**Joint TSG-SA WG2 / TSG-RAN WG2 / TSG-RAN WG3 meeti… …04**
**Sophia Antipolis, France, August 23-27, 1999**

**Ag…**
**So… …tel**
**Tit… …uen… …arts of User Data Retrieve at SRNS Relocation …PS d…ain (Edition 3)**
**Do… …Approval**



## 1 INTRODUCTION

This contribution is the updated version of R3-99683 that was presented at the previous RAN WG3 meeting. Some editorial changes and corrections to the proposed text have been made (re-phrasing), and a section "Discussion" have been added.

This contribution is intended to describe the different phases of SRNS Relocation procedure **in the case of non real time but highly reliable data**, and more precisely, when and how the transfer of downlink data stored in the Source SRNC are transferred to the Target SRNC.

## 2 ASSUMPTIONS

It is based on the specification TS 23.121 v3.0.0 [4] which has been agreed at TSG SA in which:
Section 4.2.2.1 of [4] presents Data Retrieve principles in the PS domain for SRNS relocation, UMTS hard-handover via the CN and GPRS/UMTS handover.
Section 4.3.12.2 of [4] describes flow charts for SRNS relocation. The mechanisms proposed in these flow charts are similar to the mechanisms used in GPRS. In addition, they can be extended to UMTS/GPRS handover case.

In the following proposal, only two assumptions are made. These assumptions have a very low impact on the proposed texts and figures.

The first assumption consists of using Iu interface at lower layers to benefit from the ATM bandwidth sharing but having only one GTP-u tunnel between the two RNCs. The impact only consists in putting the IP address of the target SRNC instead of the IP address of the SGSN.
In the TS 23.121 v3.0.0, it is proposed to have several GTP tunnels. This could be modified by an appropriate CR. However, the proposed procedures are not impacted by the number of GTP tunnels between the SRNCs.

It is also assumed that the RLC connections between the UE and the target SRNC are established with re-initialised RLC sequence numbers. Continuing the RLC sequence numbering and the HFN numbering is not appropriate since the mechanism should also work in the case of GPRS/UMTS handover. In this case, the GPRS layer 2 and Ciphering function are different from the ones used in UMTS (LLC in GPRS, RLC in UMTS).

## 3 PROPOSAL

It is proposed to modify TS 25.931, TS 25.413 and TS 25.423 as follows.

## 3.1 Proposed text for UMTS 25.931 [1] section 9.14.3 "Serving RNS Relocation"

It is proposed to modify [1] section 9.14.3 "SRNS Relocation" as follows:

### 9.14.3 SRNC Relocation (UE connected to CS and PS domains~~two CN nodes~~)

*Editor note: the text description need to be aligned to the figure contents.*

This example shows SRNS Relocation, in situation in which the UE is connected to CS and PS domains~~two CN nodes~~ simultaneously. It is assumed that:

- all cells in the active set are in one DRNC;
- the CN performs hard switching of the user traffic.

**SRNC Relocation (UE connected to two CN nodes)**

Note that the SRNC makes the decision to perform the Serving RNC relocation procedure. The Serving RNC also decides into which RNC (Target RNC) the Serving RNC functionality is to be relocated.

