

Title: SDAP Header Format

Source: Huawei, HiSilicon

Agenda item: 10.3.4.2

Document for: Approval

1 Introduction

Last RAN2 meetings discussed the SDAP header format and agreed as follows.

Agreements at RAN2#98 meeting

1. The QoS flow ID is present once the AS reflective QoS is active. FFS whether it is always present.
2. gNB should be informed when NAS layer reflective QoS is activated (e.g. can be used). It is FFS how we handle NAS reflective QoS and dependent on how/when it will be provided.
3. RAN2 will support a mode in which SDAP header is not present and is configured per DRB. If configured, FFS how the different fields are handled.

Agreements at RAN2#97bis meeting

- New AS layer PDU is PDCP SDU
- AS layer header is byte-aligned
- DL packets over Uu are not marked with “Flow ID” at least for cases where UL AS reflective mapping and NAS reflective QoS is not configured for DRB.
- AS layer header include the UL “Flow ID” depending on network configuration

And a LS on NAS reflective QoS was agreed in [1]. In this contribution, some further details of SDAP header format are provided.

2 Discussion

2.1 Issues regarding SDAP Header design

✧ QoS Flow ID size

The LS to SA2 includes the question about the length of QoS flow ID (QFI), which has much impact the format of the SDAP header. Currently, the largest 5QI standardized value is 79, which hints QFI is at least 7bits. Considering that the non-standardized 5QI may be defined and the potential various services supported in the future, we assume the QoS flow ID may occupy at least 7 bits while the exact value may be determined by SA2. In order to further reduce the QoS flow ID, a shorter QoS flow ID in AS layer is proposed in [2].

Proposal 1: The QoS flow ID is at least 7 bits size, and the exact size could be decided by SA2.

✧ NAS Reflective QoS

It has been agreed in RAN2 that the gNB should be informed when NAS layer reflective QoS is activated (e.g. can be used), while it is FFS what the impact on RAN2 is. In SA2, two reflective QoS control mechanisms are agreed as follows [3].

- Via UP control, it is on per-packet basis. The gNB will receive the packets from N3 with QFI and RQI.

- Via CP control, it is per-QoS flow basis. In this case, the UE is provided with reflective QoS attribute (RQA) to control the reflective QoS. RAN will be notified for this CP control [3].

Hence for UP control mechanism, the gNB should forward the QFI and RQI via SDAP header for UE deriving the QoS rules in NAS layer. For CP case, the gNB may take the same action, it will set the RQI based on the received RQA of QoS flow via N2.

Proposal 2: The QoS flow ID and RQI should be included in the SDAP header when NAS reflective QoS is applied either by UP control or CP control.

✧ Independence between AS Reflective mapping and NAS reflective QoS

It was agreed that “QoS flow ID is presence once the AS reflective QoS is active”. Once the AS reflective QoS is activated, the UE detects the QoS flow ID in SDAP header and applies the same mapping between QoS flow and DRB in the uplink.

As AS reflective mapping and NAS reflective QoS are targeted for different purposes, these two would be operated independently. Considering proposal 2, the QFI included in the SDAP header could be used for the NAS reflective QoS if controlled by CP or UP mechanism and AS reflective QoS under the gNB’s decision.

Proposal 3: NAS reflective QoS and AS reflective mapping can be enacted independently. The QFI in the SDAP header can be used to derive both NAS layer IP flow to QoS flow mapping and AS layer QoS flow to DRB mapping.

✧ Impact of ROHC

Last meeting agreed that “As a baseline no specification impacts are needed to handle ROHC operation”. Thus it makes sense that the SDAP header can be placed at the beginning of the SDAP PDU.

It was also agreed that SDAP header could be not present for a DRB. For this DRB, the PDCP may perform header compression the same as what LTE does. When SDAP header is included, generally there are two possible SDAP header formats.

- Variable size: in order for header compression, the SDAP layer should indicate the length of the SDAP header to PDCP layer at the transmitter. While at the receiver, the PDCP layer may detect the SDAP header size first before the packet decompression. Hence this case may complicate the ROHC operation.
- Fixed size: There is no tight inter-layer interaction between PDCP and SDAP for RoHC operation. However, for cases where QFI is not included e.g., neither NAS reflective QoS nor AS reflective mapping is implemented, the fixed SDAP header size brings additional UP overhead.

