3GPP TSG CN Plenary **Tdoc NP-0007261~~7~~**
Meeting #10, Bangkok, Thailand
6th – 8th December 2000

Title: **R99 Lossless Relocation for UMTS**

Source: **TSG CN Plenary**

To: **TSG RAN, TSG RAN WG3**

Cc: **TSG SA WG2**

Contact Person:

Name: **Yun-Chao Hu (Ericsson)**
E-mail Address: **Yun-Chao.Hu@era.ericsson.se**
Tel. Number: **+46 70 211 3857**

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1. Overall Description:

TSG CN received a LS from WG CN4 on the issue of R99 Lossless Relocation for UMTS (NP-000593). This LS identified a misalignment between the specifications TS 23.060 & TS 29.060. Within TS 23.060 and TS 25.413 the R99 Lossless SRNS Relocation describes the situation of an Y-shaped GTP tunnel between "Source RNC" & "SGSN" and "Target RNC".

Within TS 29.060 it has been explicitly stated that "*no two remote GTP-U endpoints shall send traffic to a GTP-U protocol entity using the same TEID value*", which excludes the possibility of an Y-shaped GTP tunnel.

Two solutions have been identified to solve this misalignment:

1. Use a totally separate tunnel for forwarding and "regular" Iu. This is estimated that it would require new IE in RANAP, and changes to TS 23.060).
2. Modify the rule in GTP (29.060), to allow this scenario in the case of data forwarding.

TSG CN has reviewed the two mentioned solutions and concluded that the working assumption shall be solution 2. This means that work to resolve the ~~for~~ R99 Lossless Relocation problem can assume the ~~should~~ use of Y-shaped GTP tunnels. ~~However, (some) delegate(s) raised some concerns, but these concerns needs to be raised at the WG CN4. TSG CN is confidant that the concerns will be adequate addressed.~~ However there are open issues with the Y-shaped GTP tunnel identified ~~proposal~~ and CN4 is requested to ensure that all technical issues are resolved.

2. Actions:

To TSG RAN, WG RAN3 group.

ACTION: TSG CN asks TSG RAN and WG RAN3 to note the working assumption TSG CN has been taken on the R99 Lossless Relocation. ~~It also asks TSG RAN and WG RAN3 to note that the same mechanism can be used for the Real Time SRNS Relocation for PS Domain RABs~~

3. Attachments:

NP-000593.

3GPP TSG CN Plenary **Tdoc NP-000593**
Meeting #10, Bangkok, Thailand
6th – 8th December 2000

Agenda item: 5.1

3GPP TSG-CN4 *Tdoc N4-001120*
#05 Meeting, Paris, FRANCE
13th November – 17th November 2000

Title: LS on R99 Lossless Relocation for UMTS to TSG_CN

Source: TSG_CN WG4

To: TSG_CN

Cc: SA2, RAN3

Contact Person:

Name: **Ahti Muhonen**
E-mail Address: **Ahti.Muhonen@nokia.com**
Tel. Number: +358 (40) 5318469

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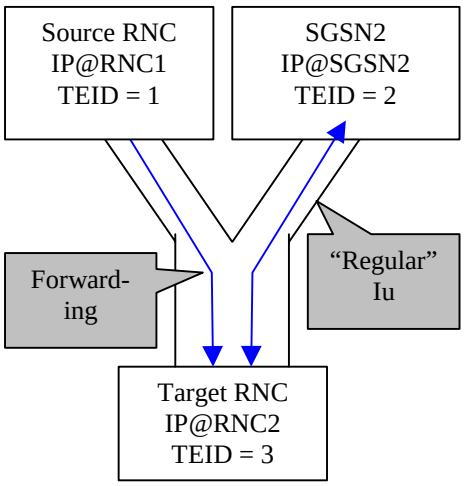
1. Overall Description:

CN4 would like to inform TSG-CN on our discussions on R99 Lossless Relocation for UMTS. There are currently two possible solutions that have been identified. There was a heavy debate on the R99 Lossless Relocation for UMTS but no consensus has been reached. Most of the companies in CN4 preferred the **solution 2**, but one company wanted to have **solution 1**.

