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Technical Report

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RAB Quality of Service Negotiation over Iu

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z   the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document gives a presentation of the current status of the Work Item "RAB Quality of Service Negotiation over Iu" within TSG RAN WG3.

It describes requirements, additional studies needed, and agreements reached so far for the Work Item.

It identifies the affected specifications.

It also describes the schedule of the Work Task.

If information needs to be communicated to groups outside of TSG RAN WG3, this is also indicated.

The document is a 'living' document, i.e. it is continuously updated and presented to all TSG-RAN meetings.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3G TS 25.413: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; ; UTRAN Iu Interface RANAP Signalling (Release 1999)".

[2]   RAB Quality of Service Negotiation over Iu, Work Item Description, TSG-RAN#7 RP-000137

[3]   3G TS 24.008: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network; Mobile Radio Interface Layer 3 Specification; Core Network Protocols – Stage 3 (Release 1999)".

[4]   3G TS 25.331: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; RRC Protocol Specification (Release 1999)".

[5]   3G TS 25.423: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iur Interface RNSAP Signalling (Release 1999)".

[6]   3G TS 25.433: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iub Interface NBAP Signalling (Release 1999)".

[7]   3G TS 29.060: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network ; General Packet Radio Service (GPRS); GPRS Tunneling Protocol (GTP) across the Gn and Gp Interface (Release 1999)".

3 Definitions, symbols and abbreviations

3.1 Definitions

None.

3.2 Symbols

None

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CC	Call Control
CN	Core Network
CS	Circuit Switched
DRNC	Drift RNC
PDP	Packet Data Protocol
PS	Packet Switched
QoS	Quality of Service
RAB	Radio Access Bearer
RANAP	Radio Access Network Application Part
RB	Radio Bearer
RNC	Radio Network Controller
SDU	Service Data Unit
SM	Session Management
SRNC	Serving RNC
UE	User Equipment
UTRAN	Universal Terrestrial Radio Access Network

4 Background

The general idea behind the RAB QoS negotiation is to have a solution for the following situation:

A user is asking for a service with specified QoS parameters, but for some reason (e.g. resources not available) the system can not fulfil the request precisely, even though an almost matching bearer would be available.

The inability to provide the requested RAB most likely causes the service to fail, leaving the user without service, and the operator without the revenue from the service. Clearly, if the user had accepted the bearer with the available resources rather than having no service at all, it would have been a common benefit to do so.

Many of the applications expected to be used in 3G would be able to use alternative QoS parameters, e.g. most data, voice and video applications can be operated at different data rates.

It also seems that in many situations the user would rather have taken the connection with compromised QoS rather than no connection, simply to save another try. Also in many cases the time consumed by making another try would overrun the time it takes to complete some simple tasks with the compromised QoS parameters.

The concern of the operator is that the user might be annoyed if the connection doesn't go through with one try, and will not try again at all, and might ultimately change service provider.

5 Requirements

5.1 General requirements

The chosen solution for RAB QoS Negotiation shall:

- be a simple solution

- not cause any significant delay in the RAB Assignment procedure

- be a generic solution common for both the PS and the CS domain

5.2 Scope

RAB QoS Negotiation shall, according to [2] be possible to do:

- at RAB establishment

Any changes to this scope need to be approved by TSG-RAN. (See 7.)

5.3 Negotiable parameters

The parameters agreed to be negotiable shall be based on the Rel4 set of RAB parameters.

The number of negotiable parameters shall be kept to as few as possible, since the negotiation will become complicated if several parameters are involved and since also combinations of these parameters then need to be considered.

5.4 Control of allowed negotiation

From Iu point of view, it is the CN that decides that RAB QoS Negotiation is allowed for one or more parameters.

5.5 Control of needed negotiation

The RNC shall, based on the current resource situation and on the information received from the CN, decide if RAB QoS Negotiation shall be done.

If a RAB with parameter values within the limits given by the CN can be provided by the RNC, the RAB Assignment procedure shall be reported as successful to the CN. Otherwise it shall be reported as failed.