**"Resource reservation" Phase**

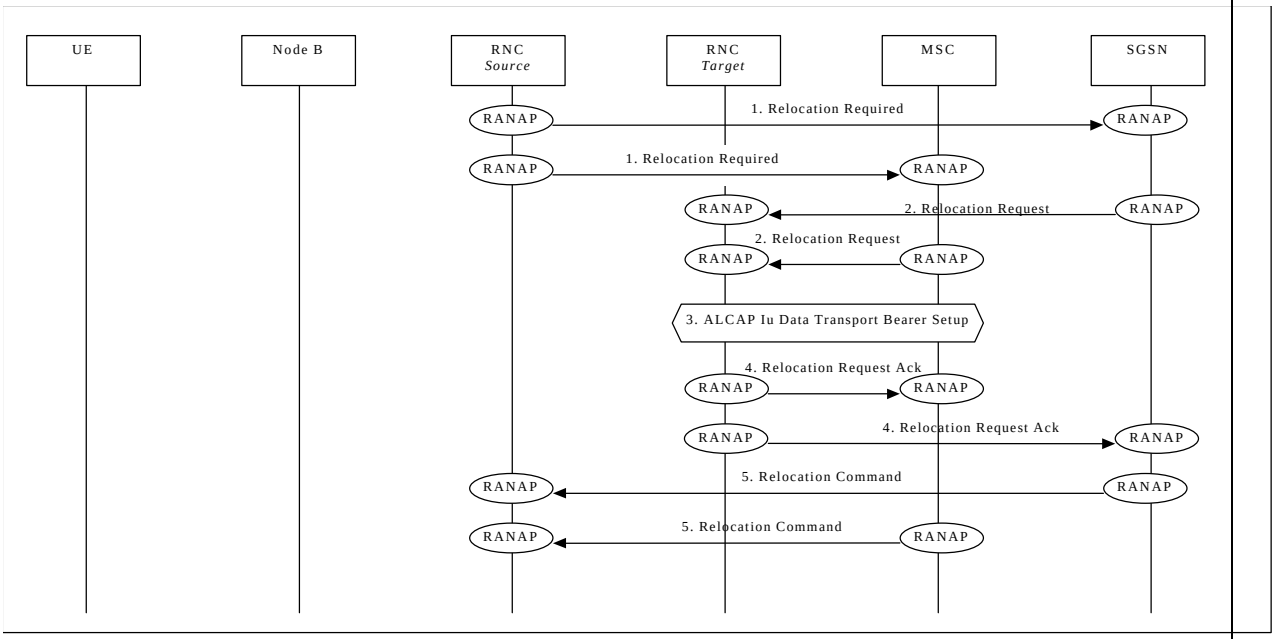



**Figure 1: SRNS Relocation, Reservation phase**

During this phase, the transmission of packets (N-PDUs) between GGSN and UE through the source SRNC goes on.

1. The source SRNC sends **Relocation Required** messages to both CN nodes.
   *Parameters*: target RNC identifier, Information field that the CN node(s) shall pass transparently to the target RNC. This transparent field contains the UE identifier, number of CN nodes and other TBD data.
   Upon reception of **Relocation Required** message eachthe CN element participates in the preparation for switching from old to new Iu interface. User data traffic is not suspended by the CN.~~prepares itself for the switch and may also suspend user data traffic and/or signalling between UE and itself for some bearers.~~
2. When preparation is completed the CN node conveys a **Relocation Request** message to the target RNC.

*Parameters*: indication of which bearers should be routed towards this CN node, transparent information field sent by the source RNC, UE identifier.