1.1. The Problem

There is an apparent contradiction between 23.060 and 29.060 on the Release 99 lossless SRNS Relocation mechanism. In the current specifications for the R99 packet-forwarding scheme for lossless relocation (i.e. RANAP (25.413) and 23.060), it appears that, from the perspective of the target RNC, a single tunnel is used for "regular" Iu traffic and for data forwarding from the source RNC. In other words, there is a tunnel with three terminations, as shown below:



In 29.060, this appears to be strictly forbidden, when it is stated that (in v.3.3.0):

"The TEID in the GTP-U header is used to de-multiplex traffic incoming from remote tunnel endpoints so that it is delivered to the User plane entities in a way that allows multiplexing of different users, different packet protocols and different QoS levels. Therefore ***no two remote GTP-U endpoints shall send traffic to a GTP-U protocol entity using the same TEID value****."*

It is believed that there will be no duplication of PDUs between the two sources, although the PDUs may not arrive in sequence. There has been identified two possible solutions: for the problem

Solution 1: Use a totally separate tunnel for forwarding and “regular” Iu (would need new IE in RANAP, and changes to 23.060).

Solution2: Modify the rule in GTP (29.060), to allow this scenario in the case of data forwarding.

2. Actions:

To TSG_CN:

ACTION: CN4 kindly asks **TSG_CN** to provide the guidance for solving the contradiction between 23.060 and 29.060 on the Release 99 lossless SRNS Relocation mechanism. It is clear that CN4 cannot reach decision by consensus between solutions, so CN4 asks TSG_CN to decide between the possible solutions. If this is not possible, this issue should be brought up in TSG_SA meeting.

3. Attachments:

N4-000943, N4-000959, N4-001022, N4-001044, N4-001054.

4. The next CN4 meeting

The next CN4 meeting will be held 15th – 19th January 2001 in Beijing.

T-doc N4-000943

3GPP TSG-CN4
Paris, France
13th Nov. – 17th Nov. 2000

Title:	**Proposed LS back to RAN3 on R99 Lossless Relocation for UMTS**
From:	**NEC (will be CN4)**
To:	**RAN3**
Cc:	**SA2**

Contact Person:

Name: **NEC, Toshiyuki Tamura (+81-471-85-6901)**
E-mail Address: **tamurato@nsf.ncos.nec.co.jp**

CN4 would like to inform RAN3 of our decision on R99 Lossless Relocation for UMTS that has been identified by the LS R3-(00)2874.

Issue 1

N4 recognised the problem that described in the LS R3-(00)2874.
N4 prefers to modify the current rule in GTP in order to allow the scenario stated in the LS. The expected modification to the 29.060 is shown below. The reason to choose this approach is to minimise the impact to the current R99 specifications.

> The TEID in the GTP-U header is used to de-multiplex traffic incoming from remote tunnel endpoints so that it is delivered to the User plane entities in a way that allows multiplexing of different users, different packet protocols and different QoS levels. Therefore no two remote GTP-U endpoints shall send traffic to a GTP-U protocol entity using the same TEID value **except the data forwarding in SRNS relocation and Routing Area Update procedures.**
>
> **Note: The RED COLORED WORDS may be added.**

CN4 will wait a LS from RAN3 to inform us a final decision on this issue. Thereafter, CN4 will start an appropriate CR work to the 29.060.

Issue 2

CN4 also believes that SA2 is an appropriate WG to make a decision on this issue. Please inform us whenever a decision will have been made.

TSG-RAN Working Group 3 meeting #16 ***N4-000959***

Windsor, UK 16-20 October 2000 ***(TSGR3#16(00)2874)***

Agenda Item: xx

Source: BT

Title: Proposed LS to N4 and S2 on R99 Lossless Relocation for UMTS

Document for: Approval

To: **TSG CN WG4, TSG SA WG2**

From: **TSG RAN WG3**

Subject: **R99 Lossless Relocation for UMTS**

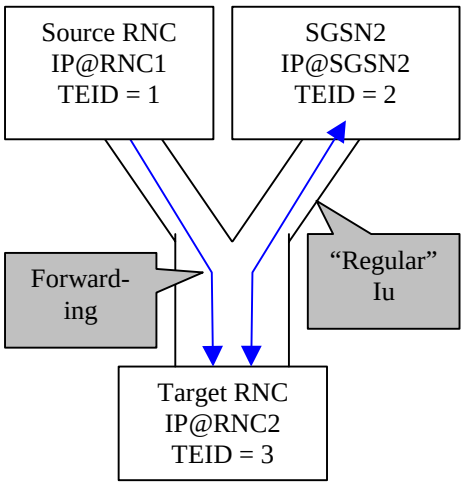
Contact: richard.townend@bt.com

RAN3 respectfully asks N4 and S2 to consider the following issues and provide some clarification:

Issue 1:

During a discussion on the Release 99 lossless SRNS Relocation mechanism, an apparent contradiction between 23.060 and 29.060 was identified, leading to some confusion in RAN3.

