Technical Specification Group Services and System Aspects ***TSGS#11(01)0116***

Meeting #11, Palm Springs, USA, 19-22 March 2001

Source: **TSG SA WG2**
Title: **CRs on 03.60 v.7.5.0 and 23.060 v.3.6.0**
Agenda Item: **7.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #11.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

CRs applicable to several Releases

SA2 meeting	S2 Tdoc #	Source	Title	Spec	CR #	cat	Rel	WI
S2#17	S2-010706	SA2	Failure of Update GPRS Location when HLR is not reachable	03.60	A199	F	97	
S2#17	S2-010707	SA2	Failure of Update GPRS Location when HLR is not reachable	03.60	A200	A	98	
S2#17	S2-010708	SA2	Failure of Update GPRS Location when HLR is not reachable	23.060	217	A	99	

CRs applicable to Release 99

SA2 meeting	S2 Tdoc #	Source	Title	Spec	CR #	cat	Rel	WI
S2#14	S2-001530	SA2	Details on CAMEL interworking with SGSN (SGSN CAMEL procedures)	23.060	169	F	99	
S2#16	S2-010123	SA2	MS permanent (static) PDP address allocation by External PDN/correction	23.060	183r2	F	99	
S2#17	S2-010720	SA2	Suspend/Resume at Intersystem change	23.060	186r3	F	99	
S2#16	S2-010286rev1	SA2	Clarification of TFT request during secondary PDP context activation.	23.060	200r1	F	99	
S2#16	S2-010284	SA2	Correction on PDCP Conversion at inter and intra SGSN inter system change UMTS-GSM	23.060	204r1	F	99	
S2#16	S2-010171	SA2	Correction to Annex A, SDL-diagram on the rules applied upon PDP context activation to determine the APN and the corresponding GGSN	23.060	205	F	99	
S2#17	S2-010507	SA2	Connection re-establishment on forward handover without Iur	23.060	209r2	F	99	
S2#17	S2-010799	SA2	Clarification of subscribed QoS	23.060	212r1	F	99	
S2#17	S2-010731	SA2	Handling of user data during the SRNS relocation procedure	23.060	215r1	F	99	
S2#17	S2-010721	SA2	Clarification of Error Indication procedure	23.060	216r1	F	99	
S2#16	S2-001917	SA2	Correction to the relocation procedure	23.060	218 (was 183r1)	F	99	

CR applicable to Release 4(to be implemented on the version of 23.060 which includes all the other CRs presented here)

SA2 meeting	S2 Tdoc #	Source	Title	Spec	CR #	cat	Rel	WI
S2#16	S2-010104	SA2	Add new feature ODB for Packet Oriented Services	23.060	202	B	4	ODB

3GPP TSG SA 2 **Tdoc S2-010706**
Gothenberg, 26/2-2/3/01

~~**3GPP TSG-CN4 Meeting #06**~~ **Tdoc N4-010091**
~~**BEIJING, CHINA 15th 19th January 2001**~~

CR-Form-v3

CHANGE REQUEST

⌘ **03.60** **CR** A199 ⌘ rev **-** ⌘ Current version: **6.7.0** ⌘

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

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

Title:	⌘	Failure of Update GPRS Location when HLR is not reachable
Source:	⌘	Vodafone UK Ltd
Work item code:	⌘	GPRS R97
Date:	⌘	5 Jan 2001
Category:	⌘	**F** (critical correction)
Release:	⌘	R97

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Returning "Roaming Not Allowed" if the HLR is not reachable can cause undesirable behaviour of the MS which tries to register in an SGSN when a GPRS roaming agreement has not been set up between the HPLMN and VPLMN operators
Summary of change:	⌘	Show the handling of the error "Unknown HLR"
Consequences if not approved:	⌘	Unnecessary denial of CS service to GPRS capable MSs

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2		
Other specs affected:	⌘	X Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	GSM 09.02
Other comments:	⌘			

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

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

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

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

6.9.1.2.2 Inter SGSN Routeing Area Update

...

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

...

**** Next modified section ****

6.9.1.3.2 Combined Inter SGSN RA / LA Update

...

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

...

3GPP TSG SA 2 **Tdoc S2-010707**
Gothenberg, 26/2-2/3/01
~~**3GPP TSG-CN4 Meeting #06**~~ **Tdoc N4-010092**
~~**BEIJING, CHINA 15th 19th January 2001**~~

CR-Form-v3

CHANGE REQUEST

⌘ **03.60** **CR** A200 ⌘ rev **-** ⌘ Current version: **7.5.0** ⌘

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

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

Title:	⌘	Failure of Update GPRS Location when HLR is not reachable
Source:	⌘	Vodafone UK Ltd
Work item code:	⌘	GPRS R97
Date:	⌘	5 Jan 2001
Category:	⌘	**A**
Release:	⌘	R98

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	Returning "Roaming Not Allowed" if the HLR is not reachable can cause undesirable behaviour of the MS which tries to register in an SGSN when a GPRS roaming agreement has not been set up between the HPLMN and VPLMN operators
Summary of change:	⌘	Show the handling of the error "Unknown HLR"
Consequences if not approved:	⌘	Unnecessary denial of CS service to GPRS capable MSs

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2		
Other specs affected:	⌘	☒ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	GSM 09.02
Other comments:	⌘			

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

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

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

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

6.9.1.2.2 Inter SGSN Routeing Area Update

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

...

**** Next modified section ****

6.9.1.3.2 Combined Inter SGSN RA / LA Update

...

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

...

3GPP TSG-SA-WG2

Bristol, UK
4th - 8th of September 2000

Tdoc 3GPP S2-001530 (Revised from S2-001353)

3GPP TSG-SA-WG2
Bristol, UK
4th - 8th of September 2000

Tdoc 3GPP S2-001353

3GPP TSG-CN-WG2#13
Seattle, Washington USA
28th of August - 1st of September 2000

Tdoc 3GPP N2-000429 rev N2-000401

CHANGE REQUEST

23.060	CR r1	169	Current Version:	3.4.0

For submission to:	~~CN # 09~~ SA #09	for approval	X	strategic	
		for information	~~X~~	non-strategic	

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

Source: Alcatel **Date:** 31 August 2000

Subject: Details on CAMEL interworking with SGSN (SGSN CAMEL procedures)

Work item: CAMEL Phase 3

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:

23.060 defines the CAMEL triggering points either TDPs or EDPs with C1, C2 and C3.

The purpose of this CR is to align 23.060 with the SGSN procedures already defined in 23.078 version 3.5.0 (as modified by CRs approved in N2), paragraph 6.5.2 “handling GPRS in the SGSN” and paragraph 7.5.2.1 “Handling of mobile originating SMS in the originating MSC/SGSN”

The procedures specific to CAMEL are the following:

- Procedure CAMEL_GPRS_Attach;

- Procedure CAMEL_GPRS_Detach;
- Procedure CAMEL_GPRS_Routeing_Area_Update_Session;
- Procedure CAMEL_GPRS_Routeing_Area_Update_Context;
- Procedure CAMEL_GPRS_PDP_Context_Establishment;
- Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement;
- Procedure CAMEL_GPRS_Change_Of_QoS;
- Procedure CAMEL_GPRS_PDP_Context_Disconnection.
- Procedure CAMEL_O_SMS_INIT;
- Procedure CAMEL_O_SMS_SUBMITTED;
- Procedure CAMEL_O_SMS_FAILURE.

Clauses affected: 6.5.3, 6.6.1, 6.6.2, 6.9.1.2.1 6.9.1.2.2, 6.9.1.3.1, 6.9.1.3.2, 6.9.2.1, 6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3, 6.11.1, 6.13.1.1, 6.13.1.2,6.13.2.1,6.13.2.2,9.2.2, 9.2.2.1.1, 9.2.3.1, 9.2.3.2, 9.2.3.3, 9.2.4.1, 9.2.4.2, 9.2.4.3, 15.1, 16.1.1.2

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: 3GPP TSG-CN-WG2 have endorsed thisTDoc at their 3GPP TSG-CN-WG2#13 meeting.

— First modified section in paragraph 6.5.3 GPRS attach function —

6.5.3 Combined GPRS / IMSI Attach Procedure

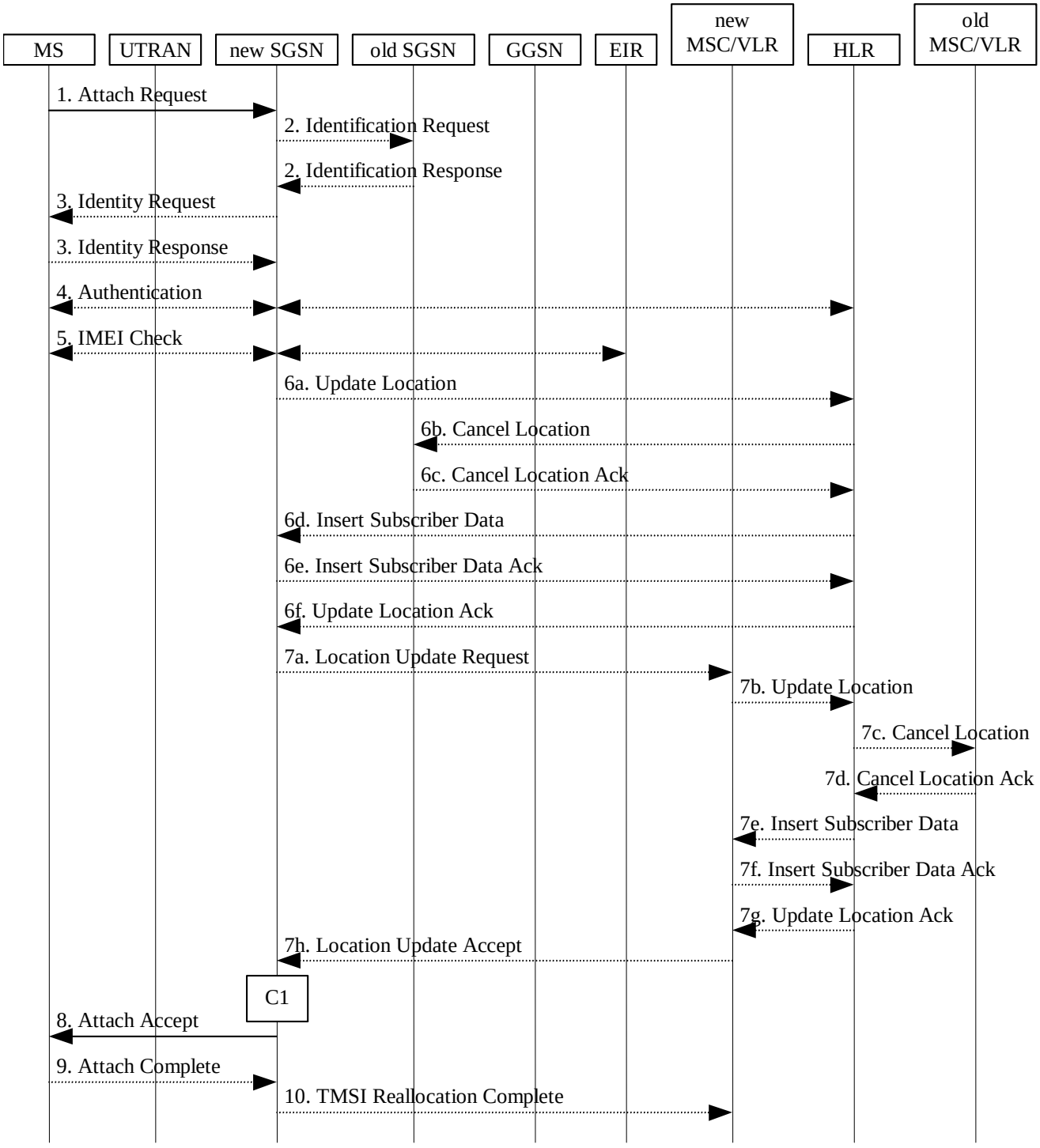


Figure 21: Combined GPRS / IMSI Attach Procedure

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

C1) ~~CAMEL_GPRS_Attach~~CAMEL_GPRS_Attach

In this figure the procedure returns as result “Continue”.

— Second modified section in paragraph 6.6.1 MS initiated Detach —

6.6.1 MS-Initiated Detach Procedure

The MS-Initiated Detach procedure when initiated by the MS is illustrated in Figure 22.

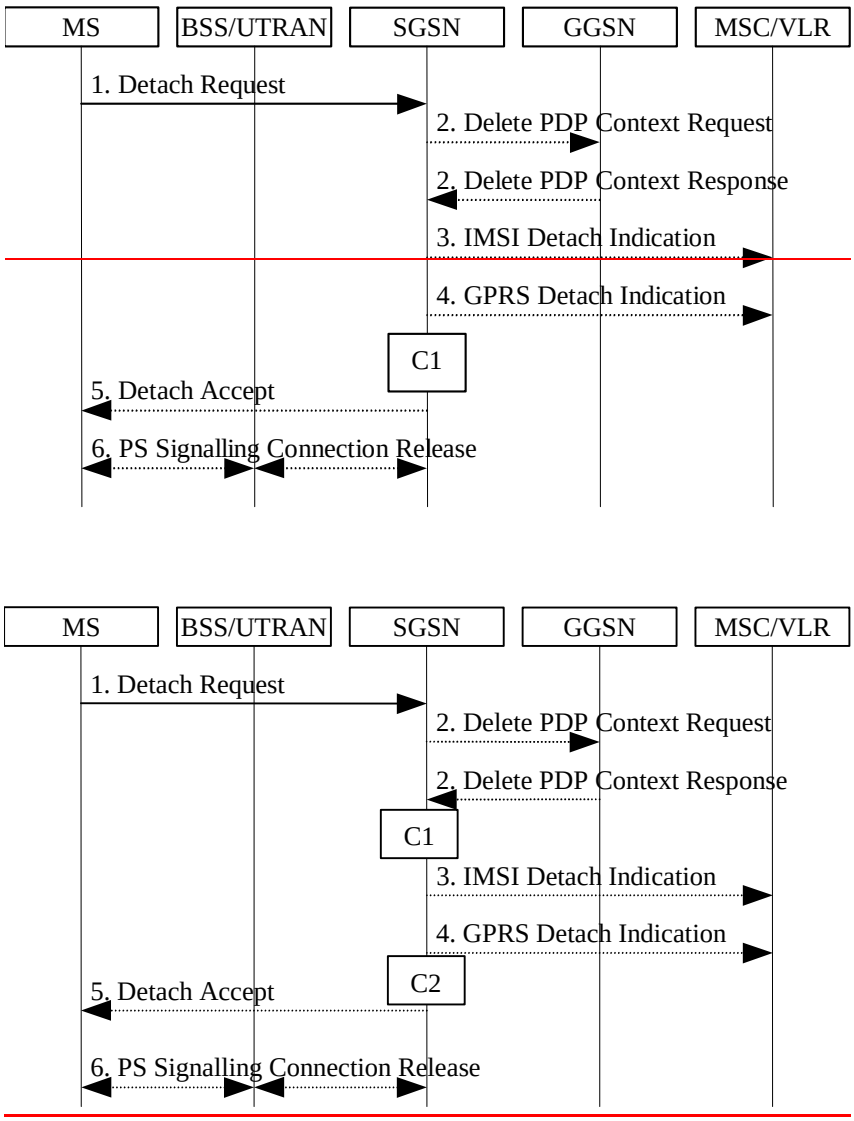


Figure 22: MS-Initiated Combined GPRS / IMSI Detach Procedure

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

C1) CAMEL_GPRS_PDP_Context_Disconnection.

This procedure is called several times: once per PDP context. The procedure returns as result “Continue”.

C21) ~~CAMEL_GPRS_Detach~~CAMEL_GPRS_Detach.

The procedure returns as result “Continue”.

— 3rd modified section in paragraph 6.6.2 NW initiated Detach —

6.6.2 Network-Initiated Detach Procedure

6.6.2.1 SGSN-Initiated Detach Procedure

The SGSN-Initiated Detach procedure when initiated by the SGSN is illustrated in Figure 23.

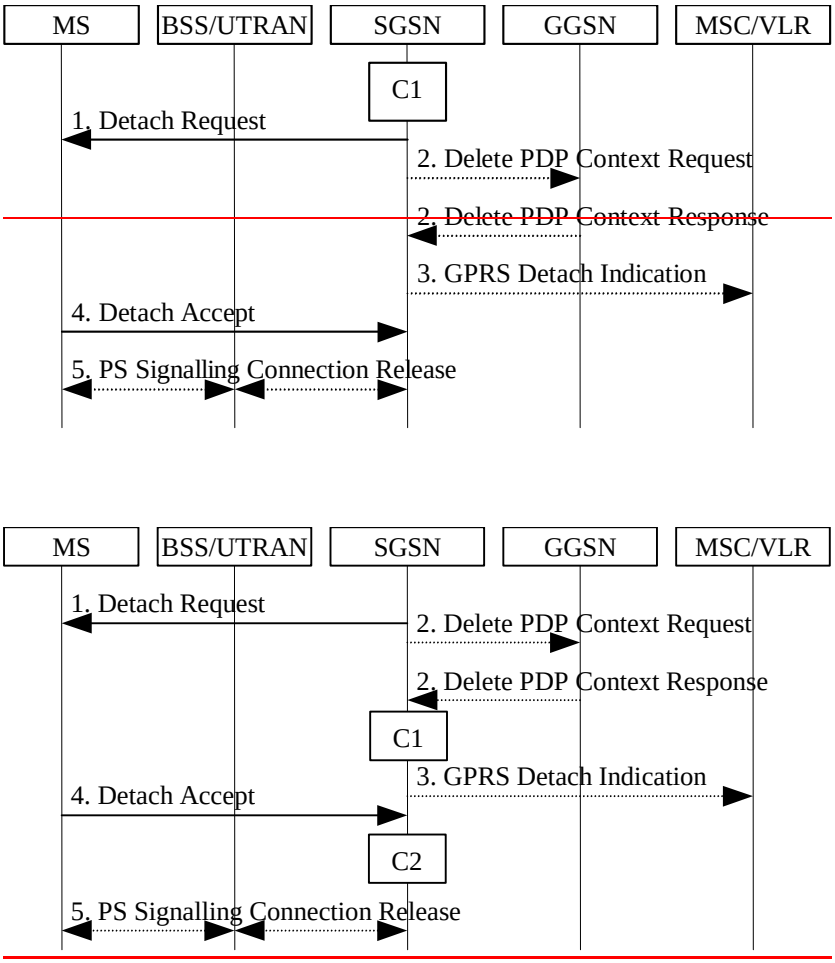


Figure 23: SGSN-Initiated GPRS Detach Procedure

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

C1) CAMEL_GPRS_PDP_Context_Disconnection.

This procedure is called several times: once per PDP context. The procedure returns as result “Continue”.

C2~~1~~) ~~CAMEL-GPRS-Detach~~CAMEL_GPRS_Detach.

The procedure returns as result “Continue”.

6.6.2.2 HLR-Initiated Detach Procedure

The HLR-Initiated Detach procedure is initiated by the HLR. The HLR uses this procedure for operator-determined purposes to request the removal of a subscriber's MM and PDP contexts at the SGSN. The HLR-Initiated Detach Procedure is illustrated in Figure 24.

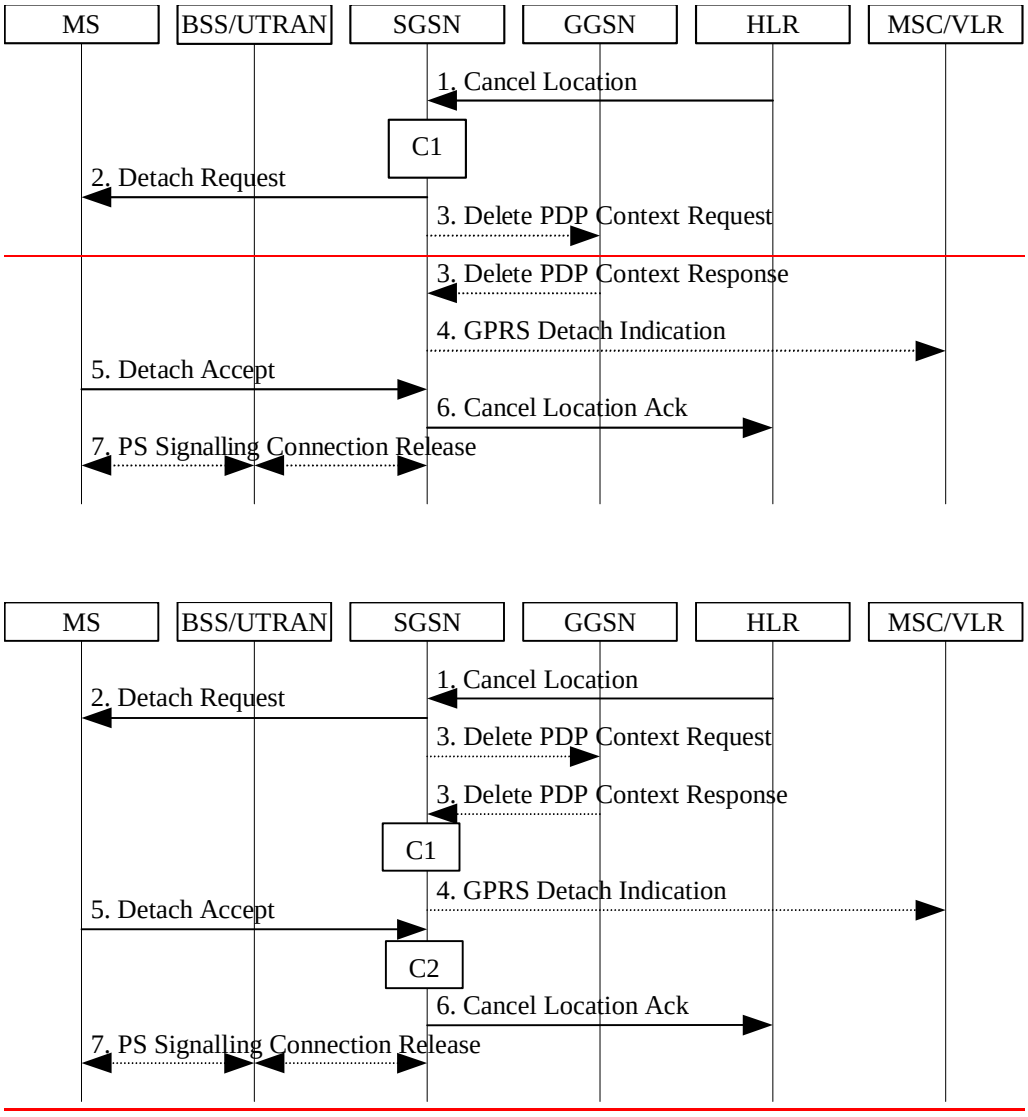


Figure 24: HLR-Initiated GPRS Detach Procedure

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

C1) CAMEL_GPRS_PDP_Context_Disconnection.

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

C2~~1~~) ~~CAMEL_GPRS_Detach~~CAMEL_GPRS_Detach.

The procedure returns as result "Continue".

— 4th modified section in paragraph 6.9.1.2.1 Intra SGSN Routeing Area Update —

6.9.1.2.1 Intra SGSN Routeing Area Update

The Intra SGSN Routeing Area Update procedure is illustrated in Figure 31.

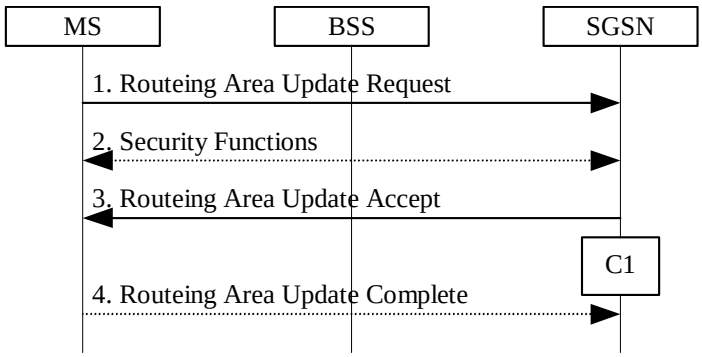


Figure 31: Intra SGSN Routeing Area Update Procedure

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

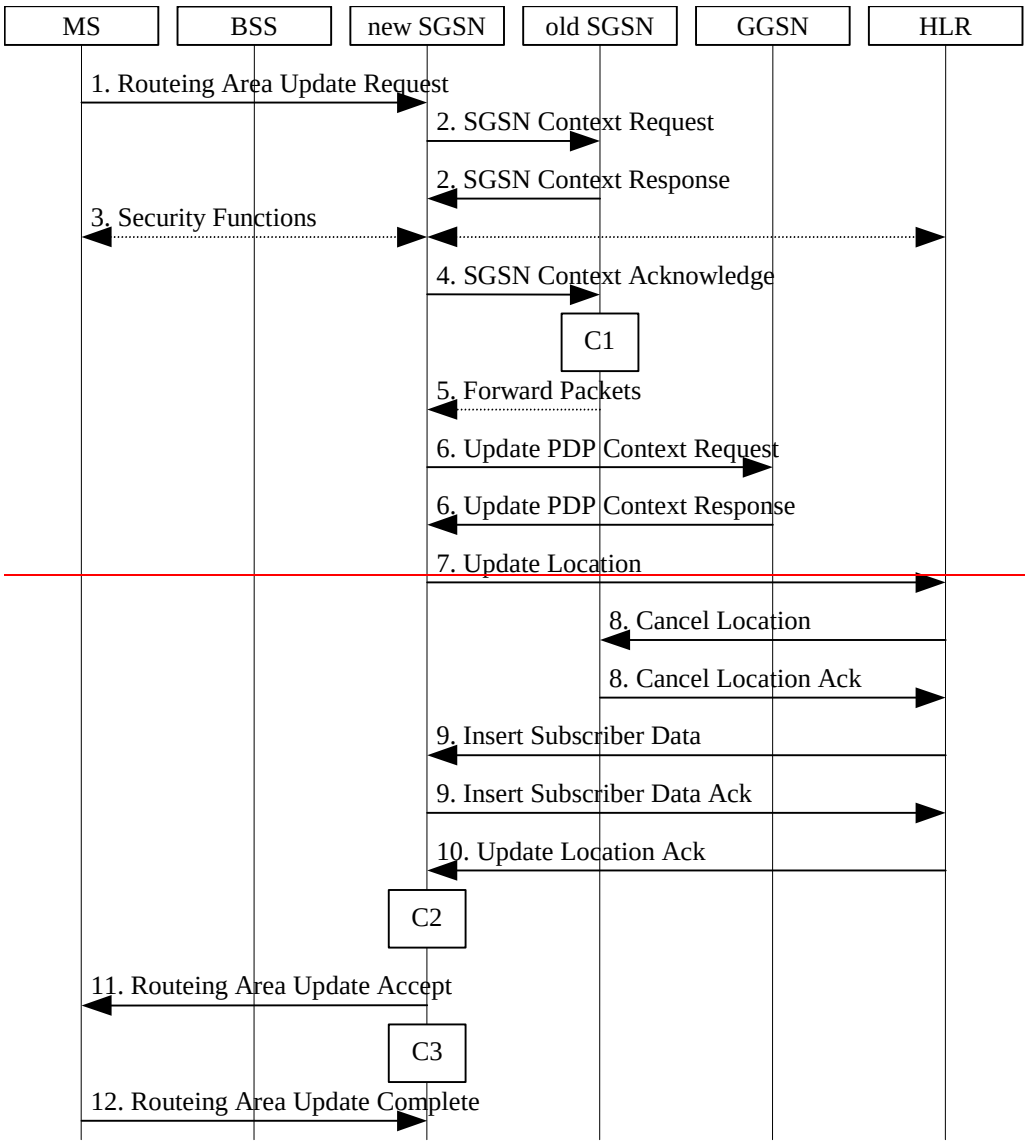
C1) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_GPRS_Routeing_Area_Update_Context.

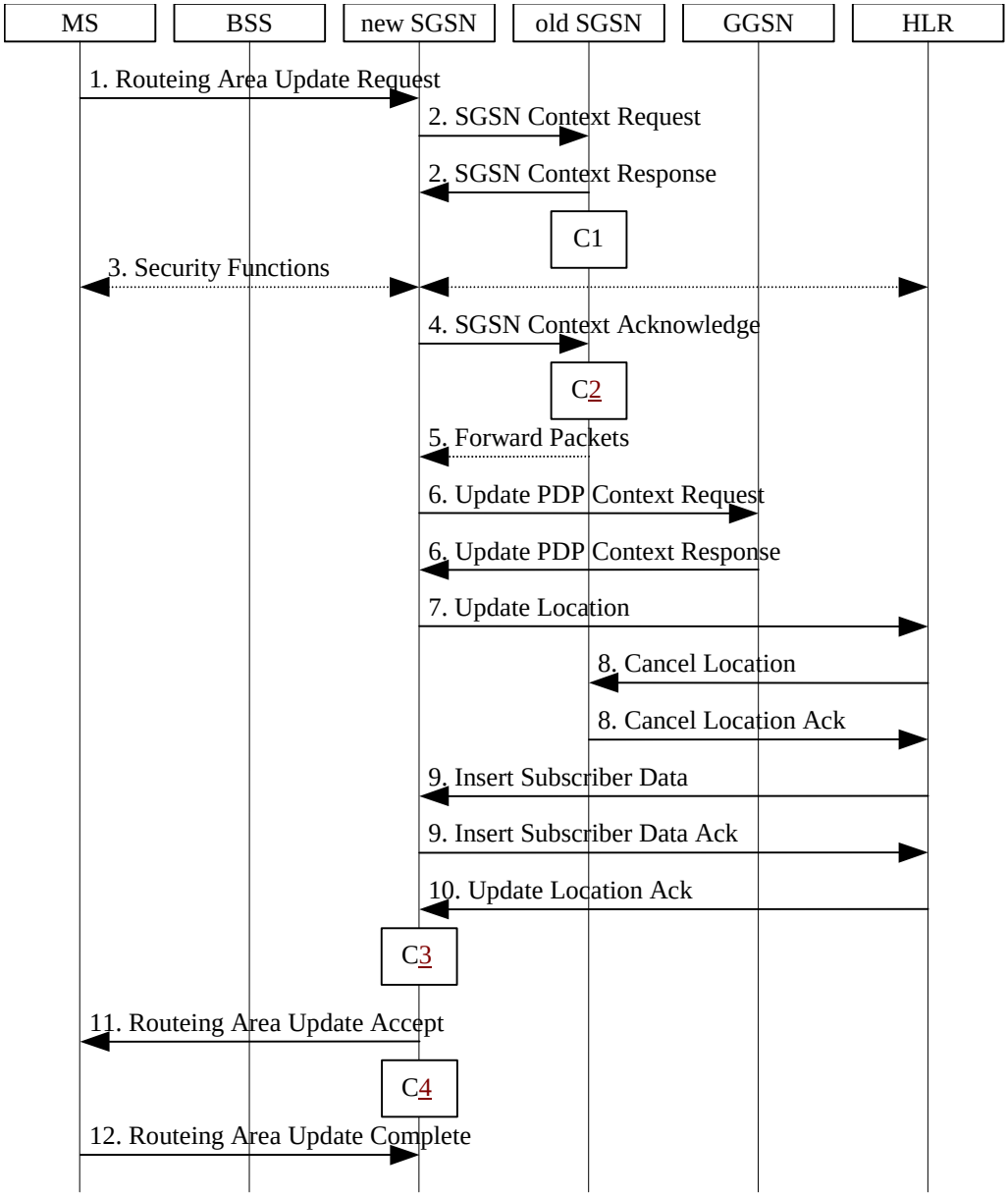
- The procedure CAMEL_GPRS_Routeing_Area_Update_Session is called once relative to the session. In this figure the procedure returns as result “Continue”.
- Then the procedure CAMEL_GPRS_Routeing_Area_Update_Context is called once per PDP context. In this figure the procedure returns as result “Continue”.

— 5th modified section in paragraph 6.9.1.2.2 Inter SGSN Routeing Area Update —

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 32~~Figure 32~~~~Figure 32~~.





CR Editor's Note: The Cx boxes in the above figure are renumbered!

Figure 32: Inter SGSN Routeing Area Update Procedure

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

C1) CAMEL_GPRS_PDP_Context_Disconnection

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

C2~~1~~) ~~CAMEL-GPRS-SGSN-Context-Acknowledge.~~ CAMEL_GPRS_Detach

The procedure returns as result "Continue".

C3~~2~~) ~~CAMEL-GPRS-Routeing-Area-Update-Session~~CAMEL_GPRS_Routeing_Area_Update_Session.

In this figure the procedure returns as result "Continue".

C4~~3~~) ~~CAMEL-GPRS-Routeing-Area-Update-Context~~CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result "Continue".

—6th modified section in paragraph 6.9.1.3.1 Combined Intra RA/LA Update –

6.9.1.3.1 Combined Intra SGSN RA / LA Update

The Combined RA / LA Update (intra SGSN) procedure is illustrated in Figure 33.

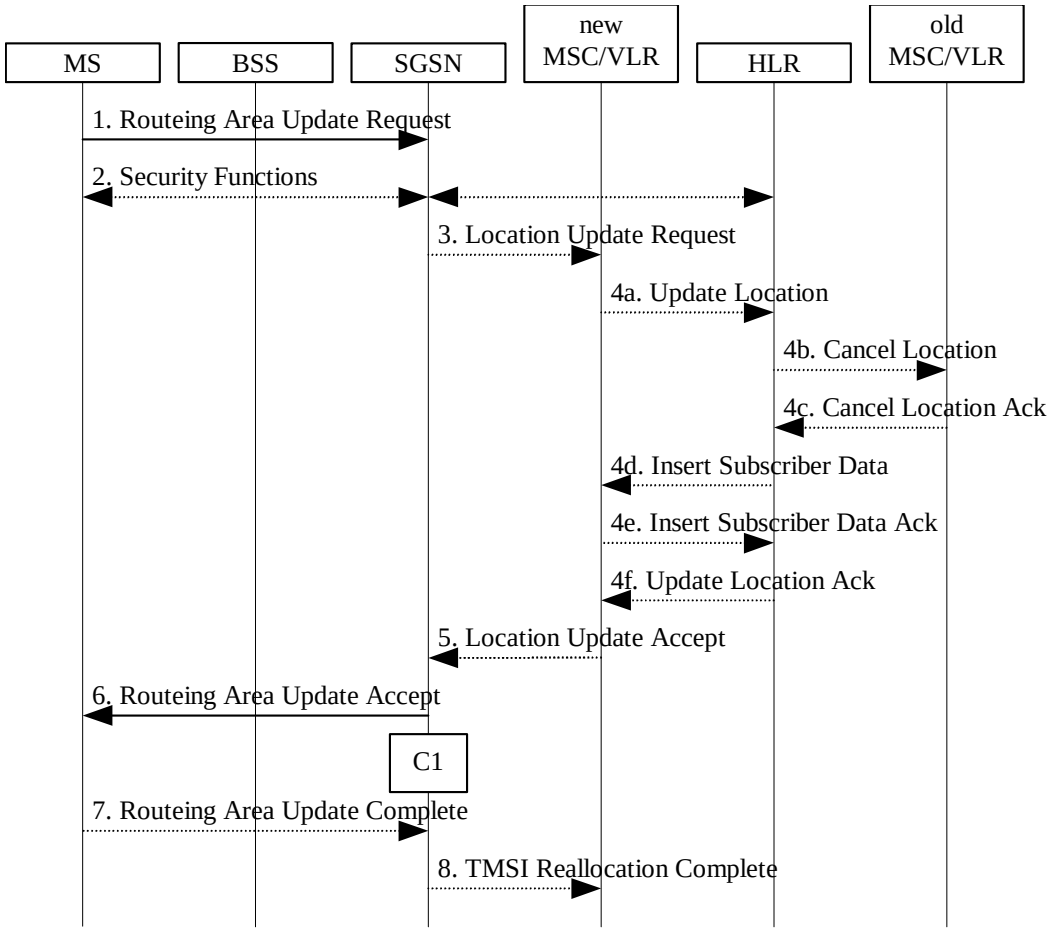


Figure 33: Combined RA / LA Update in the Case of Intra SGSN RA Update Procedure

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

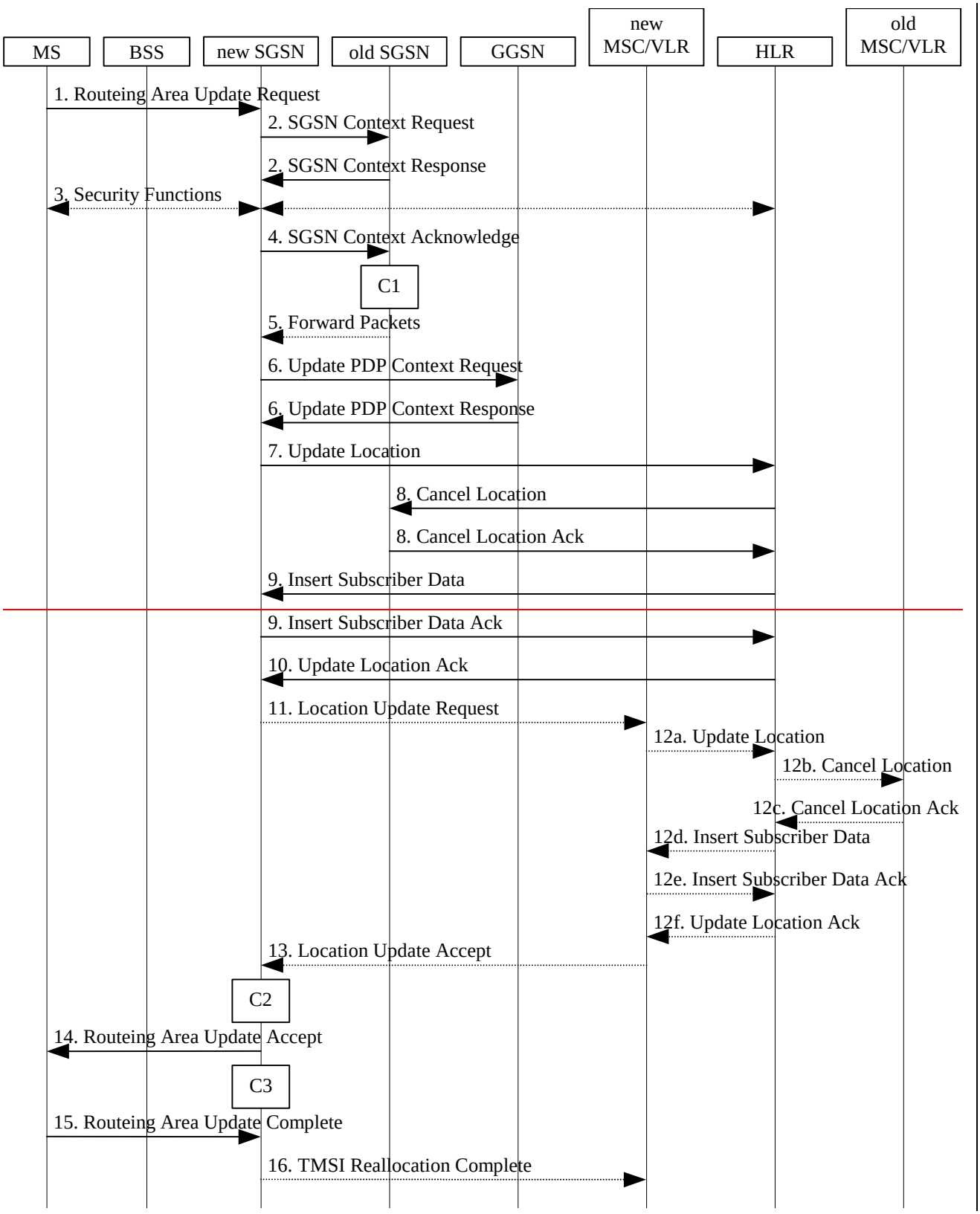
C1) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_GPRS_Routeing_Area_Update_Context.

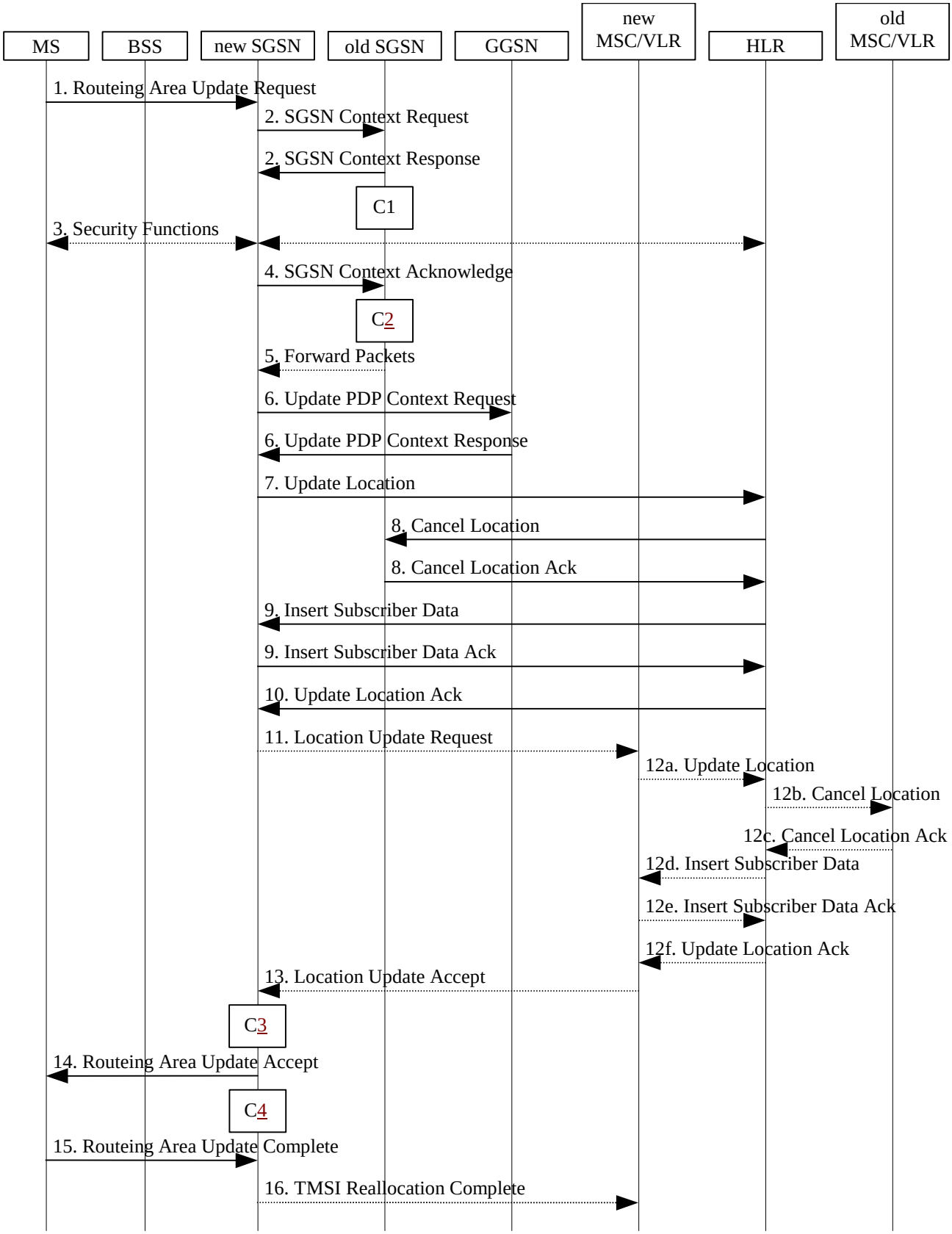
- The procedure CAMEL_GPRS_Routeing_Area_Update_Session is called once relative to the session. In this figure the procedure returns as result “Continue”.
- Then the procedure CAMEL_GPRS_Routeing_Area_Update_Context is called once per PDP context. In this figure the procedure returns as result “Continue”.

