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Technical Report

3rd Generation Partnership Project; Technical Specification Group (TSG) RAN3; Transcoder Free Operation (Release 4)

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Contents

Foreword

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

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Version x.y.z

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  - 1 presented to TSG for information;
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- 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 provides the current status of the work item “Transcoder Free Operation” within 3GPP TSG RAN WG3.

The purpose of this Rel4 Work Task is to define necessary enhancements of specifications under RAN WG3 control to support the procedures specified within the parent Building Block “Out of Band Transcoder Control”.

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] “Out of Band Transcoder Control”, Work Item Description, TSG CN#9, submitted as NP-000529

[2] “Transcoder Free Operation”, Work Item Description, TSG RAN#9, submitted as RP-000507

[3] UMTS 23.153: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network; Out of Band Transcoder Control - Stage 2"

[4] UMTS 23.205: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network; Bearer Independent CS Core Network; Stage 2"

[5] UMTS 21.401: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Overall Description"

[6] UMTS 25.410: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu Interface: General Aspects and Principles"

[7] UMTS 25.413: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu interface RANAP signalling"

[8] UMTS 25.415: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu Interface User Plane Protocols"

[9] UMTS 21.905: "3rd Generation Partnership Project (3GPP) Technical Specification Group Services and System Aspects; Vocabulary for 3GPP specifications"

[10] Status Report of TrFO Workshop to TSG#09, TSG CN#9, submitted as NP-000516

[11] ITU-T H.248: "Media Gateway Control Protocol"

[12] “Report of an Adhoc meeting ...”, Document for WS between R3/S4/N4 on TrFO during RAN3#16, submitted as TRFO_IU_014

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:

CS	circuit switched
OoBTC	Out of Band Transcoder Control
SS	Supplementary Service
TICC	Transport Independent Call Control
TrFO	Transcoder Free Operation

4 Introduction

[Note: this section should briefly describe the intention of the parent work task and outline its consequences within RAN3 work.]

Figure 4/1 illustrates the architecture for Rel4 for a UMTS to UMTS TrFO connection from a system wide point of view.

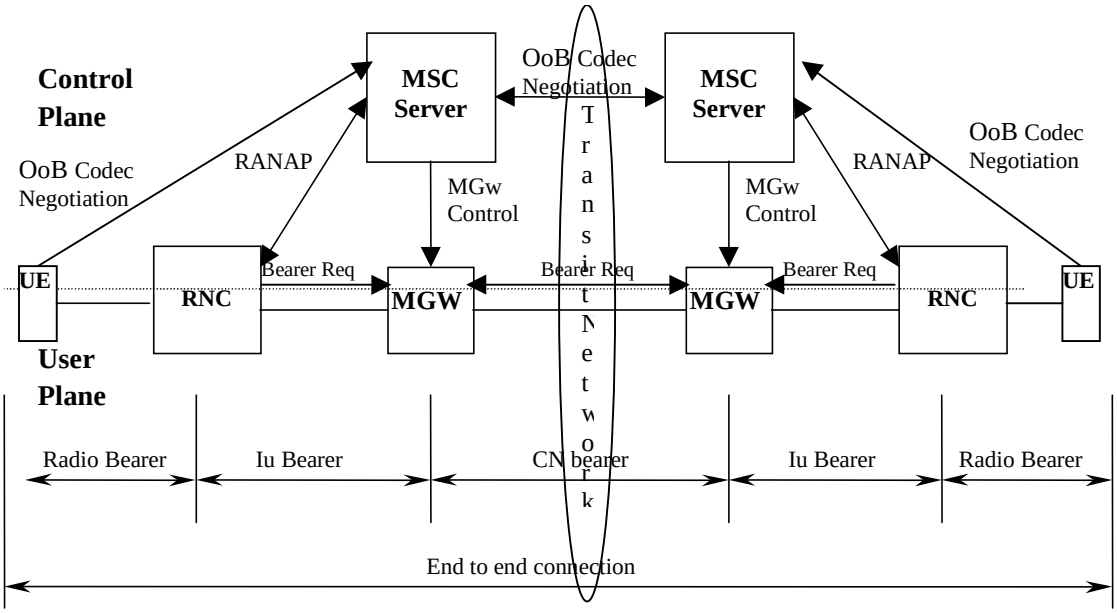

Figure 4/1. Basic Architecture for UMTS to UMTS TrFO Connection [3].