5.6 Backwards Compatibility

6 Study Areas

6.1 Negotiable parameters

If any more parameters than the one(s) already agreed to be negotiable (see 8.1) shall be included needs to be studied. The following figure gives an indication of what parameters out of the R99 set that could be considered:

invariable service parameters	(possible) variable service parameters
traffic class	maximum bitrate
delivery order	guaranteed bitrate
asymmetry indicator	
SDU size	
SDU format information	
SDU error ratio	
residual bit error ratio	
Delivery of erroneous SDUs	
transfer delay	
traffic handling priority	
allocation/retention priority	
source statistics descriptor	

6.2 Control of allowed negotiation

6.2.1 General

Two different solutions for control of negotiation has been defined, one with negotiation information from the CN and one without. These are presented below as scenario 1 and scenario 2. Common for both scenarios is that the CN indicates to the RNC which parameters that are negotiable.

6.2.2 Scenario 1

In the CN side, the requested RAB parameters are mapped in a fairly straight forward manner from the QoS parameters used at CC/SM level, and CN does not have any other essential information than what the RNC has. Only the application/user has this information.

To assure that there is no need for trial-and-error method based on educated guesses at any protocol layer/network element, the necessary information should be made available by the application/the user, and it should be conveyed by both CC/SM and RANAP [1] protocols. The possibility of this needs to be studied. Any changes to the CC/SM protocols are, however, outside the scope of TSG-RAN3, why input from other relevant groups will be needed. It must also be noted that solutions requiring changes to the CC/SM protocols may prohibit the use of RAB QoS Negotiation together with R99 mobiles.
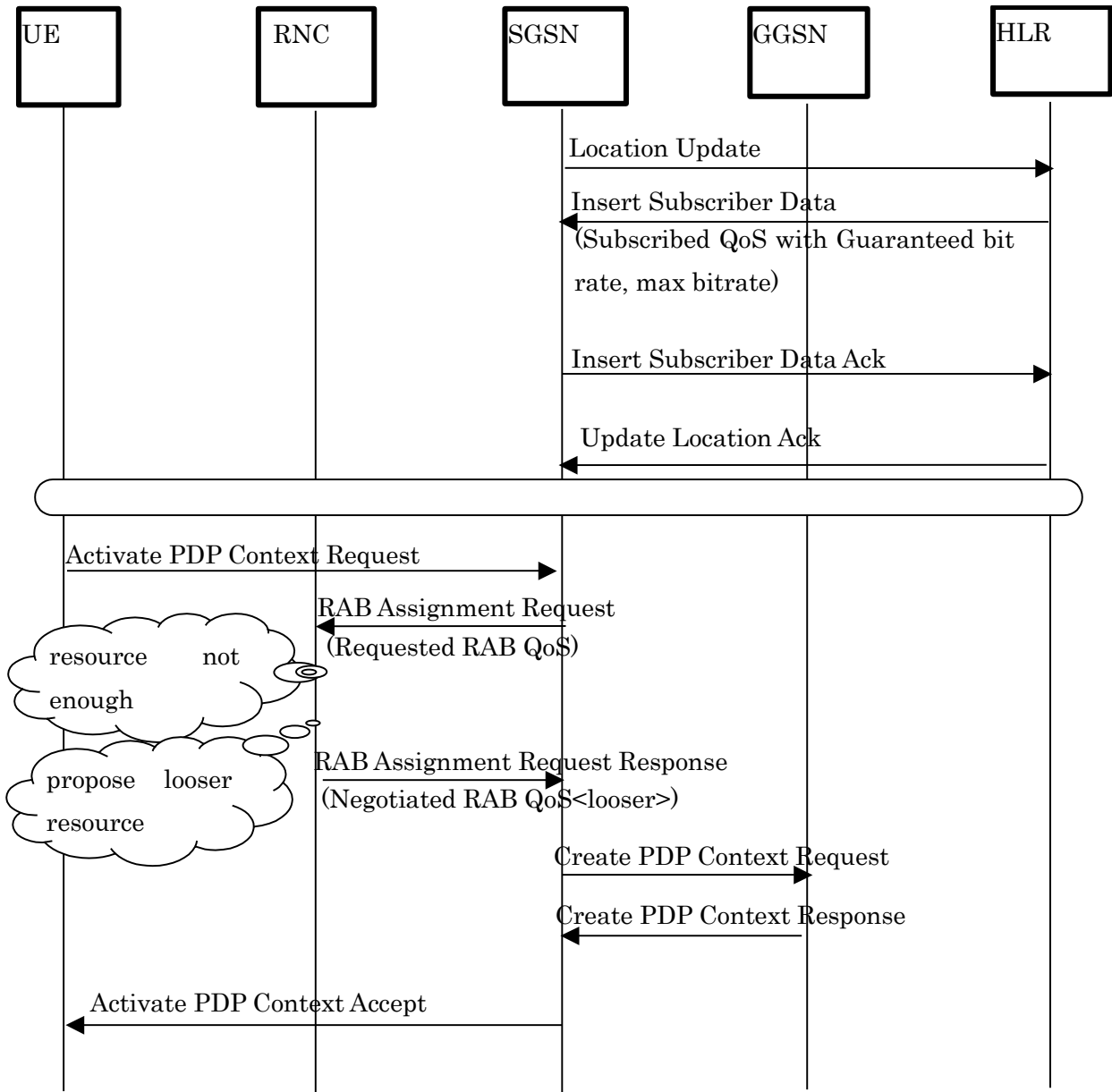
Figure 1 RAB QoS Negotiation during RAB Establishment for PS domain

