TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3) ***TSGR2#2(99)155***
Stockholm 8th to 11th March 1999

Agenda Item:

Source: **NTT DoCoMo**

Title: **Explanation of RLC retransmission scheme proposed by TTC/ARIB**

Document for: **Decision**

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1. Introduction

This paper explains the proposed retransmission scheme whose SDL is shown in ANNEX1 of S2.22 (Ver 0.0.1). This retransmission scheme is applied to acknowledged mode data transfer.

2. Basic concept of proposed retransmission scheme

1) Type of retransmission
   - Selective retransmission
2) How to confirm acknowledgement
   - Status report from the receiver respond to the polling from the transmitter
   - Unsolicited status report from the receiver caused by detecting the latest loss of AMD PDUs
3) The case retransmission is taken place
   - Receiving status report from the receiver and it requests retransmission
   - Receiving unsolicited status report
   - Retransmission timer expires
4) Timing of polling

Basically to confirm acknowledgement every RLC SDU can reduce extra overhead and improve the throughput. But if small RLC SDUs are given continuously, many status reports will be transmitted and it will cause overhead. To solve the problem, this retransmission scheme uses the timer which prohibits excessive polling. This timer only prohibits polling for every RLC SDU.

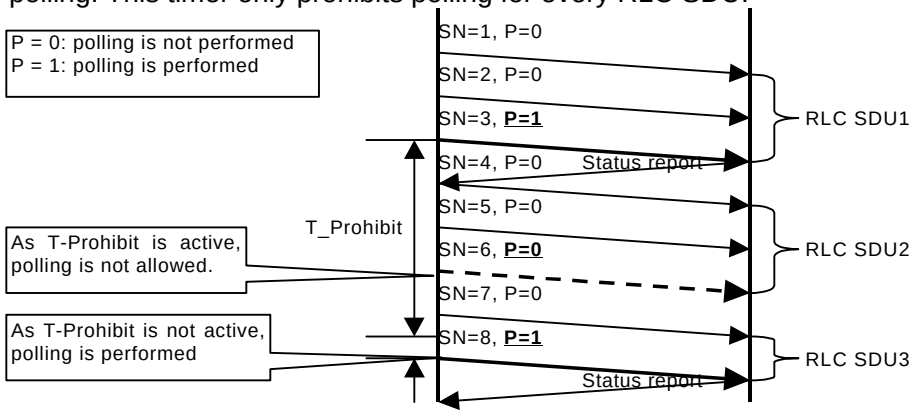

Fig. 1 How to reduce excessive polling

3. Outline of proposed retransmission scheme

3.1 PDUs used for retransmission

Following PDUs are necessary for this retransmission scheme.

- AMD PDU:
  Transfers user data and requests status report by setting Poll bit.
- STAT PDU:
  Reports the status of receiver to transmitter when AMD PDU with status report request is received.

- USTAT PDU:
  Indicates the loss of AMD PDU from receiver when receiver detects the new loss.

3.2 Timers used for retransmission

Following two timers are necessary for this retransmission scheme.

- Timer_STAT:
  This timer is set when AMD PDU with polling (i.e. P bit is set to “1”) is transmitted. And it will be stopped when the transmitter receives Ack or Nack for the AMD PDU with polling. If polling is taken place during this timer is active, it will be once stopped and set again.
- Timer_Prohibit:
  This timer is set when AMD PDU with polling is transmitted. If polling is taken place during this timer is active, it will be once stopped and set again. This timer will not be stopped by Ack or Nack. When this timer expires no action is performed.

3.3 Trigger of Polling

Polling message is transmitted when;

- the last segment of AMD SDU is transmitted (every RLC SDU) and Timer_Prohibit is not active
- the retransmission timer (Timer_STAT) expires
- the last AMD PDU in the transmission queue is transmitted
- the transmitter window has to move
- the last AMD PDU among those which are requested to be retransmitted by a STAT is transmitted.

3.4 Flow of retransmission

Case1) In case STAT is received

- Polling is performed from the transmitter comply with the polling trigger.
- At this moment, the transmitter sets Timer_STAT and Timer_Prohibit.
- The receiver transmits STAT which requests retransmission for SN = 2, 3, 4 of AMD PDU in response to the polling.
- The transmitter receives the STAT and stops Timer_STAT. Then the AMD PDUs (SN = 2, 3, 4) requested by the STAT are retransmitted.
- When the AMD PDU whose SN =4 is transmitted, poll bit is set to 1 (polling is performed).
- At this moment, Timer_STAT is set and Timer_Prohibit is reset.
- When the transmitter receives STAT from the receiver, Timer_STAT is stopped.