In the current specifications for the R99 packet-forwarding scheme for lossless relocation (i.e. RANAP (25.413) and 23.060), it appears that, from the perspective of the target RNC, a single tunnel is used for "regular" Iu traffic and for data forwarding from the source RNC. In other words, there is a tunnel with three terminations, as shown below:



In 29.060, this appears to be strictly forbidden, when it is stated that (in v.3.3.0):

"The TEID in the GTP-U header is used to de-multiplex traffic incoming from remote tunnel endpoints so that it is delivered to the User plane entities in a way that allows multiplexing of different users,

different packet protocols and different QoS levels. Therefore ***no two remote GTP-U endpoints shall send traffic to a GTP-U protocol entity using the same TEID value****."*

R3 believes that there will be no duplication of PDUs between the two sources, although the PDUs may not arrive in sequence.

R3 has identified two possible solutions:

- use a totally separate tunnel for forwarding and "regular" Iu (would need new IE in RANAP, and changes to 23.060)
- modify the rule in GTP, to allow this scenario in the case of data forwarding

R3 asks S2 and N4 to confirm that the contradiction exists, and to make a decision as to which solution is preferred.

Issue 2:

During the same discussion, it was also raised that it is currently unclear which node is responsible for deciding which RABs are "subject to data forwarding" and which can sustain data loss.

It appears (from the RRC specification, 25.331) that the Source RNC indicates whether each RAB is to be handled as lossless to the Target RNC in the RRC transparent container (in the PDCP Info IE).

The Target SGSN sends "one or more" "RNC Tunnel Endpoint Identifiers and RNC IP address for data forwarding" to the Source SGSN.

The Source SGSN sends TEID/IP addresses to the Source RNC for "RABs subject to data fowarding".

It is not clear to R3 whether the decision to perform data forwarding should be made in the RAN or the CN, and how this information is shared with **all** necessary nodes.

For example, if the SGSN makes the decision, this needs to be communicated to the Source RNC and the Target SGSN (the Target RNC already receives the information from the Source RNC). Similarly, if the Source RNC makes the decision, this needs to be communicated to both SGSNs.

R3 asks for guidance from S2 as to where the decision to perform data forwarding should occur (CN or RAN) and how the information should be shared between all concerned nodes. Changes may be needed to 23.060, 25.413 and/or 29.060 to reflect the decision.

3GPP-CN4 Meeting # 5
Paris, France 13-17 November 2000

Document N4-001022
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

29.060	CR	155r1	Current Version:	3.6.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: CN#10 *list expected approval meeting # here ↑*	for approval	X	Strategic		*(for SMG use only)*
	for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: Nokia, Alcatel, Siemens **Date:** 9 November 2000

Subject: Adding Uplink TEID for Data I and user plane GGSN address to PDP Context IE

Work item: GTP enhancement

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

Once a SRNS Relocation procedure is underway when MS in PMM-CONNECTED state, the MS may send uplink user data to the new RNC before the new SGSN has updated PDP context(s) with GGSN.

At this point, the new RNC forwards the uplink user data to the new SGSN. According to 23.121 there is no buffering of data in 3G-SGSN. Therefore, the new SGSN has to forward the uplink user packets immediately to GGSN. For that purpose the new SGSN needs to know the GGSN's user plane address and value of appropriate TEID for Data I in GGSN. Note, this would be the same TEID as the old SGSN is still using to forward the user uplink data to GGSN. However, for this moment of time the new SGSN has not received these IEs yet. Hence, the new SGSN shall drop the packets. As long as packet discarding must not take place, there is a problem that must be solved.

This CR solves the problem by adding the Uplink TEID for Data I and GGSN user plane address to the PDP Context IE. In such case, the old SGSN shall send Uplink TEID for Data I and GGSN user plane address to the new SGSN at the early stage of the SRNS Relocation Procedure. Namely, these IEs shall be carried by PDP Context IE in the Forward Relocation Request message. With this solution the packets shall not be dropped.

This change would align 29.060 with 23.121.

However, this kind of solution requires another modification to 29.060 that is discussed below.

Once new SGSN gets Uplink TEID for Data I and GGSN user plane address at the early stage of the SRNS Relocation Procedure, it shall forward uplink user data to GGSN before PDP context has been updated with GGSN. Delays in packet delivery may result in a situation when GGSN shall receive user data with the same TEID value both from the old and the new SGSNs.

However, currently spec requires, that no two remote GTP-U endpoints should send traffic to a GTP-U protocol entity using the same TEID value. In all the cases, but a short period of time during the SRNS Relocation Procedure, this shall hold without an explicit statement in the specification.