6.2.3   Scenario 2

The following diagram shows an example of how QoS negotiation can be achieved on the Iu interface with the following principles:

- no change of the current SM signalling from R99

- HLR information is used by the SGSN as done in R99

- Guaranteed bit rate used over the Iu is negotiable by the RNC. This is indicated by the CN in the RAB assignment request. This indication from the CN is not in the R99 specifications.

- If the RNC can not offer the requested guaranteed bit rate, the RNC indicates this to the CN in the RAB assignment response. This is a change from the R99 specifications since the response has to include the available guaranteed bit rate.

- The SGSN indicates the negotiated bandwith range to the UE by using the "Activate PDP context accept" messages.

Figure 2: RAB QoS Negotiation during RAB Establishment

Note that using the same call flow, the SGSN could also query a Network management entity before deciding on which value to use to set the Guaranteed bit rate that it requests from the RNC.
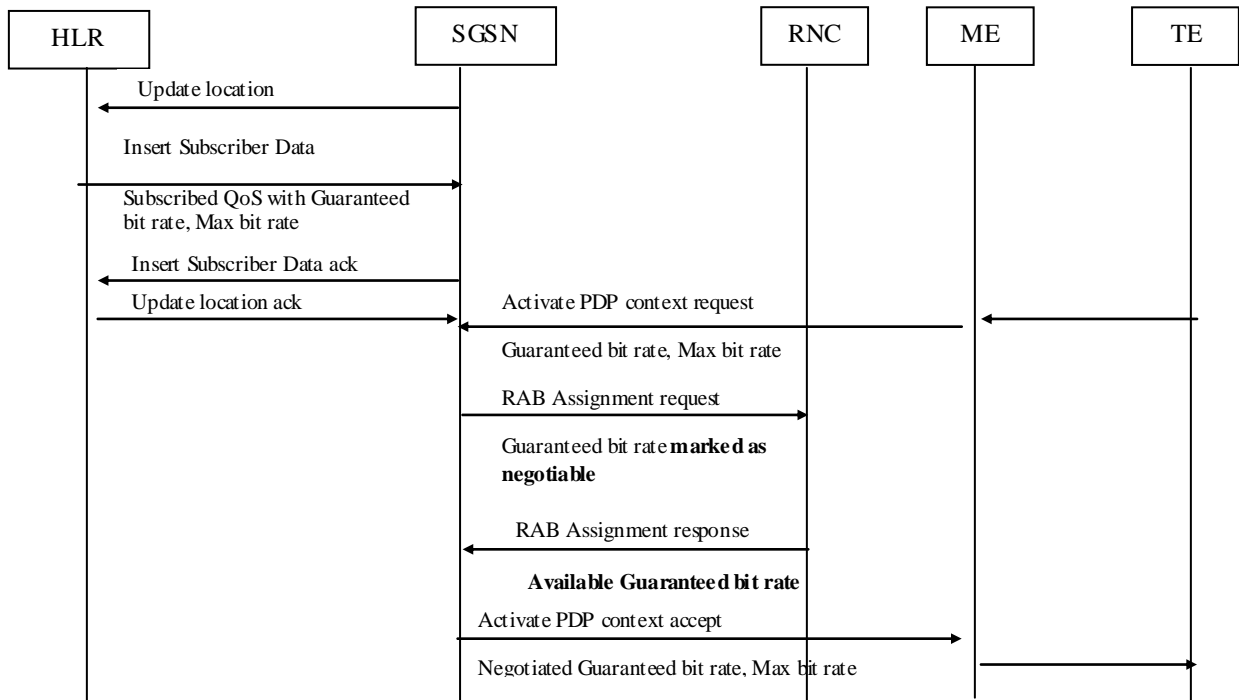
Also note that the HLR and the mobile in the picture 2 above can be R99 without precluding the network to realise the QoS negotiation. If the RNC or the SGSN do not support the new IE in the RAB assignment response, then the RNC will simply provide the Minimum Guaranteed bit rate as requested by the SGSN (or fail the RAB if it can not provide that), and the behaviour will be as per R99 standards.

