3GPP TSG-SA2 meeting #6 **Document WHS-005**

Sophia Antipolis, France, August 23, 1999

3G CHANGE REQUEST

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

23.121 **CR** Current Version: V3.0.0

3G specification number . *. CR number as allocated by 3G support team*

For submision to TSG SA#7 for approval X *(only one box should*
list TSG meeting no. here . for information *be marked with an X)*

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

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

Source: Alcatel **Date:** August 16, 1999

Subject: GTP tunnel termination points in SRNS Relocation for PS domain

3G Work item:

Category:

F	Correction	
A	Corresponds to a correction in a 2G specification	
B	Addition of feature	
C	Functional modification of feature	X
D	Editorial modification	

(only one category shall be marked with an X)

Reason for change:

In TS 23.121 v3.0.0, the SRNS Relocation procedure for PS domain, in the case of non real time data service with high reliability, includes the "Data Retrieve" procedure which consists of transferring the data buffered in the old SRNC towards the new SRNC. This is done over GTP-u/UDP/IP protocol stack over the Iu interface.

It is clear that the Iu interface is used at the ATM layer since it allows to share the ATM bandwidth for all transfers towards/from all other RNCs (e.g. by using only one single ATM VP/VC connection). However, there is no reason to have several cascaded GTP tunnels between the old SRNC and the new SRNC (one between old SRNC and old SGSN, one between old SGSN and new SGSN, and one between new SGSN and new SRNC).

On the contrary, using cascaded GTP tunnels has following drawbacks:

- It forces SGSNs to process the data stream at GTP layer instead of processing it as a simple IP router at the IP layer,
- It implies a modification of Gn interface specification: Uplink N-PDUs destined to the GGSN(s) and Downlink N-PDUs that are forwarded from the old SRNC to the new SRNC use the same GTP tunnel between old SRNC and old SGSN. Therefore, it is needed to distinguish these two data streams at SGSN.
- Once this modification on Gn interface made, the SGSN has to route the data streams to the right destination (GGSN or new SRNC), and this implies more processing power than simply route according to the IP address.

So, it is proposed to have only one single GTP tunnel between the old SRNC and the new SRNC. This can be done by simply replacing the old SGSN IP address by the new SRNC IP address. At ATM layer, everything remains unchanged since Iu interface is used for the sake of bandwidth efficiency.

Regarding the charging aspects, the data are not counted twice since the data forwarded from the old SRNC to the new SRNC use a GTP tunnel that is not seen by the SGSNs.

This CR does not lead to modifications of UMTS to/from GPRS handover .

Clauses affected:	4.2.2.1.4 Adopted solution for data retrieve in UMTS. 4.2.2.1.5 User plane protocol stacks for UMTS data retrieve. 4.3.12.2.3 SRNS relocation (UE connected to a single CN node, 3G_SGSN) followed by Location Registration in new Location Area.

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

Other comments:	


help.doc

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

4.2.2.1.4 Adopted solution for data retrieve in UMTS

Data Retrieve procedure at SRNS relocation shall be carried out through the Iu interface: data exchanged between source and target SRNC are carried over Iu at ATM layer. They are routed at IP layer towards the target SRNC and there is one single GTP tunnel between the source SRNC and the target SRNC. ~~handled by the 3G-SGSN (3 GTP pipes: source SRNC - source 3G-SGSN, source 3G-SGSN - destination 3G-SGSN and destination 3G-SGSN - destination SRNC).~~

~~Source 3G-SGSN has to decrement charging counters for user data sent from SRNC to 2G-SGSN, avoiding that such data are charged twice (in 3G-SGSN and in 2G-SGSN).~~Since neither the source SGSN nor the target SGSN do not see the GTP layer of the forwarded data stream, the user data are not charged twice.

