Source: TSG SA WG2
Title: CRs on 23.060 v.3.3.1
Agenda Item: 6.2.3

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #8.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

CRs on 03.60

No CR on 03.60 has been presented since SA plenary #7.

CRs on 23.060 v.3.3.1

spec	release	CR #	cat	Title	S2 TDoc #
23.060	R99	147r3	F	Change of GMM ready timer behaviour	S2-001206
23.060	R99	149	F	Paging is initiated even at reception of a PDP PDU	S2-000821
23.060	R99	150	F	Suspend at UMTS to GSM handover during CS call	S2-000822
23.060	R99	151	F	RABs failed information is missing in Forward Relocation Response	S2-000823
23.060	R99	152	F	Reliable transfer of GTP message "Forward SRNS Context" and "Forward Relocation Complete"	S2-000824
23.060	R99	153	D	SRNS Relocation Procedure, editorial corrections	S2-000825
23.060	R99	156	F	Conversion of QoS attributes to LLC attributes in the Aggregate BSS QoS Profile	S2-000887
23.060	R99	159	D	Clarification of radio bearer re-establishment	S2-000904
23.060	R99	161r2	F	SNRS Relocation and Inter System HO, when PDCP doesn't support lossless relocation	S2-001058
23.060	R99	162r1	F	Establishment of LLC link after inter-system HO	S2-000960
23.060	R99	163r1	F	Classmark handling	S2-000961
23.060	R99	164	F	Reset of RLC during SRNS relocation	S2-000923
23.060	R99	165r1	F	Move of Detection Point C2 for Inter SGSN Routeing Area Update	S2-000962
23.060	R99	166r1	B	Addition of charging characteristics per PDP context	S2-001050
23.060	R99	167r1	F	IPv6 stateless address autoconfiguration	S2-001015
23.060	R99	168	F	Addition of charging characteristics per PDP context	S2-001049

Source:	TSG CN1
To:	TSG SA2
Title:	LS to S2 on optimisation of Cell Update Procedure
Document for:	Approval

_____

The issue of staying of MM in state READY virtually forever is discussed in N1-000723 and a solution has been proposed which is backward compatible.

There are changes necessary in 24.007 (CR A014r2), 24.008 (CR 208r3), 04.64 (CR 142r2) R99.

This changes need to be regarded by 23.060 R99 to be valid. The proposed changes are attached as CRA147r3.

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060	**CR**	**A147r3**	Current Version:	**3.3.0**	

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

For submission to:	CN #8	for approval	**X**	Strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ]   ME [X]   UTRAN / Radio [ ]   Core Network [X]
(at least one should be marked with an X)

Source:	Ericsson/Siemens		**Date:**	2000-05-18

Subject:	Change of the Cell update procedure

Work item:	GPRS

Category: F Correction [X]   **Release:** Phase 2 [ ]
                       A Corresponds to a correction in an earlier release [ ]   Release 96 [ ]
(only one category B Addition of feature [ ]   Release 97 [ ]
shall be marked   C Functional modification of feature [ ]   Release 98 [ ]
with an X)   D Editorial modification [ ]   Release 99 [X]
                                                                Release 00 [ ]

Reason for change:	The MS/SGSN shall restart the GMM READY timer at transmission/reception of any LLC frame, including an LLC frame without an information field transmitted in order to perform cell update.

If the user is travelling around in an urban area, where the cell size is small, the READY timer will be restarted, even if there is no active user-data transmission. Thus, the MS and SGSN will remain in GMM ready state for considerably longer than is necessary, and the MS will continue to perform cell updates.

Frequent cell updates will lead to:
- increase of network load;
- waste of radio resources;
- significant increase of MS battery consumption, due to increased signalling and time spent in non-DRX mode.

In order to overcome this problem, it is proposed to introduce an optional cell update procedure where the READY timer will not be started if the LLC frame transmitted (by the MS)/received (by the SGSN) contains a cell update.

This proposed change is optional for both the network and the MS. |

Clauses affected:	6.9.1.1, 8.4

Other specs affected:	Other 3G core specifications	[ ]	→ List of CRs:	
	Other GSM core specifications	[X]	→ List of CRs:	
	MS test specifications	[ ]	→ List of CRs:	
	BSS test specifications	[ ]	→ List of CRs:	
	O&M specifications	[ ]	→ List of CRs:	

Other   The proposed solution introduces a "Cell Notification" (which is in fact an optimised Cell

comments:	Update Procedure) into MS and SGSN. The possibility to use the Cell Notification will be indicated by the network and shall be used by the MS when the MS does support it. The update will be triggered by the LLC NULL frame (introduced in 04.64) which is only allowed to be send by the MS if the network indicates the Cell Notification.

The feature is mandatory for R99 but a R99 network must be able to handle pre R99 MS which do not support Cell Notification.

Indication of the Cell Notification

A new, optional information element (optional on syntax level but on semantic level mandatory for R99) is introduced into the ATTACH ACCEPT and ROUTING AREA UPDATE ACCEPT message to indicate the ability of the network to support the Cell Notification.

If both the MS and SGSN support the Cell Notification, and the ATTACH ACCEPT message or ROUTING AREA UPDATE ACCEPT message contains a new value of the READY timer, the MS shall send any LLC frame except the LLC NULL frame in order to start the READY timer (LLC NULL frame can not be sent because it does not trigger the start of the READY timer).

Behaviour at Cell Notification (new cell is entered)

A LLC NULL frame is introduced at the LLC layer. If both the MS and SGSN support the Cell Notification, an MS shall transmit the LLC NULL frame in order to indicate a cell change to the network. The MS shall not start the READY timer as a result of transmitting the LLC NULL frame. Similarly, the SGSN shall not start the READY timer as a result of receiving LLC NULL frame.

Further:

An MS shall not transmit LLC NULL frame as a response to paging for PS services. If the MS does not support the Cell Notification but the SGSN indicates the ability to support them then the behaviour at cell update remains as currently specified.

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<--------- double-click here for help and instructions on how to create a CR.

6.9.1.1　　Cell Update Procedure

A cell update takes place when the MS enters a new cell inside the current RA and the MS is in READY state. If the RA has changed, a routeing area update is executed instead of a cell update.

If the network does not support the Cell Notification (in fact an optimised Cell Update Procedure, see 24.008) Tthe MS performs the cell update procedure by sending an uplink LLC frame of any type except the LLC NULL frame (see 04.64), containing the MS's identity, to the SGSN. If the network and the MS support the Cell Notification then the MS shall use the LLC NULL frame, containing the MS's identity, in order to perform a cell update. The support of Cell Notification is mandatory for MS and network but the network as well as the MS has to support the Cell Update Procedure, not using the LLC NULL frame, for backward compatibility reasons.

In the direction towards the SGSN, the BSS shall add the Cell Global Identity including RAC and LAC to all BSSGP frames, see GSM 08.18. A cell update is any correctly received and valid LLC PDU carried inside a BSSGP PDU containing a new identifier of the cell.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the new cell.


Next Section to Modify

8.4　　Paging for GPRS Downlink Transfer

An MS in STANDBY state is paged by the SGSN before a downlink transfer to that MS. The paging procedure shall move the MM state to READY to allow the SGSN to forward downlink data to the radio resource. Therefore, any uplink data from the MS that moves the MM context at the SGSN to READY state is a valid response to paging.

The SGSN supervises the paging procedure with a timer. If the SGSN receives no response from the MS to the Paging Request message, it shall repeat the paging. The repetition strategy is implementation dependent.

The MS shall accept pages also in READY state if no radio resource is assigned. This supports recovery from inconsistent MM states in MS and SGSN.

The GPRS Paging procedure is illustrated in **Error! Reference source not found.**. Each step is explained in the following list.
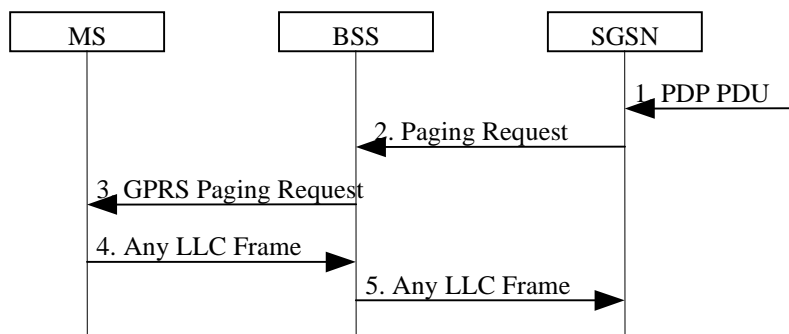
Figure 1: GPRS Paging Procedure

1) The SGSN receives a downlink PDP PDU for an MS in STANDBY state. Downlink signalling to a STANDBY state MS initiates paging as well.

2) The SGSN sends a BSSGP Paging Request (IMSI, P-TMSI, Area, Channel Needed, QoS, DRX Parameters) message to the BSS serving the MS. IMSI is needed by the BSS in order to calculate the MS paging group. P-TMSI is the identifier by which the MS is paged. Area indicates the routeing area in which the MS is paged. Channel Needed indicates GPRS paging. QoS is the negotiated QoS for the PDP context that initiates the paging procedure, and indicates the priority of this Paging Request relative to other Paging Request messages buffered in the BSS. DRX Parameters indicates whether the MS uses discontinuous reception or not. If the MS uses discontinuous reception, then DRX Parameters also indicate when the MS is in a non-sleep mode able to receive paging requests.

3) The BSS pages the MS with one Paging Request (P-TMSI, Channel Needed) message in each cell belonging to the addressed routeing area. This is described in GSM 03.64.

4) Upon receipt of a GPRS Paging Request message, the MS shall respond with either any single valid LLC frame (e.g., a Receive Ready or Information frame) that implicitly is interpreted as a page response message by the SGSN. The MS shall not use the LLC NULL frame as a page response. When responding, the MS changes MM state to READY. The response is preceded by the Packet Channel Request and Packet Immediate Assignment procedures as described in GSM 03.64.

5) Upon reception of the LLC frame, the BSS adds the Cell Global Identity including the RAC and LAC of the cell and sends the LLC frame to the SGSN. The SGSN shall then consider the LLC frame to be an implicit paging response message and stop the paging response timer.

No further changes.

CHANGE REQUEST

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23.060 CR **149**   Current Version: **3.3.0**

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

For submission to: **SA #8**   for approval **X**   strategic ☐   *(for SMG*
list expected approval meeting # here ↑   for information ☐   non-strategic ☐   *use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

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

Source: Ericsson   **Date:** 2000-05-18

Subject: Paging is initiated even at reception of a PDP PDU

Work item: Release 99

Category:	F	Correction	**X**	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	**X**
					Release 00	

Reason for change: In the " PS Paging Initiated by 3G-SGSN <u>With</u> RRC Connection for CS" procedure also reception of downlink PDP PDU in 3G-SGSN will trigger paging, in the same way as in the "… <u>without</u> RRC Connection for CS" procedure.
This is missing in chapter 8.2.3.2 Figure 55 bullet 1.

Clauses affected: 8.2.3.2

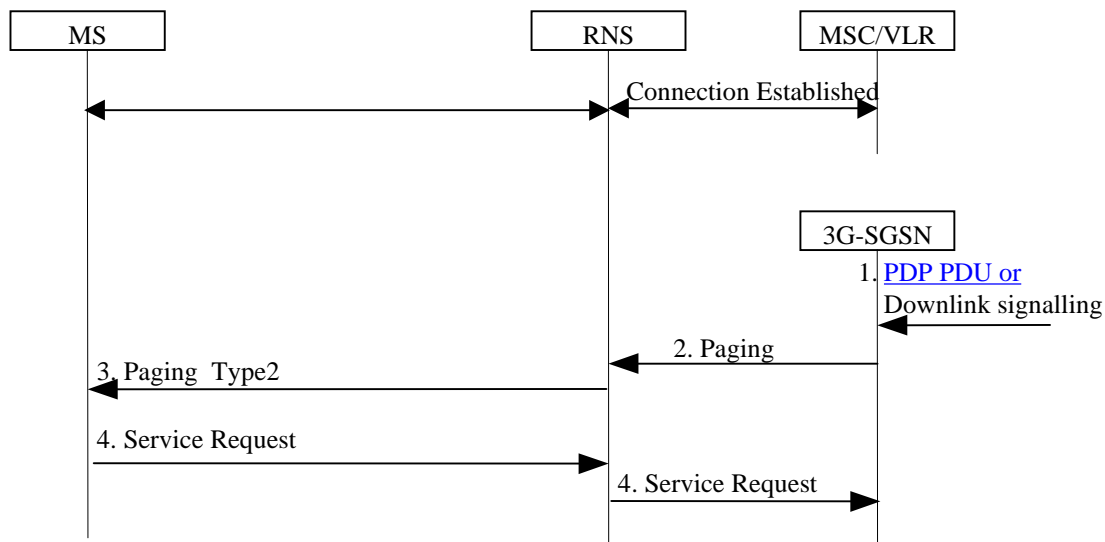| **Other specs affected:**	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:

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8.2.3.2   PS Paging Initiated by 3G-SGSN With RRC Connection for CS

Figure 1: PS Paging With RRC Connection for CS

1) The 3G-SGSN receives a PDP PDU or downlink signalling for an MS in PMM Idle state.

2) The 3G-SGSN sends a RANAP Paging (IMSI, P-TMSI, Area, CN Domain Indicator) message to each RNS belonging to the routeing area in which the MS is located. IMSI is needed by the RNS in order to calculate the MS paging group. If 3G-SGSN assigned the P-TMSI to the MS, P-TMSI is included, and it identifies the MS is paged. Area indicates the routeing area in which the MS is paged. CN Domain Indicator indicates to which domain (MSC or 3G-SGSN) the paging was initiated, and it represents "3G-SGSN" in this case.

3) The RNS controls whether the MS has an established RRC connection or not. In this case, MS has an established RRC connection for CS service, so RNS sends a RRC Paging Type 2(CN domain ID) message to the MS on established RRC connection. CN Domain ID indicates to which domain (CS or PS) the paging shall be directed, so it represents "PS" in this case.

4) The paging request triggers the Service Request procedures in the MS. The service request procedures are described in subclause "Service Request Procedure (UMTS Only)".

CHANGE REQUEST

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23.060	**CR**	**150**		Current Version:	3.3.0

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

For submission to:	SA #8	for approval	X		strategic		*(for SMG*
list expected approval meeting # here ↑		for information			non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM		ME	X	UTRAN / Radio		Core Network	X

Source:	Ericsson		**Date:**	2000-05-18

Subject:	Suspend at UMTS to GSM handover during CS call

Work item:	Release 99

Category:

(only one category shall be marked with an X)

				Release:		
F	Correction		X		Phase 2	
A	Corresponds to a correction in an earlier release				Release 96	
B	Addition of feature				Release 97	
C	Functional modification of feature				Release 98	
D	Editorial modification				Release 99	X
					Release 00	

Reason for change:	In 23.060 it is not described that in an intersystem change from UMTS in CS/PS mode of operation to GSM in class-B mode of operation during CS connection the MS must initiate suspend of packet services.

Clauses affected:	16.2.1

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	GSM TS 04.18 CR A112
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

| **Other comments:**	A related CR will be introduced in SMG2 on ETSI specification 04.18. (see CR A112)

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16.2   Circuit-switched Services (GSM Only)

The ability for a GPRS user to access circuit-switched services depends on the subscription held, the network capabilities, and the MS capabilities. Interaction between GPRS and circuit-switched services is described in subclause "Interactions Between SGSN and MSC/VLR".

16.2.1   Suspension of GPRS Services

When a GPRS-attached MS enters dedicated mode or when an MS in CS/PS mode of operation in UMTS during a CS connection reverts to class-B mode of operation in GSM, and when the MS limitations make it unable to communicate on GPRS channels, the MS shall request the network for suspension of GPRS services. The Suspend and Resume procedure is illustrated in Figure 1.
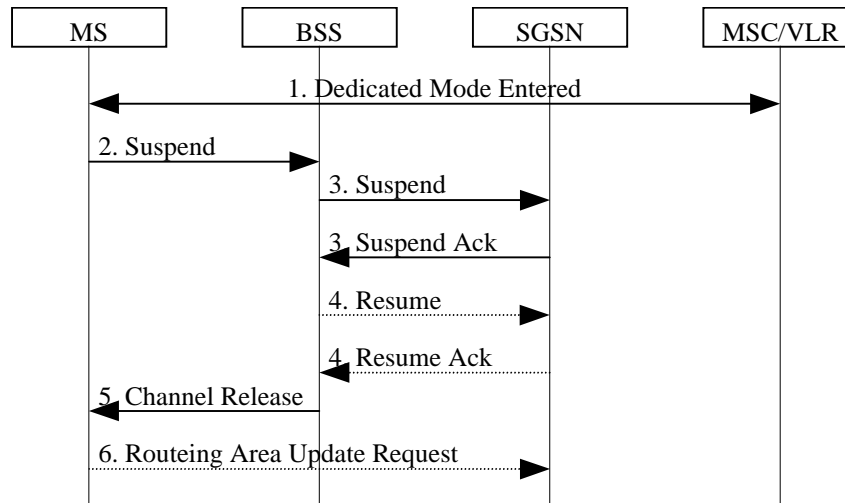
Figure 1: Suspend and Resume Procedure

1) The MS enters dedicated mode, or perform handover from UMTS to GSM (where the MS reverts to GSM class-B mode of operation) during CS connection.

2) The MS sends an RR Suspend (TLLI, RAI) message to the BSS. The BSS may terminate any ongoing GPRS traffic for this TLLI.

3) The BSS sends a Suspend (TLLI, RAI) message to the SGSN, and the SGSN acknowledges by returning Suspend Ack. The BSS shall store TLLI and RAI in order to be able to request the SGSN to resume GPRS services when the MS leaves dedicated mode.

4) Eventually, the BSS determines that the circuit-switched radio channel shall be released. If the BSS is able to request the SGSN to resume GPRS services, the BSS shall send a Resume (TLLI, RAI) message to the SGSN. The SGSN acknowledges the successful outcome of the resume by returning Resume Ack.

5) The BSS sends an RR Channel Release (Resume) message to the MS. Resume indicates whether the BSS has successfully requested the SGSN to resume GPRS services for the MS, i.e., whether Resume Ack was received in the BSS before the RR Channel Release message was transmitted. The MS leaves dedicated mode.

6) If the BSS did not successfully request the SGSN to resume GPRS services, or if the RR Channel Release message was not received before the MS left dedicated mode, or an MS in GSM class-B mode of operation during CS connection performs handover to CS/PS mode of operation in UMTS , then the MS shall resume GPRS services by sending a Routeing Area Update Request message to the SGSN, as described in subclause "Routeing Area Update Procedure".

The full handling of suspended MSs in the BSS and the SGSN is implementation dependent. Typically, the SGSN should not page suspended MSs.

If the MS performs an inter-BSC handover while suspended, then TLLI and RAI should be transferred as BSC-to-BSC information in the Handover Required and Handover Request messages, see GSM 08.08. This allows the new BSC to initiate the Resume request procedure to the SGSN. In the case where the BSC-to-BSC information was not transferred

or not understood, then the MS doesn't receive an indication that resumption has been successful, and the MS shall resume GPRS services by initiating a Routeing Area Update Request procedure as described in step 6.

CHANGE REQUEST

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23.060	**CR**	**151**		Current Version:	3.3.0

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

For submission to:	SA #8	for approval	**X**	strategic	☐	*(for SMG*
list expected approval meeting # here ↑		for information	☐	non-strategic	☐	*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

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

Source:	Ericsson		**Date:**	2000-05-18

Subject:	RABs failed information missing in Forward Relocation Response

Work item:	Release 99

Category:	F	Correction		**X**	**Release:**	Phase 2	☐
	A	Corresponds to a correction in an earlier release		☐		Release 96	☐
(only one category	B	Addition of feature		☐		Release 97	☐
shall be marked	C	Functional modification of feature		☐		Release 98	☐
with an X)	D	Editorial modification		☐		Release 99	**X**
						Release 00	☐

Reason for change:	During relocation the target RNC informs the new SGSN of the RABs setup but also the RABs that failed to setup. Currently the information about which RABs that failed to setup is not transferred in the Forward Relocation Response message. Furthermore, the new SGSN may decide that some of the RABs shall not be relocated and this should be communicated to the source RNC. The proposed changes are to include information about which RABs that shall be released and to rename the Target Information element to 'RAB Setup Information'.

Clauses affected:	6.9.2.2

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other GSM core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments:	See approved CR 090r1, N4-000075

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6.9.2.2   Serving RNS Relocation Procedures

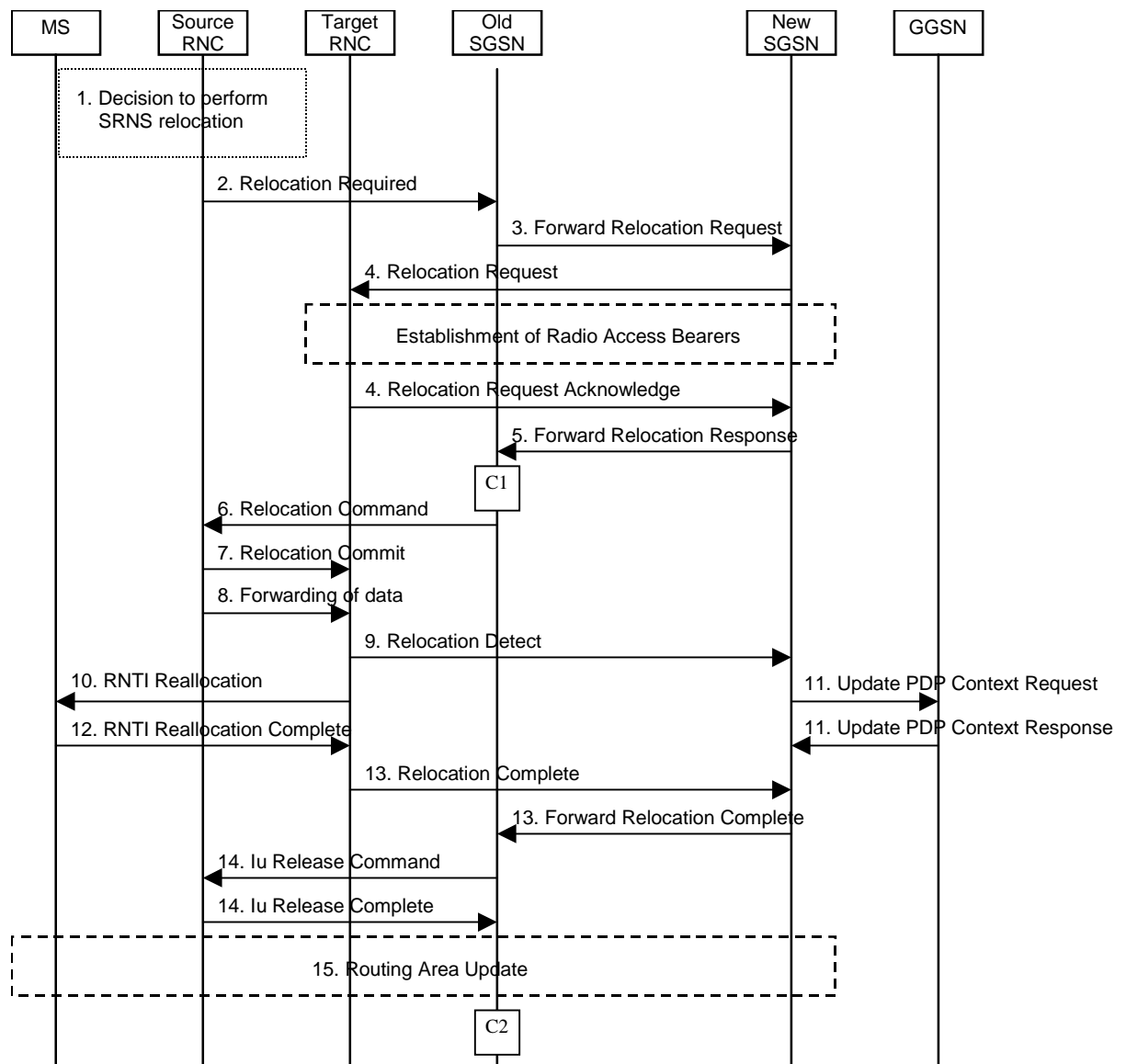### 6.9.2.2.1   Serving SRNS Relocation Procedure

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

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

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

After the Serving SRNS Relocation procedure and RA 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 Serving SRNS Relocation procedure is illustrated in Figure 1. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 1: Serving SRNS Relocation Procedure

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

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

3)   The old SGSN determines from Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4)   The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5)   When resources for the transmission of user data between target RNC and new SGSN has been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup~~Target RNC~~ Information) is sent from new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The RAB Setup~~Target RNC~~ Information, one information element for each RAB ~~to be setup~~, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. <u>If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI.</u> 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. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7)   Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8)   After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

9)   The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the

Relocation Commit message from the Iur interface. When Relocation Detect message is sent, target RNC shall start SRNC operation.

