Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the PDU Session user plane protocol being used over the NG-U, Xn-U and N9 interfaces. Applicability to other interfaces is not precluded.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.300: "NextGen Radio Access Network (NG-RAN); Overall description; Stage 2".

[3] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

NG-U: logical interface between NG-RAN node and UPF as described in TS 38.300 [2].

Xn-U: logical interface between NG-RAN nodes as defined in TS 38.300 [2].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

QFI	QoS Flow Identifier
RQA	Reflective QoS Attribute
RQI	Reflective QoS Indication
UP	User Plane
UPF	User Plane Function

4 General

4.1 General aspects

The PDU Session User Plane protocol is located in the User Plane of the Radio Network Layer above the Transport Network Layer of the interface.

Each PDU session User Plane protocol instance is associated to one PDU Session.

In this version of the present document, the PDU session user plane protocol data is conveyed by GTP-U protocol means, more specifically, by means of the "GTP-U Container" GTP-U Extension Header as defined in TS 29.281 [3].

5 PDU Session user plane protocol

5.1 General

The PDU session UP layer uses services of the Transport Network Layer in order to send its packets over the interface.

5.2 PDU Session user plane protocol layer services

The following functions are provided by the PDU Session User Plane protocol:

- Provision of control information elements (e.g. QFI, RQI) associated with a PDU session.

5.3 Services expected from the Transport Network Layer

The PDU session UP layer expects the following services from the Transport Network Layer:

- Transfer of PDU session User Plane PDUs.

5.4 Elementary procedures

5.4.1 Transfer of DL PDU Session Information

5.4.1.1 Successful operation

The purpose of the Transfer of DL PDU Session Information procedure is to send control information elements related to the PDU Session from UPF/NG-RAN to NG-RAN.

A PDU Session user plane instance making use of the Transfer of DL PDU Session Information procedure is associated to a single PDU Session. The Transfer of DL PDU Session Information procedure may be invoked whenever packets for that particular PDU Session need to be transferred across the related interface instance.

The DL PDU Session Information frame includes a QoS Flow Identifier (QFI) field associated with the transferred packet. The NG-RAN shall use the received QFI to determine the QoS flow and QoS profile which are associated with the received packet.

The DL PDU Session Information frame shall also include the Reflective QoS Indicator (RQI) field to indicate that user plane Reflective QoS shall be activated or not. The NG-RAN shall, if RQA has been configured for the involved QoS flow, take the RQI into account and propagate the activation towards the UE or a peer NG-RAN node for this particular packet.

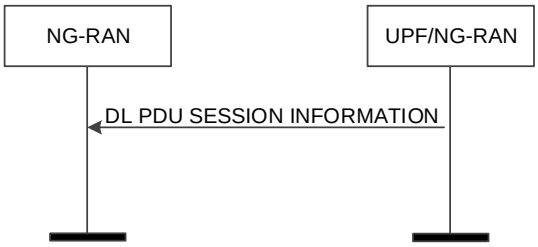

Figure 5.4.1.1-1: Successful Transfer of DL PDU Session Information

5.4.1.2 Unsuccessful operation

Void.

5.4.2 Transfer of UL PDU Session Information

5.4.2.1 Successful operation

The purpose of the Transfer of UL PDU Session Information procedure is to send control information elements related to the PDU Session from NG-RAN to UPF.

An UL PDU Session user plane instance making use of the Transfer of UL PDU Session Information procedure is associated to a single PDU Session. The Transfer of UL PDU Session Information procedure may be invoked whenever packets for that particular PDU Session need to be transferred across the related interface instance.

The UL PDU Session Information frame includes a QoS Flow Identifier (QFI) field associated with the transferred packet. The UPF shall use the received QFI to determine the QoS flow and QoS profile which are associated with the received packet.

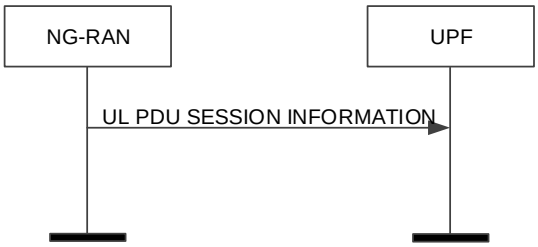

Figure 5.4.2.1-1: Successful Transfer of UL PDU Session Information

5.4.2.2 Unsuccessful operation

Void.