The CR proposes to lift the restriction and solve this new problem as well.

Clauses affected: 7.7.29; 9.1.

Other specs affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments:


help.doc

<--------- double-click here for help and instructions on how to create a CR.

7.7.29 PDP Context

The PDP Context information element contains the Session Management parameters, defined for an external packet data network address, that are necessary to transfer between SGSNs at the Inter SGSN Routeing Area Update procedure.

NSAPI is an integer value in the range [0; 15].

The NSAPI points out the affected PDP context.

The SAPI indicates the LLC SAPI that is associated with the NSAPI.

The Transaction Identifier is the 4 or 12 bit Transaction Identifier used in the 3G TS 24.008 Session Management messages which control this PDP Context. If the length of the Transaction Identifier is 4 bit, the second octet shall be set to all zeros. The encoding is defined in 3G TS 24.007. The latest Transaction Identifier sent from SGSN to MS is stored in the PDP context IE.

Reordering Required (Order) indicates whether the SGSN shall reorder T-PDUs before delivering the T-PDUs to the MS. When the Quality of Service Negotiated (QoS Neg) is Release 99, the Reordering Required (Order) shall be ignored by receiving entity.

The VPLMN Address Allowed (VAA) indicates whether the MS is allowed to use the APN in the domain of the HPLMN only or additionally the APN in the domain of the VPLMN.

The QoS Sub Length, QoS Req Length and QoS Neg Length represent respectively the lengths of the QoS Sub, QoS Req and QoS Neg fields, excluding the QoS Length octet.

The Quality of Service Subscribed (QoS Sub), Quality of Service Requested (QoS Req) and Quality of Service Negotiated (QoS Neg) are encoded as described in section ‘Quality of Service (QoS) Profile’. Their minimum length is 4 octets; their maximum length may be 255 octets.

The Sequence Number Down is the number of the next T-PDU that shall be sent from the new SGSN to the MS. The number is associated to the Sequence Number from the GTP Header of an encapsulated T-PDU.

The Sequence Number Up is the number that new SGSN shall use as the Sequence Number in the GTP Header for the next encapsulated T-PDU from the MS to the GGSN.

The Send N-PDU Number is used only when acknowledged peer-to-peer LLC operation is used for the PDP context. Send N-PDU Number is the N-PDU number to be assigned by SNDCP to the next down link N-PDU received from the GGSN. It shall be set to 255 if unacknowledged peer-to-peer LLC operation is used for the PDP context.

The Receive N-PDU Number is used only when acknowledged peer-to-peer LLC operation is used for the PDP context. The Receive N-PDU Number is the N-PDU number expected by SNDCP from the next up link N-PDU to be received from the MS. It shall be set to 255 if unacknowledged peer-to-peer LLC operation is used for the PDP context.

The Up link Tunnel Endpoint Identifier Control Plane is the Tunnel Endpoint Identifier used between the old SGSN and the GGSN in up link direction for control plane purpose. It shall be used by the new SGSN within the GTP header of the Update PDP Context Request message.

The GGSN address for user traffic and the Up-link Tunnel Endpoint Identifier User Plane are the GGSN address and the Tunnel Endpoint Identifier used between the old SGSN and the GGSN in up-link direction for user plane traffic on a PDP context. They shall be used by the new SGSN to send uplink user plane PDU (until possibly superseded by a new value received in Update PDP Context Response message from GGSN).

The PDP Context Identifier is used to identify a PDP context for the subscriber.

The PDP Type Organisation and PDP Type Number are encoded as in the End User Address information element.

The PDP Address Length represents the length of the PDP Address field, excluding the PDP Address Length octet.

The PDP Address is an octet array with a format dependent on the PDP Type. The PDP Address is encoded as in the End User Address information element if the PDP Type is IPv4 or IPv6.

The GGSN Address Length represents the length of the GGSN Address field, excluding the GGSN Address Length octet.

The old SGSN includes the GGSN Address for control plane that it has received from GGSN at PDP context activation or update.

The APN is the Access Point Name in use in the old SGSN. I.e. the APN sent in the Create PDP Context request message.

The spare bits x indicate unused bits that shall be set to 0 by the sending side and which shall not be evaluated by the receiving side.