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a RNTI Reallocation message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

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

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

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.
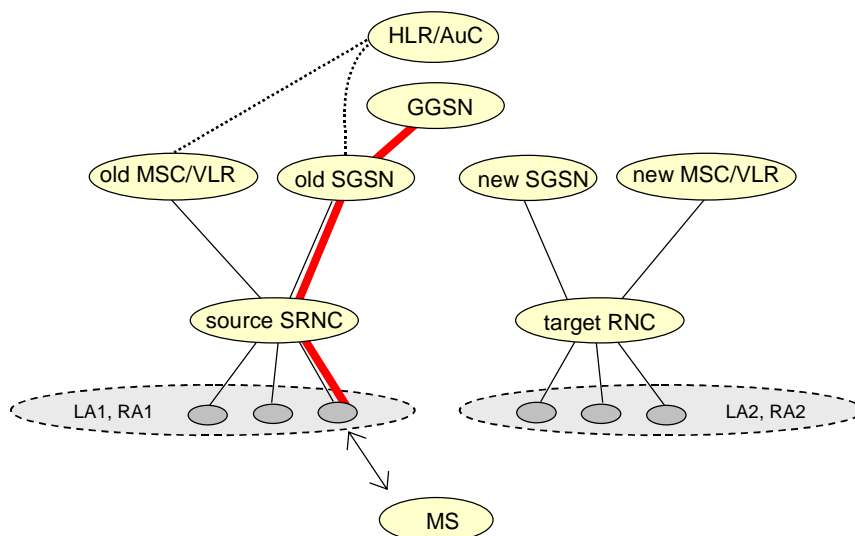
C2)   CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.2   Combined Hard Handover and SRNS Relocation Procedure

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

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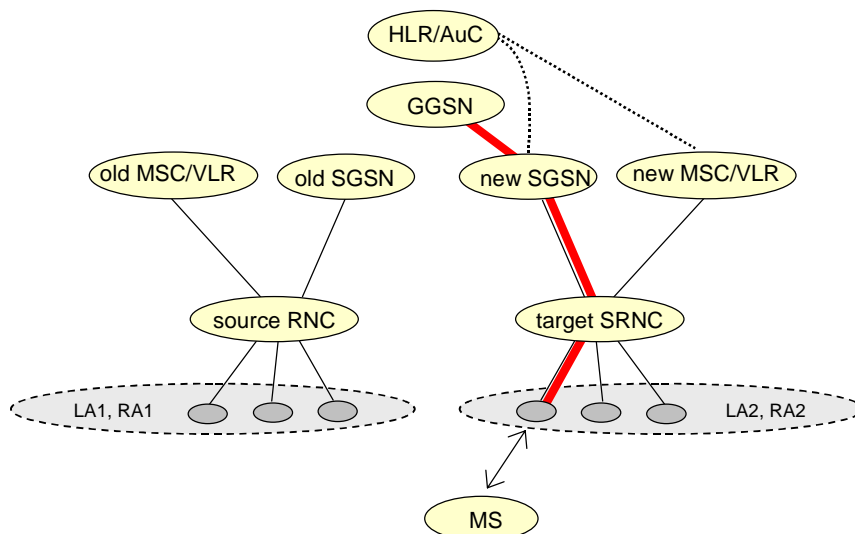
If the target RNC is connected to a different SGSN than the source SRNC, an Inter SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter SGSN Routeing Area Update procedure.

Figure 2 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 3 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 2 and Figure 3 the MS is in MM IDLE state.

Figure 2: 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.
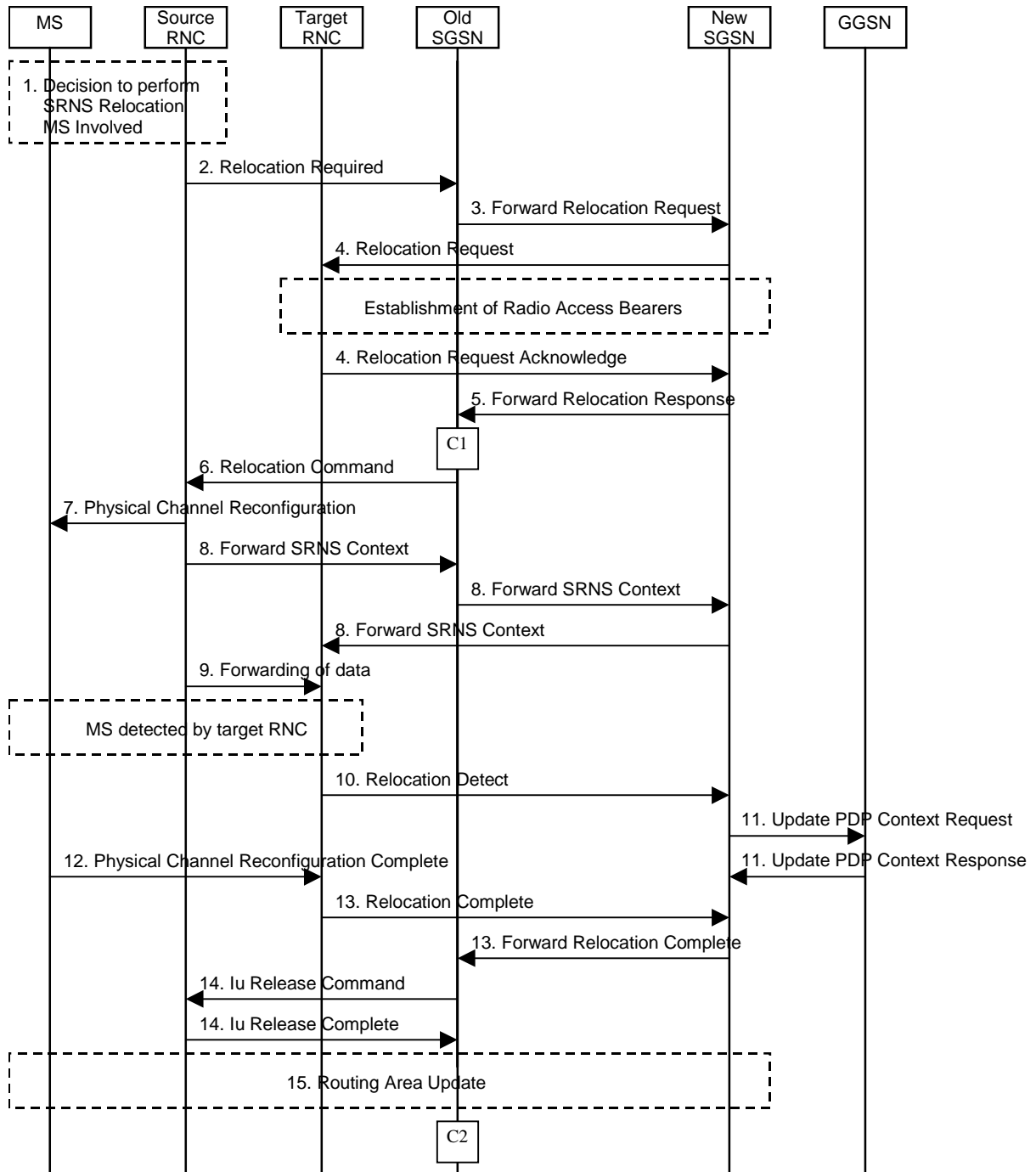
Figure 3: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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 4. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 4: Combined Hard Handover and SRNS Relocation Procedure

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

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

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

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

    After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, RAB Setup~~Target RNC~~ Information) message is sent from the new SGSN to the old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The RAB Setup~~Target RNC~~ Information, one information element for each RAB ~~to be setup~~, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. <u>If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI.</u> The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, then the source SRNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC when handover is made with switching in CN. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

9) After having sent the Forward SRNS Context message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

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

12) When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.3   Combined Cell / URA Update and SRNS Relocation Procedure
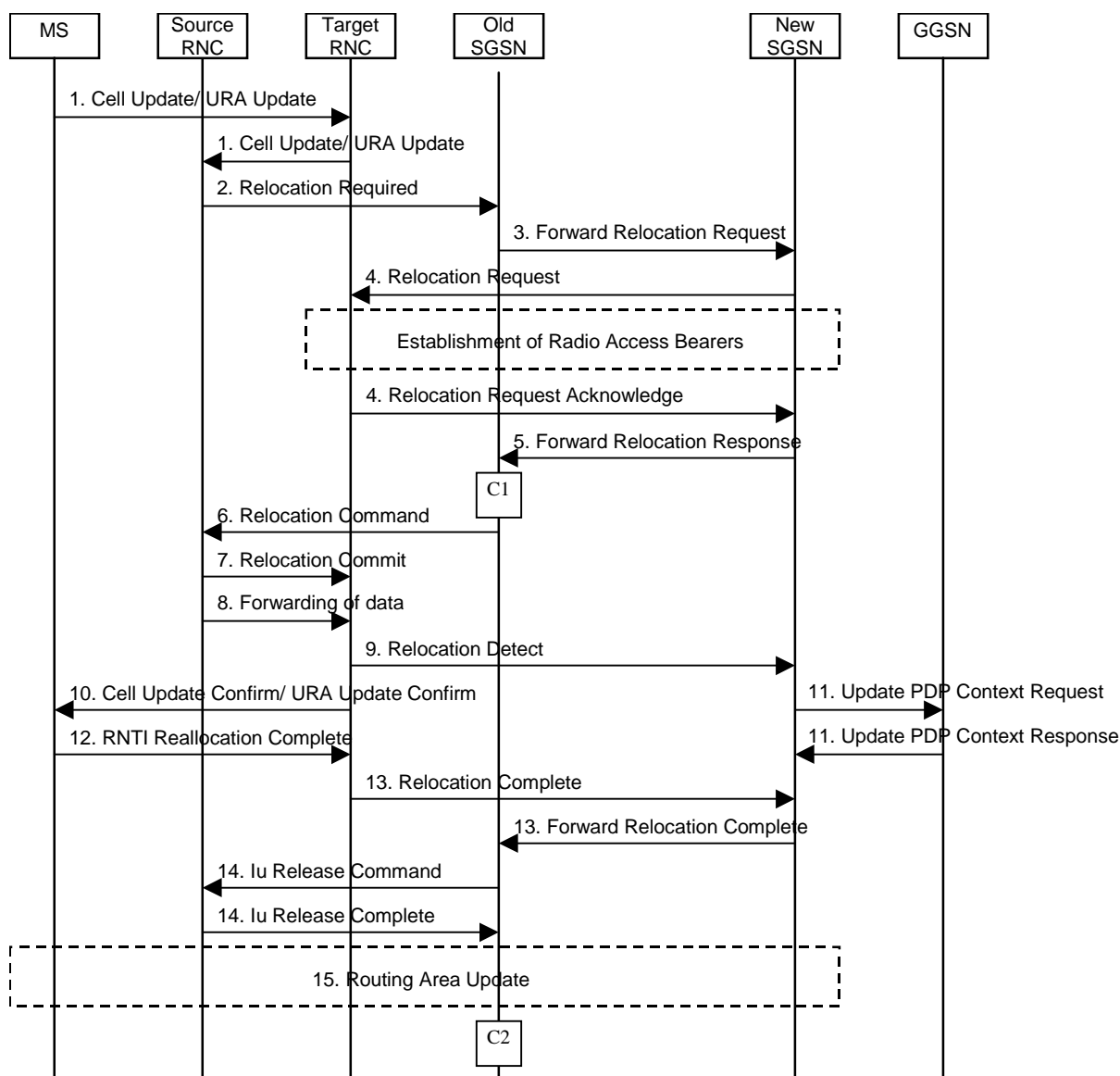
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur carries control signalling but no user data.

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

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

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

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in Figure 5. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

Figure 5: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the UTRAN, after having made cell re-selection. Upon reception of the message, the target RNC forwards the received message towards the source SRNC via Iur. Source SRNC decides to perform a combined cell / URA update and SRNS relocation towards the target RNC.

2) The source SRNC initiates the relocation preparation procedure by sending a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old

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

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

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

   After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (RABs setup, RABs failed to setup) message to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup~~Target RNC~~ Information) is sent from new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The RAB Setup~~Target RNC~~ Information, one information element for each RAB ~~to be setup~~, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. <u>If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI.</u> 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. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit (SRNS Contexts) message to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs subject to data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a Cell Update Confirm / URA Update Confirm message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

11) Upon reception of Relocation Detect message, 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) message.

12) When the MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060	**CR**	**152**	Current Version:	**3.3.0**

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

For submission to: **SA #8**   for approval   **X**   strategic   ☐   *(for SMG*
list expected approval meeting # here ↑   for information   ☐   non-strategic   ☐   *use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

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

Source:	Ericsson	**Date:**	2000-05-18

Subject:	Reliable transfer of GTP message "Forward SRNS Context" and "Forward Relocation Complete"

Work item:	Release 99

Category:	F	Correction	**X**	**Release:**	Phase 2	☐
	A	Corresponds to a correction in an earlier release	☐		Release 96	☐
(only one category	B	Addition of feature	☐		Release 97	☐
shall be marked	C	Functional modification of feature	☐		Release 98	☐
with an X)	D	Editorial modification	☐		Release 99	**X**
					Release 00	☐

Reason for change:	In order to use the general principles in GTP (TS 29.060) for reliable delivery of signalling messages for message "Forward SRNS Context" and "Forward Relocation Complete" two new messages has to be introduced, "Forward SRNS Context Acknowledge" and "Forward Relocation Complete Acknowledge".

Clauses affected:	6.9.2.2

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:
	Other GSM core specifications	☐	→ List of CRs:
	MS test specifications	☐	→ List of CRs:
	BSS test specifications	☐	→ List of CRs:
	O&M specifications	☐	→ List of CRs:

Other comments:	See corresponding CR 087 (N4-000033) submitted to N4#1 (postponed)

help.doc

<--------- double-click here for help and instructions on how to create a CR.

6.9.2.2   Serving RNS Relocation Procedures

6.9.2.2.1   Serving SRNS Relocation Procedure

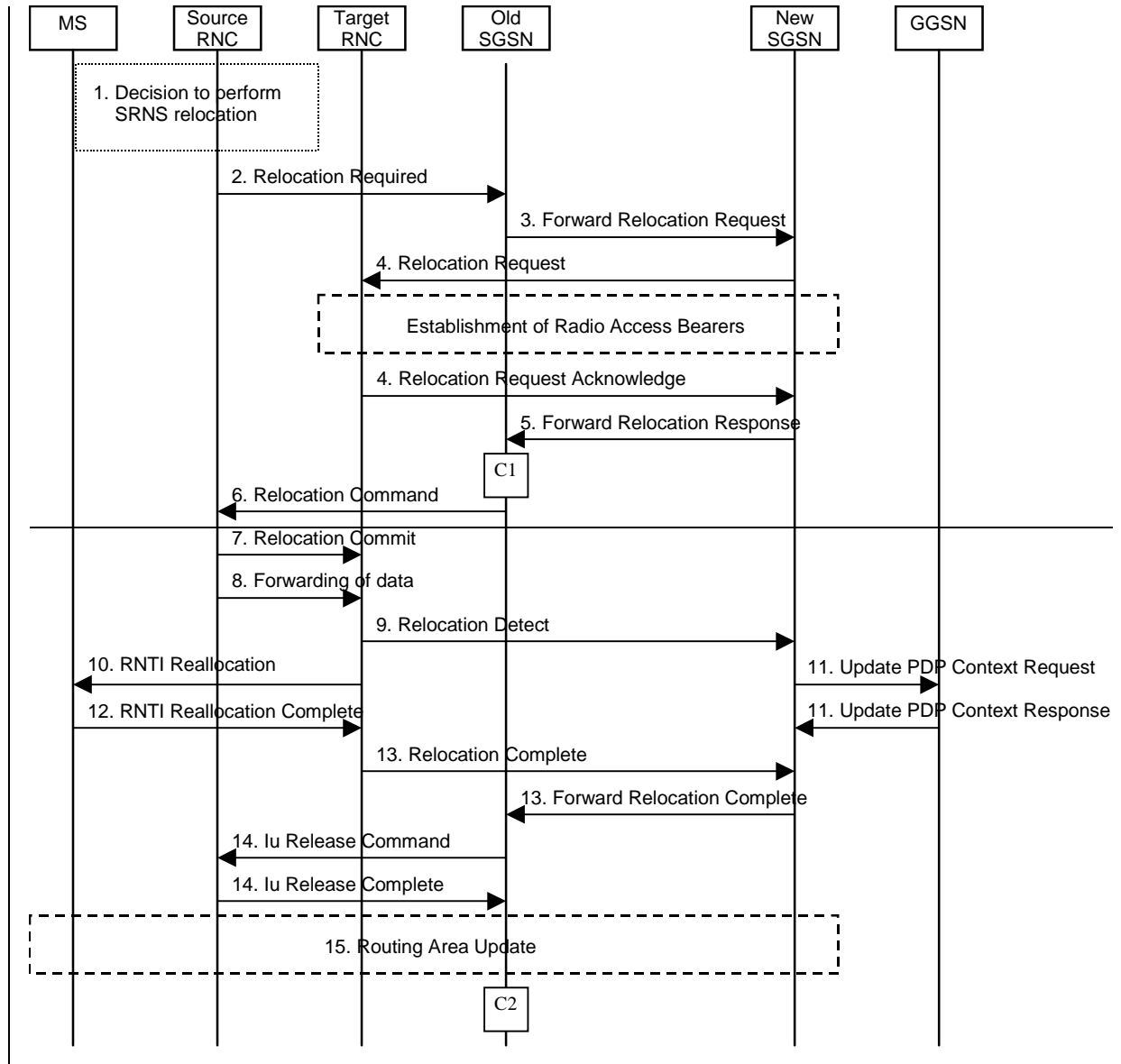This procedure is only performed for an MS in PMM-CONNECTED state.

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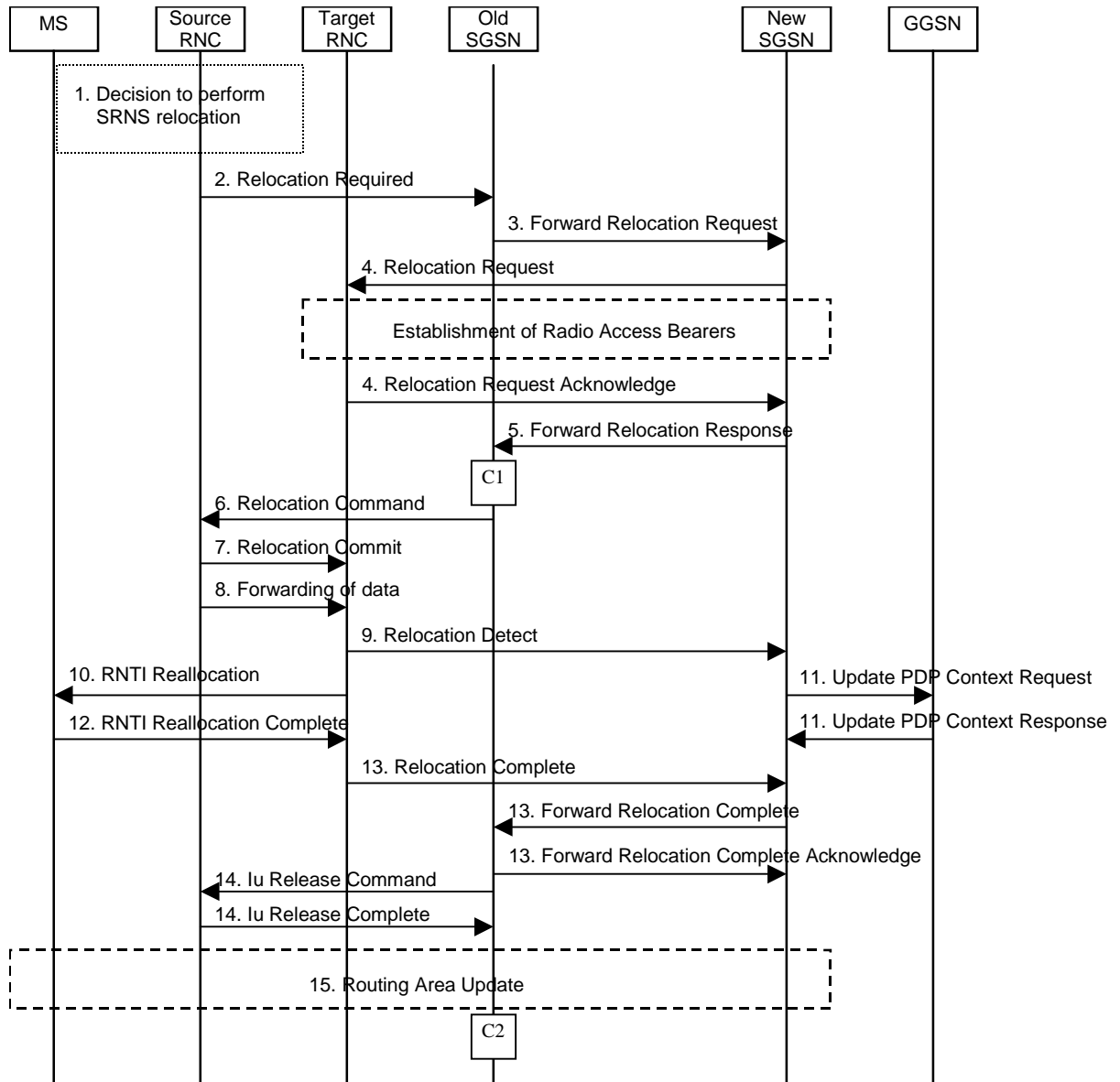
Before the Serving SRNS Relocation procedure and RA update, the MS is registered in the old SGSN. The source RNC is acting as serving RNC (SRNC).

After the Serving SRNS Relocation procedure and RA 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 Serving SRNS Relocation procedure is illustrated in Figure 1. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 1: Serving SRNS Relocation Procedure

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

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

3) The old SGSN determines from Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a RNTI Reallocation message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

    The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

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

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

13) When target SRNC receives the RNTI Reallocation Complete message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the UE by the radio protocols, target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to new SGSN. The purpose of Relocation Complete procedure is to indicate by the target SRNC the completion of relocation of 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 acknowledge by a Forward Relocation Complete Acknowledge message.

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.
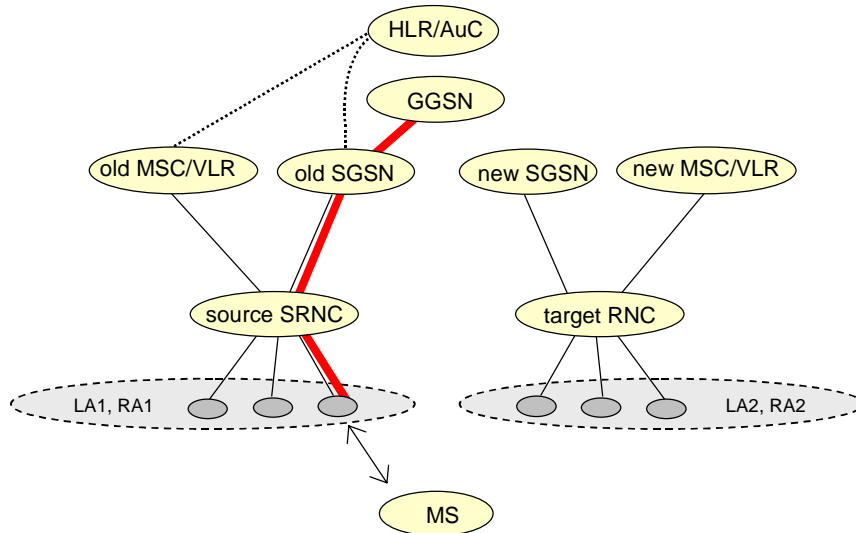
C2)   CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.2   Combined Hard Handover and SRNS Relocation Procedure

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

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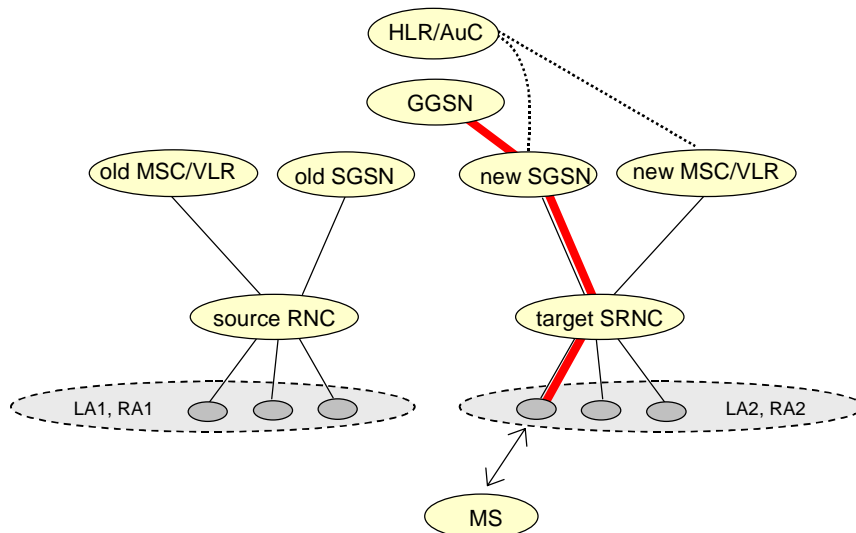
If the target RNC is connected to a different SGSN than the source SRNC, an Inter SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter SGSN Routeing Area Update procedure.