— 7th modified section in paragraph 6.9.1.3.2 Combined Inter RA/LA Update – –

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter SGSN) procedure is illustrated in Figure 34.





CR Editor's Note: The Cx boxes in the above figure are renumbered!

Figure 34: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

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

C1) CAMEL_GPRS_PDP_Context_Disconnection

This procedure is called several times: once per PDP context. The procedure returns as result “Continue”.

C2~~1~~) ~~CAMEL-GPRS-SGSN-Context-Acknowledge~~CAMEL_GPRS_Detach.

The procedure returns as result “Continue”.

C3~~2~~) ~~CAMEL-GPRS-Routeing-Area-Update-Session~~CAMEL_GPRS_Routeing_Area_Update_Session.

In this figure the procedure returns as result “Continue”.

C4~~3~~) ~~CAMEL-GPRS-Routeing-Area-Update-Context~~CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result “Continue”.

— 8th modified section in paragraph 6.9.2.1 Routeing Area Update Procedure (UMTS only)—

6.9.2.1 Routeing Area Update Procedure

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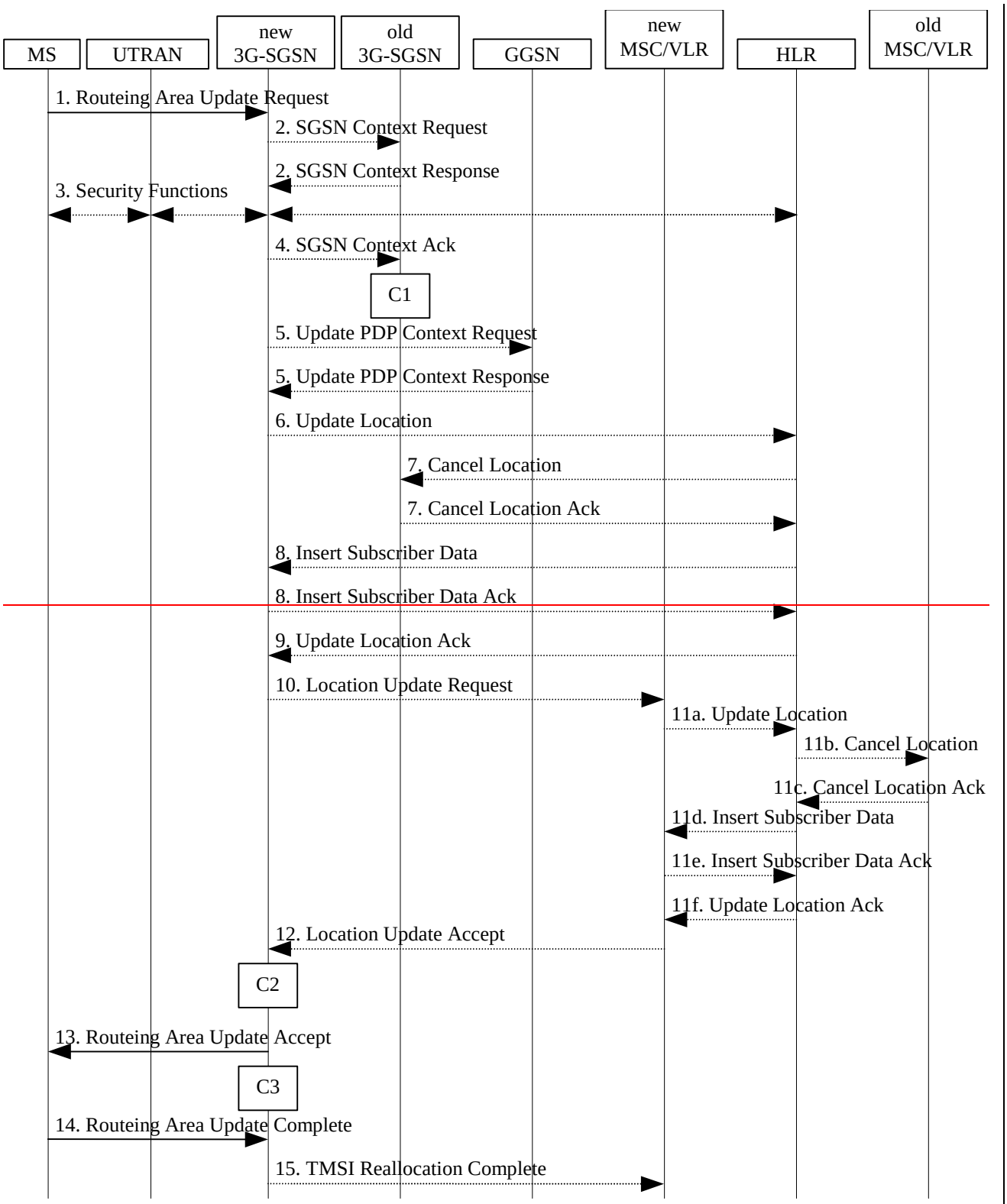
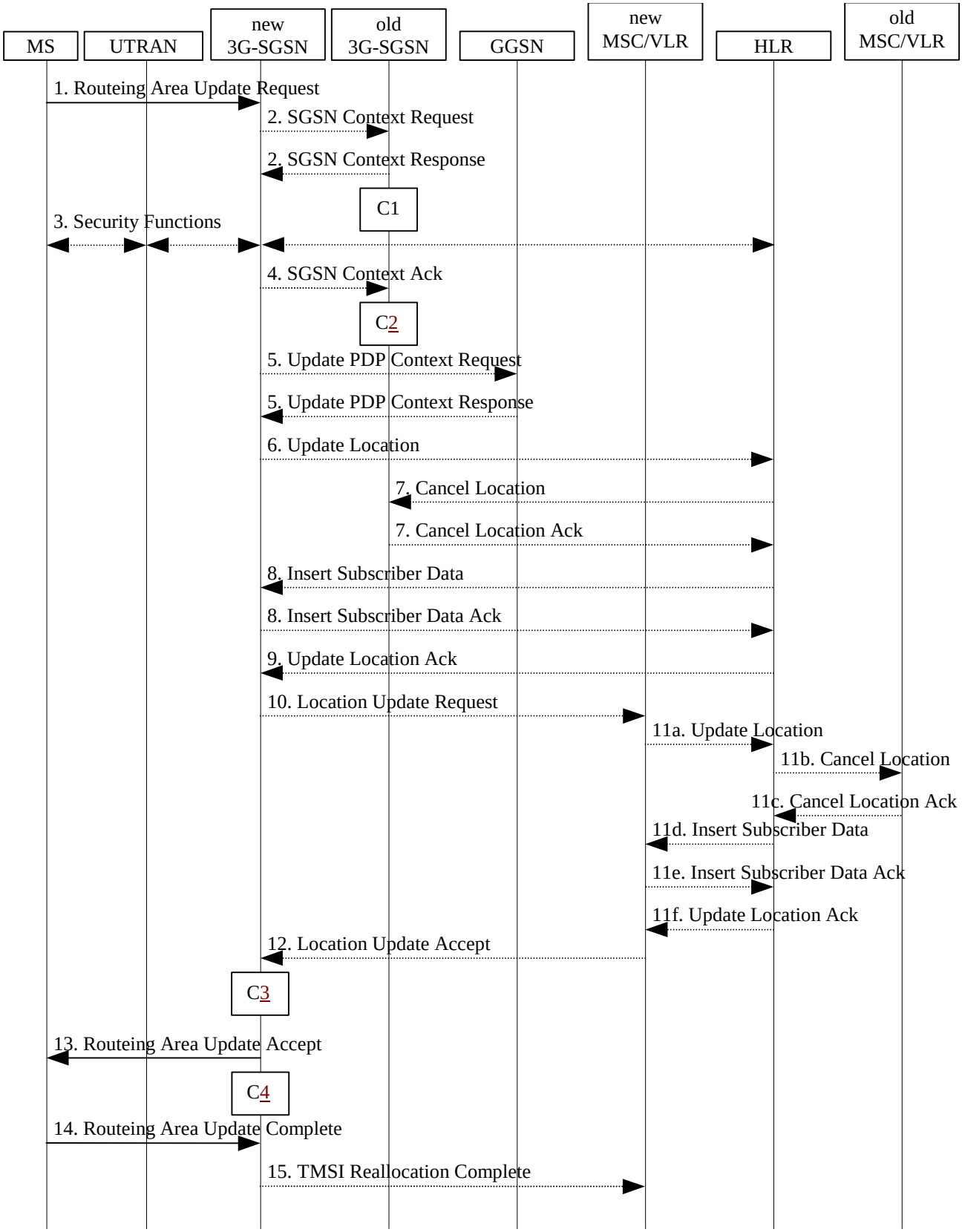

MS
UTRAN
new 3G-SGSN
old 3G-SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Routeing Area Update Request
2. SGSN Context Request
2. SGSN Context Response
3. Security Functions
4. SGSN Context Ack
C1
5. Update PDP Context Request
5. Update PDP Context Response
6. Update Location
7. Cancel Location
7. Cancel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



CR Editor's Note: The Cx boxes in the above figure are renumbered!

Figure 35: UMTS RA Update Procedure

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

C1) CAMEL_GPRS_PDP_Context_Disconnection

This procedure is called several times: once per PDP context. The procedure returns as result “Continue”.

C2~~1~~) ~~CAMEL-GPRS-SGSN-Context-Acknowledge~~CAMEL_GPRS_Detach.

The procedure returns as result “Continue”.

C3~~2~~) ~~CAMEL-GPRS-Routeing-Area-Update-Session~~CAMEL_GPRS_Routeing_Area_Update_Session.

In this figure the procedure returns as result “Continue”.

C4~~3~~) ~~CAMEL-GPRS-Routeing-Area-Update-Context~~CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result “Continue”.

— 9th modified section in paragraph 6.9.2.2.1 Serving RNS Relocation Procedures—

6.9.2.2.1 Serving SRNS Relocation Procedure

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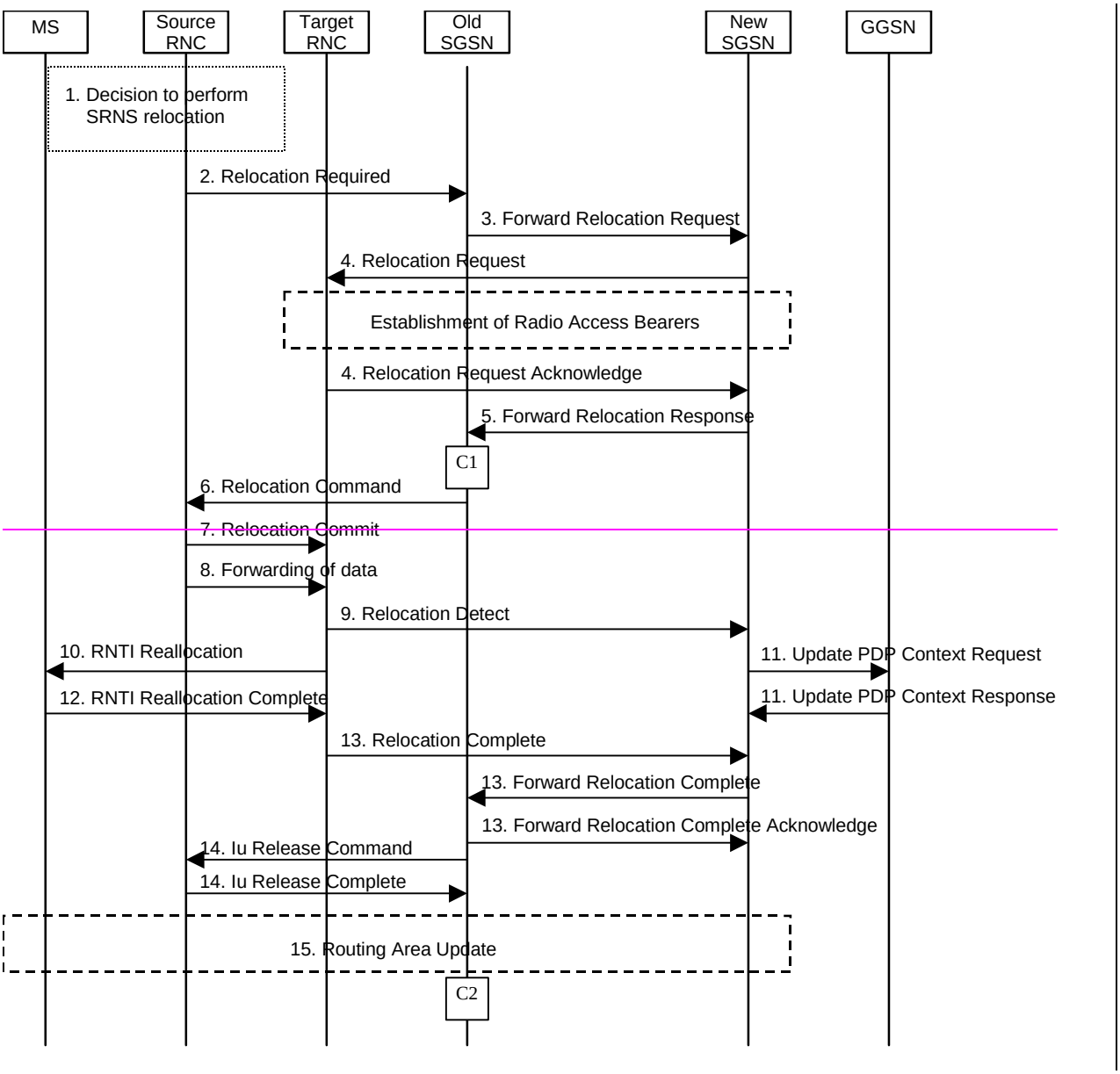
MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS relocation
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command
7. Relocation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

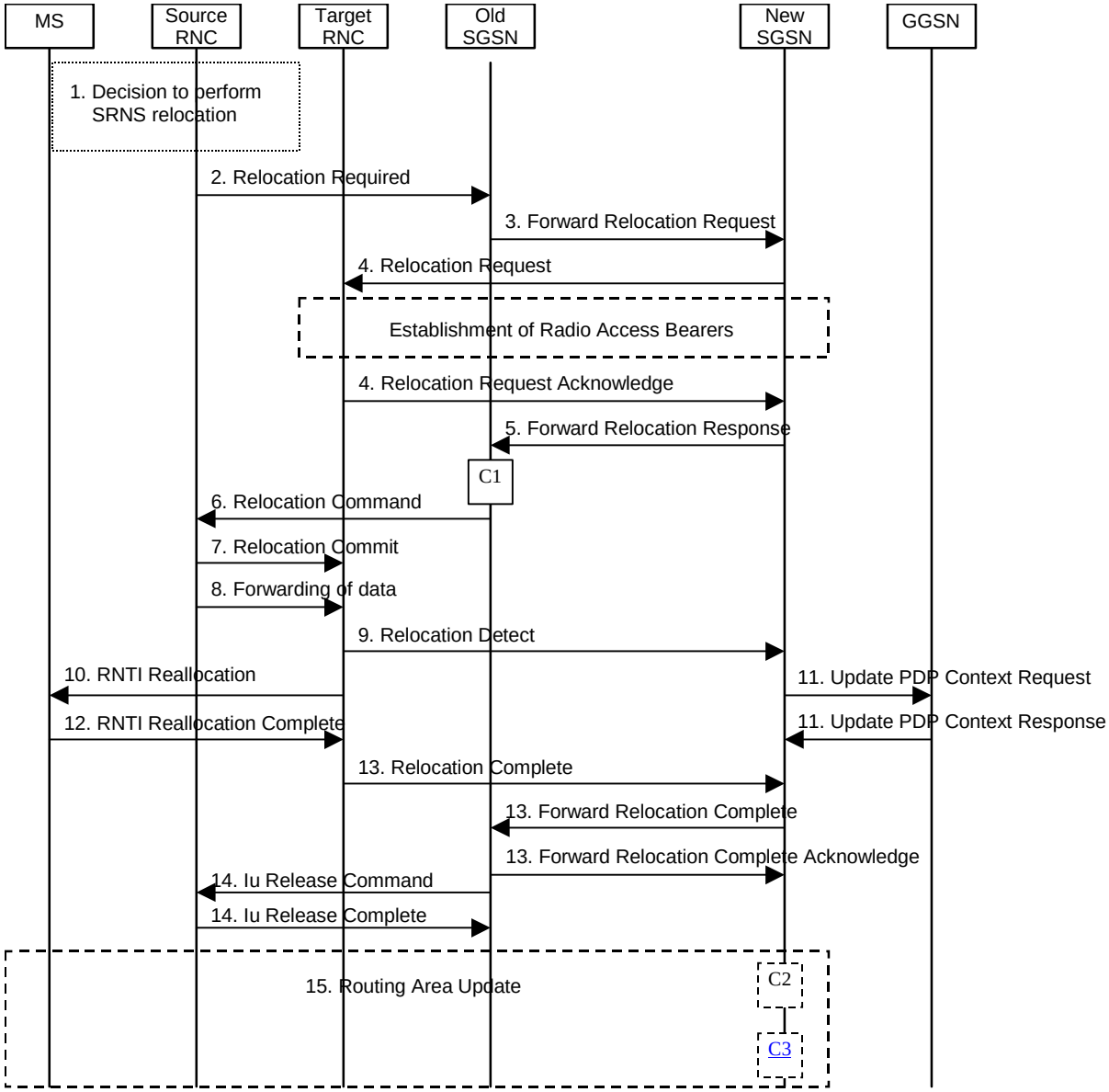

Figure 38: Serving SRNS Relocation Procedure

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~~CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

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

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

In this figure the procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result “Continue”.

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

— 10th modified section in paragraph 6.9.2.2.2 Combined Hard Handover and SRNS relocation procedure—

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

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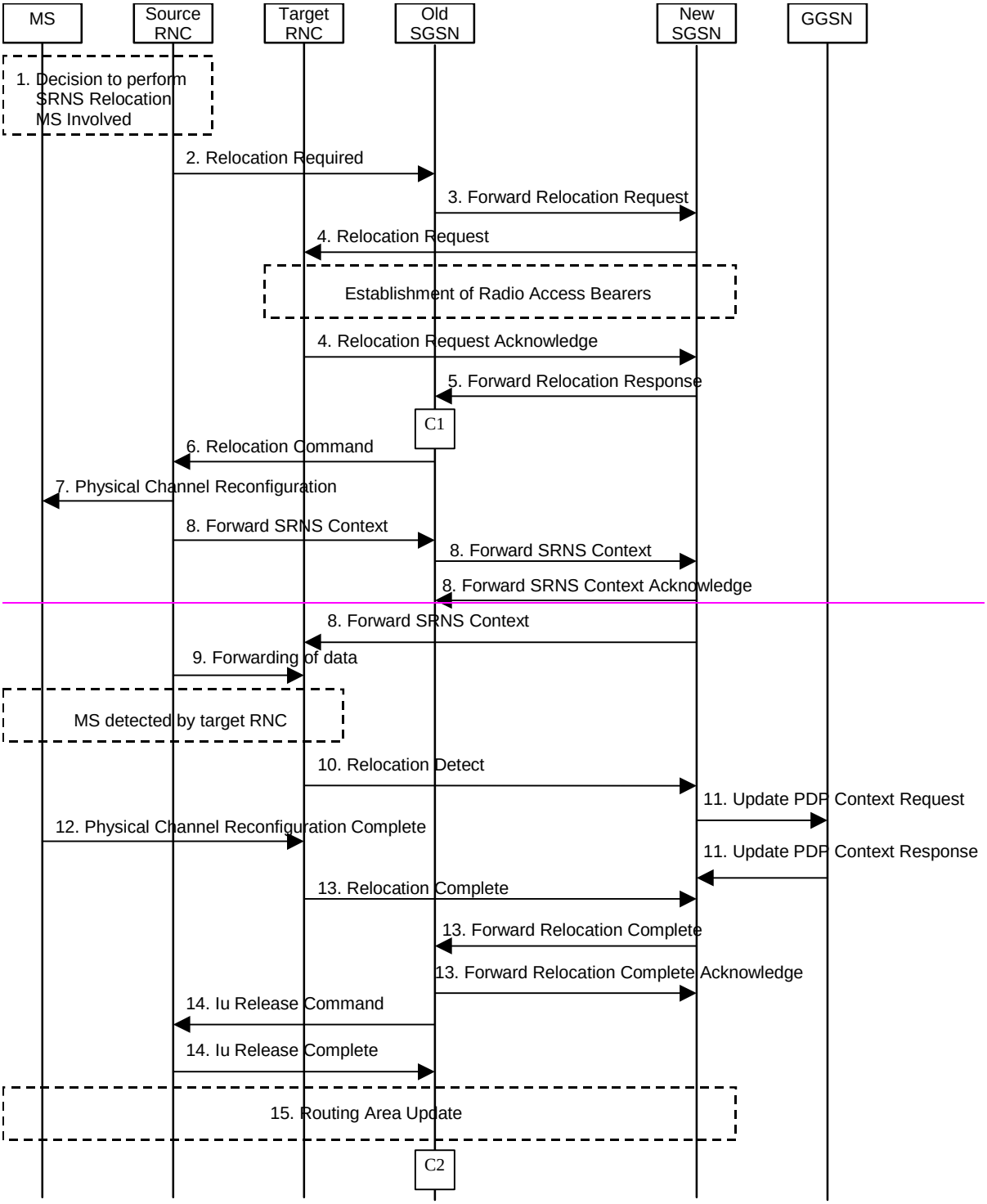
MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Decision to perform SRNS Relocation MS Involved
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command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

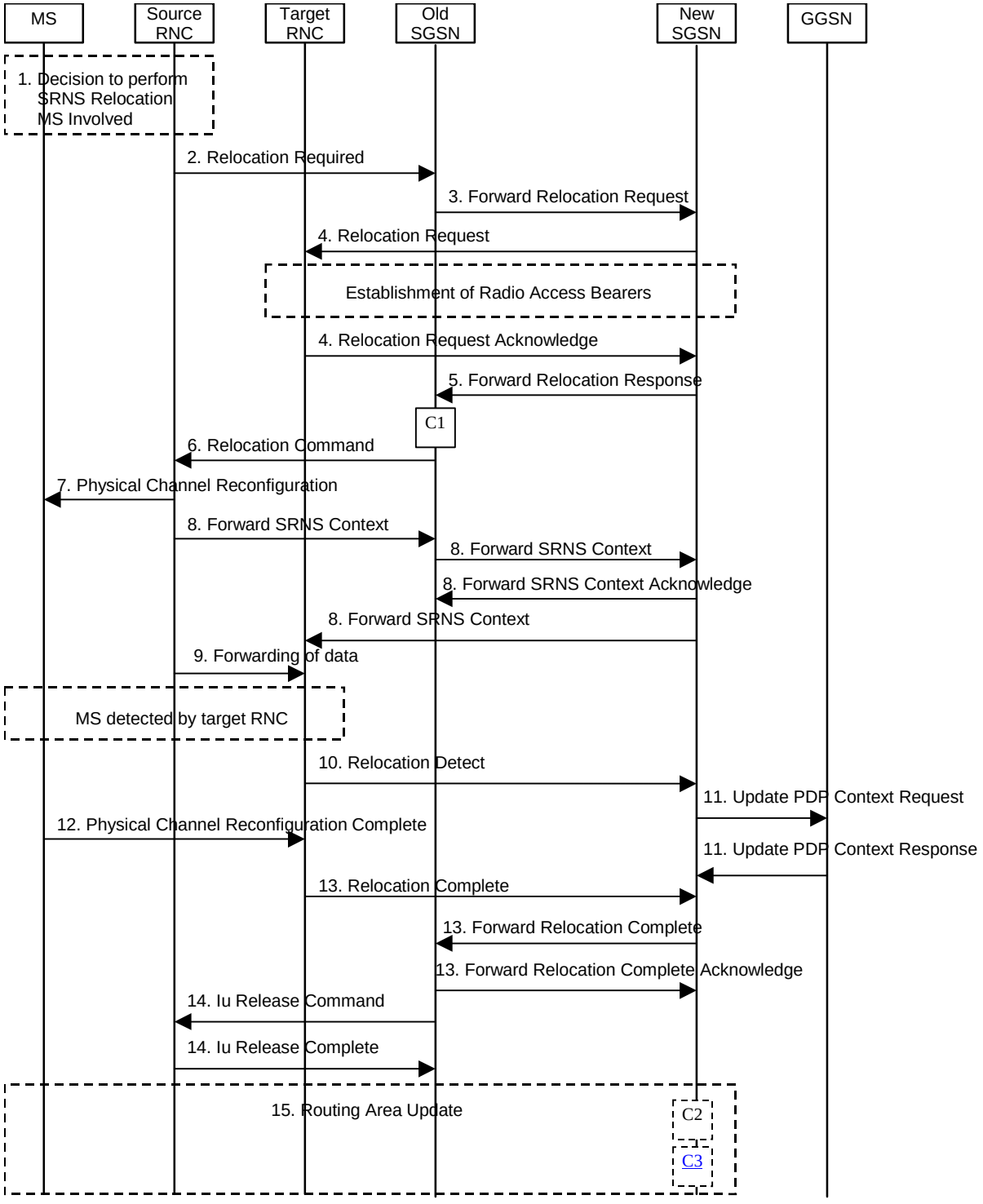

Figure 411: Combined Hard Handover and SRNS Relocation Procedure

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~~CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

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

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

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

In this figure the procedure returns as result “Continue”.

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result “Continue”.

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

— 11th modified section in paragraph 6.9.2.2.3 Combined Cell/URA Update and SRNS relation procedure—

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

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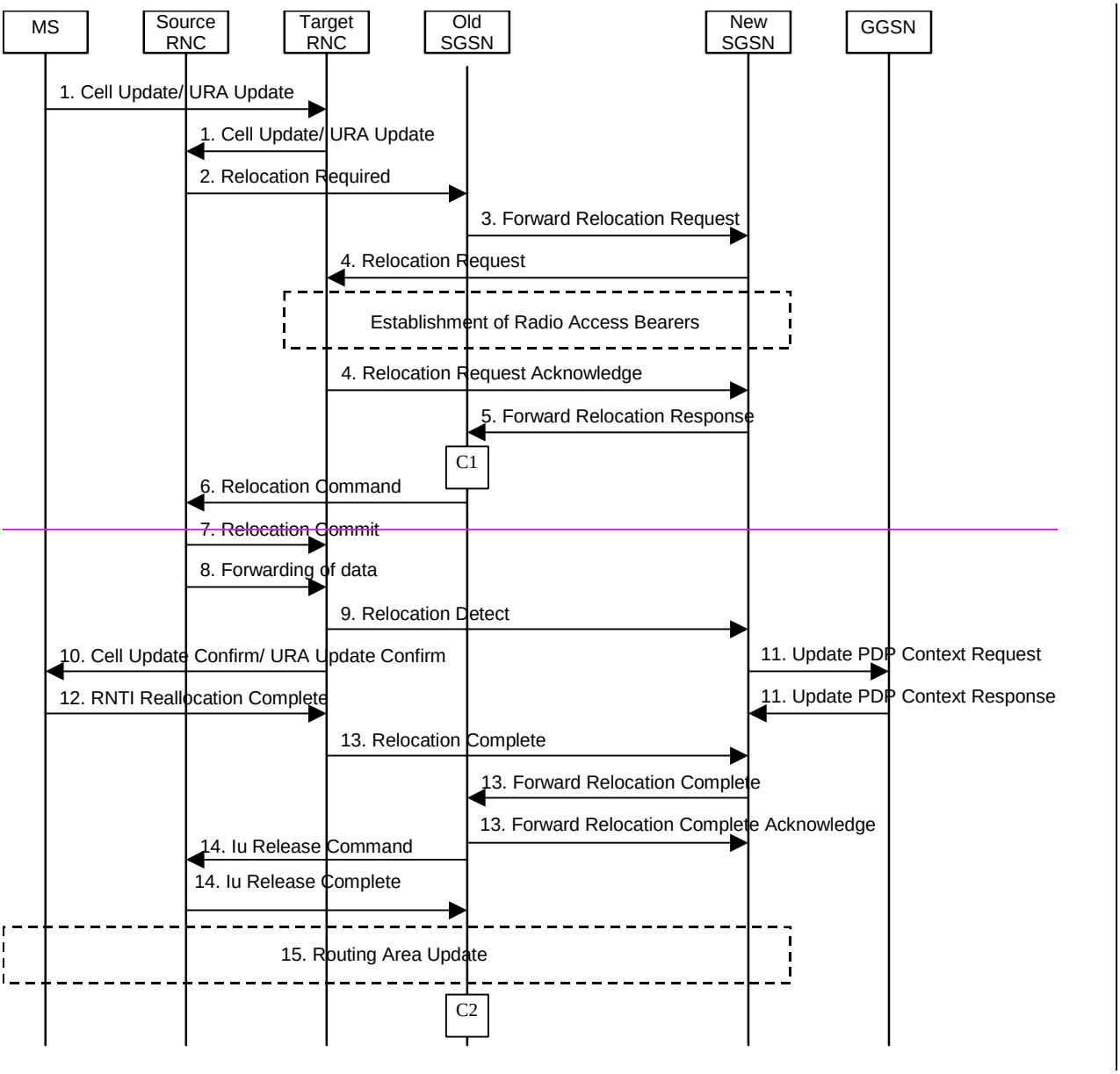
MS
Source RNC
Target RNC
Old SGSN
New SGSN
GGSN
1. Cell Update/ URA Update
1. Cell Update/ URA Update
2. Relocation Required
3. Forward Relocation Request
4. Relocation Request
Establishment of Radio Access Bearers
4. Relocation Request Acknowledge
5. Forward Relocation Response
C1
6. Relocation Command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

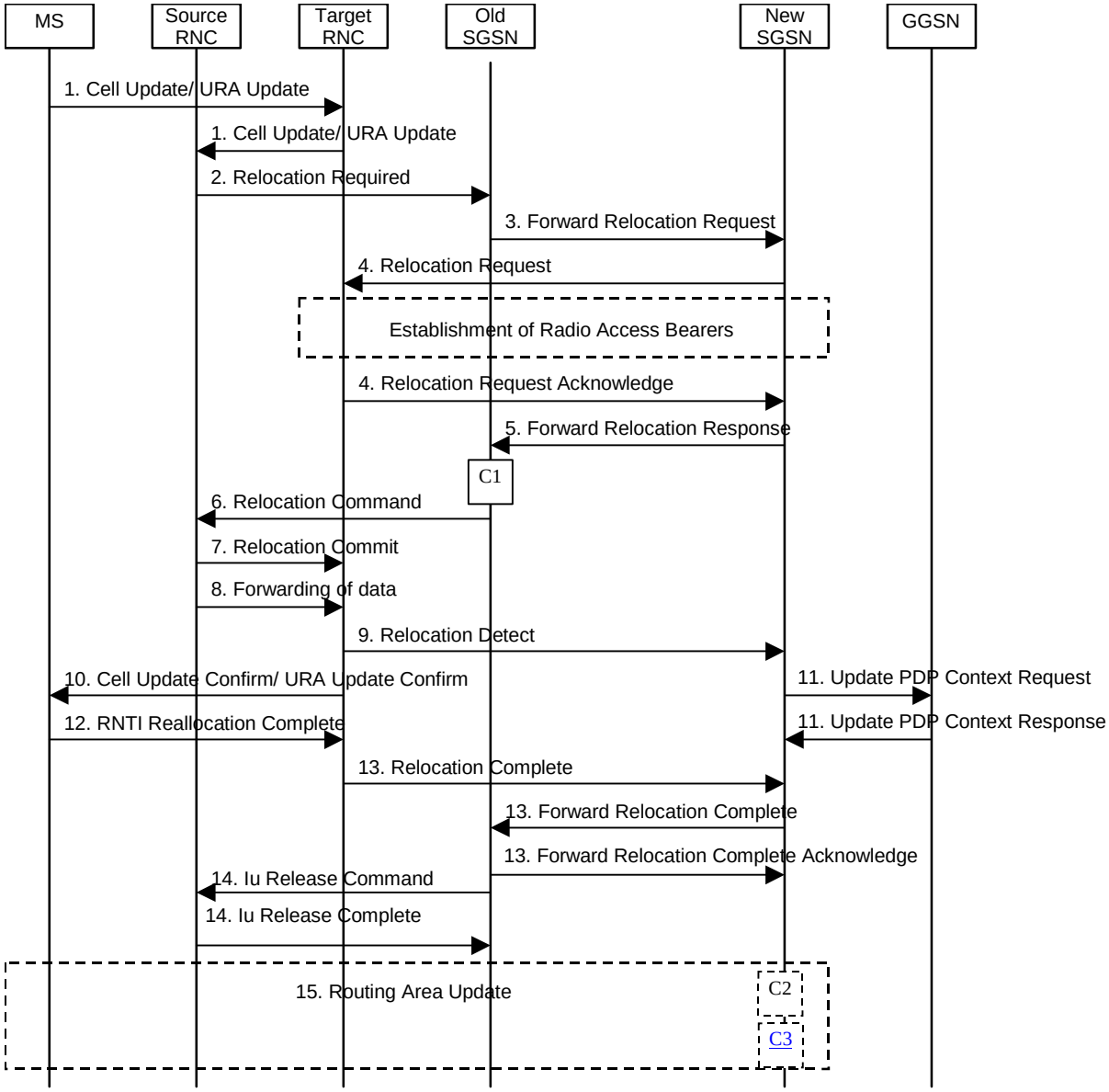

Figure 42: Combined Cell / URA Update and SRNS Relocation Procedure

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~~ CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

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

C2) CAMEL GPRS Routeing Area Update-Session

In this figure the procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result “Continue”.

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

— 12th modified section in paragraph 6.11.1 Subscriber Management Procedures—

6.11.1 Subscriber Management Procedures

Whenever the PS subscription data is changed for a PS subscriber in the HLR, and the changes affect the PS subscription data stored in the SGSN, then the SGSN node shall be informed about these changes by means of the following procedures:

- Insert Subscriber Data procedure, used to add or modify PS subscription data in the SGSN; or
- —Delete Subscriber Data procedure, used to remove PS subscription data in the SGSN.

For an MS with GPRS-CSI or/and with SMS-CSI defined, CAMEL interactions may be performed, see referenced procedures in 3G TS 23.078.

— 13th modified section in paragraph 6.13.1 UMTS-GSM Intersystem Change, intra SGSN Intersystem change—

6.13.1.1 UMTS to GSM Intra SGSN Change

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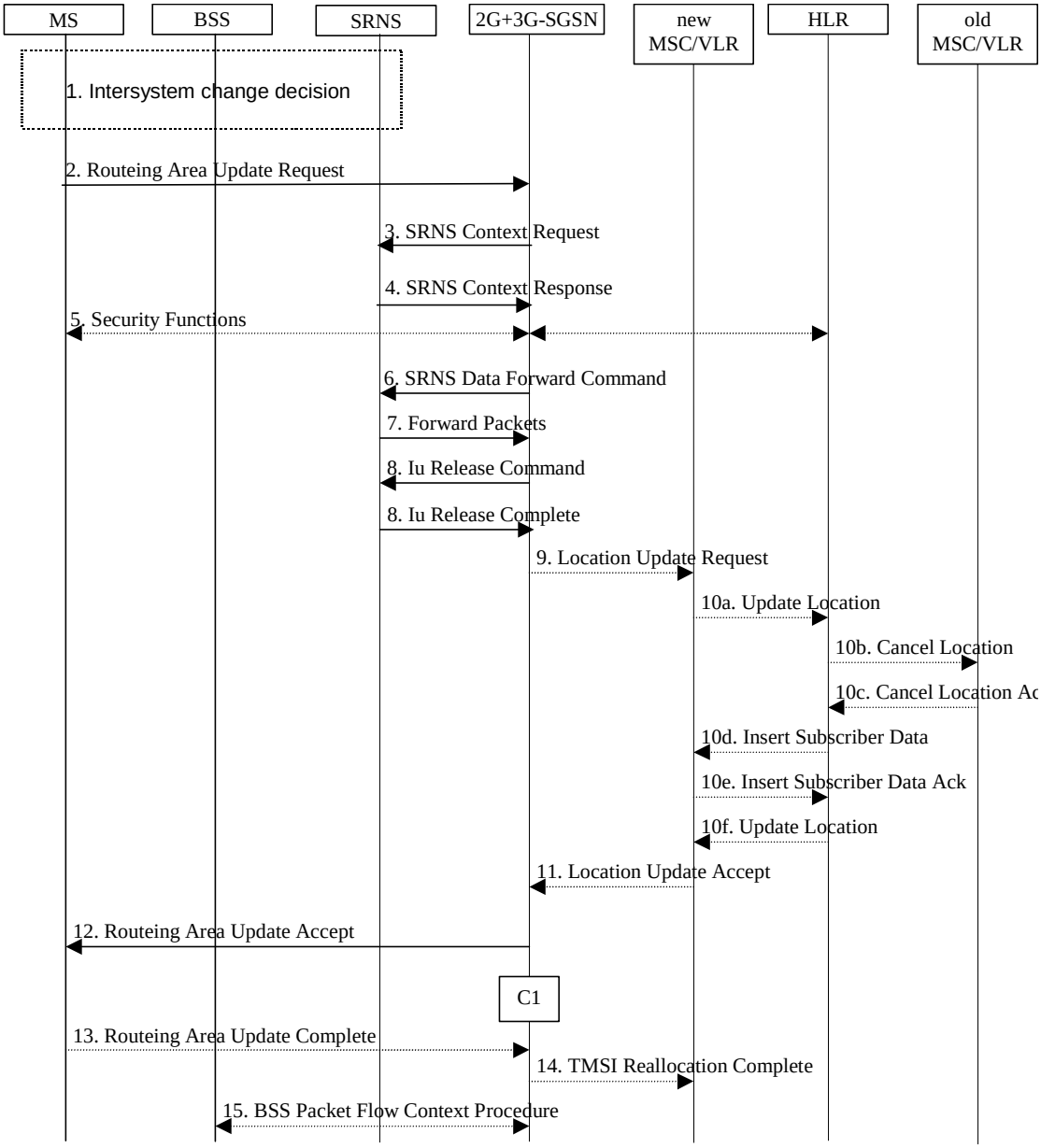

Figure 50: UMTS to GSM Intra SGSN Change

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_Session and CAMEL_GPRS_Routeing_Area_Update_Context.

- The procedure CAMEL_GPRS_Routeing_Area_Update_Session is called once relative to the session. In this figure the procedure returns as result “Continue”.
- Then the procedure CAMEL_GPRS_Routeing_Area_Update_Context is called once per PDP context. In this figure the procedure returns as result “Continue”.

— 14th modified section in paragraph 6.13.1 .2UMTS-GSM Intersystem Change, GSM to UMTS Intra SGSN change—

6.13.1.2 GSM to UMTS Intra SGSN Change

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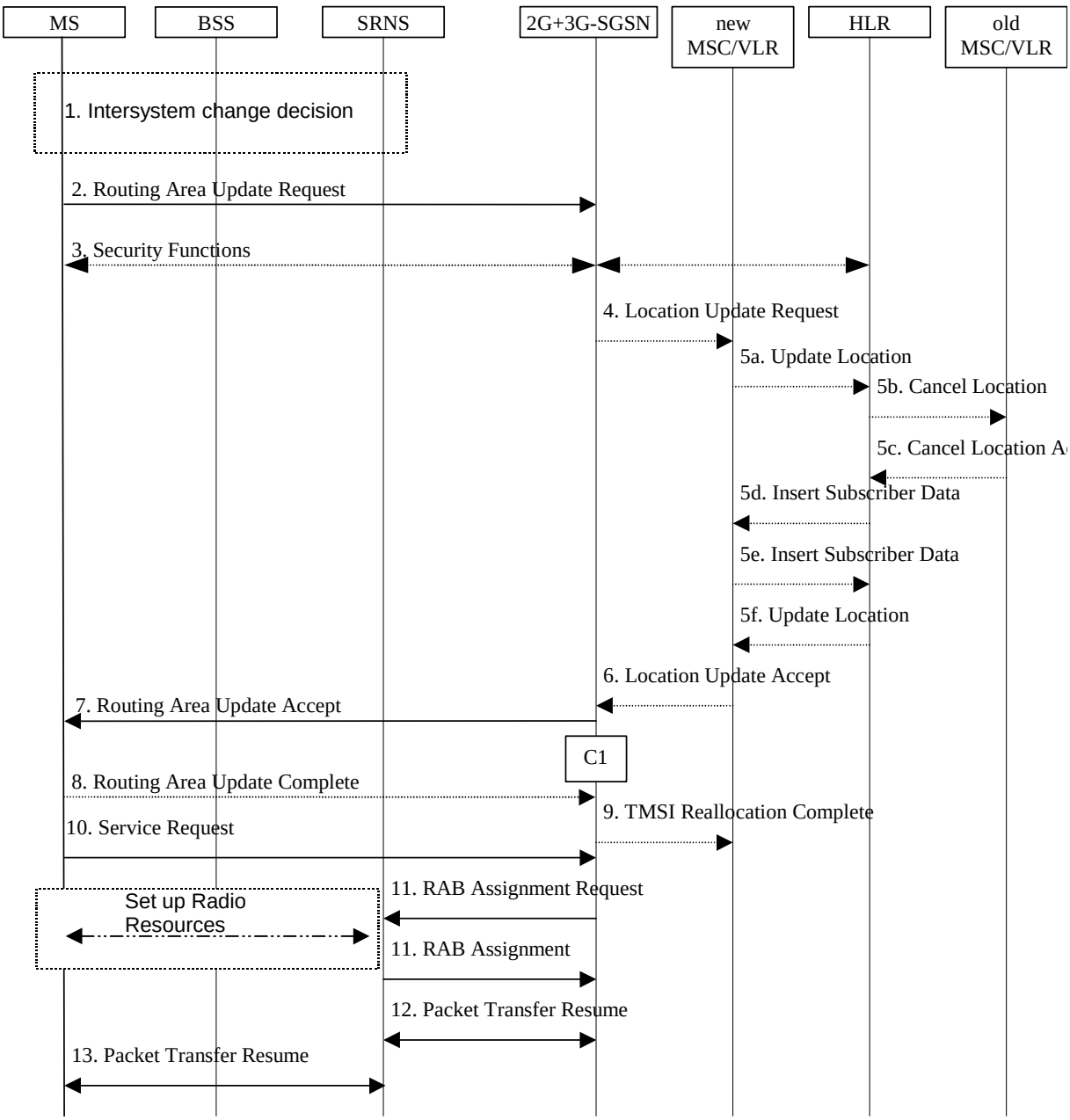

Figure 51: GSM to UMTS Intra SGSN Change

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

C1) CAMEL_GPRS_Routeing_Area_Update_Session and CAMEL_GPRS_Routeing_Area_Update_Context.

