

Service Data Adaptation Protocol

SDAP

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Introduction

- Responsible for mapping QoS bearers to radio bearers according to their quality-of-service requirements.
- Introduced in NR (not present in LTE)
 - ▶ When connecting to the 5G core network due to the new quality-of-service handling.
- In case of NR-userplane connected to EPC (4G Core network), SDAP is not used.

Jargon

- Core Network (5GCN)
- Radio Access Network (NG-RAN)
- LTE, NR, eNB, gNB, UE, Uplink, Downlink
- Layers (1,2,3)
- Configuration, Initialization, Session establishment, PDU sessions
- Entity Establishment, Entity Release
- SDAP entity, SDAP PDU, SDAP SDU
- User Plane, Control Plane
- User Data, Control Data
- Quality of Service
- QoS Flow, QoS flow handling
- SDAP layer
- IP layer
- Radio Bearers (SRB, DRB)
- QoS flow to DRB mapping rule, Reflective QoS mapping
- Channels
- NAS layer, NAS messages

Overall Architecture

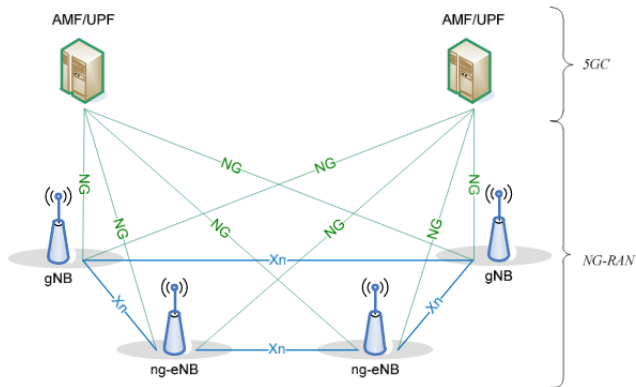


Figure: Overall Architecture

RAN Architecture

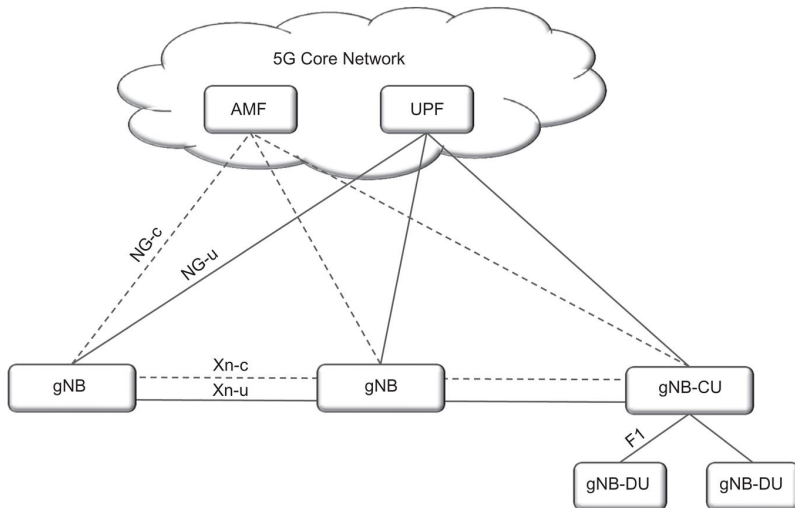
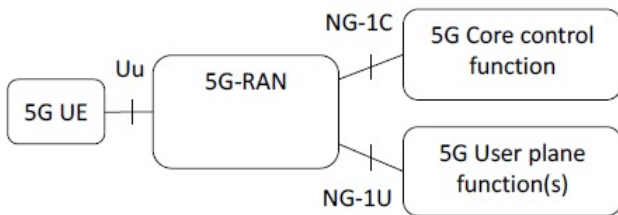


FIGURE 6.3 Radio-access network interfaces.