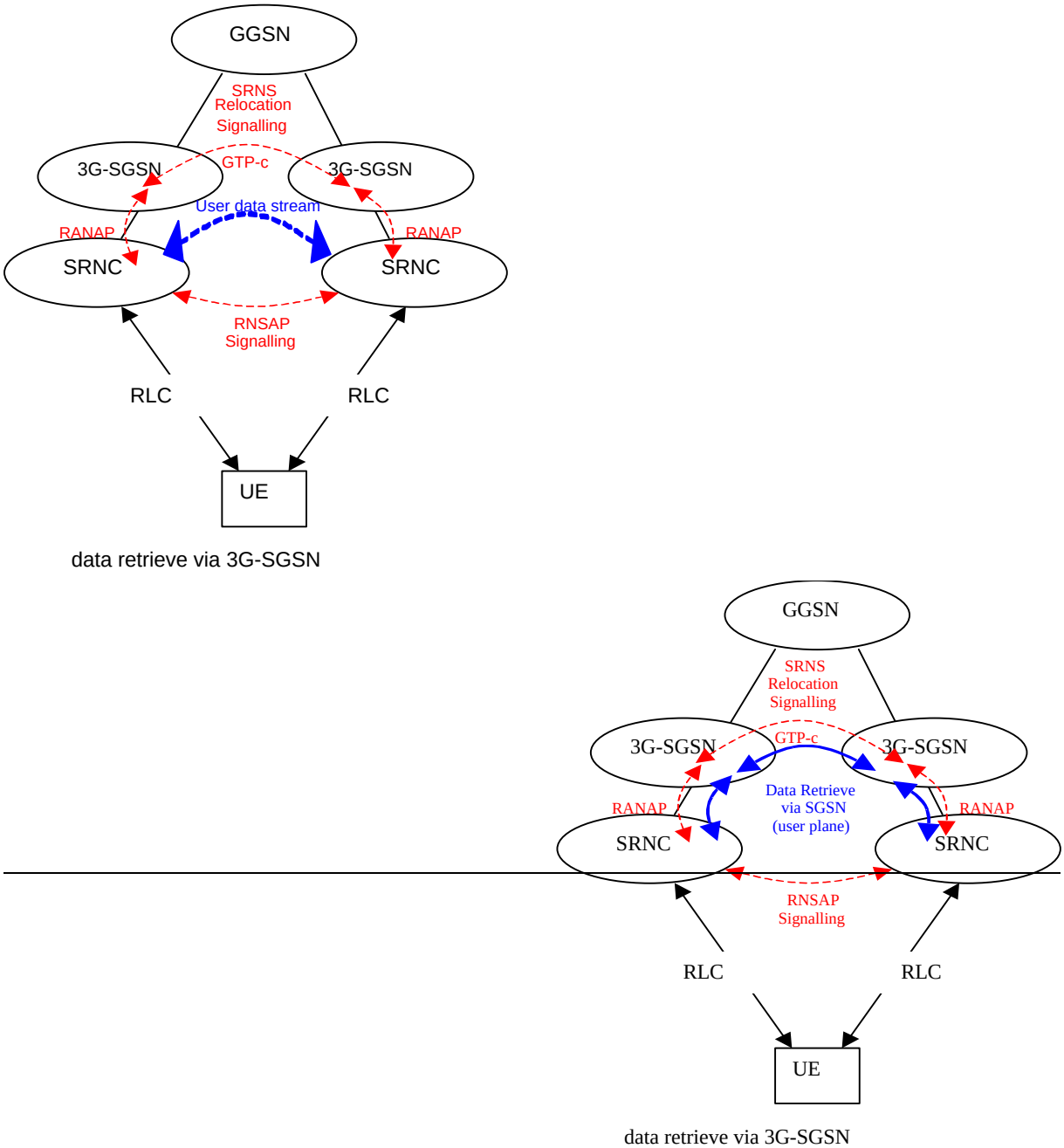

Figure 6: User data Retrieve in UMTS

4.2.2.1.5 User plane protocol stacks for UMTS data retrieve

The user plane for data retrieve between two RNCs is based on GTP-u/UDP/IP. The GTP connections are terminated in the ~~3G-SGSNs~~source SNRC and the target SRNC as described in the following figure.