1	Type = 130 (Decimal)				
2-3	Length				
4	Res-erved	VAA	Res-erved	Order	NSAPI
5	X	X	X	X	SAPI
6	QoS Sub Length				
7 - (q+6)	QoS Sub [4..255]				
q+7	QoS Req Length				
(q+8)-(2q+7)	QoS Req [4..255]				
2q+8	QoS Neg. Length				
(2q+9)-(3q+8)	QoS Neg [4..255]				
(3q+9)-(3q+10)	Sequence Number Down (SND) [1)]				
(3q+11)-(3q+12)	Sequence Number Up (SNU) [1)]				
3q+13	Send N-PDU Number [1)]				
3q+14	Receive N-PDU Number [1)]				
(3q+15)-(3q+18)	Uplink Tunnel Endpoint Identifier Control Plane				
(3q+19)-(3q+22)	Uplink Tunnel Endpoint Identifier for Data I				
3q+23~~19~~	PDP Context Identifier				
3q+24~~0~~	Spare 1 1 1 1				PDP Type Organisation
3q+25~~1~~	PDP Type Number				
3q+26~~2~~	PDP Address Length				
(3q+27~~3~~)-m	PDP Address [1..63]				
m+1	GGSN Address for control plane Length				
(m+2)-n	GGSN Address for control plane [4..16]				
n+1	GGSN Address for user plane Length				
(n+2)-o	GGSN Address for user plane [4..16]				
~~n~~o+1	APN length				
(~~n~~o+2)-~~p~~o	APN				
~~o~~p+1	Spare (sent as 0 0 0 0)				Transaction Identifier
~~O~~p+2	Transaction Identifier				

Figure 43: PDP Context Information Element

1) This field shall not be evaluated when the PDP context is received during UMTS intra system handover/relocation.

Table 48: Reordering Required Values

Reordering Required	Value (Decimal)
No	0
Yes	1

Table 49: VPLMN Address Allowed Values

VPLMN Address Allowed	Value (Decimal)
No	0
Yes	1

*** *Next Modification* ***

9 GTP-U

GTP-U Tunnels are used to carry encapsulated T-PDUs between a given pair of GTP-U Tunnel Endpoints. The Tunnel Endpoint ID (TEID) which is present in the GTP header shall indicate which tunnel a particular T-PDU belongs to. In this manner, packets are multiplexed and de-multiplexed by GTP-U between a given pair of Tunnel Endpoints. The TEID value to be used in the TEID field shall be negotiated for instance during the GTP-C Create PDP Context and the RAB assignment procedures that take place on the control plane.

The maximum size of a T-PDU that may be transmitted without fragmentation by GGSN or the MS is defined in UMTS 23.060. The GGSN shall fragment, reject or discard T-PDUs, depending on the PDP type and implementation decisions, directed to the MS if the T-PDU size exceeds the maximum size. The decision if the T-PDUs shall be fragmented or discarded is dependent on the external packet data network protocol.

9.1 GTP-U Protocol Entity

The GTP-U protocol entity provides packet transmission and reception services to user plane entities in the GGSN, in the SGSN and, in UMTS systems, in the RNC. The GTP-U protocol entity receives traffic from a number of GTP-U tunnel endpoints and transmits traffic to a number of GTP-U tunnel endpoints. There is a GTP-U protocol entity per IP address.

The TEID in the GTP-U header is used to de-multiplex traffic incoming from remote tunnel endpoints so that it is delivered to the User plane entities in a way that allows multiplexing of different users, different packet protocols and different QoS levels. ~~Therefore~~

In a handover or relocation phase, ~~no~~ two different remote GTP-U endpoints ~~shall~~ may send traffic to a GTP-U protocol entity at the GGSN using the same TEID value. The traffic from both GTP-U endpoints belongs to only one bearer service of the same user.

3GPP-CN4 Meeting # 5 **Document N4-001044**
Paris, France 13-17 November 2000

Source: **Nortel Networks**

Title: **Handling of GTP-U packets in the UL direction during relocation**

Document for: **Discussion**

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1. Introduction and Background

This document discusses the proposal made in the contribution in Tdoc 1022 Uplink TEID for Data I and user plane GGSN address to PDP Context IE (GTP Enhancement).

As explained in this updated version of the proposal after Tdoc 970, the proposal to add a TEID inside the PDP context IE can result in a Y shape configuration at the GGSN. Therefore to introduce this change would mean that GTP implementations in particular at the GGSN and at the RNC would be changed from the current design.

The implications of enabling this Y shape configuration in GTP should be carefully analysed before making such a change.

There is a liaison on this subject that was sent from RAN3 to SA2 and CN4. Therefore a decision can not be made without discussing the liaison, seeking SA2's opinion and exploring other ways of fixing the R99 problem, if there is indeed one. Note that there is no request from any other group to fix a potential problem with the uplink packets in R99.