6.3   Mechanisms for negotiation

Three different ways of indicating the possible values to choose from during the negotiation shall be studied:

1   A number of discrete values are indicated from the CN. The RNC has to choose the best value it can support out of these values.

2   A desired value and a lower limit value are indicated from the CN. The RNC has to choose the best value it can support within the range given by these two values.

3   Only an indication that negotiation is allowed for a specific parameter is included from the CN. The RNC has to choose the best value it can support if not the desired value can be supported.

6.4 Specification Impact and associated Change Requests

6.4.1 RANAP specification [1]

6.4.1.1 Impacts

6.4.1.1.1 RAB ASSIGNMENT REQUEST

For those parameters that shall be possible to negotiate, a possibility to indicate the values that the RNC are allowed to choose from or just an indication that negotiation is allowed, must be added according to one of the methods described in 6.3.

6.4.1.1.2 RAB ASSIGNMENT RESPONSE

For those parameters that have been negotiated, the chosen value must be possible to indicate. The value of the not negotiated parameters does not need to be indicated.

7 Study Areas regarding possible extensions to the WI

7.1 RAB QoS Negotiation at relocation

7.1.1 Message sequence chart related to RAB QoS negotiation during Relocation

This chapter shows some examples of the relocation message sequence chart.

Figure 3 shows the message sequence chart of the relocation triggered by Cell Update.

Figure 4 shows the message sequence chart of the relocation triggered by the RNC (receiving of RRC: Measurement Report message).

UE	Target RNC	Source RNC	SGSN	GGSN

Cell Update

Uplink Signalling Transfer Indication

Relocation Required

Relocation Request(Requested QoS)

resource not enough

propose looser resource

Relocation Request Acknowledge (Negotiated RAB QoS<looser>)

Relocation Command

Cell Update Confirm SRNS Relocation Commit (TrCH Information)

Relocation Detect

Physical CH Reconfiguration Complete
Or
Transport CH Reconfiguration Complete
Or
Radio Bearer Reconfiguration Complete

