

Agenda Item: 10.3.4.2
Source: Ericsson
Title: SDAP Header Format
Document for: Discussion, Decision

1 Introduction

In RAN2 June Ad Hoc following was agreed:

Agreements:

1. There is a need to tell the UE that it has to update the mapping rule. For the AS reflective QoS it is up to the RAN to decide when to update the mapping rules. FFS on the details of the header format.
2. It is up to the RAN to decide when and which mechanism, explicit RRC re-configuration and/or AS reflective QoS, should be used to provide mapping information to the UE.
3. A UE follows the latest QoS flow to DRB mapping information regardless of the fact whether it was explicit RRC or AS reflective QoS.
4. Whether a SDAP header is present or not is configured by RRC per DRB
5. The gNB indicates to UE using RRC signaling the default DRB for a PDU session.
6. RAN decides and configures the default DRB for a PDU session.

2 Discussion

2.1 SDAP header format and N3 signalling

Based on LS from SA2 [1], it can be expected that the length of the QFI is 6-bit or 7-bit. In order to allow efficient implementation from gNB towards 5CN, SDAP header format should be aligned with the N3 header format. QFI is always attached to N3 header when there are multiple flows in PDU session. Having QFI aligned between SA2 and RAN allows implementations to copy the QFI to SDAP header and vice versa.

Proposal 1 **SDAP header format is aligned with SA2 to allow QFI and RQI copying behaviour from and to N3 header if QFI size is 6 or 7-bits.**

2.2 SDAP Header format

In RAN2 97-bis meeting, decision was made to include Flow ID in SDAP header and to have the header byte aligned. Yet, the question of Flow ID length remains open. Possible sizes of flow ID are from 7 bits up to 16 bits when SDAP header is assumed to be one or two bytes and Maximum defined QFI value in QFI table defined by SA is 79 [1]. Flow ID value range with 7-bits should be already sufficient as it allows 128 flows to exist in one PDU session. Having larger Flow ID range requires UE to allocate more resources for Flow to DRB mapping.

Table 1: 3GPP TS23.501 System Architecture for 5G System, Stage2, V0.4.0 (2017-04)

5.7.5.4.2 Reflective QoS Activation via User Plane

When the 5GC determines to activate reflective QoS via U-plane, the SMF shall include a QoS rule including an indication to the UPF via N4 interface to activate User Plane with user plane reflective. When the UPF receives a DL packet matching the QoS rule that contains an indication to activate reflective QoS, the UPF shall include the RQI in the encapsulation header on N3 reference point. **The UE creates a UE derived QoS rule when the UE receives a DL packet with a RQI.** (*Reflective QoS Indication*).

Based on the input from SA2 that UEs shall be told whether a DL packet requires an update of the NAS level SDF-to-Flow mapping. We propose that there is one-bit indication in the DL header. When the bit is set to 1, the UE indicates to NAS that it shall determine and possibly update the SDF-to-Flow mapping based on the Flow-ID present in the SDAP header [2].

Proposal 1 The DL SDAP header includes 1-bit NAS-RQI indication that indicates whether the UE shall create (or update) a UE derived QoS rule.

Similarly, to NAS RQI, there could be AS RQI bit indication in SDAP header indicating whether the UE shall create or update a QoS Flow to DRB mapping. Having both, NAS and AS RQI indication would require the SDAP header to be 2-bytes assuming that a 6-bit flow id length is not sufficient.

Figure 1 shows the header when both, AS and NAS RQI exists in the header. Length of the Flow ID is between 7 and 16.

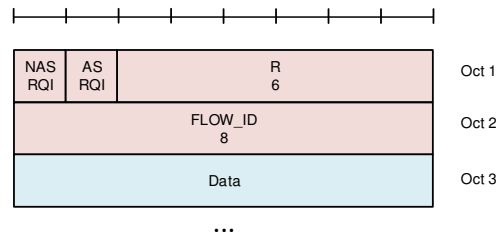


Figure 1: DL SDAP header with 8-bit Flow ID, NAS-RQI, AS-RQI and 6-bit Reserved field.

Observation 1 In DL, when NAS-RQI and AS-RQI fields are present and Flow ID is greater than 7-bits, SDAP header grows to 2 bytes

Having NAS-RQI and AS-RQI allows gNB transmitter to omit the AS Flow ID in downlink header when neither the NAS RQI bit nor the AS RQI bit is set. This would allow reducing the header size to one octet in all DL packets that should not trigger any filter-update. But of course, it would also result in a variable SDAP header size. Such header is presented in the figure 1.