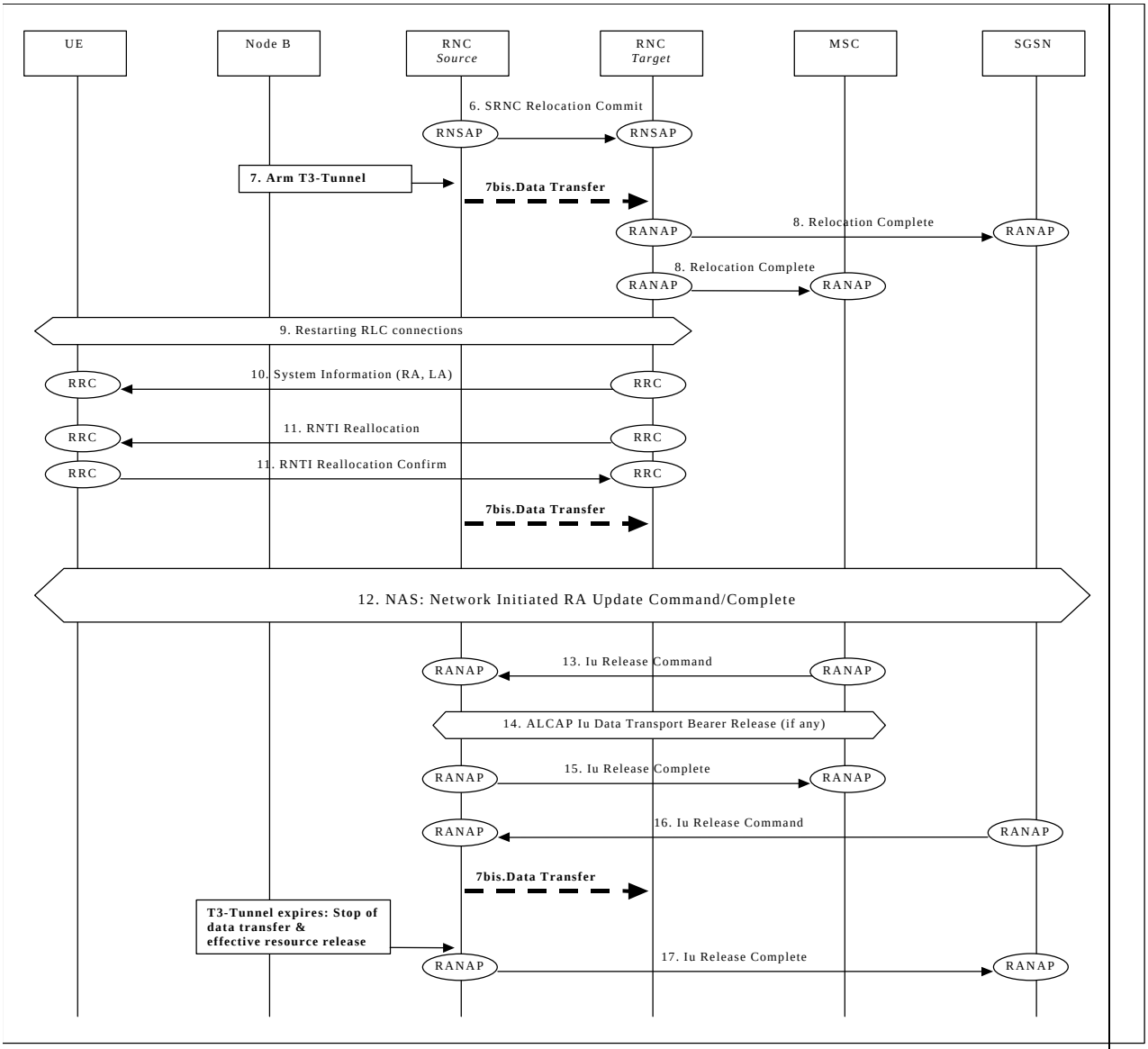
The target RNC uses the UE identifier to link the requests from multiple CN nodes to each other and to the resources (e.g. Iub links) that the UE is currently using.
~~FFS: The target RNC allocates necessary Iur branches to be used after the SRNC relocation switch will be made.~~

3. The target RNC and CN node establish the new Iu transport bearers for each Radio Access Bearer related to that CN node.

4. When the RNC has completed its preparation phase, **Relocation Request Acknowledge** ~~**Proceeding 1**~~ message is sent to CN. At this point, the target SRNC is ready to receive the downlink N-PDUs that have not been acknowledged by the UE, from the Source SRNC.

5. When the CN node is ready for the SRNC move, the CN node indicates the completion of preparation phase at the CN side for the SRNC relocation by sending the **Relocation Command**~~**Proceeding 2**~~ message ~~.~~ ~~T~~to the source RNC. Relocation Command message contains the IP addresses (possibly one address per PDP context) corresponding to the Target RNC and the GTP flow label for each GTP tunnel to be used for the transfer of non acknowledged user data.

**"Handover of SRNC" Phase**




6. When the source RNC has received **Relocation Command~~Proceeding 2~~** messages from all the CN nodes, the source RNC stops the exchange of N-PDUs with the UE and sends a **Relocation Commit** message to the target RNC. The **Relocation Commit** message contains all parameters required to ensure the sequence integrity of the N-PDU user data to be transmitted to the UE (e.g. avoid loss and duplications of N-PDUs to/from the UE).

7. The source SRNC arms a timer "T3-Tunnel" and starts tunneling the buffered downstream N-PDUs towards the target SRNC via the established GTP tunnel(s). The UL data that were still in the Source SRNC continue to be transmitted normally to the Source SGSN.

8. The target SRNC executes both the DL and UL switch for all bearers at the earliest suitable time instance.- Immediately after these successful switches, the target RNC (= new SRNC) sends **Relocation Complete** messages to the involved CN nodes.