2. Possible handlings of uplink packets

Here are some possible ways that the uplink buffering can be handled with the current R99 data forwarding mechanism mechanism (it should be noted that these are not all considered to be equally sensible!):

1. Buffer the UL packets at the 3G-SGSN. This is not prevented by the current text in 23.121 because the current text only applies to downlink. It says: "Since the 3G-SGSN does not buffer downstream data, the source RNC may have to buffer ..."
Also the title of the whole paragraphs related to data forwarding refer to "downstream data". It can therefore be argued that there is no problem with the UL handling today.
Indeed it was the understanding in the RAN3 group when the UL handling was discussed, that there is no issue with the UL handling today, because buffering is acceptable for non real-time services and therefore for R99. This is why the problem highlighted by RAN3 on this subject, only applies to release 4, not to release 99.

2. Use the procedure as defined today and agree that there can be some packet loss UL.

3. Forward the TEID from SGSN1 to SGSN2. However this will result in the Y shape configuration at the GGSN, since the same TEID will be used at the GGSN for the old and the new path. Also the failure cases when there is an error in the GGSN, need to be studied.

4. Use separate Update PDP context request messages from SGSN to GGSN, the first one to update the UL path (at the beginning of the relocation), and the second one to update the DL path

at the end of the procedure. Doing this does not require to hold up the Handover command over the radio more than today, since the update PDP messages can be sent from the SGSN2 to the GGSN while in parallel sending the Relocation Request over the Iu to the target RNC.

5. Use a bi-directional tunnel between the 2 RNCs. The forwarding tunnel would be used for both UL and DL packets.

6. Buffer the UL packets at the target RNC. This will require a new RANAP procedure for the SGSN to indicate to the RNC that it can now send UL packets to it.

7. Buffer the UL packets at the UE. This will require a new RANAP/RRC procedure or a new MM message for the SGSN to indicate to the UE that it can now send UL packets to it.

8. Buffer the DL and UL packets at the SGSNs. Potentially add some forwarding from source to target SGSNs. In this case, the forwarding tunnel between RNCs is not used.

Considering that enabling the Y shape configuration (a result of solution 3):

- Would restrict the current implementations which may have put hooks in place to prevent this to happen at the GGSN (or at the RNC).
- May create new error cases if the GGSN detects any GTP-U errors in UL packets.
- Would prevent to have the GTP-U tunnel SGSN1-GGSN and the GTP-U tunnel SGSN2-GGSN on separate VPNs.
- Is likely to cause an error in the GGSN because the GTP sequence numbers received on the same TEID at the GGSN would be reset to 0 when the target SGSN takes over
- Can not be decided before SA2 has answered the liaison on this very subject
- Is not required for Rel99

It is not a decision that should be made unless other solutions have been explored. Using different TEIDs at the GGSN as done today and as has been done so far in GRPS, is a much cleaner solution.

3. Proposal

Therefore it is proposed to discuss the other options. It should be demonstrated first that there is indeed a problem in Release 99 rather than in Release 4.
If there is indeed an issue, this has to be agreed with other groups and clarified in other specifications. CN4 could fix the problem by using solution 4 above. Other solutions would require other groups' input. In any case appropriate co-ordination and agreements with other groups is needed.

3GPP-CN4 Meeting # 5 **Document N4-00xxxx**

Paris, France 13-17 November 2000

Source: **Nortel Networks**

Title: **Handling of GTP-U packets in the UL direction during relocation**

Document for: **Discussion**

---

1. Introduction and Background

This document discusses the proposal made in the contribution in Tdoc 1022 Uplink TEID for Data I and user plane GGSN address to PDP Context IE (GTP Enhancement).

As explained in this updated version of the proposal after Tdoc 970, the proposal to add a TEID inside the PDP context IE can result in a Y shape configuration at the GGSN. Therefore to introduce this change would mean that GTP implementations in particular at the GGSN and at the RNC would be changed from the current design.

The implications of enabling this Y shape configuration in GTP should be carefully analysed before making such a change.

Y shape tunneling may take place in R98- netwok during the RAU. The new SGSN sends the SGSN Context Acknowledge message to the old SGSN and threrafter the new SGSN starts forwarding the buffered packets to the new SGSN. Meanwhile, PDP Cntext may be updated and the GGSN shall start forwarding the packets to the new SGSN as well.

Note: in R99 we have Y shape tunnels over Iu interface to the tagret RNC. The old SRNC starts forwarding the buffered data to the target RNC – first Iu tunnel. While data transfer is underway, target RNC starts to receive DL packets – second Iu tunnel.

