

Study on User Plane Protocol at 3GPP (FS_UPPS)

Satoru Matsushima
Rapporteur of FS_UPPS, 3GPP CT4 WG

IETF101

Background

- **So far no intensive study on User Plane Protocol.**
- **Need to investigate potential alternatives.**

3 Justification

CT4 has worked to study user-plane protocol for N9 in TR 29.891 based on stage 2 requirements from TS 23.501 for Rel-15. While existing user-plane protocol is for that release the same as in previous releases, growth of IPv6 adoption as user packet data protocol has been observed. IAB consequently released a statement that recommends SDOs to review existing standards to ensure they will work with IPv6 and encourage the industry to develop strategies for IPv6-only operation. Although current user-plane protocol works on IPv6 network, there was no study on whether there is any space or not to improve current user-plane operations in IPv6 network. In the case of IPv6-only network, a standard and a work in progress are developed in IETF.

It is worth to investigate potential limits of the existing user plane solution and potential benefits of alternative user plane solutions, including enhancing existing user plane solution, based on stage 2 requirements specified in 3GPP TS 23.501 and 23.502. As 3GPP encouraged IETF to work together and collaboration toward 5G, data-plane optimization work is being taken up in IETF DMM Working Group which will be ready to communicate with 3GPP. All this work thereby might impact user-plane protocol and interface under CT4 and RAN3 WG responsibility.

Objectives and Approach

The Study will contribute to protocol selection.

i.e: Another work will follow it to make the selection.

Objectives	Phase.1	<ul style="list-style-type: none">• Liaise with IETF on the current GTP-U specification. (TS29.281 v15.1.0)	<ul style="list-style-type: none">• Jan '18 ~• Collect candidate protocols incl. IETF
	Phase.2	<ul style="list-style-type: none">• <i>Set criteria</i> for protocol selection based on Rel-16 requirements.• <i>Evaluate</i> candidate protocols.	<ul style="list-style-type: none">• July '18 ~• <i>Control Plane impact</i> should be taken into account.
Approach	Investigation	<ul style="list-style-type: none">• Investigate solutions alternative to GTP-U, including IETF solutions.	<ul style="list-style-type: none">• Other WGs in 3GPP would need to be involved: RAN3, CT3, etc.,
	Comparison	<ul style="list-style-type: none">• Compare GTP-U an other solutions to see if there is matter for User Plane protocol swap.	<ul style="list-style-type: none">• A protocol recommendation will be the outcome of phase.2 as TR29.892.

LS to IETF DMM

- Ask “any” info, but hope that ease to digest.
- Help to set the protocol selection criteria and evaluations.

2. Actions:

To IETF DMM:

ACTION: CT4 respectfully asks IETF DMM to provide any information that may be relevant to the above CT4 work by July 2018.

3. Date of Next CT and CT4 Meetings:

CT4#83	26 th Feb – 2 nd Mar 2018	Montreal, CAN
CT#79	19 th – 20 th Mar 2018	Chennai, India
CT4#84	16 th – 20 th April 2018	Kunming, China
CT4#85	21 st – 25 th May 2018	Osaka, Japan
CT#80	11 th – 12 th June 2018	La Jolla, USA
CT4#85-bis	9 th – 13 th July 2018	TBD, France
CT4#86	20 st – 24 th Aug 2018	TBD, USA

Overview of TS29.281 GTPv1-U

GTPv1-U Protocol Stack

- **GTPv1-U is an tunnel protocol over UDP/IPv(4|6)**
- **RFC2460 is IPv6 spec reference.** (i.e, no UDP zero-checksum?)