- The procedure CAMEL_GPRS_Routeing_Area_Update_Session is called once relative to the session. In this figure the procedure returns as result "Continue".
- Then the procedure CAMEL_GPRS_Routeing_Area_Update_Context is called once per PDP context. In this figure the procedure returns as result "Continue".

— 15th modified section in paragraph 6.13.2.1 Inter SGSN Intersystem Change, UMTS to GSM Inter SGSN change—

6.13.2.1 UMTS to GSM Inter SGSN Change

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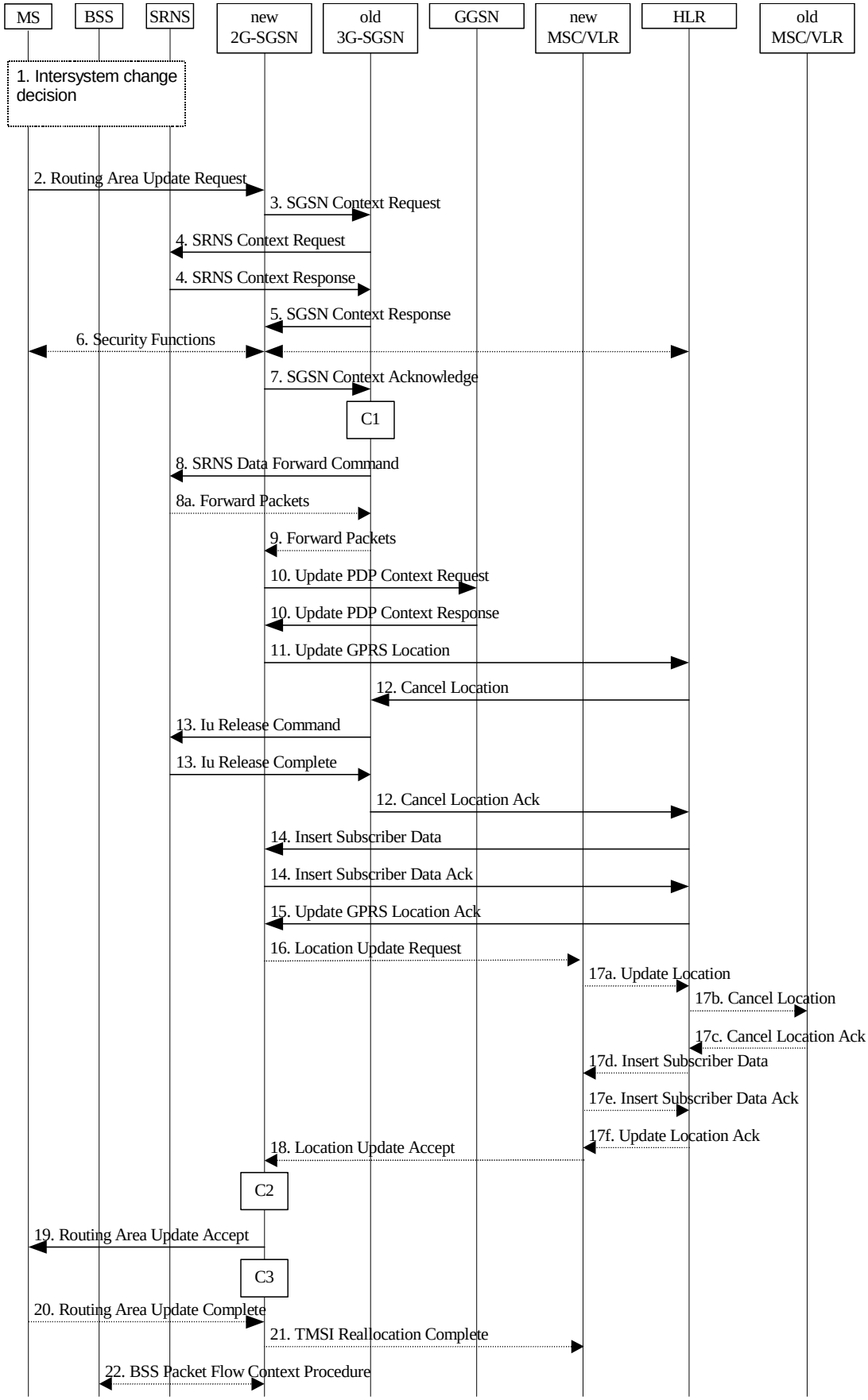

Figure 52: UMTS to GSM Inter SGSN Change

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.~~ CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

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

C2) ~~CAMEL-GPRS-Routeing-Area-Update-Session~~CAMEL_GPRS_Routeing_Area_Update_Session.

In this figure the procedure returns as result “Continue”.

C3) ~~CAMEL-GPRS-Routeing-Area-Update-Context~~CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times once per PDP context. In this figure the procedure returns as result “Continue”.

— 16th modified section in paragraph 6.13.2.2 GPRS to UMTS Inter SGSN Change—

6.13.2.2 GPRS to UMTS Inter SGSN Change

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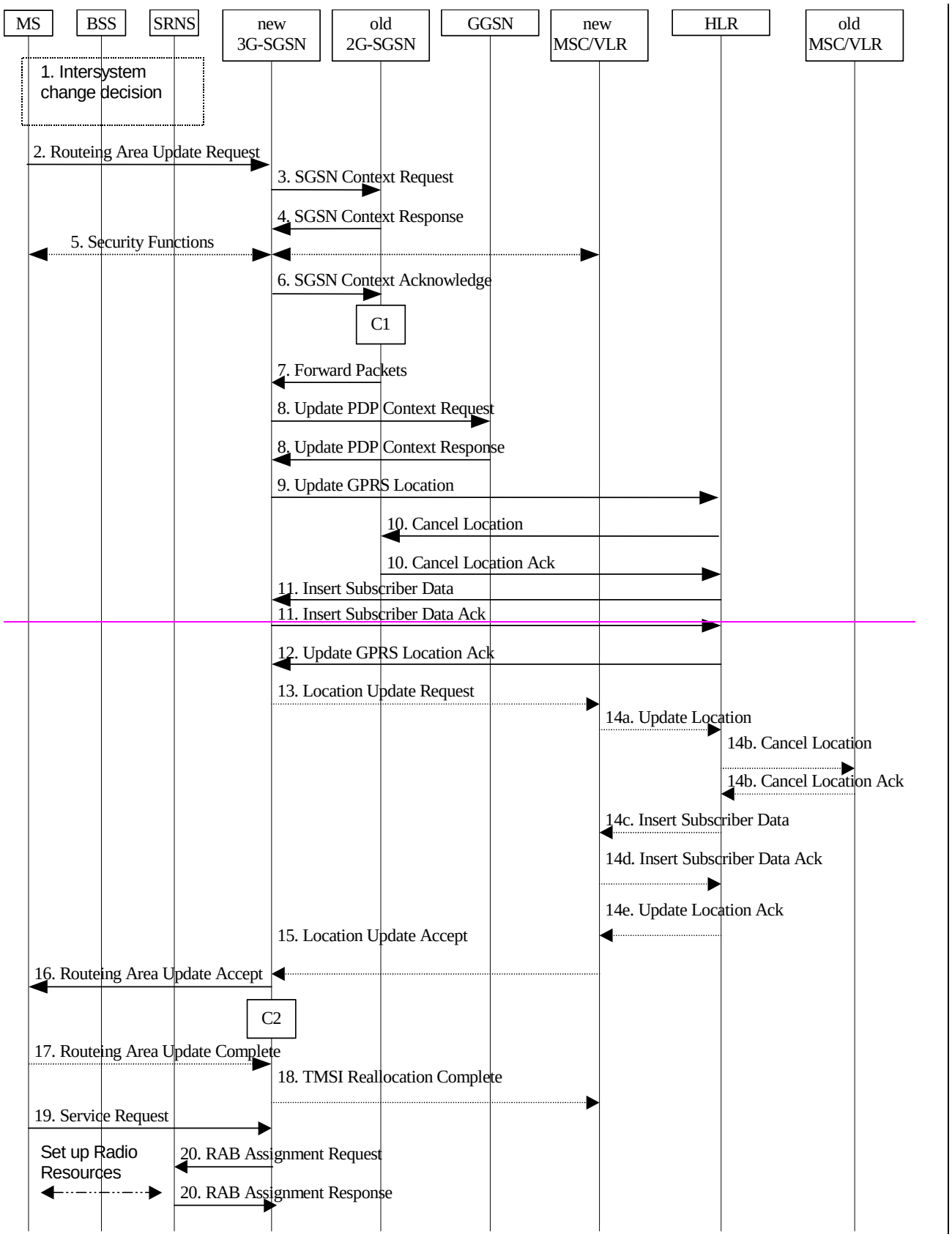
MS
BSS
SRNS
new 3G-SGSN
old 2G-SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Intersystem change decision
2. Routeing Area Update Request
3. SGSN Context Request
4. SGSN Context Response
5. Security Functions
6. SGSN Context Acknowledge
C1
7. Forward Packets
8. Update PDP Context Request
8. Update PDP Context Response
9. Update GPRS Location
10. Cancel Location
10. Cancel Location Ack
11. Insert Subscriber Data
11. Insert Subscriber Data Ack
12. Update GPRS Location Ack
13. Location Update Request
14a. Update Location
14b. Cancel Location
14b. Cancel Location Ack
14c. Insert Subscriber Data
14d. Insert Subscriber Data Ack
14e. Update Location Ack
15. Location Update Accept
16. Routeing Area Update Accept
C2
17. Routeing Area Update Complete
18. TMSI Reallocation Complete
19. Service Request
Set up Radio Resources
20. RAB Assignment Request
20. RAB Assignment Response

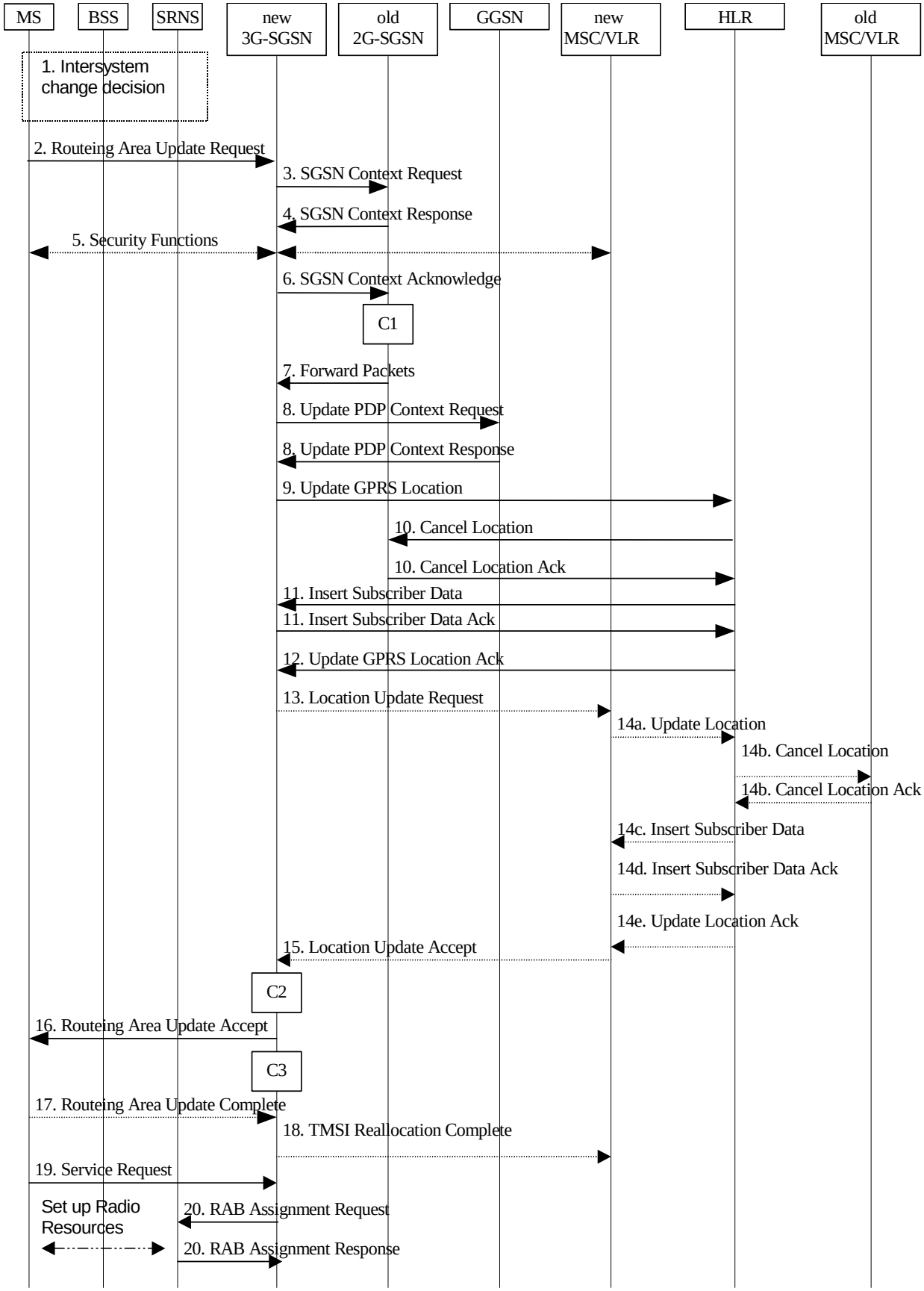

Figure 53: GSM to UMTS Inter SGSN Change

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-~~CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

They are called in the following order:

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

C2) ~~CAMEL-GPRS-Routeing-Area-Update-Session~~CAMEL_GPRS_Routeing_Area_Update_Session.

In this figure the procedure returns as result “Continue”.

C3) ~~CAMEL-GPRS-Routeing-Area-Update-Context~~CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. In this figure the procedure returns as result “Continue”.

— 17th modified section in paragraph 9.2.2 PDP Context Activation

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 60 and Figure 61.

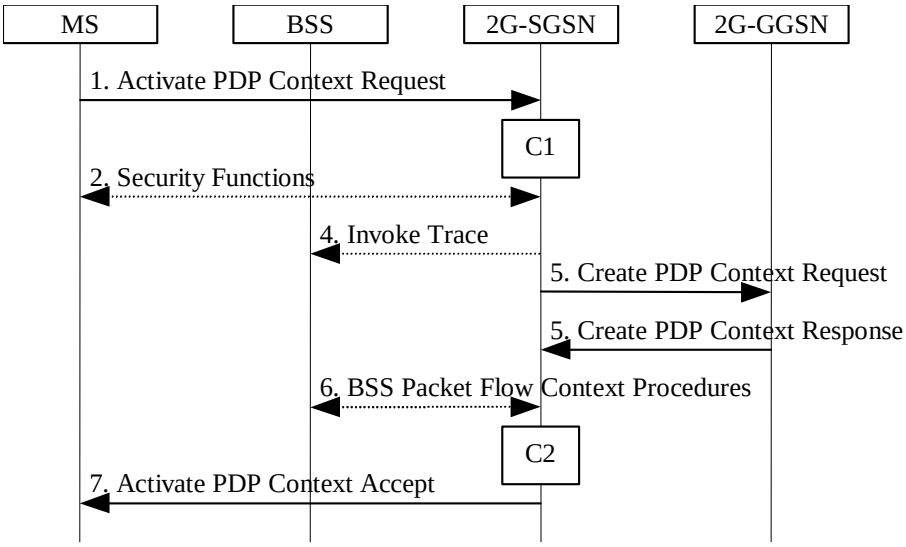

Figure 60: PDP Context Activation Procedure for GSM

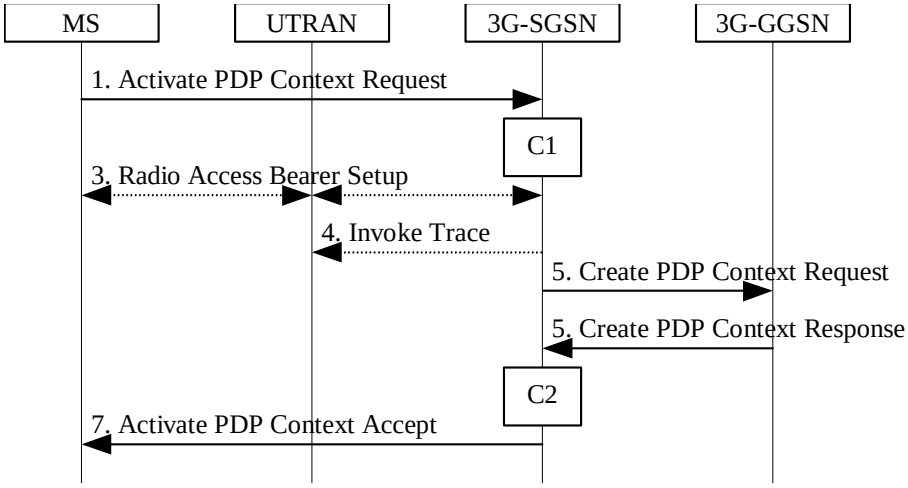

Figure 61: PDP Context Activation Procedure for UMTS

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.~~

C1) CAMEL_GPRS_PDP_Context_Establishment.

In this figure the procedure returns as result "Continue".

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

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In this figure the procedure returns as result "Continue".

— 18th modified section in paragraph 9.2.2.1.1 Secondary PDP Context Activation Procedure

9.2.2.1.1 Secondary PDP Context Activation Procedure

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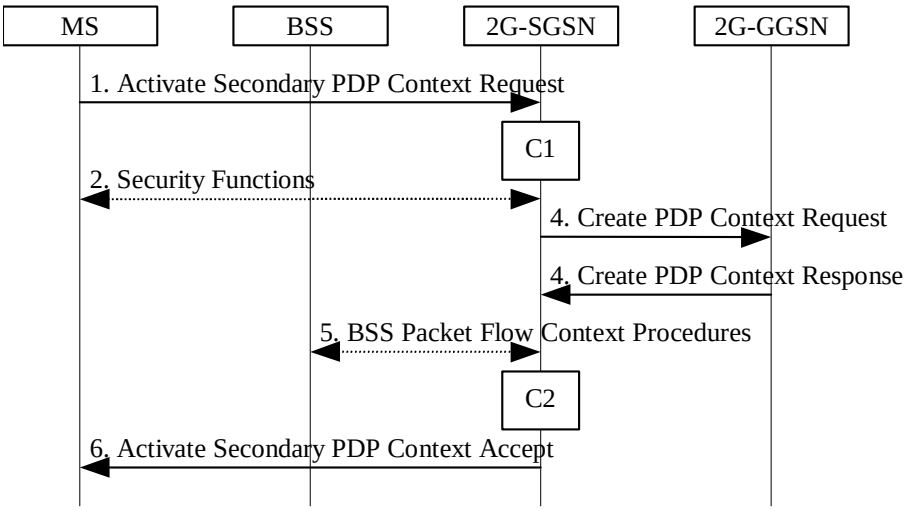

Figure 62: Secondary PDP Context Activation Procedure for GSM

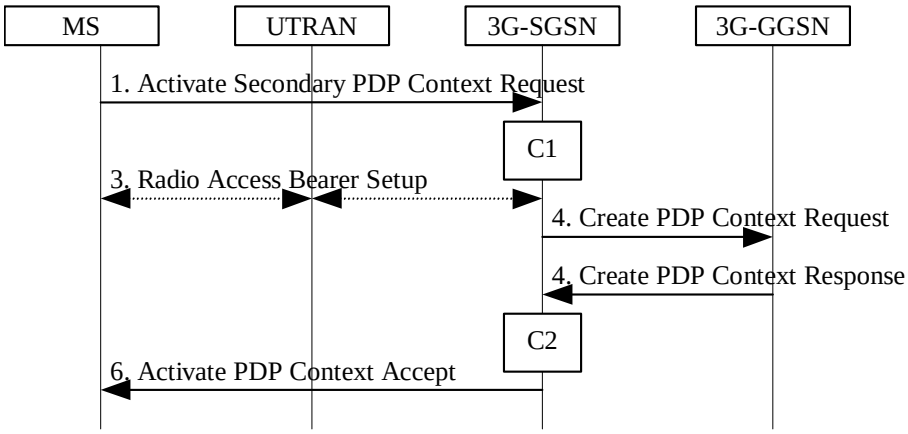

Figure 63: Secondary PDP Context Activation Procedure for UMTS

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.~~

C1) CAMEL_GPRS_PDP_Context_Establishment.

In this figure the procedure returns as result “Continue”.

~~C2) CAMEL_GPRS_SGSN_Create_PDP_Context.~~

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In this figure the procedure returns as result “Continue”.

— 19th modified section in paragraph 9.2.3.1 SGSN initiated PDP context Modification Procedure

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in Figure 67.

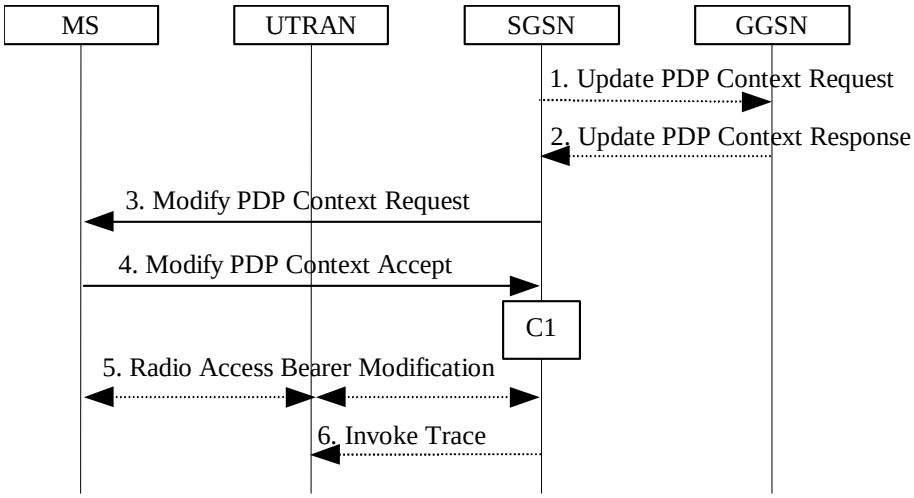

Figure 67: SGSN-Initiated PDP Context Modification Procedure

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

C1) ~~CAMEL-GPRS-Modify-PDP-Context~~CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result “Continue”.

— 20th modified section in paragraph 9.2.3.2 Modification Procedures-GGSN initiated PDP context Modification Procedure

9.2.3.2 GGSN-Initiated PDP Context Modification Procedure

The GGSN-Initiated PDP Context Modification procedure is illustrated in Figure 68.

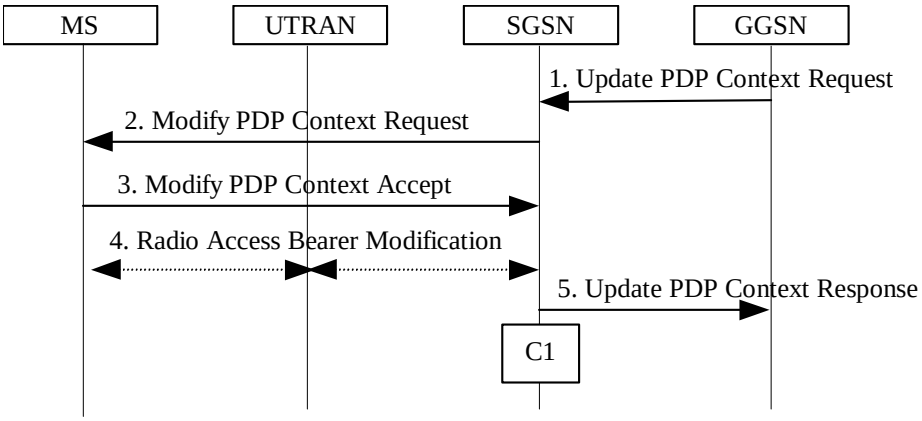

Figure 68: GGSN-Initiated PDP Context Modification Procedure

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

C1) ~~CAMEL-GPRS-Modify-PDP-Context~~CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result “Continue”.

— 21th modified section in paragraph 9.2.3.3 MS Initiated PDP context Modification Procedure

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in Figure 69

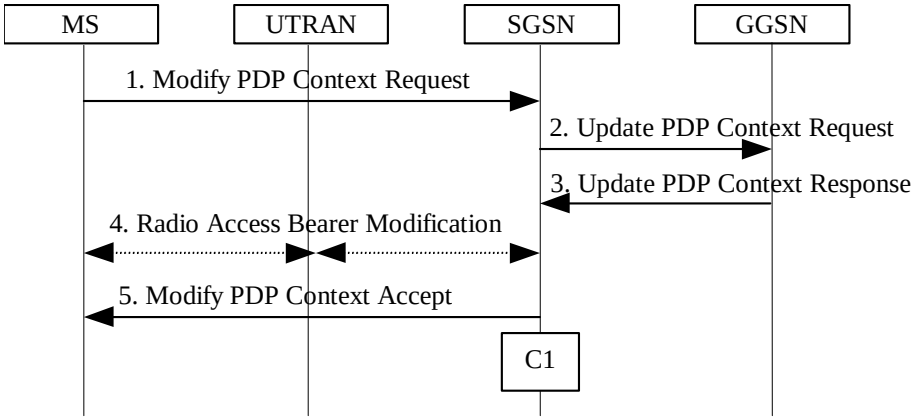

Figure 69: MS-Initiated PDP Context Modification Procedure

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

C1) ~~CAMEL-GPRS-Modify-PDP-Context~~CAMEL_GPRS_Change_Of_QoS.

The procedure returns as result "Continue".

— 22th modified section in paragraph 9.2.4.1 PDP context desactivation initiated by MS Procedure

9.2.4.1 PDP Context Deactivation Initiated by MS Procedure

The PDP Context Deactivation Initiated by MS procedure is illustrated in Figure 70.

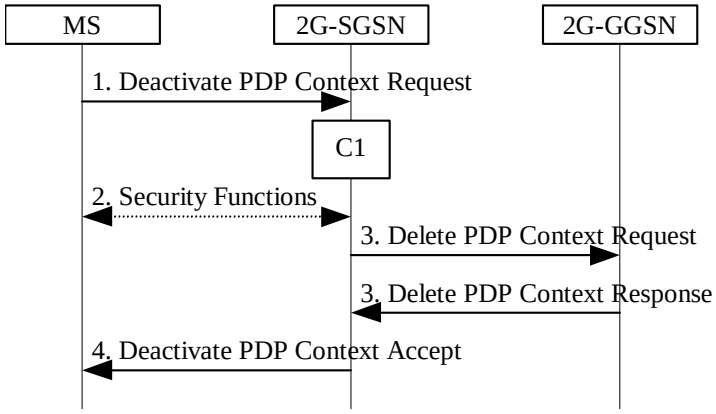

Figure 70: PDP Context Deactivation Initiated by MS Procedure for GSM

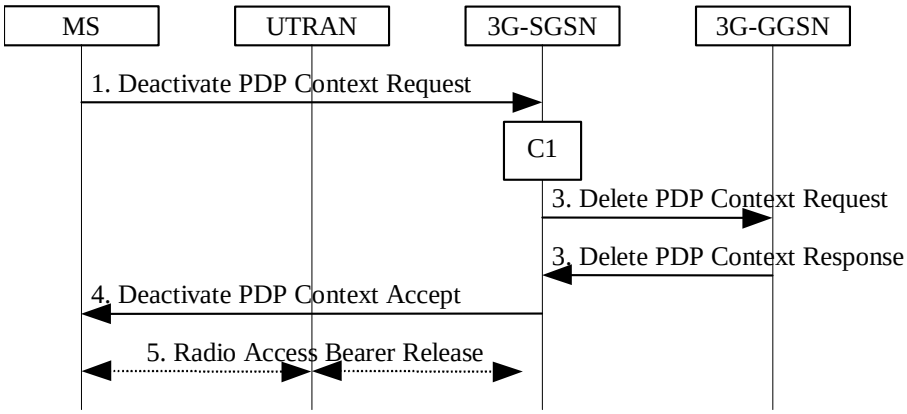

Figure 71: PDP Context Deactivation Initiated by MS Procedure for UMTS

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

C1) ~~CAMEL-GPRS-Deactivate-PDP-Context~~CAMEL_GPRS_PDP_Context_Disconnection.

The procedure returns as result "Continue".

— 23th modified section in paragraph 9.2.4.2 PDP context desactivation initiated by SGSN Procedure

9.2.4.2 PDP Context Deactivation Initiated by SGSN Procedure

The PDP Context Deactivation Initiated by SGSN procedure is illustrated in Figure 72.

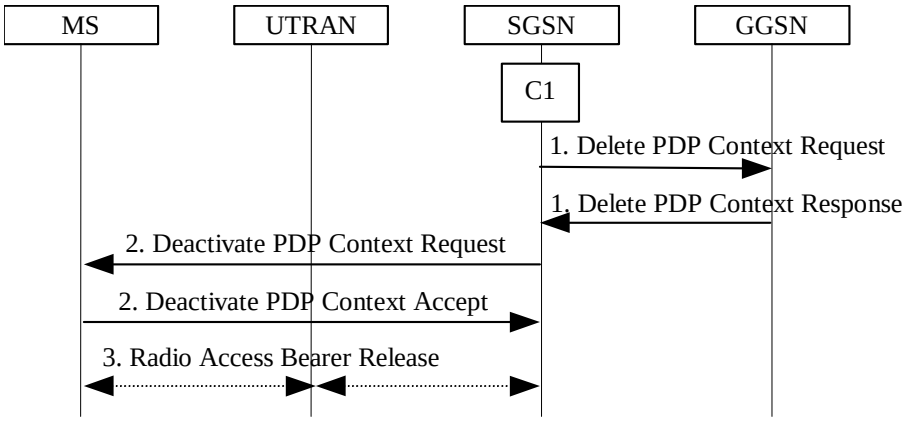

Figure 72: PDP Context Deactivation Initiated by SGSN Procedure

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

C1) ~~CAMEL_GPRS_Deactivate_PDP_Context.~~CAMEL_GPRS_PDP_Context_Disconnection

The procedure returns as result “Continue”.

— 24th modified section in paragraph 9.2.4.3 PDP context desactivation initiated by GGSN Procedure

9.2.4.3 PDP Context Deactivation Initiated by GGSN Procedure

The PDP Context Deactivation Initiated by GGSN procedure is illustrated in Figure 73.

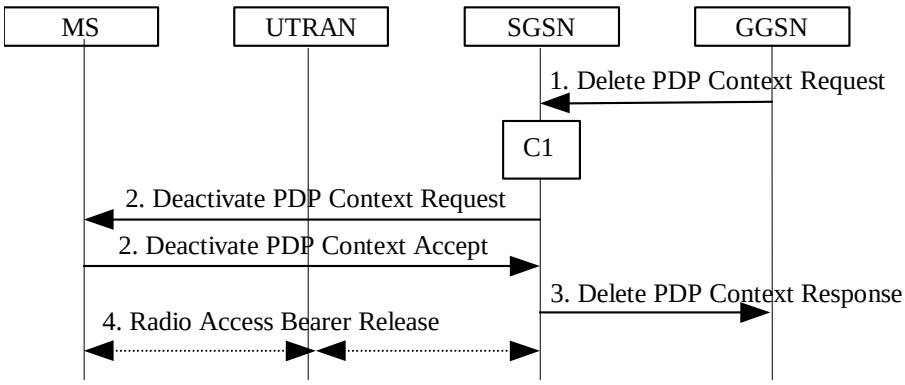

Figure 73: PDP Context Deactivation Initiated by GGSN Procedure

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

C1) ~~CAMEL-GPRS-Deactivate-PDP-Context~~CAMEL_GPRS_PDP_Context_Disconnection.

The procedure returns as result “Continue”.

— 25th modified section in paragraph 15.1 Charging

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 his 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.

Charging may be also realised by a CAMEL server using CAMEL interaction procedures, see referenced procedures in 3G TS 23.078.

— 26th modified section in paragraph 16.1.1.2 MO SMS Transfer

16.1.1.2 Mobile-originated SMS Transfer

Figure 96 and the description below explain the steps involved in sending a SM from an MS over a GPRS radio channel.

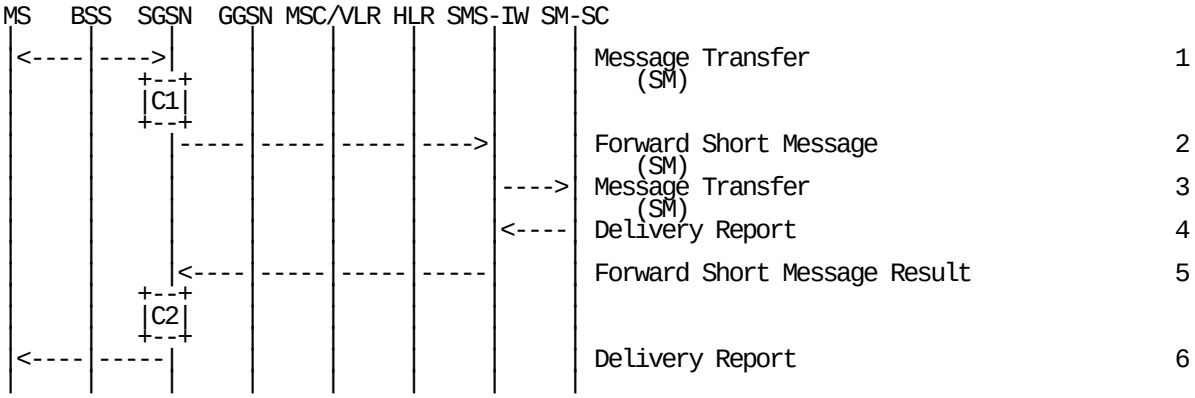

Figure 96: MO SMS Transfer, Successful

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

~~C1) CAMEL-GPRS-SMS-MO-Request.~~

~~C2) CAMEL-GPRS-SMS-MO-Result.~~

C1) CAMEL_O_SMS_INIT.

C2) CAMEL_O_SMS_SUBMITTED

3GPP TSG-SA2 Meeting #16
Los Angeles, 22-26 January, 2001

Tdoc S2-010123

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **CR 183** ⌘ rev **r2** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	MS permanent (static) PDP address allocation by External PDN/correction
Source:	⌘	Rapporteur
Work item code:	⌘	***Date:*** ⌘ 02/22/01
Category:	⌘ **F**	***Release:*** ⌘ R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	The CR was approved by SA2 #15, however it wasn't implemented because it was omitted in the package approved by SA #10 plenary. In 23.060 clause 9.2.1 paragraph 4, the following text restricts the scope of the External PDN Address Allocation to only dynamic address allocation: "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]." The purpose of this CR is to clarify that External PDN Address Allocation allows both static and dynamic address allocation between the MS and the PDN.
Summary of change:	⌘	Modification of text in clause 9.2.1 bullet item 1 of paragraph 1 and paragraph 4 to clarify that the "External PDN dynamic Address Allocation" case allows permanent and dynamic PDP address allocation between the MS and the PDN. The text was coordinated with CR 195 r1 in S2-001973.
Consequences if not approved:	⌘	Ambiguity in interpretation of scope of the text related to PDP address allocation by the external PDN operator or administrator, i.e., whether or not static PDP address allocation by an external PDN operator is a valid scenario.

Clauses affected:	⌘	9.2.1
Other specs	⌘ ☐	Other core specifications ⌘

affected:	☐ Test specifications ☐ O&M Specifications	
Other comments: ⌘		

How to create CRs using this form:

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

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

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

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

9.2.1 Static and Dynamic PDP Addresses

PDP addresses can be allocated to an MS in four different ways:

- the HPLMN operator assigns a PDP address permanently to the MS (static PDP address);
- the HPLMN operator assigns a PDP address to the MS when a PDP context is activated (dynamic HPLMN PDP address);
- the VPLMN operator assigns a PDP address to the MS when a PDP context is activated (dynamic VPLMN PDP address); or
- the PDN operator or administrator assigns a permanent or dynamic IP address to the MS (External PDN Address Allocation).

It is the HPLMN operator that defines in the subscription whether a dynamic HPLMN or VPLMN PDP address can be used.

For every IMSI, zero, one, or more dynamic PDP 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, the PLMN may obtain a PDP address from the PDN and provide it to the MS during PDP context activation, or the MS may directly negotiate a PDP address with the PDN after the PDP context activation procedures are executed. If the PLMN provides the address during PDP context activation for External PDN Address Allocation, then it is the responsibility of the GGSN and PDN to allocate and release the dynamic PDP address by means of protocols such as DHCP or RADIUS . If DHCP is used, the GGSN provides the function of a DHCP Client. If the MS negotiates a PDP address with the PDN after PDP context activation for External PDN Address Allocation, it is the responsibility of the MS and the PDN to allocate and release the PDP address by means of protocols such as DHCP, or MIP. In case of DHCP, the GGSN provides the function of a DHCP Relay Agent as defined in RFC 2131 [47] and RFC 1542 [45]. In case of MIP, the GGSN provides the function of a Foreign Agent as defined in RFC 2002 [46].

Only static PDP addressing is applicable in the network-requested PDP context activation case.

3GPP TSG SA2 Meeting #17 ***S2-010720***
Gøteborg, Sweden, 26 February - 2 March

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **186** ⌘ rev **R3** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Suspend/Resume at Intersystem change
Source:	⌘	Ericsson
Work item code:	⌘	Release 99
Date:	⌘	2001-02-27
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘ The existing procedure for Suspend/Resume handling is only describing the case with combined 2G/3G SGSN, and not facing the fact that 2G SGSN and 3G SGSN could be different nodes.

This leads to problems when an MS during CS connection moves from a cell supporting DTM in one SGSN to a cell not supporting DTM in another SGSN, since it is not possible to initiate suspend between SGSN's.

The problem is valid for both intra system (GSM-GSM) and inter system (UMTS-GSM).

Another problem is the resume handling after intersystem change (GSM-UMTS) since the MS due to "Selective RAU" not always will send an RAU directly when entering the UMTS cell.

Summary of change: ⌘ 1) Introduce a new Suspend message between SGSN's.
2) Change MS handling to always send RAU directly at entering DTM capable cell when in suspend mode.

Due to the complexity with all the different traffic cases in one figure it is also proposed to split the suspend description into intra/inter system and intra/inter SGSN figures.

Consequences if not approved: ⌘ Old SGSN will continue to send downlink PDU's against the MS, even though the MS has left the cell.

Clauses affected: ⌘ 16.2.1

Other specs Affected: ⌘
[X] Other core specifications ⌘ 29.060
[ ] Test specifications
[ ] O&M Specifications

Other comments: ⌘	

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

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

The MS shall request the network for suspension of GPRS services when the MS or the network limitations make it unable to communicate on GPRS channels in one or more of the following scenarios:

1 When a GPRS-attached MS enters dedicated mode and the support of Class A mode of operation is not posssible (e.g. the MS only supports DTM (see GSM 03.64) and the network only supports independent CS and PS).

2 During CS connection, the MS performs handover from UMTS to GSM, and the MS or the network limitations make it unable to support CS/PS mode of operation, e.g. ~~When~~ an MS in CS/PS mode of operation in UMTS during a CS connection reverts to class-B mode of operation in GSM.

3 When an MS in class A mode of operation is handed over to a cell where the support of Class A mode of operation is not possible (e.g. a DTM mobile station entering a cell not supporting DTM).

16.2.1.1 Intra GSM (GSM Only) Suspend and Resume procedure

16.2.1.1.1 Intra SGSN Suspend and Resume procedure

The Suspend and Resume procedure for intra SGSN is illustrated in figure 96.

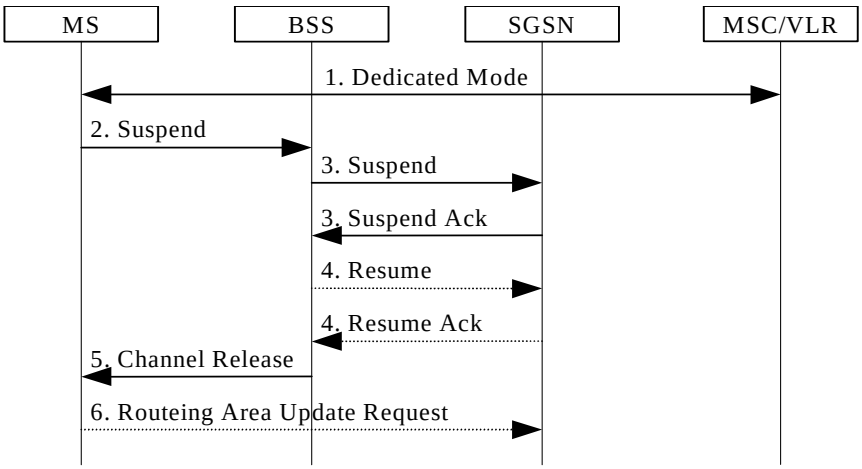

Figure 96: Suspend and Resume Procedure for intra SGSN

1) The MS enters dedicated mode and the MS or the network limitations make it unable to support of Class A mode of operation, ~~performs handover from UMTS to GSM (where the MS reverts to GSM class-B mode of operation) during CS connection~~ or during CS connection, ~~the~~ a DTM MS performs handover from a cell supporting ~~class~~ DTM to a cell not supporting DTM.

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 may determine that theconditions for the GPRS suspension have disappeared. 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) If the circuit switched radio channel is to be released, the BSS sends an RR Channel Release (Resume) message to the MS. The Resume message 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) 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":

- if the BSS did not successfully request the SGSN to resume GPRS services,
- if the RR Channel Release message was not received before the MS left dedicated mode,
- ~~if an MS in GSM class B mode of operation during CS connection performs handover to CS/PS mode of operation in UMTS or~~
- if the MS locally determines that the conditions for the GPRS suspension have disappeared

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.

16.2.1.1.2 Inter SGSN Suspend and Resume procedure

The Suspend and Resume procedure for inter SGSN is illustrated in figure xx.

This describes the scenario where the old cell and the new cell are handled by different SGSN's, i.e. suspend message is received in an SGSN that is different from the SGSN currently handling the packet date transmission.