OoBTC is required to establish Transcoder Free Operation. Out of Band Transcoder Control (OoBTC) is the term used for the capability of a network to negotiate codec types and codec modes for a call with out-of-band signalling procedures.

In [3] these procedures are specified to take place at the call setup phase or possibly later if there is a need to re-negotiate the codec due to e.g. SS interworking. OoBTC is performed between serving core network nodes taking into account transcoding capabilities of all involved parties, i.e. UEs and MGWs under the control of their serving nodes. OoBTC relies on the mechanisms and the architecture defined for an bearer independent circuit switched core network, as specified in [4].

The general principle of Transcoder Free Operation, from a RAN3 point of view, is to enable the support mode operation of the framing protocol defined within [8] not only on the Iu interface but to allow an end to end operation of the support mode procedures on Iu and CN bearers. It shall be possible that the end to end operation of the UP support mode is possible between network nodes that permanently terminate the IuUP protocol, e.g. between two RNCs in case

of a mobile to mobile call or an RNC and a gateway CN node in case of a mobile to fixed call, i.e. it shall not be limited to Figure 4/1.

This principle is enabled due to the agreement during the TrFO workshop to use the Iu UP Protocol as a framing protocol within the circuit-switched AAL2/ATM and IP core network for compressed speech and CS data services. (see [10])

Figure 4/2 outlines a network configuration during a mobile to mobile call setup involving certain network entities (RNCs, MGWs, MSC-Servers) and respective protocol entities (RANAP, IuUP terminations and Transport Independent Call Control (TICC)). Call Contexts, containing terminations (see [11]) with properties that shall be defined within [8] are involved as well (T1-T4).

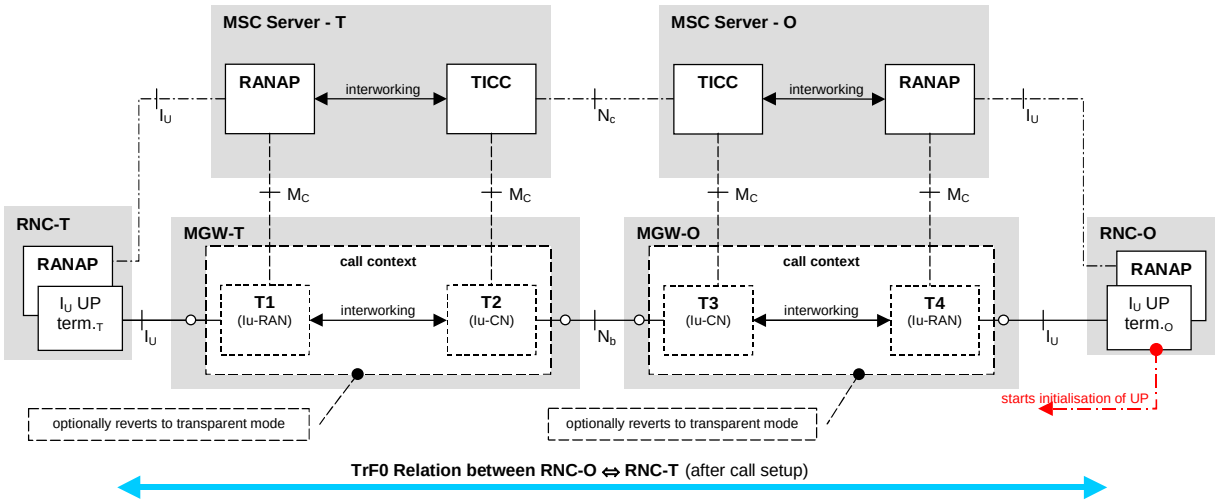

Figure 4/2. Configuration during Call Setup of a Mobile to Mobile Call [3].