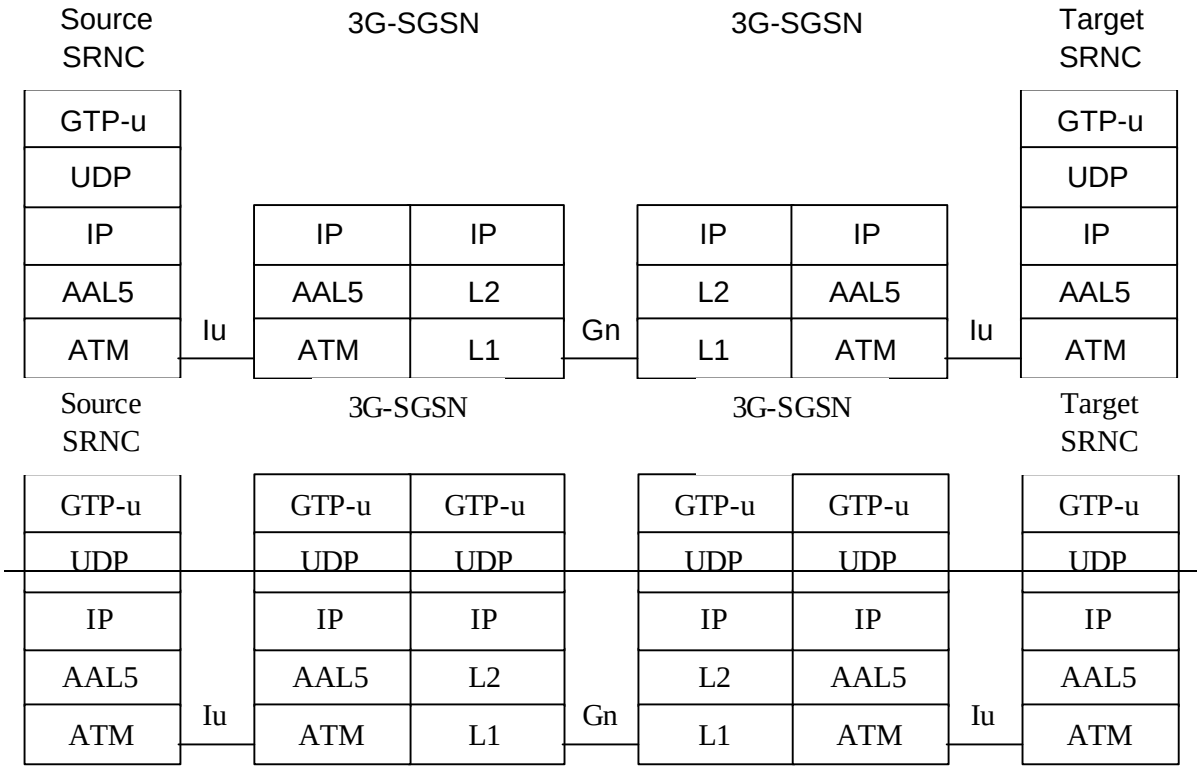

Figure 7: User plane protocol stack for data retrieve in UMTS

4.3.12.2.3 SRNS relocation (UE connected to a single CN node, 3G_SGSN) followed by Location Registration in new Location Area

This example shows SRNS relocation when source RNC and target RNC are connected to different 3G_SGSN. Figure 33 and Figure 35 illustrate the situation before respective after the SRNS relocation and location registration. Figure 37 illustrates the signalling sequence where each step is explained in the following list.

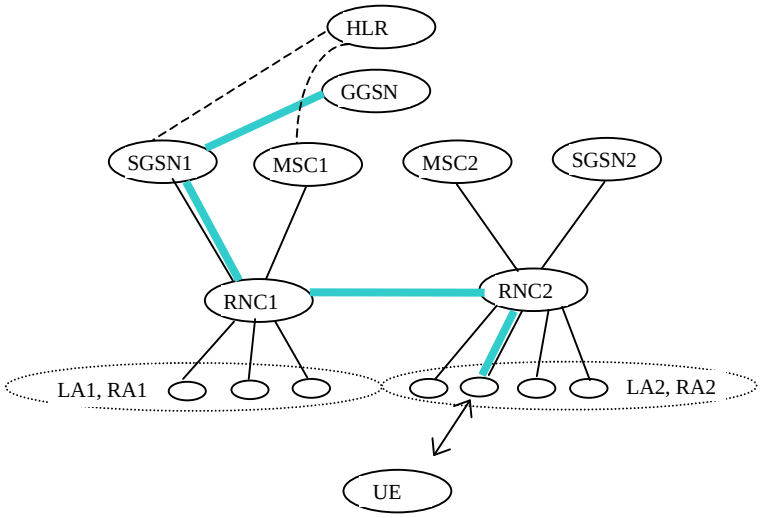

Figure 33 Before the SRNS relocation and location registration

Before the SRNS relocation and location registration the UE is registered in SGSN1 and in MSC1. The UE is in state MM connected towards the SGSN1 and in state MM idle towards the MSC1. The RNC1 is acting as SRNC and the RNC2 is acting as DRNC.