5.5 Elements for the PDU Session user plane protocol

5.5.1 General

In the present document the structure of frames are specified by using figures similar to figure 5.5.1-1.

Bits								Number of Octets	
7	6	5	4	3	2	1	0		
Field 1				Field 2				1	Octet 1
Field 3						Field 4		2	Octet 2
Field 4 continue				Spare					Octet 3
Field 6								2	Octet 4
Field 6 continue				Padding bits					Octet 5
Future Extension								0-m	
Padding								0-3	

Figure 5.5.1-1: Example frame format

Unless otherwise indicated, fields which consist of multiple bits within an octet have the most significant bit located at the higher bit position (indicated above frame in figure 5.5.1-1). In addition, if a field spans several octets, most significant bits are located in lower numbered octets (right of frame in figure 5.5.1-1).

On the NG interface, the frame is transmitted starting from the lowest numbered octet. Within each octet, the bits are sent according to decreasing bit position (bit position 7 first).

Spare bits should be set to "0" by the sender and should not be checked by the receiver.

The header part of the frame is always an integer number of octets. The payload part is octet aligned (by adding 'Padding Bits' when needed).

The receiver should be able to remove an additional Future Extension field that may be present.
See description of Future Extension field in A.1.

Padding octets may be added at the end of the frame, see Padding in 5.5.3.5.

5.5.2 Frame format for the PDU Session user plane protocol

5.5.2.1 DL PDU SESSION INFORMATION (PDU Type 0)

This frame format is defined to allow the NG-RAN to receive some control information elements which are associated with the transfer of a packet over the interface.

The following shows the respective DL PDU SESSION INFORMATION frame.

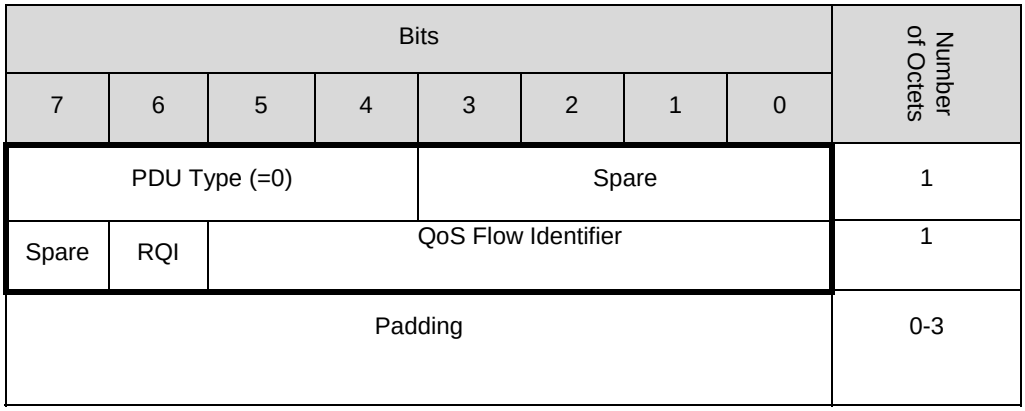

Figure 5.5.2.1-1: DL PDU SESSION INFORMATION (PDU Type 0) Format

5.5.2.2 UL PDU SESSION INFORMATION (PDU Type 1)

This frame format is defined to allow the UPF to receive some control information elements which are associated with the transfer of a packet over the interface.

The following shows the respective UL PDU SESSION INFORMATION frame.

