group.

CHANGE REQUEST

23.060 CR 432 # rev **2** # Current version: **5.5.0**

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

Proposed change affects: UICC apps# ME Radio Access Network Core Network

Title:	# Max SDU Size and MTU clarification				
Source:	# Ericsson				
Work item code:	# TEI5	Date:	# 15/05/2003		
Category:	# F	Release:	# Rel-5		
	Use <u>one</u> of the following categories:		Use <u>one</u> of the following releases:		
	F (correction)		2 (GSM Phase 2)		
	A (corresponds to a correction in an earlier release)		R96 (Release 1996)		
	B (addition of feature),		R97 (Release 1997)		
	C (functional modification of feature)		R98 (Release 1998)		
	D (editorial modification)		R99 (Release 1999)		
	Detailed explanations of the above categories can be found in 3GPP TR 21.900.		Rel-4 (Release 4)		
			Rel-5 (Release 5)		
			Rel-6 (Release 6)		

Reason for change:	# Subclause 9.3 "Packet Routeing and Transfer Function" clearly states the maximum size of each N-PDU (1 502 octets for PDP type PPP and 1500 octets for all other PDP Types) and clearly states that PDP PDUs that are not larger than the maximum N-PDU size shall be routed and transferred as one N-PDU. Later in the same subclause there is a sentence that may be interpreted as giving the MS the possibility to restrict the maximum N-PDU PDU size due to MS limitations. But the MS has no means to communicate this restriction to the GGSN
Summary of change:	# The contentious sentence is removed.
Consequences if not approved:	# Significant ambiguity as to whether the MS can restrict the maximum N-PDU size to less than 1500/1502 octets . The contentious sentence may also be misinterpreted that the standard allow application control of the MTU between GGSN and UE.

Clauses affected:	# 9.3								
Other specs affected:	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">X</td> </tr> </table> Other core specifications # 23.107 (CR 135r2) Test specifications O&M Specifications	Y	N	X			X		X
Y	N								
X									
	X								
	X								
Other comments:	#								

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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 routing within the MS is an MS-local matter. The GGSN shall not match uplink N-PDUs against TFTs.

TFTs are used for PDP types IP and PPP only. For PDP type PPP a TFT is applicable only when PPP is terminated in the GGSN (i.e. GGSN does not provide PDN interworking by means of tunnelled PPP, e.g. by the Layer Two Tunnelling Protocol (L2TP)) and IP traffic is carried over PPP. To support roaming subscribers, and for forward compatibility, the SGSN is not required to know the tunnelled PDP. Every SGSN shall have the capability to transfer PDUs belonging to PDPs not supported in the PLMN of the SGSN.

The GGSN could also optionally support IP Multicast: this allows the MSs to join multicast groups and start receiving multicast packets. The GGSN duplicates the incoming multicast packets and relays them to the already active TEIDs. These TEIDs are those of MSs that have joined a multicast group.

3GPP TSG-SA2 #32

San Diego, USA, 12-16/5/03

Tdoc S2-031945

Rel 6 mirror to S2-031944

CR-Form-v7

CHANGE REQUEST

⌘ 23.060 CR 451 ⌘ rev 0 ⌘ Current version: 6.0.0 ⌘

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

Proposed change affects: UICC apps⌘ ME Radio Access Network Core Network

Title:	⌘	Changes for Early UE handling
Source:	⌘	Vodafone Ltd
Work item code:	⌘	Late_UE
		Date: ⌘ 15/5/03
Category:	⌘	A
		Release: ⌘ Rel-6
		Use <u>one</u> of the following categories:
		Use <u>one</u> of the following releases:
		F (correction)
		2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)
		R96 (Release 1996)
		B (addition of feature),
		R97 (Release 1997)
		C (functional modification of feature)
		R98 (Release 1998)
		D (editorial modification)
		R99 (Release 1999)
		Detailed explanations of the above categories can
		Rel-4 (Release 4)
		Rel-5 (Release 5)
		Rel-6 (Release 6)
		be found in 3GPP TR 21.900 .