9. The target SRNC establishes new 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)).

10. The target SRNC exchanges the new UTRAN parameters (S-RNTI and SRNC-ID) with the UE.

    After the switch UL traffic from node-B's is routed via the newly established Macro Diversity Combiner to the new MAC/RLC entities and finally to the correct Iu transport bearer. UL data transmission to the old Iur transport bearer is ceased.
    DL data arriving from the new Iu link is routed to newly established RLC entities, to the MAC and to the Macro Diversity Splitter and Nodes B. ~~The DL data received from the old Iur is discarded~~

11. The target SRNC sends the RRC message **System Information** to the UE with RA and LA information. This may trigger a Location Update procedure when the UE is in CS-IDLE mode. ~~Immediately after a successfull switch at RNC, target RNC (=SRNC) sends **Relocation Complete** messages to the involved CN nodes.~~

~~Upon reception of messages 9 and 10, the CN switches from the old Iu transport bearers to the new ones.~~

12. The target SGSN sends Network Initiated Update Request NAS message to the UE. This message includes the new RAI, and possible new TMSI. The UE makes necessary updates and sends Network Initiated Update Complete NAS message to the SGSN.

13. After a successful switch at the CS-CN node (CS domain), the CS-CN node ~~initiates the release of the Iu connection to the source RNC by sending~~ sends the RANAP message **Iu Release Command**.

14. Upon reception of the **Iu Release Command** message from the CS-CN, the source SRNC releases all UTRAN resources associated with the CS domain for the UE.

15. In particular, it releases the corresponding Iu resources via ALCAP.

16. ~~7ter.~~ Upon reception of the **Iu ~~r~~Release Command** message ~~requests~~ from the PS-CN node (PS domain)~~s~~, and only when the T3-Tunnel timer has expired, the source SRNC releases all UTRAN resources associated with the PS domain. When CS and PS domain resources have been released, the source~~old~~ SRNC executes all necessary procedures to release all visible UTRAN resources that were related to the RRC connection in question.

17. ~~11~~When these resources are released, the Source SRNC sends Iu Release Complete message to the CN nodes.

At any phase, before the **SRNC Relocation Complete** message is sent, the old communication link between the CN and UE is all the time existing and working and the procedure execution can be stopped and original configuration easily restored. If any such abnormal thing occurs a **SRNC Relocation Failure** may be sent instead of any message numbered 3-11 described.

~~Note: The whole described procedure is FFS~~

## 3.2 Proposed text for UMTS 25.423 [3] section 8.1.3 "SRNS Relocation Commit"

It is proposed to modify [3] section 8.1.3 "SRNS Relocation Commit" as follows:

### 8.2.2 SRNS Relocation Commit

The SRNS RELOCATION COMMIT procedure is part of the SRNS Relocation procedure described in [1].
The source RNC sends the ~~SRNS~~ RELOCATION COMMIT message to the target RNC when it has received an indication that it can proceed with the ~~SRNC~~ Relocation procedure from all the involved CN nodes [1].
This message contains all parameters required to ensure the sequence integrity of the N-PDU user data to be transmitted to the UE (i.e. to avoid loss and duplications of N-PDUs to/from the UE), and in particular:

- For each GTP tunnel associated with the UE, the GTP sequence number (SND) of the next downlink N-PDU to be sent to the UE.
- For each GTP tunnel associated with the UE, the GTP sequence number (SNU) of the next uplink N-PDU to be tunneled to the GGSN.
- RLC-Ack which contains the acknowledgments for each RLC connection used by the UE.

At reception of the ~~SRNS~~ RELOCATION COMMIT message from the source RNC the target RNC executes the DL and UL switch for all RABs belonging to the UE at the earliest suitable time instance.
Prior to reception of the ~~SRNS~~ RELOCATION COMMIT message the target RNC has received a request to perform SRNS Relocation from all the involved CN nodes and responded to the CN nodes with a proceeding indication. The Iu transport bearers for each radio access bearer have also been established between the target RNC and all CN nodes.


Fig. 9-14: SRNC Relocation Commit procedure

## 3.3 Proposed text for UMTS 25.413 [2] section 8.2 "Relocation"

It is proposed to modify [2] section 8.2 "Relocation" as follows:

### 8.2.2 Relocation Preparation

#### 8.2.2.1 Successful operation

Procedure is initiated by the Serving RNC by sending a RELOCATION REQUIRED message to active CN nodes. Timer T(RELOCATION COMMAND) is started, upon transmitting the message. RELOCATION REQUIRED message allows a RNC to request that a relocation is to be carried out for a particular UE, having signalling connection via the serving RNC. User data traffic is not suspended by the CN.

