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Title: Liaison Statement on Maximum size of N-PDU

In 23.107 v3.0.0 sub- section 6.5.1, there is a following statement;

“4) Maximum SDU size shall at least allow UMTS network to support external PDUs having as high MTU as Internet/Ethernet (1500 octets). The need for higher values should be investigated by N1, N3, S1, R2, R3.”

This LS replies N1’s opinion to the above question.

In N1, this topic has been discussed in the last two meetings. According to our study, we find that a maximum SDU size up to 1502 octets has no impact on N1 specifications, see attached N1-99D74.

N1 also see that if S1 has considered it suitable to increase the maximum SDU size then this has got an impact on specifications under S2 control, such as 23.060 and 23.107.

We also would like to ask other concerned WGs to give their opinion on this urgent issue aimed at completion for R99.

Agenda Item: 6.11
WI / Topic: QoS
Source: NTT DoCoMo
Title: Extension of Maximum N-PDU size (Max SDU size)
Effected Specifications / Releases:
Document for: Discussion and Decision
Date: 26th, November, 99

1. Introduction

This paper studies maximum length of N-PDU and proposes extension. Currently the length is fixed in 1500 octets, but new PDP type = PPP has been introduced. In the PPP application, the packet length becomes more than 1500 octets, this cause IP packet segmentation and assembly in MS and GGSN, which increase the processing cost. In order to avoid the fragmentation process, new maximum N-PDU size is proposed.

TS 23.107 mentions that the practical length of Maximum SDU size should be studied in protocol-group rather than architecture group. (Note: in [1], it is shown as Maximum SDU size, instead Maximum N-PDU size in [2]) N1 has received LS which is N1-99B75 from S2 in the last N1 meeting on this investigation. Therefore, our group should decide the practical length and propose the length to the architecture group.

2. Discussion

2.1 Current description on N-PDU size

In [2], the maximum N-PDU size is described as 1500 octets. In [1], there is a note on the necessity of larger values of maximum N-PDU, and it is describes as for further study. When the PDP-type is IP, the received IP packet length (ex, from Ethernet) was 1500 octets, so IP packet fragmentation process has not been occurred at MS and GGSN. But, new PDP-type=PPP was introduced. In case of PPP, the N-PDU size gets always over the 1500 octets.

In [2] section 12.6.3, there is a sentence that the UMTS PPP peers at the MS and GGSN handle the PPP protocol as specified in RFC 1661[4]. The PPP framing format specified in [4] is shown in figure 1. Considering the "protocol" field which is 2octets in Figure 1, the N-PDU size gets always over the 1500 octets.



Figure 1 : PPP framing format specified in RFC1661

2.2 Problem to be solved

According to the description in [2] and also [1], if these N-PDU that over the 1500 octets have to be disposed or disassembled at MS/GGSN. This will cause additional processing loads at the nodes. Additionally in [3] chapter 12.2, the IP fragmentation is recommended to avoid if it is possible, because of increasing additional cost. At first stage of UMTS, it is assumed that PPP based service

make up the most of Packet services. So, This increasing additional cost may be critical issue.

Therefore, in order to avoid PPP packet fragmentation, extension of maximum N-PDU size to be considered. Yet, there is no limitation to send shorter packet than the maximum N-PDU size, a fragmentation will be required only when the PDP PDU size gets larger than the maximum N-PDU size. Consequently, the Maximum N-PDU size should be extend. The value should be at least 1502 byte for PDP type = PPP concerning PPP frame format shown in Figure 1.

2.3 Possible size over Uu reference point

N-PDU is the PDP PDU which shall be routed and transferred between the MS and the GGSN according to [2]. This subsection investigates the possible size over Uu reference point on extension of maximum N-PDU size. Figure 2 shows the protocol stack for UMTS user plane extract from [2] for reference.