Reason for change:	⌘ The stage 2 for “early UE handling” is being specified in 23.195 and it is not planned to duplicate requirements in 23.060. However, review of 23.060 shows that some changes are beneficial.
Summary of change:	⌘ In section 13.2, storage of the SVN is added as part of the MM context for the SGSN: this means that text in many other sections of 23.060 automatically applies to it. Because 23.195 indicates that the IMEISV is transferred between SGSNs at ‘all’ GTPv1 inter-SGSN RA updates then the SVN is added for both Iu and A/Gb modes. In section 13.7, storage of UESBI is added for the RNC.
Consequences if not approved:	⌘ The tables in section 13 may be viewed as inaccurate, and, 23.060 might be deemed to conflict with 23.195/29.060 with regard to IMEISV transfer.

Clauses affected:	⌘	2, 3.2, 13.2 and 13.7			
Other specs Affected:	⌘	<table border="1"><tr><td>Y</td><td>N</td></tr></table>	Y	N	Other core specifications ⌘ Test specifications O&M Specifications
		Y	N		
		<table border="1"><tr><td></td><td>N</td></tr></table>		N	
	N				
<table border="1"><tr><td></td><td>N</td></tr></table>		N			
	N				
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.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS ciphering algorithm requirements".
- [3] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".
- [4] 3GPP TS 23.003: "Numbering, addressing and identification".
- [5] 3GPP TS 23.007: "Restoration procedures".
- [5b] 3GPP TS 23.016: "Subscriber data management; Stage 2".
- [6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".
- [7] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [7b] 3GPP TS 23.122: "Non-Access Stratum functions related to Mobile Station (MS) in idle mode".
- [8] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".
- [8b] 3GPP TS 23.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 - Stage 2".
- [9] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications", (Release 4).
- [10] Void.
- [11] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".
- [12] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".
- [13] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".
- [13b] 3GPP TS 24.011: "Point to Point (PP) Short Message Service (SMS) support on mobile radio interface".
- [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 (SNDCCP)".
- [16b] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".
- [17] 3GPP TS 27.060: "Packet Domain; Mobile Station (MS) supporting Packet Switched services".
- [18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile-services Switching Centre - Base Station System (MSC-BSS) interface; Layer 3 specification".
- [19] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".
- [20] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".
- [21] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".
- [22] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); In-band control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".
- [23] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".
- [24] 3GPP TS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".
- [25] 3GPP TS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".
- [26] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".
- [27] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting Packet Based services and Packet Data Networks (PDN)".
- [27b] 3GPP TS 29.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3; CAMEL Application Part (CAP) Specification".
- [28] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface".
- [29] ITU-T Recommendations I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".
- [30] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".
- [31] ITU-T Recommendation Q.65: "The unified functional methodology for the characterization of services and network capabilities".
- [32] ITU-T Recommendation V.42bis: "Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".
- [33] ITU-T Recommendation X.3: "Packet assembly/disassembly facility (PAD) in a public data network".
- [34] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [39] RFC 768 (1980): "User Datagram Protocol" (STD 6).
- [40] RFC 791 (1981): "Internet Protocol" (STD 5).

- [41] RFC 792 (1981): "Internet Control Message Protocol" (STD 5).
- [42] RFC 793 (1981): "Transmission Control Protocol" (STD 7).
- [43] RFC 1034 (1987): "Domain names – concepts and facilities" (STD 13).
- [44] RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).
- [45] RFC 1542 (1993): "Clarifications and Extensions for the Bootstrap Protocol".
- [46] RFC 2002 (1996): "IP Mobility Support".
- [47] RFC 2131 (1997): "Dynamic Host Configuration Protocol".
- [48] RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification".
- [49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.
- [50] 3GPP TS 25.301: "Radio Interface Protocol Architecture".
- [51] 3GPP TS 25.303: "Interlayer procedures in Connected Mode".
- [51b] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Call Reselection in Connected Mode".
- [52] 3GPP TS 25.331: "RRC Protocol Specification".
- [53] 3GPP TS 25.401: "UTRAN Overall Description".
- [54] 3GPP TS 23.121: "Architectural Requirements for Release 1999".
- [55] 3GPP TS 25.322: "RLC protocol specification".
- [56] 3GPP TS 25.412: "UTRAN Iu Interface Signalling Transport".
- [56b] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".
- [57] 3GPP TS 25.323: "Packet Data Convergence Protocol (PDCP) specification".
- [58] 3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".
- [59] ITU-T Recommendation I.361: "B-ISDN ATM layer specification".
- [60] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification".
- [61] 3GPP TS 33.102: "3G Security; Security architecture".
- [62] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".
- [63] 3GPP TS 25.411: "UTRAN Iu interface Layer 1".
- [64] 3GPP TS 25.414: "UTRAN Iu interface data transport & transport signalling".
- [65] 3GPP TS 23.271: "Functional stage 2 description of LCS".
- [66] 3GPP TS 23.015: "Technical realization of Operator Determined Barring (ODB)".
- [67] ITU-T Recommendation I.363.5: "B-ISDN ATM Adaptation Layer (AAL) specification: Type 5 AAL".
- [68] RFC 2373 (1998): "IP Version 6 Addressing Architecture".
- [69] RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".
- [70] 3GPP TS 32.215: "3G Telecom Management; Charging management; Charging data description for the Packet Switched (PS) domain".