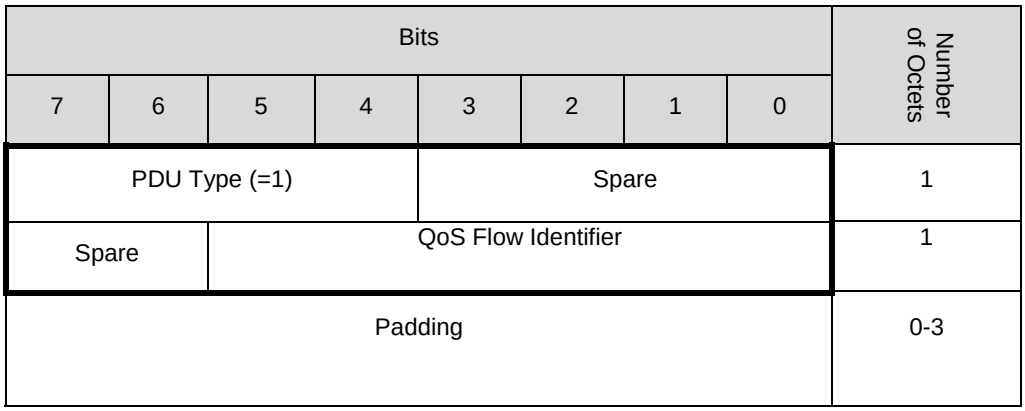

Figure 5.5.2.2-1: UL PDU SESSION INFORMATION (PDU Type 1) Format

5.5.3 Coding of information elements in frames

5.5.3.1 PDU Type

Description: The PDU Type indicates the structure of the PDU session UP frame. The field takes the value of the PDU Type it identifies; i.e. "0" for PDU Type 0. The PDU type is in bit 4 to bit 7 in the first octet of the frame.

Value range: {0=PDU SESSION INFORMATION 1-15=reserved for future PDU type extensions}.

Field length: 4 bits.

5.5.3.2 Spare

Description: The spare field is set to "0" by the sender and should not be interpreted by the receiver. This field is reserved for later versions.

Value range: $(0–2^n-1)$.

Field Length: n bits.

5.5.3.3 QoS Flow Identifier (QFI)

Description: When present this parameter indicates the QoS Flow Identifier of the QoS flow to which the transferred packet belongs.

Value range: $\{0..2^6-1\}$.

Field length: 6 bits.

5.5.3.4 Reflective QoS Indicator (RQI)

Description: This parameter indicates activation of the reflective QoS towards the UE for the transferred packet as described in clause 5.4.1.1. It is used only in the downlink direction. If RQA (Reflective QoS Activation) has not been configured for the involved QoS flow, the RQI shall be ignored by the NG-RAN node.

Value range: {0= Reflective QoS activation not triggered, 1= Reflective QoS activation triggered}.

Field length: 1 bit.

5.5.3.5 Padding

Description: The padding is included at the end of the frame to ensure that the PDU Session user plane protocol PDU length (including padding and the future extension) is (n*4– 2) octets, where n is a positive integer. If there is any future extension, the padding should be added after the future extensions.

Field Length: 0–3 octets.

5.5.4 Timers

Void.

5.6 Handling of unknown, unforeseen and erroneous protocol data

Void.

Annex A (informative): Example of using Future Extension Field

A.1 Example of using Future Extension field

New IE flag 7(E)	New IE flag 6	New IE flag 5	New IE flag 4	New IE flag 3	New IE flag 2	New IE flag 1	New IE flag 0	1 Octet New IE Flags
New IE 1								3 Octets
New IE 2								2 Octets

Figure A.1-1: Example of future Extension Field

In the Example of the future Extension Field, New IE flag 0 indicates if the New IE 1 is present or not. New IE flag 1 indicates if the new IE 2 is present or not.

A.1.1 New IE Flags

Description: The *New IE Flags* IE is only present if at least one new IE is present. The *New IE Flags* IE contains flags indicating which new IEs that are present following the *New IE Flags* IE. The last bit position of the *New IE Flags* IE is used as the Extension Flag to allow the extension of the *New IE Flags* IE in the future. Extension octets of the *New IE Flags* IE shall follow directly after the first octet of the *New IE Flags* IE. When an extension octet of the *New IE Flags* IE is present, then all previous extension octets of the *New IE Flags* IE and the *New IE Flags* IE shall also be present, even if they have all their flag bits indicating no presence of their respective new IEs.