As a response to the RELOCATION REQUIRED message the CN sends RELOCATION COMMAND to the source RNC. RELOCATION COMMAND message contains the IP addresses (possibly one address per PDP context) corresponding to the Target RNC and the GTP flow label for each GTP tunnel to be used for the transfer of non acknowledged user data.

Upon reception of RELOCATION COMMAND belonging to ongoing procedure the RNC resets the timer T(RELOCATION COMMAND). Depending on the case the source RNC either triggers the handover procedure in the air. interface or commits the execution of the relocation in the target system.

In the case of SRNS Relocation with losseless Radio Access Bearers, the source RNC stops the exchange of packets with the UE and sends a RELOCATION COMMIT message to the target RNC via the Iur.

The Source RNC arms a timer "T3-Tunnel" and starts tunneling the buffered downstream N-PDUs towards the target SRNC via the established GTP tunnel(s). The UL data that were still in the Source RNC continue to be transmitted normally to the Source SGSN.

The signalling flow between the source RNC and the CN is shown in Figure 2.

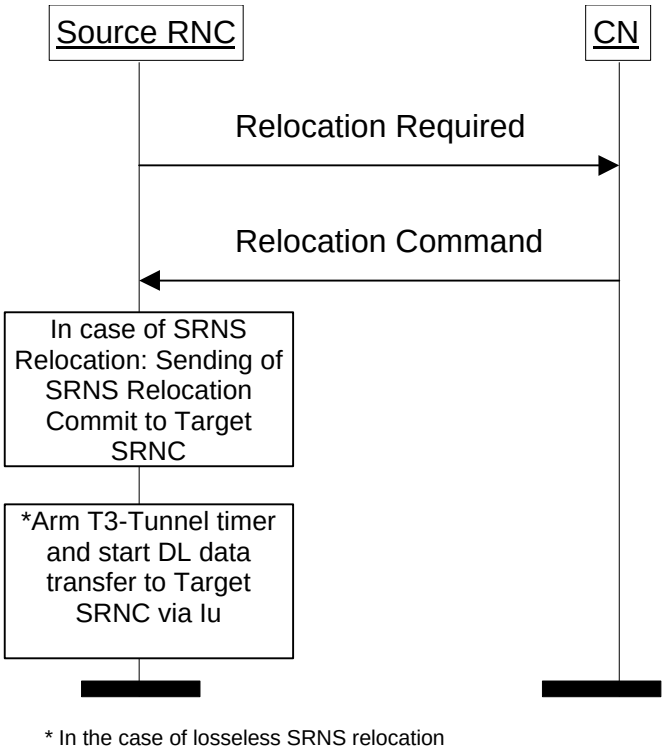



**Figure 2. Relocation Preparation procedure between source RNC and CN.**

### 8.2.3 Relocation resource allocation

#### 8.2.3.1 Successful operation

The CN node sends a RELOCATION REQUEST message to the target RNC (selected by the source RNC and indicated in the RELOCATION REQUIRED message). This message contains details of the resource(s) required like bearer identifier and binding ID of each bearer to be established to the new Iu interface.

On receipt of this message the target RNC shall check availability of requested resources.

If all necessary resource(s) are successfully allocated the target RNC sends back to the CN a RELOCATION REQUEST ACKNOWLEDGE message. At this point, in the case of lossless radio access bearers in the PS domain, the Target RNC is ready to receive downlink N-PDUs that continue to arrive at Source RNC. The RELOCATION REQUEST ACKNOWLEDGE message sent by the target RNC may optionally contain a transparent field, which ~~–~~is transferred by the CN node to the source RNC using the RANAP message RELOCATION COMMAND.

To ensure the necessary load sharing on the Iu-PS interface,

- When the CN sends RELOCATION REQUEST for all Radio Access Bearers (associated with PDP contexts) of an UE, the CN specifies the IP address of the packet processing function allocated to this / each of these PDP context(s) ~~in the CN~~.
- In the response to the CN request, i.e. in RELOCATION REQUEST ACKNOWLEDGE, the RNC specifies the IP address of the packet processing function allocated to this / each of these Radio Access Bearer(s) in the RNC.