- [71] RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)".
- [72] 3GPP TS 29.202: "Signalling System No. 7 (SS7) signalling transport in core network; Stage 3".
- [73] 3GPP TS 23.236: "Intra Domain Connection of RAN Nodes to Multiple CN Nodes".
- [74] 3GPP TS 43.051: "Radio Access Network; Overall description – Stage 2".
- [75] 3GPP TS 24.229: IP Multimedia Call Control Protocol based on SIP and SDP.
- [76] [3GPP TS 23.195: "Provision of UE Specific Behaviour Information to Network Entities"](#).

3 Definitions, abbreviations and symbols

3.1 Definitions

Definitions can be found in 3GPP TS 22.060 [3] and 3GPP TS 25.401 [53]. For the purposes of the present document, the following terms and definitions apply:

GPRS: packet bearer service of the packet domain

A/Gb mode: indicates that this (sub)clause or paragraph applies only to a system or sub-system which operate in A/Gb mode of operation, i.e. with a functional division that is in accordance with the use of an A or a Gb interface between the radio access network and the core network. This definition is consistent with the A/Gb mode definition for the RAN in 3G 43.051 [74]. Note that A/Gb mode is independent of the support of both interfaces, e.g. an SGSN in A/Gb mode uses only the Gb interface.

Iu mode: indicates that this clause or paragraph applies only to a system or a sub-system which operates in Iu mode of operation, i.e. with a functional division that is in accordance with the use of an Iu-CS or Iu-PS interface between the radio access network and the core network. This definition is consistent with the Iu mode definition for the RAN in 3G 43.051 [74]. Note that Iu mode is independent of the support of both parts of the Iu interface, e.g. an SGSN in Iu mode uses only the Iu-PS interface.

Inter-system change: change of an MS from A/Gb mode to Iu mode of operation and vice versa.

MS: this specification makes no distinction between MS and UE

2G- / 3G-: prefixes 2G- and 3G- refer to systems or sub-systems, that support A/Gb mode or Iu mode, respectively, e.g. 2G-SGSN refers to all functionality of an SGSN which serves an MS in A/Gb mode.

NOTE: When the prefix is omitted, reference is made independently from the A/Gb mode or Iu mode functionality.

Pool area: refers to a grouping of one or more RA(s) that, from a RAN perspective, are served by a certain group of CN nodes, as defined for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes.

3.2 Abbreviations

Applicable abbreviations can be found in GSM 01.04 [1] and 3GPP 21.905 [9]. For the purposes of the present document the following abbreviations apply:

AAL5	ATM Adaptation Layer type 5
APN	Access Point Name
ATM	Asynchronous Transfer Mode
AUTN	Authentication Token
BG	Border Gateway
BSSAP+	Base Station System Application Part +
BSSGP	Base Station System GPRS Protocol
BVCI	BSSGP Virtual Connection Identifier
CCU	Channel Codec Unit
CDR	Call Detail Record
CGF	Charging Gateway Functionality