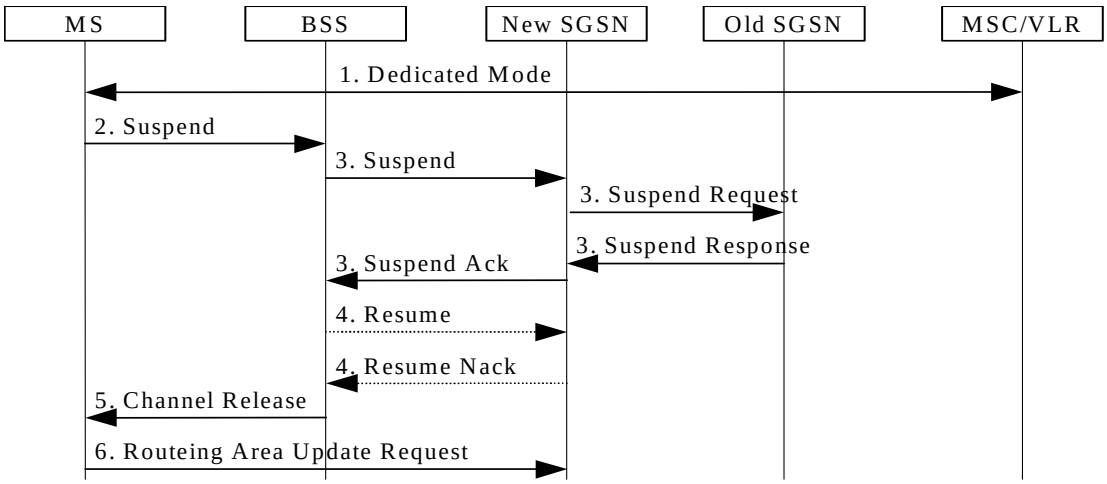

Figure X: Suspend and Resume Procedure for inter SGSN

1) During CS connection, ~~The~~ a DTM MS performs handover from a cell supporting DTM to a cell not supporting DTM ~~during CS connection.~~

2) The MS sends an RR Suspend (TLLI, RAI) message to the BSS.

3) The BSS sends a Suspend (TLLI, RAI) message to the SGSN.

- Since this SGSN that receives the Suspend message are not the one currently handling the packet data transmission, an indication to perform suspend will be sent to the old SGSN by means of a SUSPEND REQUEST message on the Gn interface. The ~~A~~address of the old SGSN is derived by "old RAI" received in Suspend message.
- The Old SGSN return a SUSPEND RESPONSE.

- New SGSN then returns Suspend Ack to BSS.

4) After CS connection is terminated, BSS may send a Resume (TLLI, RAI) message to the new SGSN, but since resume is not needed against the old SGSN, the new SGSN acknowledges the resume by Resume Nack. (Resume is not needed against old SGSN since MS in this case always will perform an RA Update for updating of GPRS services when the CS connection is terminated and the MM context will be moved from old to new SGSN.)

5) The BSS sends an RR Channel Release message to the MS, indicating that BSS has not successfully requested the SGSN to resume GPRS services for the MS. The MS leaves dedicated mode.

6) 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".

16.2.1.2 Inter System (UMTS-GSM) Suspend and Resume procedure

16.2.1.2.1 Intra SGSN Suspend and Resume procedure

The Suspend and Resume procedure for intra SGSN is illustrated in figure 96.

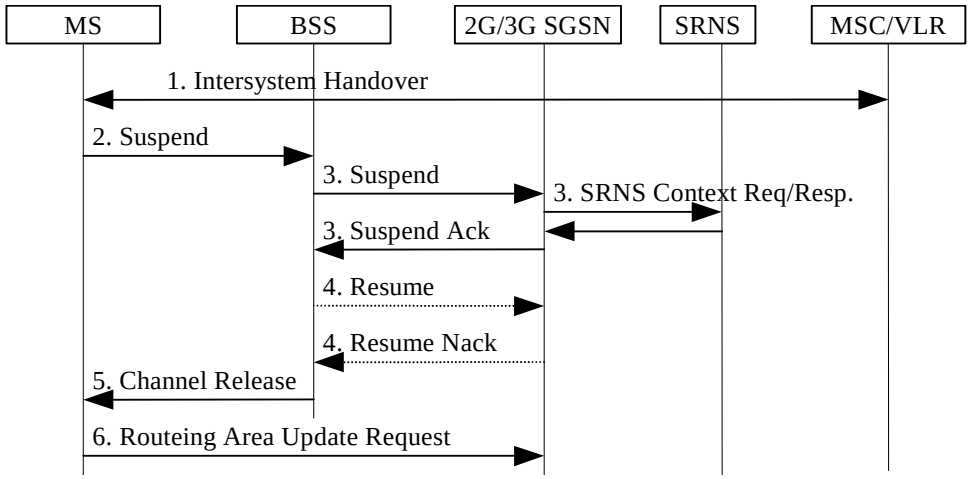

Figure X: Suspend and Resume Procedure for intra SGSN

1) During CS connection, the MS performs handover from UMTS to ~~a~~ GSM ~~cell~~ and ~~either~~ the MS or the network limitations make unable to support CS/PS mode of operation.

2) The MS sends an RR Suspend (TLLI, RAI) message to the BSS.

3) The BSS sends a Suspend (TLLI, RAI) message to the SGSN.

- The SGSN will then request the SRNS to stop sending downlink PDU's by the SRNS Context Request message. The SRNS then starts buffering the downlink PDU's.

- The SRNS responds with an SRNS Context Response message.

- SGSN then returns Suspend Ack to BSS.

4) After CS connection is terminated BSS may send a Resume (TLLI, RAI) message to the SGSN, but resume is not possible since MS has changed radio system, so the SGSN acknowledges the resume by Resume Nack.

5) The BSS sends an RR Channel Release message to the MS, indicating that BSS has not successfully requested the SGSN to resume GPRS services for the MS.

6) The MS shall resume GPRS services by sending a Routeing Area Update Request message to the SGSN, as described in subclause "Inter System Change Procedure".

16.2.1.2.2 Inter SGSN Suspend and Resume procedure

The Suspend and Resume procedure for inter SGSN is illustrated in figure xx.

This describes the scenario when the suspend message is received in an SGSN that is different from the SGSN currently handling the packet date transmission and would be valid for at least the following cases:

- MS performs inter system handover from UMTS to GSM during CS connection and the SGSN handling the GSM cell are different from the SGSN handling the UMTS cell, i.e. the 2G and 3G SGSN's are separated.

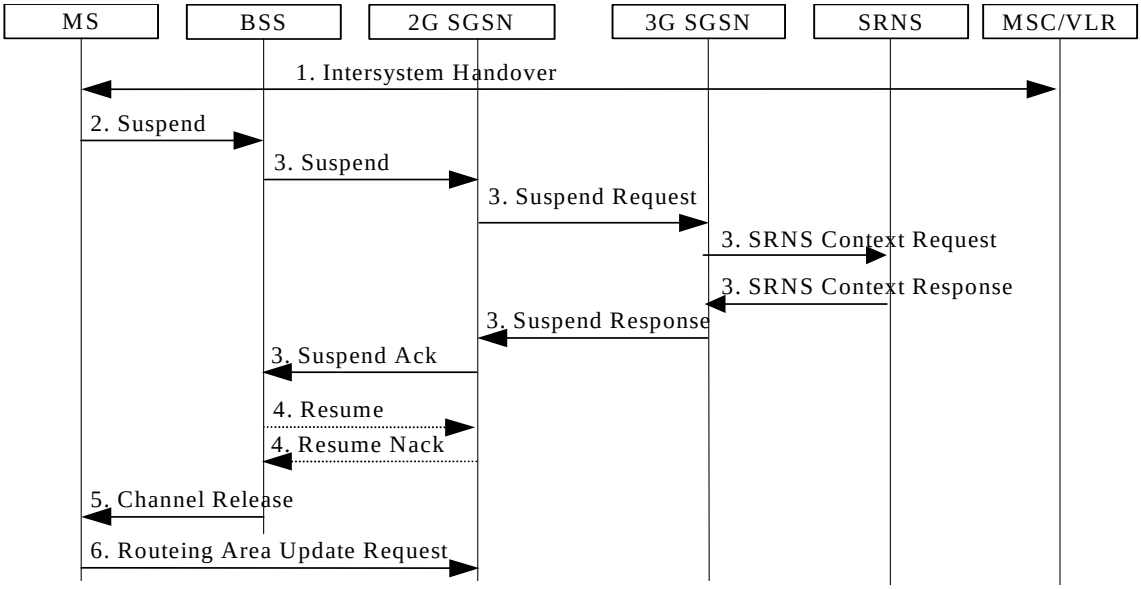

Figure X: Suspend and Resume Procedure for inter SGSN

1) During CS connection, the MS performs handover from UMTS to GSM, and the MS or the network limitations make it unable to support CS/PS mode of operation.

2) The MS sends an RR Suspend (TLLI, RAI) message to the BSS.

3) The BSS sends a Suspend (TLLI, RAI) message to the SGSN.

   - Since this SGSN that receives the Suspend message are not the one currently handling the packet data transmission, an indication to perform suspend will be sent to the 3G SGSN by means of a SUSPEND REQUEST message on the Gn interface. The a~~A~~address of the old SGSN is derived by "old RAI" received in Suspend message.

   - The 3G SGSN will then request the SRNS to stop sending downlink PDU's by the SRNS Context Request message. Upon reception of the SRNS Context Request message the SRNS starts buffering the downlink PDU's.

   - The SRNS responds with an SRNS Context Response message.

   - The 3G SGSN return a SUSPEND RESPONSE.

   - 2G SGSN then returns Suspend Ack to BSS.

4) After CS connection is terminated BSS may send a Resume (TLLI, RAI) message to the 2G SGSN, but since resume is not needed against the 3G SGSN the 2G SGSN acknowledges the resume by Resume Nack. (Resume is not needed in this case since MS always will perform an RA Update for updating of GPRS services when the CS connection is terminated and the MM context will be moved from 3G to 2G SGSN.)

5) The BSS sends an RR Channel Release message to the MS, indicating that BSS has not successfully requested the SGSN to resume GPRS services for the MS.

6) The MS shall resume GPRS services by sending a Routeing Area Update Request message to the SGSN, as described in subclause " Inter System Change Procedure".

16.2.1.3 Inter System (GSM-UMTS) Resume procedure

Only resume is applicable in the GSM to UMTS intersystem case.

~~16.2.1.1.1~~16.2.1.3.1 Intra SGSN Resume procedure

The procedure for resume of GPRS traffic at intra SGSN case is illustrated in figure xx.

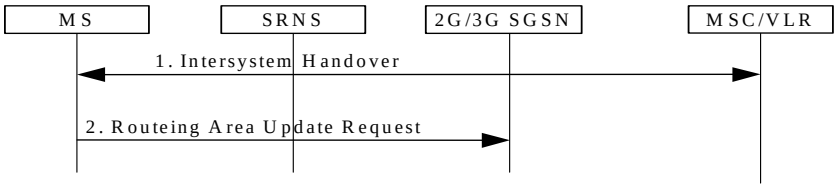

Figure X: Resume of GPRS traffic at intra SGSN

1) The MS in GSM class-B mode of operation during CS connection performs handover to CS/PS mode of operation in UMTS;
or the MS in class-A mode of operation capable of DTM performs handover during CS connection from a GSM cell not supporting DTM to a UMTS cell.

2) The MS shall resume GPRS services, directly after the CS handover is completed, by sending a Routeing Area Update Request message to the SGSN, as described in subclause " Inter System Change Procedure".

16.2.1.3.2 Inter SGSN Resume procedure

The procedure for resume of GPRS traffic at inter SGSN case is illustrated in figure xx.

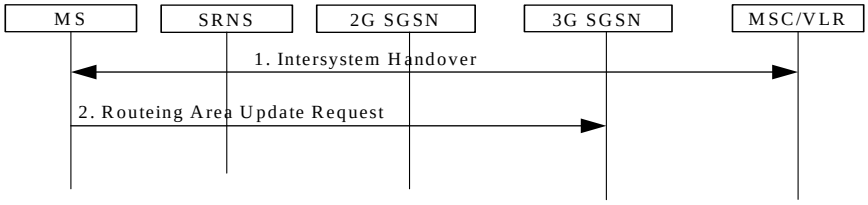

Figure X: Resume of GPRS traffic at inter SGSN

1) The MS in GSM class-B mode of operation during CS connection performs handover to CS/PS mode of operation in UMTS;
or the MS in class-A mode of operation capable of DTM performs handover during CS connection from a GSM cell not supporting DTM to a UMTS cell.

2) The MS shall resume GPRS services, directly after the CS handover is completed, by sending a Routeing Area Update Request message to the SGSN, as described in subclause " Inter System Change Procedure":

16.2.2 GPRS and Dedicated Mode Priority Handling

An MS in class-B mode of operation that communicates on GPRS radio channels when a dedicated channel is needed, shall immediately abort the GPRS communication and trigger the Suspend and Resume procedure.

Response to circuit-switched paging, non-emergency MO circuit-switched calls, MO SMS, and MO supplementary services are exceptions to the above rule. In these cases, it is an implementation choice whether to immediately abort GPRS communication or to delay the dedicated mode establishment.

3GPP TSG SA2 Meeting #16 **Tdoc S2-010286**
Los Angeles, USA 22-26 January, 2001 **(revision of S2-010261)**

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **200** ⌘ rev **1R ~~2~~** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Clarification of TFT request during secondary PDP context activation.
Source:	⌘	Lucent Technologies UK
Work item code:	⌘	GPRS ***Date:*** ⌘ 2001-01-17
Category:	⌘	**F** ***Release:*** ⌘ R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	Confusion could exist with regard to secondary PDP contexts requiring Traffic Flow Templates. It is acceptable for all active PDP contexts to have an associated, individual TFT or for all but one PDP context to have an associated TFT. 3G TS 23.060 states, 'Each PDP context may be associated with a TFT. At most one PDP context associated with the same PDP address may exist at any time with no TFT assigned to it'. Therefore, whether a secondary PDP context requests a TFT, at activation, is dependent upon whether a PDP context without a TFT already exists for the particular PDP address.
Summary of change:	⌘	Amend the text in 23.060 Traffic Flow Template to indicate when a ~~secondary~~ PDP context is required to be associated with a TFT.
Consequences if not approved:	⌘	MS may request a TFT during secondary PDP context activation procedure when not explicitly required.

Clauses affected:	⌘	clause 15.3		
Other specs affected:	⌘	☒ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	24.008 CR 366/367
Other comments:	⌘	~~A~~ CR366/367 to 24.008 ~~has~~ have been accepted at CN1#15.		

How to create CRs using this form:

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

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

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

15.3 Traffic Flow Template

A TFT consists of from one and up to eight packet filters, each identified by a unique packet filter identifier. A packet filter also has an evaluation precedence index that is unique within all TFTs associated with the PDP contexts that share the same PDP address. This evaluation precedence index is in the range of 255 (lowest evaluation precedence) down to 0 (highest evaluation precedence). The MS manages packet filter identifiers and their evaluation precedence indexes, and creates the packet filter contents.

At any given time, there ~~should~~shall be a maximum of one PDP context, for a particular PDP address, that is not associated with a TFT.

A TFT ~~is always~~can be associated with a PDP context either during the Secondary PDP Context Activation procedure or ~~. A TFT may be added to a PDP context that was created with the PDP Context Activation Procedure~~ by means of the MS-Initiated PDP Context Modification procedure if the PDP context is already active but has no TFT associated with it. By means of the MS-Initiated PDP Context Modification procedure any TFT can be modified. A PDP context can never have more than one TFT associated with it.

3GPP TSG-SA2 Meeting *Tdoc S2-010104*
Los Angeles, CA, USA, 22nd – 26th January 2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **202** ⌘ rev ⌘ Current version: **3.5.0** ⌘

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

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

Title:	⌘	Add new feature 'ODB for the Packet Oriented Services'
Source:	⌘	NEC
Work item code:	⌘	ODB enhancements
Date:	⌘	11th January 2001
Category:	⌘	**B**
Release:	⌘	REL-4

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	According to the WID of ODB for Packet Oriented Services, this CR expands to apply the ODB feature to the Packet Oriented Services
Summary of change:	⌘	This CR consists of the following 6 Changes. 1. TS 23.015 is out in the section 2 References. 2. ODB is put in the Abbreviations. 3. ODB functionality is declared in the section 5.3 Network Access Control Functions. 4. Section 5.5 Assignment of Functions to General Logical Architecture includes the assignment of functions for 5. Annex A includes the ODB judgements while the SGSN performs the APN and GGSN selection. 6. The ODB for PS related parameters are newly defined as the subscription data to be kept in the HLR and SGSN.
Consequences if not approved:	⌘	The ODB for Packet Oriented Services cannot be standardised as the Release 4 feature.

Clauses affected:	⌘	2, 3.2, 13.1, 5.3.17, 5.5, 13.2, Annex A
Other specs Affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	The SDL file that attached in this CR contains the entire Annex A SDL diagrams for the purpose of the electrical maintenance.

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

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

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

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

2 References

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

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

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

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

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

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

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

[5b] 3G TS 23.016: "Subscriber Data Management; Stage 2".

[6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[7] GSM 03.22: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

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

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

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

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

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

[13] 3G TS 24.008: "Mobile radio interface layer 3 specification; Core Network Protocols – Stage 3".

[14] GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".

[15] GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station – Serving GPRS Support Node (MS - SGSN) Logical Link Control (LLC) layer specification".

[16] GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[16b] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[17] 3G TS 27.060: "General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS".

[18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification".

[19] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".

[20] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".

[21] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[22] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

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

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

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

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

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

[27b] 3G TS 29.078: "3rd Generation Partnership Project; Customised Applications for Mobile Network Enhanced Logic (CAMEL) Phase 3; CAMEL Application Part (CAP) Specification".

[28] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[29] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.2 Abbreviations

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

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

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

5.3.1 Network Access Control Functions

Network access is the means by which a user is connected to a telecommunication network in order to use the services and/or facilities of that network. An access protocol is a defined set of procedures that enables the user to employ the services and/or facilities of the network.

User network access may occur from either the mobile side or the fixed side of the network. The fixed network interface may support multiple access protocols to external data networks, for example IP. The set of access protocols to be supported is determined by the PLMN operator.

Individual PLMN administrations may require specific access-control procedures in order to limit the set of users permitted to access the network, or to restrict the capabilities of individual users, for example by limiting the type of service available to an individual subscriber. Such access control procedures are beyond the scope of the specifications.

5.3.1.1 Registration Function

Registration is the means by which a user's Mobile Id is associated with the user's packet data protocol(s) and address(es) within the PLMN, and with the user's access point(s) to the external PDP network. The association can be static, i.e., stored in an HLR, or dynamic, i.e., allocated on a per need basis.

5.3.1.2 Authentication and Authorisation Function

This function performs the identification and authentication of the service requester, and the validation of the service request type to ensure that the user is authorised to use the particular network services. The authentication function is performed in association with the Mobility Management functions.

5.3.1.3 Admission Control Function

The purpose of admission control is to calculate which network resources are required to provide the quality of service (QoS) requested, determine if those resources are available, and then reserve those resources. Admission control is performed in association with the Radio Resource Management functions in order to estimate the radio resource requirements within each cell.

5.3.1.4 Message Screening Function

A screening function concerned with filtering out unauthorised or unsolicited messages is required. This should be supported through packet filtering functions. All types of message screening are left to the operators' control, e.g., by use of Internet firewalls.

5.3.1.5 Packet Terminal Adaptation Function

This function adapts data packets received / transmitted from / to terminal equipment to a form suitable for transmission across the packet domain network.

5.3.1.6 Charging Data Collection Function

This function collects data necessary to support subscription and/or traffic fees.

5.3.1.7 Operator Determined Barring Function

The purpose of this function is to be able to limit the service provider's financial exposure to new subscribers, or to those who have not promptly paid their bills by regulating a particular packet oriented services.

The functionality of ODB is described in the 3G TS 23.015: "Technical realization of operator determined barring (ODB)" [66].

5.5 Assignment of Functions to General Logical Architecture

The functions identified in the functional model are assigned to the logical architecture.

Table 11: Mapping of Functions to Logical Architecture

Function	2G-MS	3G-MS	BSS	UTRAN	2G-SGSN	3G-SGSN	GGSN	HLR
Network Access Control:								
Registration								X
Authentication and Authorisation	X	X			X	X		X
Admission Control	X	X	X	X	X	X		
Message Screening							X	
Packet Terminal Adaptation	X	X						
Charging Data Collection					X	X	X	
Operator Determined Barring					X	X		X
Packet Routeing & Transfer:								
Relay	X	X	X	X	X	X	X	
Routeing	X	X	X	X	X	X	X	
Address Translation and Mapping	X	X		X	X	X	X	
Encapsulation	X	X		X	X	X	X	
Tunnelling				X	X	X	X	
Compression	X	X		X	X			
Ciphering	X	X		X	X			X
Mobility Management:	X	X			X	X	X	X
Logical Link Management:								
Logical Link Establishment	X				X			
Logical Link Maintenance	X				X			
Logical Link Release	X				X			
Radio Resource Management:	X	X	X	X	X			

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 90.

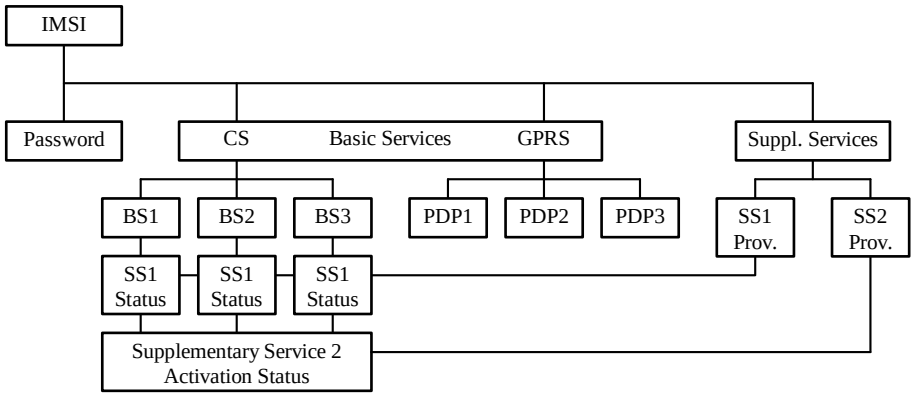


Figure 11: Packet Domain Subscription Data

As figure 90 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 5 shows the packet domain subscription data contained in the HLR.

Table 5: 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
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	X

13.2 SGSN

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

Table 6: 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	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
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g., PPP or IP.	X	X
PDP Address	PDP address, e.g., an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used.	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

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

Annex A (normative): APN and GGSN Selection

This annex contains the rules applied upon PDP context activation to determine the APN and the corresponding GGSN.

A.1 Definitions

The SGSN knows from the subscription data the parameters (S for Subscribed): PDP type (S), PDP address (S), APN (S), and VPLMN address allowed.

The SGSN may know from configuration the default APN supporting a given PDP type. This APN is called APN (SGSN) and does not include an APN Operator Identifier.

The SGSN knows the parameters requested by the MS (R for Requested): PDP type (R), PDP address (R), and APN (R). APN (R) is the APN Network Identifier requested by the MS.

In case of "an APN chosen by the SGSN" the activated PDP context is always linked with a dynamic PDP address.

An MS may have multiple subscription records for the same PDP type and the same PDP address, but with different APNs.

An MS may have one or two subscription records with the same PDP type and the same APN: one with a static PDP address, one with a dynamic PDP address.

When the MS is in its HPLMN, if the MS requests an APN that does not correspond to any GGSN of its HPLMN, the request shall be rejected by SGSN. When the MS is in a VPLMN, if the MS requests an APN that does not correspond to any GGSN of its HPLMN nor of this VPLMN, the request shall be rejected by SGSN.

If APN (S) = wild card (see GSM 03.03), it means either:

- that a default APN (a default PDN) has to be chosen by the SGSN (APN (SGSN)) if no APN (R) has been provided; or
- that a PDP context with dynamic PDP address may be activated towards any APN requested by the MS.

In order to derive APN (R) from the APN sent by the MS, the SGSN shall check if the APN sent by the user ends with ".gprs". If not, then APN (R) is equal to APN sent by the MS. If yes, then APN (R) is the APN sent by the MS without the three last labels.

A.2 Selection Rules

The SGSN shall select the APN to be used to derive the GGSN address, and set the selection mode parameter according to the rules in the SDL diagrams in this subclause. The following definitions apply to the SDL diagrams:

AddrMode: Addressing Mode.

APN-OI: APN Operator Identifier.

HPLMN AP: HPLMN Access Point

HPLMN-OI: HPLMN APN Operator Identifier.

Number <condition>: determines the PDP context subscription records that satisfy the given condition.

PDPaddr: PDP address.

SelMode := ChosenBySGSN: Network-provided APN, subscription not verified.

SelMode := SentByMS: MS-provided APN, subscription not verified.

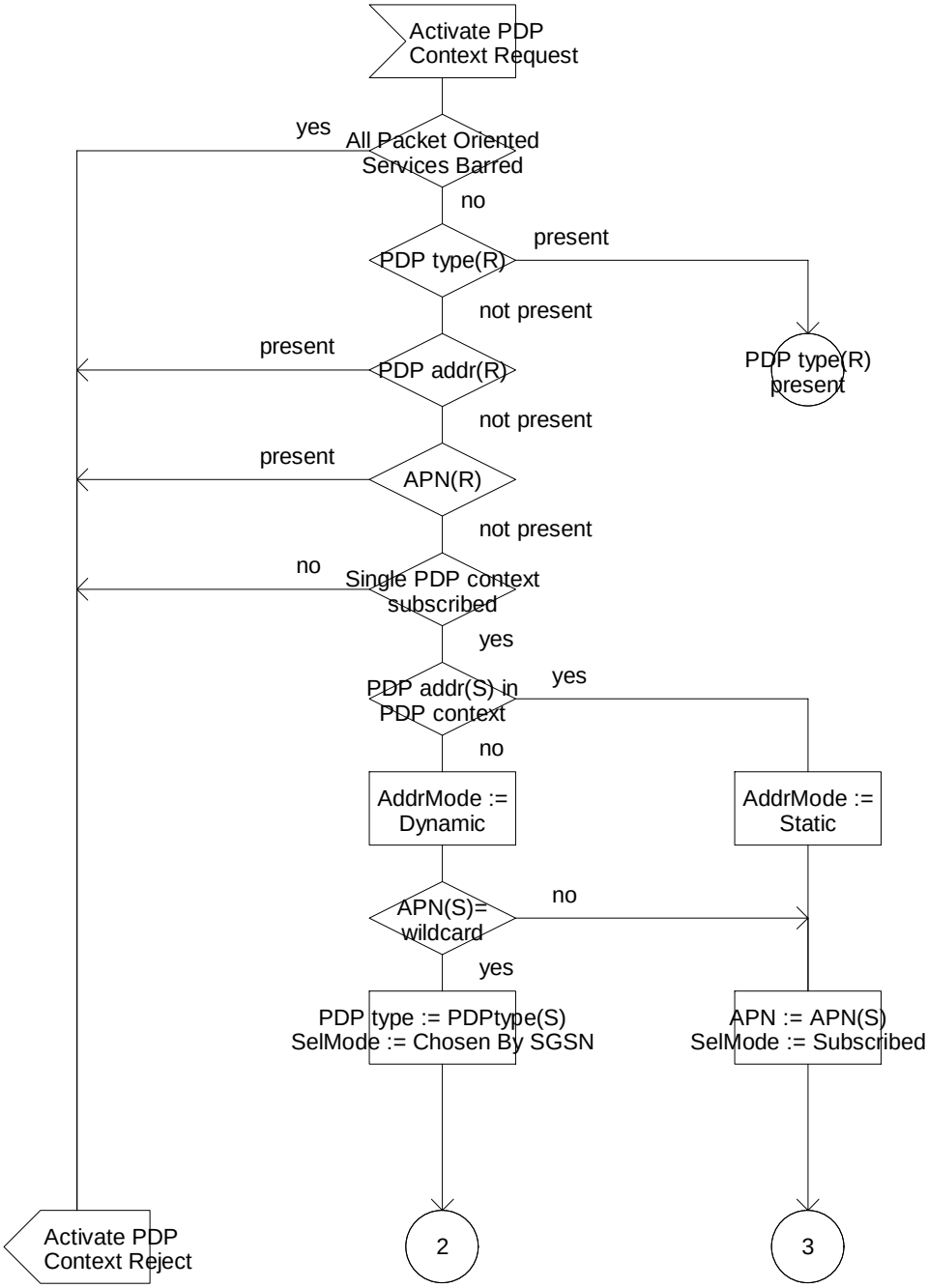
SelMode := Subscribed: MS or Network-provided APN, subscription verified.

SelMode: Selection Mode.

VPLMN AP: VPLMN Access Point

VPLMN-OI: VPLMN APN Operator Identifier.

+: concatenation operation.



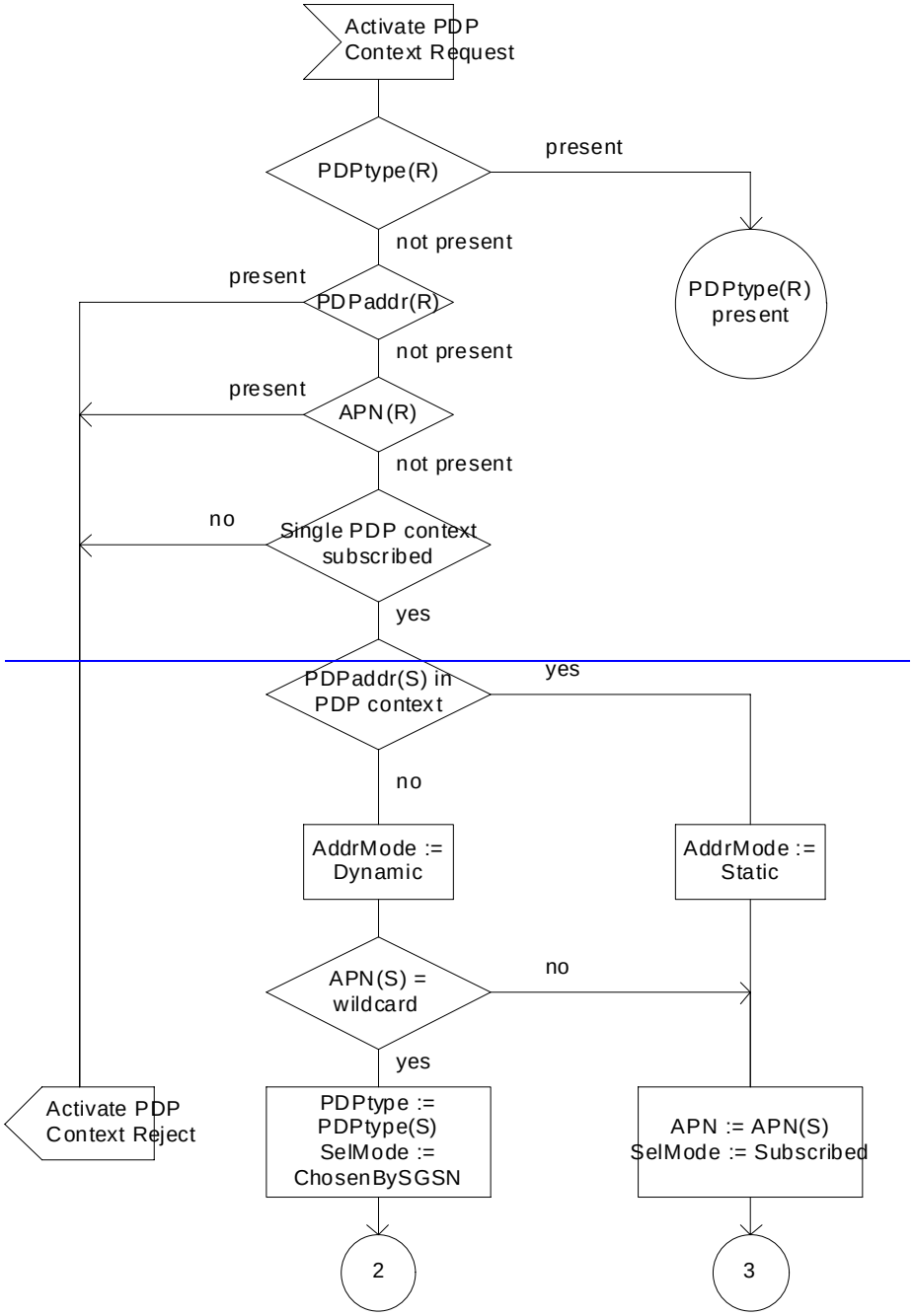
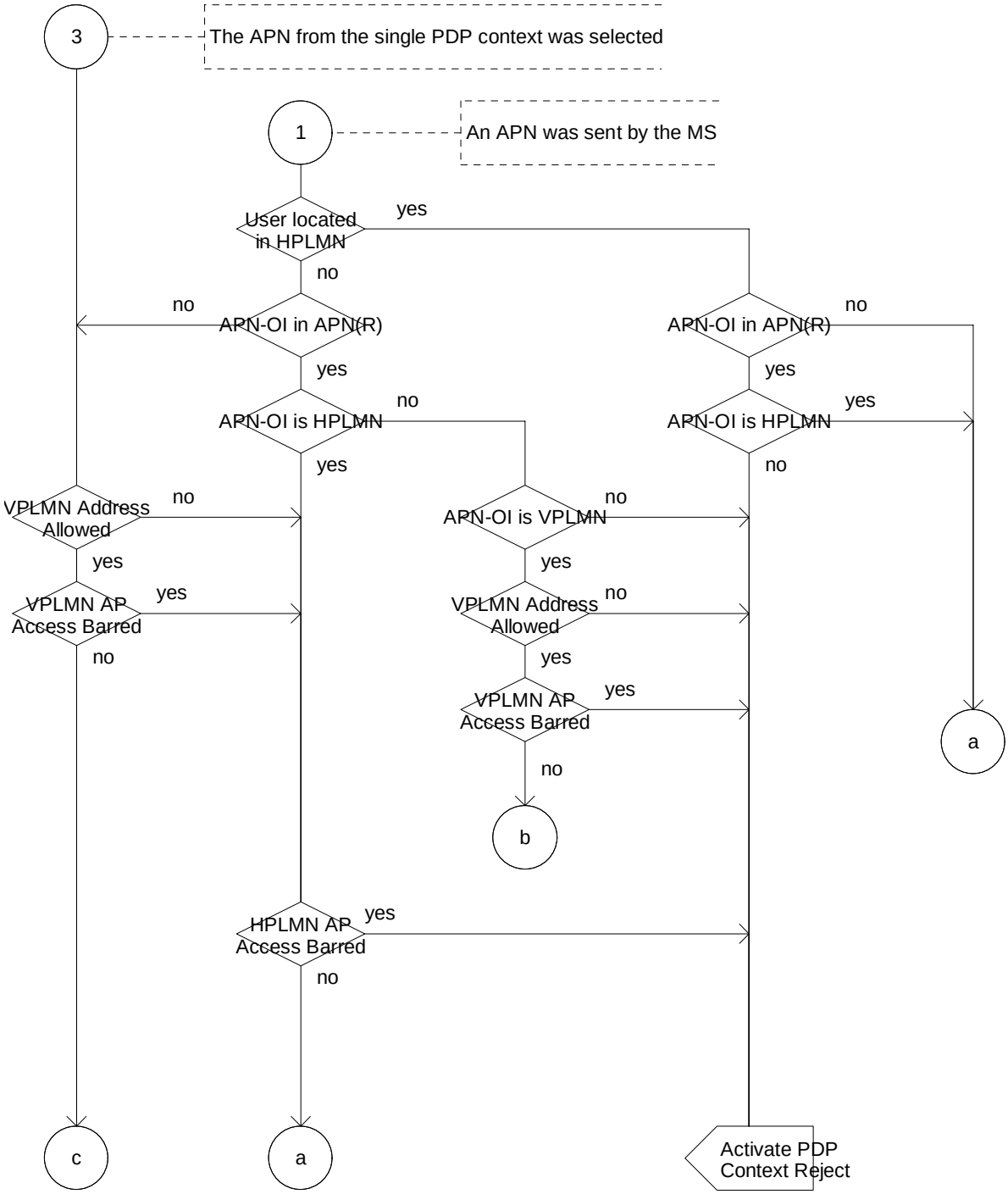


Figure A.1: SDL Diagram 1


3
The APN from the single PDP context was selected
1
An APN was sent by the MS
User located in HPLMN
yes
no
APN-OI in APN(R)
no
yes
APN-OI is HPLMN
no
yes
VPLMN Address Allowed
no
yes
VPLMN AP Access Barred
yes
no
APN-OI is VPLMN
no
yes
VPLMN Address Allowed
no
yes
VPLMN AP Access Barred
yes
no
HPLMN AP Access Barred
yes
no
APN-OI in APN(R)
no
yes
APN-OI is HPLMN
yes
no
a
b
c
a
Activate PDP Context Reject

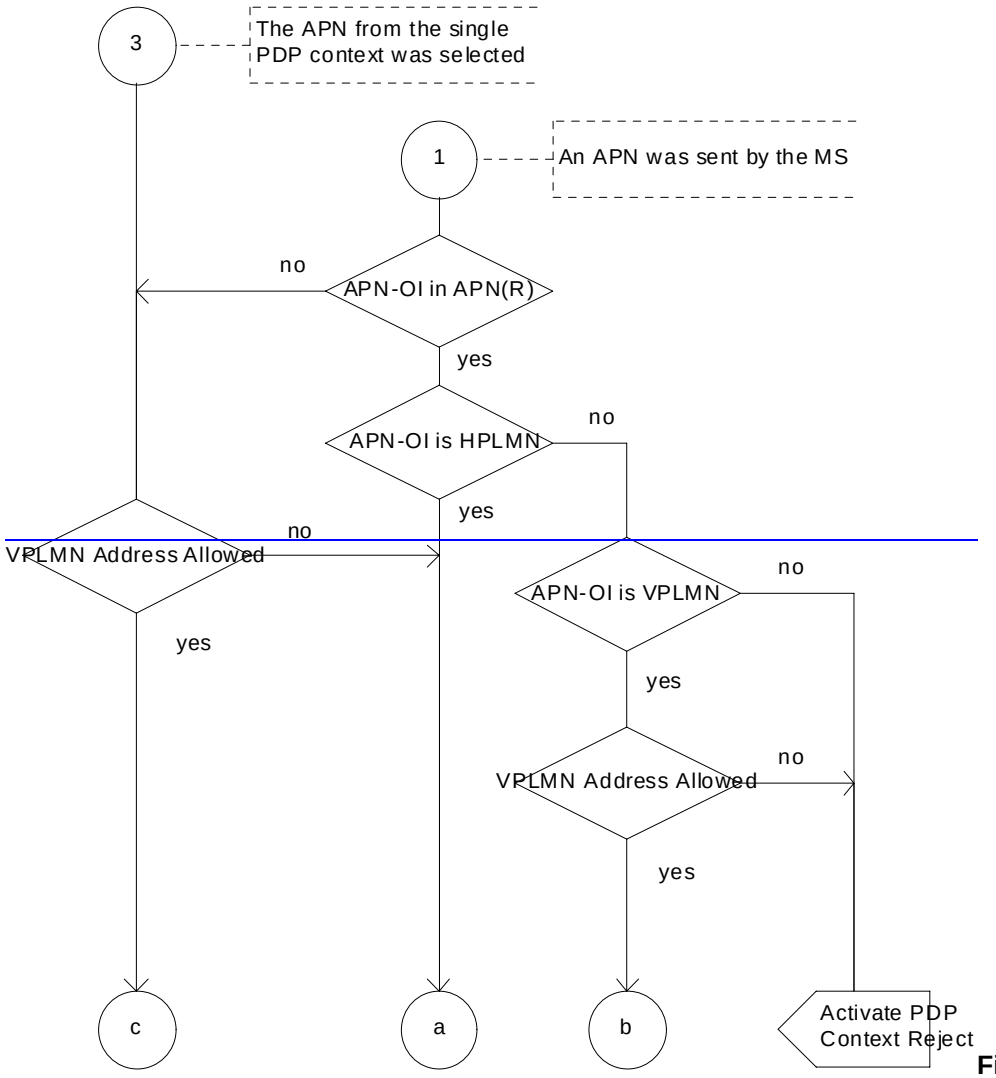
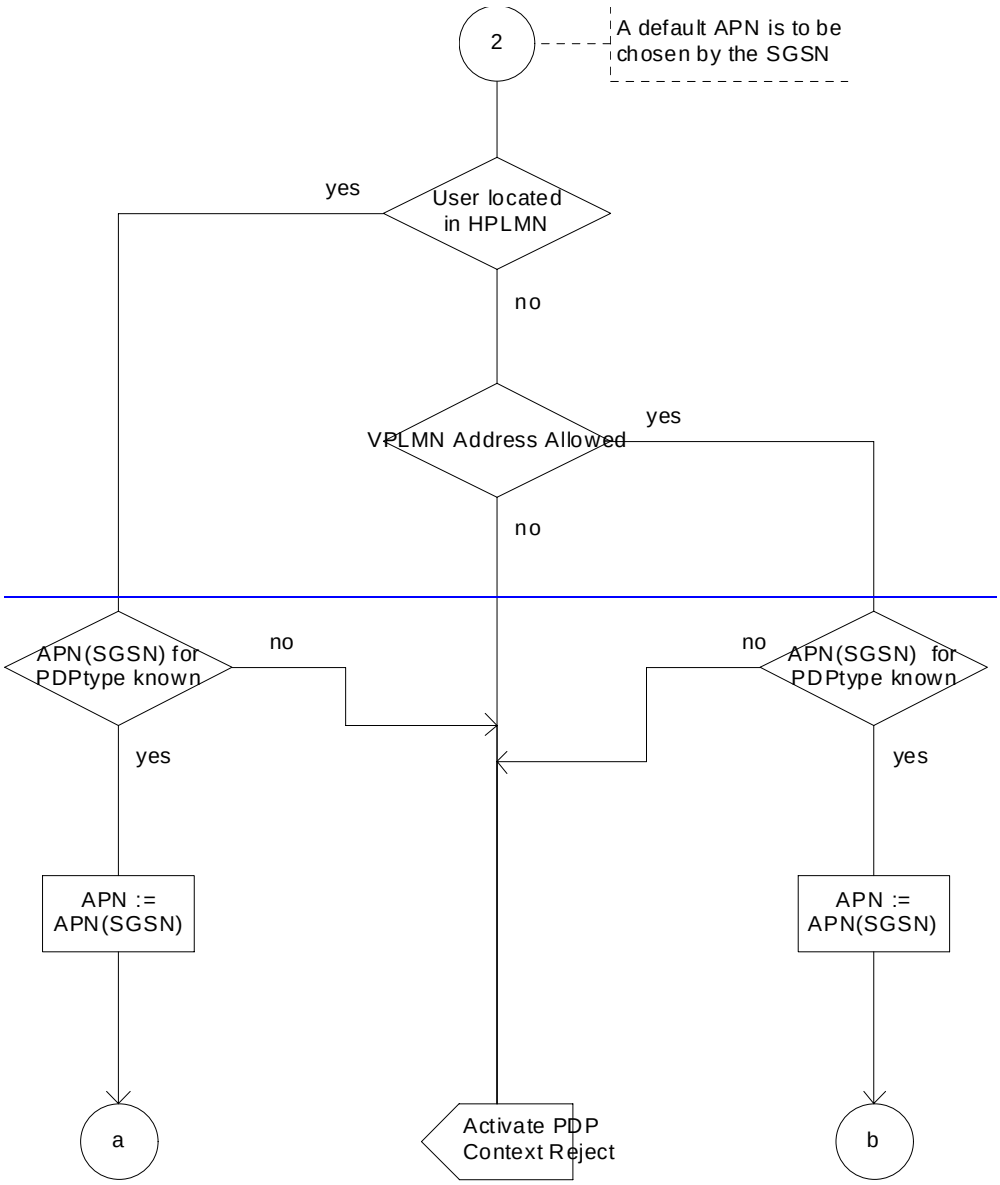


Figure A.4: SDL Diagram 4


2
A default APN is to be chosen by the SGSN
User located in HPLMN
yes
no
VPLMN Address Allowed
yes
no
APN(SGSN) for PDPtype known
no
APN(SGSN) for PDPtype known
no
yes
yes
APN := APN(SGSN)
APN := APN(SGSN)
a
Activate PDP Context Reject
b

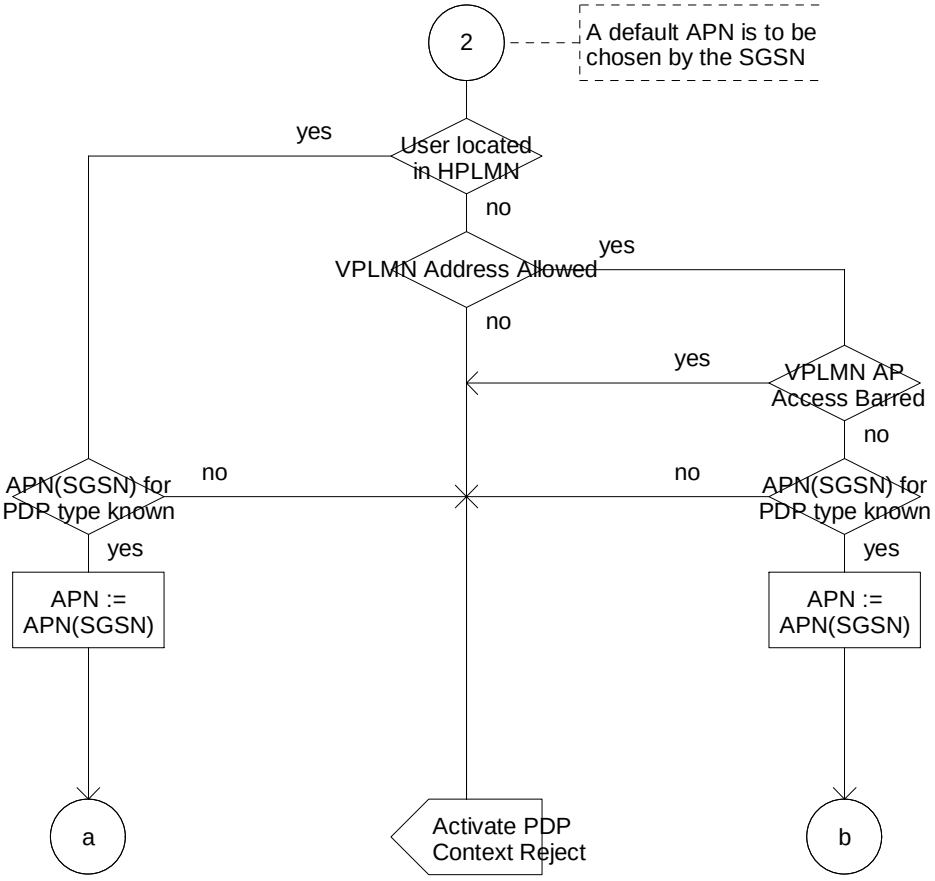


Figure A.5: SDL Diagram 5

3GPP TSG-SA2 Meeting #16
Los Angeles, USA, 22nd – 26th January 2001

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CHANGE REQUEST

⌘ **23.060** **CR** **204** ⌘ rev **R1** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Correction on PDCP conversion at inter and intra SGSN inter system change UMTS - GSM
Source:	⌘	Ericsson
Work item code:	⌘	Release 99
Date:	⌘	2001-01-25
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	Correct the description of where the conversion of PDCP sequence number to SNDCP sequence number is done in inter SGSN and intra SGSN inter system change.
Summary of change:	⌘	The conversion of PDCP sequence number to SNDCP sequence number shall be done in the new (target) SGSN or, if the new SGSN doesn't support GTP version 1, in the node where the conversion to GTP version 0 is done.
Consequences if not approved:	⌘	The sequence numbers will not be forwarded to the target SGSN.

