TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3) ***TSGR2#7(99)b31***
th to 24th September, 1999

Agenda Item:

Source: Bosch

Title: Proposal for multiplexing in PDCP

Document for: Discussion and Decision

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1. Introduction

In this contribution multiplexing within the Packet Data Convergence Protocol (PDCP) is proposed. First it is shown that the memory allocated by the Radio Link Control (RLC) could be reduced with multiplexing.
Afterwards a multiplexing scheme is introduced which enables Packet Data Protocol (PDP) contexts to share header compression entities and RLC entities if the same Quality of Service (QoS) is used. Because of the schemes' simplicity, an identification of the PDP context in the PDCP Packet Data Unit (PDU) is sufficient for the receiving entity to route the packet to the correct compression entity and PDP context.

2. Memory allocated by RLC

One of the RLC functions in acknowledged mode is retransmission of defective Payload Units (PU). Thus, for each RLC entity the PUs have to be stored until the errorless transmission has been acknowledged.

2.1.Example

Fig.1 shows an example where no multiplexing is used. Assuming there are six PDP contexts demanding three different QoS, every PDP context has to use its own RLC entity. Thus, six RLC entities have to be created. In acknowledged mode transmission is bi-directional. Therefor every RLC entity has to allocate memory for transmission and reception buffer.

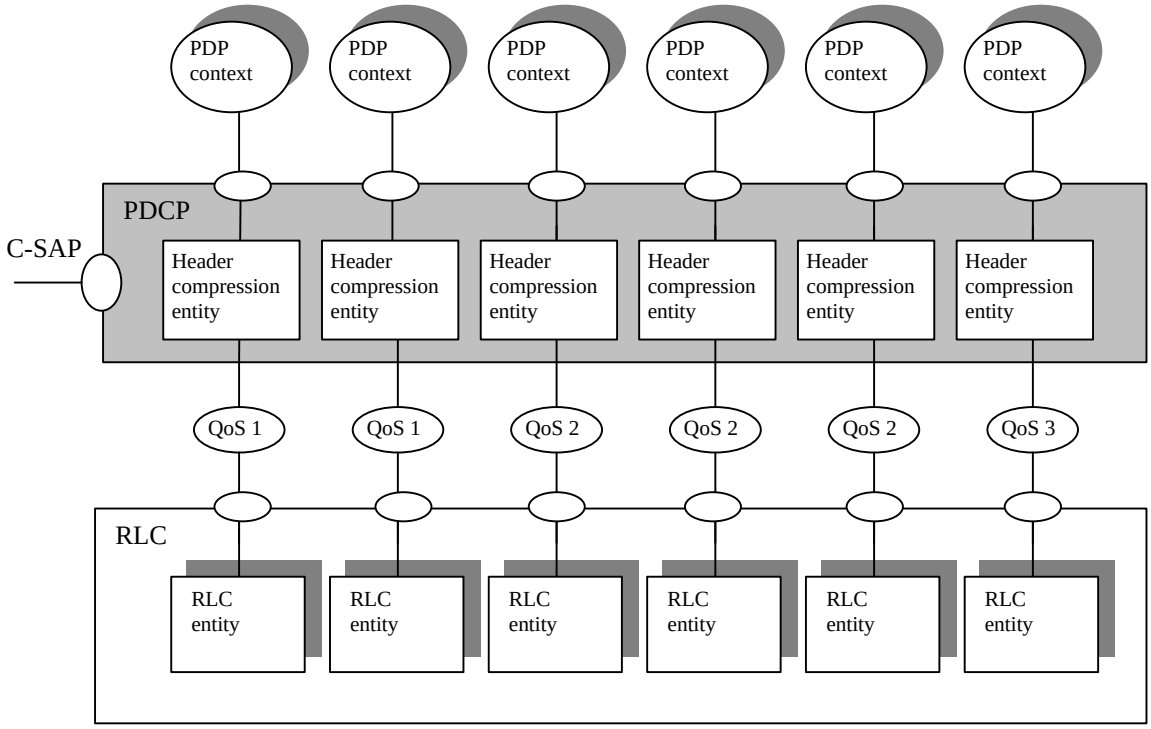

Fig. 1 Example of PDCP without multiplexing

It is assumed that the PU size is 40 octets (320 bit). With a maximum number of stored PUs of 4096 (12 bit sequence number in acknowledged mode), the allocated memory for each buffer without any management information is 164 kbyte. Consequently, each RLC entity allocates 328 kbyte (transmission and reception buffer).

PU size:	40 bytes.
maximum sequence number:	4096.
Allocated memory for each buffer:	40 bytes * 4096 = 164 kbytes.
Transmission + reception buffer:	2*164 kbytes = 328 kbytes.