There is a liaison on this subject that was sent from RAN3 to SA2 and CN4. Therefore a decision can not be made without discussing the liaison, seeking SA2's opinion and exploring other ways of fixing the R99 problem, if there is indeed one. Note that there is no request from any other group to fix a potential problem with the uplink packets in R99.

2. Possible handlings of uplink packets

Here are some possible ways that the uplink buffering can be handled with the current R99 data forwarding mechanism mechanism (it should be noted that these are not all considered to be equally sensible!):

1. Buffer the UL packets at the 3G-SGSN. This is not prevented by the current text in 23.121 because the current text only applies to downlink. It says: "Since the 3G-SGSN does not buffer downstream data, the source RNC may have to buffer ..."

23.121v3.4.0 reads the following:

4.2.2.1.3 Requirements for data retrieve in UMTS

NOTE: This subclause deals with the case of SRNS relocation and of UMTS hard hand-over (when this hard hand-over involves also the CN i.e. involves a change of Serving RNC).

Since:

- there is no buffering in the 3G-SGSN;
- there is an ARQ mechanism in the Serving RNC (the RLC layer) similar to the LLC layer in the 2G-SGSN;
- the data reliability is ensured by the transfer of non-acknowledged user data from the Source RNC to the Target RNC. This transfer ("data retrieve") can be performed with a mechanism similar to the one used between 2G-SGSNs in GPRS;
- the Data retrieve between two RNCs belonging to the same UTRAN is required for non real-time data services during a SRNS relocation procedure;
- regarding the SRNS Relocation procedure Control Plane, SRNS relocation procedure uses both RANAP signalling over the Iu and RNSAP signalling over the Iur.

Regarding the user plane, some requirements can be listed:

Synchronisation:

Since the 3G-SGSN does not buffer downstream data, the source RNC may have to buffer all GTP frames that are not yet transmitted or acknowledged at RLC layer. It also has to buffer all GTP frames that continue to arrive from the GGSN (the GGSN continues to send them to the source RNC as long as its PDP context has not been updated by the SGSN. Furthermore, data that are sent by the GGSN may take a certain time to get to the source RNC).

This means that:

The target RNC has to start as Serving RNC just after having received SRNS Relocation Commit message from the source RNC even if all downstream data have not been retrieved yet.

The user data retrieve may last a relatively long time. A timer is armed in the Source SRNC at the beginning of the data transfer phase. The contexts related to the UE in the Source SNRC will be released when the timer expires, i.e. when downstream data from GGSN is considered as finished.

Data reliability:

Depending upon the required reliability, there could be a need for a layer 2 protocol or not. In the GPRS, the user data is transfer via GTP/UPD/IP if the user-to-user data is IP-based, and via GTP/TCP/IP if the user-to-user data is X25-based. Here, only GTP/UDP/IP is considered.

Multiplexing of PDP contexts during data retrieve:

Several SRNS Relocation procedures for different users and/or different bearers may be carried out simultaneously and independently. GTP is used to differentiate the data retrieve contexts.

Associated signalling:

Considering signalling, there are two kinds of signalling:

Signalling linked with transmission of CN parameters. This corresponds to signalling exchanged on Gn between 3G-SGSNs during the (first) phase of resources for the SRNS relocation.

Signalling linked with the transmission of the sequence numbers of the acknowledged protocol (RLC) between SRNC and UE. This can be done over Iur when the source SRNC actually hands-over the role of SRNC (when sending the RNSAP "Relocation commit" to the target SRNS).

Also the title of the whole paragraphs related to data forwarding refer to “downstream data”.

The titles of the sub clauses in question read:

4.2.2 Iu User plane

4.2.2.1 Principles of User Data Retrieve in UMTS and at GSM-UMTS Hand-Over for PS Domain

4.2.2.1.1 Requirements for Data retrieve at GPRS/UMTS handover

4.2.2.1.2 Adopted solution for data retrieve at GPRS-UMTS handover

4.2.2.1.3 Requirements for data retrieve in UMTS

4.2.2.1.4 Adopted solution for data retrieve in UMTS

4.2.2.1.6 User plane protocol stacks for data retrieve between UTRAN and 2G-SGSN

4.2.2.2 Packet buffering in SRNC and transmission of not yet acknowledged downstream packets at SRNC relocation

Hence, it is just sub clause 4.2.2.2 which describes the DL data handling with buffering in RNC

It can therefore be argued that there is no problem with the UL handling today.Indeed it was the understanding in the RAN3 group when the UL handling was discussed, that there is no issue with the UL handling today, because buffering is acceptable for non real-time services and therefore for R99. This is why the problem highlighted by RAN3 on this subject, only applies to release 4, not to release 99.