Clauses affected:	⌘	6.13.1.1, 6.13.2.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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.

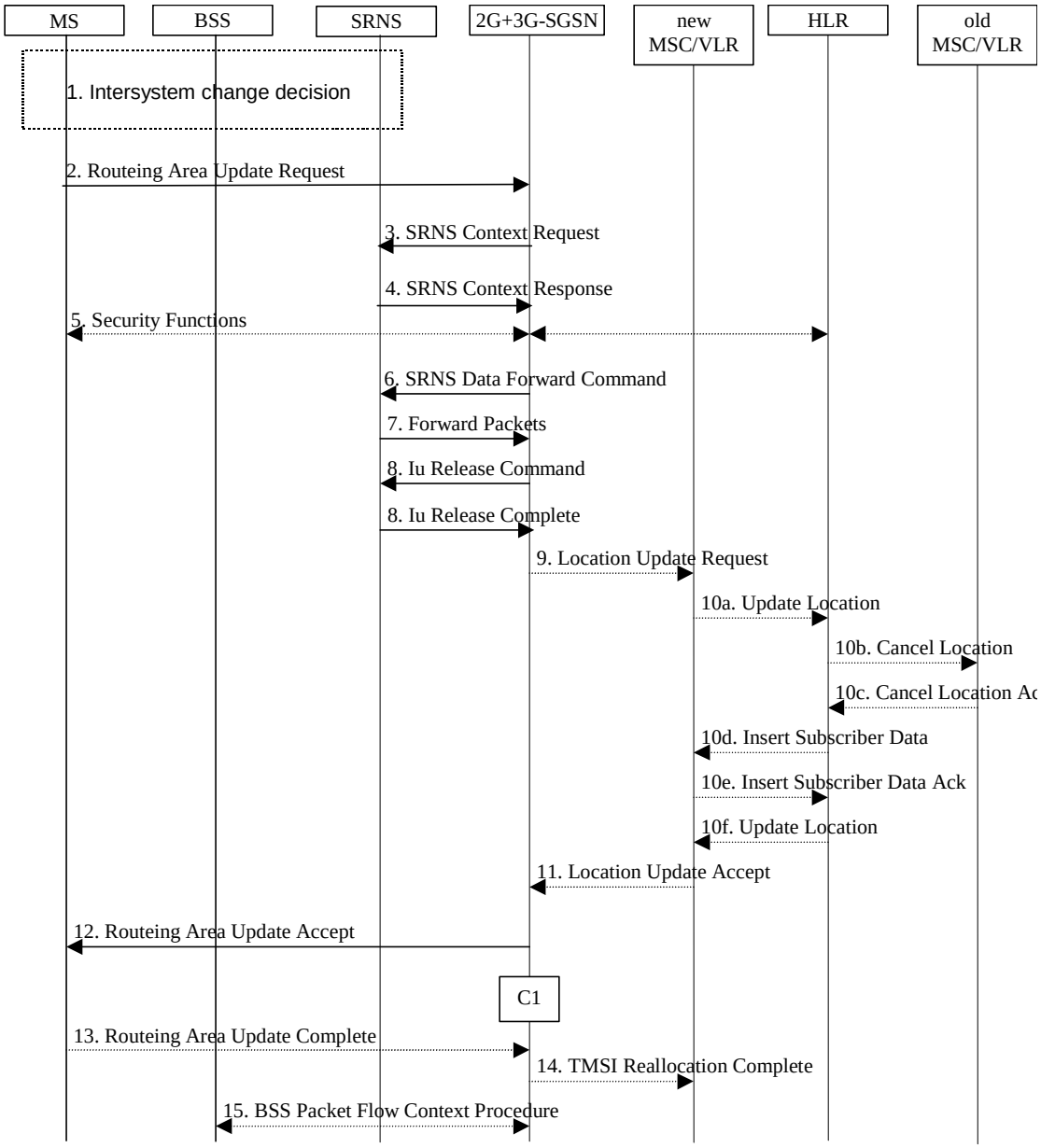

Figure 1: UMTS to GSM Intra SGSN Change

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.

4) Upon reception of the SRNS Context Request message the SRNS starts buffer and stops sending downlink PDUs to the MS. 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 converts the PDCP sequence numbers to SNDCP sequence numbers~~shall (by~~ stripping off the eight most significant bits of the PDCP sequence numbers~~) accompanying the received N-PDUs~~ before sending the~~m~~ N-PDUs 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 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.

********** NEXT 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 53.

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.

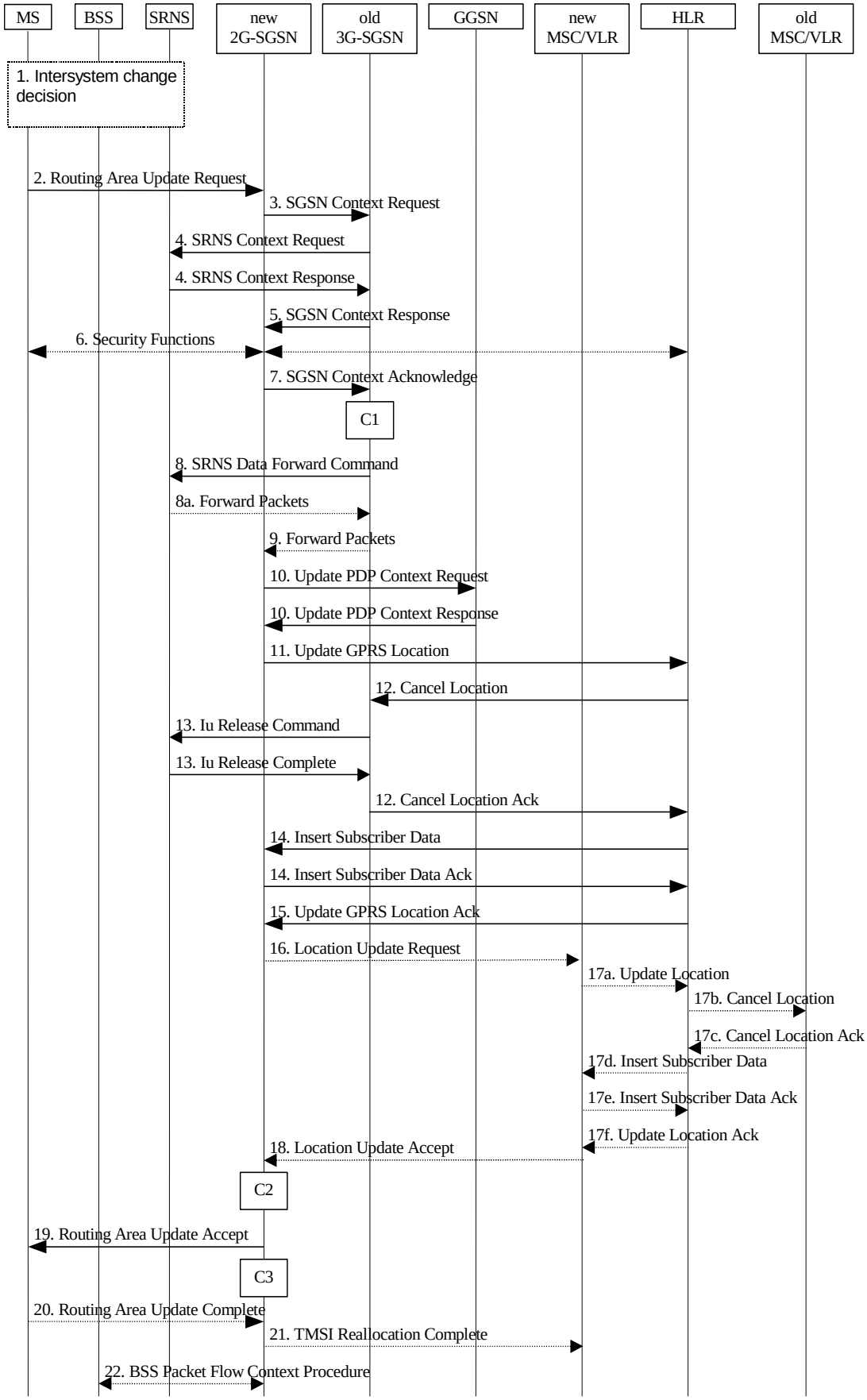

Figure 2: UMTS to GSM Inter SGSN Change

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, MS Network Capability) message to the new 2G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the new 2G-SGSN.

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

4) If the MS is PMM-CONNECTED the old 3G-SGSN sends an SRNS Context Request (IMSI) message to the SRNS. Upon 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. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

6) Security functions may be executed.

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

8) If the MS is 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. In case of GTPv1 t~~T~~he conversion of PDCP sequence numbers to SNDCP sequence numbers (the eight most significant bits shall be stripped off) shall be done in the new SGSN. In case of GTPv0 is used between the SGSNs then the conversion of PDCP sequence numbers to SNDCP numbers shall be done in the old 3G-SGSN (by stripping off the eight most significant bits).~~= 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-Session.

C3) CAMEL-GPRS-Routeing-Area-Update-Context.

3GPP TSG–SA2 Meeting #16
Los Angeles, USA, 22nd – 26th January 2001

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CHANGE REQUEST

⌘ **23.060** **CR** **205** ⌘ rev **-** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Correction to Annex A, SDL-diagram on the rules applied upon PDP context activation to determine the APN and the corresponding GGSN.
Source:	⌘	Ericsson
Work item code:	⌘	Release 99
Date:	⌘	2001-01-15
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	The SDL diagram is not correct and does not describe the correct rules to determine APN and GGSN.
Summary of change:	⌘	• SDL diagram 1, the selection of PDP type is added in case of static address mode. • SDL diagram 4, the APN-OI in APN(R) check is replaced by "APN-OI sent from MS", due to that APN-OI has already been removed from APN(R).
Consequences if not approved:	⌘	The SDL diagrams will not be correct.

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

Annex A (normative): APN and GGSN Selection

This annex contains the rules applied upon PDP context activation to determine the APN and the corresponding GGSN.

A.1 Definitions

The SGSN knows from the subscription data the parameters (S for Subscribed): PDP type (S), PDP address (S), APN (S), and VPLMN address allowed.

The SGSN may know from configuration the default APN supporting a given PDP type. This APN is called APN (SGSN) and does not include an APN Operator Identifier.

The SGSN knows the parameters requested by the MS (R for Requested): PDP type (R), PDP address (R), and APN (R). APN (R) is the APN Network Identifier requested by the MS.

In case of "an APN chosen by the SGSN" the activated PDP context is always linked with a dynamic PDP address.

An MS may have multiple subscription records for the same PDP type and the same PDP address, but with different APNs.

An MS may have one or two subscription records with the same PDP type and the same APN: one with a static PDP address, one with a dynamic PDP address.

When the MS is in its HPLMN, if the MS requests an APN that does not correspond to any GGSN of its HPLMN, the request shall be rejected by SGSN. When the MS is in a VPLMN, if the MS requests an APN that does not correspond to any GGSN of its HPLMN nor of this VPLMN, the request shall be rejected by SGSN.

If APN (S) = wild card (see GSM 03.03), it means either:

- that a default APN (a default PDN) has to be chosen by the SGSN (APN (SGSN)) if no APN (R) has been provided; or
- that a PDP context with dynamic PDP address may be activated towards any APN requested by the MS.

In order to derive APN (R) from the APN sent by the MS, the SGSN shall check if the APN sent by the user ends with ".gprs". If not, then APN (R) is equal to APN sent by the MS. If yes, then APN (R) is the APN sent by the MS without the three last labels. Note: if yes, then the APN-OI shall be saved for later use, see Figure A.4.

A.2 Selection Rules

The SGSN shall select the APN to be used to derive the GGSN address, and set the selection mode parameter according to the rules in the SDL diagrams in this subclause. The following definitions apply to the SDL diagrams:

AddrMode: Addressing Mode.

APN-OI: APN Operator Identifier.

HPLMN-OI: HPLMN APN Operator Identifier (derived from IMSI).

Number <condition>: determines the PDP context subscription records that satisfy the given condition.

PDPaddr: PDP address.

SelMode := ChosenBySGSN: Network-provided APN, subscription not verified.

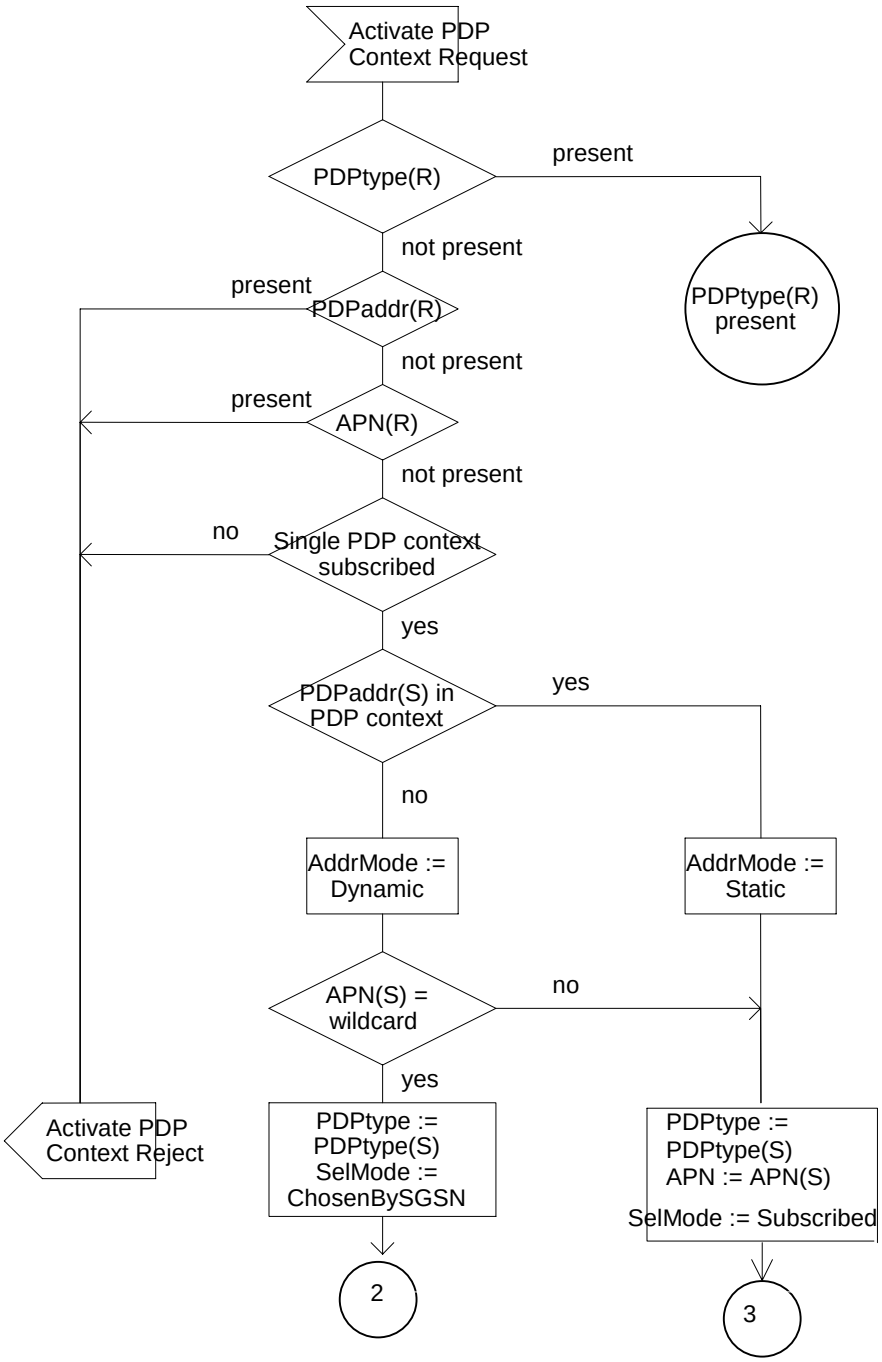
SelMode := SentByMS: MS-provided APN, subscription not verified.

SelMode := Subscribed: MS or Network-provided APN, subscription verified.

SelMode: Selection Mode.

VPLMN-OI: VPLMN APN Operator Identifier.

+: concatenation operation.


Activate PDP Context Request
PDPtype(R)
present
PDPtype(R) present
not present
present
PDPaddr(R)
not present
present
APN(R)
not present
no
Single PDP context subscribed
yes
PDPaddr(S) in PDP context
yes
no
AddrMode := Dynamic
AddrMode := Static
APN(S) = wildcard
no
yes
Activate PDP Context Reject
PDPtype := PDPtype(S) SelMode := ChosenBySGSN
PDPtype := PDPtype(S) APN := APN(S) SelMode := Subscribed
2
3

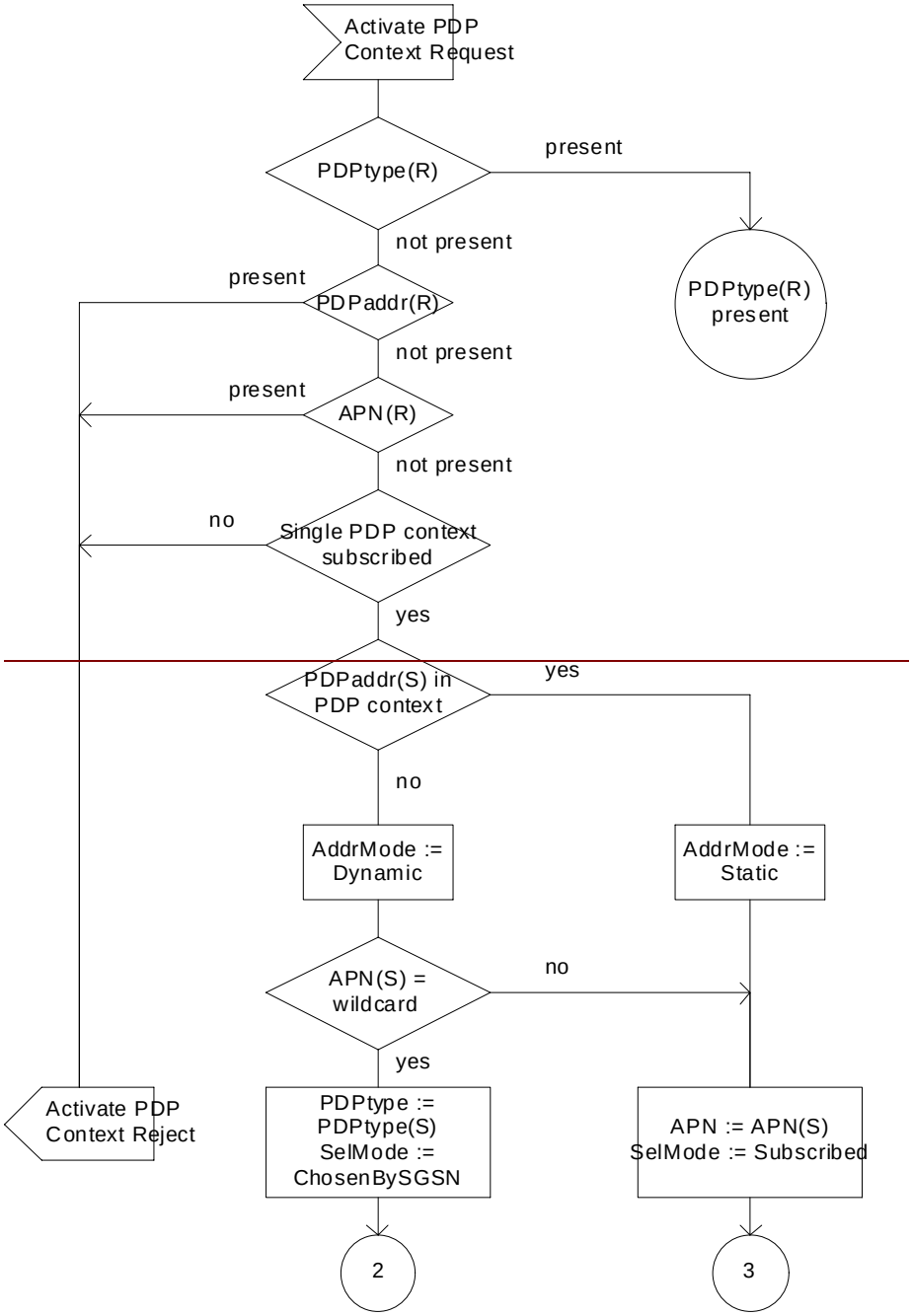


Figure A.1: SDL Diagram 1

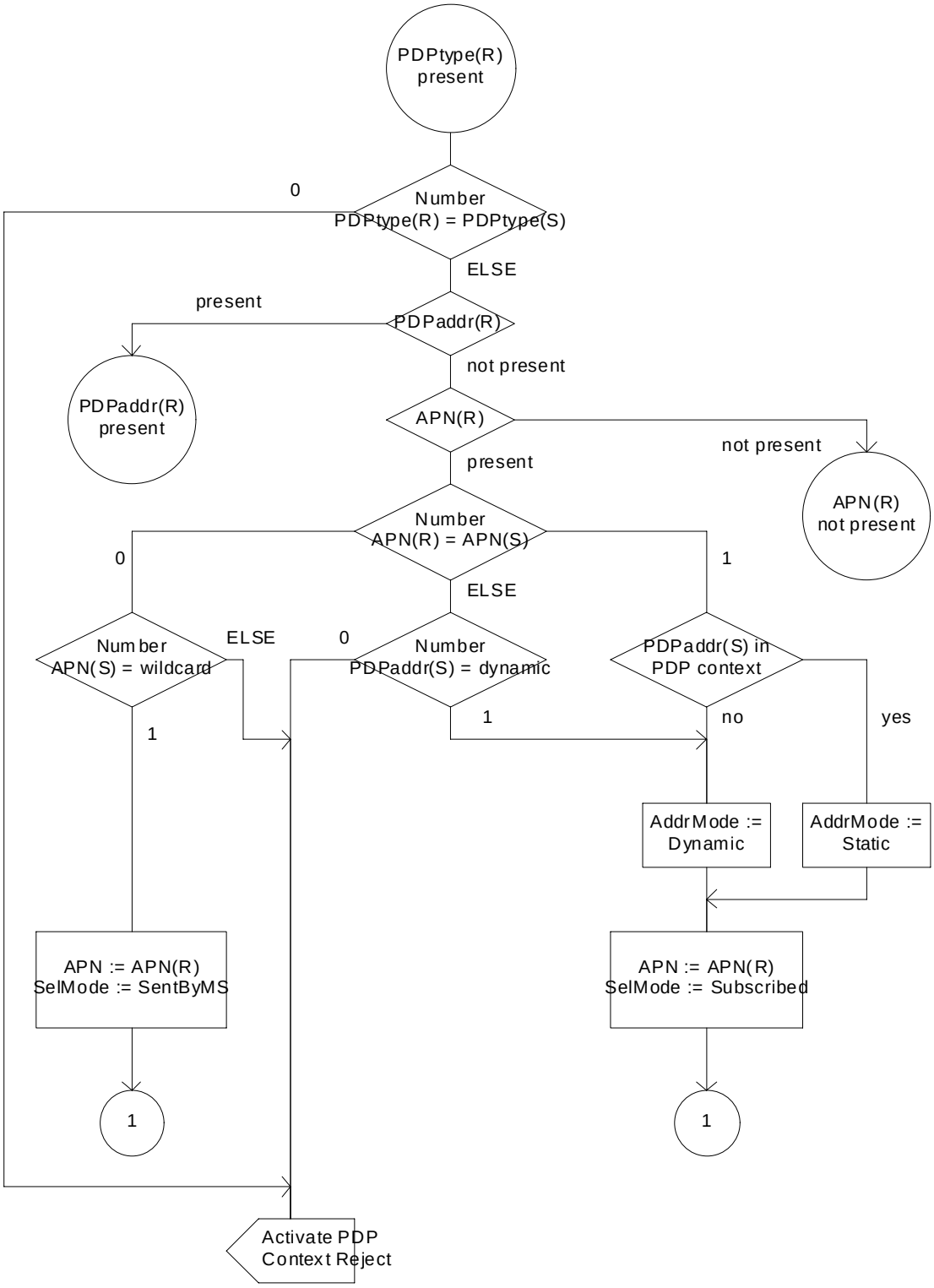


Figure A.2: SDL Diagram 2

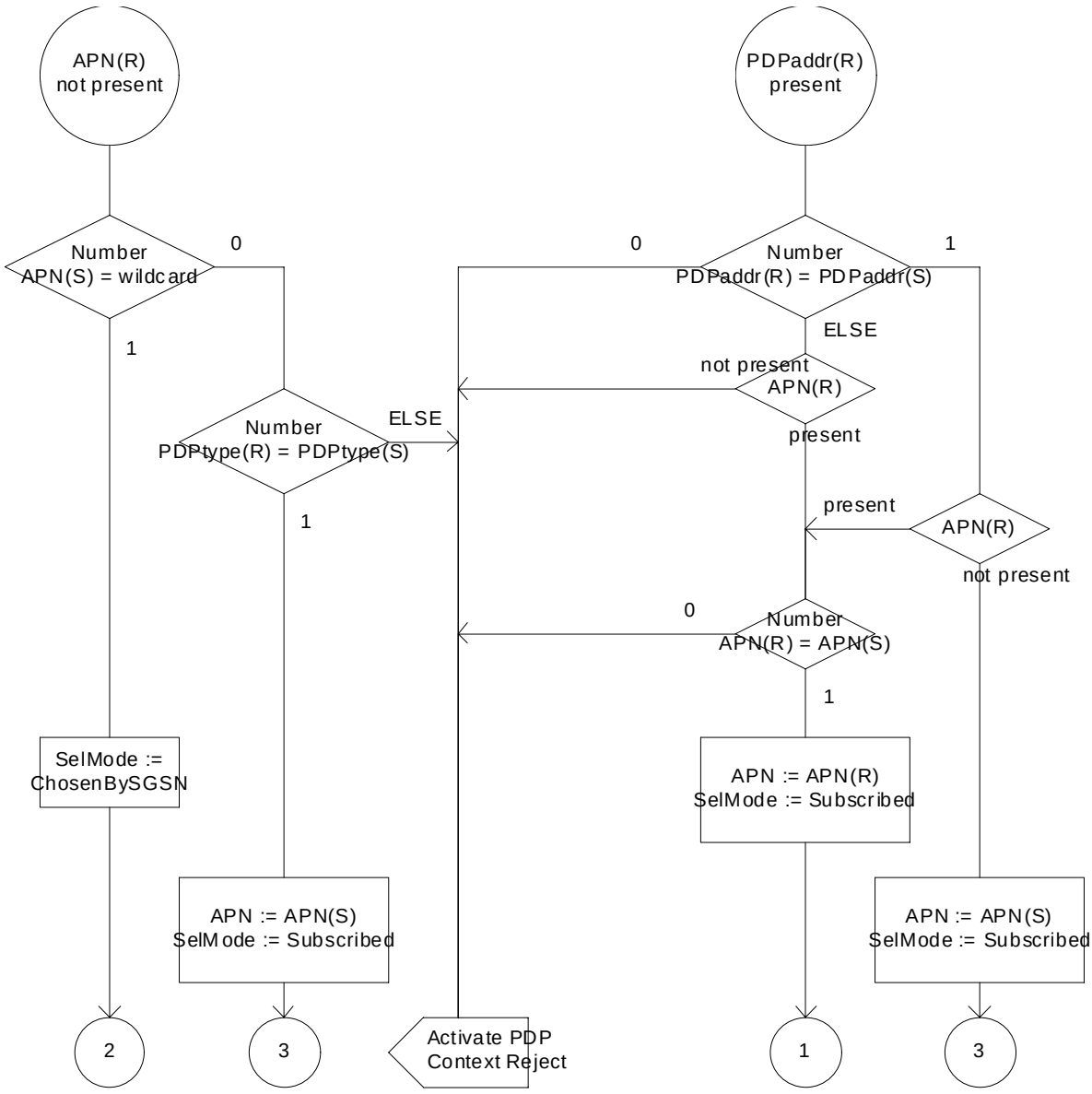
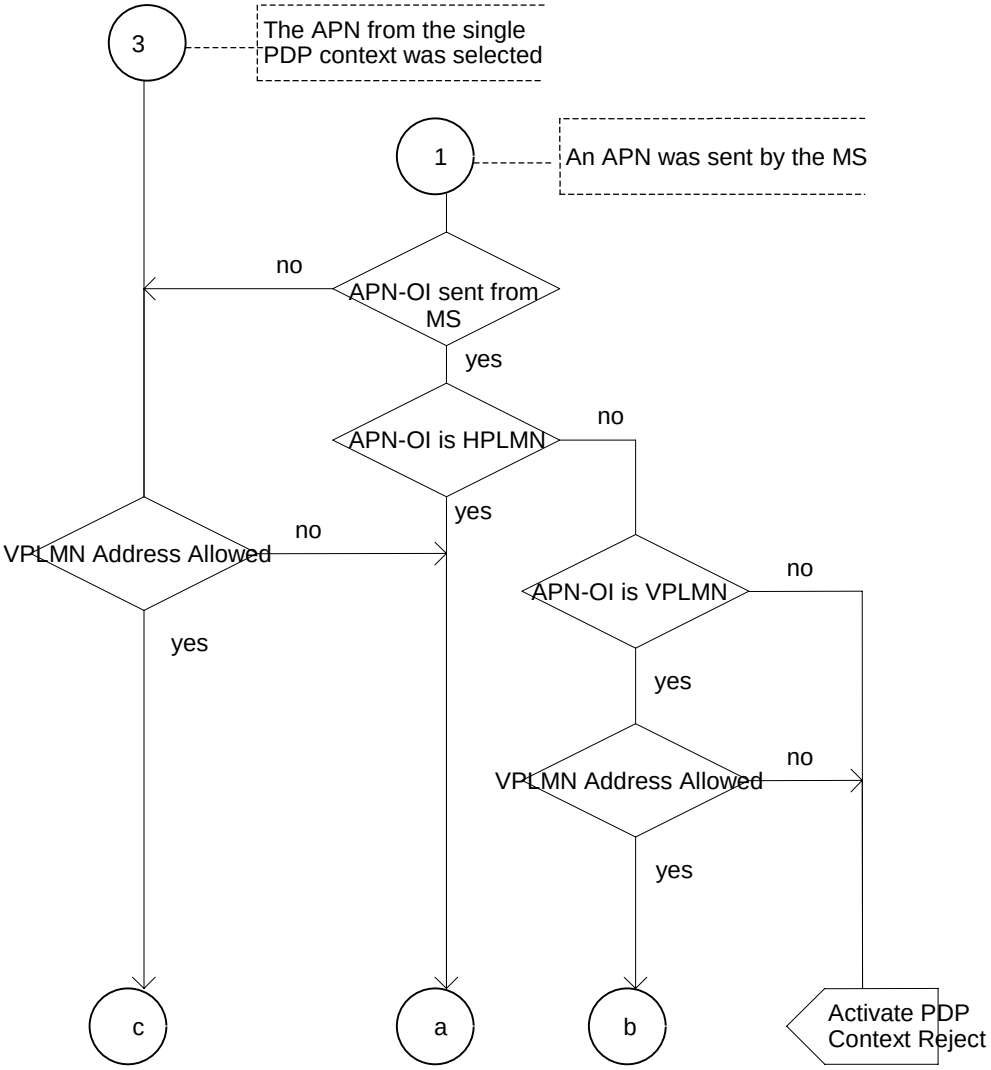


Figure A.3: SDL Diagram 3


3
The APN from the single PDP context was selected
1
An APN was sent by the MS
APN-OI sent from MS
no
yes
APN-OI is HPLMN
no
yes
VPLMN Address Allowed
no
yes
APN-OI is VPLMN
no
yes
VPLMN Address Allowed
no
yes
c
a
b
Activate PDP Context Reject

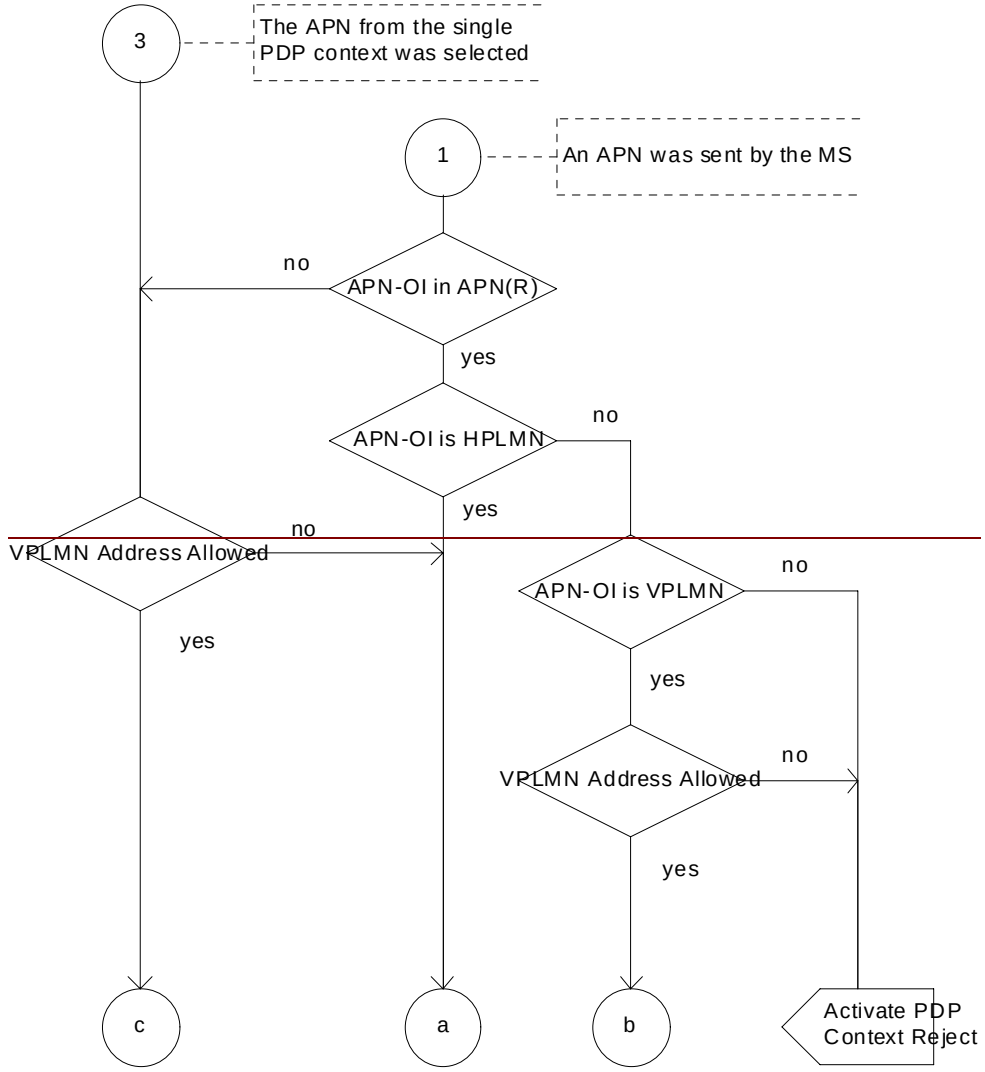


Figure A.4: SDL Diagram 4

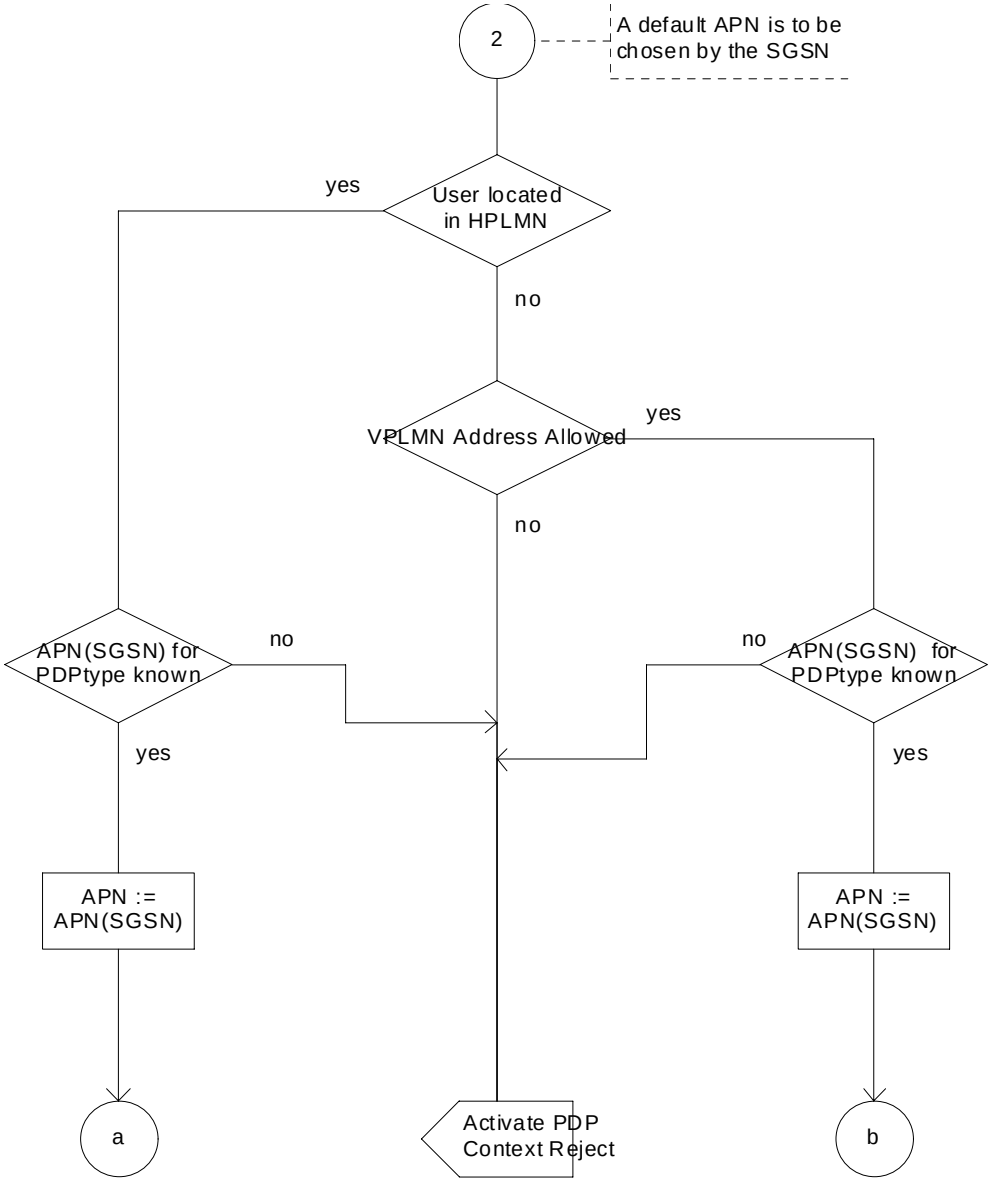


Figure A.5: SDL Diagram 5

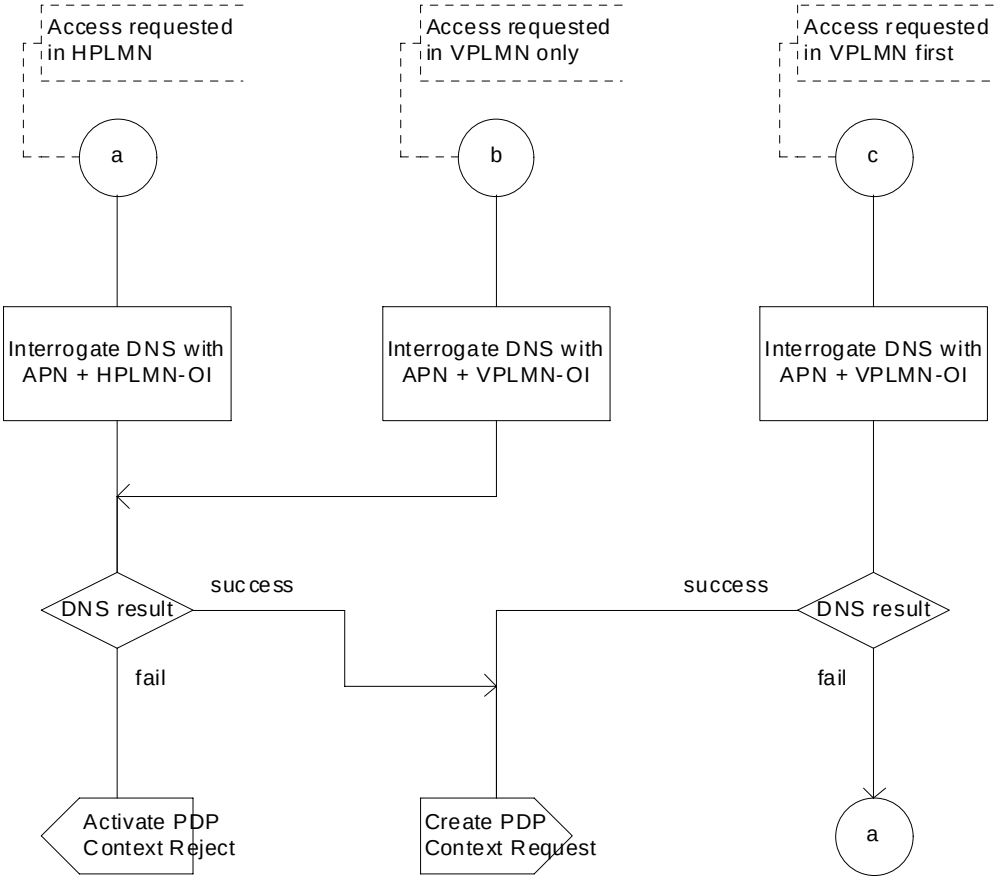


Figure A.6: SDL Diagram 6

3GPP-SA WG2 Meeting #16 **S2-010690**
Los Angeles, USA. 22 - 26 January 2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **206** ⌘ rev **2** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Handling the user data during the SRNS Relocation Procedure
Source:	⌘	Nokia
Work item code:	⌘	
Date:	⌘	~~26~~ February~~January~~ 2001
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change: ⌘