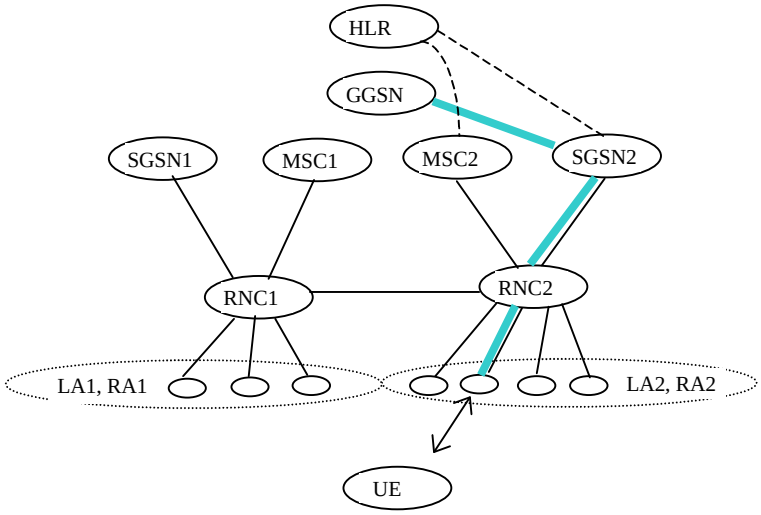

Figure 35 After the SRNS relocation and location registration

After the SRNS relocation and location registration the UE is registered in MSC2 and in SGSN2. The UE is in state MM connected towards the SGSN2 and in state MM idle towards the MSC2. The RNC2 is acting as SRNC.

At SRNS relocation:

The source and target SGSN exchange CN level information (CN classmark, list of established PDP contexts)

The source and target SRNC exchange UTRAN level information (UTRAN classmark,…) and information used to ensure that no user packet is lost nor duplicated during the SRNS relocation procedure