Update PDP Context Request

Update PDP Context Response

Relocation Complete
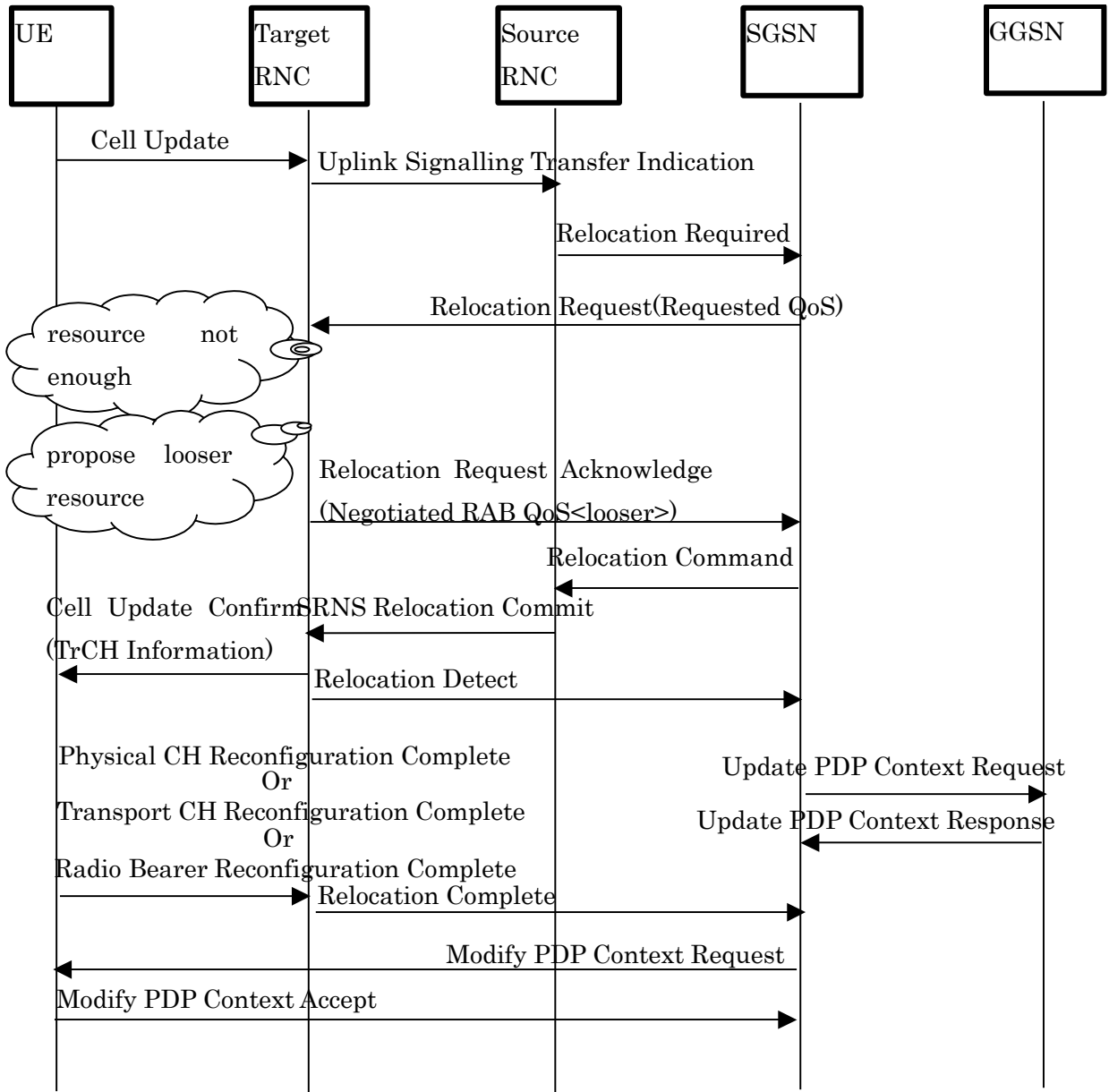
Modify PDP Context Request