[Note:procedural description necessary; either flows, or reference to [3]?]

5 Requirements

[Note: this section will contain the requirements for supporting Transcoder Free Operation. Different subsections possible.]

5.1 General Requirements

[Note: this section will contain general requirements to supporting Transcoder Free Operation]

- The general requirement is to allow end-to-end communication between mobile users or between a mobile and a fixed user without inserting a transcoding equipment into the communication path, as far as possible.
- It shall be possible to define the protocols in a way the support mode operation within the call context in a MGW may revert to transparent mode (i.e. without the requiremen to permanently scan IuUP specific control frames) to allow reduction of processing time and HW equipment.

[Note: additional requirements are most likely to be stated for Transcoder Free Operation, possibly in a new chapter]

6 Study Area

6.1 RAB establishment and UP initialisation

[Note: This section introduces RAB assignment and UP initialisation in the light of TrFO. In principle R'99 concepts shall be re-used with some modifications. Appropriate text to be included.]

6.1.1 Initial UP initialisation

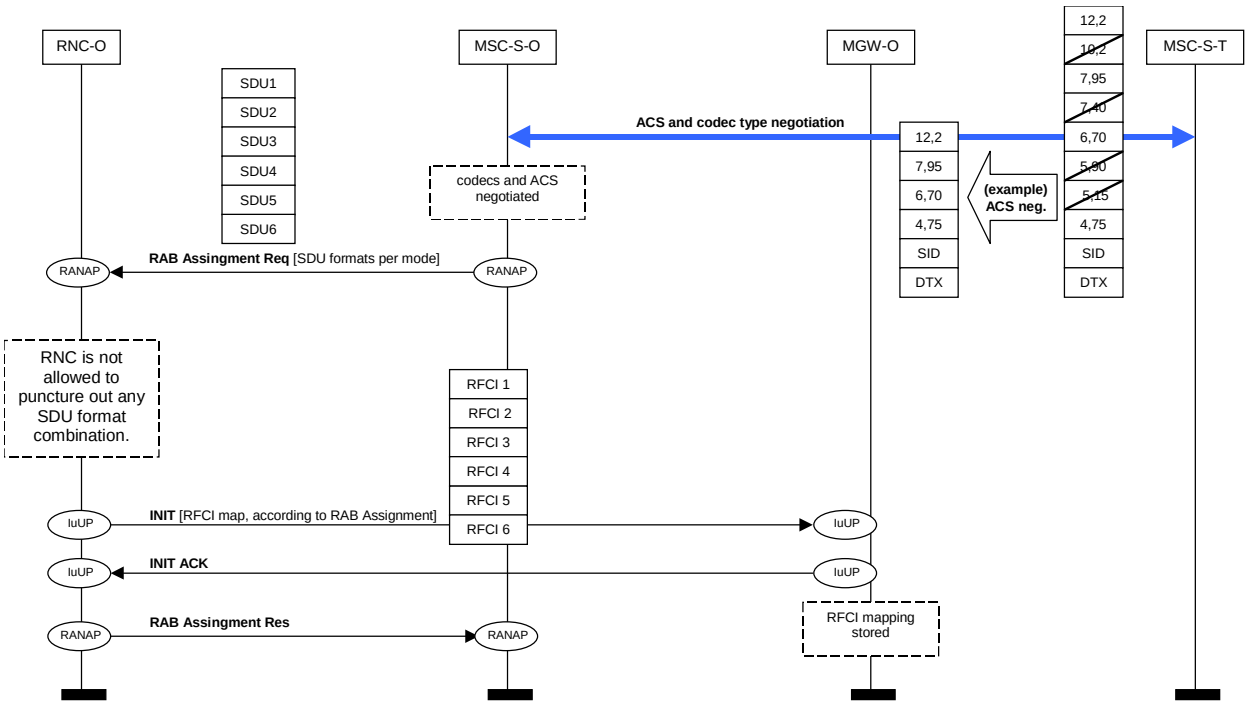

Figure 6/1. Initialisation procedure in conjunction with codec negotiation and RAB Assignment.