Proposal 4: The SDAP header should be placed at the beginning of SDAP PDU.

Observation 1: Fixed SDAP header size is beneficial for ROHC in PDCP but may bring additional UP overhead. While variable size may complicate the ROHC operation due to the tight inter-layer interactions.

✧ Uplink and Downlink

For DRBs configured with no SDAP header, the receiver can derive the QFI implicitly. It may equally apply to both UL and DL. For example,

- It may apply to DL QoS flows without the requirements of NAS reflective QoS and AS reflective QoS
- It may apply to DL or UL QoS flows with one to one mapping to DRBs.

For other DRBs, in UL the QFI is always needed in SDAP header for the marking to the NGC, based on which the NGC may perform the QoS verification upon the receiving packet. For DL, as proposed in proposal 3, the QFI is included in the SDAP header when either of NAS reflective QoS or AS reflective mapping is implemented.

Proposal 5: No SDAP header mode can be configured for UL or DL independently by the network.

2.2 SDAP Header Format

For the header format in which SDAP header is not present, the following format in Fig. 1 could be applied for DL and UL as addressed in Proposal 5.

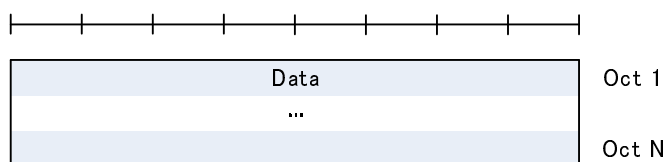


Fig. 1 The format when SDAP header is not present

When the SDAP header is present, two options (fixed size and variable size as discussed above) are provided as follows.

✧ **Option1: SDAP Header with fixed size**

In this option, the SDAP header is fixed with one byte size, wherein the QFI size is 7 bits. In DL, the RQI is used for indication for NAS reflective QoS, where '1' indicating enabled and '0' otherwise.

As the SDAP header is always 1 byte length, the QFI could be always present. Typically, the QFI usage example is given in Table 1.

Table I: QFI usage example

	NAS reflective QoS enabled (RQI set to '1')	NAS reflective QoS disabled/not implemented (RQI set to '0')
AS reflective QoS enabled	QFI is used for both	QFI is used for AS
AS reflective QoS disabled/not implemented	QFI is used for NAS	QFI is included but for neither purpose

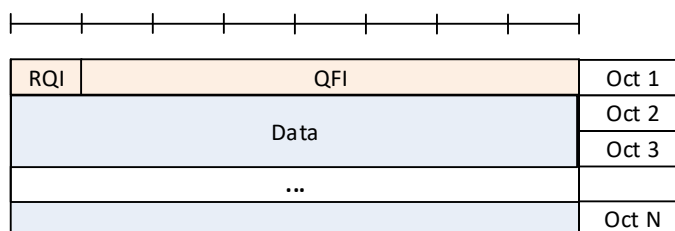


Fig. 2 The SDAP header with fixed size for DL

The data format for UL is given in Fig.3 where the R is the redundancy bit and QFI is always included.

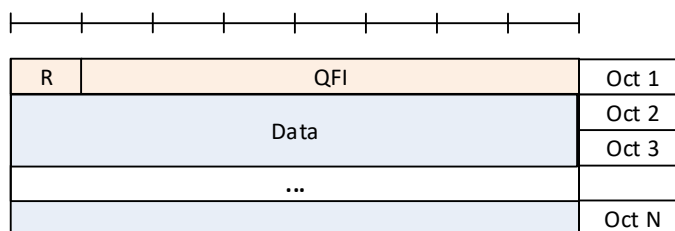


Fig.3 The SDAP header with fixed size for UL

✧ **Option2: SDAP Header with variable size**

In this option, the SDAP header has variable size depending whether the QFI is included or not. Considering the potential supported services in the future, we assume the size of QoS flow id is 10bits.