Modify PDP Context Accept

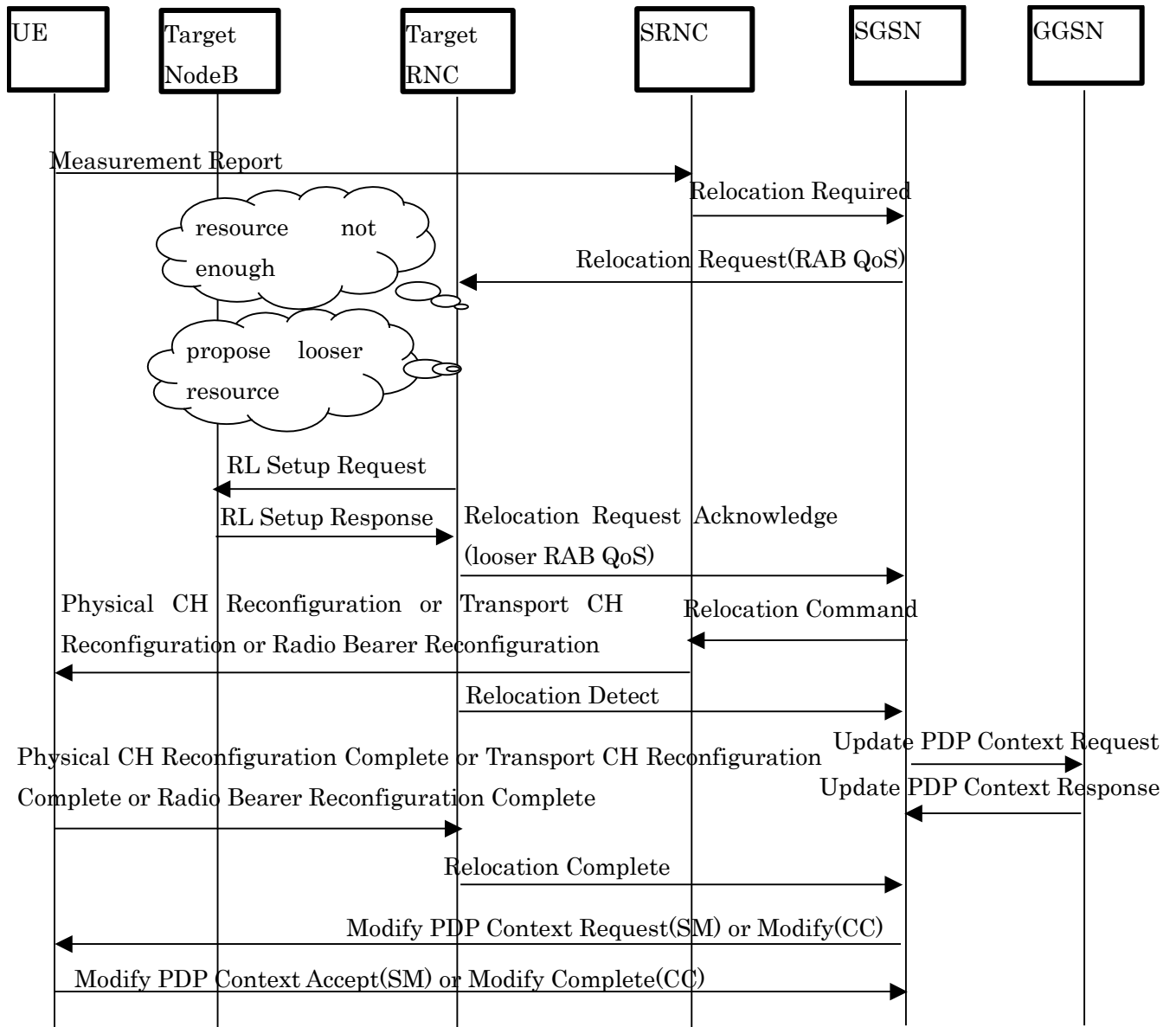**Figure 3 Relocation Sequence Chart (Cell Update with SRNS Relocation)**

Figure 4 Relocation Sequence Chart (Handover with switching in the CN)

7.1.2 What should be considered?

RRC: 25.331 [4]

As shown in figure 3, the RRC: Cell Update Confirm message shall contain transport channel information to reflect the change of the RAB QoS.

As shown in figure 4, the RRC: Physical Channel Reconfiguration message shall contain transport channel information to reflect the change of the RAB QoS.

According the 25.331 RRC specification, the necessary information is already existing to reconfigure the transport channel information e.g. TFCS. It is therefore understood that there will be no enhancement needed in 25.331 RRC specification considering this.

SM and CC: 24.008 [3]

The messages needed to be considered are Modify PDP Context Request message and Modify PDP Context Accept message for Session Management, and Modify message and Modify Complete message for Call Control. These messages have a capability to change the RAB QoS to the UE, therefore there is no need to enhance the Session Management and Call control protocol.

RANAP: 25.413 [1]

The messages needed to be considered are Relocation Request message and Relocation Request Acknowledge message.

Relocation Request message: An alternative RAB QoS needs to be added

Relocation Request Acknowledge message: A selected RAB QoS needs to be added

7.1.3 The timing of switching the user plane in the CN nodes

Since the CN can inform the change of RAB QoS after receiving the Relocation Detect message, there is no issue that can be seen regarding the timing of switching the user plane from source RNC to Target RNC in the CN

7.1.4 Evaluate if it can be included in RAB QoS Negotiation Working Item

The enhancement in Relocation procedure is almost the same as in the enhancement of the RAB Assignment procedure. What the target RNC has to progress is the same as in RAB Assignment procedure, i.e. when receiving the Relocation Request message, evaluating whether the radio resource is enough or not. If the resource is enough, the target RNC handles normally, i.e. the same as in R99. If resource is not enough, then the target RNC may choose the looser RAB QoS among the request from the CN and send it in the Relocation Request Acknowledge message. The CN informs the UE after receiving the Relocation Detect message by sending the NAS message (Modify PDP Context Request or Modify).