In the given example the six RLC entities have to allocate an entire memory of 1968 kbyte.

Multiplexing would enable the PDP contexts, which are demanding the same QoS, to use the same RLC entity. Because of that, the maximum number of needed RLC entities could be reduced to the number of different QoSs.
In the given example, the number of needed RLC entities could be reduced by halves and an entire memory of 984 kbyte would be sufficient.

2.2.Reasons for multiplexing

Multiplexing within the PDCP reduces the number of RLC entities to the number of different QoSs and thus decreases the memory allocated by the RLC.

3. Multiplexing scheme

Fig.2 shows the proposed multiplexing scheme within the PDCP.

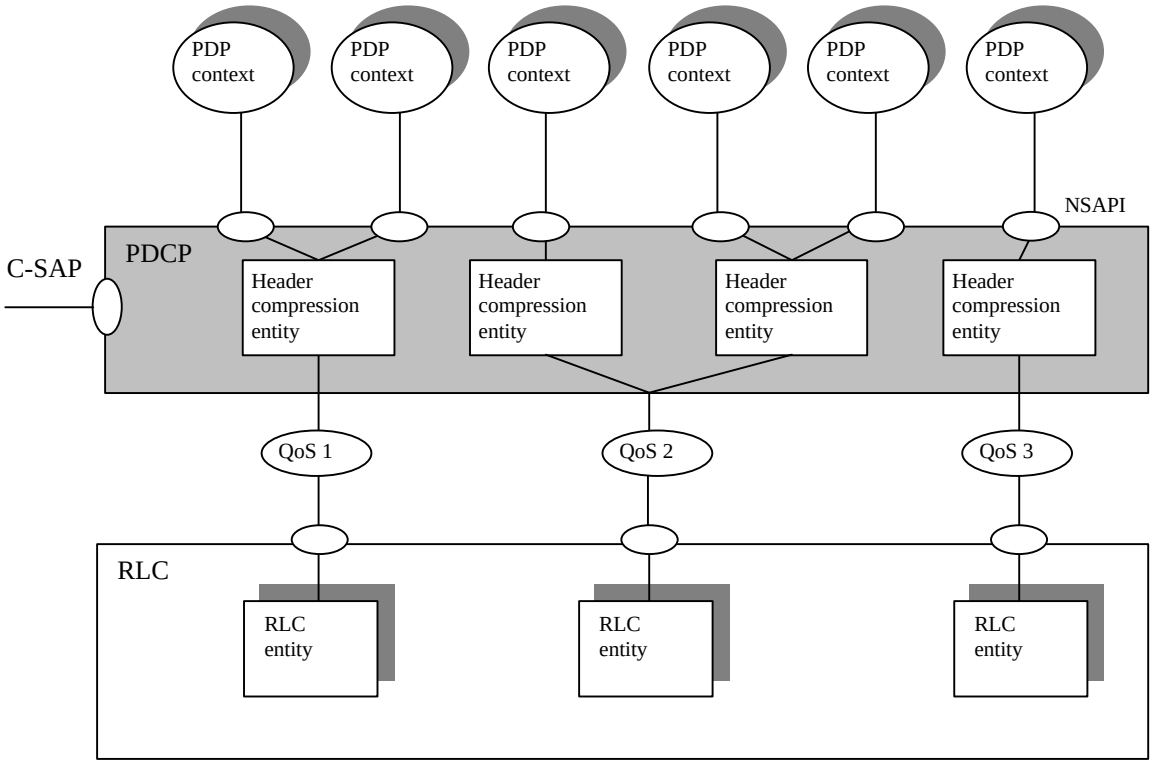

Fig.2 Multiplexing scheme within PDCP

The scheme is characterised by the following rules:
- Every PDP context is identified by a network layer service access point (NSAPI).
- Every PDP context shall use one header compression entity.
- A header compression entity may be used by one or more PDP contexts.
- A header compression entity shall be connected to one RLC entity.
- A RLC entity may be connected to one or more header compression entities.

Protocol control information (or header-) compression shall be an optional feature. Compression entities are characterised by the following rules:
- One compression entity shall use zero or one compression algorithms.

- More than one compression entity may use the same algorithm type.
- Algorithm types and their parameters of the compression entities are negotiated by the RRC.

3.1.Advantages of the proposed scheme

- PDP contexts, which demand the same quality of service may use a common RLC entity, consequently memory allocation by the RLC is reduced, as described above.
- Because of the simple structure of the scheme, one identifier for the PDP context, the NSAPI, is sufficient for the receiving entity to route a packet to the correct compression entity and PDP context.

4. Proposal

It is proposed to allow multiplexing within PDCP and to adopt the presented multiplexing scheme into 25.323.