Figure 6/1 outlines issues that represent additional functionality compared to R'99:

Codec negotiation has to be performed at the very start of the setup-phase. Involved parties: MSC-Servers, that serve the calling/called UE and the served UEs. The UEs only report their capabilities. Codec negotiation implies negotiation of the codec type and active codec set (ACS). (See [3] for further details, outside RAN3 scope.) TrFO specific RAB assignment and UP initialisation may take place after codec negotiation, if TrFO was found possible.

RNC shall accept the number of subflow combinations contained within the RAB ASSIGNMENT REQUEST message. Internal handling of mode restriction will be performed via maximum rate control. (Note: Codec negotiation should be able to avoid unnecessary large number of requested RFCs in RAB Assignment).

When the MSC requests for a RAB to be assigned, it shall always define at least one speech mode SDU (lowest rate), DTX SDU and no data SDU as non-rate controllable. Other SDU formats for higher rates shall be defined as rate controllable.

[Note:ongoing discussion in SA4 and CN4 may change the principle outlined in the paragraph above]

The RNC shall not indicate RABs as successfully established within the RAB ASSIGNMENT RESPONSE message before the UPs of the respective Iu bearers have been successfully initialised.

6.1.2 IuUP Initialisation throughout the CN

The Iu UP Protocol is established throughout the CN in forward direction, i.e. from the originating node (that could be a border GW node, as outlined within Figure 6/2 or an originating RNC) onwards. The initialisation process of the UP will stop at the terminating MGW. The terminating RNC will start the UP initialisation as well, as already defined within R'99.

As outlined within Figure 6/2, the initialisation procedure shall be always acknowledged between peers IuUP protocol entities.