Figure 2 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 3 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 2 and Figure 3 the MS is in MM IDLE state.

Figure 2: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update
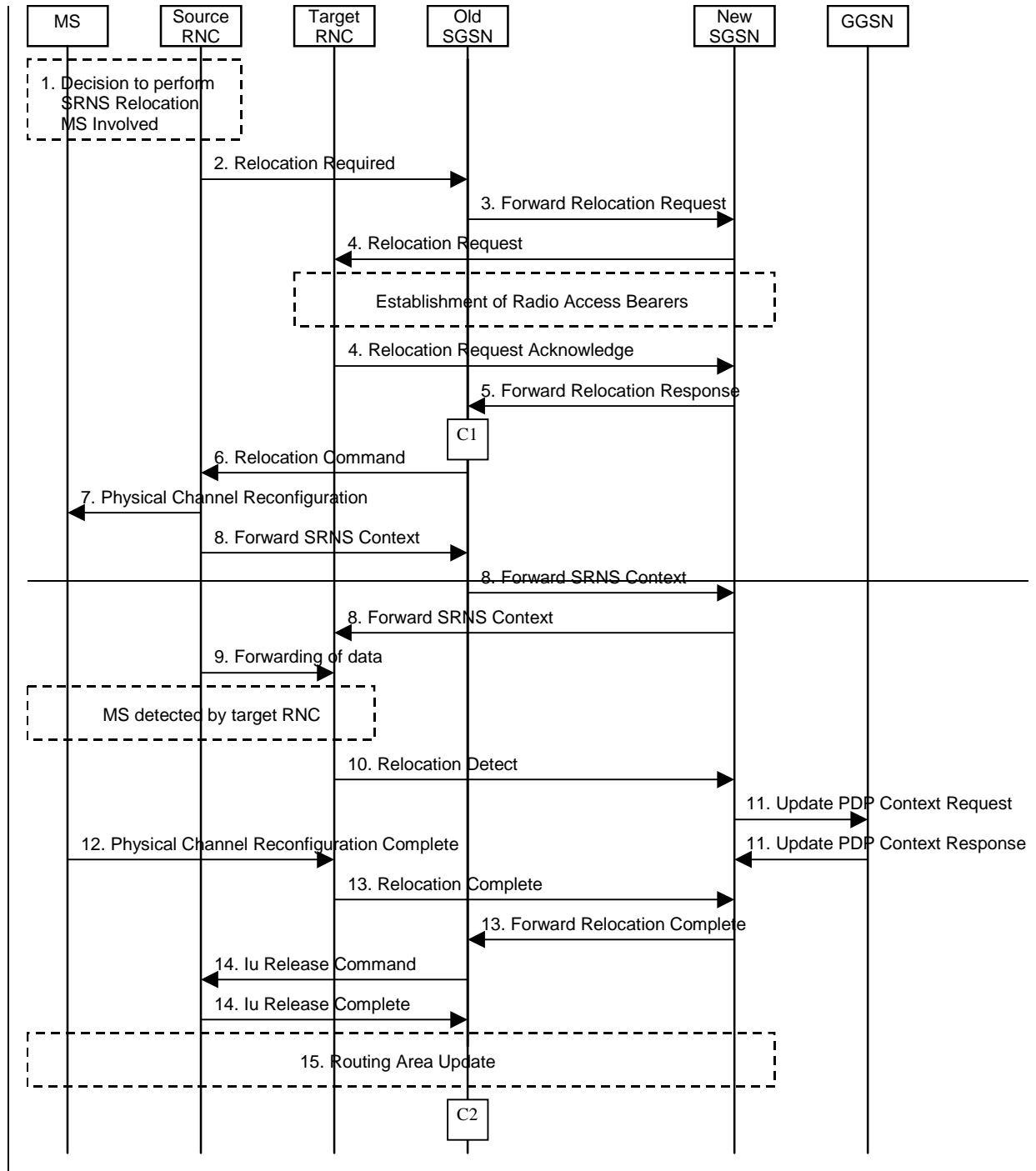
Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.

Figure 3: 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 4. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 4: Combined Hard Handover and SRNS Relocation Procedure

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

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

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

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

    After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, then the source SRNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is acknowledge by a Forward SRNS Context Acknowledge message. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC when handover is made with switching in CN. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

9)   After having sent the Forward SRNS Context message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

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

12) When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

13) When target SRNC receives the Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message, i.e., the new SRNC-ID + S-RNTI are successfully exchanged with the UE by the radio protocols, then target SRNC shall initiate Relocation Complete procedure by sending the Relocation Complete message to new SGSN. The purpose of Relocation Complete procedure is to indicate by the target SRNC the completion of relocation of 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, then the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message acknowledge by a Forward Relocation Complete Acknowledge message.

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

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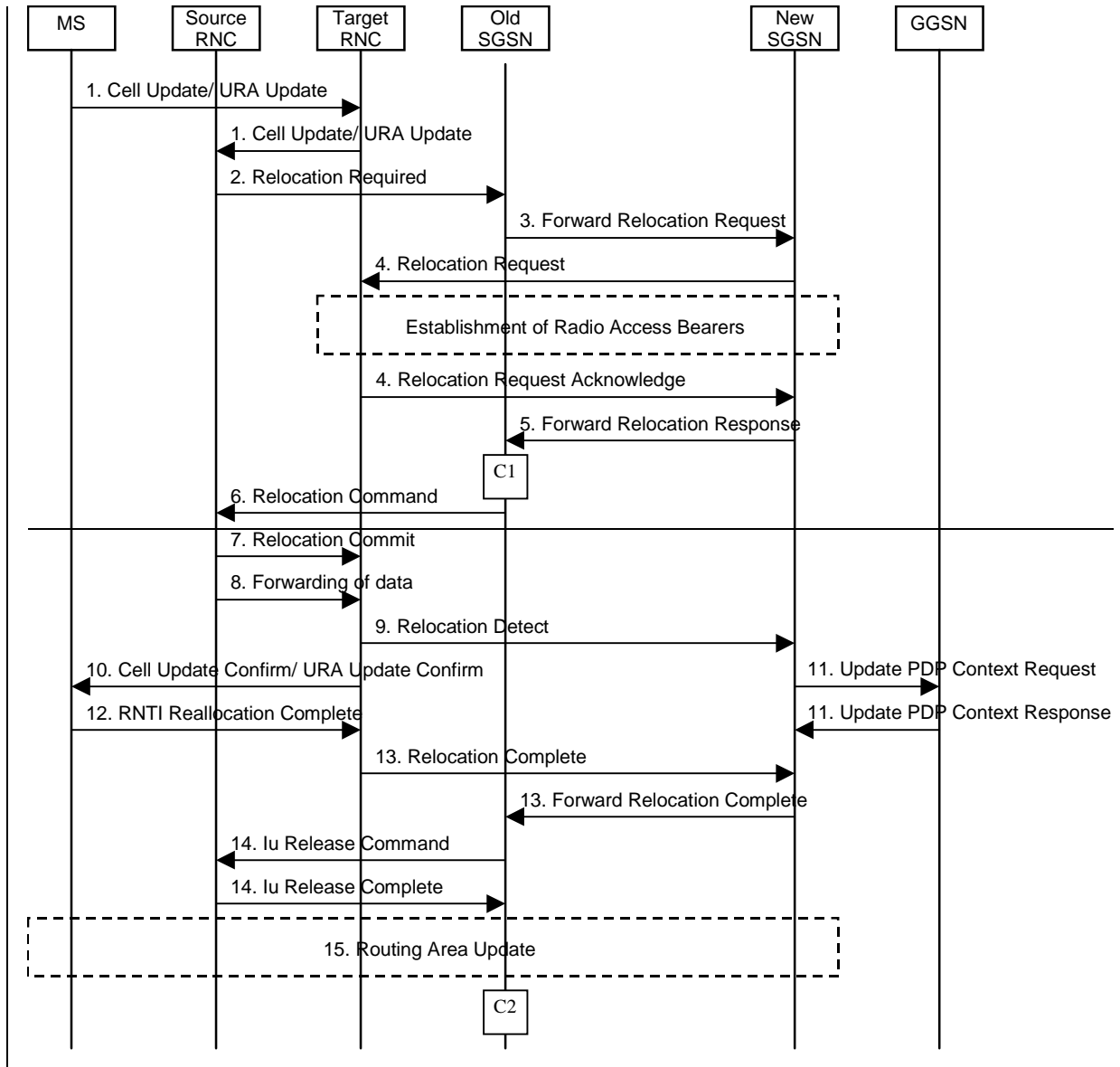
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur carries control signalling but no user data.
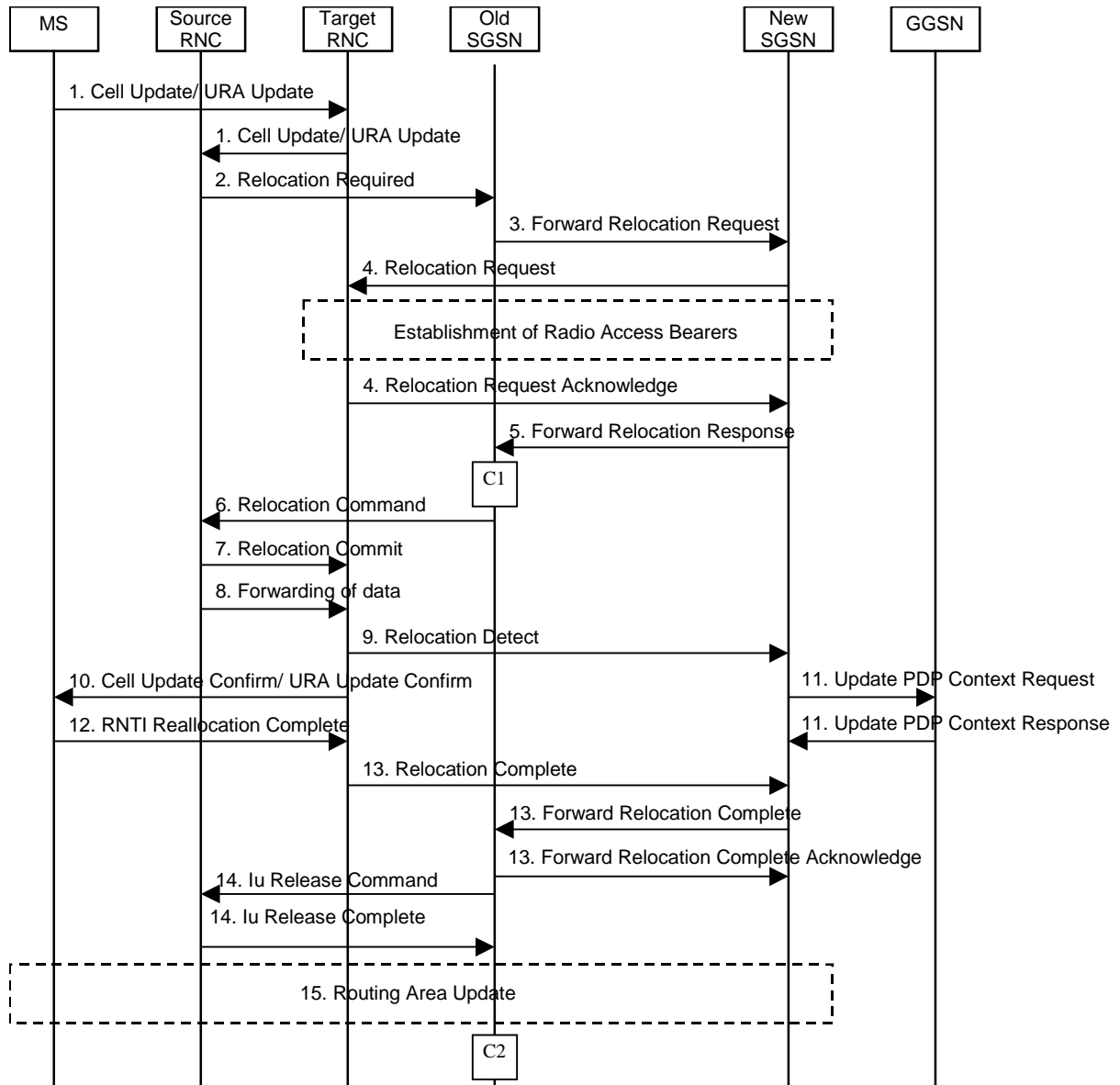
The Combined Cell / URA Update and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a cell re-selection in the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the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

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

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

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in Figure 5. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

Figure 5: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the UTRAN, after having made cell re-selection. Upon reception of the message, the target RNC forwards the received message towards the source SRNC via Iur. Source SRNC decides to perform a combined cell / URA update and SRNS relocation towards the target RNC.

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

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

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

Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data.

After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (RABs setup, RABs failed to setup) message to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit (SRNS Contexts) message to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs subject to data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a Cell Update Confirm / URA Update Confirm message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

11) Upon reception of Relocation Detect message, 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) message.

12) When the MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.

13) When target SRNC receives the RNTI Reallocation Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the UE by the radio protocols, target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to new SGSN. The purpose of Relocation Complete procedure is to indicate by the target SRNC the completion of relocation of 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 acknowledge by a Forward Relocation Complete Acknowledge message.

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

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

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

    C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

    C2)   CAMEL-GPRS-Routeing-Area-Update.

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060	**CR**	**153**	Current Version:	**3.3.0**

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

For submission to:	**SA #8**	for approval	**X**	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

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

Source:	Ericsson		**Date:**	2000-05-18

Subject:	SRNS Relocation Procedures, editorial corrections

Work item:	Release 99

Category: F   Correction   **Release:**

	A Corresponds to a correction in an earlier release		Phase 2	
(only one category	B Addition of feature		Release 96	
shall be marked	C Functional modification of feature		Release 97	
with an X)	D Editorial modification	**X**	Release 98	
			Release 99	**X**
			Release 00	

Reason for change:	A figure describing how a Serving SRNS Relocation Procedure is done on a overall level is added, some editorial corrections are also added.

Clauses affected:	6.9.2.2

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other GSM core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments:	

help.doc

<--------- double-click here for help and instructions on how to create a CR.
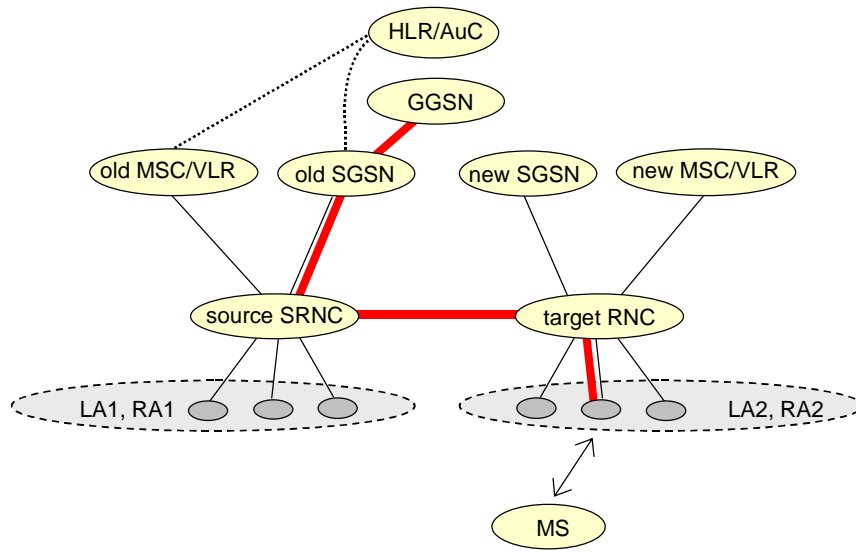
6.9.2.2   Serving RNS Relocation Procedures

6.9.2.2.1   Serving SRNS Relocation Procedure

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

The Serving SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, from a "standing still position". In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra SGSN SRNS Relocation procedure is performed. If the routeing area is changed, then 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.

Figure 1 shows SRNS relocation when source SRNC and target RNC are connected to different SGSNs. Figure 2 shows the situation after SRNS Relocation procedure and Routing Area Update procedure have been completed. In the case described in Figure 1and Figure 2 the MS is in state MM-IDLE.

Figure 1: Before SRNS Relocation and Routing Area Update

Before the Serving SRNS Relocation procedure and RA update, the MS is registered in the old SGSN. The source RNC is acting as serving RNC (SRNC).
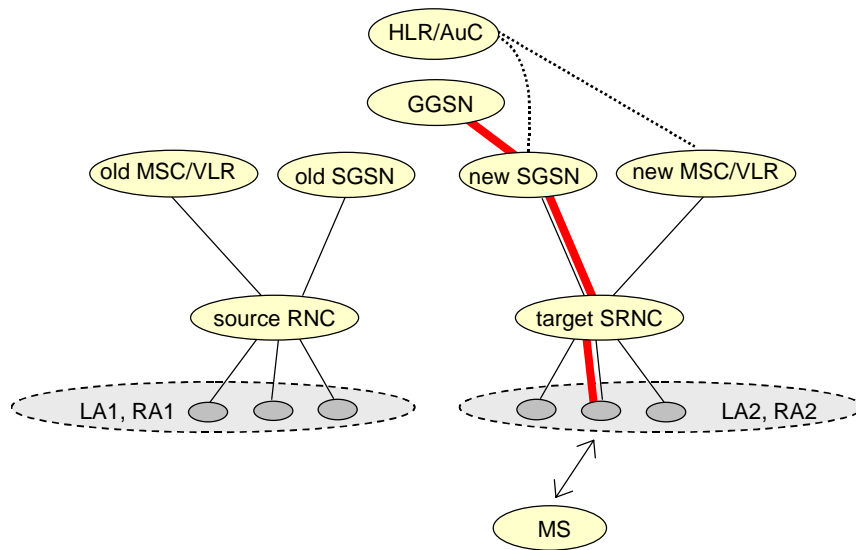
Figure 2: After SRNS Relocation and Routing Area Update

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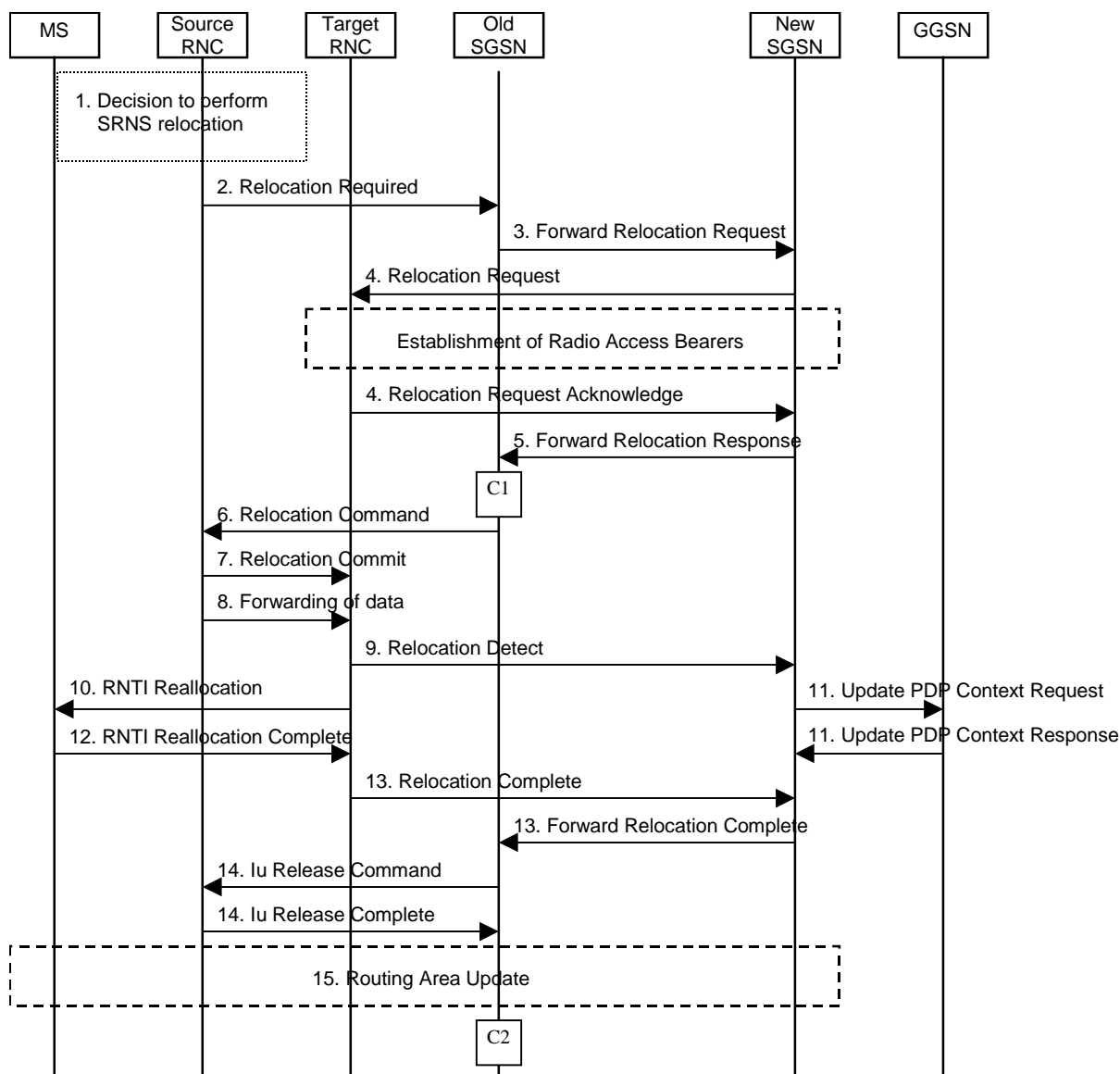
The Serving SRNS Relocation procedure is illustrated in Figure 3. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 3: Serving SRNS Relocation Procedure

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

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

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. The tTarget RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN haves 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC isare ready to receive from source SRNC the downstream packets not yet acknowledged by the MS, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a RNTI Reallocation message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

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

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

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.2   Combined Hard Handover and SRNS Relocation Procedure