Figure: RAN Architecture



5G RAN Architecture

SDAP Functionalities

- Transmitting Entity

- ① Transfer of **user plane data**
- ② Mapping of QoS flow to DRB
- ③ Marking QoS flow ID
- ④ SDAP header addition

- Receiver Entity

- ① Reflective QoS mapping to DRB
- ② RQI handling
- ③ Retrieving SDAP Data by removing header

QoS Flow Handling

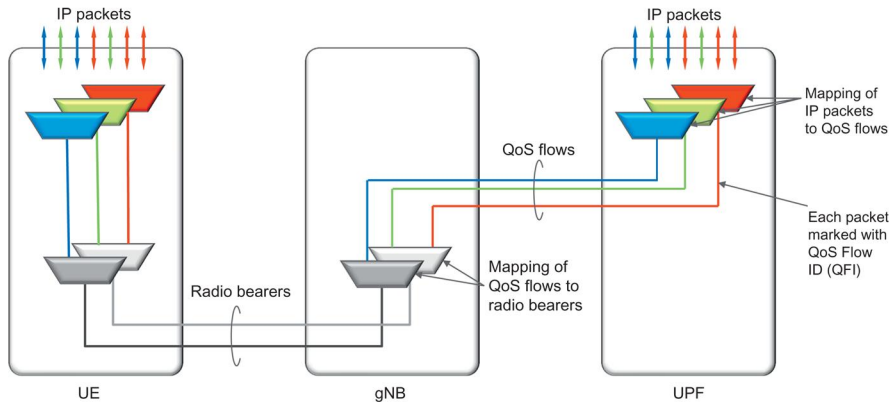
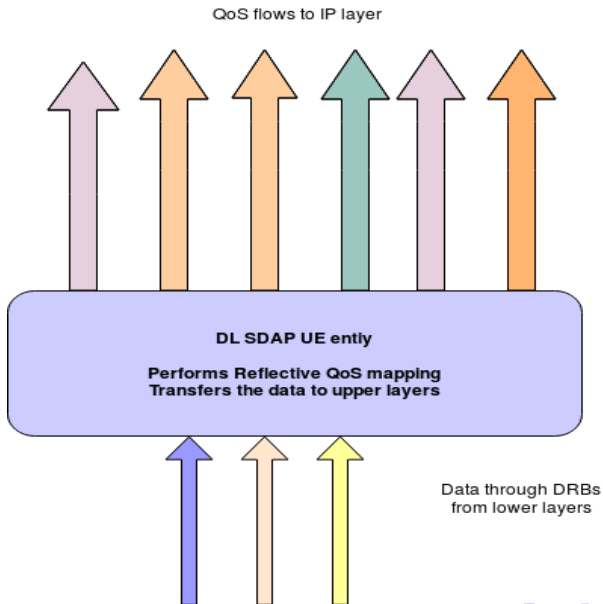
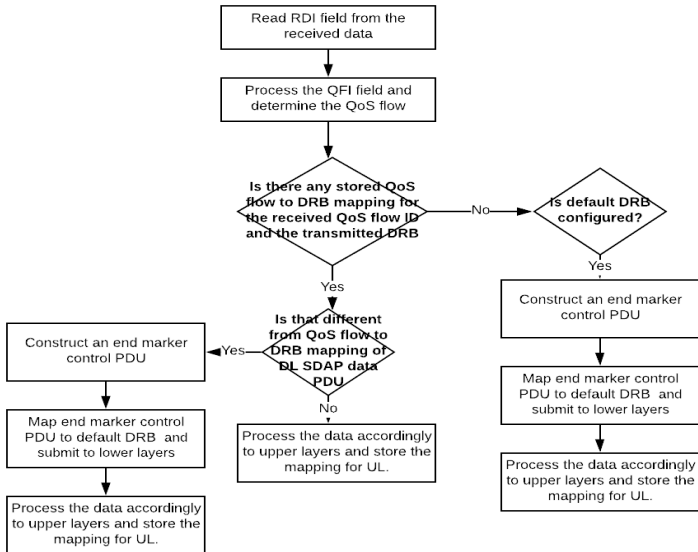