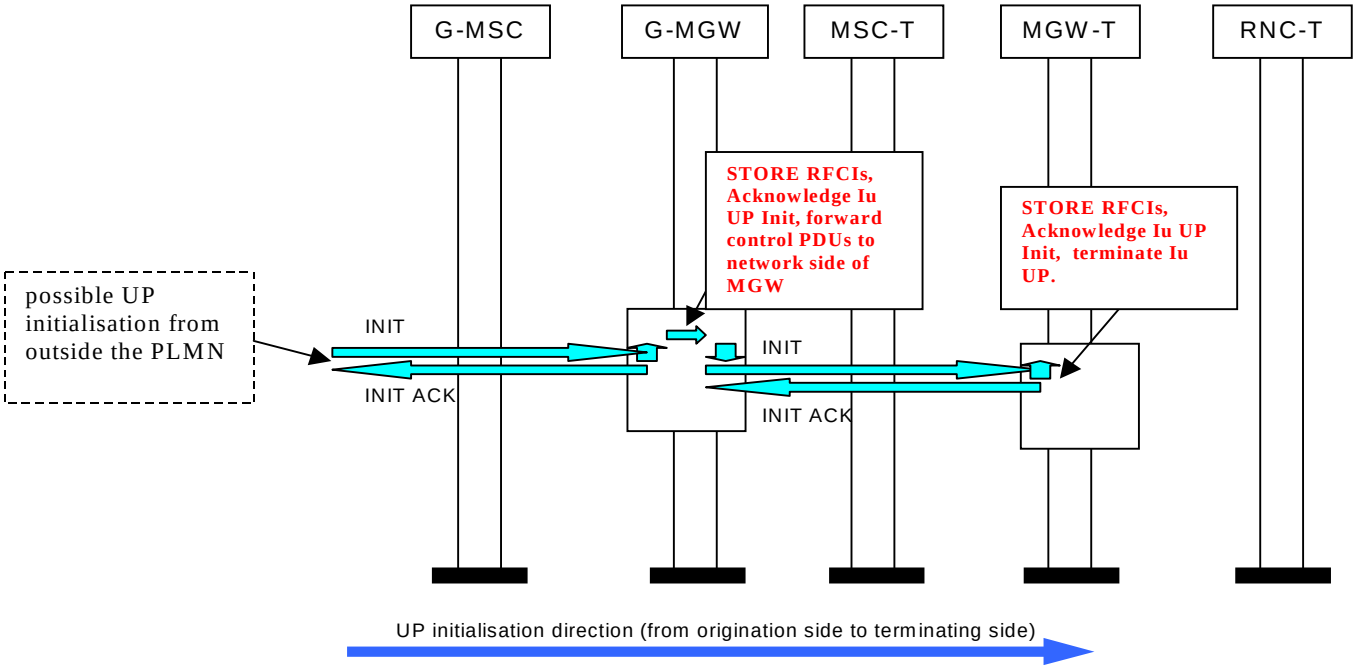

Figure 6/2. Iu UP Establishment up to the terminating MGW.

[Note: RFCI mismatch resolution, i.e. UP re-negotiation as outlined in next chapter, could be incorporated in Figure 6/2 to complete the view of UP establishment.]

The RFCI parameters shall always be stored for that Iu UP termination that received the Iu UP initialisation.

6.1.3 UP re-initialisation

*[Note:in principle two kinds of UP re-initialisation are known: "**RFCI mismatch resolution**" and **" re-initialisation due to SS or relocation/handover interworking"**. content necessary ...*

and: The RNCs are not allowed to issue unsolicited initialisation procedures after the first successfully performed UP initialisation.]

6.1.4 Reversion to transparent mode

If a MGW has two terminations with Iu UP package connected to the same context and both RFCI sets match then the MGW (e.g. T1& T2 and T3&T4 in Figure 4/2) may switch to Iu UP transparent mode – no monitoring of the Iu frames is performed, provided that the terminations are connected through. The resulting user plane configuration (according to Figure 4/2) can be found in Figure 6/3 below:

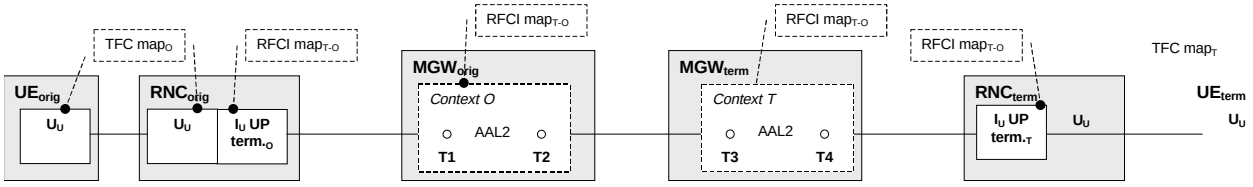

Figure 6/3. Optional removal of IuUP protocol terminations within MGWs.

6.2 Inband Rate Control

[Note: some nice words, see also ref.[12]]

6.2.1 Distributed and Maximum Rate Control

Inband rate control shall only allow the RNCs to set the maximum codec mode (maximum bitrate) from the set of codec modes that have been negotiated out of band. This procedure is called Maximum Rate Control. In TrFO maximum rate control shall be supported by the peer Iu UP protocol entities. The maximum rate control procedures needs to be defined within the Iu UP protocol [8].

The final maximum rate results from a rate control request from one side and the maximum rate supported at the side that receives the rate control request; the lower rate of these two is selected. This is known as Distributed Rate Decision. Figure 6/3 outlines the principle.