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

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

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

Figure 4 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 5 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 4 and Figure 5 the MS is in MM IDLE state.
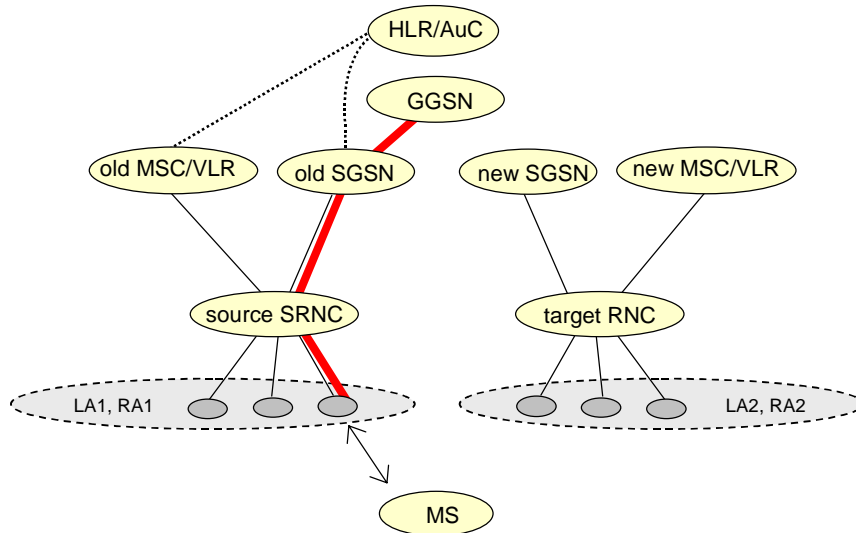
Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.
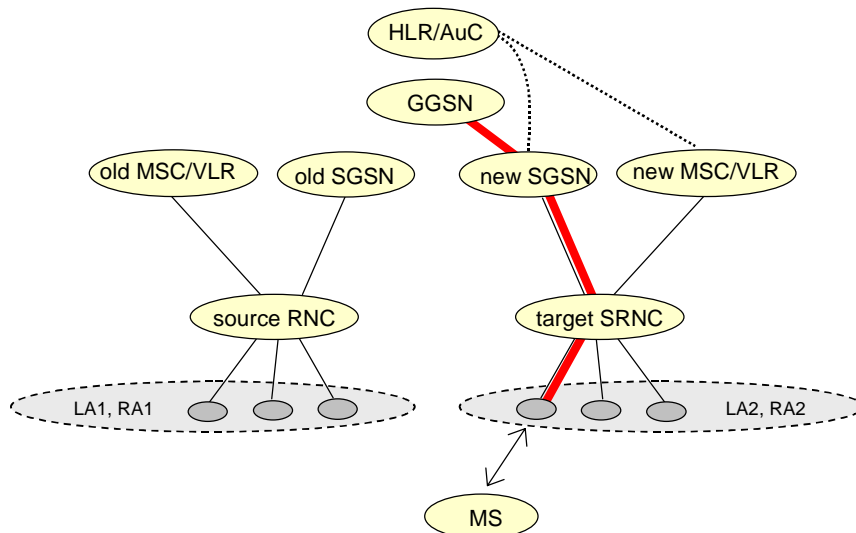
Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 6. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.
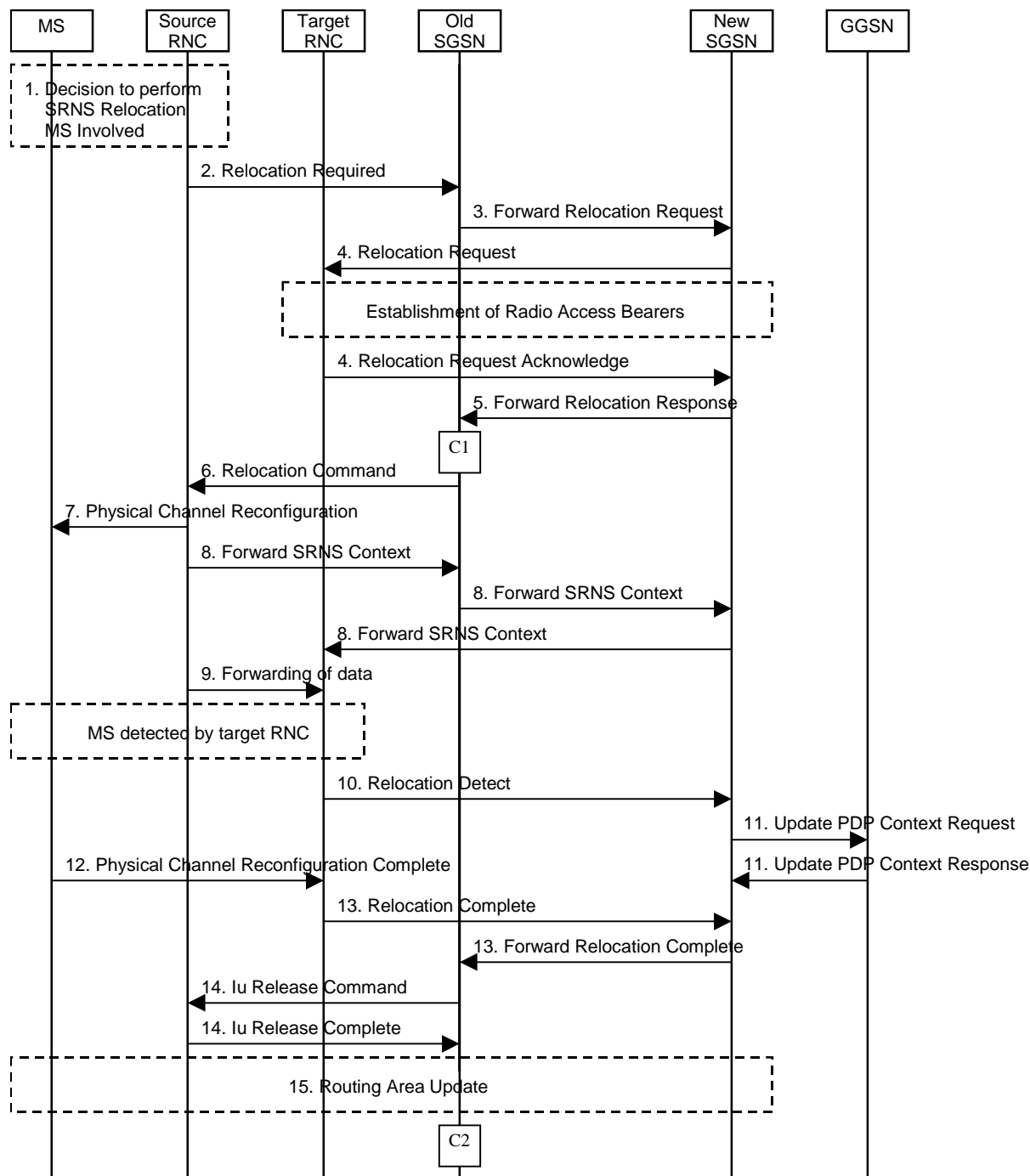
Figure 6: Combined Hard Handover and SRNS Relocation Procedure

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

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

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

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

After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. The tTarget RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN haves been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the new SGSN and target RNC isare ready to receive from source SRNC the downstream packets not yet acknowledged by the MS, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, then the source SRNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC when handover is made with switching in CN. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

9) After having sent the Forward SRNS Context message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

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

12) When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

13) When the target SRNC receives the Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message, i.e., the new SRNC-ID + S-RNTI are successfully exchanged with the UE by the radio protocols, then the target SRNC shall initiate 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, then the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.3   Combined Cell / URA Update and SRNS Relocation Procedure

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

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

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

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

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in Figure 7. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.
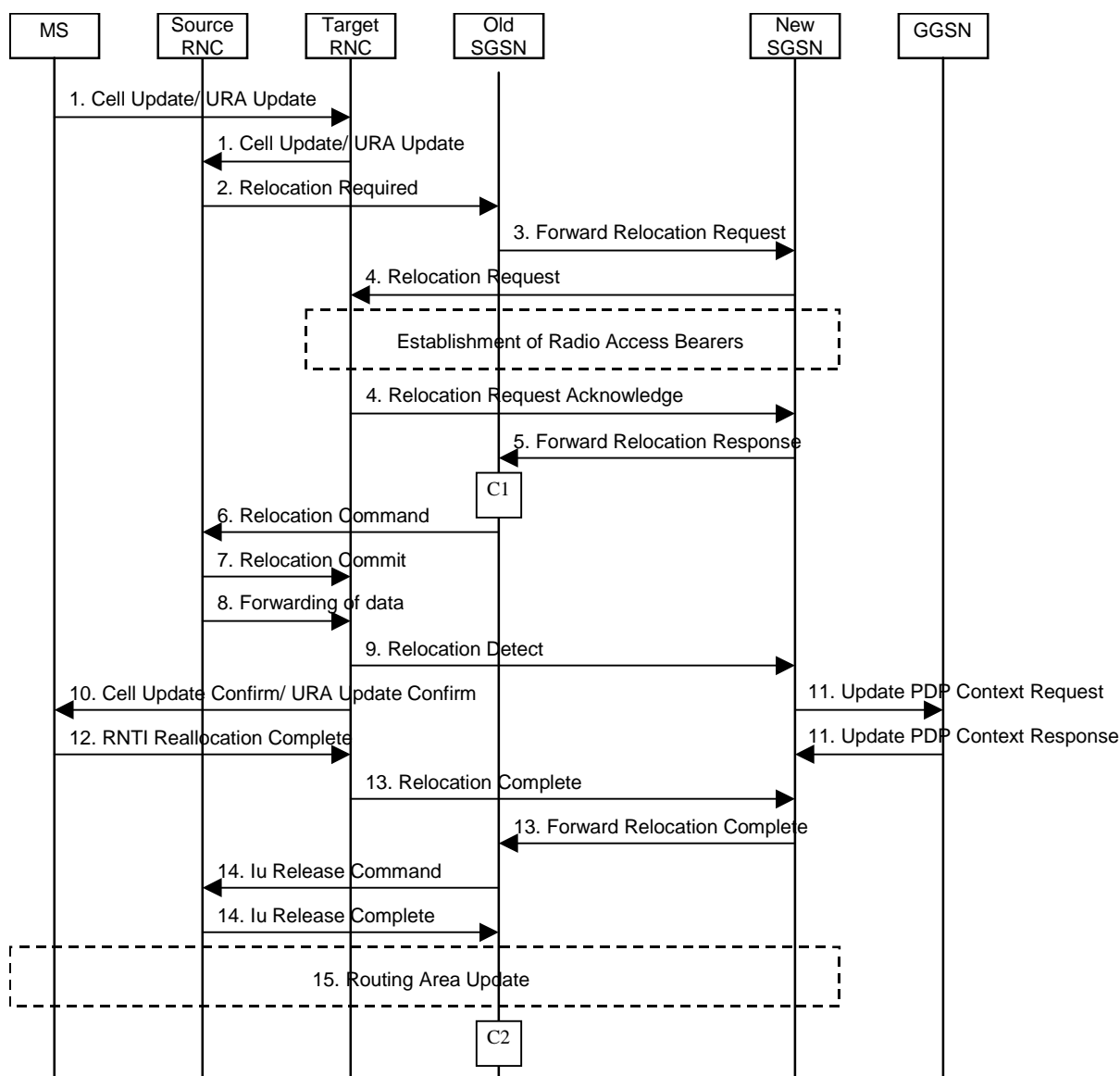
Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the UTRAN, after having made cell re-selection. Upon reception of the message, the target RNC forwards the received message towards the source SRNC via Iur. Source SRNC decides to perform a combined cell / URA update and SRNS relocation towards the target RNC.

2) The source SRNC initiates the relocation preparation procedure by sending a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old

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

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

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

After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (RABs setup, RABs failed to setup) message to the new SGSN. The t Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5)   When resources for the transmission of user data between target RNC and new SGSN haves 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC isare ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7)   Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit (SRNS Contexts) message to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8)   After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs subject to data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a Cell Update Confirm / URA Update Confirm message. Both messages contain UE information elements and CN information

elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

11) Upon reception 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) message.

12) When the MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

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</table>

	23.060	**CR**	**156**	Current Version:	3.3.0

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

For submission to:	TSG SA#8	For approval	**X**	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM		ME		UTRAN / Radio		Core Network	**X**

Source:	Ericsson		**Date:**	2000-05-18

Subject:	Conversion of QoS attributes to LLC attributes in the Aggregate BSS QoS Profile

Work item:	

Category:

(only one category shall be marked with an X)

				Release:		
F	Correction		**X**		Phase 2	
A	Corresponds to a correction in an earlier release				Release 96	
B	Addition of feature				Release 97	
C	Functional modification of feature				Release 98	
D	Editorial modification				Release 99	**X**
					Release 00	

Reason for change:	In release 99 the BSS Packet Flow Context concept was introduced. During the BSS Packet Flow Context Creation procedure an Aggregate BSS QoS Profile is sent by the SGSN to the BSS. Currently the Aggregate BSS QoS Profile contains UMTS attributes that are basically the same as the corresponding UMTS QoS attributes, except for the transfer delay which reflects the BSS part of the network only.
	Since the BSS transports LLC PDUs obtained after segmentation of SDUs by the SNDCP layer, the SGSN shall convert the values of the UMTS bearer service attributes maximum SDU size, SDU error ratio, residual bit error ration, maximum bitrate, guaranteed bitrate and the BSS part of the transfer delay to values applicable to the LLC PDUs.

Clauses affected:	12.7.3.5.1

Other specs affected:

| Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:	

12.7.3.5.1   BSS Packet Flow Context Creation Procedure

On receiving a request to transmit an uplink or downlink LLC PDU for which no BSS packet flow context exists in the BSS, the BSS may request the download of the BSS packet flow context from the SGSN.

The SGSN may at any time request the creation of a BSS packet flow context, e.g., due to the activation of a PDP context.

The BSS Packet Flow Context Creation procedure is illustrated in Figure 1.
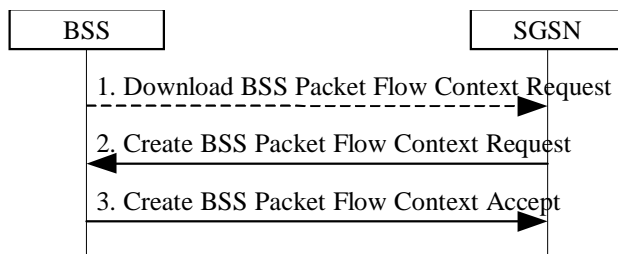
Figure 1: BSS Packet Flow Context Creation Procedure

1) The BSS receives a request to transfer an uplink or downlink user data LLC PDU for which it currently does not have a BSS packet flow context. In the uplink case, TLLI, Radio Priority, and Packet Flow Id are received from the MS as defined in GSM 04.60. In the downlink case, TLLI and Packet Flow Id are received from the SGSN as defined in GSM 08.18. If Packet Flow Id does not indicate best-effort service nor SMS, then the BSS sends a Download BSS Packet Flow Context Request (RAI, TLLI, Packet Flow Id) message to the SGSN. Until the BSS receives the BSS packet flow context, the BSS shall handle uplink and downlink transfers according to a default aggregate BSS QoS profile. For uplink transfers, the default profile is specific to the radio priority level.

2) The SGSN sends a Create BSS Packet Flow Context Request (IMSI, TLLI, Packet Flow Id, Aggregate BSS QoS Profile Requested, BSS Packet Flow Timer) message to the associated BSS. The SGSN derives Aggregate BSS QoS Profile Requested from the QoS profile negotiated for the PDP contexts that share a packet flow as follows. The SGSN shall divide the transfer delay attribute in the QoS profile in one core network part and one BSS part. The SGSN estimates the transfer delay in the core network and subtracts this from the UMTS bearer service transfer delay. The result ~~shall be used as the transfer delay attribute in Aggregate BSS QoS Profile Requested, that~~ only covers the delay in the MS to SGSN segment of the GPRS PLMN. Since the BSS transports LLC PDUs obtained after segmentation of SDUs by the SNDCP layer, the SGSN shall convert the values of the UMTS bearer service attributes ~~M~~maximum SDU size, SDU error ratio, residual bit error ration, maximum bitrate, guaranteed bitrate and the resulting transfer delay to values applicable to the LLC PDUs. ~~SDU format information, and transfer delay may also need to be corrected in order to accommodate for segmentation introduced by SNDCP.~~ All other attributes in Aggregate BSS QoS Profile shall be the same as the corresponding UMTS bearer service attribute, see 3G TS 23.107.

3) The BSS may restrict the requested aggregate BSS QoS profile given its capabilities and the current load. The BSS creates a BSS packet flow context and inserts the parameters in its BSS context. The BSS returns a Create BSS Packet Flow Context Accept (IMSI, Packet Flow Id, Aggregate BSS QoS Profile Negotiated) message to the SGSN. The BSS uses the negotiated aggregate BSS QoS profile when allocating radio resources and other resources such as buffer capacity.

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23.060	**CR**	**159**		Current Version:	**3.3.0**

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

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Proposed change affects:	(U)SIM		ME	**X**	UTRAN / Radio		Core Network	**X**

(at least one should be marked with an X)

Source:	Fujitsu	**Date:**	19 May, 2000

Subject:	Clarification of radio bearer re-establishment

Work item:	

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification	**X**		Release 99	**X**
					Release 00	**X**

Reason for change:	This modification is to clarify that all the radio bearers released by resource optimisation or radio link failure and whose PDP context are preserved are to be re-established if RAB assignment procedure is executed.

Clauses affected:	12.8.4

Other specs affected:	Other 3G core specifications	→ List of CRs:
	Other GSM core specifications	→ List of CRs:
	MS test specifications	→ List of CRs:
	BSS test specifications	→ List of CRs:
	O&M specifications	→ List of CRs:

Other comments:	

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<--------- double-click here for help and instructions on how to create a CR.

12.8.4   RAB Assignment Procedure

The purpose of the RAB Assignment procedure is to enable establishment of new RABs for a given MS and/or modification and/or release of already established RABs. When this procedure is executed and if there is any PDP context without radio access bearer assigned, all the radio access bearer are re-established. The same messages are used for the three mentioned actions and it is only the content carried by the messages that is different. The RAB Assignment procedure, which is shown below, is specified in 3G TS 25.413. The RRC protocol is specified in 3G TS 25.331.
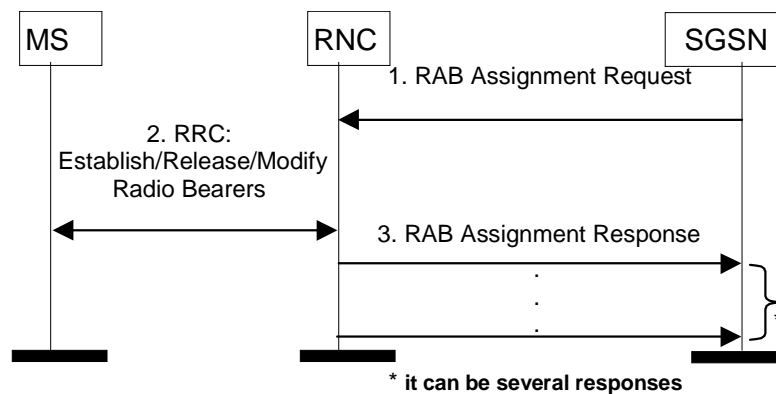
Figure 1: RAB Assignment Procedure

1) The SGSN sends a RAB Assignment Request message to the RNC to establish, modify, or release one or several RABs. For each RAB requested to be established or modified, if the RAB is allowed for queuing and the resource situation requires it, the RNC may place the RAB in the establishment queue.

2) The RNC establishes, modifies, or releases the appropriate radio bearers.

3) The RNC returns a RAB Assignment Response message to the SGSN. If the request to establish or modify one or several RABs has been queued, the RNC will report the outcome of the establishment or modification in subsequent RAB Assignment Response messages. If the SGSN receives a RAB Assignment Response message with a cause indicating that the requested QoS profile(s) can not be provided (e.g., "Requested Maximum Bit Rate not Available"), then the SGSN may send a new RAB Assignment Request message with different QoS profile(s). The number of re-attempts, if any, as well as how the new QoS profile(s) values are determined is implementation dependent.

3GPP TSG SA WG2 Meeting #13
Berlin, 22-26 May 2000

Document ***S2-001058***

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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23.060	**CR**	**161 rev2**	Current Version:	**3.3.0**	

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

For submission to:	SA#8	for approval	**X**	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

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

Source:	Nokia	**Date:**	23.5.2000

Subject:	SNRS Relocation and Inter System HO, when PDCP doesn't support lossless relocation

Work item:	

Category:	F	Correction	**X**	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	**X**
					Release 00	

| **Reason for change:** | If PDCP doesn't support lossless relocation, then the PDCP sequence numbers are not used even in acknowledged mode. In this case, the normal procedures for acknowledged mode in SRNS relocation and inter-system HO can not be used.

The proposal in this CR is that the HO procedures are made in acknowledged mode similarly than in unacknowledged mode. |
|---|---|

Clauses affected:	6.9.2.2; 6.13

Other specs affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

6.9.2.2 Serving RNS Relocation Procedures

6.9.2.2.1   Serving SRNS Relocation Procedure

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

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

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

After the Serving SRNS Relocation procedure and RA 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 Serving SRNS Relocation procedure is illustrated in Figure 1. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 1: Serving SRNS Relocation Procedure

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

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

3) The old SGSN determines from Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

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

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a RNTI Reallocation message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

If PDCP does not support lossless relocation, the acknowledged mode SRNS relocation procedures shall be performed as in unacknowledged mode. Hence there shall not be any PDCP sequence numbers exchange between target RNC and MS.

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

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

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.2   Combined Hard Handover and SRNS Relocation Procedure

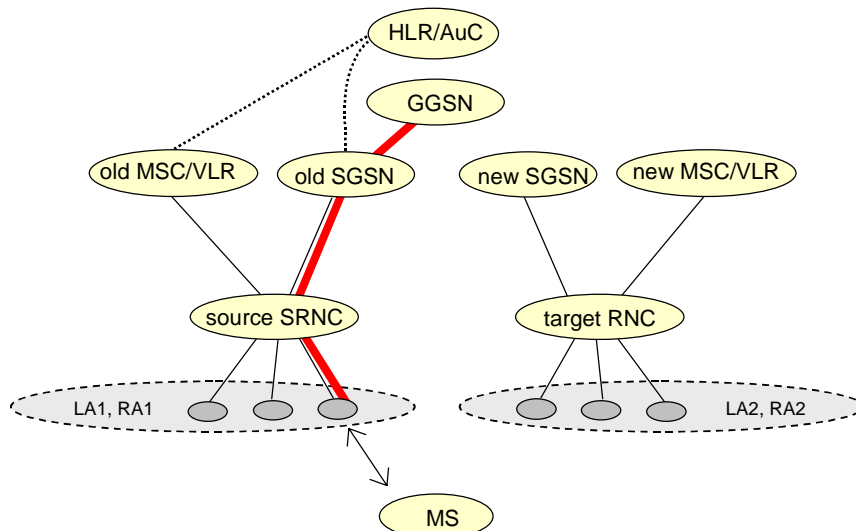This procedure is only performed for an MS in PMM-CONNECTED state.

The Combined Hard Handover and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a hard handover decided by the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an

Intra SGSN SRNS Relocation procedure is performed. If the routeing area is changed, then this procedure is followed by an Intra SGSN Routeing Area Update procedure. The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the HLR about the new MS location.

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

Figure 2 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 3 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 2 and Figure 3 the MS is in MM IDLE state.

Figure 2: 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 3: 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 4. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 4: Combined Hard Handover and SRNS Relocation Procedure

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

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

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

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

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5)   When resources for the transmission of user data between target RNC and new SGSN has been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6)   The old SGSN continues the relocation of SRNS by sending a Relocation Command (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7)   Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, then the source SRNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.

8)   The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC when handover is made with switching in CN. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

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

The target SRNC exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

If PDCP does not support lossless relocation, the acknowledged mode SRNS relocation procedures shall be performed as in unacknowledged mode. Hence there shall not be any PDCP sequence numbers exchange between target RNC and MS.

9) After having sent the Forward SRNS Context message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

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

12) When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

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

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

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

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

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

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

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

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

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

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in Figure 5. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

Figure 5: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the UTRAN, after having made cell re-selection. Upon reception of the message, the target RNC forwards the received message towards the source SRNC via Iur. Source SRNC decides to perform a combined cell / URA update and SRNS relocation towards the target RNC.

2) The source SRNC initiates the relocation preparation procedure by sending a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old

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

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

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

   After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (RABs setup, RABs failed to setup) message to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit (SRNS Contexts) message to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

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

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs subject to data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a Cell Update Confirm / URA Update Confirm message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

11) Upon reception of Relocation Detect message, 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) message.

12) When the MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.

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

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

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

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

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6.13   UMTS - GSM Intersystem Change

The UMTS - GSM intersystem change procedures may be supported for network elements conforming to GSM releases 97, 98, and 99, and to UMTS release 99. At intersystem change release 99 network elements shall use GTP release 97 or 98 on the Gn interface when interworking with release 97 or 98 network elements, respectively.

An intersystem change from UMTS to GSM or GSM to UMTS takes place when an MS supporting both UMTS and GSM changes the radio access technology. A prerequisite for an intersystem change is that the MS is GPRS-attached. The transition of the mobility management states is as specified for the corresponding mobility management procedures.

There is no transition of the session management states at an intersystem change.

6.13.1   Intra SGSN Intersystem Change

An SGSN that supports both the Gb and Iu-PS interfaces may support an intra SGSN intersystem change if the radio access technology nodes serving the MS before and after the intersystem change are both served by this SGSN.

6.13.1.1   UMTS to GSM Intra SGSN Change

The intersystem change from UMTS to GSM takes place when an MS changes from UTRAN to GSM radio access. Depending on the PMM state before the intersystem change and whether the RA is changed or not, one of the following procedures is initiated by the MS:

- When an MS in PMM-IDLE state changes to the GSM radio access without changing the RA, the MS shall follow the selective RA update procedures, see subclause "Selective RA Update".

- When an MS in PMM-IDLE state changes to the GSM radio access and the RA changes, the MS shall initiate the GPRS RA update procedure, see subclause "Intra SGSN Routeing Area Update".

- When an MS in PMM-CONNECTED state changes to the GSM radio access , the MS shall initiate the GPRS RA update procedure independent of whether the RA has changed or not. The RA update procedure is either combined RA / LA update or only RA update.

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 Routeing Area Update Request message 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 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.

Figure 6: UMTS to GSM Intra SGSN Change

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

2) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) message to the 2G+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 attached 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 2G+3G-SGSN.

3) The 2G+3G-SGSN sends an SRNS Context Request (IMSI) message to the SRNS and stops transmission of GTP PDUs to the SRNS.

