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(Release 4)

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Contents

Foreword

This Technical Report (TR) has been produced by the 3rd Generation Partnership Project (3GPP), Technical Specification Group RAN.

The contents of this TR 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 m.x.y

where:

m   the first digit indicates:

1   presented to TSG for information;

2   presented to TSG for approval;

3   or greater indicates TSG approved document under change control.

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

y   the third digit is incremented when editorial only changes have been incorporated into the specification.

1 Scope

The present document provides the current status of the work item "RAB Quality of Service Renegotiation over Iu" within 3GPP TSG RAN WG3. It describes the requirements, discusses the renegotiation procedure, and identifies the affected specifications. If information needs to be communicated to groups outside of TSG RAN WG3, it is recorded in this document.

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.

- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1]   RAB Quality of Service Renegotiation over Iu, Work Item Description, TSG-RAN#9 RP-000500.

[2]   3G TS 24.008 v3.6.0: "3rd Generation Partnership Project (3GPP); Technical Specification Group Core Network; Mobile Radio Interface Layer 3 Specification; Core Network Protocols – Stage 3 (Release 1999)".

[3]   3G TS 25.331 v3.5.0: "3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; RRC Protocol Specification (Release 1999)".

[4]   3G TS 25.413 v3.4.0: "3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; UTRAN Iu Interface RANAP Signalling (Release 1999)".

[5]   3G TS 25.423 v3.4.0: "3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; UTRAN Iur Interface RNSAP Signalling (Release 1999)".

[6]   3G TS 25.433 v3.4.1: "3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; UTRAN Iub Interface NBAP Signalling (Release 1999)".

[7]   3G TR 25.935 v0.1.0: "3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network 3; Radio Resource Management (RRM) Optimisations for Iur and Iub".

[8] 3G TR 25.946 v0.2.0: "3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; RAB Quality of Service Negotiation over Iu (Release 4)".

3 Definitions, Symbols, and Abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

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3.2 Symbols

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

-

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
GSN	GPRS Support Node
IE	Information Element
MSC	Mobile Services Switching Center
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
SGSN	Serving GSN
SM	Session Management
SRNC	Serving RNC
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network

4 Introduction and Motivation

The purpose of RAB Quality of Service Renegotiation over Iu Work Item Description [1] is to provide the UMTS Terrestrial Radio Access Network (UTRAN) with a mechanism to initiate Radio Access Bearer (RAB) renegotiation/reconfiguration. Current 3GPP specifications allow Core Network (CN) and User Equipment (UE) initiated RAB renegotiation/reconfiguration. In order for the UTRAN to efficiently manage the radio interface, it also needs to have the ability to intiate RAB

renegotiation/reconfiguration. Failure to perform UTRAN initiated RAB renegotiation/reconfiguration may result in radio network overload, dropped calls, and degradation of the quality of remaining calls.

Change in the radio environment or user mobility may lead to situations where the radio infrastructure is unable to deliver the Quality of Service (QoS) promised during RAB setup. In the absence of an UTRAN initiated RAB renegotiation/reconfiguration procedure, such scenarios may result in overload of the radio interface (possibly due to more power being allocated by the radio infrastructure to the RAB in question), which also negatively impacts the quality of other calls, and may ultimately lead to calls being dropped. To avoid such negative outcomes, the UTRAN must be able to renegotiate RAB/QoS parameters, which it may have agreed to earlier.

5 Requirements

5.1 General Requirements

- The UTRAN shall be able to initiate RAB renegotiation/reconfiguration.

- The RAB renegotiation/reconfiguration procedure shall be a generic procedure and shall apply both to PS and CS domains.

6 Study Area

6.1 Solution 1: UTRAN Initiated RAB Renegotiation/Reconfiguration Procedure

6.1.1 Procedure Description

The proposed procedure introduces one new message to the Iu interface, and reuses two messages already defined for RANAP signalling. The three messages over the Iu interface necessary for this procedure are:

- RAB Modify Request (new message)
- RAB Assignment Request (existing message)
- RAB Assignment Response (existing message)

The RAB Modify Request message constitutes a Class 2 Elementary Procedure (EP), which may be followed by the Class 3 RAB Assignment EP consisting of RAB Assignment Request message and RAB Assignment Response message. These messages are used in the following procedure steps to perform an UTRAN, or more specifically Radio Network Controller (RNC) initiated RAB renegotiation/reconfiguration:

1. RNC determines need to modify RAB(s).

2. RNC formats and sends the RAB Modify Request message to the CN indicating which RABs require modification. The RAB Modify Request message structure is given in section 6.1.2.1, and is consistent with the RAB Assignment Request and RAB Assignment Response messages already specified in [4]. In the RAB Modify Request message, the '*RAB ID*' information element (IE) identifies the RABs for which modifications are requested, and the corresponding

'*Requested RAB Parameter Values*' IE lists those RAB parameters the RNC would like modified and the associated new RAB parameter values it is requesting. (Note: the message structure for RAB Modify Request is similar to the Modify PDP Context Request message used between UE and CN to request modification of an active PDP context. Since the CN can already handle the Modify PDP Context Request message, it may not require much additional work on part of the CN to be able to handle the RAB Modify Request message. Refer to [2] for more details on Modify PDP Context Request message.)

3. Upon reception of the RAB Modify Request message, the CN, if it chooses to honor the request, determines if the modifications are acceptable and returns the appropriate indication to the RNC in the RAB Assignment Request message. If the CN accepts the RNC suggested RAB modifications, the '*RAB Parameters*' IE under 'RABs To Be Setup Or Modified' IE group of the RAB Assignment Request message reflects those changes - the RAB parameter values are the same as those sent via the RAB Modify Request message, in that case. If the CN does not accept the RNC suggested RAB modifications, it can indicate the previously agreed upon RAB parameter values or suggest different RAB parameter values in the '*RAB Parameters*' IE under 'RABs To Be Setup Or Modified' IE group of the RAB Assignment Request message. Alternatively it can instruct the RNC to release the appropriate RABs by identifying those RABs under 'RABs To Be Released' IE group of the RAB Assignment Request message.

   The CN may need to communicate with the UE before accepting a RAB Modify Request (may be even before suggesting a different set of RAB parameter values). This can be done through the PDP Context Modification procedure. If the network initiated PDP Context Modification is acceptable to the UE, the CN may respond to the RNC by completing the 'RABs To Be Setup Or Modified' IE group of the RAB Assignment Request message for the appropriate RABs. If the network initiated PDP Context Modification is not acceptable to the UE, the UE deactivates the PDP context through the UE initiated PDP Context Deactivation procedure. The CN in that case sends a RAB Assignment Request message to the RNC, requesting the RNC to release the corresponding RAB. See [2] for details on PDP Context Modification and PDP Context Deactivation procedures.

   In addition, in the case of PS domain for example, the SGSN may need to communicate with the GGSN before accepting a RAB Modify Request. This can be done through the Update PDP Context procedure.

4. Upon reception of the RAB Assignment Request message, the RNC considers the RAB modifications agreed to by the CN. If CN has accepted the RNC proposed RAB modifications, the RNC makes those modifications and indicates to the CN that the appropriate RABs have been modified through the RAB Assignment Response message. The 'RABs Setup Or Modified' IE group lists the RAB IDs that have been modified. If the CN has not accepted the RNC proposed RAB modifications, and has either suggested different RAB modifications or has repeated the previously agreed upon RAB parameter values, the RNC decides if that is acceptable to it or not. If acceptable, the RNC makes the appropriate RAB modifications, if any, and lists the corresponding RAB IDs in the 'RABs Setup Or Modified' IE group of the RAB Assignment Response message it sends back to the CN. If the RAB parameter values indicated in the RAB Assignment Request message are not acceptable to the RNC, the RNC sends a RAB Assignment Response message listing the appropriate RAB IDs in the 'RABs Failed To Setup Or Modify' IE group of the message. Lastly, if CN has not accepted the RNC proposed RAB modifications, and has requested RABs to be released through the RAB Assignment Request message, the RNC releases the appropriate RABs and lists the corresponding RAB IDs in the 'RABs Released' IE group of the RAB Assignment Response message it sends to the CN.

5. Once RAB Assignment Response message is received at the CN for each RAB the RNC wanted to modify through its RAB Modify Request message, the procedure ends.