~~The definition of the SRNS Relocation procedure in 23.060 has the following flaws. The description of the procedure is not sufficiently accurate, and therefore the text may be interpreted in different ways. In fact, neither 23.121, nor 23.060 describes the dynamics of the user traffic flow during the procedure in a sufficiently detailed and clear way.~~

~~Besides, there is a number of errors that need to be corrected. For instance, Sub clause 6.9.2.2.1 contains two contradicting statements: "This procedure is only performed for an MS in PMM-CONNECTED state" and "In the case described in figure 37and figure 38 the MS is in state MM-IDLE".~~

~~23.107defines that when an application cannot accept out-of-sequence SDUs, then the QoS must provide for in-sequence delivery of the user packets (UMTS bearer service attribute 'Delivery order' should be set to 'Yes'). Normally it means, that for such user traffic loss-less relocation should be used (PDCP PDUs should be delivered in-sequence to both, MS and SRNC). However, in such a case it is not mandatory to deliver in-sequence the respective packets between SRNC and GGSN (decision is left to an operator).~~

~~RRC specification has changed and the respective text in 23.060 needs update~~

~~It is proposed to clarify the above mentioned ambiguities and align 23.060 with 23.107 and 25.331.~~

23.121 requires that 3G-SGSN shall not buffer user data. 23.107 requires that for the Interactive and Background QoS classes the payload content must be preserved. During the SRNS relocation procedure, after target RNC receives the Relocation Commit message it may receive up-link user data packet. Target SRNC should send the packet to the new SGSN. However, at this point the new SGSN has not received the Update PDP Context Response message. That is,

		the new SGSN does still not know IP address and TEID of the GGSN. As long as SGSN has no buffer, it has to discard the packet. In order to get around the problem, CN4 approved a way of letting the new SGSN to know GGSN's IP address and TEID for data beforehand. This is accomplished by adding to the PDP context these IEs. PDP context is send from the old SGSN to the new one at the beginning of the relocation with the Forward relocation request message.
Summary of change:	⌘	GGSN Address and Uplink TEID for Data is transferred within PDP Context from the old SGSN to the new SGSN. If sequence numbers are used, they are kept throughout the connection and not reset to 0.
Consequences if not approved:	⌘	If the CR is not approved, it is highly probable that in loss-less case the SRNS Relocation procedure will fail in a network which uses RNC, SGSN and GGSN from different vendors.

Clauses affected:	⌘	6.9.2.2		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.9.2.2 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 37 shows SRNS relocation when source SRNC and target RNC are connected to different SGSNs. figure 38 shows the situation after SRNS Relocation procedure and Routeing Area Update procedure have been completed. In the case described in figure 37and figure 38 the MS is in state MM-IDLE.

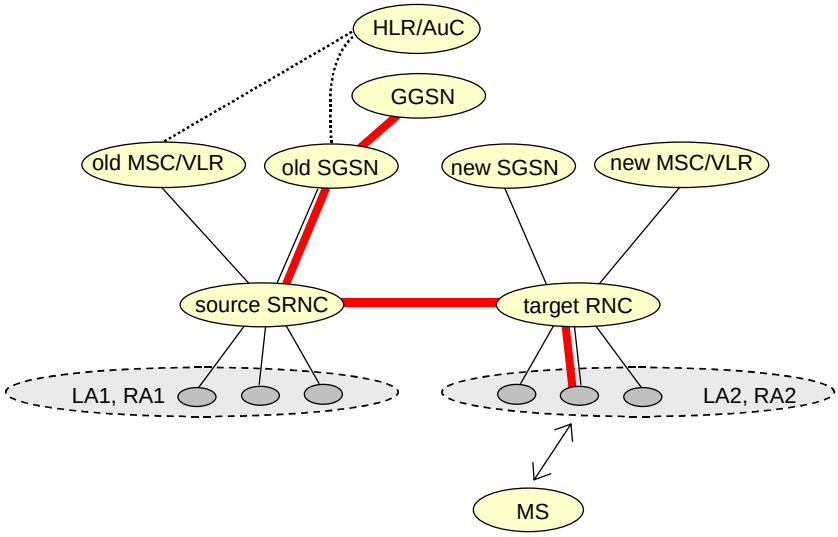


Figure 1: Before SRNS Relocation and Routeing Area Update

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

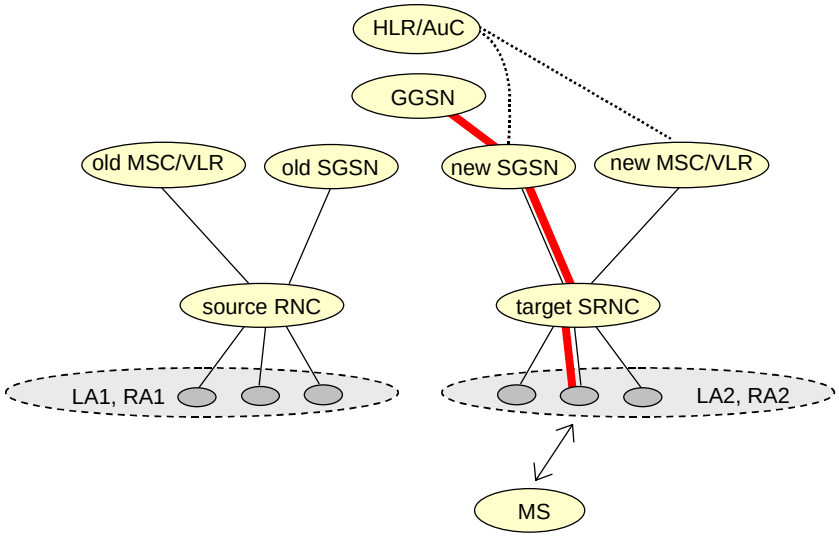


Figure 2: After SRNS Relocation and Routeing Area Update

After the Serving SRNS Relocation procedure and RA update, the MS is registered in the new SGSN The MS is in 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 39. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

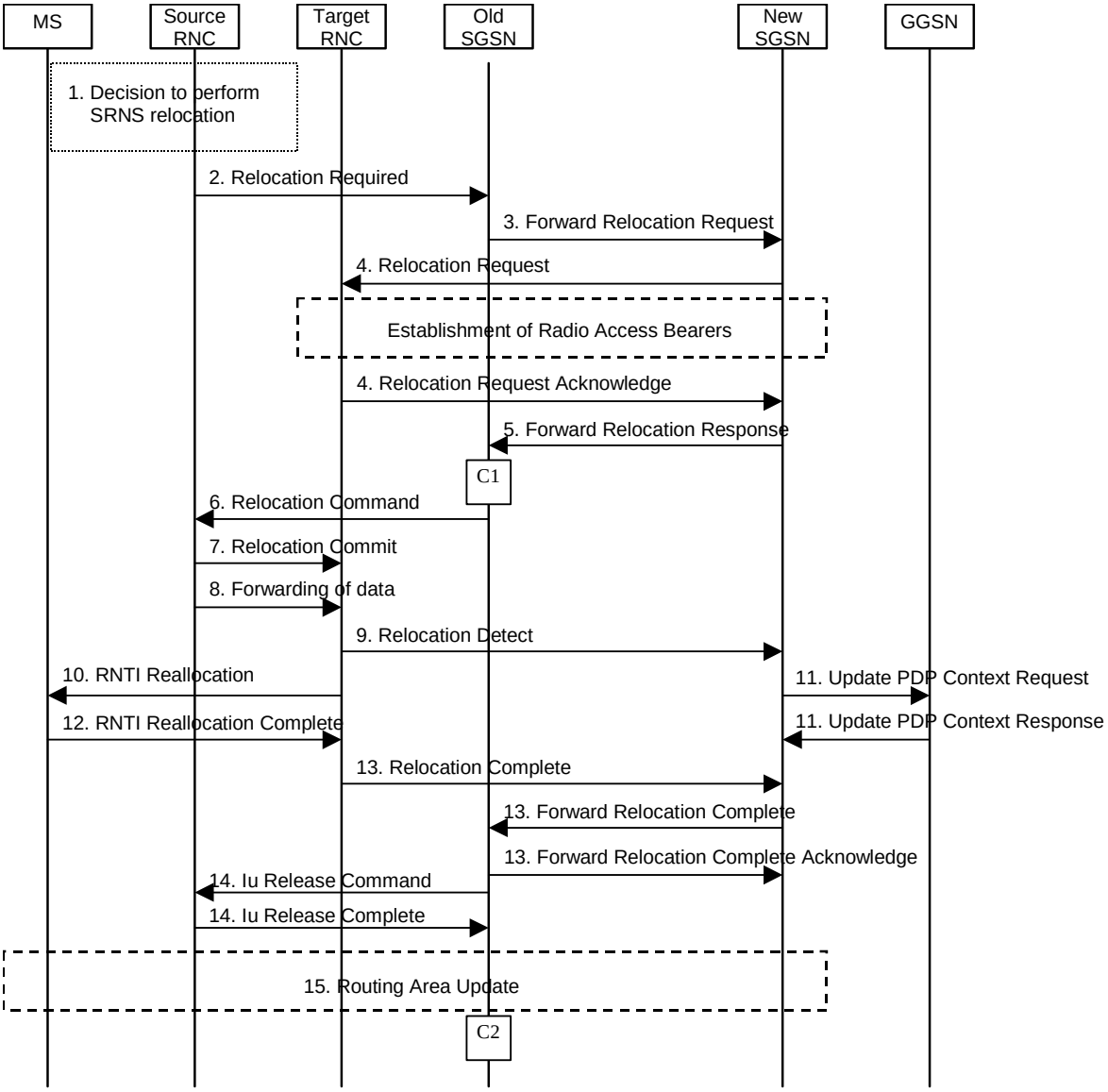


Figure 3: Serving SRNS Relocation Procedure

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

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. The target RNC will for each RAB to be 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 have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from new SGSN to old SGSN. This message indicates that the target RNC is 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 RAB Setup Information, one information element for each RAB, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter SGSN SRNS relocation.

6) 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. For ~~connections~~PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used.

If delivery order is required (QoS profile), consecutive GTP-PDU sequence numberings ~~are used, they~~ shall be ~~kept~~maintained throughout the lifetime of the PDP context(s) ~~connection, also in the relocation case~~. Therefore, ~~D~~during the entire SRNS relocation procedure for the ~~connection~~PDP context(s) using delivery order required (QoS profile), the responsible GTP-U entities (RNCs and GGSN) shall assign consecutive GTP-PDU sequence numbers to user packets belonging to the same PDP context for up-link and down-link respectively.

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

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

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

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

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

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

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

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

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

C1) CAMEL-GPRS-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 40 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 41 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in figure 40 and figure 41 the MS is in MM IDLE state.

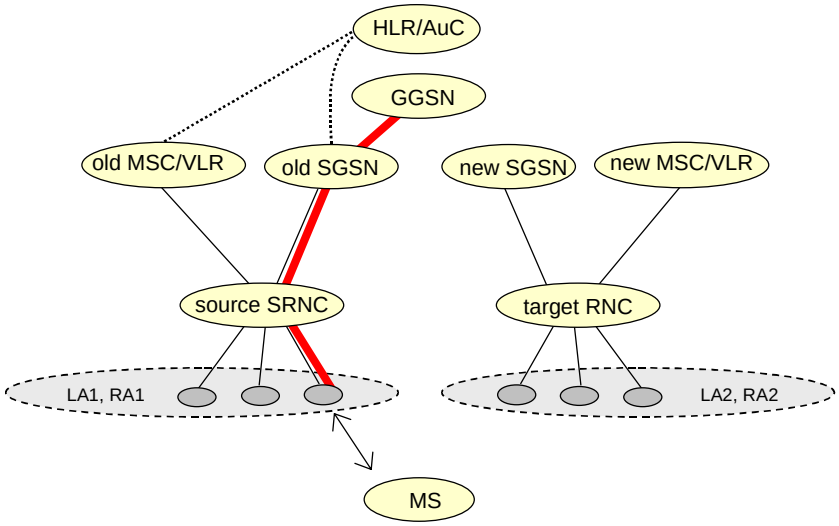


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

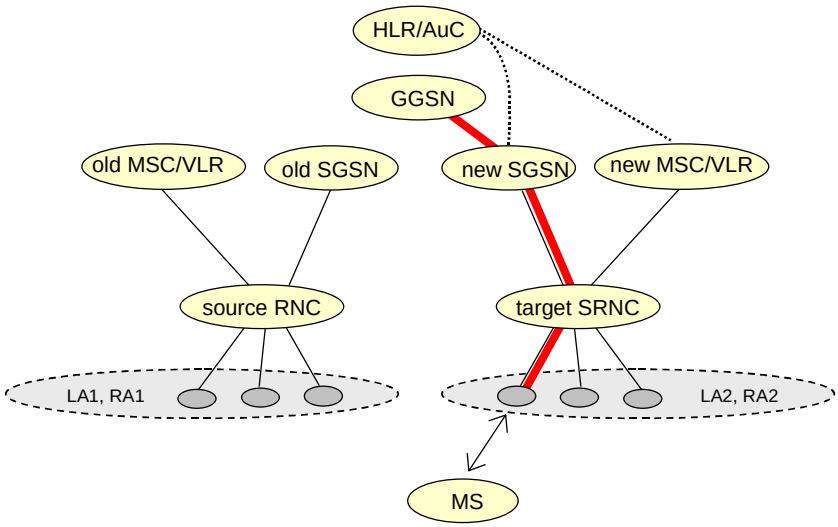


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

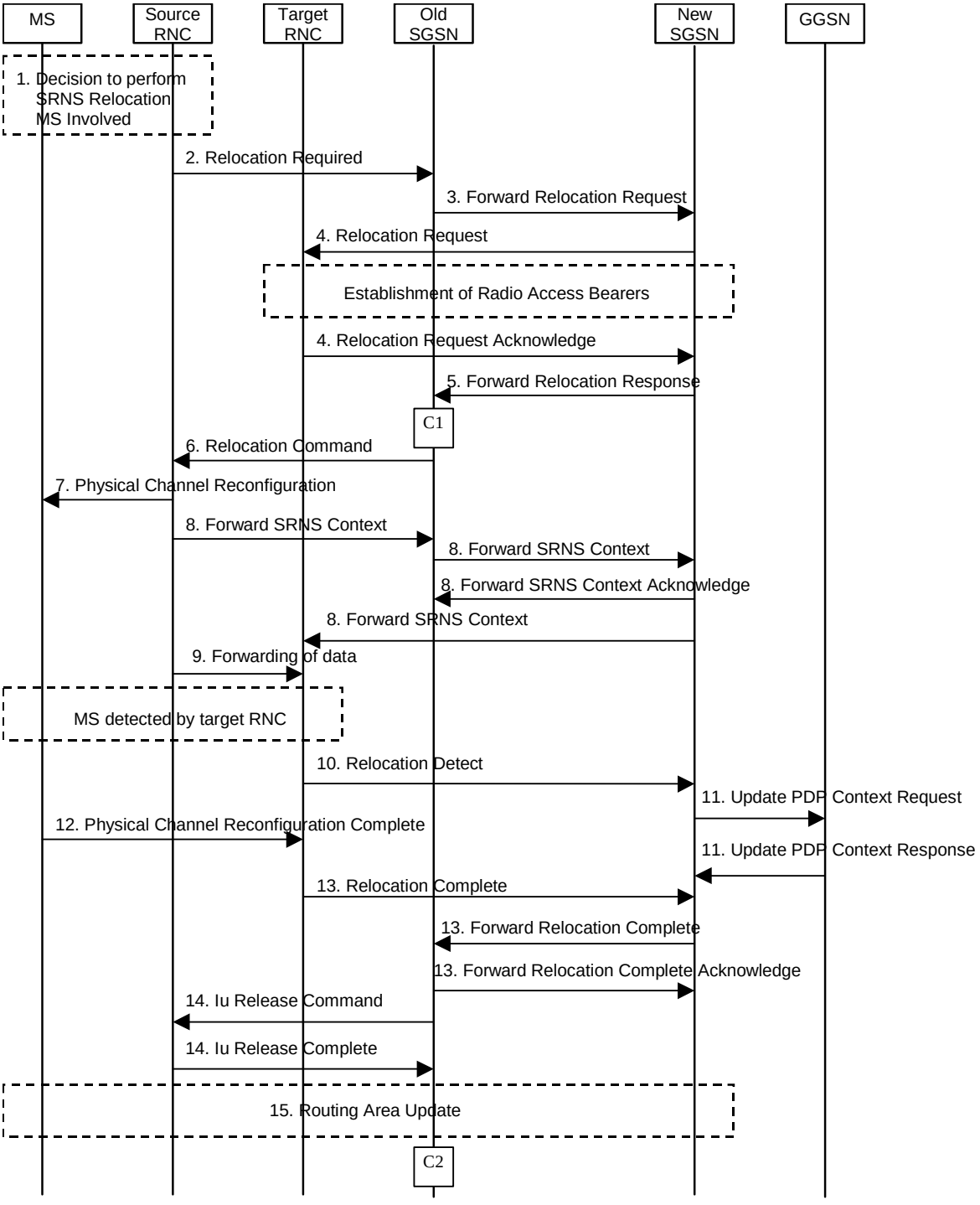


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

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

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

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. The target RNC will for each RAB to be 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 have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the 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 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.
Before the RRC message is sent (e,g, Physical Channel Reconfiguration) uplink and downlink data transfer in the source SRNC shall be suspended for RABs which requires loss-less relocation.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is 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. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used.

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

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 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, 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 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 43. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

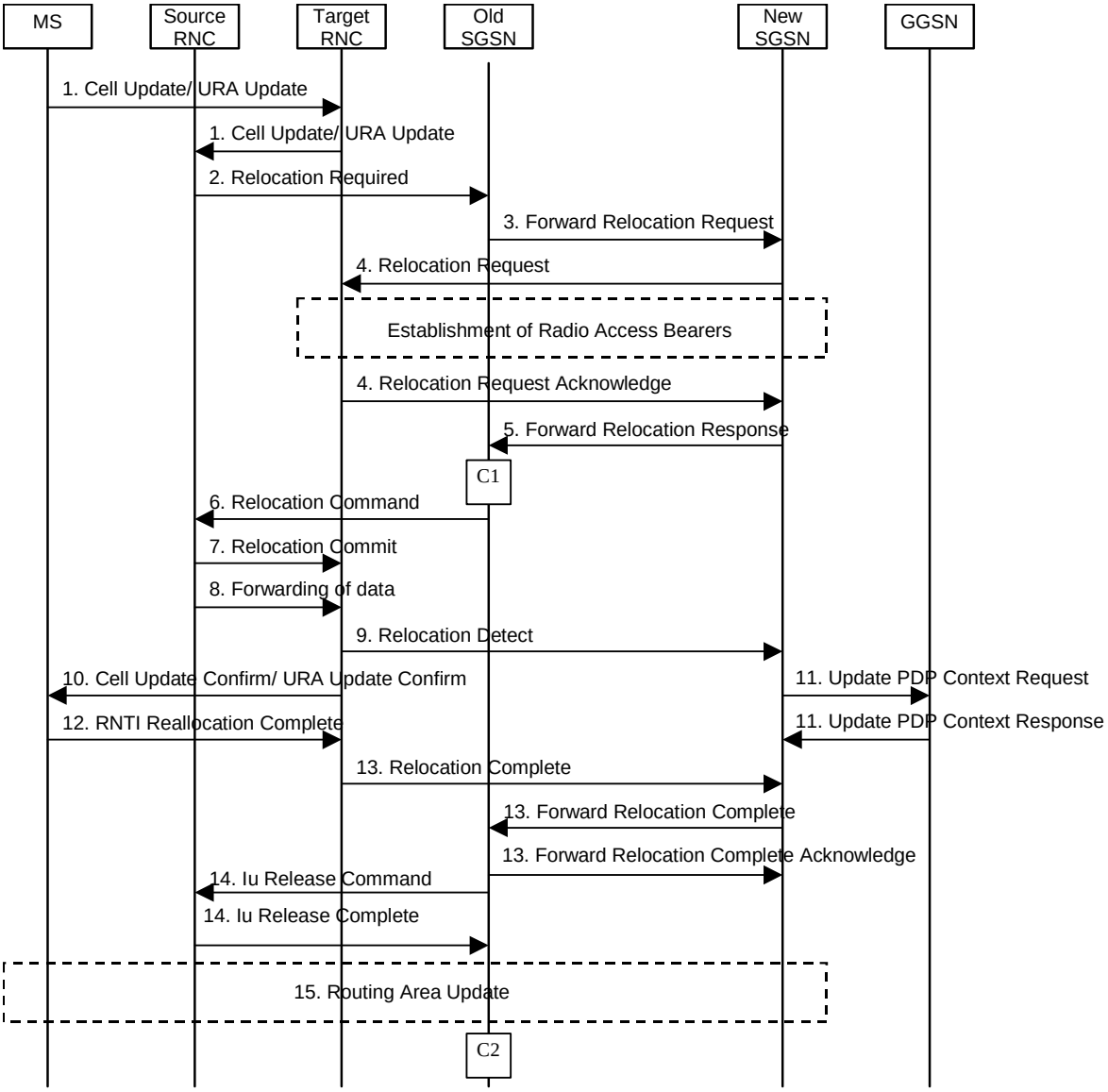


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

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

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

   After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (RABs setup, RABs failed to setup) message to the new SGSN. The target RNC will for each RAB to be 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 have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from new SGSN to old SGSN. This message indicates that the target RNC is 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 Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter SGSN SRNS relocation.

6) 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 number is not used. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used.

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

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.

3GPP TSG-SA2 Meeting #17 ***Tdoc S2-010507***
26 February – 2 March 2001 Gothengburg, Sweden

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **209** ⌘ rev **2** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Connection re-establishment on forward handover without Iur
Source:	⌘	Lucent Technologies
Work item code:	⌘	GPRS ***Date:*** ⌘ 22/02/2001
Category:	⌘	**F** ***Release:*** ⌘ R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The UE enters PMM idle on RRC connection failure. This could be for example, when the RRC connection is explicitly released by an RNC unable to communicate with the SRNC due to lack of Iur support. The new RNC uses the cause value "Directed Signalling connection re-establishment". On the network side, the UE may still be PMM connected with an Iu-ps connection to the old SRNC. The unsynchronised PMM on the UE and network side can cause data loss especially in the downlink where the SGSN will continue to send data over the existing connection until the connection times out. The release cause "Directed signalling connection re-establishment" in the RRC CONNECTION RELEASE message was added in 25.331 to recover from this case. The release cause distinguishes the case when a signalling connection shall be requested by the upper layers immediately after the RRC connection release.
Summary of change:	⌘	The NAS in the UE shall initiate a RA procedure to re-synchronise the PMM on the UE and network and to re-establish a signalling connection when the release cause "Directed signalling connection re-establishment" in the RRC CONNECTION RELEASE message is received. The RA update procedure will also trigger the release of any existing Iu connection from SGSN to old SRNC.
Consequences if not approved:	⌘	Unsynchronised PMM states in UE and SGSN and failure to deliver downlink packets to the UE after an RRC failure due to no Iur connection to the SRNC.

Clauses affected:	⌘	Sections 6.1.2.4.1 and 6.9.2.1
Other specs Affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications

Other comments:	⌘	This CR is related to LS from S2 to N1 (S2-001526) and N1 response (N1-001407). Changes to UTRAN specifications and 24.008 have already been approved.

How to create CRs using this form:

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

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

6.1.2 Mobility Management States (UMTS Only)

6.1.2.1 PMM-DETACHED State

In the PMM-DETACHED state there is no communication between the MS and the 3G-SGSN. The MS and SGSN contexts hold no valid location or routeing information for the MS. The MS MM state machine does not react on system information related to the 3G-SGSN. The MS is not reachable by a 3G-SGSN, as the MS location is not known.

In order to establish MM contexts in the MS and the SGSN, the MS shall perform the GPRS Attach procedure. When the PS signalling connection is established between the MS and the 3G-SGSN for performing the GPRS attach, the state changes to PMM-CONNECTED in the 3G-SGSN and in the MS. The PS signalling connection is made up of two parts; an RRC connection and an Iu connection.

6.1.2.2 PMM-IDLE State

The MS location is known in the 3G-SGSN with an accuracy of a routeing area. Paging is needed in order to reach the MS, e.g., for signalling. The MS and SGSN have established MM contexts as described in clause "Information Storage".

The MS shall perform a routeing area update if the RA changes. Signalling towards the HLR is needed if the 3G-SGSN does not have an MM context for this MS.

The MS and 3G-SGSN shall enter the PMM-CONNECTED state when the PS signalling connection is established between the MS and the 3G-SGSN.

GPRS detach changes the state to PMM-DETACHED. The 3G-SGSN may perform an implicit GPRS detach any time after the MS reachable timer expiry. The MS's MM context is deleted, preferably after a certain (implementation dependent) time. The HLR may be informed about the deletion (see subclause "Purge Function").

6.1.2.3 PMM-CONNECTED State

The MS location is known in the 3G-SGSN with an accuracy of a serving RNC. In the PMM-CONNECTED state, the location of the MS is tracked by the serving RNC. The MS performs the routeing area update procedure when RAI in the MM system information changes.

When an MS and a 3G-SGSN are in the PMM-CONNECTED state, a PS signalling connection is established between the MS and the 3G-SGSN.

In the 3G-SGSN, PS signalling connection release or failed downlink transfer with cause "IMSI unknown in RNC" changes the state to PMM-IDLE.

The MS shall enter the PMM-IDLE state when its PS signalling connection to the 3G-SGSN has been released or broken. This release or failure is explicitly indicated by the RNC to the MS or detected by the MS (RRC connection failure). The radio connection shall also be released if a URA update fails because of "RRC connection not established", or if the URA update timer expires while the MS is out of coverage.

After a signalling procedure (e.g., routeing area update), the 3G-SGSN may decide to release the PS signalling connection, after which the state is changed to PMM-IDLE.

GPRS detach changes the state to PMM-DETACHED.

6.1.2.4 State Transitions and Functions

Figure 17 introduces the MM states for a GPRS subscriber (PMM). The states and activations are further described below the figure.

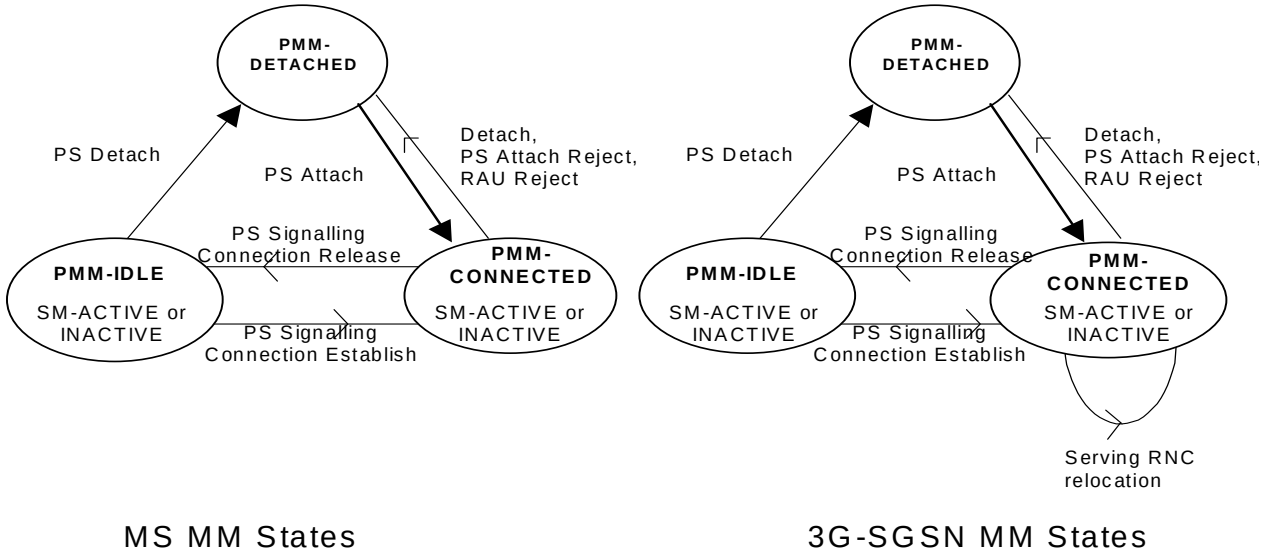


Figure 1: PMM State Model

NOTE: In both the PMM-IDLE and the PMM-CONNECTED states, session management may or may not have activated a PDP context. The consequence is that in PMM-CONNECTED state, only a signalling connection may be established. In PMM-IDLE state, a PDP context may be established, but no corresponding connection over the Iu interface nor the radio are established.

Moving from PMM-DETACHED to PMM-CONNECTED in the MS:

- GPRS Attach: Th MM context shall move to the PMM-CONNECTED state when a PS signalling connection is established between the MS and the 3G-SGSN for performing a GPRS attach. If the GPRS attach is accepted an MM context is created in MS.

Moving from PMM-CONNECTED to PMM-DETACHED in the MS:

- GPRS Detach: The MM context shall move to the PMM-DETACHED state when the PS signalling connection is released between the MS and the 3G-SGSN after the MS has performed a GPRS detach or after the network-initiated GPRS detach is performed. The MM context in the MS may be deleted.

- RAU Reject: The MM context shall move to the PMM-DETACHED state when the PS signalling connection is released between the MS and the 3G-SGSN after a RAU is rejected by the 3G-SGSN. The MM context may be deleted.

- GPRS Attach Reject: The MM context shall move to the PMM-DETACHED state when the PS signalling connection is released between the MS and the 3G-SGSN after a GPRS attach is rejected by the 3G-SGSN. The MM context may be deleted.

Moving from PMM-CONNECTED to PMM-IDLE in the MS:

- PS Signalling Connection Release: The MM context shall move to the PMM-IDLE state when the PS signalling connection is released.

Moving from PMM-IDLE to PMM-CONNECTED in the MS:

- PS Signalling Connection Establishment: The MM context shall move to the PMM-CONNECTED state when the PS signalling connection is established between the MS and the 3G-SGSN.

Moving from PMM-IDLE to PMM-DETACHED in the MS:

- Implicit GPRS Detach: The MM context shall locally move to the PMM-DETACHED state, e.g., in the case of removal of the battery, the USIM, or the GSIM from the TE.

Moving from PMM-DETACHED to PMM-CONNECTED in the 3G-SGSN:

- GPRS Attach: The MM context shall move to the PMM-CONNECTED state when a PS signalling connection is established between the MS and 3G-SGSN for performing a GPRS attach. If the GPRS attach is accepted, an MM context is created in 3G-SGSN.

Moving from PMM-CONNECTED to PMM-DETACHED in the 3G-SGSN:

- GPRS Detach: The MM context shall move to the PMM-DETACHED state when the PS signalling connection is released between the MS and the 3G-SGSN after the MS has performed a GPRS detach or after the network-initiated GPRS detach is performed. The MM context in the 3G-SGSN may be deleted.

- RAU Reject: The MM context shall move to the PMM-DETACHED state when the PS signalling connection is released between the MS and the 3G-SGSN after a RAU is rejected.

- GPRS Attach Reject: The MM context shall move to the PMM-DETACHED state when a PS signalling connection is released between the MS and the 3G-SGSN after a GPRS attach is rejected by the 3G-SGSN.

Moving from PMM-CONNECTED to PMM-IDLE in the 3G-SGSN:

- PS Signalling Connection Release: The MM context shall move to the PMM-IDLE state when the PS signalling connection is released.

Moving from PMM-IDLE to PMM-CONNECTED in the 3G-SGSN:

- PS Signalling Connection Establishment: The MM context shall move to the PMM-CONNECTED state when the PS signalling connection is established.

Moving from PMM-IDLE to PMM-DETACHED in the 3G-SGSN:

- Implicit GPRS Detach: The MM context may locally move to the PMM-DETACHED state after expiry of the MS Reachable timer. The MM and PDP context(s) in the 3G-SGSN may be deleted, preferably after an implementation-dependent time.

6.1.2.4.1 Handling of unsynchronous PMM states in the UE and the network~~Error Cases~~

In case of RRC connection release with cause “Directed Signalling connection re-establishment” or ~~I~~in case of an error, the PMM state of the MS and the 3G-SGSN may lose synchronisation. In this case the MS may be in the PMM-IDLE state while the 3G-SGSN is in the PMM-CONNECTED state.

NOTE: The opposite (MS in the PMM-CONNECTED state and SGSN in the PMM-IDLE state) shall never happen because the 3G-SGSN may not have the RAI where the MS is really located, so downlink transfer is impossible until the periodic URA update timer expires.

This situation is recovered by a successful RAU moving the MS to the PMM-CONNECTED state, or by a failed downlink transfer with cause "IMSI unknown in RNC", triggering a paging procedure from the 3G-SGSN.

The UE shall also perform a RAU procedure immediately on entering PMM-IDLE state when it has received a RRC Connection Release message with cause “Directed Signalling connection re-establishment” even if the RA has not changed since the last update.

The UE shall perform a subsequent Service request procedure after successful completion of the RA Update procedure to re-establish the radio access bearer when it has pending user data to send.

Note: The RNC will send a RRC CONNECTION RELEASE message with cause “Directed Signalling Connection re-establishment” when it is unable to contact the SRNC to validate the UE due to lack of Iur connection (see TS 25.331).

~~NOTE: An RNC shall not release the Iu connection if it could not inform the MS that the radio connection was released.~~

** Next Modification **

6.9.2 Location Management Procedures (UMTS Only)

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

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

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

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

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

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

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

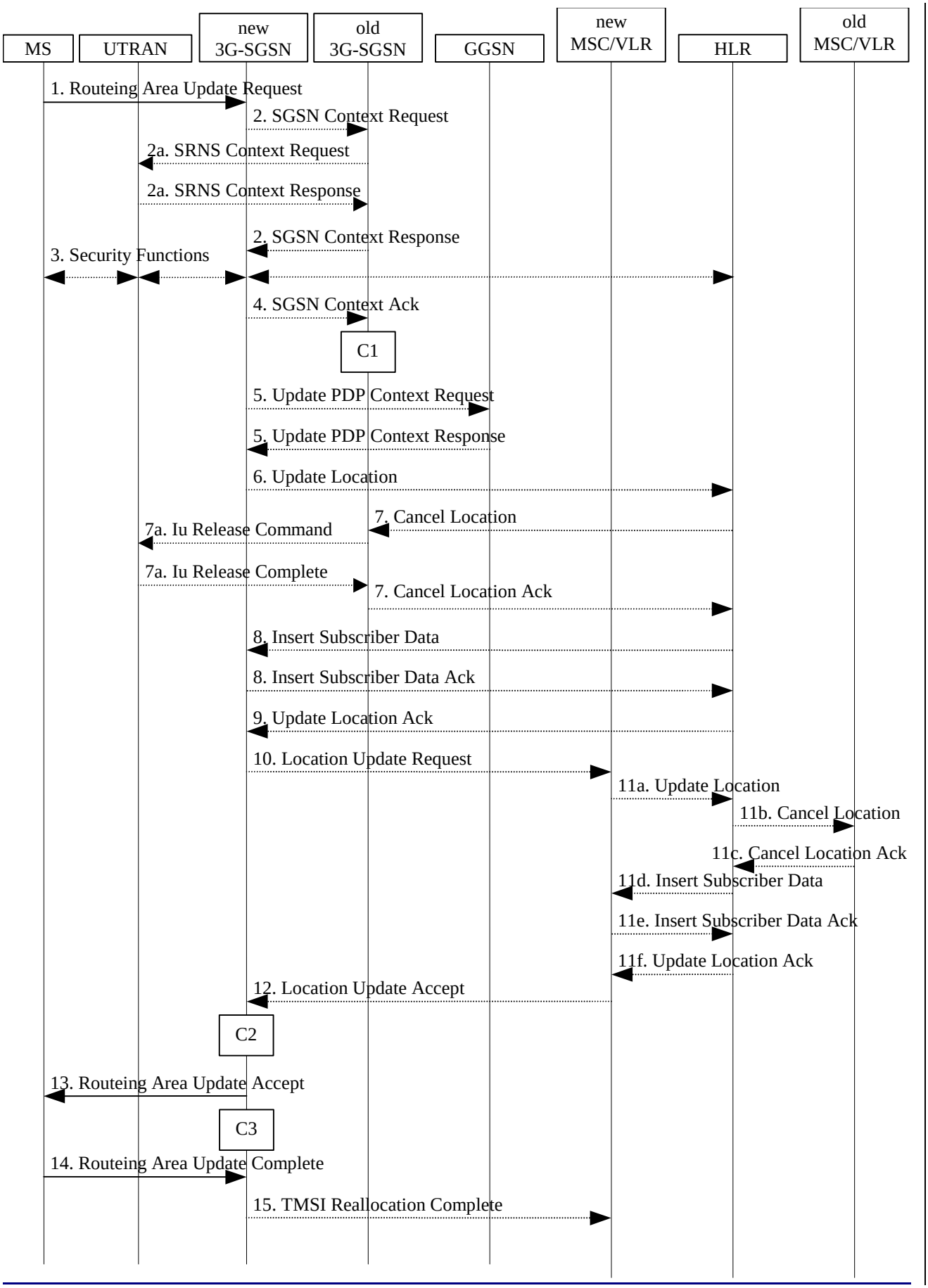
6.9.2.1 Routeing Area Update Procedure

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

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

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

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


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

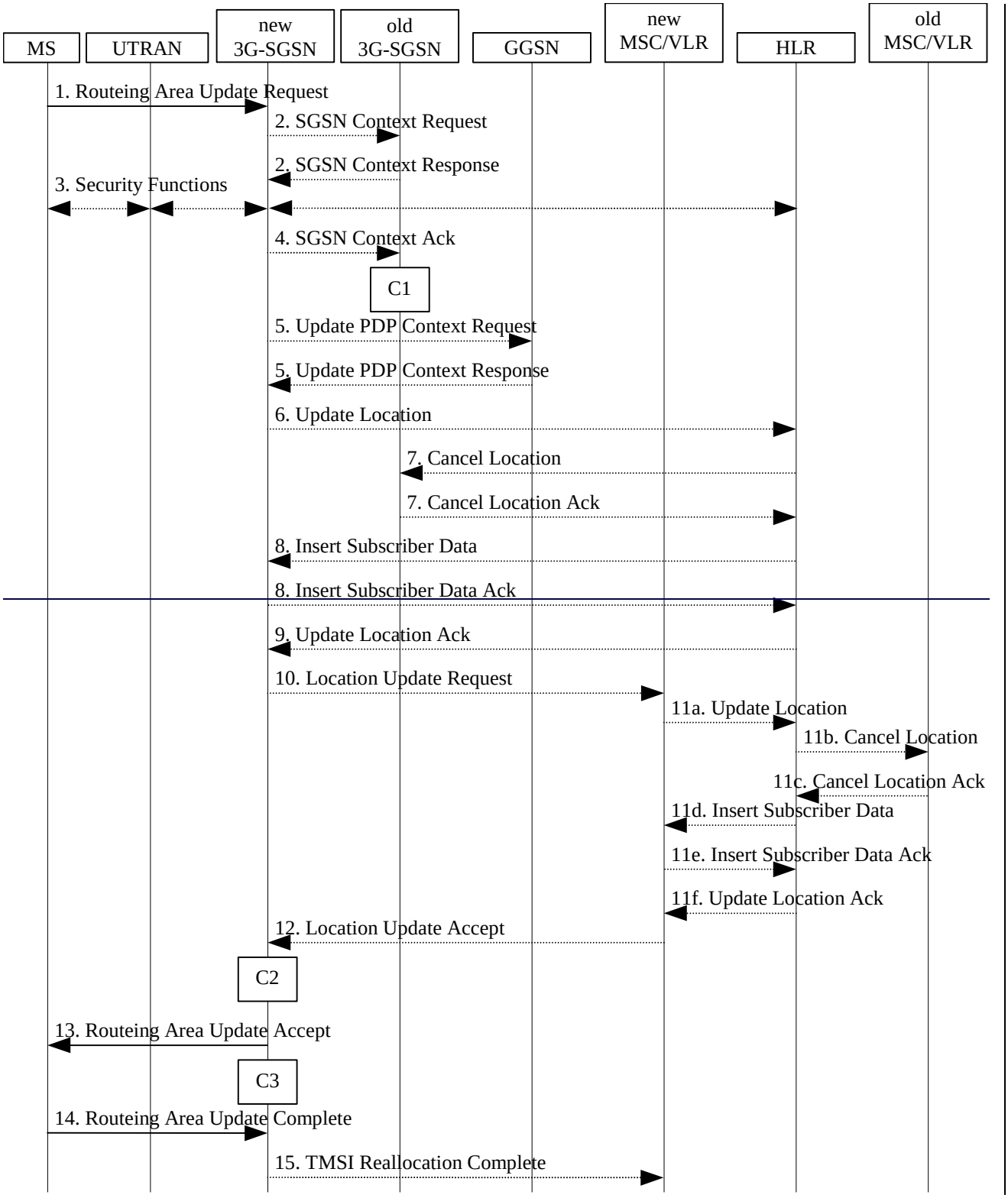


Figure 2: UMTS RA Update Procedure

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

   - RA Update if the RA Update is triggered by a change of RA;

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

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

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

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

2a) If the MS is PMM-CONNECTED in the old 3G-SGSN, the old SGSN shall send an SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message from the SRNS. Upon reception of this message the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer).