4) The SRNS responds with an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The GTP sequence numbers are included for each PDP context indicating the next in-sequence downlink PDU to be sent to the MS and the next in-sequence GTP PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in acknowledged mode from the MS for each radio bearer, which requires lossless relocation. The 2G+3G-SGSN shall strip off the eight most significant bits of the passed PDCP sequence numbers, thus converting them to SNDCP N-PDU numbers of the respective 2G GPRS PDP contexts.

If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence PDCP sequence numbers shall not be transferred from the RNC to the 2G+3G-SGSN.

5) Security functions may be executed.

6) The 2G+3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. This informs the SRNS that the 2G+3G-SGSN is ready to receive data packets. Upon reception of SRNS Data Forward Command message from the 2G+3G-SGSN the SRNS shall start the data-forwarding timer.

7) The transmitted but not acknowledged PDCP-PDUs together with the downlink PDCP sequence number and the buffered downlink GTP PDUs are tunnelled back to the 2G+3G-SGSN. The 2G+3G-SGSN shall strip off the eight most significant bits of the PDCP sequence numbers accompanying the received N-PDUs before sending them to the MS.

8) The 2G+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.

9) 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 routeing area update, then the 2G+3G-SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI by the 2G+3G-SGSN. The VLR creates or updates the association with the 2G+3G-SGSN by storing SGSN Number.

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

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

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

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

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

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

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

11) The new VLR allocates a new VLR TMSI and responds with Location Update Accept (VLR TMSI) to the 2G+3G-SGSN. VLR TMSI is optional if the VLR has not changed.

12) The 2G+3G-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, then the 2G+3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the 2G+3G-SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number (= converted PDCP-SNU)) message is returned to the MS. 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.

If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence the 2G+3G-SGSN shall not send Receive N-PDU Number to the MS.

13) 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 (= converted PDCP-SND) 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. 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 acknowledged mode in the MS per radio bearer, which requires lossless handover.

   If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence the MS shall not send Receive N-PDU Number to the 2G+3G-SGSN.

14) The 2G+3G-SGSN sends a TMSI Reallocation Complete message to the VLR if the VLR TMSI is confirmed by the MS.

15) The 2G+3G-SGSN and the BSS may execute the BSS Packet Flow Context procedure.

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

   C1)   CAMEL-GPRS-Routeing-Area-Update.

6.13.1.2   GSM to UMTS Intra SGSN Change

The intersystem change from GSM to UMTS takes place when a GPRS-attached MS changes from GSM radio access to UTRAN. Depending on the GPRS mobility management state before the intersystem change and whether the RA is changed or not one of the following procedures is initiated by the MS:

-   When an MS in STANDBY state changes to UTRAN inside the current RA, the MS shall follow the selective RA update procedures, see subclause "Selective RA Update".

-   When an MS in STANDBY state changes to UTRAN and the RA changes, the MS shall initiate the UMTS RA update procedure, see subclause "Routeing Area Update Procedure".

-   When an MS in READY state changes to UTRAN independent of whether the RA has changed or not, the MS shall initiate the UMTS RA update procedure and afterwards initiate the RABs by the Service Request procedure, see subclause "Service Request Initiated by MS Procedure". The RA update procedure is either combined RA / LA update or only RA update.

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 procedure. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.
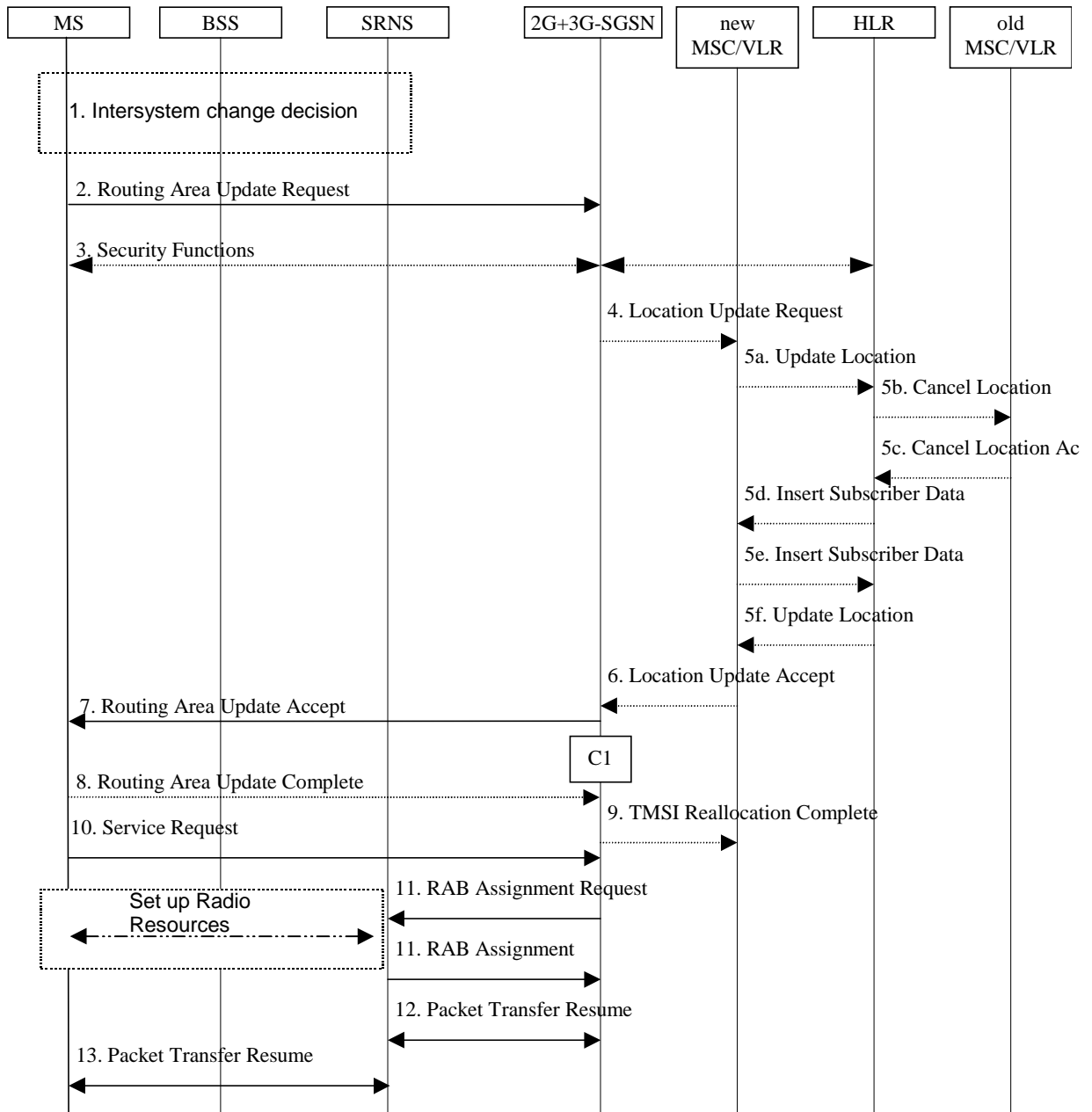
Figure 7: GSM to UMTS Intra SGSN Change

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

2) The MS initiates an RRC connection establishment and sends Routeing Area Update Request (P-TMSI, Old RA, Old P-TMSI Signature, Update Type, CM) message to the combined 2G+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. The SRNS shall add an identifier of the area where the message was received before passing the message to the 2G+3G-SGSN. The 2G+3G-SGSN stops transmission of N-PDUs to the MS.

3) Security functions may be executed.

4) 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 routeing area update, then the 2G+3G-SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI by the 2G+3G-SGSN. The VLR creates or updates the association with the 2G+3G-SGSN by storing SGSN Number.

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

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

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

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

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

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

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

6) The new VLR allocates a new VLR TMSI and responds with Location Update Accept (VLR TMSI) to the 2G+3G-SGSN. VLR TMSI is optional if the VLR has not changed.

7) The 2G+3G-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, then the 2G+3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the 2G+3G-SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A Routeing Area Update Accept (P-TMSI, P-TMSI Signature) message is returned to the MS.

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

9) The 2G+3G-SGSN sends a TMSI Reallocation Complete message to the VLR if the VLR TMSI is confirmed by the MS.

10) The MS sends a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.

11) The 2G+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 shall be derived from the N-PDU sequence numbers stored in the 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 SRNS responds with a RAB Assignment Response message.

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

   If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence there shall not be any sequence numbers exchange between target RNC and MS.

12) Traffic flow is resumed between the 2G+3G-SGSN and the SRNS. The SRNS shall discard all N-PDUs with N-PDU sequence numbers older than the downlink N-PDU sequence number received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with sequence numbers older than the GTP-SNU received from the SRNS. If this is not the case the N-PDU shall be transmitted to the SRNS.

13) The traffic flow is resumed between the SRNS and the MS.

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

   C1)   CAMEL-GPRS-Routeing-Area-Update.

6.13.1.3   Selective RA Update

The MS shall use the following procedures when in STANDBY or PMM-IDLE state.

Note that upon expiry of the periodic RA update timer, the MS shall carry out the periodic routeing area update procedure.

6.13.1.3.1   Uplink Signalling or Data Transmission

In STANDBY or PMM-IDLE state the MS shall not perform an RA update procedure until uplink data or signalling information is to be sent from the MS.

If the MS is in the same access network as when it last sent data or signalling, then the procedures defined for that access system shall be followed. This shall be sending of an LLC PDU in GPRS, or for example sending of a Service Request message in UMTS.

If the MS is in a different access network as when it last sent data or signalling, the RA update procedure shall be performed before the sending of data or signalling. The RA update procedure needs not be performed if the signalling message is a power-off detach.

6.13.1.3.2   Downlink Signalling or Data Transmission

If the 2G+3G-SGSN receives data for an MS in STANDBY or PMM-IDLE state, then the SGSN shall page in the RA where the MS is located. This may include both 2G and 3G cells.

If the MS receives this page in the same access network as when it last sent data or signalling, then the procedures defined for that access system shall be followed. This shall be sending of an LLC PDU in a GSM cell or for example sending of a Service Request message in a UMTS cell.

If the MS receives this page in a different access network as when it last sent data or signalling, then the RA update procedure shall be performed. The 2G+3G-SGSN shall accept this RAU as a valid response.

6.13.2   Inter SGSN Intersystem Change

6.13.2.1   UMTS to GSM Inter SGSN Change

An inter SGSN intersystem change from UMTS to GSM takes place when an MS in PMM-IDLE or PMM-CONNECTED state changes from UTRAN to GSM radio access and the GSM radio access node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a GSM 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 8.

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 Routeing Area Update Request indicating that an LA update may also need to be performed, in which case the SGSN forwards the LA update to the VLR. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.
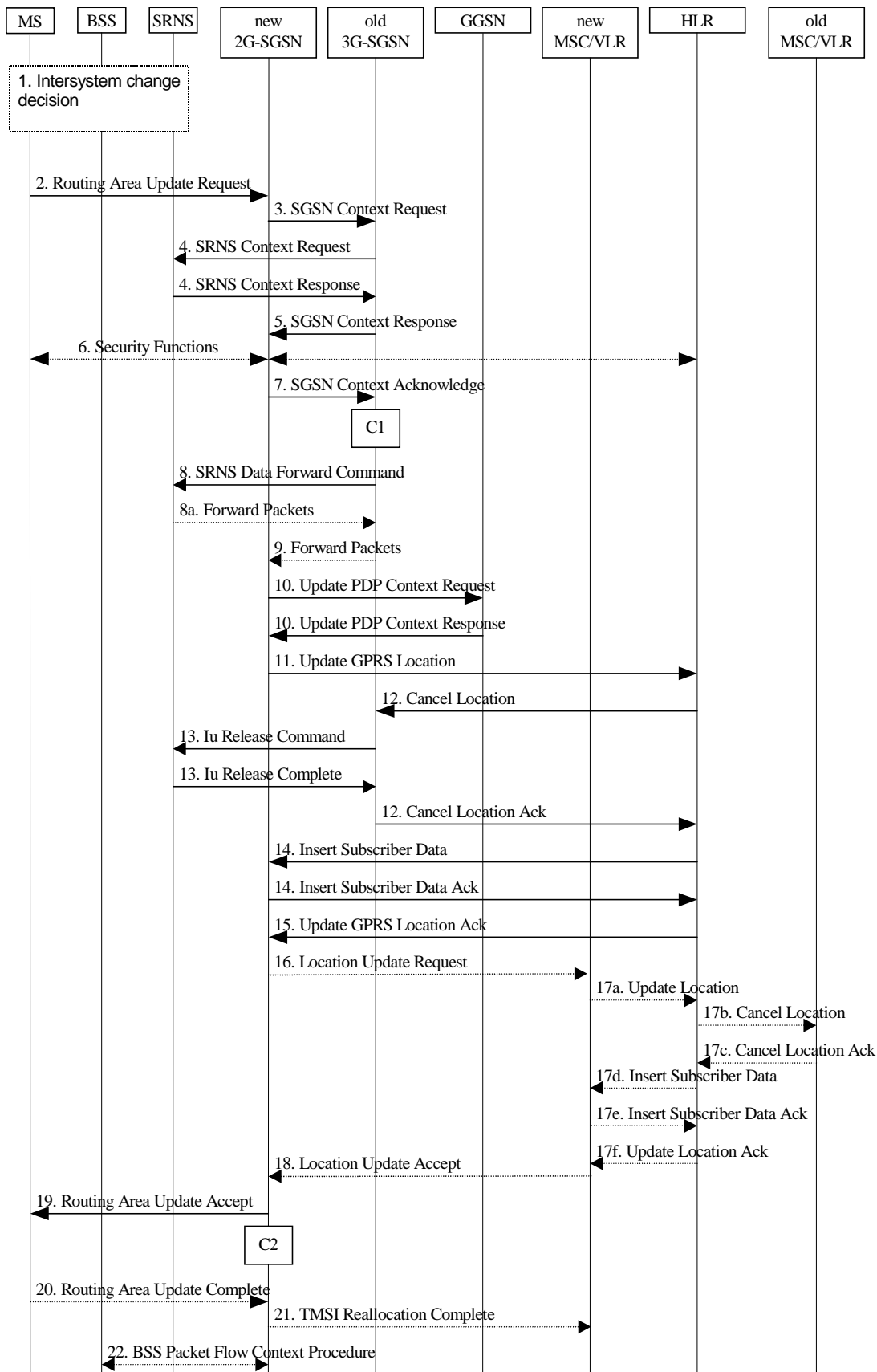
Figure 8: UMTS to GSM Inter SGSN Change

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

2) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) 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. 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 3G-SGSN. 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 reception of this message the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). The 3G-SGSN shall strip off the eight most significant bits of the passed PDCP sequence numbers, thus converting them to SNDCP N-PDU numbers.

   If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence PDCP sequence numbers shall not be transferred from the RNC to the 2G+3G-SGSN.

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 donwlink GTP sequence number for the next in-sequence N-PDU to be sent to the MS. Each PDP Context also includes the SNDCP Send N-PDU Number (the value is 0) for the next in-sequence downlink N-PDU to be sent in acknowledged mode to the MS and the SNDCP Receive N-PDU Number (= converted PDCP-SNU) for the next in-sequence uplink N-PDU to be received in acknowledged mode from the MS.

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 PMM-CONNECTED the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. The SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with the PDCP downlink sequence number (the eight most significant bits shall be stripped off), and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon reception of 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. The sequence numbers (= converted PDCP sequence numbers) shall not be modified in the GTP header of the tunnelled PDUs.

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) message.

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 then 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 construct an MM context and PDP contexts for the MS and return 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 routeing area update, then 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. The VLR number is translated from the RAI by the 2G-SGSN. 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 (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

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

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

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

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

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

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

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 2G-SGSN, or if subscription checking fails, then the new 2G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then 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. The new 2G-SGSN responds to the MS with a Routeing 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 acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

   If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence the 2G+3G-SGSN shall not send Receive N-PDU Number to the MS.

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 acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. 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 acknowledged mode in the MS per radio bearer, which requires lossless handover.

   If PDCP does not support lossless relocation, the acknowledged mode inter-system HO procedures shall be performed as in unacknowledged mode. Hence the MS shall not send Receive N-PDU Number to the 2G+3G-SGSN.

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

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

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

> C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

> C2)   CAMEL-GPRS-Routeing-Area-Update.

6.13.2.2   GPRS to UMTS Inter SGSN Change

The intersystem change from GSM to UMTS takes place when a GPRS-attached MS changes from GSM radio access to UTRAN and the UTRAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a UMTS RA update procedure by establishing a 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 9.

If the network operates in mode I, then an MS that is both PS-attached and CS-attached shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.
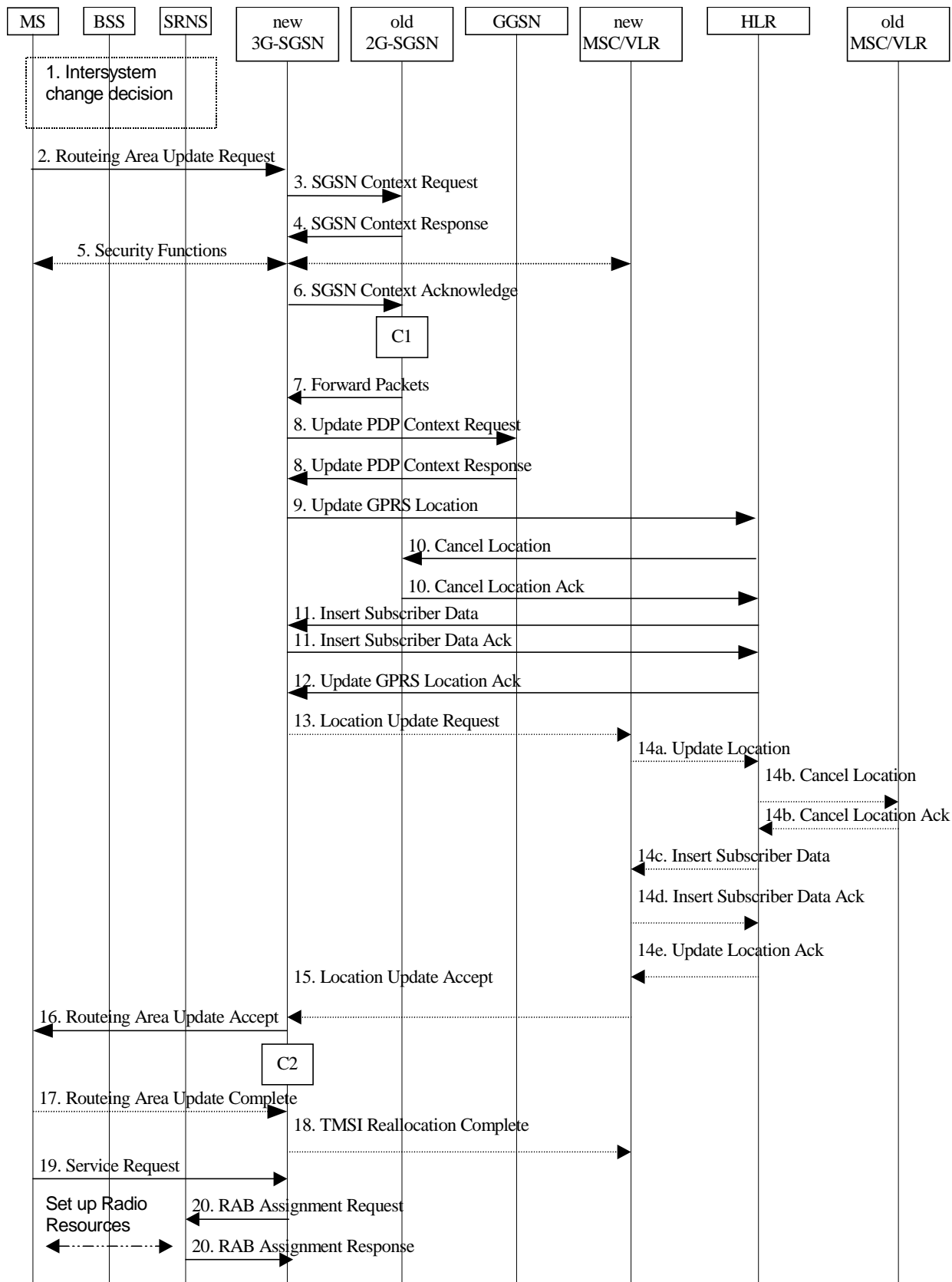
Figure 9: GSM to UMTS Inter SGSN Change

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

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM) 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. 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 2G-SGSN to get the MM and PDP contexts for the MS. The old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

4) The old 2G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. Each PDP Context includes the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS and the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS. The new 3G-SGSN shall use the GTP sequence numbers for in-sequence delivery over the Iu interface.

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. 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 return an Update PDP Context Response (TEID) message.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

18) The new 3G-SGSN sends TMSI Reallocation Complete message to the new VLR if the VLR TMSI is confirmed by the MS.

19) If the MS was in GPRS MM state READY it sends a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.

20) If the MS has send 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 shall be derived from the N-PDU sequence numbers stored in the 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 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 PDCP-SNDs received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with sequence numbers older than the PDCP-SNUs received from the SRNS. Other N-PDUs shall be transmitted to the SRNS.

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

If PDCP does not support lossless relocation, the acknowledged mode inter-system HO~~SRNS relocation~~ procedures shall be performed as in unacknowledged mode. Hence there shall not be any PDCP sequence numbers exchange between target RNC and MS.

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

C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

C2)   CAMEL-GPRS-Routeing-Area-Update.

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Berlin, 22-26 May 2000

Document **S2-000960**

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060	CR	**162 rev1**	Current Version:	**3.3.0**	

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

For submission to: **SA#8**   for approval **X**   strategic ☐ *(for SMG*
list expected approval meeting # here ↑   for information ☐   non-strategic ☐ *use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

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

Source: Nokia   **Date:** 23.5.2000

Subject: Establishment of LLC link after inter-system HO.

Work item:

Category: F   Correction   **X**   **Release:**   Phase 2   ☐
                       A   Corresponds to a correction in an earlier release   ☐   Release 96   ☐
(only one category   B   Addition of feature   ☐   Release 97   ☐
shall be marked   C   Functional modification of feature   ☐   Release 98   ☐
with an X)   D   Editorial modification   ☐   Release 99   **X**
                                                                                                                              Release 00   ☐

Reason for change: There is not specified which side (MS or SGSN) creates LLC link after intersystem handover from UMTS to GSM. If both sides starts establishment procedure, the collision of procedures will happen and the establishment of LLC link may delay.

In this CR it is proposed that SGSN starts establishment procedure of LLC link.

Clauses affected: 6.13

Other specs affected: Other 3G core specifications   ☐   → List of CRs:
                                 Other GSM core specifications   ☐   → List of CRs:
                                 MS test specifications   ☐   → List of CRs:
                                 BSS test specifications   ☐   → List of CRs:
                                 O&M specifications   ☐   → List of CRs:

Other comments:

6.13   UMTS - GSM Intersystem Change

The UMTS - GSM intersystem change procedures may be supported for network elements conforming to GSM releases 97, 98, and 99, and to UMTS release 99. At intersystem change release 99 network elements shall use GTP release 97 or 98 on the Gn interface when interworking with release 97 or 98 network elements, respectively.

An intersystem change from UMTS to GSM or GSM to UMTS takes place when an MS supporting both UMTS and GSM changes the radio access technology. A prerequisite for an intersystem change is that the MS is GPRS-attached. The transition of the mobility management states is as specified for the corresponding mobility management procedures.

There is no transition of the session management states at an intersystem change.