CGI	Cell Global Identification
CK	Cipher Key
CMM	Circuit Mobility Management
CS	Circuit Switched
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DTM	Discontinuous Transfer Mode
EGPRS	Enhanced GPRSESP Encapsulating Security Payload
GEA	GPRS Encryption Algorithm
GERAN	GSM EDGE Radio Access Network
GGSN	Gateway GPRS Support Node
GMM/SM	GPRS Mobility Management and Session Management
GPRS-SSF	GPRS Service Switching Function
GPRS-CSI	GPRS CAMEL Subscription Information
GRA	GERAN Registration Area
GSM-SCF	GSM Service Control Function
GSIM	GSM Service Identity Module
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
GTP-C	GTP Control Plane
GTP-U	GTP User Plane
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IK	Integrity Key
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IPX	Internet Packet eXchange
ISP	Internet Service Provider
KSI	Key Set Identifier
L2TP	Layer-2 Tunnelling Protocol
LL-PDU	LLC PDU
LLC	Logical Link Control
MAC	Medium Access Control
MIP	Mobile IP
MNRF	Mobile station Not Reachable Flag
MNRG	Mobile station Not Reachable for GPRS flag
MNRR	Mobile station Not Reachable Reason
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NACC	Network Assisted Cell Change
NGAF	Non-GPRS Alert Flag
N-PDU	Network Protocol Data Unit
NS	Network Service
NSAPI	Network layer Service Access Point Identifier
NSS	Network SubSystem
ODB	Operator Determined Barring
P-TMSI	Packet TMSI
PCU	Packet Control Unit
PDCH	Packet Data CHannel
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g. IP
PDU	Protocol Data Unit
PMM	Packet Mobility Management
PPF	Paging Proceed Flag
PPP	Point-to-Point Protocol
PTP	Point To Point
PVC	Permanent Virtual Circuit
RA	Routeing Area
RAB	Radio Access Bearer
RAC	Routeing Area Code
RAI	Routeing Area Identity
RANAP	Radio Access Network Application Protocol

RAU	Routeing Area Update
RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SBSC	Serving Base Station Controller
SBSS	Serving BSS
SGSN	Serving GPRS Support Node
SM	Short Message
SM-SC	Short Message service Service Centre
SMS-GMSC	Short Message Service Gateway MSC
SMS-IWMSC	Short Message Service Interworking MSC
SN-PDU	SNDCP PDU
SNDC	SubNetwork Dependent Convergence
SNDCP	SubNetwork Dependent Convergence Protocol
SPI	Security Parameter Index
SRNC	Serving RNC
SRNS	Serving RNS
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TFT	Traffic Flow Template
TEID	Tunnel Endpoint IDentifier
TLLI	Temporary Logical Link Identity
TOM	Tunnelling Of Messages
TOS	Type of Service
TRAU	Transcoder and Rate Adaptor Unit
UDP	User Datagram Protocol
UEA	UMTS Encryption Algorithm
UESBI-Iu	UE Specific Behaviour Information - Iu
UESBI-Uu	UE Specific Behaviour Information - Uu
UIA	UMTS Integrity Algorithm
URA	UTRAN Registration Area
USIM	User Service Identity Module
UTRAN	UMTS Terrestrial Radio Access Network

3.3 Symbols

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA does not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

Table 6: SGSN MM and PDP Contexts

Field	Description	A/Gb mode	Iu mode
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
SVN	Software Version Number (stored by SGSNs supporting the "Provision of UE Specific Behaviour Information to Network Entities" feature as defined in 3GPP TS 23.195 [76].)	3)	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
Authentication Vectors	Authentication and ciphering parameters (authentication triplets or quintets)..	X	X
Kc	Currently used A/Gb mode ciphering key.	X	2)
CKSN	Ciphering key sequence number of Kc.	X	2)
Ciphering algorithm	Selected ciphering algorithm.	X	X
CK	Currently used Iu mode ciphering key.	1)	X
IK	Currently used Iu mode integrity key.	1)	X
KSI	Key Set Identifier.	1)	X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	X
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g. normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g. operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3GPP TS 23.016	X	X
MG-CSI	Optional Mobility Management for GPRS CAMEL subscription information, see 3GPP TS 23.016.	X	X
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g. PPP or IP.	X	X
PDP Address	PDP address, e.g. an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used. This APN shall be composed of the APN Network Identifier and the APN Operator Identifier.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain	X	X

Field	Description	A/Gb mode	Iu mode
	of the HPLMN only, or additionally the APN in the domain of the VPLMN.		
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC/BSC currently used.		X

The information marked with a "1)" in table 6 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 6 may be maintained if authentication is performed by the GSM authentication procedure.

The information marked with a "3)" in table 6 is optional. It can be sent to a new SGSN at RA update.

13.7 RNC/BSC for Iu mode

RNC/BSC maintains RNC/BSC Context for CN-related information in PMM-CONNECTED state. RNC/BSC also contains RAB contexts for activated RABs. Table 11 shows the context fields for one MS.