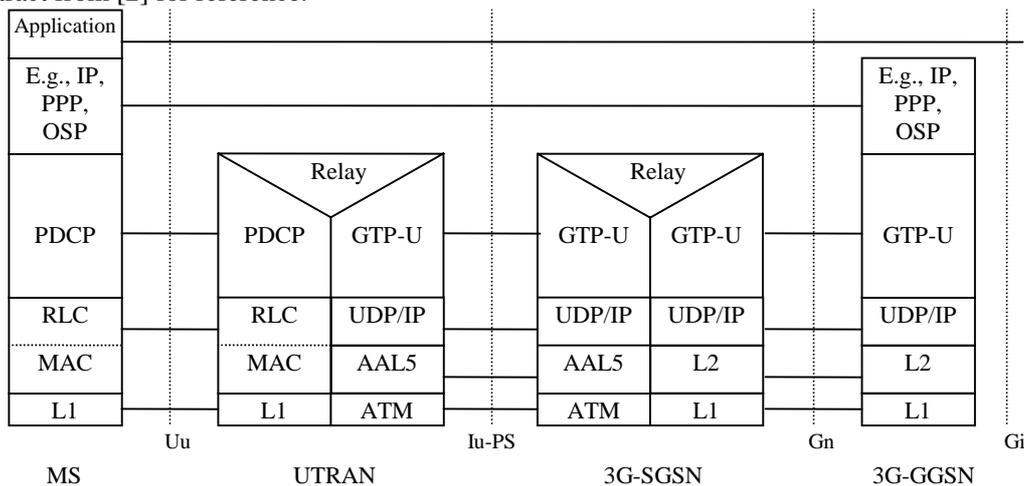


Figure 2: TS23.060 ver3.1.0 Sect.5.6.2 :User Plane for UMTS

Uu reference point:

- **PDCP** is applicable to introduce over the 1500 octet. No restriction is provided.
- No impact on **RLC**, because **RLC** shall transfer data every 40, 80bytes. Maximum size of PDU which is transferred between RLC peers is 128bytes • **We think no impact in Radio part.**

2.4 Maximum N-PDU size on GPRS

In [5], there is a description that “The maximum size of each N-PDU shall be 1500 octets.”. However taking into account of “Frame Relay”, the data size may be permissible until 1600 octet between MS and SGSN. This point should be clarify. Consequently, this fact may be make the extension of Maximum N-PDU size easy to apply from interworking point of view.

3. Comments in the last N1 meeting

In the last N1 meeting, following comments are pointed out. This section clarifies these points.

- **Backwards compatibility is difficult to analyse as the negotiation procedure was not presented in detail.**
→ It should be possible to negotiate within the limits of Maximum size of N-PDU. This negotiation procedure is QoS negotiation procedure. Therefore, it is very clear.
- **The proposal seems to apply to UMTS single mode networks only as the GSM limitation can not be removed even from R99**
→ The extension of N-PDU size should be applied to UMTS. GSM single mode networks shall not applied this extension. The GSM/GPRS networks are not sent PDU over 1500octet, and interworking between GSM/GPRS and UMTS can be referred to interworking on QoS profile.
- **Is the increased packet size intended for PS only or should it apply to CS also?**
→ This proposal of N-PDU size extension is for PS on case of PDP type = PPP.
- **What is the current max. limit at RLC? Is the intention to increase this limit?**
→ No. This proposal is not to increase the current max. limit at RLC. See section 2.3

4. Proposal

This paper proposes the following points.

- The maximum N-PDU size of QoS profile in TS 23.107 to be up to at least 1502(2¹¹) octets. It should be assigned 11 bits to indicate up to 1502 (2¹¹) octet in QOS profile for UMTS.
- The description of maximum N-PDU size in TS 23.060 should refer TS 23.107 as shown in the

attachment. We propose to issue LS to inform our decision to related WGs.

5. References

- [1] TS23.107 ver3.1.0 QoS Concept and Architecture
- [2] TS23.060 ver3.1.0 General Packet Radio Service (GPRS) Service description Stage 2
- [3] TS29.060 ver3.2.0 General Packet Radio Service (GPRS) GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface
- [4] RFC1661:PPP over Simple Data Link (SDL) using raw lightwave channels with ATM-like framing
- [5] TS03.60 ver7.0.0 General Packet Radio Service (GPRS) Service description Stage 2

ATTACHMENT 1 ---Image for revising 23.060---

9.3 Packet Routeing and Transfer Function

The packet routeing and transfer function:

- routes and transfers packets between a mobile TE and an external network, i.e., between reference point R and reference point Gi;
- routes and transfers packets between mobile TE and other GPRS PLMN, i.e., between reference point R and reference point Gi via interface Gp; and
- routes and transfers packets between TEs, i.e., between the R reference point in different MSs.