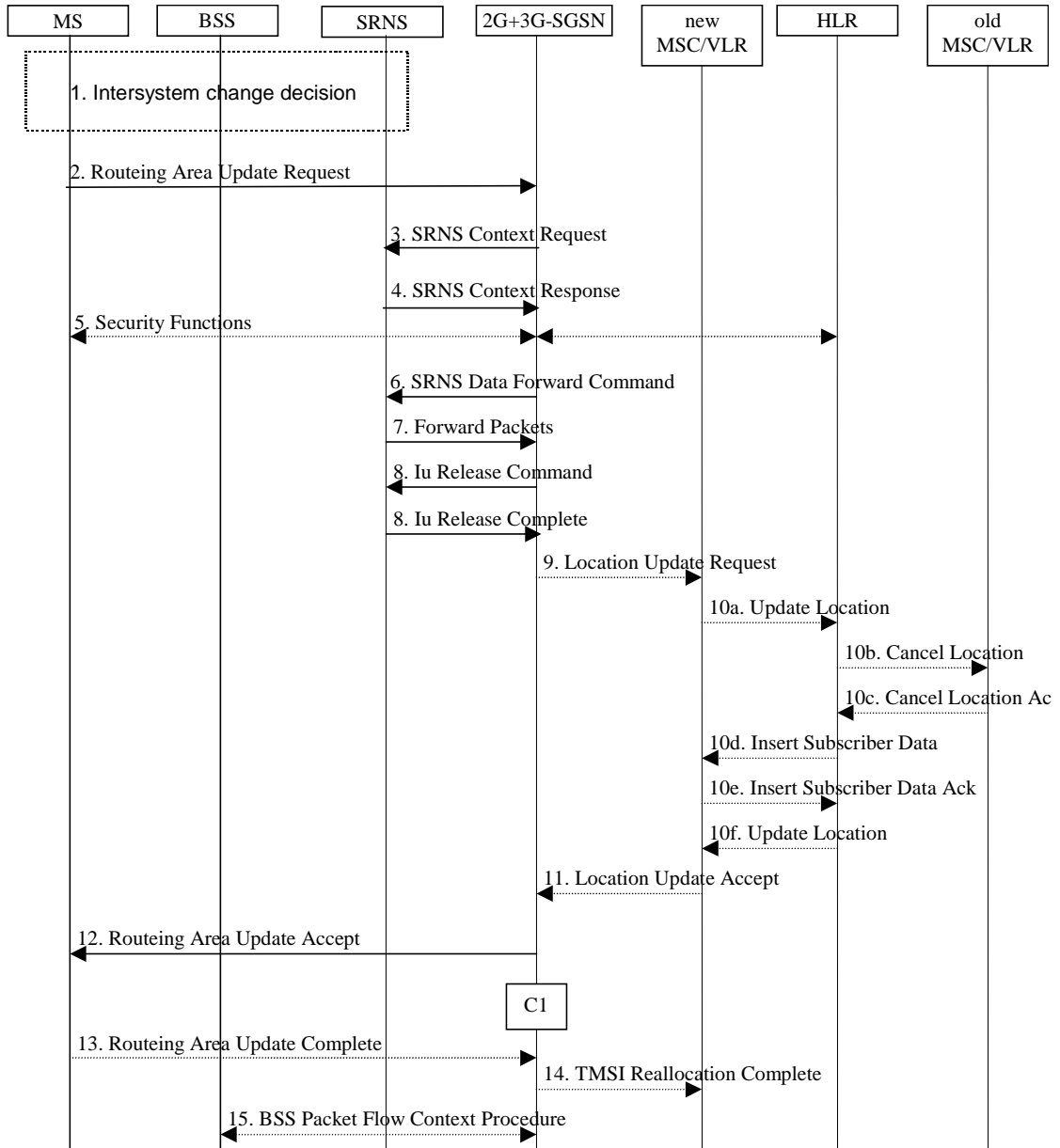## 6.13.1   Intra SGSN Intersystem Change

An SGSN that supports both the Gb and Iu-PS interfaces may support an intra SGSN intersystem change if the radio access technology nodes serving the MS before and after the intersystem change are both served by this SGSN.

6.13.1.1   UMTS to GSM Intra SGSN Change

The intersystem change from UMTS to GSM takes place when an MS changes from UTRAN to GSM radio access. Depending on the PMM state before the intersystem change and whether the RA is changed or not, one of the following procedures is initiated by the MS:

-   When an MS in PMM-IDLE state changes to the GSM radio access without changing the RA, the MS shall follow the selective RA update procedures, see subclause "Selective RA Update".

-   When an MS in PMM-IDLE state changes to the GSM radio access and the RA changes, the MS shall initiate the GPRS RA update procedure, see subclause "Intra SGSN Routeing Area Update".

-   When an MS in PMM-CONNECTED state changes to the GSM radio access , the MS shall initiate the GPRS RA update procedure independent of whether the RA has changed or not. The RA update procedure is either combined RA / LA update or only RA update.

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 Routeing Area Update Request message 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 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.

Figure 1: UMTS to GSM Intra SGSN Change

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

2) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) message to the 2G+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 attached 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 2G+3G-SGSN.

3) The 2G+3G-SGSN sends an SRNS Context Request (IMSI) message to the SRNS and stops transmission of GTP PDUs to the SRNS.

4) The SRNS responds with an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The GTP sequence numbers are included for each PDP context indicating the next in-sequence downlink PDU to be sent to the MS and the next in-sequence GTP PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU is the PDCP sequence number for the next expected in-sequence uplink packet to be received in acknowledged mode from the MS for each radio bearer, which requires lossless relocation. The 2G+3G-SGSN shall strip off the eight most significant bits of the passed PDCP sequence numbers, thus converting them to SNDCP N-PDU numbers of the respective 2G GPRS PDP contexts.

5) Security functions may be executed.

6) The 2G+3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. This informs the SRNS that the 2G+3G-SGSN is ready to receive data packets. Upon reception of SRNS Data Forward Command message from the 2G+3G-SGSN the SRNS shall start the data-forwarding timer.

7) The transmitted but not acknowledged PDCP-PDUs together with the downlink PDCP sequence number and the buffered downlink GTP PDUs are tunnelled back to the 2G+3G-SGSN. The 2G+3G-SGSN shall strip off the eight most significant bits of the PDCP sequence numbers accompanying the received N-PDUs before sending them to the MS.

8) The 2G+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.

9) 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 routeing area update, then the 2G+3G-SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI by the 2G+3G-SGSN. The VLR creates or updates the association with the 2G+3G-SGSN by storing SGSN Number.

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

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

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

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

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

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

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

11) The new VLR allocates a new VLR TMSI and responds with Location Update Accept (VLR TMSI) to the 2G+3G-SGSN. VLR TMSI is optional if the VLR has not changed.

12) The 2G+3G-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, then the 2G+3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the 2G+3G-SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A logical link is established between the new 2G+3G-SGSN and the MS. The establishment procedure is initiated by 2G+3G-SGSN. A new P-TMSI may be allocated. A Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number (= converted PDCP-SNU)) message is returned to the MS. 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.

13) 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 (= converted PDCP-SND) 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. 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 acknowledged mode in the MS per radio bearer, which requires lossless handover.

14) The 2G+3G-SGSN sends a TMSI Reallocation Complete message to the VLR if the VLR TMSI is confirmed by the MS.

15) The 2G+3G-SGSN and the BSS may execute the BSS Packet Flow Context procedure.

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

C1)   CAMEL-GPRS-Routeing-Area-Update.

****

6.13.2   Inter SGSN Intersystem Change

6.13.2.1   UMTS to GSM Inter SGSN Change

An inter SGSN intersystem change from UMTS to GSM takes place when an MS in PMM-IDLE or PMM-CONNECTED state changes from UTRAN to GSM radio access and the GSM radio access node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a GSM 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 2.

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 Routeing Area Update Request indicating that an LA update may also need to be performed, in which case the SGSN forwards the LA update to the VLR. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.
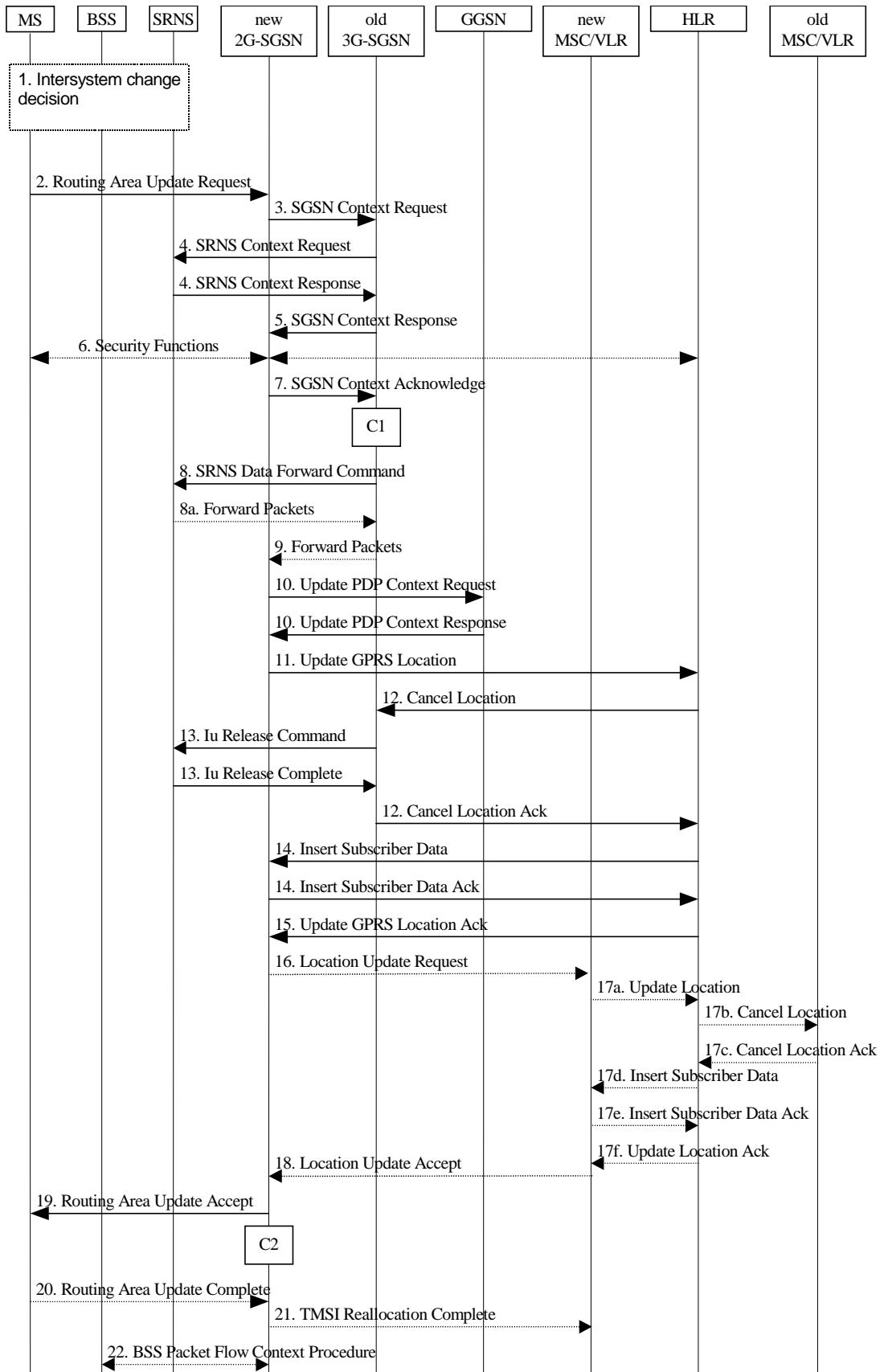
Figure 2: UMTS to GSM Inter SGSN Change

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

2) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) 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. 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 3G-SGSN. 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 reception of this message the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). The 3G-SGSN shall strip off the eight most significant bits of the passed PDCP sequence numbers, thus converting them to SNDCP N-PDU numbers.

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 donwlink GTP sequence number for the next in-sequence N-PDU to be sent to the MS. Each PDP Context also includes the SNDCP Send N-PDU Number (the value is 0) for the next in-sequence downlink N-PDU to be sent in acknowledged mode to the MS and the SNDCP Receive N-PDU Number (= converted PDCP-SNU) for the next in-sequence uplink N-PDU to be received in acknowledged mode from the MS.

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 PMM-CONNECTED the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. The SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with the PDCP downlink sequence number (the eight most significant bits shall be stripped off), and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon reception of 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. The sequence numbers (= converted PDCP sequence numbers) shall not be modified in the GTP header of the tunnelled PDUs.

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) message.

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 then 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 construct an MM context and PDP contexts for the MS and return 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 routeing area update, then 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. The VLR number is translated from the RAI by the 2G-SGSN. 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 (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

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

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

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

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

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

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

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 2G-SGSN, or if subscription checking fails, then the new 2G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then 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. The establishment procedure is initiated by 2G-SGSN. The new 2G-SGSN responds to the MS with a Routeing 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 acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

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 acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. 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 acknowledged mode in the MS per radio bearer, which requires lossless handover.

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

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

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

   C1)   CAMEL-GPRS-SGSN-Context-Acknowledge.

   C2)   CAMEL-GPRS-Routeing-Area-Update.

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060 CR **163 rev1**   Current Version: **3.3.0**

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

For submission to:	**SA#8**	for approval	**X**		strategic		*(for SMG*
list expected approval meeting # here ↑		for information			non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

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

Source:	Nokia		**Date:**	23.5.2000

Subject:	Classmark handling

Work item:	

Category:	F	Correction	**X**	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	**X**
					Release 00	

| **Reason for change:** | In RAU the MS radio access capability shall be sent to SGSN regardless if MS is a dual mode one, or UMTS-only – on one hand; if SGSN is a 3G, or 2G, or 2G/3G SGSN – on the other hand. Now, in the first place, the 3G-SGSN MM context does not contain the MS radio access capability field. Secondly, the UMTS-only MS as well shall send the MS radio access capability to SGSN. In order to get around the problem it is proposed to add MS radio access capability IE to 3G-SGSN MM context (subclause 13.2) and to MS MM Context (subclause 13.4). Consequently, this IE shall be included in the GPRS attach procedure, even if MS is being attached to UMTS (see subclause 9.4.1 of 24.008).

Besides, it should be clearly stated that a multisystem MS sends a MS radio access capability IE to 3G-SGSN in RAU Request during the GSM – UMTS intersystem change (subclause 6.14). |
|---|---|

Clauses affected:	6.14; 13.2, 13.4.

Other specs affected:	Other 3G core specifications	**X**	→ List of CRs:	24.008
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

help.doc

<---------- double-click here for help and instructions on how to create a CR.

6.14 Classmark Handling

To support efficient radio interface usage in GPRS, the MS classmark is handled differently for SGSN-based services than for MSC-based services. In particular, the classmark information is sent in MM and UMTS RRC messages to the network and stored in the network as long as the MS is attached, avoiding redundant classmark retransmissions over the radio interface. This is sometimes called the "idle-mode classmark" principle.

MS classmark shall refer to two information elements, a CS MS classmark and PS MS classmark. In order to allow introduction of new radio access technologies in the future, the PS MS classmark is split into two distinct and independent information elements, the radio access classmark, and the MS network capability. The radio access classmark is split into two information elements, the MS radio access capability (GSM) and the UE capability (UMTS). The MS network capability IE shall be common for GSM and UMTS.

6.14.1 Radio Access Classmark

MS shall send the MS radio access capability IE in GPRS Attach Request message to SGSN regardless, if the MS is about to attach to GSM, or to UMTS network, as defined in sub-clause "Attach request" in 3G TS 24.008.

6.14.1.1 MS Radio Access Capability (GSM Only)

The MS radio access capability information element contains the GSM radio capabilities of the MS (e.g., multislot capability, power class), and more generally all the information that should be known by the BSS in order to handle radio resources for that MS.

The MS radio access capability is a container for a multiplicity of radio access technology-dependent information, i.e., within the MS radio access capability there are independent sub-fields for various technologies such as GSM 900 and GSM 1800. The coding shall allow a BSS to extract only the sub-fields relevant to it without interpreting the other sub-fields. This ensures that the MS radio access capability does not need to be interpreted by the NSS, and the full MS radio access capability is always sent by the MS to the SGSN, and thereafter provided to the BSS irrespective of the actual BSS capabilities.

The SGSN shall provide the MS radio access capability as an information element on the Gb interface. It is the responsibility of the SGSN to provide the BSS with the most recent MS radio access capability received from the MS. The MS radio access capability information element can be included in a downlink transfer request, or be sent in a specific message that updates the MS radio access capability information in the BSS. The BSS may at any time request the MS radio access capability for a given MS to be transmitted from the SGSN to the BSS.

A specific optimisation allows the BSS to receive a reduced MS radio access capability at initial access directly from the MS. This enables the BSS not to wait for the full MS radio access capability to be provided by the SGSN, and is therefore quicker for the initial MS-originated transmission. The reduced MS radio access capability can be carried in several RR messages depending on the access method, e.g., in the initial random access message, or in the first uplink radio block. Details are provided in 3G TS 24.008 and GSM 04.60.

At inter system change (UMTS to GSM) the MS radio access capability shall beis sent to the SGSN in the Routing Area Update Request message., as specified in the sub-clause "Routing area update request", in 3G TS 24.008. The SGSN then provides the BSS with the GSM radio capabilities.

6.14.1.2 UE Capability (UMTS only)

The UE capability information element contains all the UMTS radio capabilities of the MS (power control, code resource, UE mode, ciphering, PDCP capabilities, etc.) that the RNC has to know in order to handle radio resources for this MS.

The MS sends the UE capability information element to the serving RNC upon RRC connection establishment, and the RNC stores it. This is done before the Attach Request or Routing Area Update Request message is sent.

NOTE: In UMTS, only the RNC handles the radio capabilities.

At SRNC relocation the source RNC sends the UE capability transparently through the core network to the target RNC. If the RNC has not received the UE capability information it can enquire the MS to send the information.

At inter system change (GSM to UMTS) the UE capability is transferred from the MS to the serving RNC on RRC connection establishment before the Routing Area Update Request message is sent.

Details are provided in 3G TS 25.331 and 3G TS 25.413.

6.14.2 MS Network Capability

The MS network capability contains non radio-related capabilities, e.g., the GSM GPRS ciphering, UMTS authentication, and TI extension capabilities. In the coding of the information element certain capabilities may be grouped together in a single indicator. The SGSN stores the MS network capability which is used both locally by the SGSN and for transfer to the new SGSN at all types of inter SGSN RA update.

13.2   SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. **Error! Reference source not found.** shows the context fields for one MS.

Table 1: SGSN MM and PDP Contexts

Field	Description	GSM	UMTS
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
Authentication Triplets	Authentication and ciphering parameters.	X	X
Authentication Vectors	Authentication and ciphering parameters for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
MS Radio Access Capability	MS radio access capabilities	X	X
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
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 3G TS 23.016	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.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X

TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data 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
RLC-SND	The next in-sequence RLC sequence number to be sent to the MS.		X
RLC-SNU	The next in-sequence RLC sequence number expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

13.4   MS

Each packet domain MS maintains MM and PDP context information in IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, and PMM-CONNECTED states. The information may be contained in the MS and the TE. **Error! Reference source not found.**Table 8 shows the MS context fields.

Table 28: MS MM and PDP Contexts

Field	SIM	Description	GSM	UMTS
IMSI	G, U	International Mobile Subscriber Identity.	X	X
MM State		Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	G, U	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	G, U	A signature used for identification checking purposes.	X	X
Routeing Area	G, U	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	G	Current GPRS ciphering key.	X	
CKSN / KSI	G, U	Key Set Identifier for IK Next, CK Next, and Kc.	X	X
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK		Currently used ciphering key.		X
CK Next	U	UMTS ciphering key to be used after the next security mode command.		X
IK		Currently used integrity key.		X
IK Next	U	Integrity key to be used after the next security mode command.		X
MS Radio Access Capability		MS radio access capabilities.	X	X
UE Capability		UE radio capabilities.		X
MS Network Capability		MS network capabilities.	X	X
DRX Parameters		Discontinuous reception parameters.	X	X
Radio Priority SMS		The RLC/MAC radio priority level for uplink SMS transmission.	X	
Each MM context contains zero or more of the following PDP contexts:				
PDP Type		PDP type, e.g., PPP or IP.	X	X
PDP Address		PDP address, e.g., an IP address.	X	X
PDP State		Packet data protocol state, INACTIVE or ACTIVE.	X	X
Dynamic Address Allowed		Specifies whether the MS is allowed to use a dynamic address.	X	X
APN Requested		The APN requested.	X	X
NSAPI		Network layer Service Access Point Identifier.	X	X
TI		Transaction Identifier.	X	X
QoS Profile Requested		The quality of service profile requested.	X	X
QoS Profile Negotiated		The quality of service profile negotiated.	X	X
TFT		Traffic flow template.	X	X
Radio Priority		The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id		Packet flow identifier.	X	
Send N-PDU Number		SNDCP sequence number of the next uplink N-PDU to be sent to the SGSN.	X	X
Receive N-PDU Number		SNDCP sequence number of the next downlink N-PDU expected from the SGSN.	X	X
RLC-SND		The next in-sequence RLC sequence number expected from the RNC.		X
RLC-SNU		The next in-sequence RLC sequence number to be sent to the RNC.		X

TSG SA WG 2#13 **TSGS2#13-S2000923**
Berlin, Germany
May 22-26, 2000

Agenda item:
Source: **Siemens**
Title: **CR 164 to 23.060 on SRNS relocation procedure**
Document for: **Approval**

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3G CHANGE REQUEST

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TS 23.060	**CR**	**164**	Current Version:	3.3.0
3G specification number ↑			*↑ CR number as allocated by 3G support team*	

For submision to TSG   SA2#13   for approval   **X**   *(only one box should*
list TSG meeting no. here ↑   for information ☐   *be marked with an X)*

Form: 3G CR cover sheet, version 1.0   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf

Proposed change affects: USIM ☐   ME **X**   UTRAN **X**   Core Network ☐
(at least one should be marked with an X)

Source:	Siemens		**Date:**	22/05/2000

Subject:	Reset of RLC during SRNS relocation

3G Work item:	

Category: F   Correction   **X**   **Release:**   Phase 2   ☐
               A   Corresponds to a correction in an earlier release   ☐   Release 96   ☐
(only one category   B   Addition of feature   ☐   Release 97   ☐
shall be marked   C   Functional modification of feature   ☐   Release 98   ☐
with an X)   D   Editorial modification   ☐   Release 99   **X**
                                                                                        Release 00   ☐

| **Reason for change:** | The Reset of RLC during SRNS relocation was already stated in the "Serving RNS Relocation Procedure" in agreed CR 109r1 presented by Nokia during the Mexico meeting and was (accidently?) removed at the Japan meeting. In this CR the reset of RLC is reintroduced.

After SRNS relocation PDCP retransmitts the PDCP SDUs that were not received by the peer PDCP before relocation. RLC PDUs belonging to PDCP SDUs that were given to RLC before relocation but that have not been sent have to be cleared from the RLC buffer to ensure they do not reach the PDCP receiver after relocation and cause dublications. To reset RLC is necessary and this should be stated in 6.9.2.2.1 "Serving RNS relocation Procedure" and 6.9.2.2.2 " Combined Hard Handover and SRNS Relocation Procedure". |
|---|---|

Clauses affected:	6.9.2.2.1, 6.9.2.2.2

Other specs affected:	Other 3G core specifications	☐	→ List of CRs:	
	Other 2G core specifications	☐	→ List of CRs:	
	MS test specifications	☐	→ List of CRs:	
	BSS test specifications	☐	→ List of CRs:	
	O&M specifications	☐	→ List of CRs:	

Other comments:	

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6.9.2.2 Serving RNS Relocation Procedures

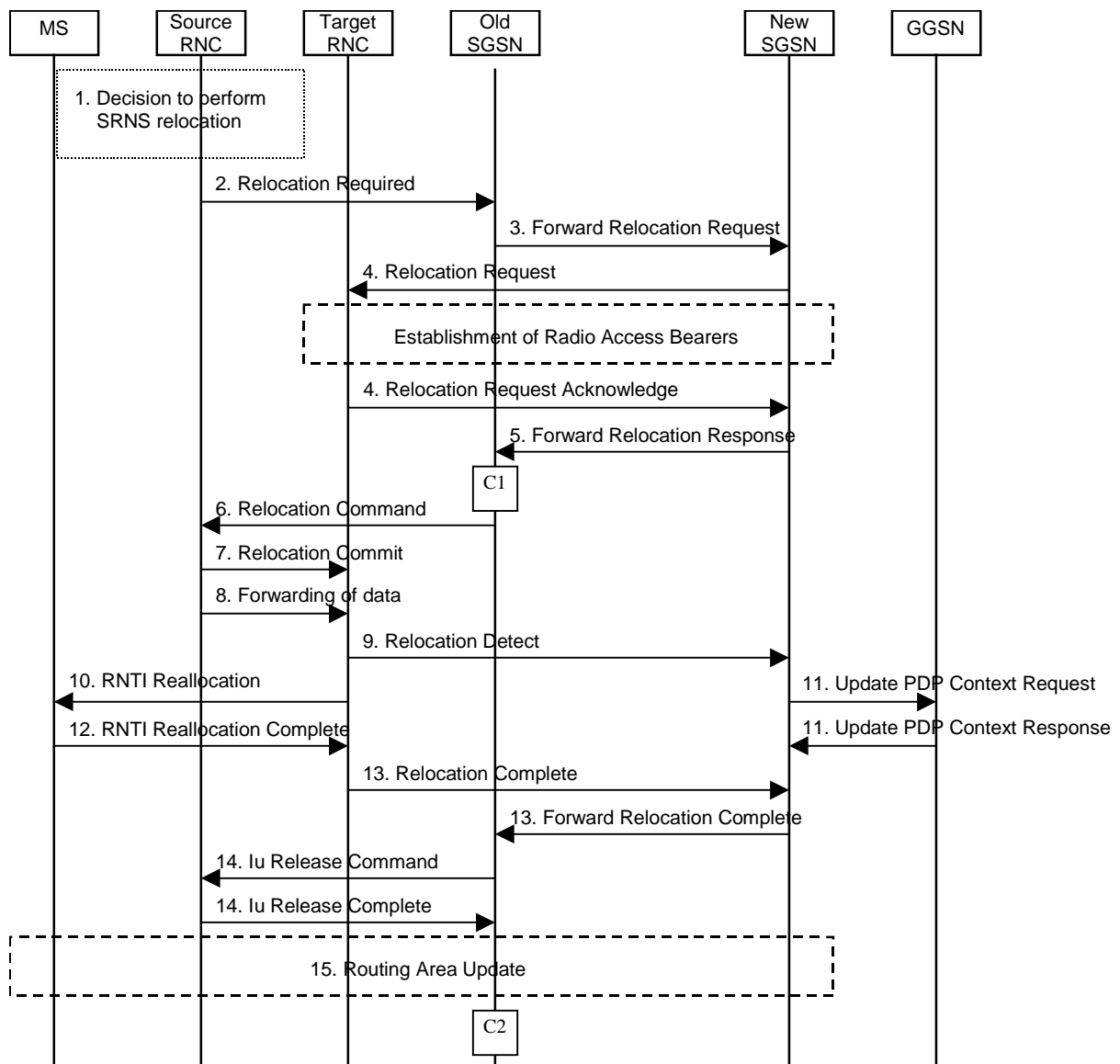### 6.9.2.2.1 Serving SRNS Relocation Procedure

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

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

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

After the Serving SRNS Relocation procedure and RA 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 Serving SRNS Relocation procedure is illustrated in Figure 1. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 1: Serving SRNS Relocation Procedure

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

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

3) The old SGSN determines from Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has 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 new SGSN to old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to 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 (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the

reception of the Relocation Commit message from the Iur interface. When Relocation Detect message is sent, target RNC shall start SRNC operation.