Figure: QoS Flows and Radio Bearers during a PDU session

DL SDAP UE Entity



Reflective QoS mapping in Downlink



Downlink SDAP UE

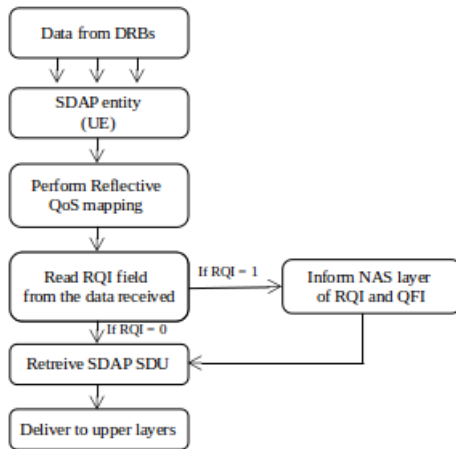
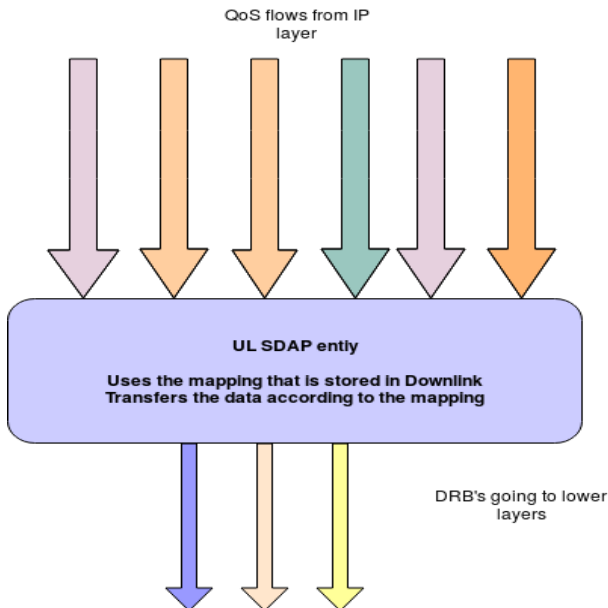
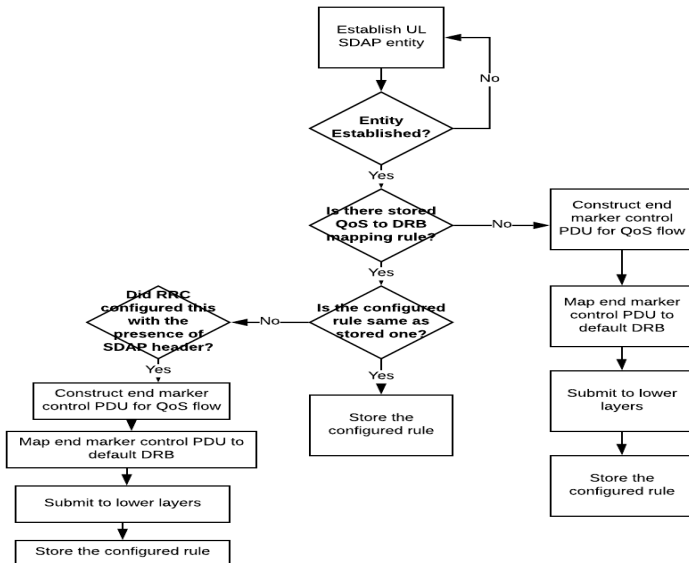


