

Agenda Item: 10.3
Source: Alcatel
Title: Changes to RANAP specifications for the support of lossless relocation
Document for: Approval

1 INTRODUCTION

At the workshop on SRNS relocation and Handovers held at Sophia Antipolis, it has been decided that UMTS release 99 shall support lossless relocation. This contribution proposes changes in TS 25.413 [4] for the support of that feature for both SRNS relocation and GPRS handovers.

The proposed text is based on the Alcatel contribution WHS-004 [1] that was presented at the workshop.

It is based on the specification TS 23.121 v3.0.0 [5] which has been agreed at TSG SA.

2 PROPOSAL

It is proposed to modify TS 25.413 as follows.

2.1 Proposed text for UMTS 25.413 [4] section 8.2 "Relocation"

It is proposed to modify [4] section 8.2 "Relocation" for SRNS relocation and GPRS handover procedures 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 logical 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.

As a response to the RELOCATION REQUIRED message the CN sends RELOCATION COMMAND to the source RNC. For user plane RABs requiring lossless relocation the RELOCATION COMMAND message contains the Transport Addresses (IP addresses, possibly one address per PDP context) corresponding to the Target RNC and the Iu Transport Association (GTP flow label) for each GTP tunnel to be used for the transfer of non acknowledged DL 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 air₂ interface or commits the execution of the relocation in the target system.

For the lossless Radio Access Bearers, the source RNC stops the exchange of packets with the UE.

The Source RNC arms a timer "T3-Tunnel" and starts tunneling the buffered and arriving downstream N-PDUs towards 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 1.

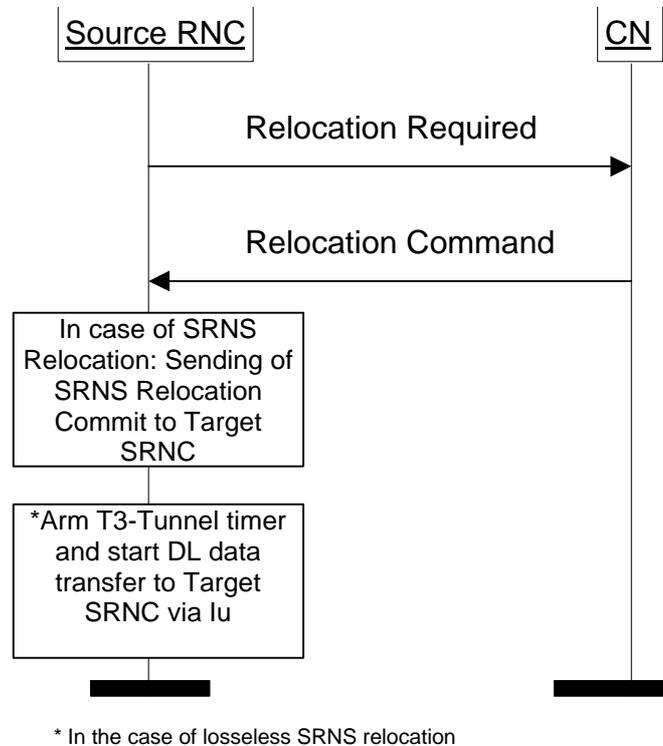


Figure 1. Relocation Preparation procedure between source RNC and CN.

8.2.3 Relocation resource allocation

8.2.3.1 Successful operation

The CN logical 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 lu 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 to be forwarded. The RELOCATION REQUEST ACKNOWLEDGE message sent by the target RNC may optionally contain a transparent field, which -is transferred by the CN logical node to the source RNC using the RANAP message RELOCATION COMMAND.

To ensure the necessary load sharing on the lu-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.

