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Technical Report

**3rd Generation Partnership Project;
Technical Specification Group (TSG) RAN;**

RAB Quality of Service Negotiation over Iu

(Release ~~2004~~)



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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.

- [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)”.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

-

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
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	UMTS 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 would have 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 7.1-~~and~~ 7.2.)

5.3 Negotiable parameters

The parameters agreed to be negotiable shall be based on the R00 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

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.

6.3 Mechanisms for negotiation

Two 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.

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 are allowed to choose from 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

If RAB QoS Negotiation shall be possible to do also at relocation needs to be studied more before any proposal to include also this possibility in the Work Item can be made.

Points that need to be clarified:

- 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).
- Furthermore, the whole message sequence including NAS messages necessary for the QoS negotiation over Iu must be studied for the Relocation Resource Allocation Procedure.
- Also it should be clarified if the QoS negotiation during Relocation would affect the timing of user data flowing. For example, upon reception of RELOCATION DETECT message, the CN may switch the user plane from the source RNC to the target RNC. Is it possible for the CN to inform the UE at this time that the QoS has been changed? If it is not possible, then should the timing of user data flow during the relocation be changed?

~~7.2 UTRAN initiated RAB QoS Negotiation~~

~~7.2.1 General~~

~~If the possibility for UTRAN to initiate a RAB QoS Negotiation at any time during an ongoing call shall be seen as part of this Work Item needs to be clarified with TSG-RAN before the solution described below can be considered.~~

~~7.2.2 Solution~~

~~7.2.2.1 UTRAN Initiated RAB Renegotiation/Reconfiguration Procedure~~

~~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)

These messages are used in the following procedure steps to perform an UTRAN, or more specifically Radio Network Controller (RNC)-initiated RAB renegotiation/reconfiguration:

RNC determines need to modify RAB(s).

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 7.2.2.2.1 and is consistent with the RAB Assignment Request and RAB Assignment Response messages already specified in [1]. In the RAB Modify Request message, the 'RAB ID' information element (IE) identifies the RABs for which modifications are requested, and the corresponding 'RAB parameters' IE lists the new RAB parameter values the RNC 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 [3] for more details on Modify PDP Context Request message.)

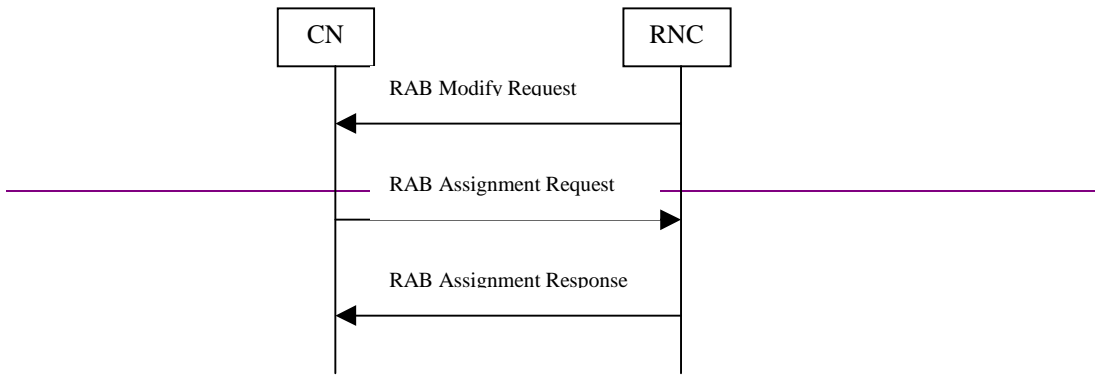
Upon reception of the RAB Modify Request message, the CN determines if the modifications are acceptable and returns the appropriate indication to the RNC in the RAB Assignment Request message. If the CN accepts the RNC suggested RAB modifications, the 'RAB parameters' IE under 'RABs to be setup or modified' 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' of the RAB Assignment Request message. Alternatively it can instruct the RNC to release the appropriate RABs by identifying those RABs in the 'RABs to be released' IE 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 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 [3] for details on PDP Context Modification and PDP Context Deactivation procedures.

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 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 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 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 of the RAB Assignment Response message it sends to the CN.

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:



7.2.2.2 Message Definitions and Contents

7.2.2.2.1 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	0 to <maxnoofRABs>			EACH	ignore
>RAB-ID	M		9.2.1.2	Uniquely identifies the RAB for a specific CN domain, for a particular UE.	-	
>RAB parameters	M		9.2.1.3	Includes all necessary parameters for RABs (both for MSC and SGSN) including QoS.	-	

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 [1].

7.2.2.2.2 RAB Assignment Request

Refer to [1] for details of this message.

7.2.2.2.3 RAB Assignment Response

Refer to [1] for details of this message.

7.2.2.3 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 [3]). 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 [4]). 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.

8 Agreements and associated agreed contributions

8.1 Negotiable parameters

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

- Guaranteed bitrate

~~9 Specification Impact and associated Change Requests~~

~~9.1 RANAP specification [1]~~

~~9.1.1 Impacts~~

~~9.1.1.1 RAB ASSIGNMENT REQUEST~~

~~For those parameters that shall be possible to negotiate, a possibility to indicate the values that are allowed to choose from must be added according to one of the methods described in 6.3.~~

~~9.1.1.2 RAB ASSIGNMENT RESPONSE~~

~~For those parameters that have been negotiated, the chosen value must be possible to indicate.~~

10 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 and R2.
- 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.
- Can RAB Negotiation during a call be introduced over CC protocol?
Information requested from N1.

11 Project Plan

11.1 Schedule

Date	Meeting	Scope	[expected] Input	[expected]Output

11.2 Work Task Status

	Planned Date	Milestone	Status
1.			
2.			

12 History

Document history		
V0.0.1	2000-08	First version
V0.1.0	2000-08	New version after RAN3#15.
<u>V0.1.1</u>	<u>2000-11</u>	<u>Rapporteur's proposal for inclusion of contributions/comments received during RAN3#17.</u>
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