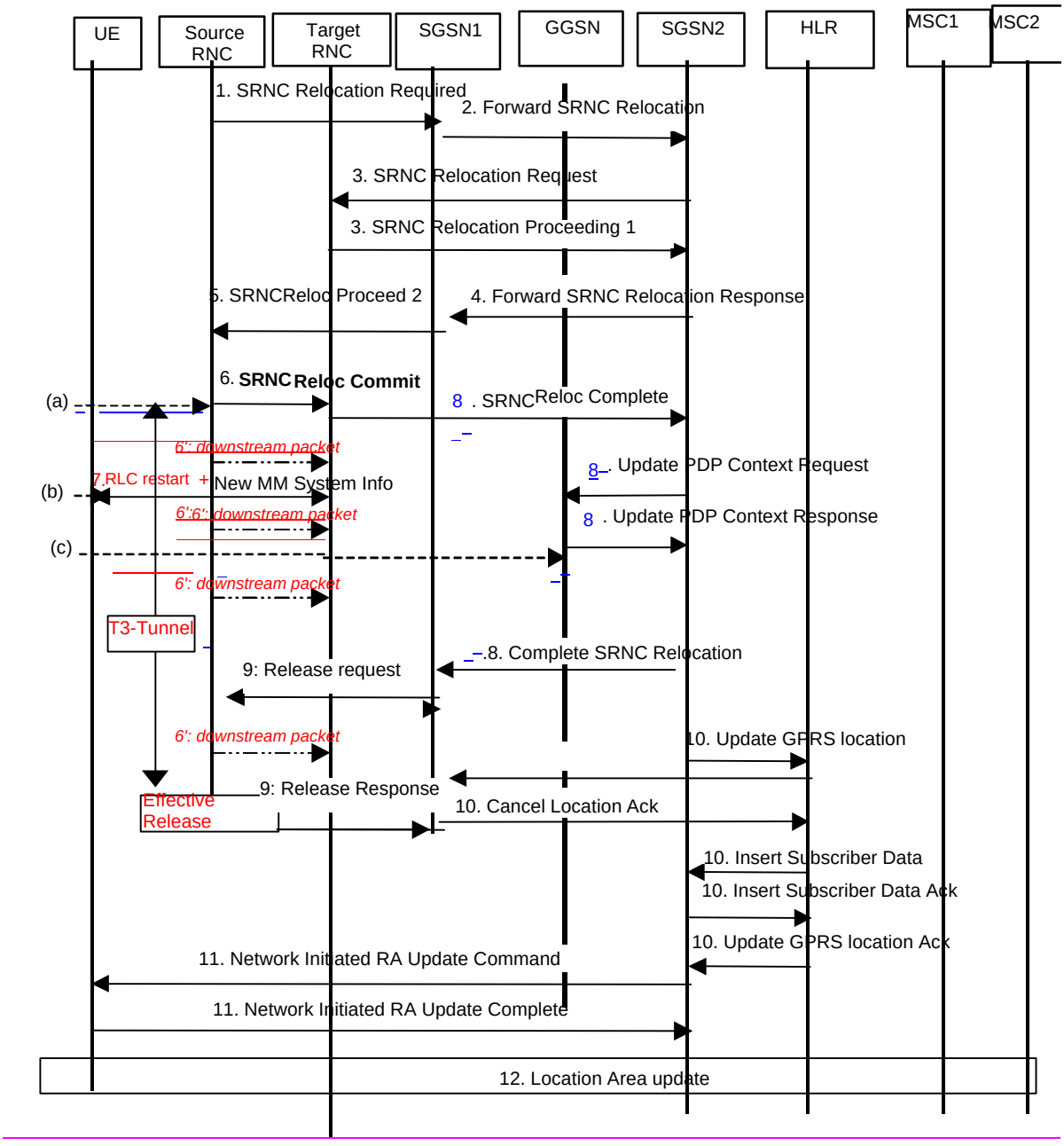

Figure 37 Interface information transfer for SRNS relocation update when changing SGSN area resulting in a change of registered location and followed by location registration in new Location Area.

"Resource reservation" Phase

During this phase, the transmission of packets between GGSN and UE through the source SRNC goes on.

1) UTRAN (source SRNC) makes the decision to perform the Serving RNC relocation procedure. This includes decision on into which RNC (Target RNC) the Serving RNC functionality is to be relocated. The source SRNC sends SRNC Relocation required messages to the SGSN1. This message includes parameters such as target RNC identifier and an information field that shall be passed transparently to the target RNC.

2) Upon reception of SRNC Relocation required message the SGSN1 determines from the received information that the SRNC relocation will (in this case) result in change of SGSN.
The SGSN will then send a Forward SRNC relocation request to the applicable SGSN, SGSN2, including the information received from the Source SRNC and necessary information for the change of SGSN (e.g. MM context, PDP context). The PDP context information contains the list of the PDP context (including PDP type, requested / negotiated QoS) currently established by the UE along with the address of the associated GGSN. It does not contain any information linked with packet transmission (sequence numbers) because such information is under the responsibility of the UTRAN

3) The SGSN2 sends a SRNC Relocation Request message to the target RNC. This message includes information for building up the SRNC context, transparently sent from Source SRNC (e.g. UE id., no of connected CN nodes, UE capability information), and directives for setting up Iu user plane transport bearers.
When the Iu user plane transport bearers have been established, and target RNC completed its preparation phase, SRNC Relocation Proceeding 1 message is sent to the SGSN2. *The SRNC Relocation Proceeding 1 message* contains the IP address(es) (possibly one address per PDP context) on which the target RNC is willing to receive these packets.

4) When the traffic resources between target RNC and SGSN2 has been allocated and the SGSN2 is ready for the SRNC move, then the Forward SRNC Relocation Response is sent from SGSN2 to SGSN1. This message indicates that necessary resources have been allocated for the SRNC relocation: SGSN2 / target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by UE. *The Forward SRNC Relocation Response message* contains the IP address(es) that were given in the SRNC Relocation Proceeding 1 message~~(possibly one address per PDP context) on which SGSN2 is willing to receive these packets~~.