In DL, the QFI is only included when either NAS or AS reflective QoS is activated or controlled. The NRQI is introduced to indicate the NAS reflective QoS and one ARQI is used to indicate the AS reflective mapping. When both NRQI and ARQI are disabled, the QFI is not included to reduce the UP overhead. Table II gives the

Table II: QFI usage example

	NAS reflective QoS enabled (NRQI set to '1')	NAS reflective QoS disabled/not implemented (NRQI set to '0')
AS reflective QoS enabled (ARQI set to '1')	QFI is used for both	QFI is used for AS
AS reflective QoS disabled/not implemented (ARQI set to '1')	QFI is used for NAS	QFI is not included

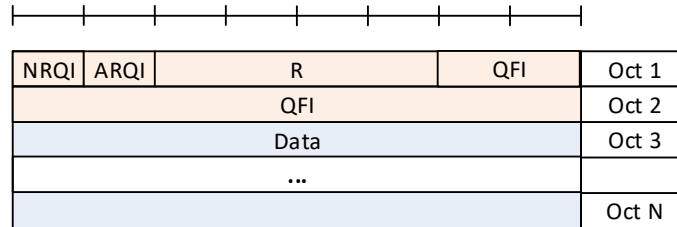


Fig. 4 The SDAP header with variable size for DL (QFI is included)

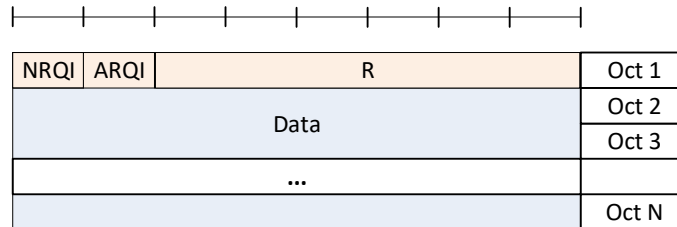


Fig. 5 The SDAP header with variable size for DL (QFI is not included)

For UL, the data format is given in Fig.6 where the QFI is always included.

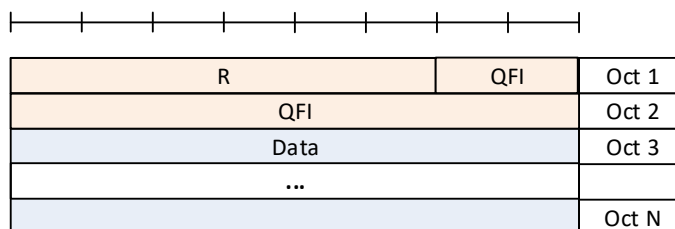


Fig. 6 The SDAP header with varying size for UL (QFI is included)

Based on the above analysis, further down selection of option 1 and option 2 is required. And the decision may depend on the exact QFI size. We make the following proposal.

Proposal 6: Further down selection between option 1 (fixed header size) and option 2 (variable size) is required after the QFI size is finally determined.

3 Conclusion

Based on the discussion in this paper on SDAP header format, we make the following observation and proposals:

Observation 1: Fixed SDAP header size is beneficial for ROHC in PDCP but may bring additional UP overhead. While variable size may complicate the ROHC operation due to the tight inter-layer interactions.

Proposal 1: The QoS flow ID is at least 7 bits size, and the exact size could be decided by SA2.

Proposal 2: The QoS flow ID and RQI should be included in the SDAP header when NAS reflective QoS is applied either by UP control or CP control.

Proposal 3: NAS reflective QoS and AS reflective mapping can be enacted independently. The QFI in the SDAP header can be used to derive both NAS layer IP flow to QoS flow mapping and AS layer QoS flow to DRB mapping.

Proposal 4: The SDAP header should be placed at the beginning of SDAP PDU.

Proposal 5: No SDAP header mode can be configured for UL or DL independently by the network.

Proposal 6: Further down selection between option 1 (fixed header size) and option 2 (variable size) is required after the QFI size is finally determined.

4 Reference

- [1] R2-1706130, LS on Reflective QoS
- [2] 5GTD0114, Use of Shorter QoS Flow ID, Huawei, HiSilicon
- [3] TS 38.413 V0.1.0
- [4] TS 23.501 V0.5.0, "System Architecture for the 5G System".
- [5] R2-1704379, Reflective QoS and Flow-ID, Ericsson