Table 11: RNC/BSC Context

Field	Description
IMSI	IMSI is the main reference key.
UE Capability	UE radio capabilities.
UESBI-Iu	Stored by an RNC which supports the "Provision of UE Specific Behaviour Information to Network Entities" feature defined in 3GPP TS 23.195 [76].
UESBI-Uu	Stored by an RNC which supports the "Provision of UE Specific Behaviour Information to Network Entities" feature defined in 3GPP TS 23.195 [76].
SAI	Current or last known SAI
SAI age	Time elapsed since the RNC last established the UE's last known SAI
Trace Reference	Identifies a record or a collection of records for a particular trace.
Trace Type	Indicates the type of trace.
Trigger Id	Identifies the entity that initiated the trace.
OMC Identity	Identifies the OMC that shall receive the trace record(s).
Each RNC context contains zero or more RNC RAB contexts:	
RAB ID	Radio Access Bearer Identifier.
PDP Type	PDP type, e.g. PPP or IP.
TEID	Tunnel Endpoint Identifier.
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
GTP-SND	GTP-U sequence number of the next downlink in-sequence N-PDU to be sent to the MS.
GTP-SNU	GTP-U sequence number of the next uplink in-sequence N-PDU to be sent to the GGSN.
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.
PDCP-SNU	Sequence Number of the next uplink in-sequence PDCP-PDU expected from the MS.

3GPP TSG-SA2 #32

San Diego, USA, 12-16/5/03

Tdoc S2-031944

rev of S2-031925

CR-Form-v7

CHANGE REQUEST

⌘ 23.060 CR 443 ⌘ rev 1 ⌘ Current version: 5.5.0 ⌘

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

Proposed change affects: UICC apps⌘ ME Radio Access Network Core Network

Title:	⌘	Changes for Early UE handling
Source:	⌘	Vodafone Ltd
Work item code:	⌘	Late_UE
		Date: ⌘ 15/5/03
Category:	⌘	F
		Release: ⌘ Rel-5
		<p>Use <u>one</u> of the following categories:</p> <p>F (correction)</p> <p>A (corresponds to a correction in an earlier release)</p> <p>B (addition of feature),</p> <p>C (functional modification of feature)</p> <p>D (editorial modification)</p> <p>Detailed explanations of the above categories can be found in 3GPP TR 21.900.</p>
		<p>Use <u>one</u> of the following releases:</p> <p>2 (GSM Phase 2)</p> <p>R96 (Release 1996)</p> <p>R97 (Release 1997)</p> <p>R98 (Release 1998)</p> <p>R99 (Release 1999)</p> <p>Rel-4 (Release 4)</p> <p>Rel-5 (Release 5)</p> <p>Rel-6 (Release 6)</p>

Reason for change:	⌘ The stage 2 for “early UE handling” is being specified in 23.195 and it is not planned to duplicate requirements in 23.060. However, review of 23.060 shows that some changes are beneficial.
Summary of change:	⌘ In section 13.2, storage of the SVN is added as part of the MM context for the SGSN: this means that text in many other sections of 23.060 automatically applies to it. Because 23.195 indicates that the IMEISV is transferred between SGSNs at ‘all’ GTPv1 inter-SGSN RA updates then the SVN is added for both Iu and A/Gb modes. In section 13.7, storage of UESBI is added for the RNC.
Consequences if not approved:	⌘ The tables in section 13 may be viewed as inaccurate, and, 23.060 might be deemed to conflict with 23.195/29.060 with regard to IMEISV transfer.

Clauses affected:	⌘	2, 3.2, 13.2 and 13.7								
Other specs affected:	⌘	<table border="1"><tr><td>Y</td><td>N</td></tr><tr><td></td><td>N</td></tr><tr><td></td><td>N</td></tr></table>	Y	N		N		N	Other core specifications	⌘
		Y	N							
			N							
	N									
	Test specifications									
	O&M Specifications									
Other comments:	⌘									

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Comprehensive information and tips about how to create CRs can be found at <http://www.3gpp.org/specs/CR.htm>. Below is a brief summary:

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

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS ciphering algorithm requirements".
- [3] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".
- [4] 3GPP TS 23.003: "Numbering, addressing and identification".
- [5] 3GPP TS 23.007: "Restoration procedures".
- [5b] 3GPP TS 23.016: "Subscriber data management; Stage 2".
- [6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".
- [7] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [7b] 3GPP TS 23.122: "Non-Access Stratum functions related to Mobile Station (MS) in idle mode".
- [8] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".
- [8b] 3GPP TS 23.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 - Stage 2".
- [9] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications", (Release 4).
- [10] Void.
- [11] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".
- [12] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".
- [13] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".
- [13b] 3GPP TS 24.011: "Point to Point (PP) Short Message Service (SMS) support on mobile radio interface".
- [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 (SNDCCP)".
- [16b] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".
- [17] 3GPP TS 27.060: "Packet Domain; Mobile Station (MS) supporting Packet Switched services".
- [18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile-services Switching Centre - Base Station System (MSC-BSS) interface; Layer 3 specification".
- [19] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".
- [20] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".
- [21] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".
- [22] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); In-band control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".
- [23] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".
- [24] 3GPP TS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".
- [25] 3GPP TS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".
- [26] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".
- [27] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting Packet Based services and Packet Data Networks (PDN)".
- [27b] 3GPP TS 29.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3; CAMEL Application Part (CAP) Specification".
- [28] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface".
- [29] ITU-T Recommendations I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".
- [30] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".
- [31] ITU-T Recommendation Q.65: "The unified functional methodology for the characterization of services and network capabilities".
- [32] ITU-T Recommendation V.42bis: "Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".
- [33] ITU-T Recommendation X.3: "Packet assembly/disassembly facility (PAD) in a public data network".
- [34] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [39] RFC 768 (1980): "User Datagram Protocol" (STD 6).
- [40] RFC 791 (1981): "Internet Protocol" (STD 5).

- [41] RFC 792 (1981): "Internet Control Message Protocol" (STD 5).
- [42] RFC 793 (1981): "Transmission Control Protocol" (STD 7).
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- [44] RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).
- [45] RFC 1542 (1993): "Clarifications and Extensions for the Bootstrap Protocol".
- [46] RFC 2002 (1996): "IP Mobility Support".
- [47] RFC 2131 (1997): "Dynamic Host Configuration Protocol".
- [48] RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification".
- [49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.
- [50] 3GPP TS 25.301: "Radio Interface Protocol Architecture".
- [51] 3GPP TS 25.303: "Interlayer procedures in Connected Mode".
- [51b] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Call Reselection in Connected Mode".
- [52] 3GPP TS 25.331: "RRC Protocol Specification".
- [53] 3GPP TS 25.401: "UTRAN Overall Description".
- [54] 3GPP TS 23.121: "Architectural Requirements for Release 1999".
- [55] 3GPP TS 25.322: "RLC protocol specification".
- [56] 3GPP TS 25.412: "UTRAN Iu Interface Signalling Transport".
- [56b] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".
- [57] 3GPP TS 25.323: "Packet Data Convergence Protocol (PDCP) specification".
- [58] 3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".
- [59] ITU-T Recommendation I.361: "B-ISDN ATM layer specification".
- [60] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification".
- [61] 3GPP TS 33.102: "3G Security; Security architecture".
- [62] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".
- [63] 3GPP TS 25.411: "UTRAN Iu interface Layer 1".
- [64] 3GPP TS 25.414: "UTRAN Iu interface data transport & transport signalling".
- [65] 3GPP TS 23.271: "Functional stage 2 description of LCS".
- [66] 3GPP TS 23.015: "Technical realization of Operator Determined Barring (ODB)".
- [67] ITU-T Recommendation I.363.5: "B-ISDN ATM Adaptation Layer (AAL) specification: Type 5 AAL".
- [68] RFC 2373 (1998): "IP Version 6 Addressing Architecture".
- [69] RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".
- [70] 3GPP TS 32.215: "3G Telecom Management; Charging management; Charging data description for the Packet Switched (PS) domain".

- [71] RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)".
- [72] 3GPP TS 29.202: "Signalling System No. 7 (SS7) signalling transport in core network; Stage 3".
- [73] 3GPP TS 23.236: "Intra Domain Connection of RAN Nodes to Multiple CN Nodes".
- [74] 3GPP TS 43.051: "Radio Access Network; Overall description – Stage 2".
- [75] 3GPP TS 24.229: IP Multimedia Call Control Protocol based on SIP and SDP.
- [76] [3GPP TS 23.195: "Provision of UE Specific Behaviour Information to Network Entities"](#).