The following message flow diagram illustrates the sequence of these messages:

```
   ┌──────┐                    ┌──────┐
   │  CN  │                    │ RNC  │
   └──────┘                    └──────┘
      │                            │
      │       RAB Modify Request   │
      │◄───────────────────────────┤
      │                            │
      │    RAB Assignment Request  │
      ├───────────────────────────►│
      │                            │
      │   RAB Assignment Response  │
      │◄───────────────────────────┤
      │                            │
```
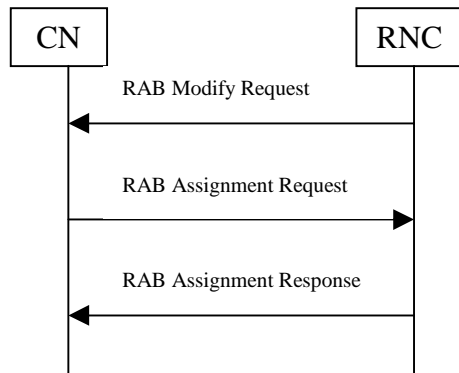
Figure 1: RAB QoS Renegotiation over Iu

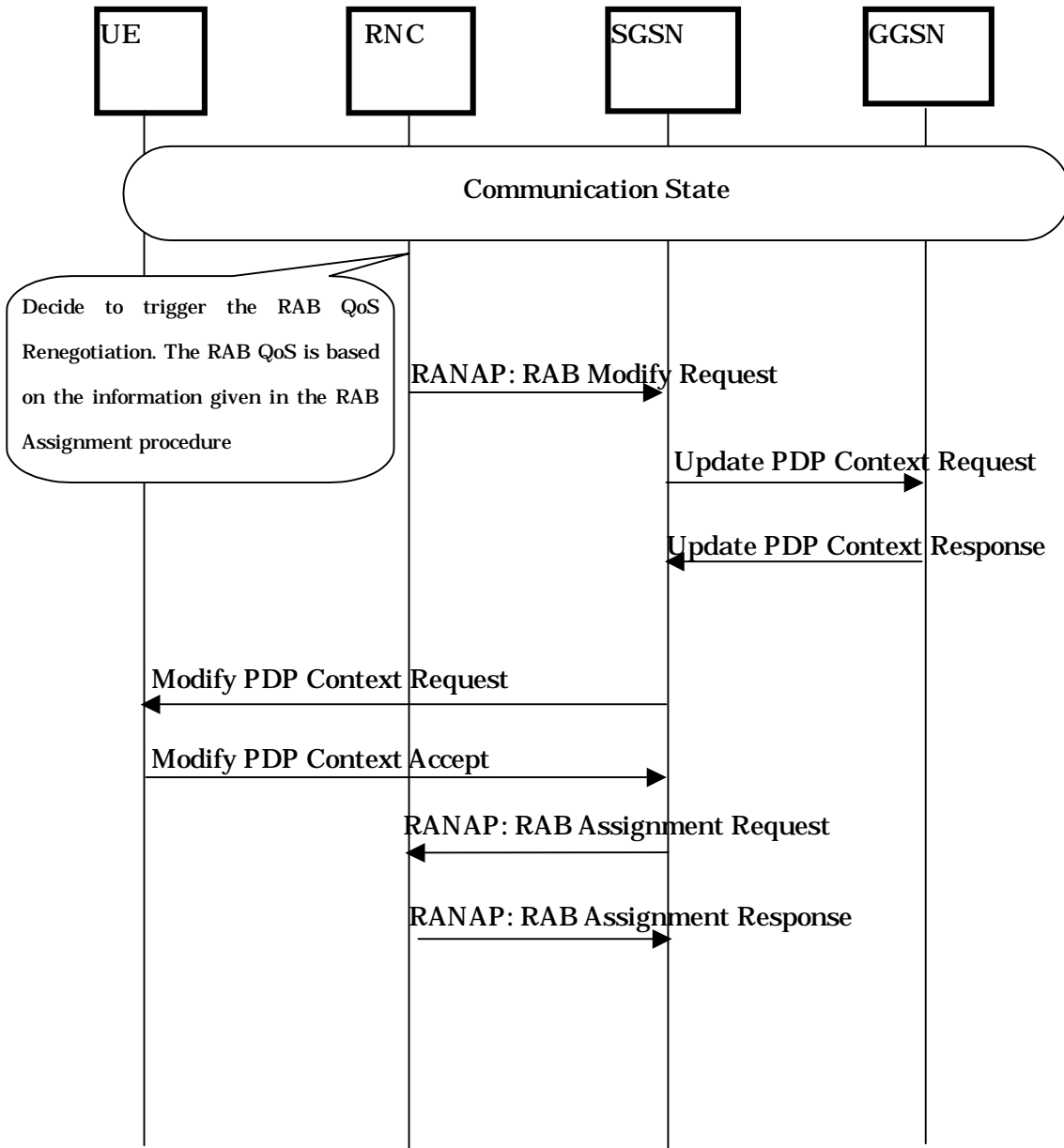The figure below provides a more detailed message flow for the PS domain:

Figure 2: RAB QoS Renegotiation for PS Domain

6.1.2 Message Definitions and Contents

6.1.2.1 RAB Modify Request

This message is sent by the RNC to the CN to request modification of one or more RABs for the same UE.

Direction: RNC → CN.

Signalling bearer mode: Connection oriented.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
RABs To Be Modified	M	1 to <maxnoofRABs>			EACH	ignore
>RAB ID	M		9.2.1.2	Uniquely identifies the RAB for a specific CN domain, for a particular UE.	-	
> Requested RAB Parameter Values	M		9.2.1.x	Includes RAB parameters for which different values than what was originally negotiated are being requested.	-	

Range bound	Explanation
maxnoofRABs	Maximum no. of RABs for one UE. Value is 256.

The 'IE type and reference' column in the above table, refers to sections in [4].

Using the '*Requested RAB Parameter Values*' IE, an RNC shall be able to propose modification of any negotiable RAB parameter that the CN has indicated as being negotiable for a given RAB.

6.1.2.2 Requested RAB Parameter Values

The purpose of *Requested RAB Parameter Values* IE is to indicate the RAB parameters for which different values are being requested, as well as those different RAB parameter values.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Requested RAB Parameter Values				
>Requested Maximum Bit Rate	C - ifReNegReq	0 to <nbr-SeparateTraffic Directions>	INTEGER (1..16,000,000)	When nbr-SeparateTrafficDirections is equal to 2, Requested Maximum Bit Rate attribute for downlink is signalled first, then Requested Maximum Bit Rate attribute for uplink.
>Requested Guaranteed Bit Rate	C - ifReNegReq	0 to <nbr-SeparateTraffic Directions>	INTEGER (0..16,000,000)	When nbr-SeparateTrafficDirections is equal to 2, Requested Guaranteed Bit Rate for downlink is signalled first, then Requested Guaranteed Bit Rate for uplink.

Range Bound	Explanation
nbr-SeparateTrafficDirection	Number of Traffic Directions being signalled separately. Set to 2 if RAB Asymmetry Indicator is asymmetric bidirectional. Set to 1 in all other cases.

Condition	Explanation
ifReNegReq	This IE is only present when a different value is being requested for the RAB parameter.

6.1.2.3   RAB Assignment Request

Refer to [4] for details of this message.

6.1.2.4   RAB Assignment Response

Refer to [4] for details of this message.

6.1.3   Supporting Procedures

A system needs additional messages/procedures to communicate the changes resulting from an UTRAN initiated RAB renegotiation/reconfiguration to the UE and other network elements. These include messages to communicate new RAB parameter values to the UE, new Radio Bearer (RB) parameter values to the UE, Node B, and possibly Drift RNC (DRNC). These messages have already been defined and exist in 3GPP specifications. For example, new RAB parameter values can be sent to the UE by the CN using the PDP Context Modification procedure (refer to [2]). Radio Bearer Reconfiguration procedure is in place for the Serving RNC (SRNC) (SRNC would be the entity initiating UTRAN initiated RAB renegotiation/reconfiguration) to communicate to the UE, changes in RBs resulting from RAB renegotiation/reconfiguration (refer to [3]). The radio link reconfigurations that may be necessitated by RAB renegotiation/reconfiguration can be communicated to involved Node Bs and DRNCs by the SRNC through the Radio Link Reconfiguration procedure (synchronised or unsynchronised) (refer to [5] and [6]).

In general, all supporting messages/procedures needed for proper implementation of UTRAN initiated RAB renegotiation/reconfiguration are already specified by 3GPP, with one small exception. The PDP Context Modification procedure between CN and UE is currently only defined for the PS domain. This concept needs to be expanded to also cover the CS domain.