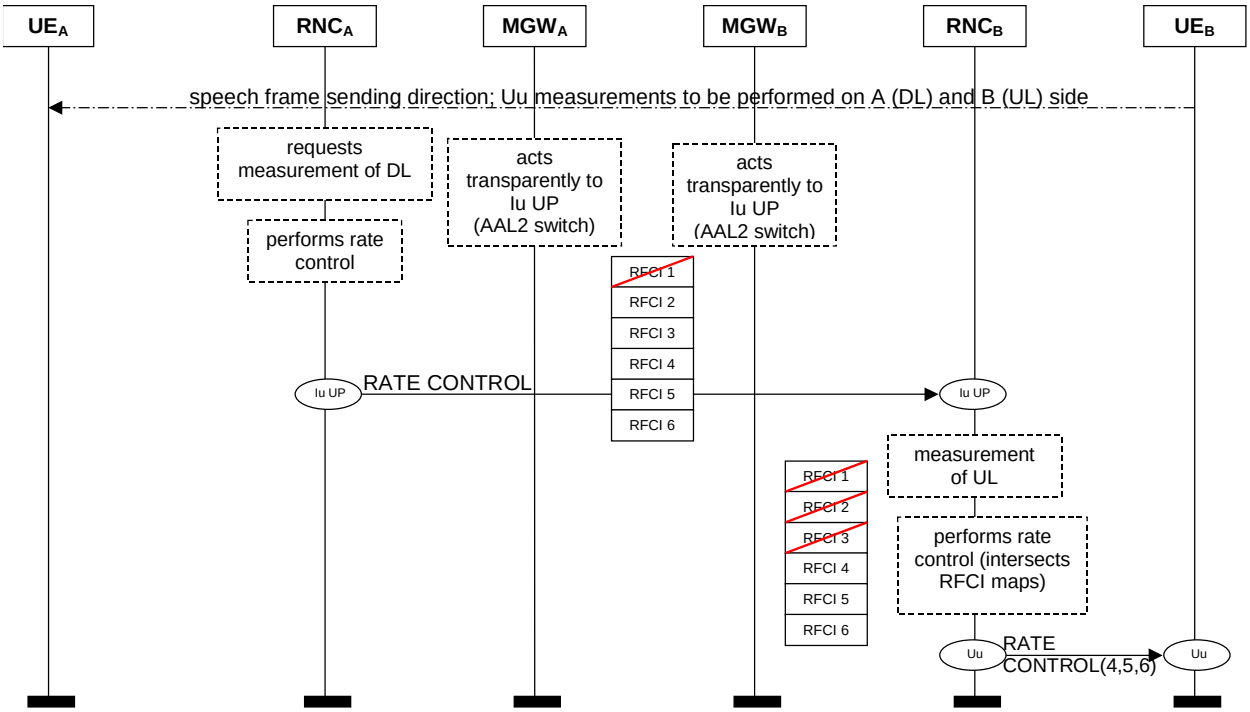

Figure 6/4. Distributed - and Maximum Rate Control Principle.

[Note: in Figure 6/4 RFCI's are ordered according to their bitrate, i.e. "RFCI 1" corresponds to the highest bitrate. This should be incorporated either within text of this section or within Figure 6/4.]

Evaluating the appropriate codec mode for sending speech frames from UE_B to UE_A, two measurement processes are involved: UL for UE_B and DL for UE_A. RNC_A requests UE_A's DL measurement and performs the appropriate rate control action (if necessary). It is not allowed to puncture out any mode of the ACS with a bitrate below the maximum allowed just evaluated. RNC_B performs UL measurement for UE_B as well and might, if the UL quality is worse, reduce the maximum rate. The resulting maximum rate will be sent to UE_B, which is now able to sent speech frames of that mode, that fits in the radio conditions on both air interfaces.

Whereas in R'99 a peer IuUP protocol entity performing rate control is allowed to indicate any mode-vector within the rate control frame, it is not allowed in Rel4 to puncture out any mode below a certain rate, to avoid non-matching mode vectors in the peer IuUP protocol entity that receives the rate control frame.