7.1.5 Open issues

- It should be clarified if current RRC provides a capability that can reconfigure the radio resource information for Cell Setup Confirm (for UE not involved relocation) and Physical Channel Reconfiguration (for UE involved relocation).

7.1.6 Specification Impact and associated Change Requests

Change Request related to the RAB QoS Negotiation over Iu during relocation

25.413

Places	What should be enhanced	Further Explanation
Procedure description	• Relocation Resource Allocation	The description can be almost the same as the one in RAB Assignment procedure.
Messages and IEs	**RELOCATION REQUEST message** • The allowed negotiated RAB QoS	The content of the allowed negotiated RAB Parameter shall be the same as the one in RAB ASSIGNMENT REQUEST message.

	RELOCATION REQUEST ACKNOWLEDGE message • The Negotiated RAB Parameter	The content of the negotiated RAB Parameter shall be the same as the one in RAB ASSIGNMENT RESPONSE message.

23.060

Places	What should be enhanced	Further Explanation
Chapter 9.2.3	• A stage 2 message sequence chart	This is to show the timing of sending and receiving the relevant messages e.g. Update PDP Context Request etc.

8 Agreements and associated agreed contributions

8.1 Negotiable parameters

The following parameters have so far been agreed to be negotiable:

- Guaranteed bitrate

- Maximum bitrate

8.2 Not negotiable parameters

The following parameters have so far been agreed not to be negotiable:

- Traffic class

- Asymmetry indicator

- Source statistics descriptor

- Delivery of erroneous SDUs

- Traffic Handling Priority

9 Relation and communication with other groups

Any changes to the scope of the Work Item need to be communicated with TSG RAN.

For the following items, a discussion with relevant groups is necessary:

- Negotiation also at relocation? Supported by CC/SM protocols? Supported by RRC protocol?
  Information requested from SA2, CN1, CN4 (LS R3-001963) and R2 (LS R3-001955).

  Sum up of answer from RAN2 received in LS R3-002944 (R2-001869): For R99 within the RRC protocol there is no radio bearer reconfiguration capability foreseen in the RRC Cell Update procedure to support the Relocation procedure initiated by RANAP. RAN2 will consider the impacts on RAB QoS Negotiation over Iu within the work in R2000 and will keep RAN3 informed about the progress on this issue.

- Can CC/SM protocols support the two ways of indicating possible values as described in 6.3 above?
  Information requested from SA2, CN1 and CN4 (LS R3-001963).

  Sum up of answer from SA received in LS R3-002791 (S2-001651): SA2 sees the need for a mechanism for QoS negotiation in UTRAN. SA2, however, needs to study this issue further and will come back with more information once this is done.

  Sum up of further answer from SA2 received in LS R3-003188 (S2-002108): The following two principles had been discussed but a full agreement not reached:
  - The QoS attributes Guaranteed Bitrate and Maximum Bitrate shall be possible to negotiate.
  - UE shall indicate to SGSN the acceptable values to be used when setting up a PDP context.
  The issue of discrete values versus value range had also been further discussed.
  The LS included a number of questions to different groups out of which the one applicable for RAN3 was to indicate if discrete values or a value range would be preferred from an IE coding perspective. RAN3 supplied answer to this question (value range preferred) plus gave some other information in LS R3-003308. A question regarding in what scenarios the need to negotiate both guaranteed and maximum bit rate at the same time would apply, was also raised in this LS to SA2.

  Sum up of answer from N1 received in LS R3-002244 (N1-000978): It was found to be technically feasible to

include information to support QoS negotiation during RAB setup. N1 will, however, await decision from SA2 before taking further action.

- Can RAB Negotiation during a call be introduced over CC protocol?
  Information requested from N1 (LS R3-002263).
  Not applicable any more to this TR since RAB Renegotiation has been moved to a separate TR.

Annex A:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
03/2001	11	RP-010135	-	-	Approved at TSG RAN #11 and placed under Change Control	2.0.0	4.0.0