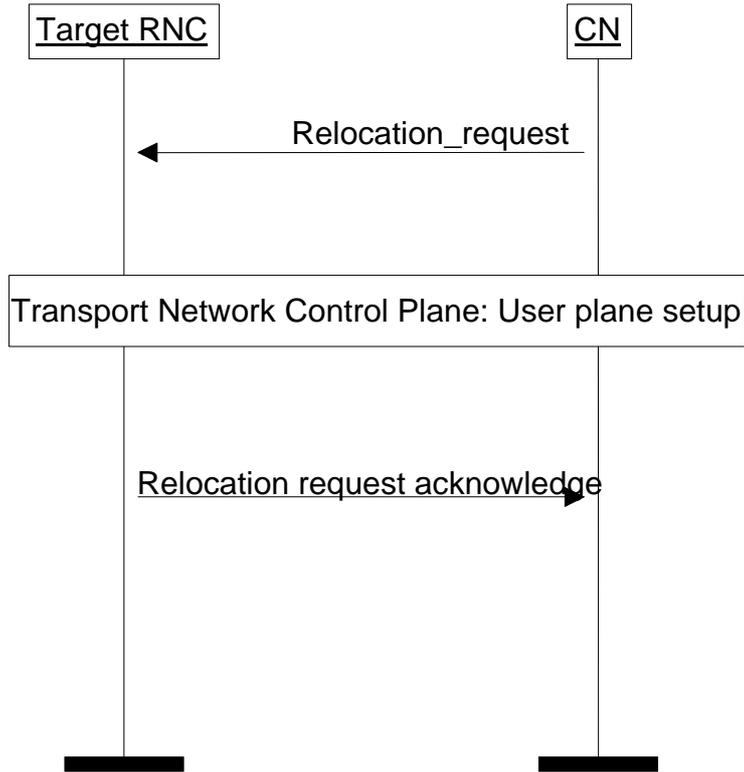


Figure 2. Resource allocation for relocation.

8.2.4 Relocation Detect

When the relocation execution trigger is received, the target RNC sends a RELOCATION DETECT message to the active CN logical nodes and start to act as an SRNC. The signalling flow for Relocation detect procedure is shown in Figure 3.

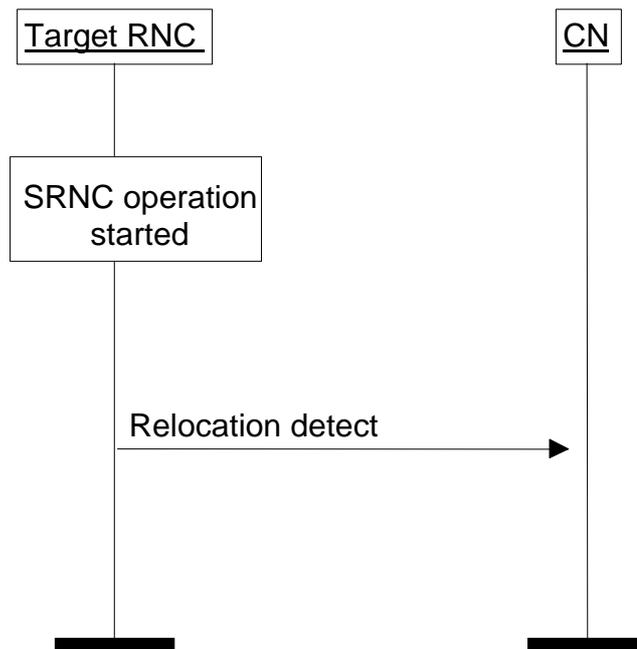


Figure 3. Relocation Detect procedure.

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 logical nodes and terminate the procedure.
The signalling flow for Relocation Complete procedure is illustrated in Figure 4.

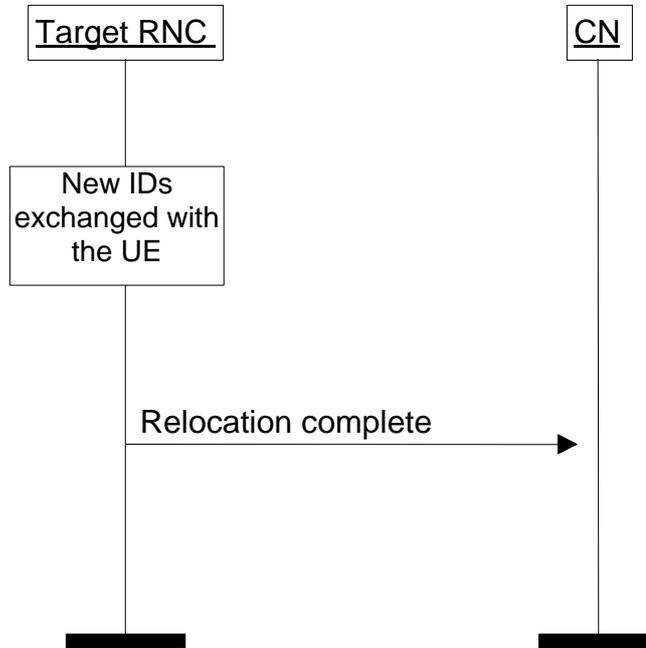


Figure 4. Relocation Complete procedure.

The CN elements shall release all resources associated to the Source RNS.
After the Target RNC has sent RELOCATION COMPLETE to the CN, it waits to lu RELEASE COMMAND from the CN.

