TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3)
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Title: **RLC SDU discard**

Document for: Decision

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1 Introduction

Because of the radio environment, there will be situations when the radio link is blocked and repeated retransmissions does not succeed. In these situations, the buffers will eventually overflow, forcing a discard of RLC SDUs. By including a SDU discard function in the ARQ of RLC, the trade-off between SDU discarding in the input buffer and SDU discarding in the retransmission buffers can optimised.

With the above reasoning this contribution proposes the introduction of packet discard functionality to the RLC protocol.

2 SDU discard function

We propose to include a SDU discard function for non-transparent mode RLC. There will be several alternative operation modes of the RLC SDU discard function, and which discard function to use will be given by the QoS requirements of the Radio Access Bearer.

The following is a preliminary list of operation modes for the RLC SDU discard function.

Table 1. List of criteria's that control when to perform SDU discard.

Operation mode	Presence
Timer based discard, with explicit signalling	Optional
Timer based discard, without explicit signalling	Optional
SDU discard after X number of retransmissions	Optional

2.1 Timer based discard, with explicit signalling

This alternative uses a timer based triggering of SDU discard. This makes the SDU discard function insensitive to variations in the channel rate and provides means for exact definition of maximum delay. However, the SDU loss rate of the connection is increased as SDUs are discarded.

For every SDU received from a higher layer, timer monitoring of the transmission time of the SDU is started. If the transmission time exceeds a predefined value for a SDU in acknowledged mode RLC, this SDU is discarded in the transmitter and a Move Receiving Window (MRW) command is sent to the receiver so that AMD PDUs carrying that SDU are discarded in the receiver and the receiver window is updated accordingly. Note that when the concatenation function is active, PDUs carrying segments of other SDUs that have not timed out shall not be discarded.

The MRW command is defined as a super-field in the RLC STATUS PDU (see [2] for definition of super-field), and piggy backed to status information of transmissions in the opposite direction. Therefore, SDU discard variants requiring peer-to-peer signalling are only possible for full duplex connections. The outline of the super-field is given in chapter 3 of this document.

2.2 Timer based discard, without explicit signalling

This alternative uses the same timer based trigger for SDU discard as the one described in chapter 2.1. The difference is that this discard method does not use any peer-to-peer signalling. For unacknowledged mode RLC, peer-to-peer signalling is never needed. The SDUs are simply discarded in the transmitter, once the transmission time is exceeded. For acknowledged mode RLC, peer-to-peer signalling can be avoided as long as SDU discard is always performed in the transmitter before it is performed in the receiver. As long as the corresponding SDU is eventually discarded in the receiver too, possible retransmission requests of PDU of discarded SDUs can be ignored by the transmitter. The bigger the time difference is between the triggering of the discard condition at the transmitter and the receiver, the bigger the unnecessary buffering need is at the receiver and the more bandwidth is lost on the reverse link due to unnecessary retransmission requests. On the other hand, forward link bandwidth is saved, as no explicit SDU discard signalling is needed.

2.3 SDU discard after X number of retransmissions

This alternative uses the number of retransmissions as a trigger for SDU discard, and is therefore only applicable for acknowledged mode RLC. This makes the SDU discard function dependent of the channel rate. Also, this variant of the SDU discard function strives to keep the SDU loss rate constant for the connection, on the cost of a variable delay. SDU discard is triggered at the transmitter, and a MRW command is necessary to convey the discard information to the receiver, like in the timer based discard with explicit signalling.

3 Proposal

It is proposed to include the SDU discard functionality in the RLC protocol specification [1].

The following addition is proposed for the RLC STATUS PDU:

The Move Receiving Window super-field
The ‘Move Receiving Window’ super-field is used to request the RLC receiver to move its receiving window, as a result of a SDU discard in the RLC transmitter. The format is given in the figure below.

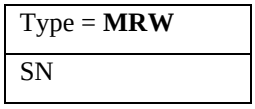

Figure 1. The MRW fields in a STATUS PDU

Type: 3 bits
Bit combination 110 can be used for Move Receiving Window (MRW) command

SN: 12 bits
Requests the RLC receiver to discard all PUs with sequence number < SN, and to move the receiving window accordingly.

The following addition is proposed for 25.322 [1], chapter 9.5 Timers:

f) Timer_Discard

This timer is used for the SDU discard function. In the transmitter, the timer is activated upon reception of a SDU from higher layer. If the SDU has not been acknowledged when the timer expires, the SDU is discarded and a Move Receiving Window request is sent to the receiver. If the SDU discard function does not use the Move Receiving Window request, the timer is also used in the receiver, where it is activated once a PDU is detected as outstanding, i.e. there is a gap between sequence numbers of received PDUs.

4 References

[1] 3GPP TS 25.322, V1.0.0, RLC Protocol Specification.
[2] Ericsson, “RLC STATUS PDU Refinement”, TSGR2#4(99)406