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a RNTI Reallocation message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC resets and restarts the RLC connections and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

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

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

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

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

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

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:
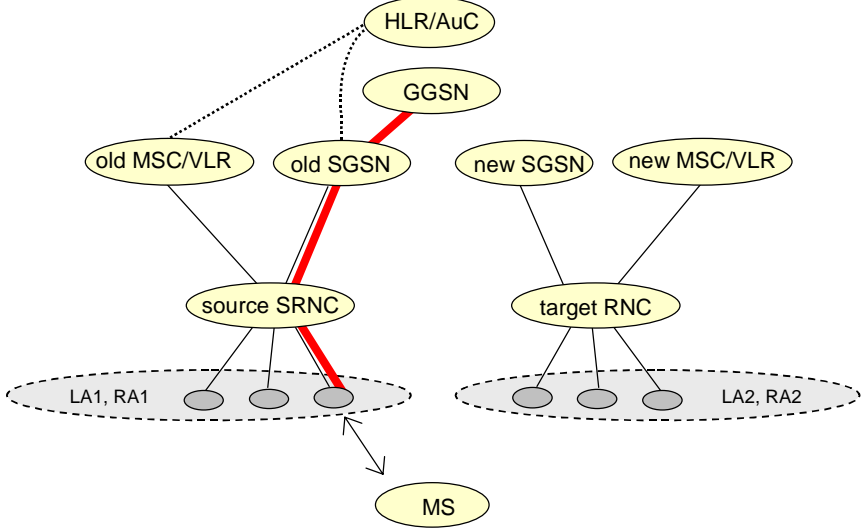
C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

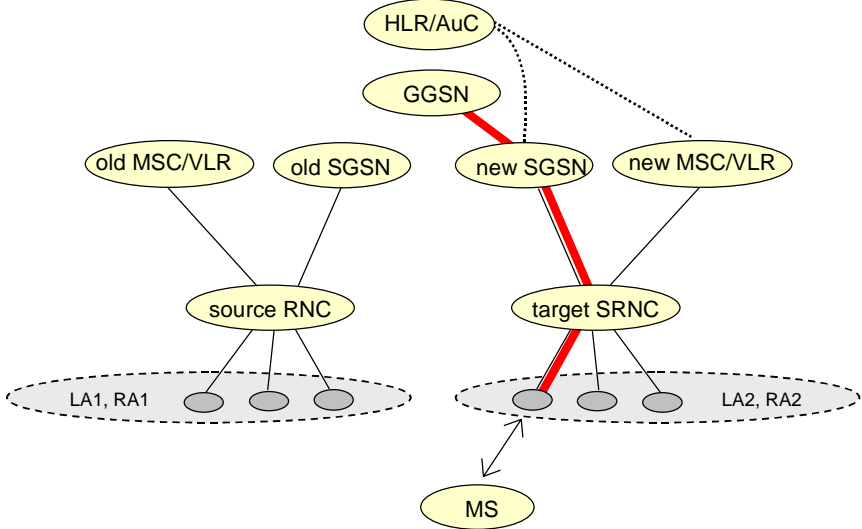This procedure is only performed for an MS in PMM-CONNECTED state.
The Combined Hard Handover and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a hard handover decided by the UTRAN. In the procedure,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

If the target RNC is connected to a different SGSN than the source SRNC, an Inter SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter SGSN Routeing Area Update procedure. Figure 2 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 3 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 2 and Figure 3 the MS is in MM IDLE state.

Figure 2: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update
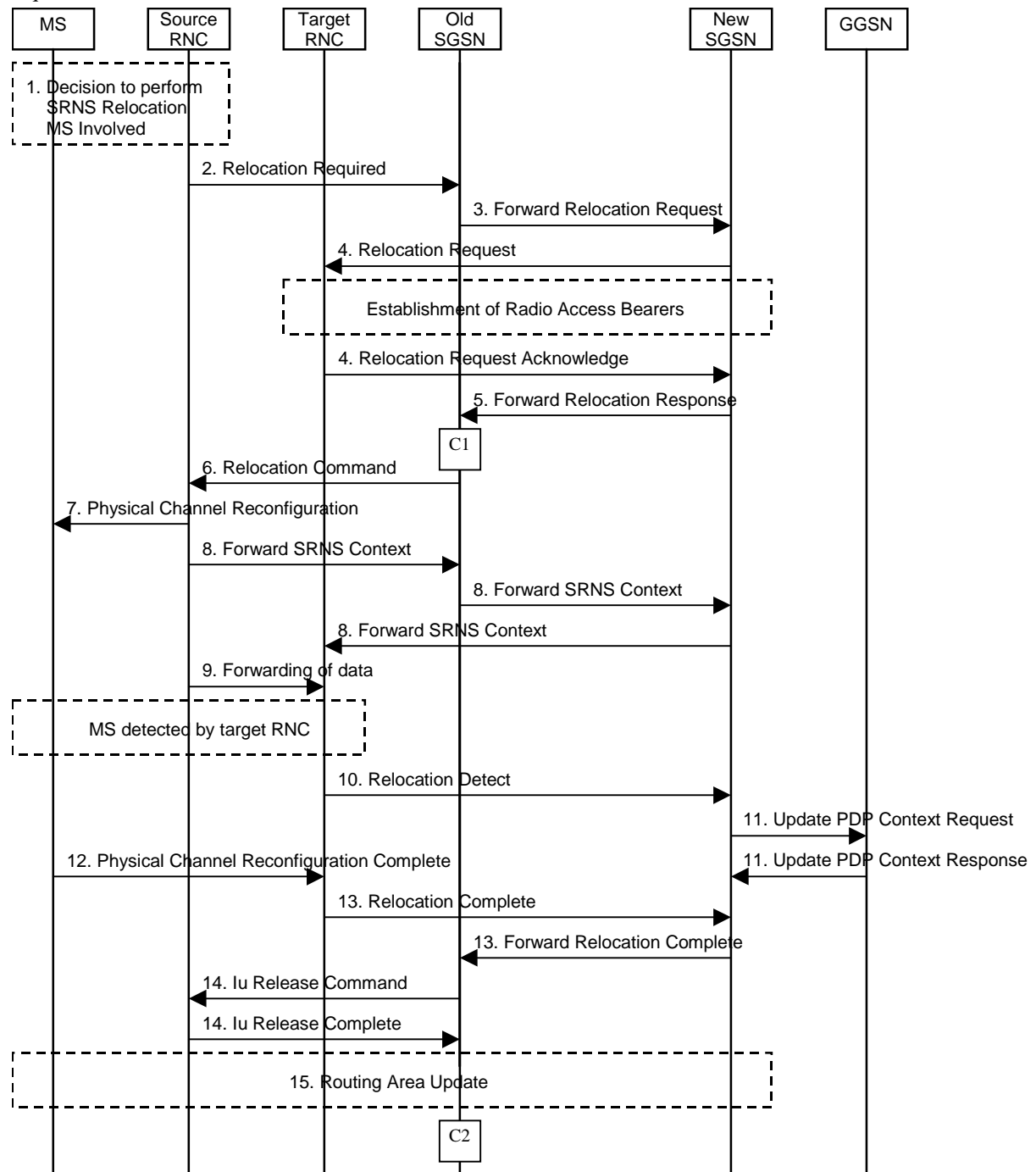
Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.

Figure 3: 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 4. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

Figure 4: Combined Hard Handover and SRNS Relocation Procedure

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

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

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

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

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. Target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN has been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the new SGSN and target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, then the source SRNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC when handover is made with switching in CN. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

The target SRNC resets and restarts the RLC connections and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

9) After having sent the Forward SRNS Context message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

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

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

12) When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

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

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

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

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

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update.

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060	CR	**166**	Current Version:	3.3.0

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

For submission to:	**SA#8**	for approval	**X**	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM		ME		UTRAN / Radio		Core Network	**X**

Source:	France Telecom (Endorsed by SA5)		**Date:**	May 2000

Subject:	Addition of charging characteristics per PDP context #.2

Work item:	

Category: F   Correction   **X**   **Release:**   Phase 2

(only one category
shall be marked
with an X)

Category			Release	
F	Correction	**X**	Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	**X**
			Release 00	

| **Reason for change:** | Currently it is possible to define for the GPRS subscribers a charging characteristics reflecting the method used to charge, e. g. normal subscription, prepaid, flat rate and/or hot billing. However , one subscriber my have different services based on different charging methods, and one service may be charged differently for different subscribers (e. g. normal and prepaid).

Therefore in order to offer more flexibility it is proposed to add charging characteristics also on PDP context basis. If both subscriber and PDP context charging characteristics are defined in subscriber's data, the PDP context will have the priority. . This CR is related to CR#168, Tdoc S2-001049. |
|---|---|

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

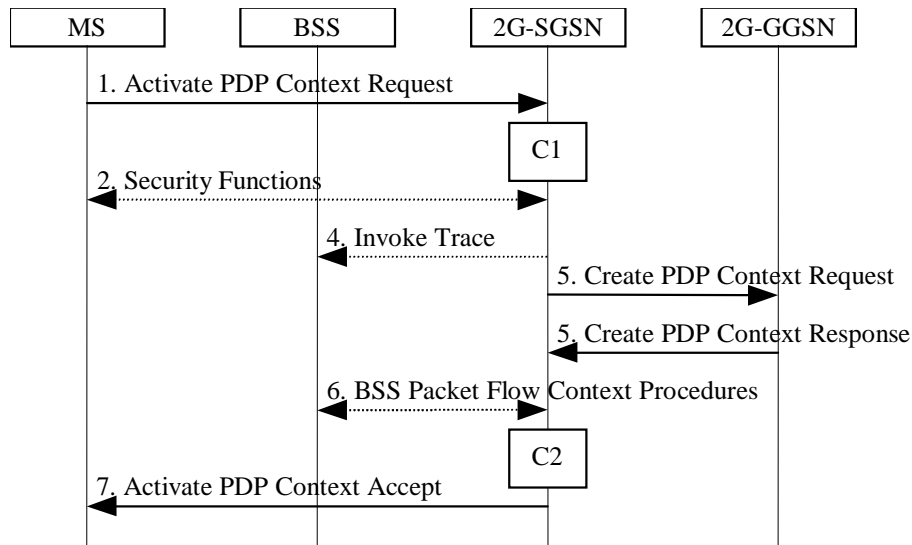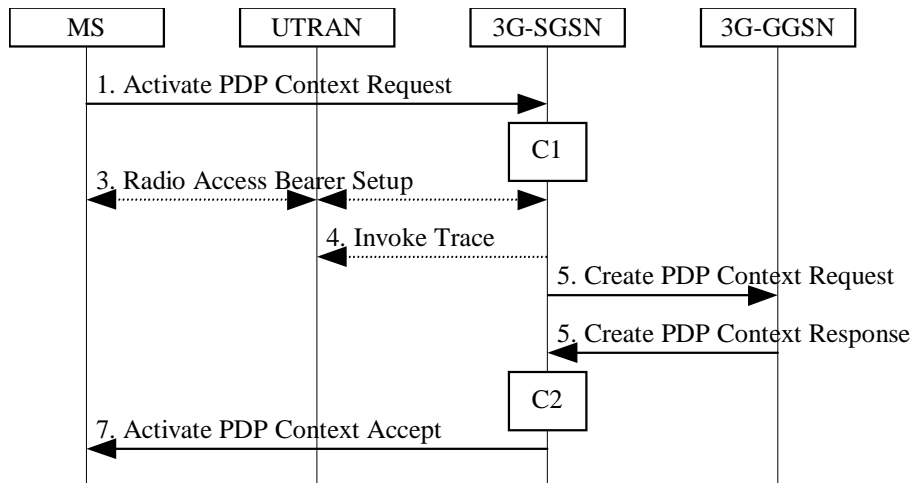| **Other specs affected:**	Other 3G core specifications	**X**	→ List of CRs:	29.060, 29.002, 23.008, 32.015
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

9.2.2   Activation Procedures

9.2.2.1   PDP Context Activation Procedure

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

Figure 1: PDP Context Activation Procedure for GSM

Figure 2: PDP Context Activation Procedure for UMTS

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

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

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

4) If BSS trace is activated, then the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS or UTRAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

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

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then 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, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, NSAPI, MSISDN, Selection Mode, Charging Characteristics, Trace Reference, Trace Type, Trigger Id, OMC Identity, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode. Charging Characteristics indicates which kind of charging the PDP context is liable for. The SGSN shall <u>derive</u> ~~copy~~ Charging Characteristics from Subscribed Charging Characteristics <u>and/or PDP context Charging Characteristics if received from the HLR as follows: if a "PDP context Charging Characteristics" is present for this PDP context, it shall be sent; otherwise if a "Subscribed Charging Characteristics" is present for this subscriber it shall be sent. If neither "PDP context Charging Characteristics" nor a "Subscribed Charging Characteristics" is present, the SGSN may choose a default Charging Characteristics which would be sent to the GGSN, and used there as well. The Charging Characteristics sent to the GGSN shall also include an indication whether it was retrieved from subscription data received from the HLR or is a default profile determined by the SGSN.</u> ~~and/or PDP context Charging Characteristics, if received from the HLR as follows: if a "PDP context Charging Characteristics" is present for this PDP context, it shall be sent; otherwise if a "Subscribed Charging Characteristics" is present for this subscriber it shall be sent. If neither "PDP context Charging Characteristics" nor a "Subscribed Charging Characteristics" is present, the SGSN may choose a default Charging Characteristics which would be sent to the GGSN. The Charging Characteristics sent to the GGSN shall also include an indication whether it was retrieved from subscription data received from the HLR or is a default profile determined by the SGSN~~. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. <u>When the Charging Characteristics sent by the SGSN have been determined by the SGSN (not retrieved from HLR subscription data), the GGSN may choose to ignore this.</u>The GGSN may further 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, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. 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, then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

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

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

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

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

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

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

C1)   CAMEL-GPRS-Activate-PDP-Context.

C2)   CAMEL-GPRS-SGSN-Create-PDP-Context.

----------------------Next modified section--------------------

13   Information Storage

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

13.1   HLR

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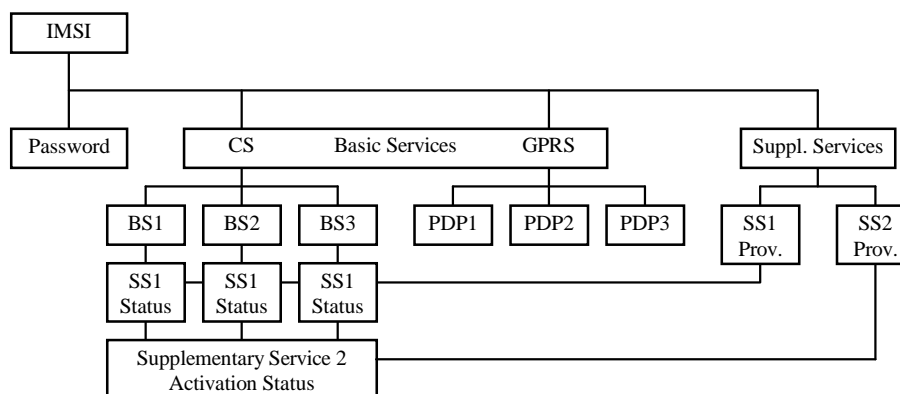
Figure 3: Packet Domain Subscription Data

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

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

Table 1: HLR Packet Domain Subscription Data

Field	Description	GSM	UMTS
IMSI	IMSI is the main reference key.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
SGSN Number	The SS7 number of the SGSN currently serving this MS.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g., normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace, e.g., MSC/BSS trace, HLR trace, and/or SGSN/GGSN/BSS trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
MS PS Purged for GPRS	Indicates that the MM and PDP contexts of the MS are deleted from the SGSN.	X	X
MNRG	Indicates that the MS is not reachable through an SGSN, and that the MS is marked as not reachable at the SGSN and possibly at the GGSN.	X	X
GGSN-list	The GSN number and optional IP address pair related to the GGSN that shall be contacted when activity from the MS is detected and MNRG is set. The GSN number shall be either the number of the GGSN or the protocol-converting GSN as described in the subclauses "MAP-based GGSN - HLR Signalling" and "GTP and MAP-based GGSN - HLR Signalling".	X	X
Each IMSI contains zero or more of the following PDP context subscription records:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP Type	PDP type, e.g., PPP or IP.	X	X
PDP Address	PDP address, e.g., an IP address. This field shall be empty if dynamic addressing is allowed.	X	X
Access Point Name	A label according to DNS naming conventions describing the access point to the external packet data network.	X	X
QoS Profile Subscribed	The quality of service profile subscribed. QoS Profile Subscribed is the default level if a particular QoS profile is not requested.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3G TS 23.016	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

13.2   SGSN

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

Table 2: SGSN MM and PDP Contexts

Field	Description	GSM	UMTS
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
Authentication Triplets	Authentication and ciphering parameters.	X	X
Authentication Vectors	Authentication and ciphering parameters for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
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 3G TS 23.016	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.	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

	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
RLC-SND	The next in-sequence RLC sequence number to be sent to the MS.		X
RLC-SNU	The next in-sequence RLC sequence number expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP context Charging Characteristics	The charging characteristics of this PDP context, e.g., normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

13.3   GGSN

GGSN maintains activated PDP contexts. Table 3 shows the PDP context fields for one PDP Address.

Table 3: GGSN PDP Context

Field	Description	GSM	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., PPP or IP.	X	X
PDP Address	PDP address, e.g., an IP address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TEID	Tunnel Endpoint Identifier.	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the SGSN.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Charging Characteristics	The charging characteristics for this PDP context, e.g., normal, prepaid, flat-rate, and/or hot billing.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X

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

-----------------------Next modified section--------------------

15   Operational Aspects

15.1   Charging

Charging information for the packet domain is collected for each MS by SGSNs and GGSNs that are serving the MS. The operator can control whether charging shall be collected in the SGSN and the GGSN on an individual MS and/or PDP context basis by appropriately setting the Subscribed Charging Characteristics and/or PDP context Charging Characteristics in the HLR. Charging characteristic shall be ignored for roaming subscribers.

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

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

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

15.1.1   Charging Information

Charging information is collected for the GPRS subscriber.

As a minimum, the SGSN shall collect the following charging information for MSs and/or individual PDP contexts that are subject to charging:

-    usage of the radio interface: the charging information shall describe the amount of data transmitted in MO and MT directions categorised with QoS and user protocols;

-    usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the packet data protocol addresses;

-    usage of the general packet domain resources: the charging information shall describe the usage of other packet domain-related resources and the MS's network activity (e.g., mobility management); and

-    location of MS: HPLMN, VPLMN, plus optional higher-accuracy location information.

As a minimum, the GGSN shall collect the following charging information for MSs and/or individual PDP contexts that are subject to charging:

-    destination and source: the charging information shall describe the destination and source addresses with a level of accuracy as defined by the packet domain operator;

-    usage of the external data networks: the charging information shall describe the amount of data sent and received to and from the external data network; and

-    usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the PDP addresses.

The RNC shall collect the following charging information for an MS's RABs when instructed by the 3G-SGSN:

-    the amount of not transferred downlink data, i.e., data that the RNC has either discarded or forwarded to a 2G-SGSN. Partially transferred packets shall be handled as not transferred. The collected charging information shall be sent by the RNC to the 3G-SGSN when a RAB is released, or when explicitly requested by the

3G-SGSN. The 3G-SGSN shall indicate at RAB setup whether data volume collection and reporting for the particular RAB is required or not.

3GPP TSG SA2 meeting #13
Berlin, Germany, 22 – 26 May 2000

Document **S2-001015**

Revised S2-000104

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060	CR	**167r1**		Current Version:	3.3.0

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

For submission to:	TSG#8	for approval	**X**	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects:
(at least one should be marked with an X)

(U)SIM [ ]   ME [ ]   UTRAN / Radio [**X**]   Core Network [**X**]

Source:	Motorola	**Date:**	24 May., 2000

Subject:	IPv6 stateless address autoconfiguration

Work item:	

Category:

(only one category shall be marked with an X)

				Release:		
F	Correction	**X**			Phase 2	
A	Corresponds to a correction in an earlier release				Release 96	
B	Addition of feature				Release 97	
C	Functional modification of feature				Release 98	
D	Editorial modification				Release 99	**X**
					Release 00	

Reason for change:

IPv6 should be supported as a subscriber address in release 99. There are three basic ways to activate a PDP context for PDP type IPv6: static IPv6 address, stateful dynamic address autoconfiguration, and stateless dynamic address autoconfiguration.

The IPv6 stateless address autoconfiguration procedure currently specified in 23.060 annex C does not provide clarity for a reader due to being separated from the appropriate section describing PDP context activation and containing incorrect way of allocating the link local address.

This CR proposes a clarified IPv6 stateless address autoconfiguration procedures that use the existing PDP Context Activation procedure for both stateful and stateless autoconfigurations, respectively. The solution currently specified in annex C with respect to stateless specification had been preserved in its principle, however, further refinement how to set local link address was added. Descriptions of both cases were moved into a new clause 9.2.2.1.1. in order to provide better clarity.

Clauses affected: 9.2.2.1.1 (new) and annex C (deleted).

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

9.2   PDP Context Activation, Modification, Deactivation and Preservation Functions

A GPRS-attached MS can initiate the activation, modification, and deactivation functions at any time for a PDP context in the MS, the SGSN, and the GGSN. A GGSN may request the activation of a PDP context to a GPRS-attached subscriber. A GGSN may initiate the deactivation of a PDP context.

NOTE: If the MS is in PMM-IDLE state, it needs to perform a service request procedure to enter the PMM-CONNECTED state before initiating these procedure.

Upon receiving an Activate PDP Context Request message or an Activate Secondary PDP Context Request message, the SGS shall initiate procedures to set up PDP contexts. The first procedure includes subscription checking, APN selection, and host configuration, while the latter procedure excludes these functions and reuses PDP context parameters including the PDP addr but except the QoS parameters. Once activated, all PDP contexts that share the same PDP address and APN shall be managed equally. At least one PDP context shall be activated for a PDP address before a Secondary PDP Context Activation procedure be initiated. When the MS performs an RA update procedure to change from a release 99 to a release 97 or 98 system, only o active PDP context per PDP address and APN shall be preserved. This PDP context is selected taking the QoS profile and NS value into account.

Upon receiving a Deactivate PDP Context Request message, the SGSN shall initiate procedures to deactivate the PDP context. When the last PDP context associated with a PDP address is deactivated, then N-PDU transfer for this PDP address is disabled.

An MS does not have to receive the (De-)Activate PDP Context Accept message before issuing another (De-)Activate PDP Context Request. However, only one request can be outstanding for every TI.

By sending a RAB Release Request or Iu Release Request message to the SGSN, UTRAN initiates the release of one or more RABs. The preservation function allows the active PDP contexts associated with the released RABs to be preserved without modification in the CN, and the RABs can then be re-established at a later stage.

9.2.1   Static and Dynamic PDP Addresses

PDP addresses can be allocated to an MS in four different ways:

- the HPLMN operator assigns a PDP address permanently to the MS (static PDP address);

- the HPLMN operator assigns a PDP address to the MS when a PDP context is activated (dynamic HPLMN PDP address);

- the VPLMN operator assigns a PDP address to the MS when a PDP context is activated (dynamic VPLMN PDP address); or

- the PDN operator or administrator assigns an IP address to the MS after a PDP context has been activated (External PDN Address Allocation).