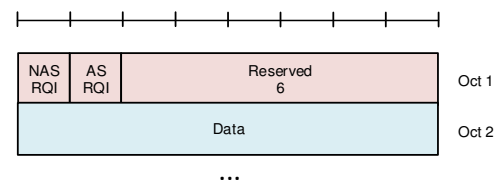


Figure 2: DL SDAP header with 1-bit NAS-RQI, 1-bit AS-RQI and Flow ID omitted (AS RQI = 0).

The header length variation in the SDAP header and adds complexity when e.g. ROHC needs to identify the starting point of the IP packet in the PDCP layer.

Considering that updating the Flow-ID to DRB mapping is significantly easier than the update of the NAS filters, we don't think that such an explicit indication should be added. Without that indication a header length of one byte provides space for a 7-bit Flow ID length.

From DRB to Flow ID mapping perspective in UE, it is not desirable to have longer Flow ID range than required as UE is required to maintain Flow to DRB mapping table. The range of 128 Flow IDs is sufficient for the use cases that currently exists [1].

The resulting downlink SDAP header is depicted in Figure 3.

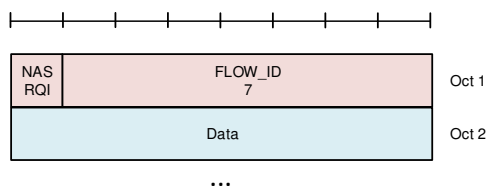


Figure 3: DL SDAP header with 7-bit Flow ID and NAS-RQI

Proposal 2 The DL and UL SDAP header contains a 7-bit Flow ID

For UL, Flow ID provides information to the gNB from which gNB is able to observe the QoS marking carried in the NG3 UL header. The NAS-RQI is not required. Hence the resulting UL header has one spare bit (R) for later use as shown in Figure 4.

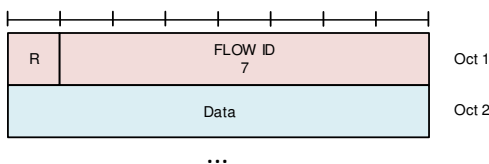


Figure 4: UL SDAP header when 7-bit Flow ID is used

Proposal 3 The UL SDAP header has one spare bit (R) for later use.

In previous meeting, companies proposed to have control PDU for SDAP layer. Information carried by the control PDU would be, for instance control of AS reflective QoS activation / deactivation. Having control PDU is not necessary as the controlling of the AS reflective QoS can be left for the gNB implementation. Since SDAP layer is used currently only with QoS and it is currently tightly coupled with the PDCP entity, control PDU would add complexity that may not be justified with the benefits. Additionally, dynamic SDAP header introduces complexity to the ROHC implementation as the position of the IP packet needs to be known by ROHC. Alternatively having SDAP header at the end would avoid the ROHC problems but introduce coupling of SDAP header with PDCP SDU length information. Parsing from the end with dynamic headers would create complexity to the receiver parser as the receiver would need to predict the length of the SDAP header or have it indicated otherwise.

Proposal 4 Control headers are not introduced in SDAP layer.

Proposal 5 SDAP header is placed at the beginning of the PDU.

Proposal 6 SDAP header size is fixed and does not depend whether QFI is included or not

3 Conclusion

In section 2 we made the following observations:

Observation 1 In DL, when NAS-RQI and AS-RQI fields are present and Flow ID is greater than 7-bits, SDAP header grows to 2 bytes

Based on the discussion in section 2 we propose the following:

- Proposal 1** SDAP header format is aligned with SA2 to allow QFI and RQI copying behaviour from and to N3 header if QFI size is 6 or 7-bits.
- Proposal 1** The DL SDAP header includes 1-bit NAS-RQI indication that indicates whether the UE shall create (or update) a UE derived QoS rule.
- Proposal 2** The DL and UL SDAP header contains a 7-bit Flow ID
- Proposal 3** The UL SDAP header has one spare bit (R) for later use.
- Proposal 4** Control headers are not introduced in SDAP layer.
- Proposal 5** SDAP header is placed at the beginning of the PDU.
- Proposal 6** SDAP header size is fixed and does not depend whether QFI is included or not

4 References

- [1] R2-1707652. LS reply on NAS Reflective QoS. SA2. Berlin, Germany, 21st – 25th August 2017.