The PDP PDUs shall be routed and transferred between the MS and the GGSN as N-PDUs. The length of maximum N-PDU size is specified in 23.107. The maximum size of each N-PDU is negotiable between UE and NW as a "Maximum SDU size" in QoS parameter. shall be 1-500 octets.

When the MS or the GGSN receives a PDP PDU that is not larger than the maximum N-PDU size, then the PDP PDU shall be routed and transferred as one N-PDU. When the MS or the GGSN receives a PDP PDU that is larger than the maximum N-PDU size, then the PDP PDU shall be segmented, discarded or rejected, depending on the PDP type and the implementation. The packet data protocol in the MS may limit the maximum size of the PDP PDUs that are routed and transferred, e.g., due to MS memory limitations.

Between the SGSN and the MS, PDP PDUs are transferred with the SNDCP.

Between the SGSN and the GGSN, PDP PDUs are routed and transferred with either the TCP/IP or the UDP/IP protocols. The GPRS Tunnelling Protocol transfers data through tunnels. A tunnel is identified by a tunnel identifier (TID) and a GSN address.

To support roaming GPRS subscribers, and for forward compatibility, the SGSN is not required to know the tunnelled PDP. Every SGSN shall have the capability to transfer PDUs belonging to PDPs not supported in the PLMN of the SGSN.

ATTACHMENT 2 ---Image for revising 23.907---

6.5.1 Ranges of UMTS Bearer Service Attributes

The following table lists the value ranges of the UMTS bearer service attributes. The value ranges reflect the capability of UMTS network.

Traffic class	Conversational class	Streaming class	Interactive class	Background class
Maximum bitrate [kbps]	<2000 (1) (2)	<2000 (1) (2)	< 2000 - overhead (2) (3)	<2000 - overhead (2) (3)
Delivery order	Yes/No	Yes/No	Yes/No	Yes/No
Maximum SDU size [octets]	<=15020 (4)	<=15020 (4)	<=15020 (4)	<=15020 (4)
SDU format information	(5)	(5)		
Delivery of erroneous	Yes/No/- (6)	Yes/No/- (6)	Yes/No/- (6)	Yes/No/- (6)

SDUs				
Residual BER	$5 \cdot 10^{-2}$, 10^{-2} , 10^{-3} , 10^{-4} (7)	$5 \cdot 10^{-2}$, 10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} (7)	$4 \cdot 10^{-3}$, 10^{-5} , $6 \cdot 10^{-8}$ (8) (7)	$4 \cdot 10^{-3}$, 10^{-5} , $6 \cdot 10^{-8}$ (8) (7)
SDU error ratio	10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} (7)	10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} (7)	10^{-3} , 10^{-4} , 10^{-6} (7)	10^{-3} , 10^{-4} , 10^{-6} (7)
Transfer delay [ms]	100 – maximum value(7)	500 – maximum value (7)		
Guaranteed bit rate [kbps]	<2000 (1) (2)	<2000 (1) (2)		
Traffic handling priority			1,2,3 (9)	
Allocation/Retention priority	1,2,3 (9)	1,2,3 (9)	1,2,3 (9)	1,2,3 (9)

- 1) Bitrate of 2000 kbps requires that UTRAN operates in transparent RLC protocol mode, in this case the overhead from layer 2 protocols is negligible.
- 2) The granularity of the bit rate parameters must be studied. Although the UMTS network has capability to support a large number of different bitrate values, the number of possible values must be limited not to unnecessarily increase the complexity of for example terminals, charging and interworking functions. Exact list of supported values shall be defined together with S1, N1, N3 and R2.
- 3) Impact from layer 2 protocols on maximum bitrate in non-transparent RLC protocol mode shall be estimated.