Fig. 3 shows the signalling flow for Relocation resource allocation.

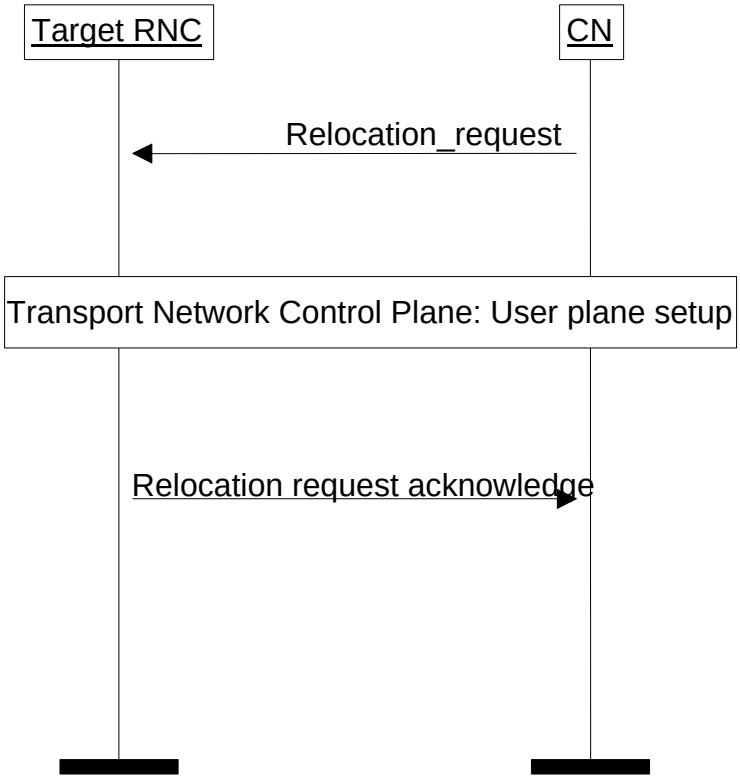



**Figure 3. Resource allocation for relocation.**

### 8.2.4 Relocation Detect

When the relocation execution trigger is received, the target RNC sends a RELOCATION DETECT message to the active CN nodes and start to act as an SRNC.
The signalling flow for Relocation detect procedure is shown in Figure 4.

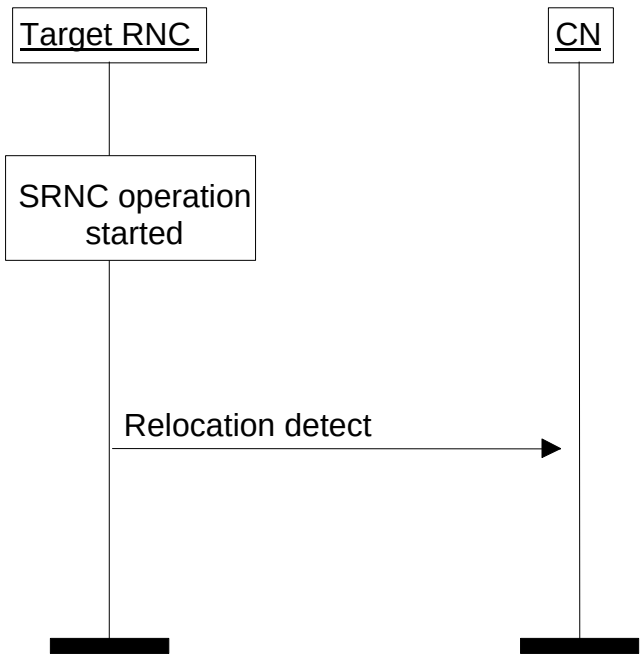



**Figure 4. Relocation Detect procedure.**

### 8.2.5 Relocation Complete

When the UE is successfully in communication with the target RNC, i.e. the new UTRAN identifiers are successfully exchanged with the UE, then the target RNC shall send a RANAP message RELOCATION COMPLETE to the CN nodes ~~and terminate the procedure~~.
The signalling flow for Relocation ~~c~~Complete procedure is illustrated in Figure 5.