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

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

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

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

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

area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

7a) If the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNC. The SRNC responds with an Iu Release Complete message.

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

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

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

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

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

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

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

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

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

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

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

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

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

15) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the VLR TMSI is confirmed by the MS.

NOTE: Steps 11, 12, and 15, are performed only if step 9 is performed.

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

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

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

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

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

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

C3) CAMEL-GPRS-Routeing-Area-Update-Context.

3GPP-SA WG2 Meeting #17 **Tdoc S2- 010799**
Gothenburg, Sweden, 26 February - 02 March 2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** **212** ⌘ rev **1-** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Clarification of subscribed QoS
Source:	⌘	Nortel Networks
Work item code:	⌘	***Date:*** ⌘ February 2001
Category:	⌘	**F** ***Release:*** ⌘ R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Currently the annex A.1 of 23.060 specifies that only one subscribed QoS profile is associated with each APN in the HLR. It is proposed to also clarify this in the body of the spec.
Summary of change:	⌘	State that the QoS profile is the maximum QoS per PDP context to the associated APN, in secondary PDP context activation procedure, in HLR chapter and in QoS profile chapter.
Consequences if not approved:	⌘	If annex A.1 is not interpreted correctly, different interpretations may lead to interoperability issues as different vendors will not use the subscribed QoS profile in the same manner.

Clauses affected:	⌘	9.2.2.1, 9.2.2.1.1, 13.1, 15.2
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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

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

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

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

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in figure 61 and figure 62.

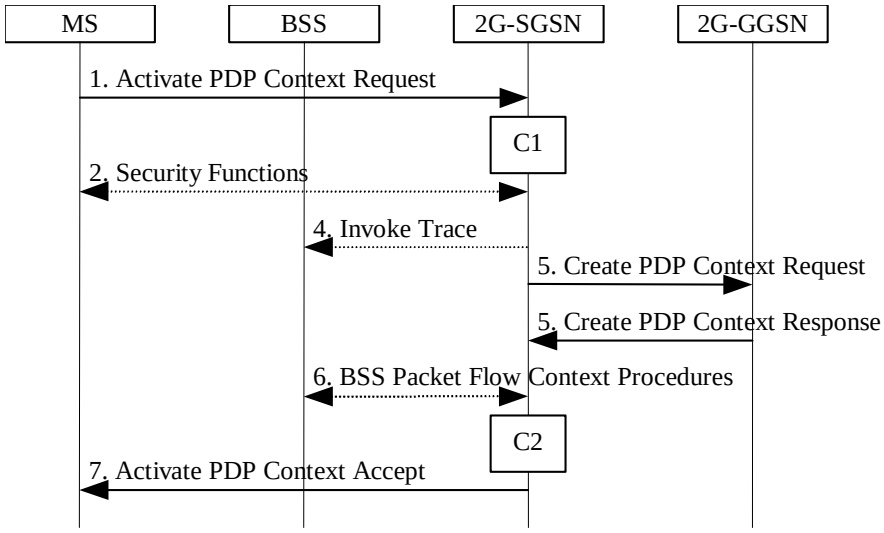


Figure 161: PDP Context Activation Procedure for GSM

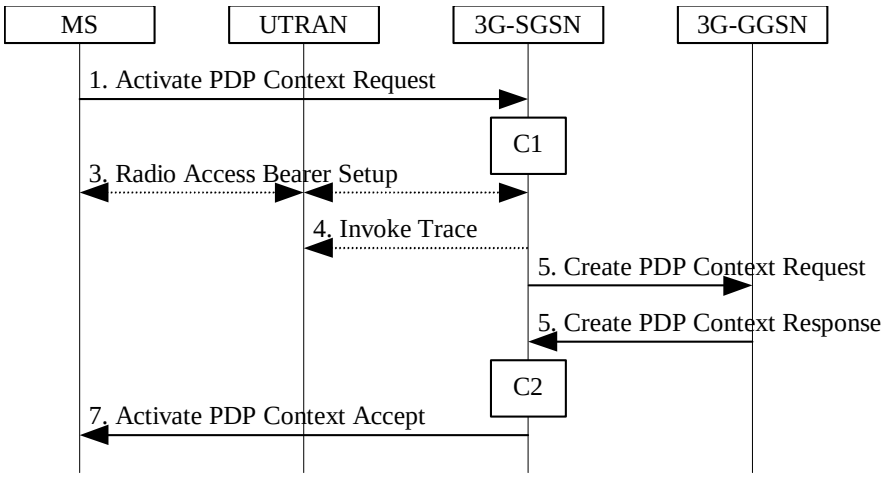


Figure 262: PDP Context Activation Procedure for UMTS

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~~,~~ and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile.

   The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, NSAPI, MSISDN, Selection Mode, Charging Characteristics, Trace Reference, Trace Type, Trigger Id, OMC Identity, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by 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 derive Charging Characteristics from Subscribed Charging Characteristics and/or PDP context Charging Characteristics if received from the HLR as follows: if a "PDP context Charging Characteristics" is present for this PDP context, it shall be sent; otherwise if a "Subscribed Charging Characteristics" is present for this subscriber it shall be sent. If neither "PDP context Charging Characteristics" nor a "Subscribed Charging Characteristics" is present, the SGSN may choose a default Charging Characteristics which would be sent to the GGSN, and used there as well. The Charging Characteristics sent to the GGSN shall also include an indication whether it was retrieved from subscription data received from the HLR or is a default profile determined by the SGSN.The 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 are specified in 3G TS 32.015 [70]. The GGSN then returns a Create PDP Context Response (TEID, PDP Address, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, 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 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 63 and figure 64.

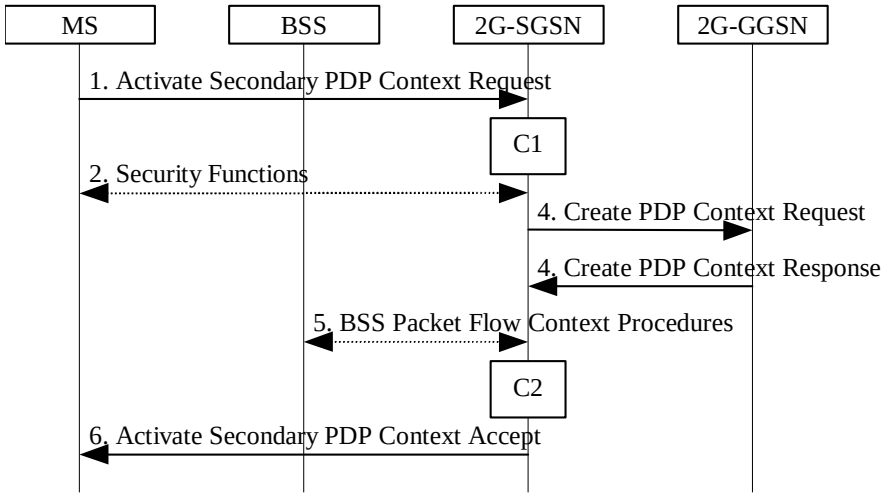


Figure 3~~63~~: Secondary PDP Context Activation Procedure for GSM

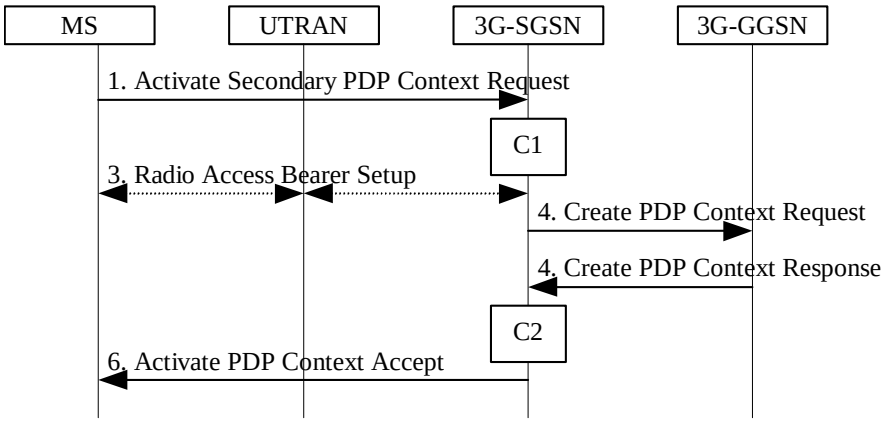


Figure 4~~64~~: Secondary PDP Context Activation Procedure for UMTS

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 may restrict the requested QoS attributes given its capabilities~~,~~ and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile which

represents the maximum QoS per PDP context to the associated APN. ~~and~~ The 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.

NEXT MODIFIED SECTION

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 90.

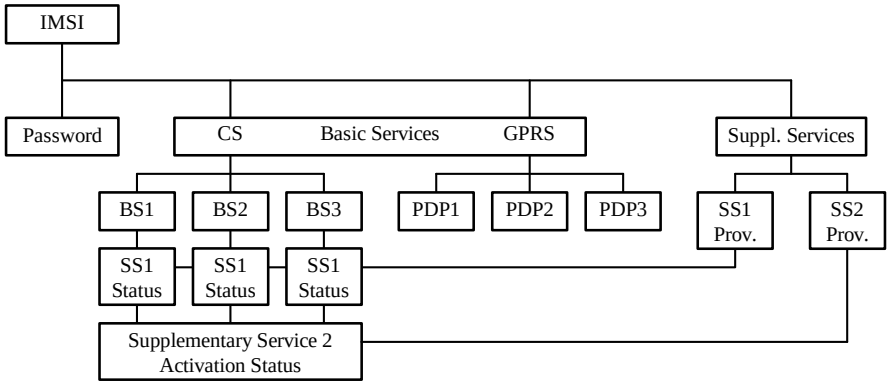


Figure ~~5~~90: Packet Domain Subscription Data

As figure 90 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 5 shows the packet domain subscription data contained in the HLR.

Table 15: 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. QoS pProfile Subscribed is also the maximum QoS per PDP context to the associated APN.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
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

NEXT MODIFIED SECTION

15.2 Quality of Service Profile

A QoS profile is associated with each PDP context. The QoS profile is considered to be a single parameter with multiple data transfer attributes. The definition of the QoS attributes for the packet domain can be found in 3G TS 23.107, which also defines the mapping between the packet-domain QoS attributes and the QoS attributes for GPRS releases 97 and 98.
There are many possible QoS profiles defined by the combinations of the attributes. A PLMN may support only a limited subset of the possible QoS profiles.
During the QoS profile negotiation defined in subclause "Activation Procedures", it shall be possible for the MS to request a value for each of the QoS attributes, including the HLR-stored subscribed default values. When the MS requests a QoS, the HLR-stored subscribed default values shall be interpreted as the maximum QoS per PDP context to the associated APN.

The network shall negotiate each attribute to a level that is in accordance with the available GPRS resources. The network shall always attempt to provide adequate resources to support the negotiated QoS profiles.

3GPP-SA WG2 Meeting #16 **S2-010731**
Gothenburg, Sweden. 26.2. – 2.3.2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060+CR206** **CR** **215** ⌘ rev **1** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Handling the user data during the SRNS Relocation Procedure
Source:	⌘	Siemens
Work item code:	⌘	***Date:*** ⌘ 21 February 2001
Category:	⌘ **F**	***Release:*** ⌘ R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘

S2-010380rev2 missed to state for relocation step7) where the GTP sequence numbers are not used. As 29.060 GTP does not allow to send PDCP or GTP numbers independently it is proposed that the receiving RNC ignores the values when the described condition occurs.

Packet transfer after hard handover in step12) can only start if sequence numbers from old RNC are already received when delivery order is required.

Editorial alignment between multiple wordings for downlink and uplink.

Referring to acknowledged RLC mode RABs for forwarding of packets is misleading in step5) of the relocation and contradicts to step 4). The SGSN does not differ between the RAB parameters at this stage, therefore more general text is proposed.

Condition for forwarding SRNS context "when handover with switching in CN" is deleted as unspecific and undefined.

Summary of change: ⌘ RNCs ignore received GTP numbers if delivery order is not required. Clarification when data transfer can start after hard handover.

Consequences if not approved: ⌘ Incompatible implementations of RNCs and SGSNs from different vendors are likely. Or, out-of-sequence packets may be transferred for PDP contexts with delivery order required.

Clauses affected: ⌘ 6.9.2.2

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

Other comments: ⌘

How to create CRs using this form:

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

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

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

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

6.9.2.2 Serving RNS Relocation Procedures

6.9.2.2.1 Serving SRNS Relocation Procedure

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

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 37 shows SRNS relocation when source SRNC and target RNC are connected to different SGSNs. figure 38 shows the situation after SRNS Relocation procedure and Routeing Area Update procedure have been completed. In the case described in figure 37and figure 38 the MS is in state MM-IDLE.

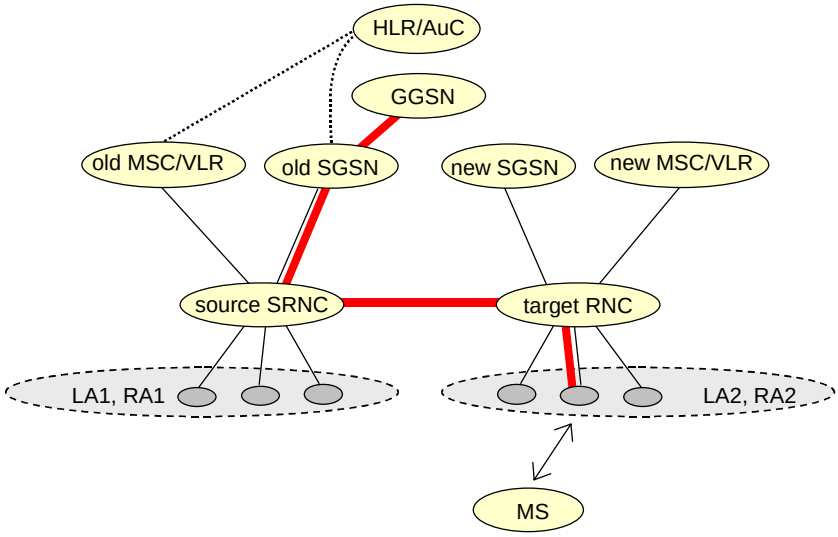


Figure 11: Before SRNS Relocation and Routeing Area Update

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

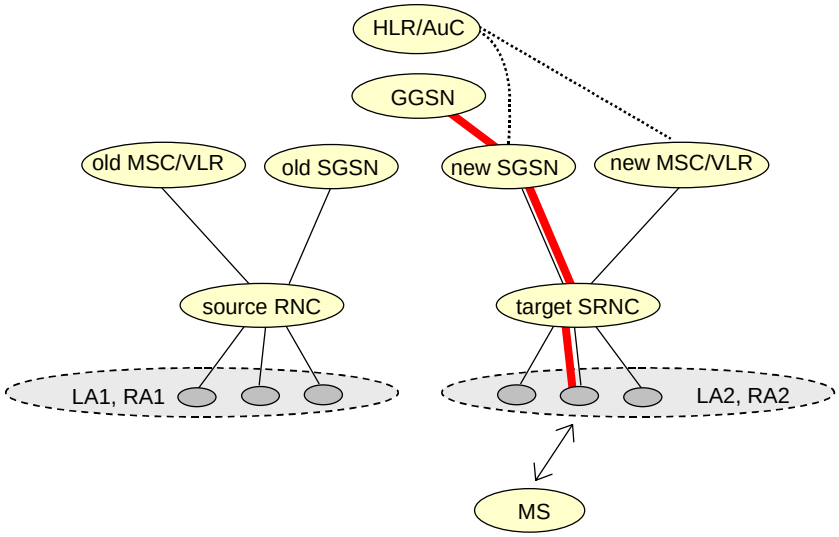


Figure 22: After SRNS Relocation and Routeing Area Update

After the Serving SRNS Relocation procedure and RA update, the MS is registered in the new SGSN The MS is in 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 39. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

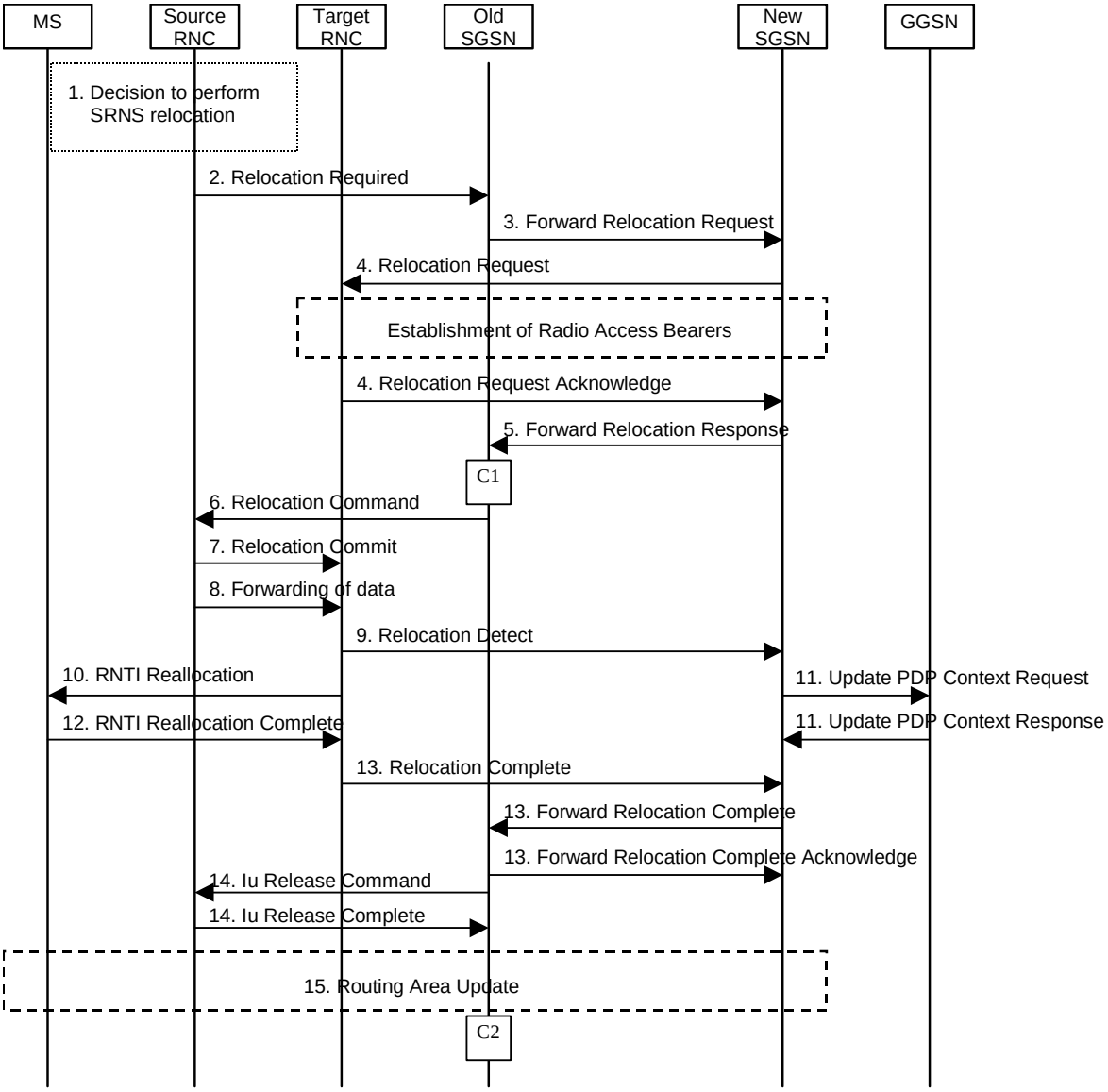


Figure ~~33~~: Serving SRNS Relocation Procedure

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

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

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN

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

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

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

6) 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~~downlink 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. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

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

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

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

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

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

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

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

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

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

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

C1) CAMEL-GPRS-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 40 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 41 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in figure 40 and figure 41 the MS is in MM IDLE state.

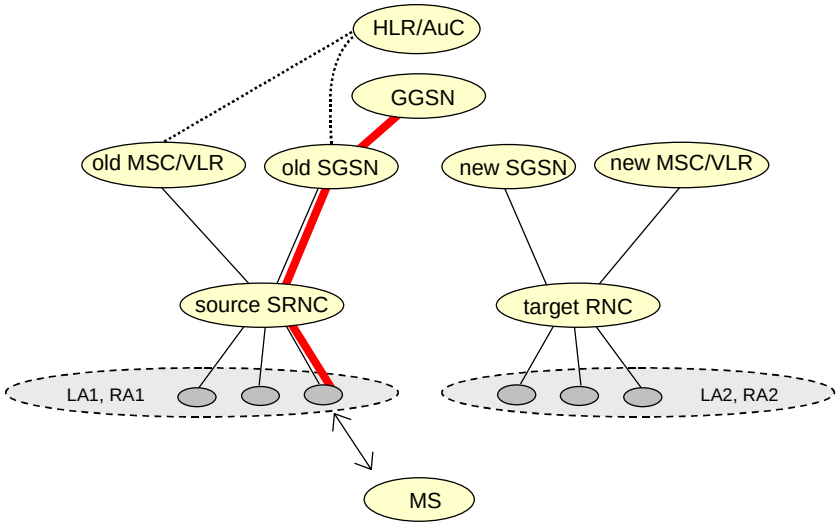


Figure 44: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

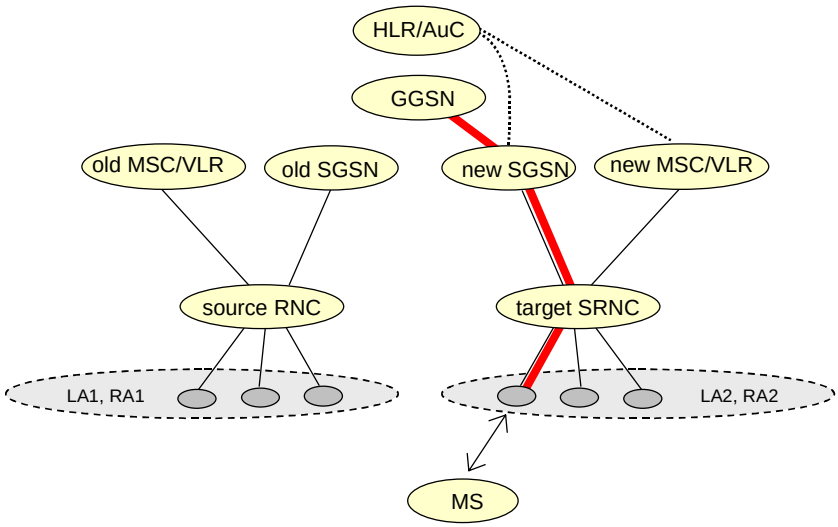


Figure 55: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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

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

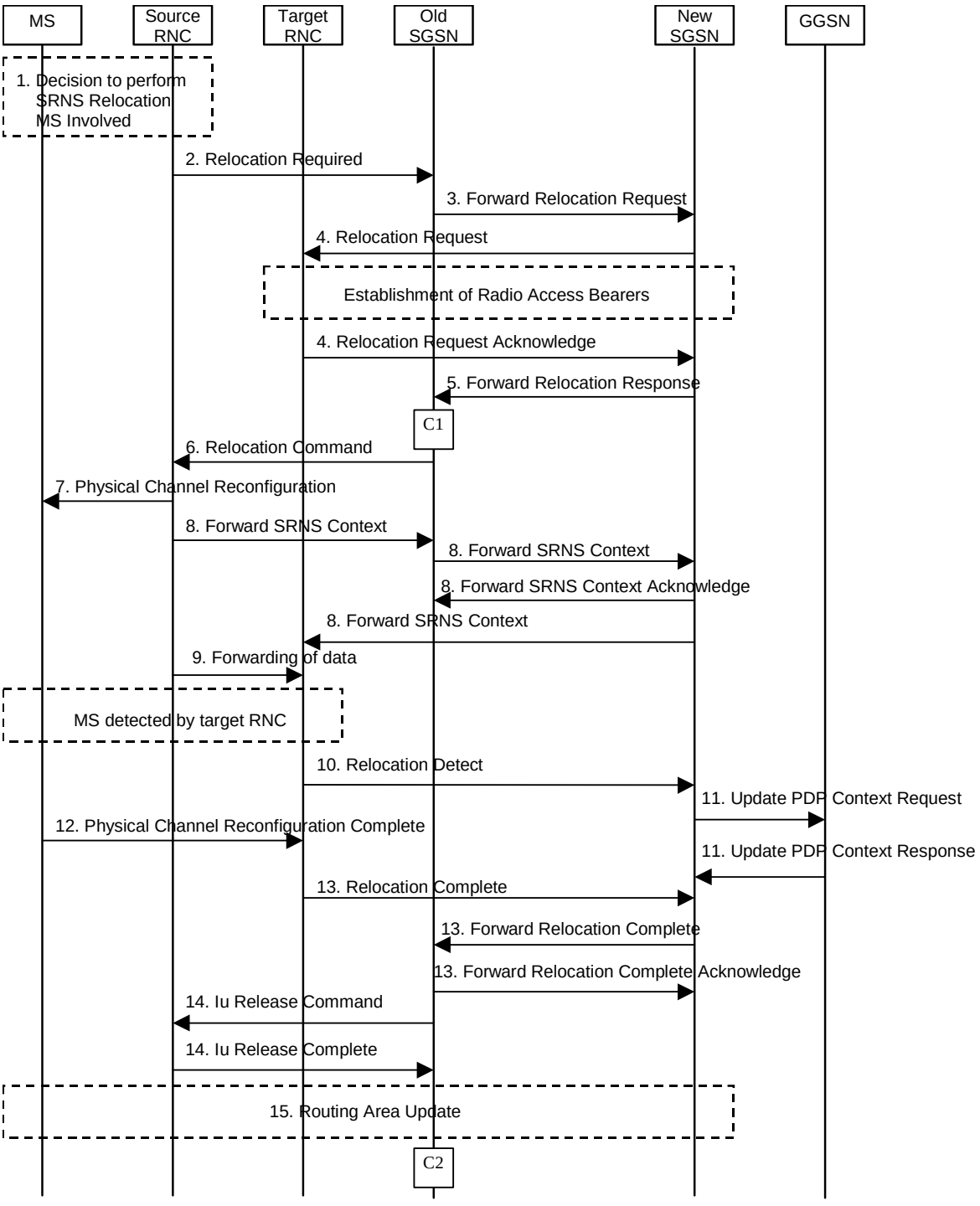


Figure 66: Combined Hard Handover and SRNS Relocation Procedure

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

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

3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) message to the new SGSN. PDP context contains GGSN Address for User Plane and Uplink TEID for Data (to this GGSN Address and Uplink TEID for Data, the old SGSN and the new SGSN send uplink packets). At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.4) The new SGSN sends a Relocation Request (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RABs To Be Setup) message to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data.

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

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the ~~downstream packets not yet acknowledged by the MS,~~forwarded downlink PDUs, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be 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~~downlink 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 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.
Before the RRC message is sent (e,g, Physical Channel Reconfiguration) uplink and downlink data transfer in the source SRNC shall be suspended for RABs which requires loss-less relocation.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is acknowledged by a Forward SRNS Context Acknowledge message. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC ~~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. ForPDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

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

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 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. If the Forward SRNS Context message with the sequence numbers is received~~From now on~~ the exchange of packets with the MS ~~can start.~~may start. ~~if the Forward SRNS Context message with the sequence numbers is received~~. If this message is not yet received the target SRNC may start the packet transfer for all RABs which do not require maintaining the delivery order.

13) When the target SRNC receives the Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the UE by the radio protocols, the target SRNC shall initiate 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 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 43. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

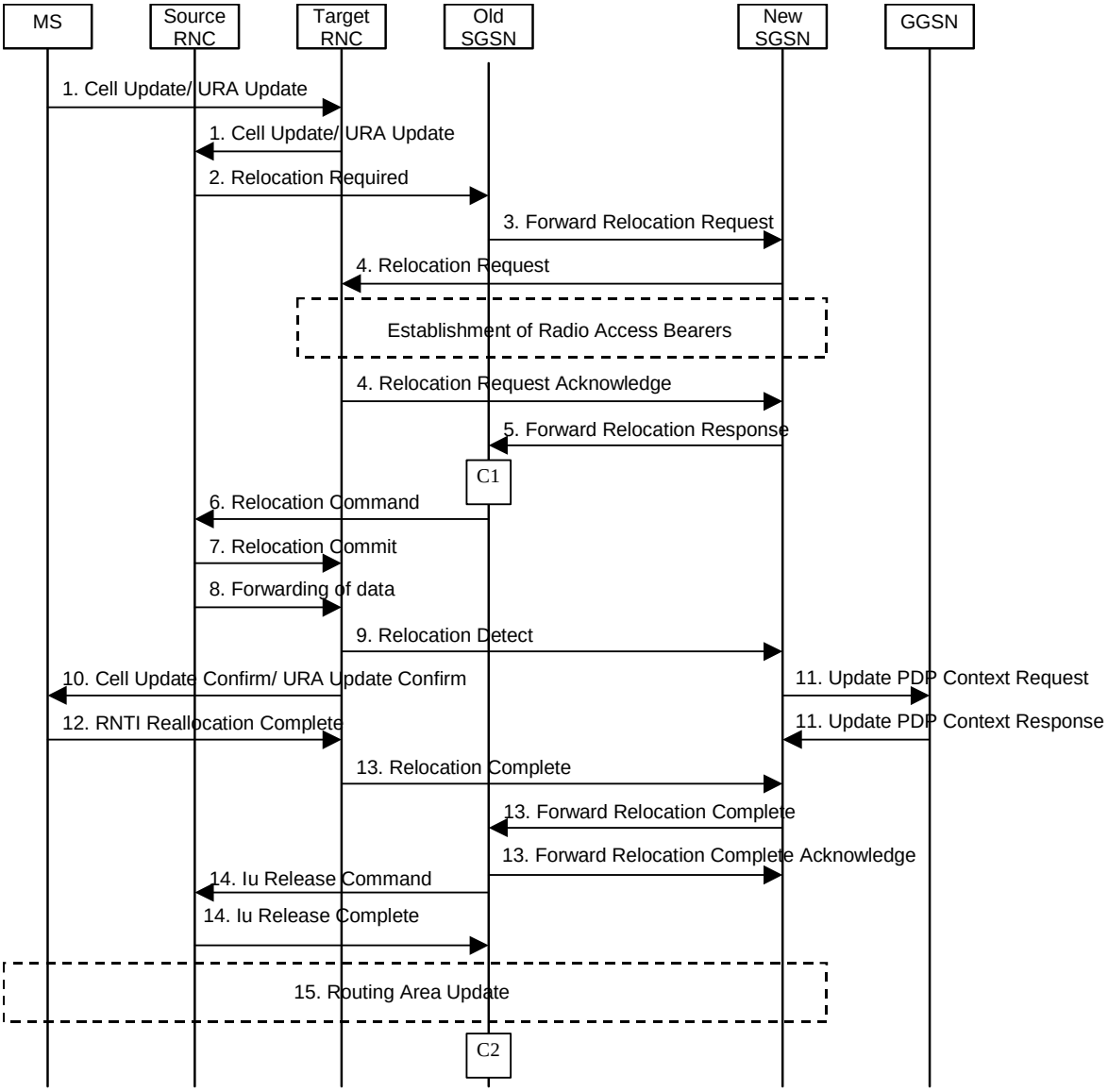


Figure 7~~7~~: Combined Cell / URA Update and SRNS Relocation Procedure

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

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

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

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

6) 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~~downlink 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 number is not used. For PDP context(s) using delivery order not required (QoS profile), the sequence numbers of the GTP-PDUs next to be transmitted are not used by the target RNC.

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

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.

3GPP-SA WG2 Meeting #17 **S2-010721**
Gothenburg, Sweden, 26 Feb - 2 March 2001

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** CR **216** ⌘ rev **1** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Clarification on use of Error Indication
Source:	⌘	Ericsson
Work item code:	⌘	***Date:*** ⌘ 21 February 2001
Category:	⌘ **F**	***Release:*** ⌘ R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	A GTP-U TEID identifies a GTP-U tunnel endpoint on Iu and Gn interfaces. In addition to this, it has somewhat different meaning on these interfaces. On Gn interface the GTP-U TEID identifies a PDP context, while on Iu the GTP-U TEID identifies a RAB. Since a RAB can be released, e.g. due to low activity, and at the same time the associated PDP context can be preserved in the SGSN, it is important to state clearly how the Error Indication message is used on Iu. The current 23.060 does not state anything on the use of Error Indication on Iu. Regarding Gn interface, it is stated that the SGSN or GGSN shall delete the related PDP context on reception of Error Indication. However, on Iu the Error Indication actually points out a RAB. Thus on reception of Error Indication, the associated RAB should be released while the associated PDP context should be preserved.
Summary of change:	⌘	It is clarified how to handle the Error Indication when used on Iu.
Consequences if not approved:	⌘	If this CR is not approved, the handling of an Error Indication on the Iu interface will not be properly specified and could lead to incorrect or inconsistent implementations.

Clauses affected:	⌘	13.8.2, 13.8.6		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	A related CR (Tdoc N4-010398) has been submitted against 29.060 to CN4.

Other comments: ⌘

How to create CRs using this form:

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

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

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

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

13.8.2 SGSN Failure

When an SGSN fails, it deletes all MM and PDP contexts affected by the failure. SGSN storage of subscriber data is volatile. Based on configuration data, the SGSN shall send a Reset message to each of its associated VLRs. The VLRs shall mark all associations containing the restarted SGSN as unreliable. See 3G TS 23.007. In the case of optional CAMEL interaction the failing SGSN shall invoke the CAMEL-GPRS-Exception procedure towards the GSM-SCFs.

If data or signalling, except GPRS attach and RA update, is received in an SGSN from an MS for which no MM context exists in the SGSN, then the SGSN shall discard the data or signalling.

If an RA update request is received in an SGSN from an MS for which no MM context exists neither in the SGSN, nor in the old SGSN for the inter-SGSN RA update case, then the SGSN shall reject the RA update with an appropriate cause. In order to remain GPRS-attached, the MS shall then perform a new GPRS attach and should (re-)activate PDP contexts.

If a service request is received in a 3G-SGSN from an MS for which no MM context exists in the 3G-SGSN, then the 3G-SGSN shall reject the service request with an appropriate cause. In order to remain GPRS-attached, the MS shall then perform a new GPRS attach and should (re-)activate PDP contexts.

NOTE: In some cases, user interaction may be required, and then the MS cannot (re-)activate the PDP contexts automatically.

When the SGSN receives a PDU Notification Request message for which no MM context exists, the SGSN returns a PDU Notification Response message to the GGSN with an appropriate cause (see subclause "Unsuccessful Network-Requested PDP Context Activation Procedure"), and the SGSN may search the MS by paging with the IMSI in the SGSN area. An MS that is paged for PS services with IMSI as the identifier shall perform a new GPRS attach and should (re-)activate PDP contexts.

When the SGSN receives a GTP-U PDU from the GGSN for which no PDP context exists it shall discard~~s~~ the GTP-U PDU and send~~s~~ a~~n~~ GTP error indication to the originating GGSN. The GGSN shall mark~~s~~ the related PDP context as invalid.

When the SGSN receives a GTP-U PDU from the RNC for which no PDP context exists, the SGSN shall discard the GTP-U PDU and send a~~n~~ GTP error indication to the originating RNC. The RNC shall locally release the RAB.

When the SGSN receives a mobile-terminated SM from the SMS-GMSC for an IMSI unknown in the SGSN, it rejects the request.

When the SGSN receives a paging request over the Gs interface for an IMSI unknown in the SGSN and the SGSN has not completed recovery, then the SGSN may page the MS for packet services with IMSI as identifier in the area specified by the location information provided by the MSC/VLR. If no such location information is provided, then the SGSN may page the MS in the routeing areas corresponding to that MSC/VLR. After the MS performs a combined GPRS attach, the SGSN may continue serving the Gs interface paging request.

*** *Next Modification* ***

13.8.6 RNC Failure (UMTS Only)

When an RNC fails, all its RNC contexts affected by the failure become invalid and shall be deleted. RNC storage of data is volatile.

When the RNC receives a GTP-U PDU from the SGSN for which no RAB context exists, ~~it~~the RNC shall discard the GTP-U PDU and return a~~n~~ GTP error indication to the originating SGSN. The SGSN shall locally release the RAB. The SGSN should preserve the associated PDP context. The SGSN may initiate the RAB Assignment procedure in order to re-establish the RAB.

3GPP TSG SA 2 **Tdoc S2-010708**
Gothenberg, 26/2-2/3/01
~~**3GPP TSG-CN4 Meeting #06**~~ **Tdoc N4-010093**
~~**BEIJING, CHINA 15th 19th January 2001**~~

CR-Form-v3

CHANGE REQUEST

⌘ **23.060** **CR** 217 ⌘ rev **-** ⌘ Current version: **3.6.0** ⌘

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

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

Title:	⌘	Failure of Update GPRS Location when HLR is not reachable
Source:	⌘	Vodafone UK Ltd
Work item code:	⌘	GPRS R97
Date:	⌘	5 Jan 2001
Category:	⌘	A
Release:	⌘	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	Returning "Roaming Not Allowed" if the HLR is not reachable can cause undesirable behaviour of the MS which tries to register in an SGSN when a GPRS roaming agreement has not been set up between the HPLMN and VPLMN operators
Summary of change:	⌘	Show the handling of the error "Unknown HLR"
Consequences if not approved:	⌘	Unnecessary denial of CS service to GPRS capable MSs

Clauses affected:	⌘	6.9.1.2.2; 6.9.1.3.2		
Other specs affected:	⌘	☒ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	GSM 09.02
Other comments:	⌘			

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

6.9.1.2.2 Inter SGSN Routeing Area Update

...

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

...

**** Next modified section ****

6.9.1.3.2 Combined Inter SGSN RA / LA Update

...

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

...

3GPP/SMG Meeting #14
Bristol, UK, 4-8 Sep 2000

Document S2-001917
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	218	Current Version:	3.5.0

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

For submission to:	TSG-SA#9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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

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

Source: Nokia **Date:** 2000-09-07

Subject: Correction to the relocation procedure

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	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:

The SRNS Relocation procedure has been clarified:

1. SRNS Context Response message has been corrected to correspond to TS 25.413.
2. It has been described when the PDCP numbering is required i.e. when the lossless relocations is supported
3. PDCP sequence number exchange text has been added to 6.9.2.2.3
4. First signal in Combined cell/URA update and relocation procedure has been corrected and clarified to is is sent to source SRNC (possibly via DRNC over Iur).
5. Header in chapter 6.13.2.2 has been changed from GPRS to GSM to be in line with other intersystem chapter headers.

Clauses affected: 6.9.2.2.1, 6.9.2.2.2, 6.9.2.2.3, 6.13.1.1, 6.13.2.1, 6.13.2.2

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 Routeing Area Update procedure have been completed. In the case described in Figure 1and Figure 2 the MS is in state MM-IDLE.