4)

4) ~~Maximum SDU size shall at least allow UMTS network to support external PDUs having as high MTU as Internet/Ethernet (1500 octets). The need for higher values must be investigated by N1, N3, S1, R2, R3. When PDP type = PPP, maximum SDU size takes more than 1500 octet to transfer transparently without fragmentation. The length of maximum SDU size shall be take flexible value up to 1502 4096 octet, and actual value is negotiable between UE and NW.~~

- 5) Definition of possible values of exact SDU sizes for which UTRAN can support transparent RLC protocol mode, is the task of RAN WG3.
- 6) If *Delivery of erroneous SDUs* is set to 'Yes' error indications can only be provided on the MT/TE side of the UMTS bearer. On the CN Gateway side error indications can not be signalled outside of UMTS network in release 1999.
- 7) Values are indicative. Exact values on Residual BER, SDU error ratio and transfer delay shall defined together with S1, N1, N3 and R2.
- 8) Values are derived from CRC lengths of 8, 16 and 24 bits on layer 1.
- 9) Number of priority levels shall be further analysed by S1, N1 and N3.

6.5.2 Ranges of Radio Access Bearer Service Attributes

The following table lists the value ranges of the radio access bearer service attributes. The value ranges reflect the capability of UTRAN.

Traffic class	Conversational class	Streaming class	Interactive class	Background class
Maximum bitrate [kbps]	<2000 (1) (2)	<2000 (1) (2)	< 2000 - overhead (2) (3)	<2000 - overhead (2) (3)
Delivery order	Yes/No	Yes/No	Yes/No	Yes/No
Maximum SDU size [octets]	<=15020 (4)	<=15020 (4)	<=15020 (4)	<=15020 (4)
SDU format	(5)	(5)		

information				
Delivery of erroneous SDUs	Yes/No/-	Yes/No/-	Yes/No/-	Yes/No/-
Residual BER	$5 \cdot 10^{-2}$, 10^{-2} , 10^{-3} , 10^{-4} (6)	$5 \cdot 10^{-2}$, 10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6} (6)	$4 \cdot 10^{-3}$, 10^{-5} , $6 \cdot 10^{-8}$ (6) (7)	$4 \cdot 10^{-3}$, 10^{-5} , $6 \cdot 10^{-8}$ (6) (7)
SDU error ratio	10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} (6)	10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} (6)	10^{-3} , 10^{-4} , 10^{-6} (6)	10^{-3} , 10^{-4} , 10^{-6} (6)
Transfer delay [ms]	80 – maximum value(6)	500 – maximum value (6)		
Guaranteed bit rate [kbps]	<2000 (1) (2)	<2000 (1) (2)		
Traffic handling priority			1,2,3 (8)	
Allocation/Retention priority	1,2,3 (8)	1,2,3 (8)	1,2,3 (8)	1,2,3 (8)

- 1) Bitrate of 2000 kbps requires that UTRAN operates in transparent RLC protocol mode, in this case the overhead from layer 2 protocols is negligible.
- 2) The granularity of the bit rate parameters must be studied. Although the UMTS network has capability to support a large number of different bitrate values, the number of possible values must be limited not to unnecessarily increase the complexity of for example terminals, charging and interworking functions. Exact list of supported values shall be defined together with S1, N1, N3 and R2.
- 3) Impact from layer 2 protocols on maximum bitrate in non-transparent RLC protocol mode shall be estimated.
- 4) ~~Maximum SDU size shall at least allow UMTS network to support external PDUs having as high MTU as Internet/Ethernet (1500 octets). The need for higher values must be investigated by N1, N3, S1, R2, R3. When PDP type = PPP, maximum SDU size takes more than 1500 octet to transfer transparently without fragmentation. The length of maximum SDU size shall be take flexible value up to 1502 4096 octet, and actual value is negotiable between UE and NW.~~
- 5) Definition of possible values of exact SDU sizes for which UTRAN can support transparent RLC protocol mode, is the task of RAN WG3.
- 6) Values are indicative. Exact values on Residual BER, SDU error ratio and transfer delay shall defined together with S1, N1, N3 and R2.
- 7) Values are derived from CRC lengths of 8, 16 and 24 bits on layer 1. Number of priority levels shall be further analysed by S1, N1 and N3.