Figure: SDAP Downlink UE entity

UL SDAP UE entity



SDAP UE entity configuration in UL



Data Transfer in UL

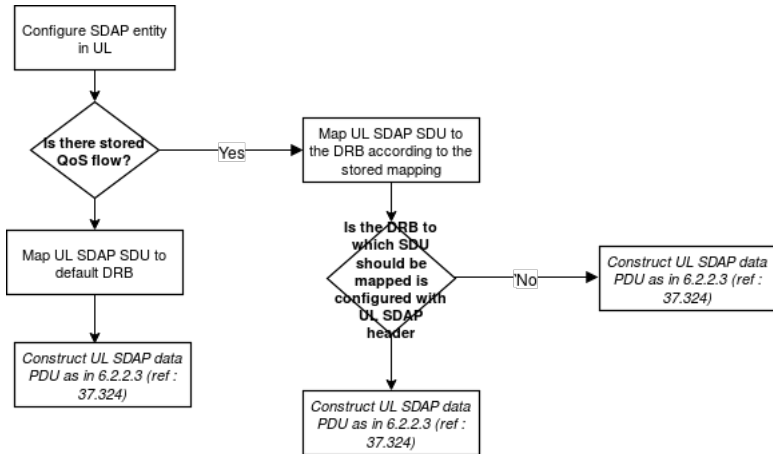


Figure: SDAP Downlink UE entity

Queires related to SDAP

- **Difference between Initialization and session establishment of an entity**
- **What are PDU sessions**
One SDAP entity is established for each PDU session. Each PDU session can carry any number of QoS flows. Max PDU Sessions per user is 250 (doubt). QoS flows are prioritized and sent via a session by NAS filters in UE and by corenetwork in gNB
- **How many SDAP entities do an UE and gNB contain**
One SDAP entity will be established to each PDU session
- **What is the need for QoS flow. Why IP packets cant directly be mapped to RB's in UE**
To prioritize and handle different IP packets

- **Why do we need RB's in userplane(Is that because of high computation in PDCP)**
- **What are NAS messages**
- **How do QFI field formed in upper layers**
- **Will the lookup table 'QoS flow to DRB mapping rule' be given to SDAP entity while configuring the entity?**
For gNB it will be given. UE will look at the mapping in downlink and apply that on the uplink
- **Based on what priority this lookup table is formed?**
*Based on the data rates and latency requirements for particular flow
 The IP packets are mapped to QoS flows based on QoS requirements, in terms of delay or data rate required. This happens in core network as part of UDF functionality.*
- **In standard, 37.324 , in page 6, it is stated that one QoS flow is mapped to one DRB at a time in UL. Why?**

- How is the QoS flow to DRB mapping rule happen in UL**
Reflective QoS mapping to DRB happens on downlink and UE applies this mapping on uplink
Each packet in downlink is marked with QoS flow Identifier (QFI) to assist QoS handling. Mapping of QoS flows to RBs is done by radio access network. Core network is aware of service requirements while RAN only maps QoS flows to radio bearers.
- Why is Reflective QoS flow to DRB mapping needed in DL**
The prioritization of services i.e. the QoS flows is handled by core network and RAN does not know about this prioritization. For this to be known at the UE, the gNB while transferring DL packets adds QFI to the packet and sends over the DRB according to the configuration given to it by RRC. UE stores this mapping in DL (Reflective QoS mapping scheme) and applies the same mapping on the UL.
- How many radio bearers get established for an UE and gNB by RRC**

- **What are QoS flows and why do we need**

Due to increased traffic of IP packets, QoS flow handling is a scheme which helps in prioritizing the services offered to an user at a given time based on the data rate and delay requirements of services. QoS flows are used to carry multiple IP packets at an instant based on this prioritization

Understanding Jargon

- SDU - Data entity from/to a higher layer protocol
PDU - Corresponding Data entity from/to a lower layer protocol
For eg., output from SDAP is a SDAP PDU which is a PDCP SDU
- What are radio bearers
There are two types of radio bearers, SRB and DRB
SRB - Signalling radio bearer (Used for transmission of RRC and NAS messages)
DRB - Data Radio Bearer (Used for transmission of user plane traffic)
- Quality of Service handling
For each connected device, there is one or more PDU sessions and with each PDU session there will be one or more QoS flows and DRBs associated.
- QoS flow to DRB mapping
A mapping rule determining on which DRB packets of a QoS flow shall be carried

- Reflective QoS flow to DRB mapping

A QoS flow to DRB mapping scheme where a UE monitors the QoS flow to DRB mapping rule in the DL, and applies it to in the UL

- NAS layer and NAS messages

Non Access Stratum (NAS) is a set of protocols in the evolved packet system. It is used to convey some signalling messages between UE and MME. It is not present in gNB or eNodeB