6.2.2 Immediate Rate Control

At SRNS relocation the new RNC shall send a rate control frame at Relocation Detect indicating its current maximum rate, it will receive in the acknowledgement the current maximum rate from the far end. This procedure is called Immediate Rate Control. Again the distributed rate decision means both RNCs will operate within a common limit.

Figure 6/5 outlines this principle.

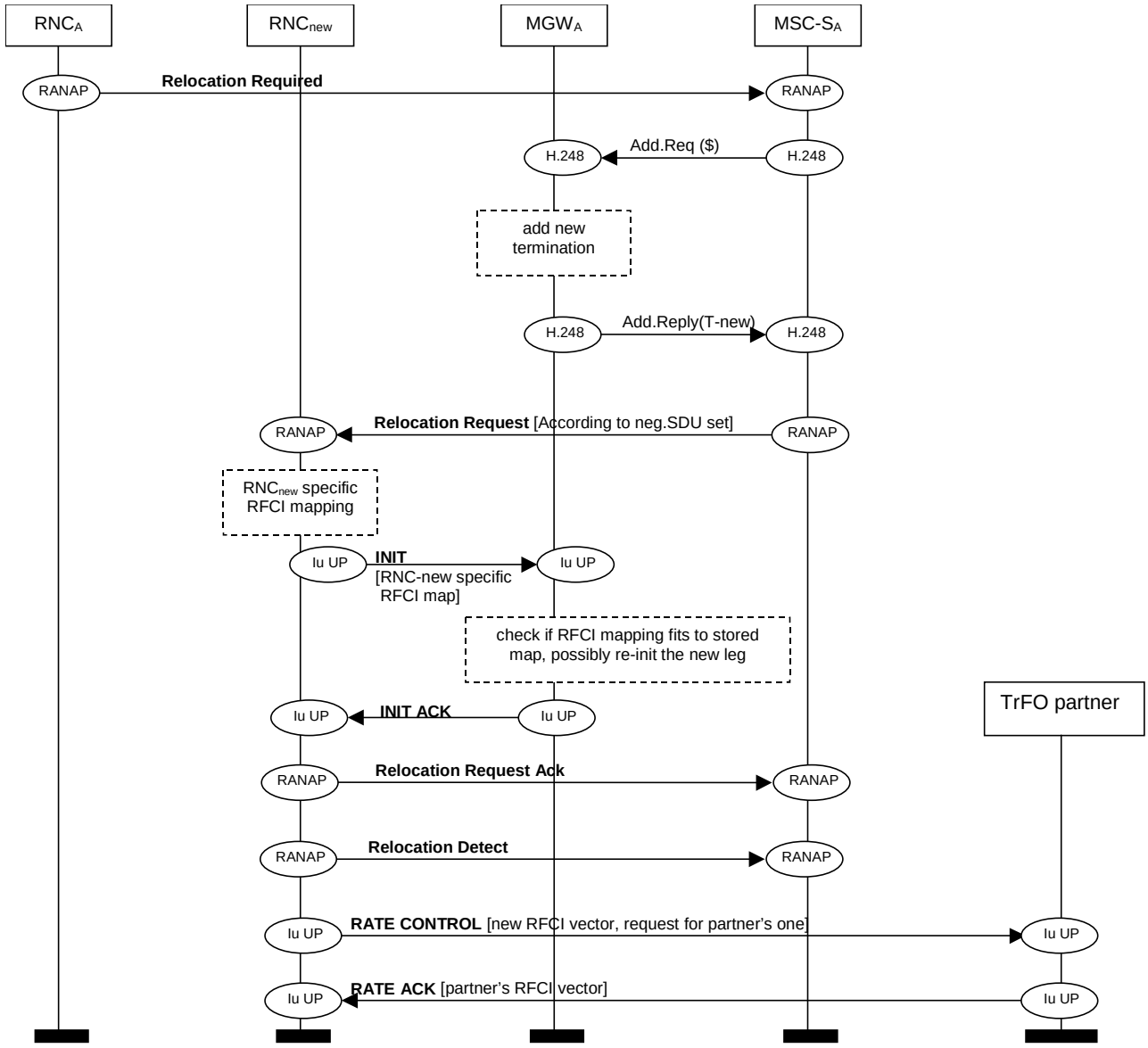

Figure 6/5. Immediate Rate Control.