5) When the Forward SRNC Relocation Response has been received in the SGSN1, the SGSN1 indicates the completion of preparation phase at the CN PS domain side for the SRNC relocation by sending the SRNC Relocation Proceeding 2 message to the Source RNC. . This message contains the IP address(es) (possibly one address per PDP context) on which to send the downstream packets not yet acknowledged by UE.

"Actual hand-over of Serving RNC" Phase

6) When the source RNC has received the SRNC Relocation Proceeding 2 message, the source RNC sends a SRNC Relocation Commit message to the target RNC(list of (SNU, UP_RLC_ack, SND)). SND is the GTP sequence number for the next downlink packet received from the GGSN. SNU is the GTP sequence number for the next uplink packet to be tunnelled to the GGSN. UP_RLC_Ack contains the acknowledgements for upstream PDU received by the source SRNC on each RLC connection used by the UE (i.e. the Receive State Variable V(R) for all RLC SAPI in acknowledged mode). The source SRNC starts a timer T3-TUNNEL , stops the exchange of the packets with the UE (point (a)), and starts tunnelling the buffered downstream packets towards the target SRNC. The target RNC executes switch for all bearers at the earliest suitable time instance.

7) The target RNC starts acting as SRNC. The target SRNC :

- Restarts the RLC connections. This includes the exchange between the target SRNC and the UE of the UP_RLC_Ack and DOWN_RLC_ACK. DOWN_RLC_ACK confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If DOWN_RLC_ACK confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. UP_RLC Ack confirms all mobile-originated packets successfully transferred before the start of the relocation procedure. From now on the exchange of the packets with the UE can restart (point (b)).

- Sends New MM System Information to the UE indicating e.g. relevant Routing Area and Location Area. Additional RRC information may then also be sent to the UE, e.g. new RNTI identity. This may trigger a location update procedure (see 12)

8) Immediately after a successful switch at RNC, target RNC (=SRNC) sends SRNC Relocation Complete message to the SGSN2. Upon reception of this message, the SGSN2 updates the GGSN(s) with a Update PDP Context Request including the new SGSN address. The GGSN(s) then update the PDP context and return Update PDP Context Response. The SGSN sends a Complete SRNC Relocation towards the SGSN1.

9) At reception of the Complete SRNC Relocation, SGSN1 will send a release indication towards the Source RNC. All resources allocated to this UE by the source RNC are released only when this message has been received and timer T3-TUNNEL has expired. Before timer T3-TUNNEL expires, all downstream packets received from the GGSN are sent towards the target SRNC..

10) The SGSN2 informs the HLR of the change of SGSN by sending Update GPRS location (IMSI, new SGSN address etc.) to the HLR. The HLR cancels the context in the old SGSN, SGSN1, by sending Cancel Location (IMSI). The SGSN1 removes the context and acknowledges with Cancel Location Ack. The HLR sends Insert subscriber data (IMSI, subscription data) to the SGSN2. The SGSN2 acknowledges with Insert Subscriber Data Ack. The HLR acknowledges the Update GPRS location by sending Update GPRS Location Ack to the SGSN2.

11) At reception of Insert subscriber data from HLR, the SGSN2 will initiate the update of MM information stored in the UE. This is done by sending Network Initiated Routing Area Update Command to the UE. This message will include new RAI, and possible also new P-TMSI. When the UE has made necessary updates it answers with Network Initiated Routing Area Update Complete.

12) When receiving new MM system information indicating a new Location Area, the UE will, in this case, initiate a Location Area update procedure towards the MSC2. This implies that the Location Area update will be performed in parallel to the above indicated activities related to the SGSN side of the Core Network.

It has to be noted that the sequence chart of Figure 19 may be further refined.

UE-GGSN Communication path during the SRNS relocation procedure

Before point (a), in Figure 37, the connection is established between UE and GGSN via Source SRNC and SGSN1.

