3GPP TSG-RAN WG1 Meeting #105-e R1-21xxxxx

e-Meeting, May 10th – 27th, 2021

Agenda Item: 8.4

Source: Ericsson

Title: Discussion on how to reply to SA2 LS on new 5QI for NTN

Document for: Discussion

# 1 Introduction

SA2 sent an LS (R1-2104155) to RAN1 about a new 5QI for GEO satellite access:

SA2 has discussed the topic of QoS for 5G satellite access and has agreed to introduce a new 5QI for best effort traffic with the intention to be able to accommodate the worst-case Packet Delay Budget for GEO.

The 5QI is available in the latest version of TS 23.501, v17.0.0, and copied below for your convenience:

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 10 | Non-GBR | 90 | 832ms  (NOTE 13)  (NOTE 17) | 10-6 | N/A | N/A | Video (Buffered Streaming)  TCP-based (e.g. www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.) and any service that can be used over satellite access type with these characteristics |

NOTE 13: A static value for the CN PDB of 20 ms for the delay between a UPF terminating N6 and a 5G-AN should be subtracted from a given PDB to derive the packet delay budget that applies to the radio interface

NOTE 17: The worst case one way propagation delay for GEO satellite is expected to be ~270ms, ,~ 21 ms for LEO at 1200km, and 13 ms for LEO at 600km. The UL scheduling delay that needs to be added is also typically 1 RTD e.g. ~540ms for GEO, ~42ms for LEO at 1200km, and ~26 ms for LEO at 600km. Based on that, the 5G-AN Packet delay budget is not applicable for 5QIs that require 5G-AN PDB lower than the sum of these values when the specific types of satellite access are used (see TS 38.300 [27]). 5QI-<New Value> can accommodate the worst case PDB for GEO satellite type.

SA2 would like to verify with RAN1 and RAN2 whether the selected PDB value, resulting in a AN PDB of 812 ms, is reasonable for use with GEO satellite access.

Several companies provide discussion papers on how to reply to this SA2 LS.

* R1-2104726 Discussion on SA2 LS on new 5QI for NTN Ericsson
* R1-2104774 Discussion on LS on PDB for new 5Q OPPO
* R1-2105199 Discussion on LS on PDB for new 5QI ZTE
* R1-2105930 Discusion on PDB for new 5QI Huawei, HiSilicon

# Discussion

For the newly proposed 5QI, the following observations can be made:

* A PDB of 812 ms is about 1.5 RTT of the maximum round trip delay in GEO satellite access with transparent payload.
* 1.5 RTT can only cover one transmission with acknowledgement.

Delivering packets without retransmission(s) with a PER of 10-6 might appear challenging at a first glance. That said, according to TS 23.501, Section 5.7.3.4, for Non-GBR, the requirement is that 98 percent of the packets should not experience a delay exceeding the 5QI's PDB.

*Services using Non-GBR QoS Flows should be prepared to experience congestion-related packet drops and delays. In uncongested scenarios, 98 percent of the packets should not experience a delay exceeding the 5QI's PDB.*

*The PDB for Non-GBR and GBR resource types denotes a "soft upper bound" in the sense that an "expired" packet, e.g. a link layer SDU that has exceeded the PDB, does not need to be discarded and is not added to the PER. However, for a Delay-critical GBR resource type, packets delayed more than the PDB are added to the PER and can be discarded or delivered depending on local decision.*

In other words, the Non-GBR requirement is not stringent. One way to satisfy the new 5QI may go as follows.

* Configure 1% BLER at the PHY/MAC layer, then 99% of the packets would be correctly delivered in one shot, which is within the PDB of 832 ms.
  + For ease of discussion, a packet is assumed to be the same as a transport block.
* Meanwhile, these 99% of the packets are error free and thus meet the PER of 10-6.
* In conclusion, the 99% of the packets delivered error free within 832 ms meet the requirement that 98% of the packets should not exceed the PDB.

Based on the above discussion, an initial proposal is made as follows. Companies are encouraged to provide views on the proposal.

**Initial proposal 1 (Moderator):**

RAN1 to reply to SA2 that the selected PDB value, resulting in a AN PDB of 812 ms, is reasonable for use with GEO satellite access.

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| Company | Comments |
| APT | Support.  From RAN1 perspective, without (blind) retransmission, the initial transmisison can achieve 1% BLER by repetition and MCS configurations. If considering processing and scheduling delay, a AN PDB can be within 600ms as shown in R1-2101748. |
| ZTE | Support. Agree with moderator’s interpretation on the 5QI.  As discussed in our contrbution, this value can be satisfied with proper setting on the scheduling. |
| Nokia, Nokia Shanghai Bell | Do not agree with moderator analysis. To obtain a PER of 10-6 delivered to higher layers we would need to accomodate either multiple HARQ retransmissions or allow for recovery on RLC layer. Further, for DL direction, it would not be sufficient to rely on HARQ-ACK information, as the NACK-to-ACK error rate would influence the minimum acheivable PER. Hence, in our understanding a much higher PDB threshold would be needed (in the order of 3.5 to 5.5 RTD). And in the moderator analysis the PER is targeted at 1%, which is contrary to the PER requirements from the 5QI, and would therefore not be fulfilling the requirements. |
| Nokia | Not support.  Regarding the moderator statement,   * In conclusion, the 99% of the packets delivered error free within 832 ms meet the requirement that 98% of the packets should not exceed the PDB.   If using this explanation, the 10^-6 PER target is equivalent as 10^-2 PER target, because at least 99% packet can be error free in the first transmission if set the BLER target 10^-2 in PHY. In the end, it will lead to the PER target is meaningless. |
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