6.3 Required behaviour of an Iu UP protocol entity

[Note: whether all requirements have to be outlined – in a general manner – within [8] or only within a possible CN3 TS "Application of IuUP on Nb" is to be discussed with CN3 and ffs. This list is a slightly modified list of requirements contained within [3], chapter 5.4.5]

As outlined within Figure 6/2, the initialisation procedure shall always be acknowledged between peer IuUP protocol entities.

The RFCI parameters shall always be stored for that Iu UP termination that received the Iu UP initialisation.

If a MGW has Iu UP termination property Initialisation Procedure = Incoming then it expects to receive an Initialisation (either internally or externally).

If a MGW has Iu UP termination property Initialisation Procedure = Outgoing then it generates a network originated Initialisation PDU.

[Note : it seems that possibly a SAP has to be specified somewhere to indicate, that the Mc interface influences the behaviour of an Iu UP protocol termination]

If a MGW has two terminations in the same context defined as supporting Iu UP package, then on receipt of an Iu Initialisation procedure from one side it shall forward the Iu UP initialisation procedure on to the peer MGW. This procedure shall be performed independently of the through-connection of the terminations in the context, but is dependent on the bearer connection from the other termination to its peer MGW being established.

[Note: the paragraph above again raises the question, whether an additional SAP needs to be defined for communication between Iu UP protocol terminations within a context. Again, this depends of what will be agreed to be specified within RAN3 and CN3 specifications]

If a MGW has one termination with Type = Iu-RAN and one with type Iu-CN in the same context then no forwarding of Iu UP initialisation out from the Iu-RAN termination shall be performed until an Iu UP initialisation has been received at the Iu-RAN side. If the RFCI values stored at the Iu-CN termination do not match the RFCI values stored at the Iu-RAN side then "RFCI Matching" may be performed to the Iu-RAN side – Iu UP initialisation is sent with the RFCI values from the Iu-CN side. No "RFCI Matching" is permitted at the Iu-CN side.

"RFCI Matching" may be delayed if terminations are not connected-through, triggered by connection modification otherwise it shall be performed immediately, this is an implementation option.

If "RFCI Matching" is not performed the MGW shall map the indexes for Iu frames from one side to the RFCI indexes from the other side.

If a MGW has two Iu-RAN terminations connected to the same context then the "RFCI Matching" is performed to the termination latest defined.

[Note: RFCI Matching is a prerequisite for performing TrFO. However, the point in time when it is performed is considered to be an implementation issue.]

If a H.248 procedure is received when a MGW is in transparent mode (but Iu UP is defined as support mode) that requires interpretation or interaction with the Iu UP then the MGW shall switch back to support mode, i.e. perform monitoring or termination of the Iu UP protocol.

7 Selected Solution

[Note: This section will contain a list of agreements that have been reached in RAN3 on this work item.]

8 Specification Impact and Associated Change Requests

[Note: impact on procedural descriptions within TS 25.413 a TS 25.415 is most likely. Impacts on general TSs and RAN3 change control like TS 25.401 and 25.410 needs to be checked]

9 Communication with other WGs

[Note: this section will contain issues to be communicated with other groups, most likely with CN3 and CN4 and the status of these issues.]

10 Project Plan

10.1 Schedule

Date	Meeting	Scope	[expected] Input	[expected]Output

10.2 Work Task Status

	Planned Date	Milestone	Status
1.			
2.			

11 History

Document history		
V0.0.0	2000-11	Scope and document outline
V0.0.1	2000-11	first content proposal
V0.0.2	2000-11	revision due to RAN3#17 discussions, ready for e-mail discussion till 2000-11-29
V0.0.3	2000-11	revision due to e-mail discussions
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