6.1.4   Specification Impact and Associated Change Requests

6.1.4.1   UTRAN Iu Interface RANAP Signalling [4]

6.1.4.1.1   Impacts

6.1.4.1.1.1   *RAB MODIFY REQUEST*
This new elementary procedure needs to be introduced.

6.2 Additional Topics for Study

6.2.1   How to Handle High Priority RAB

Will there be a mechanism to handle high/low priority RAB in RNC while there is a need to trigger the UTRAN initiated RAB renegotiation?
Currently in 25.413, a priority handling mechanism for RAB is specified. The same kind of mechanism can be introduced, i.e. the RNC should renegotiate with the RAB that has lowest priority, in ascending order of priority. That means the RABs, which have highest priority, should be left till last when the UTRAN initiated RAB QoS renegotiation has to be done.

6.2.2 What Kind of RAB QoS that the RNC Can Initiate the Renegotiation

It has been agreed that the guaranteed bitrate and maximum bit rate can be negotiated for the RAB QoS negotiation during RAB Assignment Procedure, therefore a possible RAB QoS that the RNC can initiate is guaranteed bitrate and maximum bit rate.

6.2.3 How the RNC Decides the RAB QoS to be Renegotiated

When the RNC decide to trigger the RAB QoS renegotiation to the CN, it is needed for the RNC to decide on how to decide the RAB QoS.

- Solution 1: One possible solution may be that the CN give the information to the RNC before hand, i.e. in the RAB ASSIGNMENT REQUEST message.

- Solution 2: The other solution is that the RNC does not care what the CN indicated in the RAB ASSIGNMENT REQUEST message and just decide the bitrate whatever the RNC decide.

It seems that the solution 1 is reasonable, because it has a general requirement that from the Iu point of view it is the CN that decides the RAB QoS renegotiation is allowed for one or more parameter, then it is natural that the RNC decide the bitrate among the allowed information given by the CN.

6.2.4 How the CN Decides Whether the RAB QoS Initiated by the RNC Can Be Accepted or Not

The same discussion as the RAB QoS during RAB Assignment, the CN does not have other essential information than what the RNC has, only the application and user know the information. However, the CN can base on the information received from the user in advance (i.e. the user indicates in the Activate PDP Context Request: 24.008) and decide if the RNC initiated RAB QoS renegotiation can be accepted or not.

The same mechanism used for RAB QoS negotiation can be used for RAB QoS renegotiation.

6.2.5 Modification for Transport Bearer

As a result of the RAB modification, the transport bearer for Iu, Iur and Iub may have to be modified.

7 Agreed Solution

It has been agreed that solution 1 will be pursued.

8 Communication with Other Groups

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

- Can UTRAN initiated RAB renegotiation during a call be introduced over CC protocol (using PDP Context Modification procedure)?

- RAN3 requested information from CN1 through liaison statement R3-002263.

- CN1 responded through liaison statement R3-010054. They indicated that it might be possible to adapt the in-call modification procedure for this purpose. They also requested more information from RAN3 regarding when this procedure may be invoked, and the Release 4 work item for which this change is desired.

- RAN3 responded through liaison statement R3-010305. RAN3 indicated to CN1 with copy to SA2, the agreements reached so far about negotiable/renegotiable RAB parameters. They were also informed about RAN3's expectation to be able to negotiate/renegotiate the negotiable RAB parameters at call setup and at anytime during the call. A copy of the RAB Quality of Service Renegotiation over Iu work item (RP-000500) was also forwarded with this liaison statement.

9 Project Plan

9.1 Schedule

Date	Meeting	Scope	[expected] Input	[expected]Output

9.2 Work Task Status

	Planned Date	Milestone	Status
1.			
2.			

10 History

Document history		
V0.0.0	2000-10	Document outline.
V0.0.1	2000-10	First proposal for contents.
V0.0.2	2000-11	Rapporteur's proposal for inclusion of contributions and comments received during RAN3 Meeting #17.
V0.1.0	2001-02	Approved version at RAN3 Meeting #18.
V0.1.1	2001-02	Rapporteur's proposal for inclusion of contributions and comments received during RAN3 Meeting #18. Some editorial changes also included.
V0.1.2	2001-02	Rapporteur's proposal to RAN3 Meeting #19.
V0.2.0	2001-02	Rapporteur's proposal for inclusion of contributions and comments received during RAN3 Meeting #19.
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