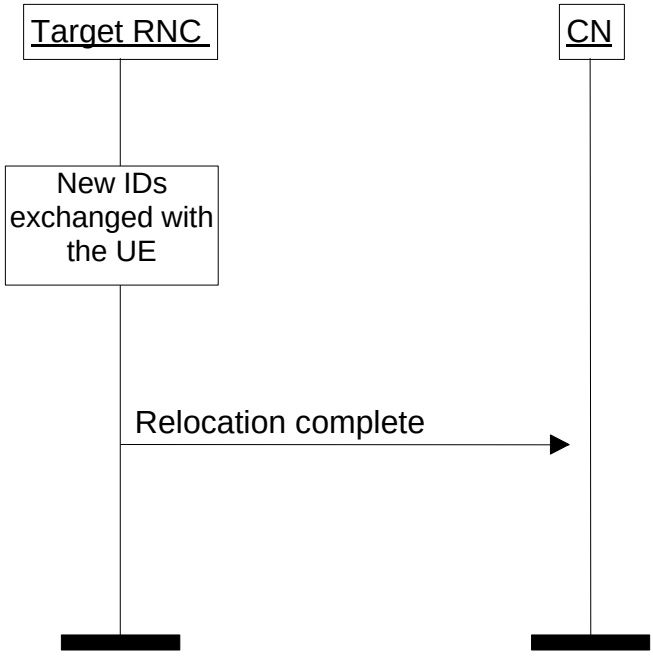



**Figure 5. Relocation Complete procedure.**

~~The CN elements shall release all resources associated to the Source RNS.~~
After having received RELOCATION COMPLETE from the Target RNC, the CN sends Iu RELEASE COMMAND to the Source RNC.

## 3.4 Proposed text for UMTS 25.413 [2] section 8.5.4 " Iu Release due to successful handover or SRNS relocation"

It is proposed to modify the section 8.5.4 "Iu Release due to successful handover or SRNS relocation" of TS 25.413 [2] as follows:

In the case of a handover or SRNS relocation being successfully completed, then the resources at the old RNS are requested to be released by the CN using the Iu release sequence. In CS and PS domains, the radio bearer and Iu resources are released immediately upon reception of Iu RELEASE COMMAND.
However, in the PS domain, when GTP tunnels are used to transfer the data from the Source RNC to the target RNC, the GTP tunnels are released only when both source RNC has received Iu RELEASE COMMAND and timer T3-TUNNEL has expired. Before timer T3-TUNNEL expires, all downstream packets received from the GGSN are sent towards the target RNC.

The source RNC sends RELEASE COMPLETE independently to each domain when all the UTRAN resources associated to the domain are released.
The cause value used by the CN in the Iu RELEASE COMMAND message shall be set to the appropriate value: “handover successful” or “SRNS relocation successful”.

When the RNS detects one of these cause values in an Iu RELEASE COMMAND message, then it shall return an Iu RELEASE COMPLETE message to the appropriate CN and take action to return to idle any resources attached to that particular Iu connection.
In the case where there is a second Iu connection for that particular UE, then the RNC shall wait the second Iu RELEASE COMMAND message before returning the remaining resources assigned to that UE to idle. Once the second Iu RELEASE COMMAND is received, the procedure completes normally.
The signalling flow for Iu Release procedure due to completion of transaction between UE and CN is shown in Figure 6:

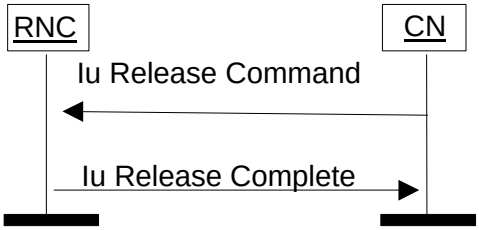



**Figure 6. Iu Release: successful handover or SRNS relocation.**

## 4 REFERENCES

[1] UMTS 25.931 UTRAN functions, Examples on signalling procedures
[2] UMTS 25.413 UTRAN Iu interface, RANAP signalling
[3] UMTS 25.423 UTRAN Iur interface, RNSAP signalling
[4] UMTS 23.121 v3.0.0 Architectural Requirements for Release 99