3 Definitions, abbreviations and symbols

3.1 Definitions

Definitions can be found in 3GPP TS 22.060 [3] and 3GPP TS 25.401 [53]. For the purposes of the present document, the following terms and definitions apply:

GPRS: packet bearer service of the packet domain

A/Gb mode: indicates that this (sub)clause or paragraph applies only to a system or sub-system which operate in A/Gb mode of operation, i.e. with a functional division that is in accordance with the use of an A or a Gb interface between the radio access network and the core network. This definition is consistent with the A/Gb mode definition for the RAN in 3G 43.051 [74]. Note that A/Gb mode is independent of the support of both interfaces, e.g. an SGSN in A/Gb mode uses only the Gb interface.

Iu mode: indicates that this clause or paragraph applies only to a system or a sub-system which operates in Iu mode of operation, i.e. with a functional division that is in accordance with the use of an Iu-CS or Iu-PS interface between the radio access network and the core network. This definition is consistent with the Iu mode definition for the RAN in 3G 43.051 [74]. Note that Iu mode is independent of the support of both parts of the Iu interface, e.g. an SGSN in Iu mode uses only the Iu-PS interface.

Inter-system change: change of an MS from A/Gb mode to Iu mode of operation and vice versa.

MS: this specification makes no distinction between MS and UE

2G- / 3G-: prefixes 2G- and 3G- refer to systems or sub-systems, that support A/Gb mode or Iu mode, respectively, e.g. 2G-SGSN refers to all functionality of an SGSN which serves an MS in A/Gb mode.

NOTE: When the prefix is omitted, reference is made independently from the A/Gb mode or Iu mode functionality.

Pool area: refers to a grouping of one or more RA(s) that, from a RAN perspective, are served by a certain group of CN nodes, as defined for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes.

3.2 Abbreviations

Applicable abbreviations can be found in GSM 01.04 [1] and 3GPP 21.905 [9]. For the purposes of the present document the following abbreviations apply:

AAL5	ATM Adaptation Layer type 5
APN	Access Point Name
ATM	Asynchronous Transfer Mode
AUTN	Authentication Token
BG	Border Gateway
BSSAP+	Base Station System Application Part +
BSSGP	Base Station System GPRS Protocol
BVCI	BSSGP Virtual Connection Identifier
CCU	Channel Codec Unit
CDR	Call Detail Record
CGF	Charging Gateway Functionality

CGI	Cell Global Identification
CK	Cipher Key
CMM	Circuit Mobility Management
CS	Circuit Switched
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DTM	Discontinuous Transfer Mode
EGPRS	Enhanced GPRSESP Encapsulating Security Payload
GEA	GPRS Encryption Algorithm
GERAN	GSM EDGE Radio Access Network
GGSN	Gateway GPRS Support Node
GMM/SM	GPRS Mobility Management and Session Management
GPRS-SSF	GPRS Service Switching Function
GPRS-CSI	GPRS CAMEL Subscription Information
GRA	GERAN Registration Area
GSM-SCF	GSM Service Control Function
GSIM	GSM Service Identity Module
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
GTP-C	GTP Control Plane
GTP-U	GTP User Plane
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IK	Integrity Key
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IPX	Internet Packet eXchange
ISP	Internet Service Provider
KSI	Key Set Identifier
L2TP	Layer-2 Tunnelling Protocol
LL-PDU	LLC PDU
LLC	Logical Link Control
MAC	Medium Access Control
MIP	Mobile IP
MNRF	Mobile station Not Reachable Flag
MNRG	Mobile station Not Reachable for GPRS flag
MNRR	Mobile station Not Reachable Reason
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NACC	Network Assisted Cell Change
NGAF	Non-GPRS Alert Flag
N-PDU	Network Protocol Data Unit
NS	Network Service
NSAPI	Network layer Service Access Point Identifier
NSS	Network SubSystem
ODB	Operator Determined Barring
P-TMSI	Packet TMSI
PCU	Packet Control Unit
PDCH	Packet Data CHannel
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g. IP
PDU	Protocol Data Unit
PMM	Packet Mobility Management
PPF	Paging Proceed Flag
PPP	Point-to-Point Protocol
PTP	Point To Point
PVC	Permanent Virtual Circuit
RA	Routeing Area
RAB	Radio Access Bearer
RAC	Routeing Area Code
RAI	Routeing Area Identity
RANAP	Radio Access Network Application Protocol

