3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 – July 2, 2021

RWS-210182

Agenda Item: 4.1

Source: Samsung

Title: High-speed Packetization for 5G Advanced

Document for: Discussion and Decision

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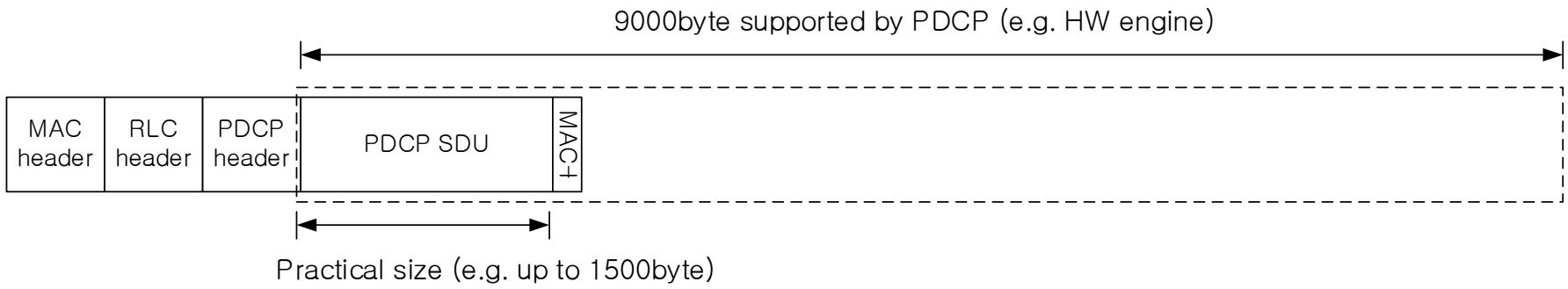
Motivation

- The NR data structure was designed to support fast data processing, which enables pre-processing before the reception of Uplink grant and the application of Hardware Accelerator (HWA) as shown in the figure.



- However, several aspects need to be further considered:
  - The L2 headers are added to each PDCP SDU, which incurs tremendous number of L2 headers to be processed at high data rate, e.g. 1.6 million of L2 headers at 20Gbps.
  - The User Plane Integrity Protection (UPIP) adopted from Rel-16 onwards would result in significant performance degradation on data processing.
  - The data processing capacity of HWA is not fully utilized, i.e. to process only 1500byte with the capacity of 9000byte.

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Key Features on High-Speed Packetization

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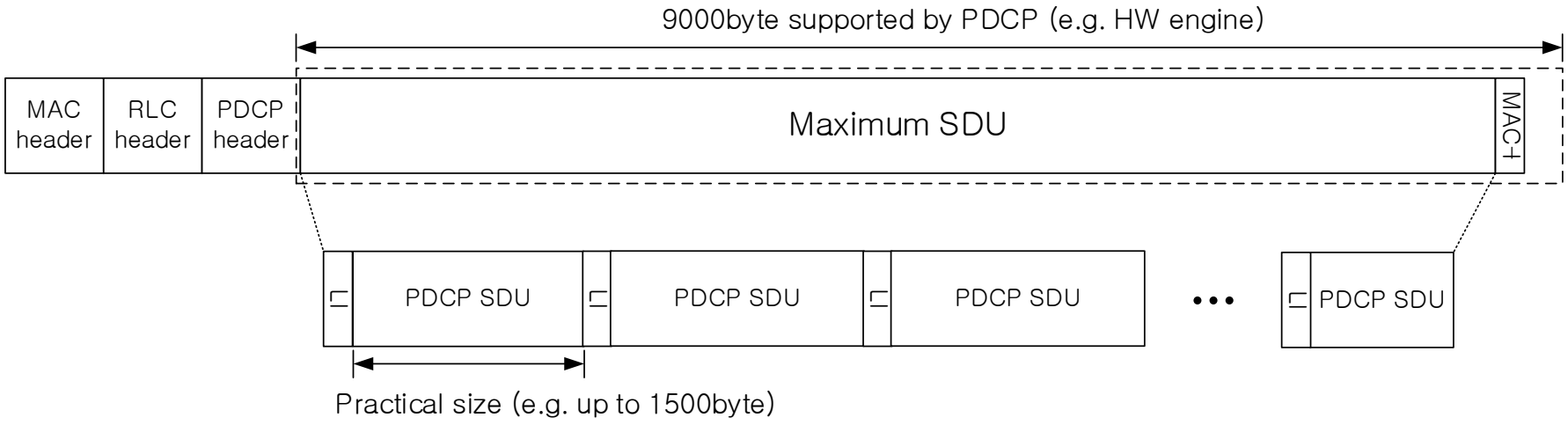
◇ PDCP concatenation enabling Maximum Service Data Unit (SDU) processing:



◇ By combining multiple PDCP SDUs into one pseudo SDU, several benefits would be foreseen as follows:

- The number of L2 headers to be processed would be significantly reduced as the number of concatenated SDUs increases, especially for high data rates.
- The maximum SDU including multiple PDCP SDUs can be processed with one-time initialization and key expansion, which reduces the UPIP processing time. The UPIP performance is enhanced as the size of maximum SDU increases.
- The data processing capacity of HWA is fully utilized, i.e. the efficiency thereof can be maximized by PDCP concatenation.

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Details on High-Speed Packetization

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- L2 Compatibility with earlier releases and implementation
  - PDCP concatenation would be an add-on feature on top of legacy and configurable by network.
  - Concatenated SDUs in PDCP can be regarded as one large PDCP PDU, which has no impact on legacy RLC/MAC/PHY.

- The reduction of header overhead and processing burden
  - L2 headers per concatenated SDUs, i.e. the number of the existing L2 headers to be processed is reduced by 1/n times where “n” is the number of SDUs to be concatenated.
  - The resource efficiency goes higher as the number of concatenated SDUs increases from network’s perspective.

- Throughput enhancement with UP IP
  - The concatenated SDUs can be processed with one-time initialization and one security key expansion, which reduces the processing time.
  - Throughput goes higher as the size of concatenated SDUs increases.

- Avoid unnecessary processing delay from PDCP concatenation
  - PDCP concatenation is applicable to the pending buffered data in a dynamic manner.

- Application
  - The scenario where the data to be processed start to be buffered.

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Objectives of this work

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- Objectives
  - Enhancements on data processing [RAN2-led]
    - Reduction of the number of L2 headers to be processed.
    - Support high data rates with User Plane Integrity Protection.
    - Maximize the utilization of the data processing capacity by implementation.
  - Possible Enhancements on data processing [RAN2-led]
    - Fixed size L2 headers for data, which makes it more friendly to hardware accelerator.
    - Enhance RLC segmentation to reduce the overhead.
  - Specification of High-Speed Packetization [RAN2-led, RAN3]
    - Concatenation function to maximize the size of a pseudo SDU, which is equal to or smaller than 9000byte.
    - The structure of PDCP PDU constructed by concatenation.
    - The allocation of COUNT value.
    - The transmit operation and the receive operation with PDCP concatenation.
    - RLC segmentation to support fixed size L2 header and reduce the overhead.
    - Support of Mobility, Carrier Aggregation, and Dual Connectivity.

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