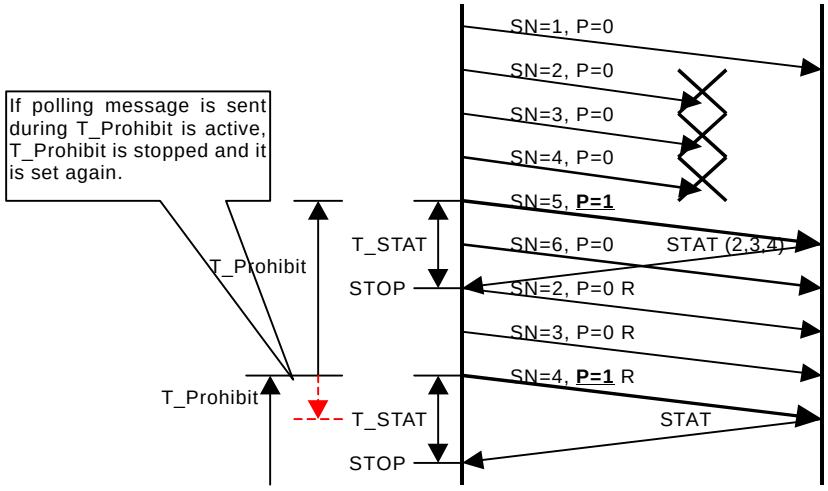

Fig. 2 In case STAT is received

Case2) In case USTAT is received

- If the receiver detects new loss of AMD PDUs, it transmits USTAT which requests retransmission of SN = 2, 3 of AMD PDU to the transmitter.

- The transmitter receives the USTAT and retransmits the requested AMD PDUs (SN = 2,3).
- In this case polling is not performed when the AMD PDU whose SN =3 is retransmitted.

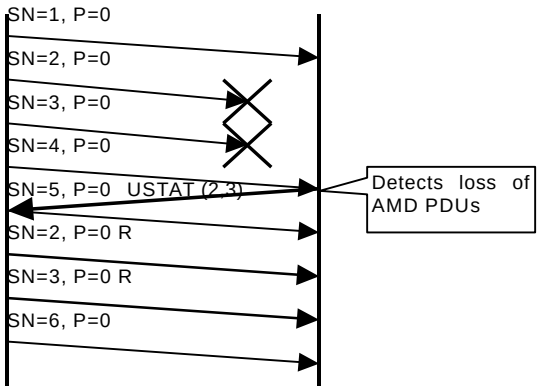

Fig. 3 In case USTAT is received

Case3) In case Timer_STAT expires

- If Timer_STAT expires due to loss of the AND PDU with polling or STAT, the transmitter retransmits the AMD PDU with polling.
- At this moment, Timer_STAT is set and Timer_Prohibit is reset.
- When the transmitter receives STAT from the receiver, Timer_STAT is stopped.

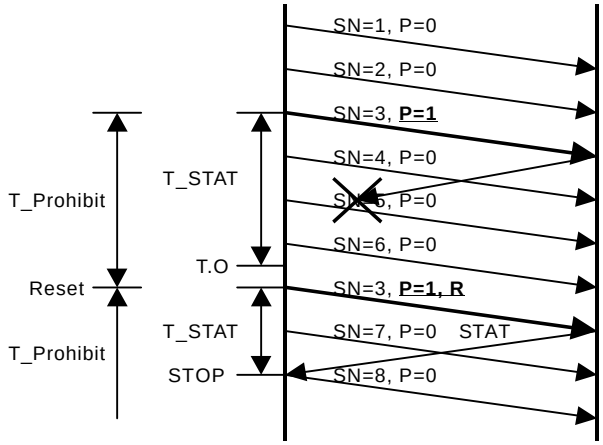

Fig. 4 In case Timer_STAT expires

4. How to adopt for C-plane

Incase of C-plane, it is necessary to confirm acknowledgement for each L3 message. Therefore polling should always be performed for every RLC SDU. But if several L3 messages are transmitted continuously, Timer_STAT may be reset next to next and it may cause retransmission delay. To avoid such situation, retransmission scheme for C-plane should perform like STOP& WAIT for every RLC SDU.

5. Conclusion

As explained above, basically retransmission scheme proposed by TTC/ARIB performs polling every RLC SDU with the essential polling (e.g. the last AMD PDU in the transmission queue is transmitted). This polling timing may be undesirable for some operators. But it does not force to always perform polling every RLC SDU. According to the value of Timer_Prohibit, it is possible to select the frequency of polling.

- T_Prohibit = 0 -> Polling is always performed for every RLC SDU
- T_Prohibit = infinity -> Polling every RLC SDU is not performed
- T_Prohibit = other value -> Polling is not always performed for every

RLC SDU. This timer value is set to optimize the frequency of polling.

Therefore we propose to adopt this retransmission scheme for RLC.