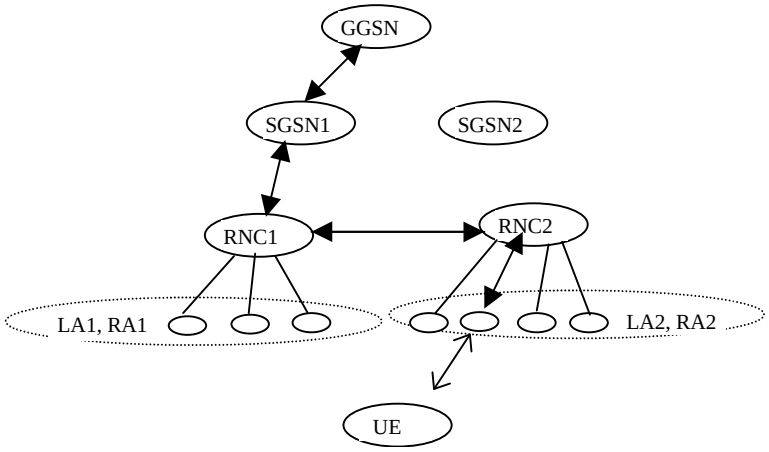

Figure 39 :Data paths before the SRNS relocation has been actually committed (before point (a) in Figure 37)

After transmission of the "SRNS relocation commit" to the target SRNC (after point (a) in figure 19), the source RNC cannot exchange data with the UE because its RLC should be frozen after the transmission of the RLC sequence numbers to the target RNC. Before the restart of the RLC between target SRNC and UE (before point (b) in Figure 19), data transfer cannot go on. All downstream packets received by the target SRNC during this phase are buffered until restart of the RLC between target SRNC and UE.

After point (c), in Figure 37, the connection is established between UE and GGSN via Target RNC and SGSN2.

Before resource release in source RNC (before T3-TUNNEL expiry), target SRNC may receive downstream packet from 2 paths. Packets remaining on the backbone are sent on the "old path" (via SGSN1 and RNC1) and forwarded by source RNC1 to target SRNC2 while packets received by the GGSN on its Gi interface are sent on the new path (via SGSN2) to target SRNC2.

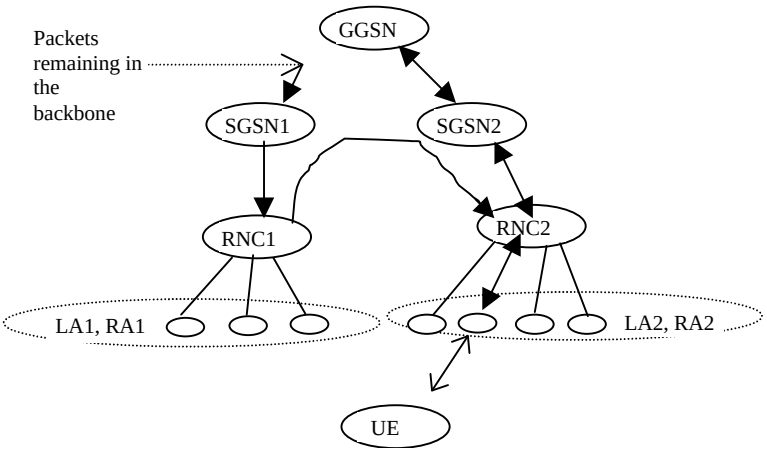

Figure 21: Data paths after the GGSN update (after point (c) in Figure 37)

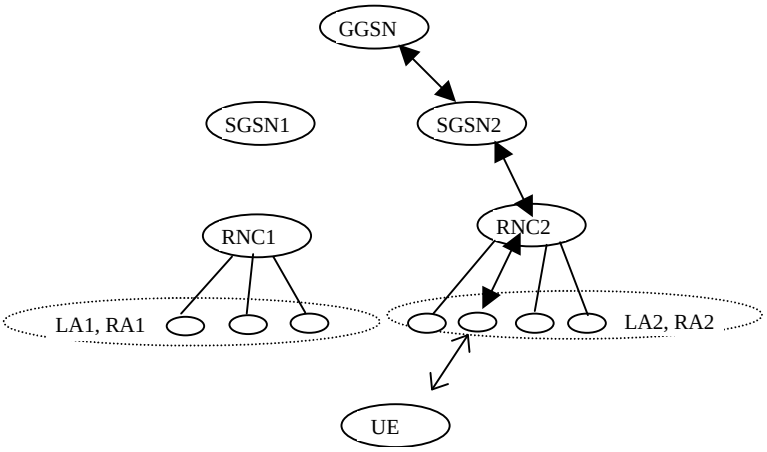

Figure 22: Data paths after the resource release in source RNC (after point (d) in Figure 37))