2. Use the procedure as defined today and agree that there can be some packet loss UL.

3. Forward the TEID from SGSN1 to SGSN2. However this will result in the Y shape configuration at the GGSN, since the same TEID will be used at the GGSN for the old and the new path.

Receiving packets from 2 different sources can happen already to R97 SGSN (from old SGSN; and GGSN on downlink)

Also the failure cases when there is an error in the GGSN, need to be studied.

What failure cases?

4. Use separate Update PDP context request messages from SGSN to GGSN, the first one to update the UL path (at the beginning of the relocation), and the second one to update the DL path at the end of the procedure.

Change to stage 2. An uplink path is defined only by GGSN IP address and TEID. It is better to get these parameter from old SGSN as defined in 23.060 than from the GGSN using a procedure not defined in stage 2). GGSN does not need update.

Doing this does not require to hold up the Handover command over the radio more than today, since the update PDP messages can be sent from the SGSN2 to the GGSN while in parallel sending the Relocation Request over the Iu to the target RNC.

5. Use a bi-directional tunnel between the 2 RNCs. The forwarding tunnel would be used for both UL and DL packets.

Change to stage 2.

6. Buffer the UL packets at the target RNC. This will require a new RANAP procedure for the SGSN to indicate to the RNC that it can now send UL packets to it.

7. Buffer the UL packets at the UE. This will require a new RANAP/RRC procedure or a new MM message for the SGSN to indicate to the UE that it can now send UL packets to it.

8. Buffer the DL and UL packets at the SGSNs. Potentially add some forwarding from source to target SGSNs. In this case, the forwarding tunnel between RNCs is not used.

Considering that enabling the Y shape configuration (a result of solution 3):

- Would restrict the current implementations which may have put hooks in place to prevent this to happen at the GGSN (or at the RNC).
- Which spec does requre to check TEID against sourse IP address? No my knowledge – none. Therefore this kind of checking wold be a non-standard implementation, an should be avoided.
- May create new error cases if the GGSN detects any GTP-U errors in UL packets.
- Which error cases?
- Would prevent to have the GTP-U tunnel SGSN1-GGSN and the GTP-U tunnel SGSN2-GGSN on separate VPNs.
- VPN between nodes are not standardised. VPN between sites is a prefered solution. Anyway if VPN between nodes need to be establish the VPN must be set up before sending packets below GTP
- Is likely to cause an error in the GGSN because the GTP sequence numbers received on the same TEID at the GGSN would be reset to 0 when the target SGSN takes over
- 29.060v3.6.0, clause 6 reads:

  Optional fields:

  - Sequence Number: This field is an optional field in GTP-U T-PDUs. It is used as a transaction identity for signalling messages having a response message defined for a request message and as an increasing

sequence number for T-PDUs, transmitted via GTP-U tunnels, when transmission order must be preserved.

- N-PDU Number: This field is used at the Inter SGSN Routeing Area Update procedure and some inter-system handover procedures (e.g. between 2G and 3G radio access networks). This field is used to co-ordinate the data transmission for acknowledged mode of communication between the MS and the SGSN. The exact meaning of this field depends upon the scenario. (For example, for GSM/GPRS to GSM/GPRS, the SNDCP N-PDU number is present in this field).

- Next Extension Header Type: This field defines the type of Extension Header that follows this field in the G-PDU.

This is in line with 23.060 sections 9.3 and 9.4. In case of losless relocation, an implementation solution for the GGSN to handle the sequenced packets coud be found.

- Can not be decided before SA2 has answered the liaison on this very subject
- SA2 always intended to support the losless relocation, as defined in 23.121
- Is not required for Rel99
- After 23.121, 3G-SGSN should not buffer user data.

It is not a decision that should be made unless other solutions have been explored. Using different TEIDs at the GGSN as done today and as has been done so far in GRPS, is a much cleaner solution.

3. Proposal

Therefore it is proposed to discuss the other options. It should be demonstrated first that there is indeed a problem in Release 99 rather than in Release 4.

If there is indeed an issue, this has to be agreed with other groups and clarified in other specifications. CN4 could fix the problem by using solution 4 above. Other solutions would require other groups' input. In any case appropriate co-ordination and agreements with other groups is needed.

Solution 3 is compliant with the current R99 specs. Besides, it is simple to introduce, doesn't require any relevant changes to the current GSN functionality, provides for losless SRNS relocation and does not require buffering in SGSN. In fact, the buffering in SGSN implyes a need of extra Gigabytes of memory and increases the data exchange delays.

Hence the solution is the best amongst the others.