It is the HPLMN operator that defines in the subscription whether a dynamic HPLMN or VPLMN PDP address can be used.

For every IMSI, zero, one, or more dynamic PDP address per PDP type can be assigned. For every IMSI, zero, one, or more static PDP addresses per PDP type can be subscribed to.
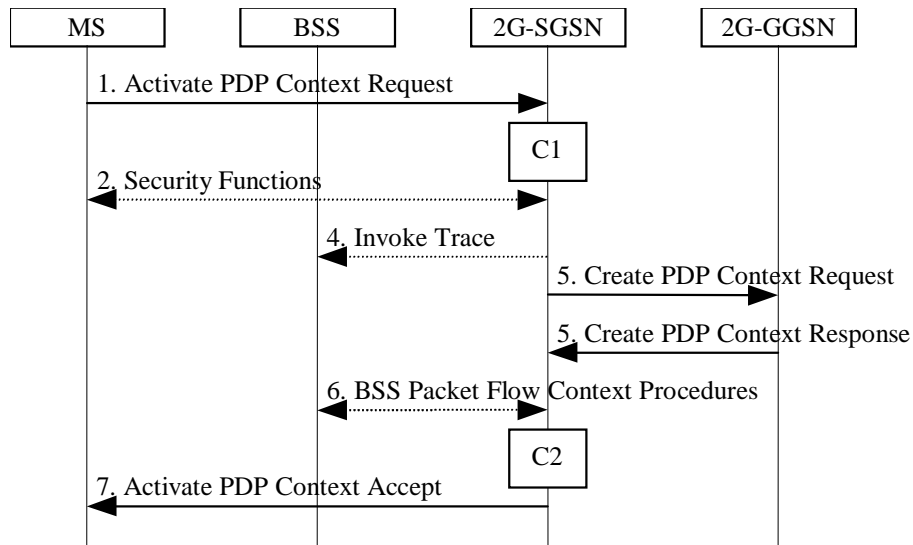
When dynamic addressing from the HPLMN or the VPLMN is used, it is the responsibility of the GGSN to allocate and release the dynamic PDP address. When External PDN Address Allocation is used, it is the responsibility of the MS and the PDN to allocate and release the dynamic PDP address by means of protocols such as DHCP or MIP. In case of DHCP, the GGSN provides the function of a DHCP Relay Agent as defined in RFC 2131 [47] and RFC 1542 [45]. In case of MIP, the GGSN provides the function of a Foreign Agent as defined in RFC 2002 [46].

Only static PDP addressing is applicable in the network-requested PDP context activation case.
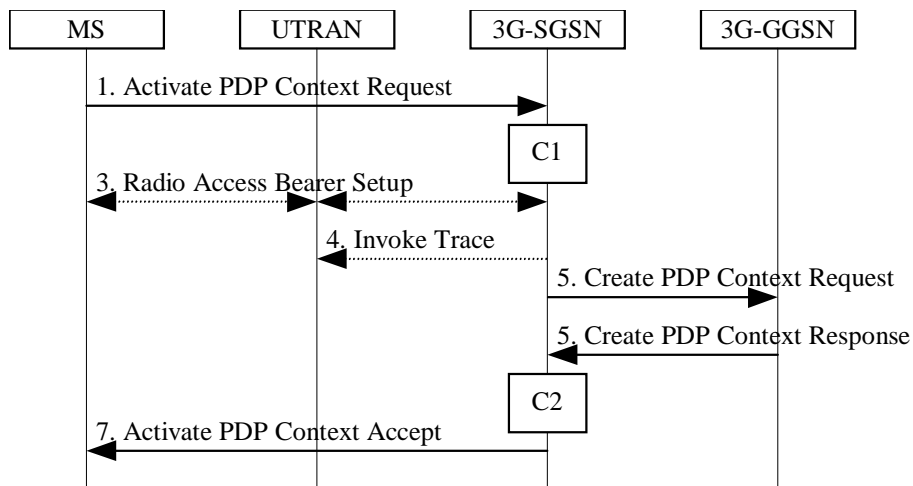
9.2.2   Activation Procedures

9.2.2.1   PDP Context Activation Procedure

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

Figure 1: PDP Context Activation Procedure for GSM

Figure 2: PDP Context Activation Procedure for UMTS

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

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

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

4) If BSS trace is activated, then the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS or UTRAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

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

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then 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, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

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

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further 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, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. 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, then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

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

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

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

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

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

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

   C1)   CAMEL-GPRS-Activate-PDP-Context.

   C2)   CAMEL-GPRS-SGSN-Create-PDP-Context.

9.2.2.1.1   IPv6 Dynamic Address Allocation

A dynamic IPv6 address can be allocated in two different ways as described in RFC 2462.

-   Stateful address autoconfiguration: Hosts obtain interface addresses and/or configuration information and parameters from a server. Servers maintain a database that keeps track of which addresses have been assigned to which hosts (e.g. a DHCP server which allocates the IPv6 address by using the standard External PDN Address Allocation procedure). The MS can request stateful allocation by means of the APN selection.

-   Stateless address autoconfiguration: A node external to the GGSN is not needed. The stateless mechanism allows a MS to generate its own addresses using a combination of locally available information and information advertised by GGSN. GGSN advertises prefixes that identify the subnet(s) associated with a link, while MS generates an "interface identifier" that uniquely identifies an interface on a subnet. An address is formed by combining the two.

9.2.2.1.1.1   IPv6 Stateful Address Autoconfiguration

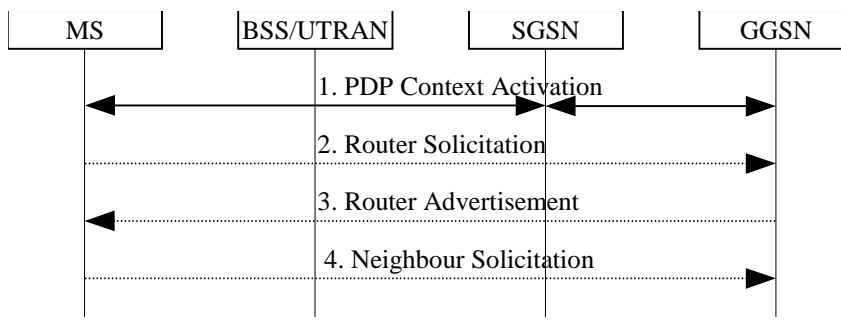The IPv6 Stateless Address Autoconfiguration procedure is illustrated in Figure 3.
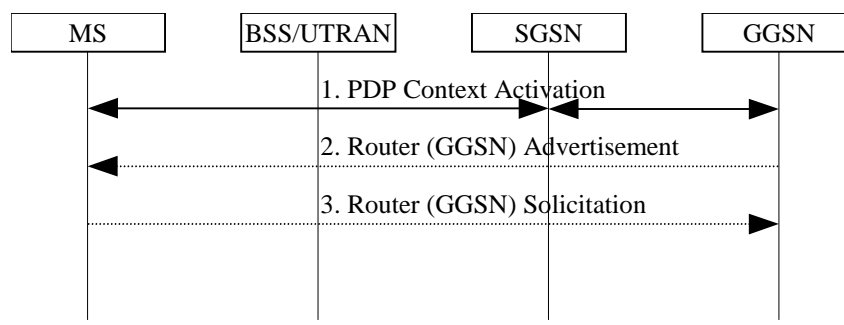
Figure 3: IPv6 Stateful Address Autoconfiguration Procedure

1.   The MS sends an Activate PDP Context Request message to the SGSN, see subclause "PDP Context Activation Procedure". The MS shall set PDP Type to IPv6 and leave PDP Address empty. The PDP Context Request message shall use APN to request stateful allocation. The SGSN sends a Create PDP Context Request message to the GGSN. The GGSN shall generate the complete Ipv6 address. The GGSN shall perform the duplicate address detection prior to sending it in the PDP Address information element in the Create PDP Context Response message.

2.   The GGSN should periodically send the Router Advertisement message after the PDP context is activated. In release 99 the GGSN shall be configured to advertise only one network prefix After the MS has received the Router Advertisement message, it verifies its already assigned site-local and global IPv.6 addresses.

3.   The MS shall send a Router Solicitation message to the GGSN. If required, the GGSN shall update the PDP context in the SGSN with the full IPv6 address, see subclause "GGSN-Initiated PDP Context Modification Procedure".

9.2.2.1.1.2   IPv6 Stateless Address Autoconfiguration

The IPv6 Stateless Address Autoconfiguration procedure is illustrated in Figure 4.

**Figure 4: IPv6 Stateless Address Autoconfiguration Procedure**

1.   The MS sends an Activate PDP Context Request message to the SGSN, see subclause "PDP Context Activation Procedure". The MS shall set PDP Type to IPv6 and fill PDP Address field with the link-local segment of the address.and shall send a Create PDP Context Request message to the GGSN. The link local address consists of a fixed 10-bit prefix (IPv6 well-known link-local prefix), zero or more 0 bits, and the interface identifier. The link local address may be generated from the Node Serial Number (or other node-specific token) [e.g. in GPRS the IMEI] or be implementation specific. The link-unique interface identifier should be generated in a manner that it does not change after a reconnect of an MS or if MS are added or deleted from the GPRS.

2.   The MS shall send a Router Solicitation message to the GGSN. Upon receipt of a Router Solicitation message, the GGSN shall return a Router Advertisement (Network Prefix) message to the MS. if required.

3.   The GGSN should automatically send the Router Advertisement message after the PDP context is activated. In release 99 the GGSN shall be configured to advertise only one network prefix. After the MS has received the Router Advertisement message, it constructs its site-local and global IPv6 addresses and is ready to start communication with the Internet.

4.   The MS may send a Neighbour Solicitation message to the network to make sure that the IPv6 address it has is unique. The GGSN shall intercept and discard the message. GGSN shall update the PDP context in the SGSN with the full IPv6 address, see subclause "GGSN-Initiated PDP Context Modification Procedure"

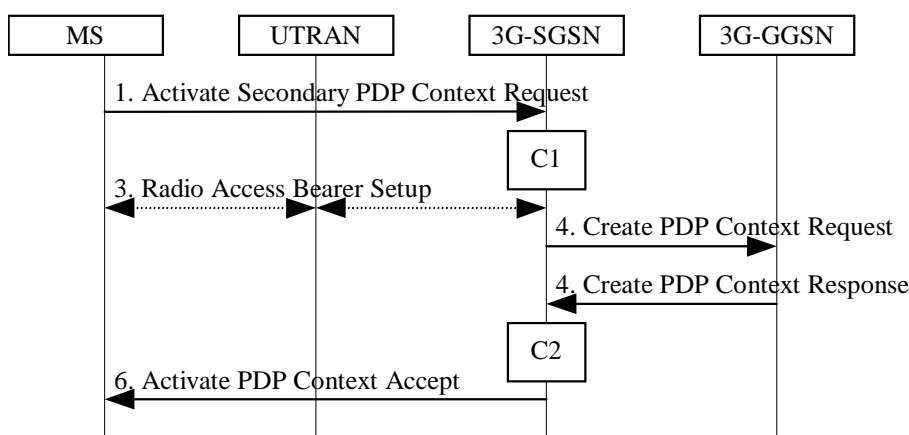## 9.2.2.1.2₁   Secondary PDP Context Activation Procedure

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. Each PDP context sharing the same PDP address and APN shall be identified by a unique TI and a unique NSAPI.

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

The Secondary PDP Context Activation procedure may only be initiated after a PDP context is already activated for the same PDP address and APN. The procedure is illustrated in Figure 4. Each step is explained in the following list.
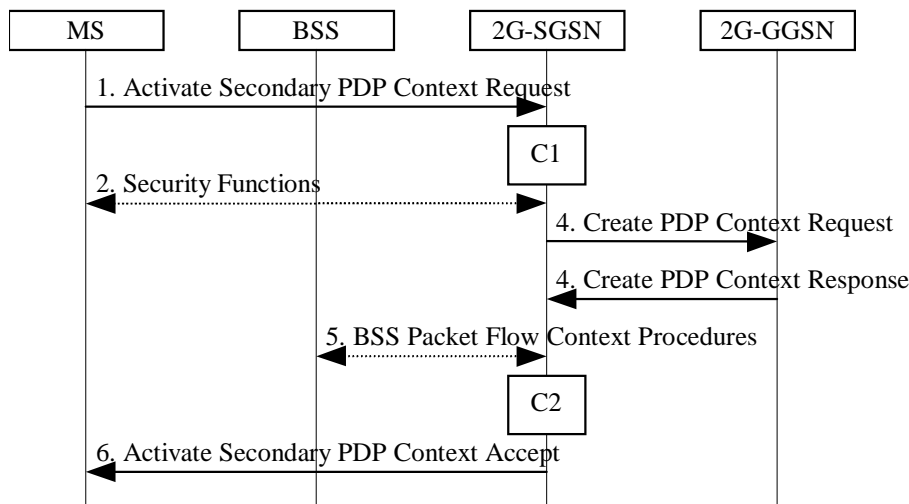
Figure 4: Secondary PDP Context Activation Procedure for GSM

Figure 5: Secondary PDP Context Activation Procedure for UMTS

1) The MS sends an Activate Secondary PDP Context Request (Linked TI, NSAPI, TI, QoS Requested, TFT) message to the SGSN. Linked TI indicates the TI value assigned to any one of the already activated PDP contexts for this PDP address and APN. QoS Requested indicates the desired QoS profile. TFT is sent transparently through the SGSN to the GGSN to enable packet classification for downlink data transfer. TI and NSAPI contain values not used by any other activated PDP context.

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

3) In UMTS, RAB setup is done by the RAB Assignment procedure.

4) 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TEID, NSAPI, Primary NSAPI, TFT) message to the affected GGSN. Primary NSAPI indicates the NSAPI value assigned to any one of the already activated PDP contexts for this PDP address and APN. TFT is included only if received in the Activate Secondary PDP Context Request message. The GGSN uses the same external network as used by the already-activated PDP context(s) for that PDP address, generates a new entry in its PDP context table, and stores the TFT. The new entry allows the GGSN to route PDP PDUs via different GTP tunnels between the SGSN and the external PDP network. The GGSN returns a Create PDP Context Response (TEID, QoS Negotiated, Cause) message to the SGSN.

5) In GSM, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

6) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS via different GTP tunnels and possibly different LLC links.

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

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

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

C1)   CAMEL-GPRS-Activate-PDP-Context.

C2)   CAMEL-GPRS-SGSN-Create-PDP-Context.

Annex C (normative):
IPv6 Stateless Address Autoconfiguration Procedure

IPv6 address allocation is somewhat different from the IPv4 address allocation procedure. There are two possibilities to allocate the address for an IPv6 node – stateless and stateful autoconfiguration. The stateful address allocation mechanism needs a DHCP server to allocate the address for the IPv6 node. In the stateless autoconfiguration, the IPv6 node is more involved in the allocation of the address. In addition, the stateless autoconfiguration procedure does not need any external entity involved in the address autoconfiguration.

IPv6 stateful address autoconfiguration uses the standard External PDN Address Allocation procedure. The MS requests stateful address autoconfiguration by using an Access Point Name referring to that service.

The IPv6 Stateless Address Autoconfiguration procedure is illustrated in Figure C.1.
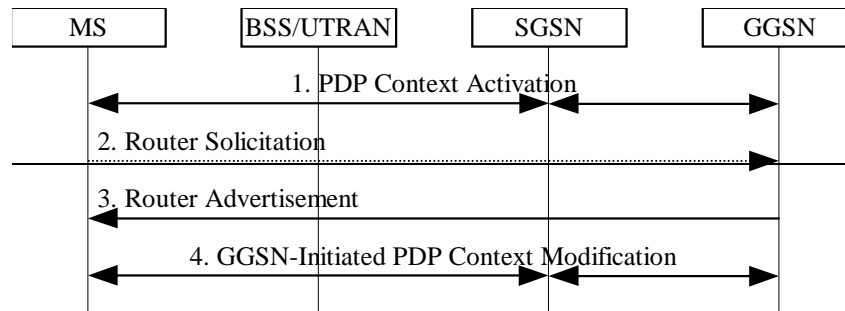
Figure C.1: IPv6 Stateless Address Autoconfiguration Procedure

1) The MS sends an Activate PDP Context Request message to the SGSN, see subclause "PDP Context Activation Procedure". The MS shall leave PDP Address empty and set PDP Type to IPv6. Otherwise, the PDP context activation is as for PDP type IPv4. The SGSN validates the Activate PDP Context Request message. The Create PDP Context procedure from the SGSN side is as defined for PDP type IPv4 except that only dynamic address allocation shall be used.

   The GGSN shall create the link-local address for the MS and send it in the PDP Address information element in the Create PDP Context Response message. The link local address consists of a fixed 10-bit prefix (IPv6 well-known link-local prefix), zero or more 0 bits, and the interface identifier. Otherwise, the procedure is as defined for PDP type IPv4.

2) The MS may send a Router Solicitation message to the GGSN to activate the sending of the Router Advertisement message.

3) The GGSN should automatically send the Router Advertisement message after the PDP context is activated. In release 99 the GGSN shall be configured to advertise only one network prefix.

   After the MS has received the Router Advertisement message it constructs its full IPv6 address and is ready to start communicating to the Internet.

   The MS may send a Neighbour Solicitation message to the network to make sure that the IPv6 address it has is unique. The GGSN shall intercept and discard any such message.

4) The GGSN updates the PDP context in the SGSN with the full IPv6 address, see subclause "GGSN Initiated PDP Context Modification Procedure".

CHANGE REQUEST		*Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.*

23.060 CR **168**   Current Version:

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

For submission to:	SA#8	for approval	**X**	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

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

Source:	Motorola and T-Mobil	**Date:**	May 2000

Subject:	Addition of charging characteristics per PDP context #1

Work item:	

Category:	F	Correction		**X**	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release				Release 96	
(only one category	B	Addition of feature				Release 97	
shall be marked	C	Functional modification of feature				Release 98	
with an X)	D	Editorial modification				Release 99	**X**
						Release 00	

Reason for change:	Currently it is possible to define for the GPRS subscribers a charging characteristics reflecting the method used to charge, e. g. normal subscription, prepaid, flat rate and/or hot billing. However , one subscriber my have different services based on different charging methods, and one service may be charged differently for different subscribers (e. g. normal and prepaid).
	Therefore in order to offer more flexibility it is proposed to add charging characteristics also on PDP context basis. If both subscriber and PDP context charging characteristics are defined in subscriber's data, the PDP context will have the priority. The charging characteristics on the GPRS subscription and individually subscribed APNs is specified in TS 32.015.

Clauses affected:	2.0, 9.2.2.1.

Other specs affected:	Other 3G core specifications	**X**	→ List of CRs:	29.060, 29.002, 23.008, 32.015
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

2   References

[All references need to be checked once release 99 stabilises.]

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

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

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

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

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

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

[5b]   3G TS 23.016: "Subscriber Data Management; Stage 2".

[6]   GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[7]   GSM 03.22: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

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

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

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

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

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

[13]   3G TS 24.008: "Mobile radio interface layer 3 specification; Core Network Protocols – Stage 3".

[14]   GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".

[15]   GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station – Serving GPRS Support Node (MS - SGSN) Logical Link Control (LLC) layer specification".

[16]   GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[16b]   GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[17]   3G TS 27.060: "General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS".

[18]   GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification".

[19]   GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".

[20]   GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".

[21]   GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[22]   GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

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

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

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

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

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

[27b]   3G TS 29.078: "3rd Generation Partnership Project; Customised Applications for Mobile Network Enhanced Logic (CAMEL) Phase 3; CAMEL Application Part (CAP) Specification".

[28]   GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[28a]   GSM 12.15: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS Charging".

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

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

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

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

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

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

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

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

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

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

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

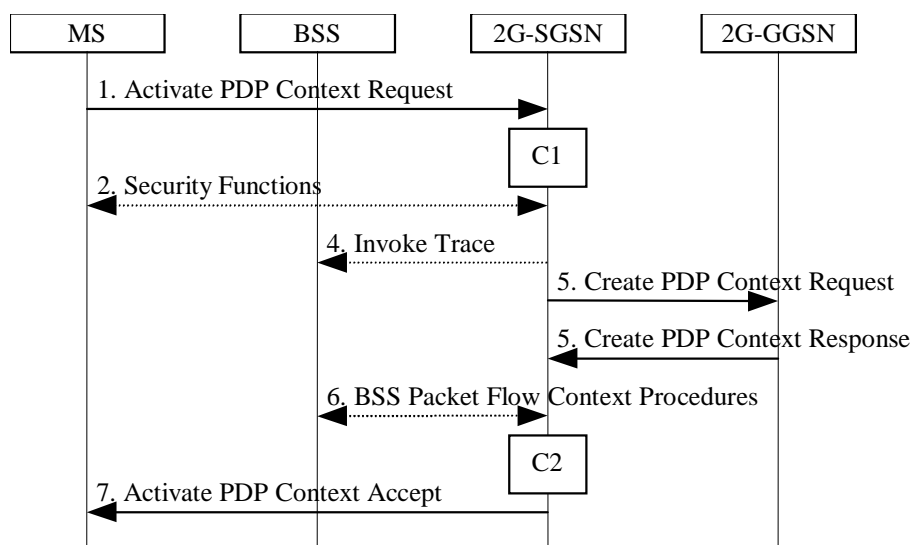[44]   IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[66]   Void

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

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

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

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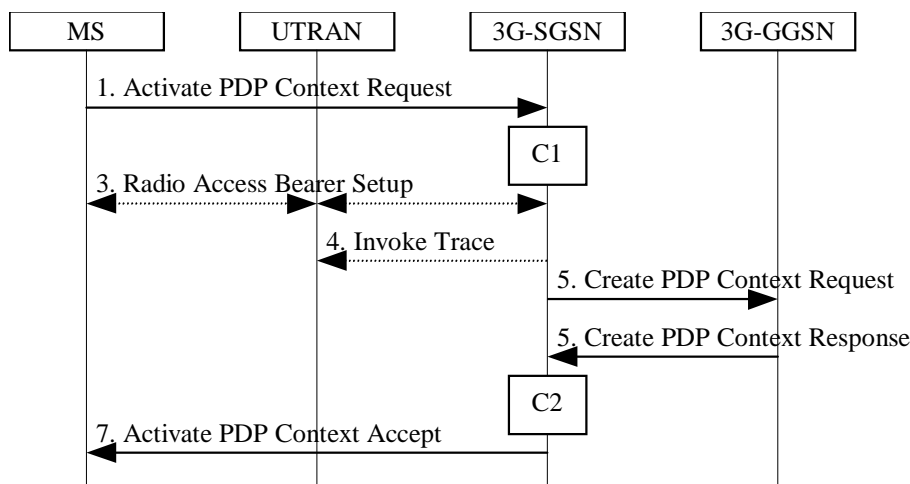
9.2.2   Activation Procedures

9.2.2.1   PDP Context Activation Procedure

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

Figure 1: PDP Context Activation Procedure for GSM

Figure 2: PDP Context Activation Procedure for UMTS

1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate

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

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

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

4) If BSS trace is activated, then the SGSN shall send an Invoke Trace (Trace Reference, Trace Type, Trigger Id, OMC Identity) message to the BSS or UTRAN. Trace Reference, and Trace Type are copied from the trace information received from the HLR or OMC.

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

   If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then 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, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

   The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, NSAPI, MSISDN, Selection Mode, Charging Characteristics, Trace Reference, Trace Type, Trigger Id, OMC Identity, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode. Charging Characteristics indicates which kind of charging the PDP context is liable for. The SGSN shall deduce Charging Characteristics from Subscribed Charging Characteristics and/or PDP context Charging Characteristics if received from the HLR as follows: if a "PDP context Charging Characteristics" is present for this PDP context, it shall be sent; otherwise if a "Subscribed Charging Characteristics" is present for this subscriber it shall be sent. If neither "PDP context Charging Characteristics" nor a "Subscribed Charging Characteristics" is present, the SGSN may choose a default Charging Characteristics which would be sent to the GGSN. The Charging Characteristics sent to the GGSN shall also include an indication whether it was retrieved from subscription data received from the HLR or is a default profile determined by the SGSN. The SGSN shall include Trace Reference, Trace Type, Trigger Id, and OMC Identity if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace information received from the HLR or OMC.

   The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. When the Charging Characteristics sent by the SGSN have been determined by the SGSN (not retrieved from HLR subscription data), the GGSN may choose to ignore this. The charging characteristics on the GPRS subscription and individually subscribed APNs is specified in 3G TS 32.015 [70]. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PD P Context Response (TEID, PDP Address, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. 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, then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

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

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

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

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

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

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

C1)   CAMEL-GPRS-Activate-PDP-Context.

C2)   CAMEL-GPRS-SGSN-Create-PDP-Context.