RAU	Routeing Area Update
RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SBSC	Serving Base Station Controller
SBSS	Serving BSS
SGSN	Serving GPRS Support Node
SM	Short Message
SM-SC	Short Message service Service Centre
SMS-GMSC	Short Message Service Gateway MSC
SMS-IWMSC	Short Message Service Interworking MSC
SN-PDU	SNDCP PDU
SNDC	SubNetwork Dependent Convergence
SNDCP	SubNetwork Dependent Convergence Protocol
SPI	Security Parameter Index
SRNC	Serving RNC
SRNS	Serving RNS
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TFT	Traffic Flow Template
TEID	Tunnel Endpoint IDentifier
TLLI	Temporary Logical Link Identity
TOM	Tunnelling Of Messages
TOS	Type of Service
TRAU	Transcoder and Rate Adaptor Unit
UDP	User Datagram Protocol
UEA	UMTS Encryption Algorithm
UESBI-Iu	UE Specific Behaviour Information - Iu
UESBI-Uu	UE Specific Behaviour Information - Uu
UIA	UMTS Integrity Algorithm
URA	UTRAN Registration Area
USIM	User Service Identity Module
UTRAN	UMTS Terrestrial Radio Access Network

3.3 Symbols

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA does not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

Table 6: SGSN MM and PDP Contexts

Field	Description	A/Gb mode	Iu mode
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
SVN	Software Version Number (stored by SGSNs supporting the "Provision of UE Specific Behaviour Information to Network Entities" feature as defined in 3GPP TS 23.195 [76].)	3)	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
Authentication Vectors	Authentication and ciphering parameters (authentication triplets or quintets)..	X	X
Kc	Currently used A/Gb mode ciphering key.	X	2)
CKSN	Ciphering key sequence number of Kc.	X	2)
Ciphering algorithm	Selected ciphering algorithm.	X	X
CK	Currently used Iu mode ciphering key.	1)	X
IK	Currently used Iu mode integrity key.	1)	X
KSI	Key Set Identifier.	1)	X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	X
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g. normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g. operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3GPP TS 23.016	X	X
MG-CSI	Optional Mobility Management for GPRS CAMEL subscription information, see 3GPP TS 23.016.	X	X
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g. PPP or IP.	X	X
PDP Address	PDP address, e.g. an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used. This APN shall be composed of the APN Network Identifier and the APN Operator Identifier.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain	X	X

Field	Description	A/Gb mode	Iu mode
	of the HPLMN only, or additionally the APN in the domain of the VPLMN.		
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC/BSC currently used.		X

The information marked with a "1)" in table 6 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 6 may be maintained if authentication is performed by the GSM authentication procedure.

The information marked with a "3)" in table 6 is optional. It can be sent to a new SGSN at RA update.

13.7 RNC/BSC for Iu mode

RNC/BSC maintains RNC/BSC Context for CN-related information in PMM-CONNECTED state. RNC/BSC also contains RAB contexts for activated RABs. Table 11 shows the context fields for one MS.

Table 11: RNC/BSC Context

Field	Description
IMSI	IMSI is the main reference key.
UE Capability	UE radio capabilities.
UESBI-Iu	Stored by an RNC which supports the “Provision of UE Specific Behaviour Information to Network Entities” feature defined in 3GPP TS 23.195 [76].
UESBI-Uu	Stored by an RNC which supports the “Provision of UE Specific Behaviour Information to Network Entities” feature defined in 3GPP TS 23.195 [76].
SAI	Current or last known SAI
SAI age	Time elapsed since the RNC last established the UE's last known SAI
Trace Reference	Identifies a record or a collection of records for a particular trace.
Trace Type	Indicates the type of trace.
Trigger Id	Identifies the entity that initiated the trace.
OMC Identity	Identifies the OMC that shall receive the trace record(s).
Each RNC context contains zero or more RNC RAB contexts:	
RAB ID	Radio Access Bearer Identifier.
PDP Type	PDP type, e.g. PPP or IP.
TEID	Tunnel Endpoint Identifier.
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
GTP-SND	GTP-U sequence number of the next downlink in-sequence N-PDU to be sent to the MS.
GTP-SNU	GTP-U sequence number of the next uplink in-sequence N-PDU to be sent to the GGSN.
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.
PDCP-SNU	Sequence Number of the next uplink in-sequence PDCP-PDU expected from the MS.