2.2 Proposed text for UMTS 25.413 [4] section 8.5.4 " lu Release due to successful handover or SRNS relocation"

It is proposed to modify the section 8.5.4 "lu Release due to successful handover or SRNS relocation" of TS 25.413 [4] for SRNS relocation and GPRS handover procedures 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 lu release sequence. In CS and PS domains, the radio access bearers and lu resources are released immediately upon reception of lu RELEASE COMMAND.

However, in the PS domain, for lossless radio access bearers, the GTP tunnels are released only when both source RNC has received lu 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 lu 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 5:

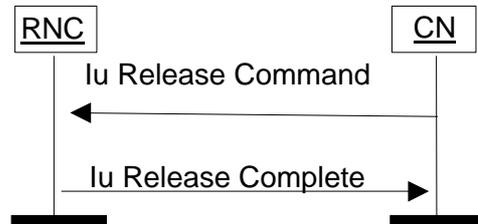


Figure 5. Iu Release: successful handover or SRNS relocation.

2.3 New text proposals for UMTS/GPRS UE-initiated handover

Following changes to TS 25.413 are proposed for SRNS relocation and GPRS UE initiated handover procedures. These changes are based on [2] and [3].

2.3.1 New cause value for Iu Release Command

A new cause value "Inter System Forward Handover" shall be defined.

2.3.2 New section "SRNS Context Transfer procedure"

A new procedure used for UMTS to GPRS handovers shall be introduced in section 8 of TS 25.413. This procedure is used to get the L2 acknowledgement status and GTP-PDU sequence numbers for each RAB from RNC to CN to be used for the lossless handover from UMTS to GPRS. This procedure is not required when duplication or losses are authorized.

8.x SRNS CONTEXT TRANSFER PROCEDURE

This procedure may be used to trigger the transfer of SRNS contexts from RNC to CN in case of inter system forward handover from UMTS. Messages belonging to this procedure are transferred over the connection oriented mode of the Iu signalling bearer.

CN initializes the procedure by sending SRNS CONTEXT REQUEST to RNC. SRNS CONTEXT REQUEST message includes the list of RABs whose contexts should be transferred.

Upon reception of SRNS CONTEXT REQUEST RNC stops the transmission of N-PDUs to the UE for the addressed RABs and starts the timer T3-TUNNEL.

RNC responds to CN with SRNS CONTEXT RESPONSE message. SRNS CONTEXT RESPONSE message contains the RAB Context information for referenced RABs. Each RAB Context includes

- RLC Ack which contains the acknowledgments for each RLC connection used by the UE (the Receive State Variable V[R] in the source RNC for all RLC SAPI in asynchronous balanced mode),
- the GTP sequence number for the next downlink N-PDU to be sent to the UE, and
- the GTP sequence number for the next uplink N-PDU to be tunneled to the GGSN.

The transfer of N-PDUs from the Source SRNC will start on the existing GTP tunnels to SGSN when the RNC receives lu RELEASE COMMAND (refer to section 8.x).

2.3.3 Modification of Relocation Command message

9.1.1.21 RELOCATION COMMAND

Information element	Reference	Type
Message type		M
Target RNC to source RNC transparent container		O (1)
<u>RABs subject to N-PDU forwarding x n</u>		<u>O</u>
<u>RAB ID</u>		<u>M</u>

2.3.4 Addition of a new message "SRNS Context Request"

9.1.1.x SRNS CONTEXT REQUEST

Information element	Reference	Type
Message type		M
<u>Bearer for which the data forwarding shall be done x n</u>		<u>O</u>
<u>RAB ID</u>		<u>M</u>

2.3.5 Addition of a new message "SRNS Context Response"

9.1.1.x SRNS CONTEXT RESPONSE

Information element	Reference	Type
Message type		M
Cause		M
<u>RAB Contexts x n</u>		<u>O</u>
<u>RAB ID</u>		<u>M</u>
<u>DL GTP Sequence Number</u>		<u>M</u>
<u>UL GTP Sequence Number</u>		<u>M</u>

2.3.6 Modification of lu Release Command message

9.1.1.15 IU RELEASE COMMAND

Information element	Reference	Type
Message type		M
Cause		M
<u>RABs subject to N-PDU forwarding x n</u>		<u>O</u>
<u>RAB ID</u>		<u>M</u>

3 REFERENCES

- [1] WHS 004, Flow charts for SRNS relocation, Alcatel
- [2] WHS 003, Sequence charts for handover from UMTS to GPRS, UE initiated

- [3] WHS 002, Sequence charts for handover from GPRS to UMTS, UE initiated
- [4] UMTS 25.413 UTRAN Iu interface, RANAP signalling
- [5] UMTS 23.121 v3.0.0 Architectural Requirements for Release 99