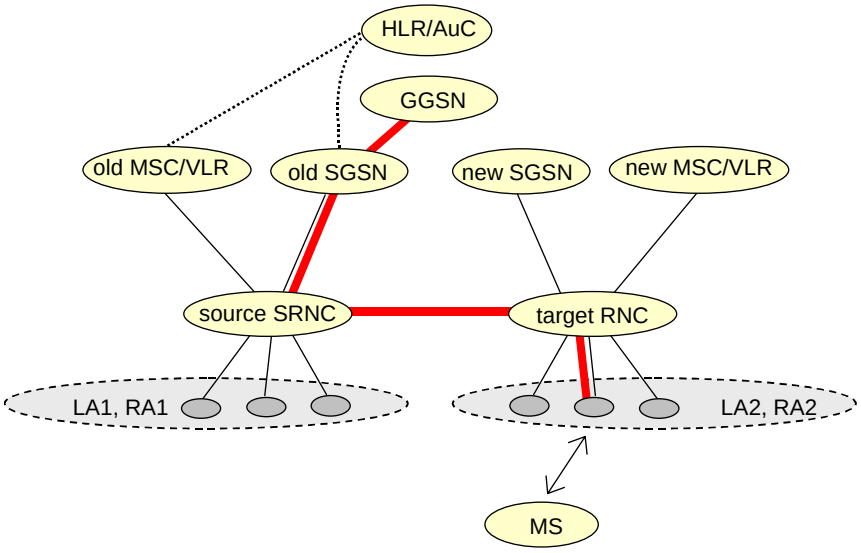


Figure 1: Before SRNS Relocation and Routeing Area Update

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

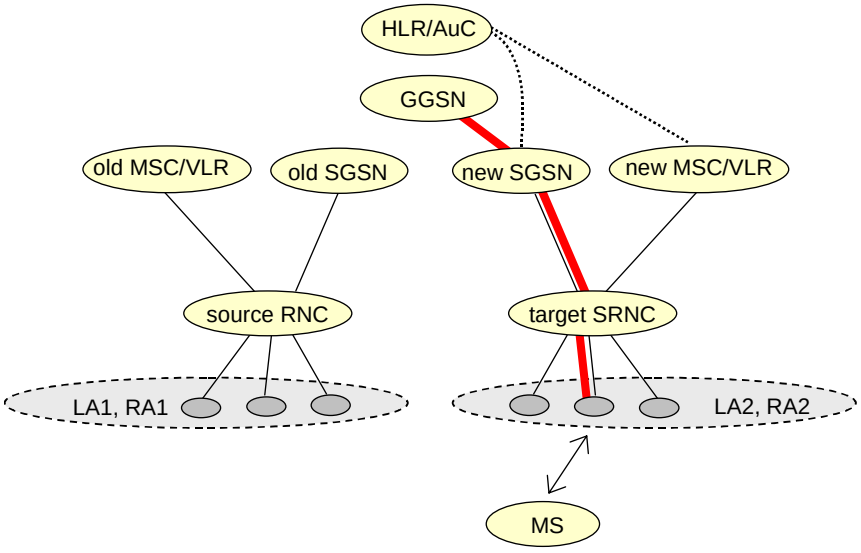


Figure 2: After SRNS Relocation and Routeing Area Update

After the Serving SRNS Relocation procedure and RA update, the MS is registered in the new SGSN The MS is in 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.

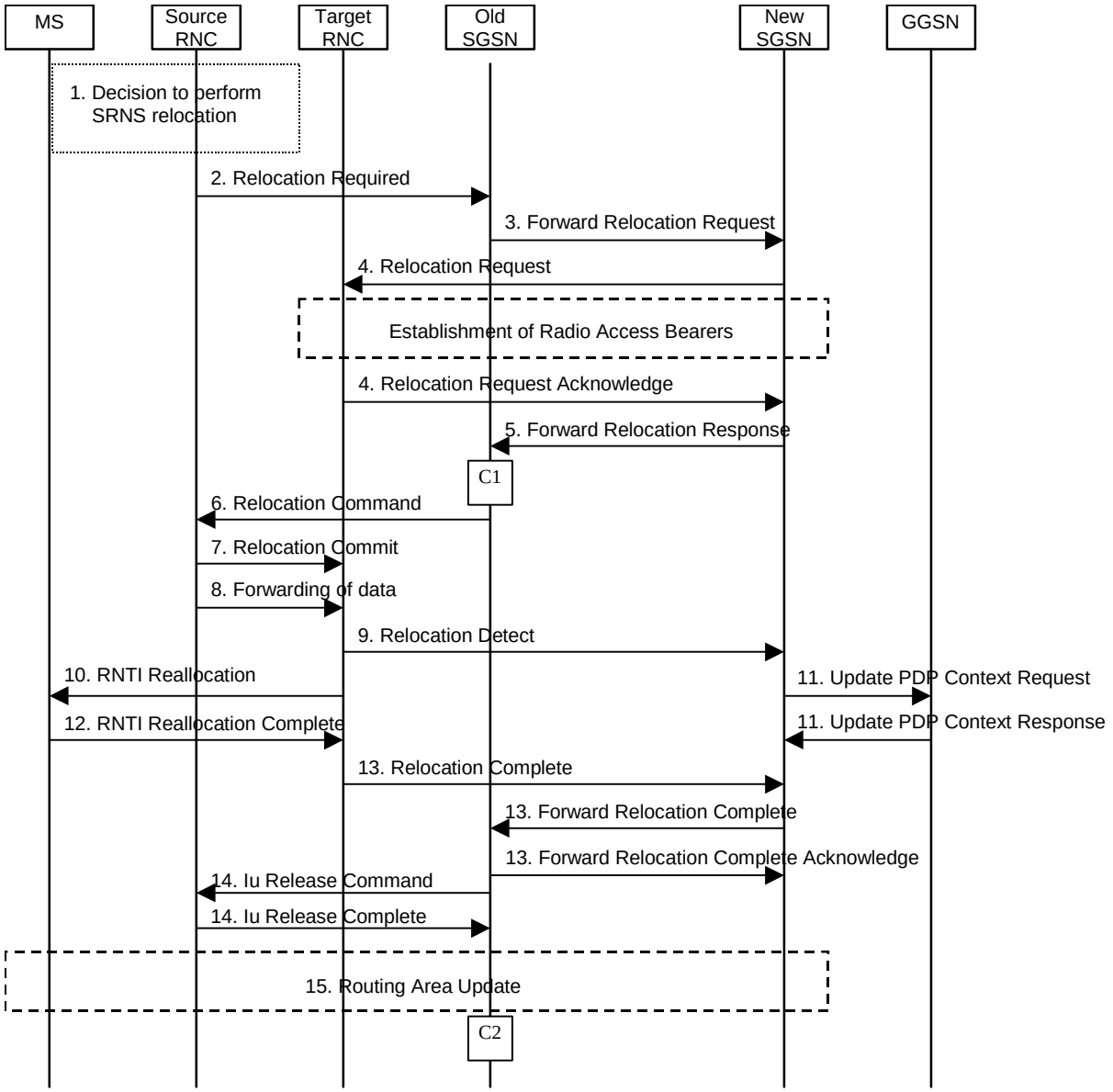


Figure 3: Serving SRNS Relocation Procedure

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 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 have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from new SGSN to old SGSN. This message indicates that the target RNC is 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 RAB Setup Information, one information element for each RAB, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter SGSN SRNS relocation.

6) 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. PDCP sequence numbers are only used when lossless SRNS relocation is configured for PDCP [57]. ~~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 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 ~~resets~~ establishes and/or 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 the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).

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

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

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

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

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

C1) CAMEL-GPRS-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.

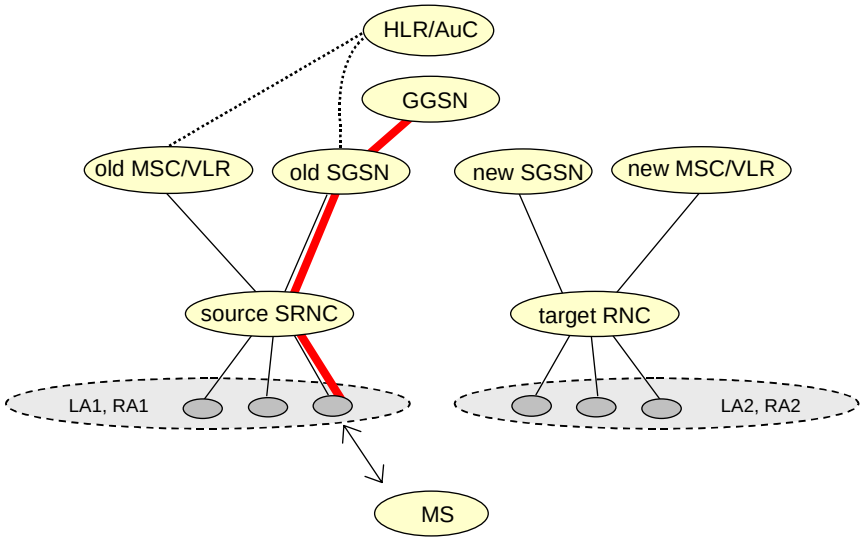


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

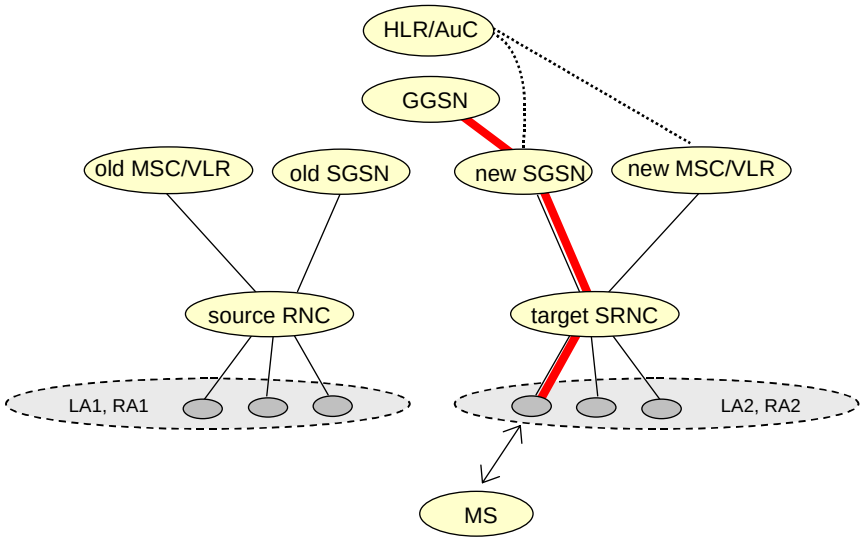


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

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.

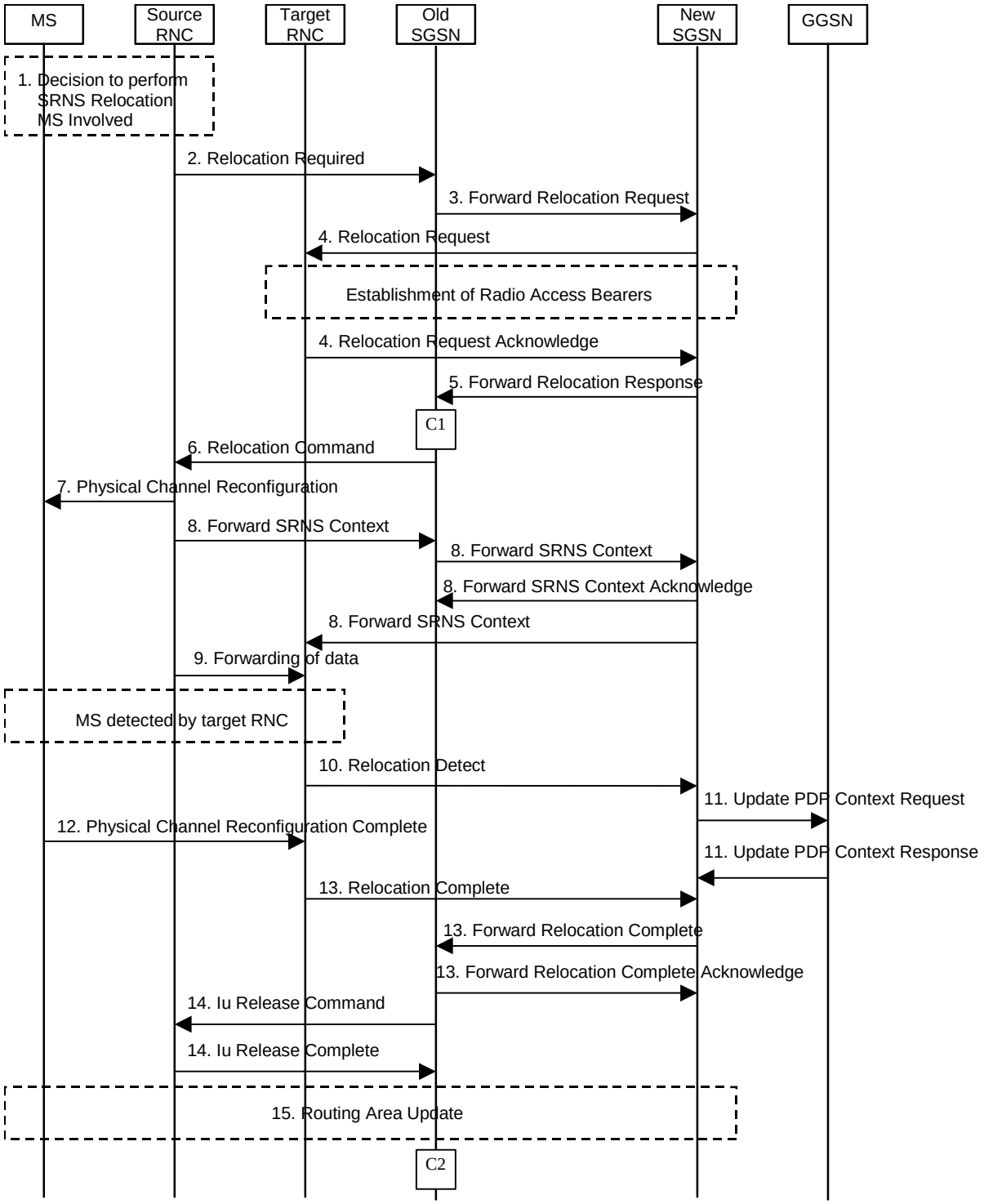


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

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

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. The target RNC will for each RAB to be 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 have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the 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, 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. PDCP sequence numbers are only used when lossless SRNS relocation is configured for PDCP [57]. ~~For connections using RLC unacknowledged mode PDCP sequence numbers is not used.~~

   The source SRNC includes the PDCP sequence number, PDCP-SNU, in the RRC message which is indicated in the Target RNC to Source RNC transparent container to the MS. The MS informs the PDCP sequence number, PDCP-SND, to the target RNC in the corresponding RRC complete message.

   The target SRNC ~~resets~~ establishes and/or 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 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, 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 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

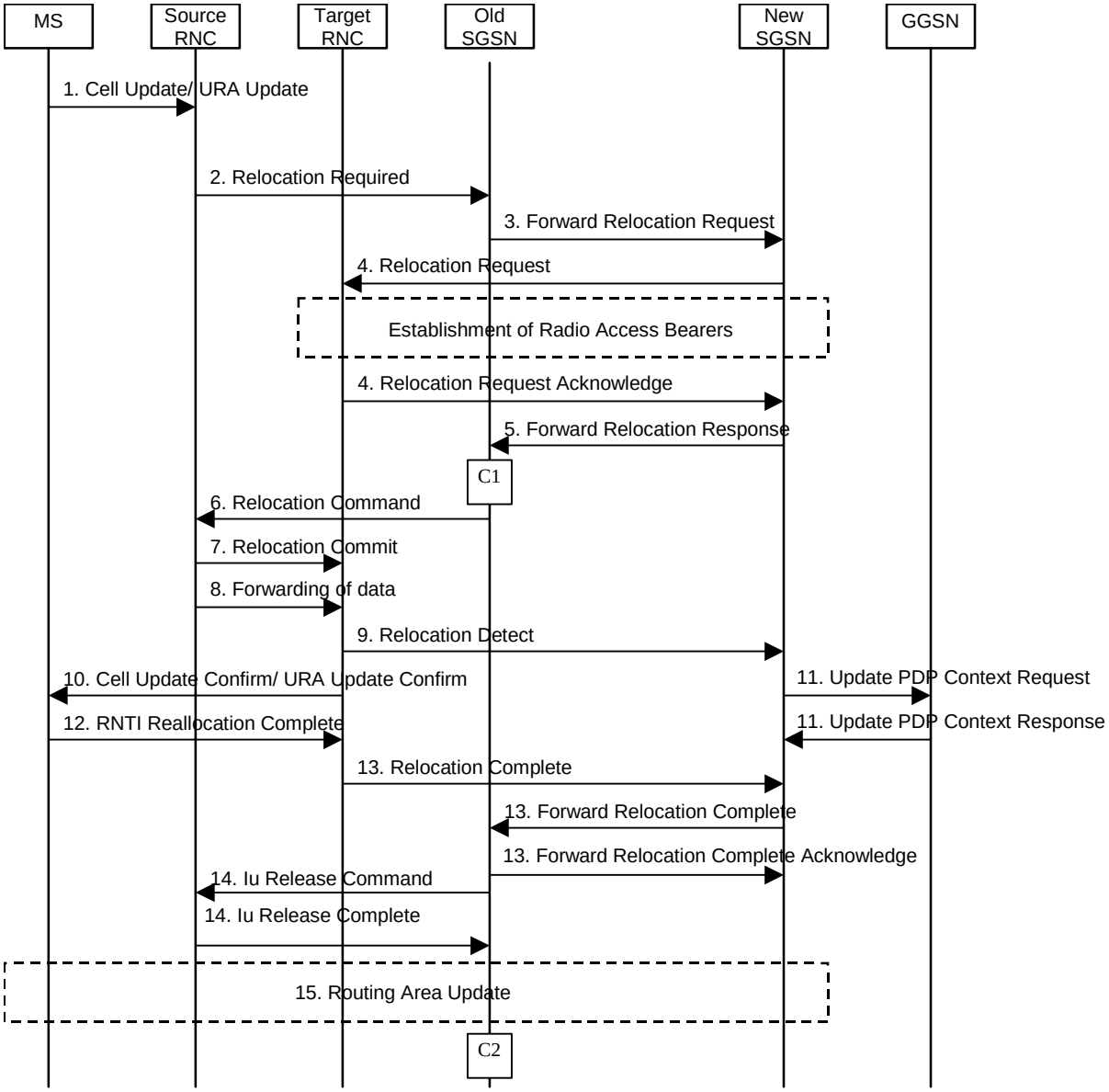
This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur carries control signalling but no user data.

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



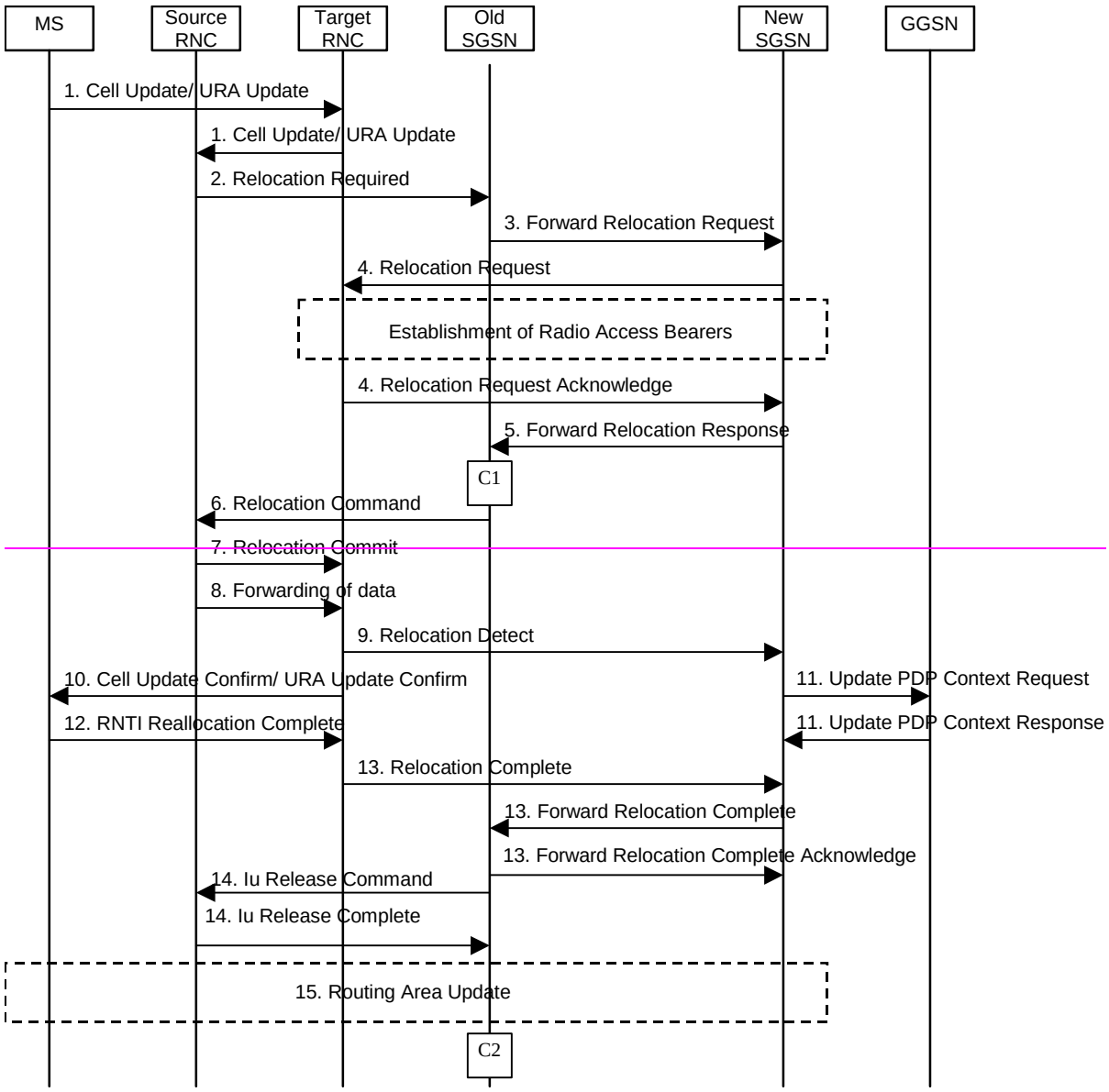


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the source SRNC (if the cell is located under another RNC the message is routed via the DRNC to SRNC over the Iur). ~~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 whether or not to perform a combined cell / URA update and SRNS relocation towards the target RNC. The rest of this section describes the case where a combined cell / URA update and SRNS relocation applies.

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

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In 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 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 have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from new SGSN to old SGSN. This message indicates that the target RNC is 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 Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter SGSN SRNS relocation.

6) 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. PDCP sequence numbers are only used when lossless SRNS relocation is configured for PDCP [57].~~For connections using RLC unacknowledged mode PDCP sequence number 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.

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

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.

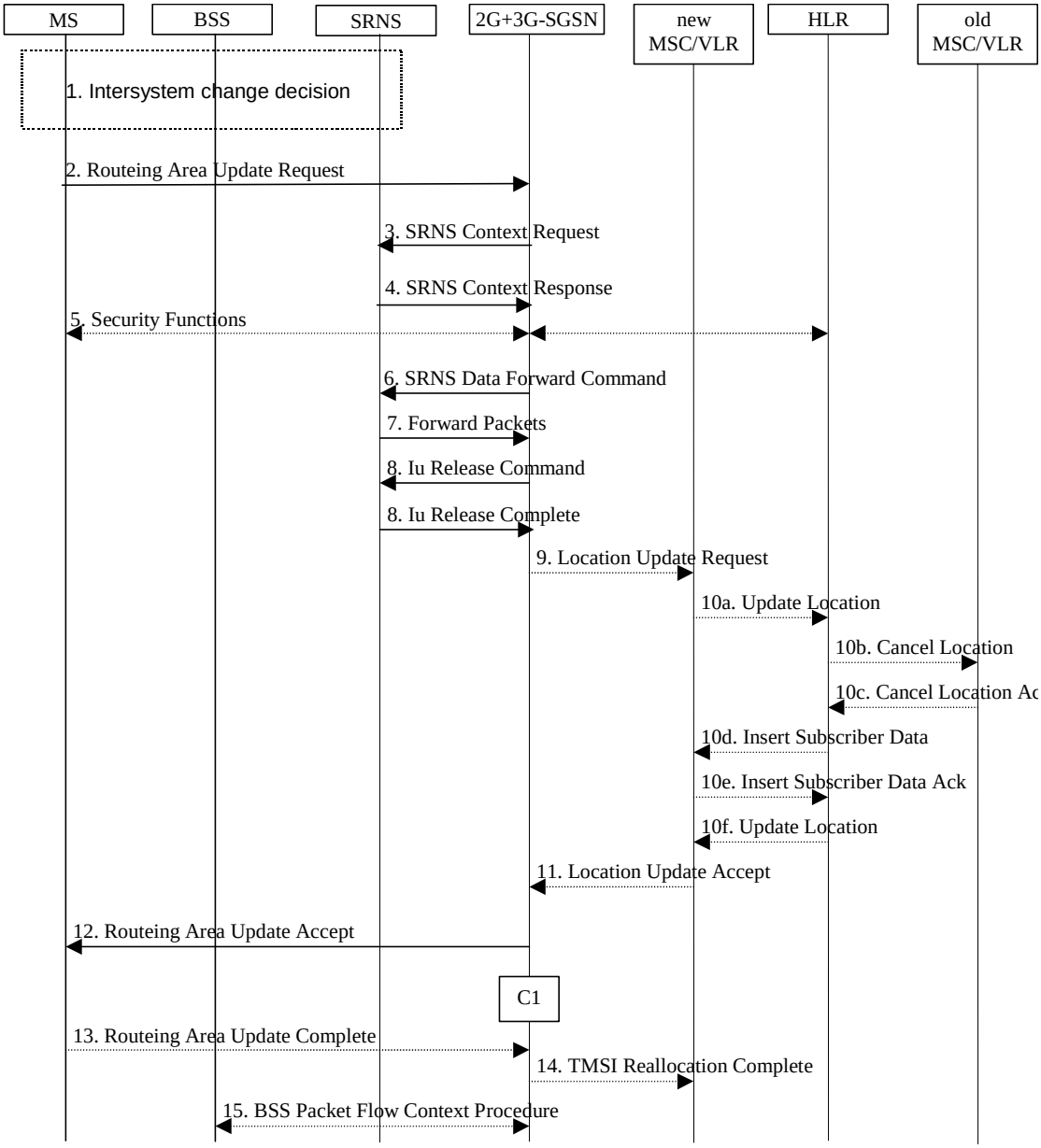


Figure 8: UMTS to GSM Intra SGSN Change

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-SNDs, 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~~requiring support of lossless ~~SRNS relocation~~intersystem change~~s~~, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU) and downlink PDCP sequence number (PDCP-SND). 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. PDCP-SND is the PDCP sequence number for the first downlink packet which successful transmission has not been confirmed. 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 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.

6.13.1.2 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.

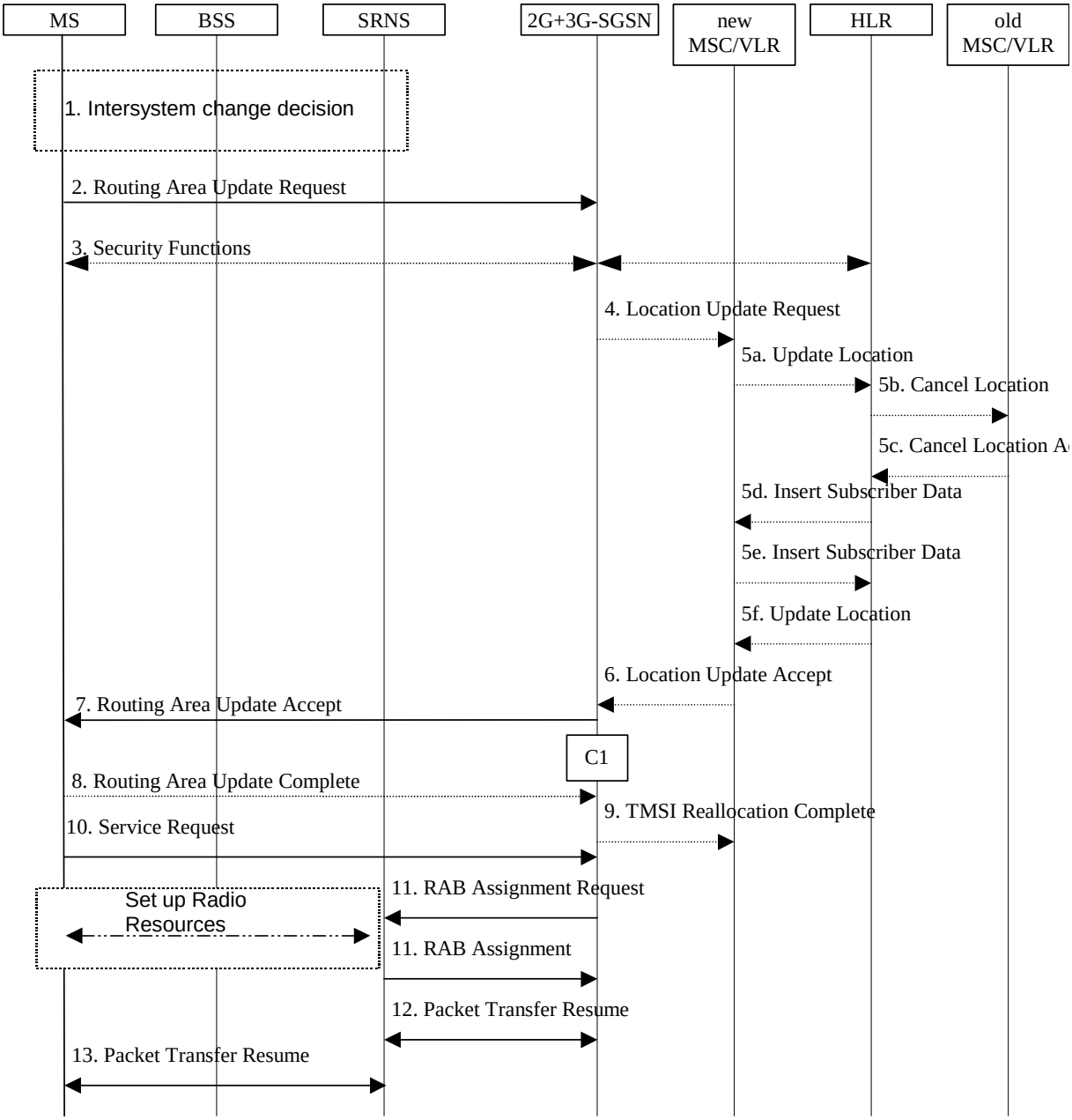


Figure 9: GSM to UMTS Intra SGSN Change

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.

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 10.

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.

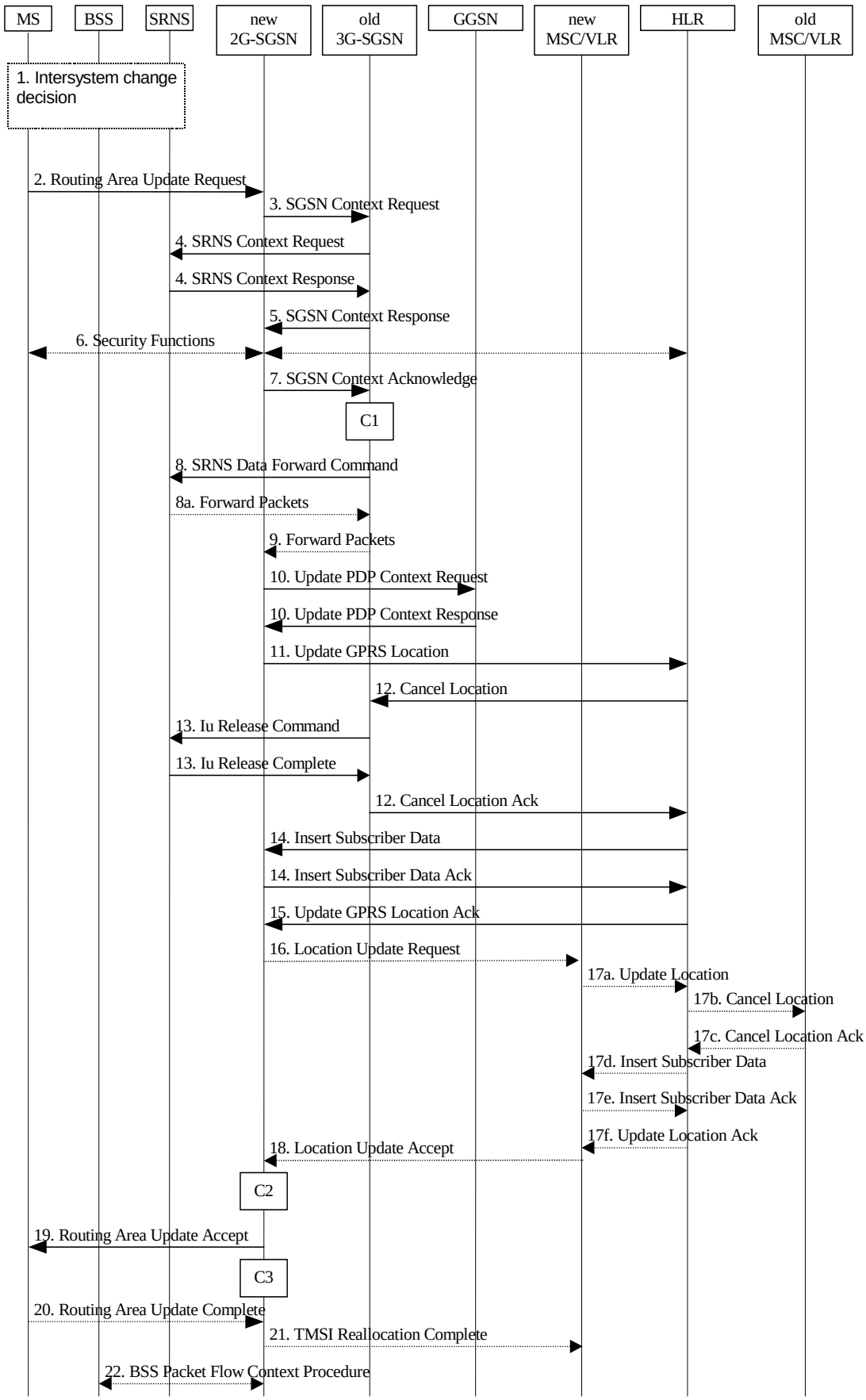


Figure 10: UMTS to GSM Inter SGSN Change

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-SNDs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context ~~using acknowledged mode~~requiring support of lossless ~~SRNS relocation~~intersystem changes~~s~~, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU) downlink PDCP sequence number (PDCP-SND). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer that requires lossless relocations). PDCP-SND is the PDCP sequence number for the first downlink packet which successful transmission has not been confirmed. The 3G-SGSN shall strip off the eight most significant bits of the passed PDCP sequence numbers, thus converting them to 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 do~~n~~wnlink 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.

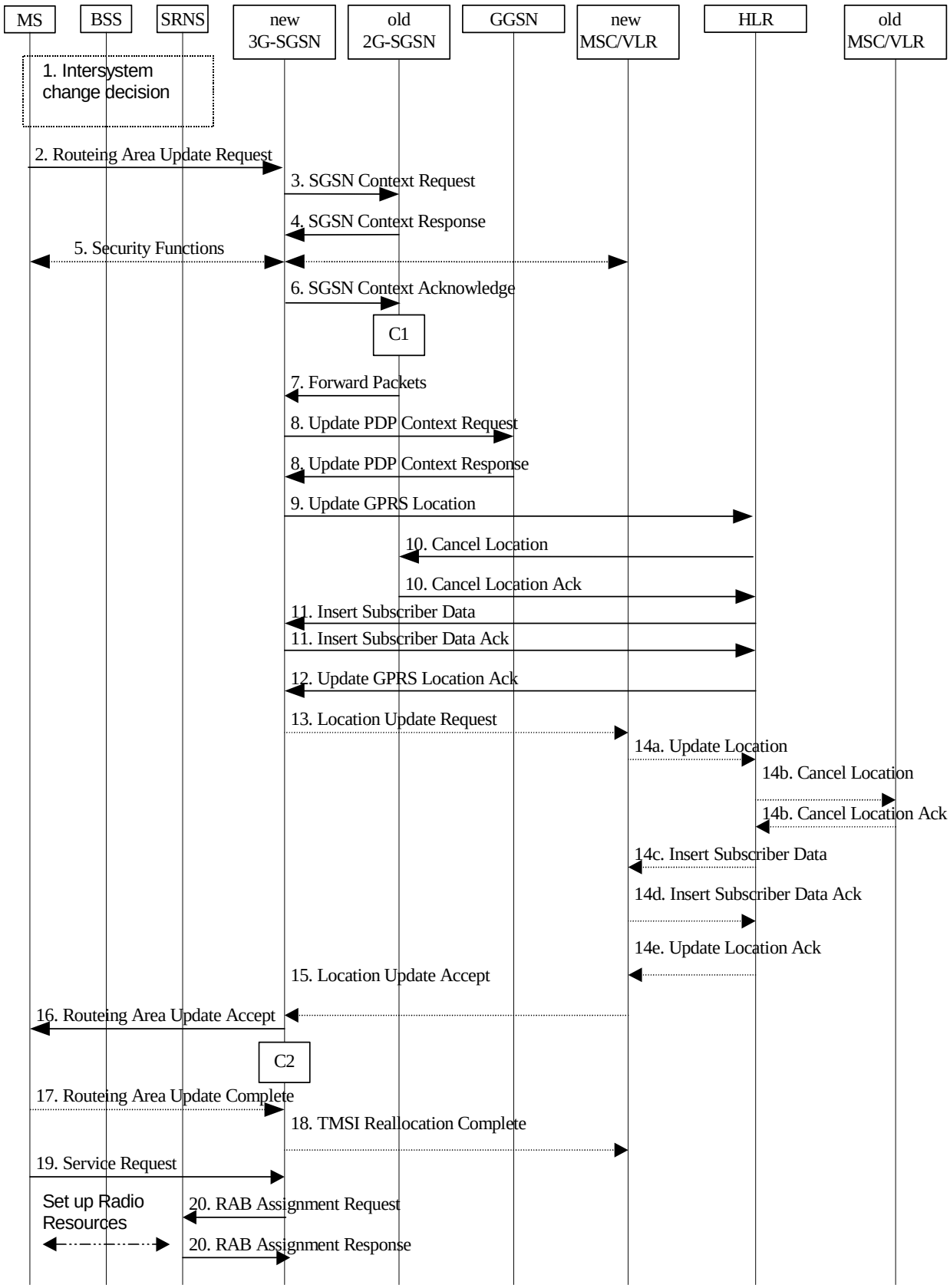
C2) CAMEL-GPRS-Routeing-Area-Update-Session.

C3) CAMEL-GPRS-Routeing-Area-Update-Context.

6.13.2.2 ~~GPRS~~ GSM 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 11.

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.


MS
BSS
SRNS
new 3G-SGSN
old 2G-SGSN
GGSN
new MSC/VLR
HLR
old MSC/VLR
1. Intersystem change decision
2. Routeing Area Update Request
3. SGSN Context Request
4. SGSN Context Response
5. Security Functions
6. SGSN Context Acknowledge
C1
7. Forward Packets
8. Update PDP Context Request
8. Update PDP Context Response
9. Update GPRS Location
10. Cancel Location
10. Cancel Location Ack
11. Insert Subscriber Data
11. Insert Subscriber Data Ack
12. Update GPRS Location Ack
13. Location Update Request
14a. Update Location
14b. Cancel Location
14b. Cancel Location Ack
14c. Insert Subscriber Data
14d. Insert Subscriber Data Ack
14e. Update Location Ack
15. Location Update Accept
16. Routeing Area Update Accept
C2
17. Routeing Area Update Complete
18. TMSI Reallocation Complete
19. Service Request
Set up Radio Resources
20. RAB Assignment Request
20. RAB Assignment Response

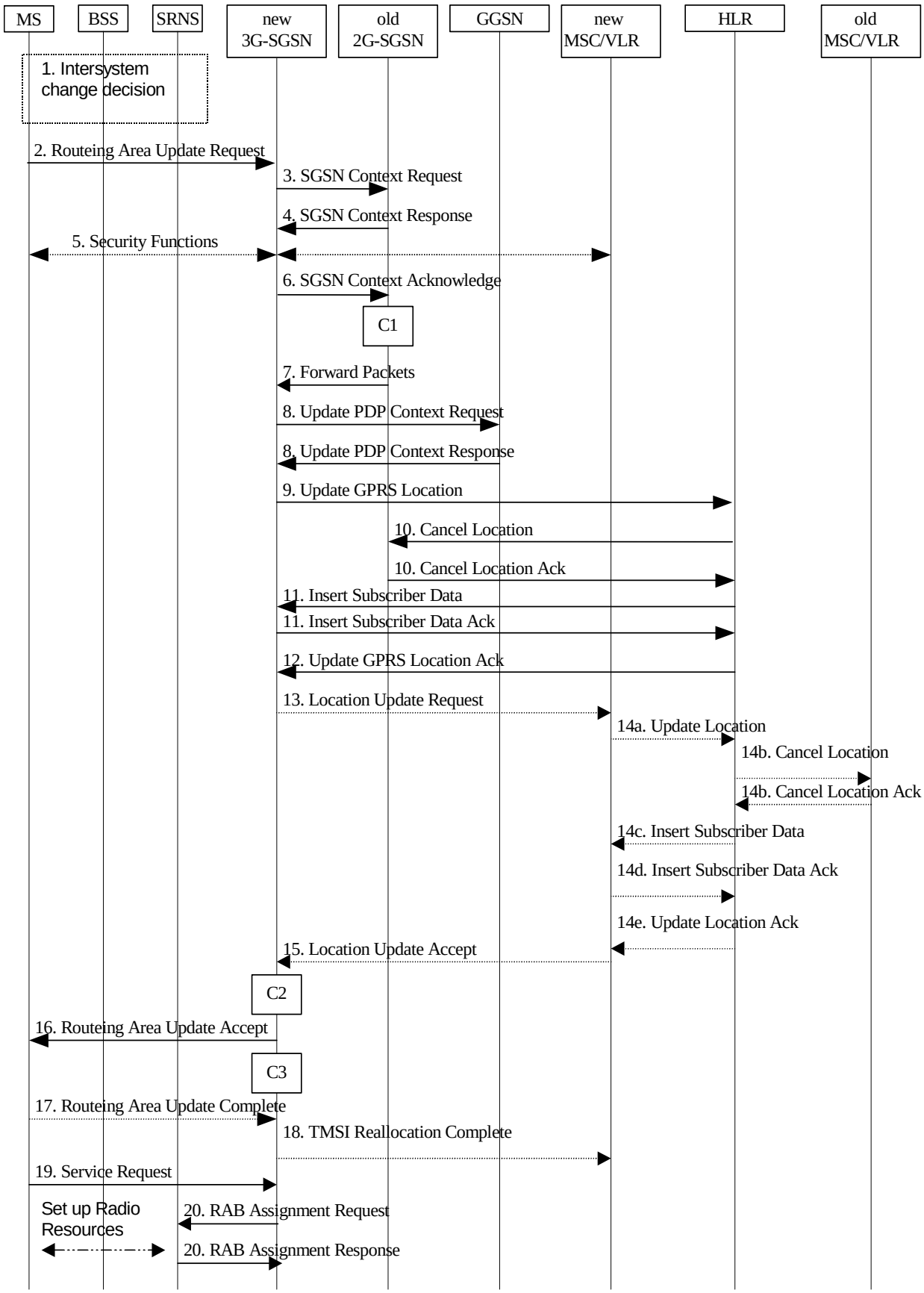


Figure 11: GSM to UMTS Inter SGSN Change

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.

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-Session.

C3) CAMEL-GPRS-Routeing-Area-Update-Context.