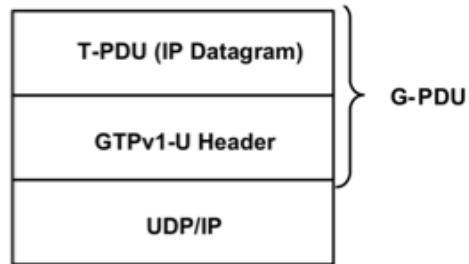


Figure: 4.4-1 G-PDU Protocol Stack

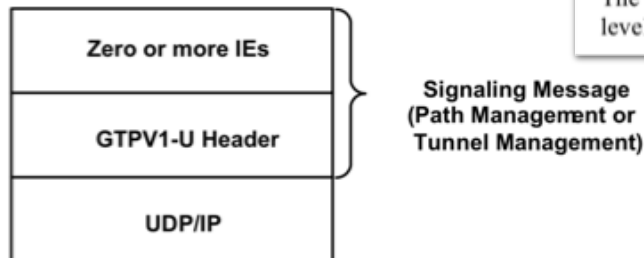


Figure: 4.4-2 Signalling Message Protocol Stack

4.4.1 UDP/IP

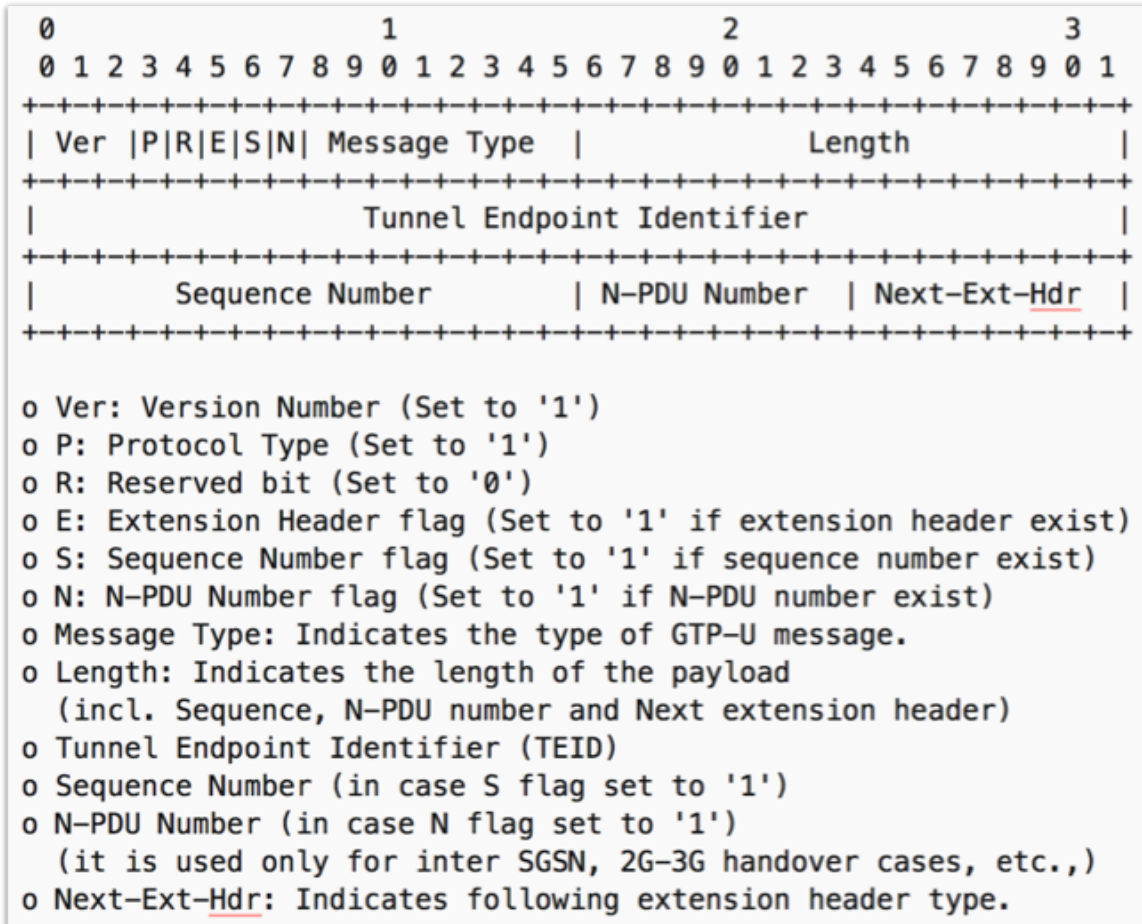
UDP/IP is the only path protocol defined to transfer GTP messages in the version 1 of GTP.

A GTPv1-U peer shall support the User Datagram Protocol (UDP) as defined by IETF RFC 768 [9] shall be used.

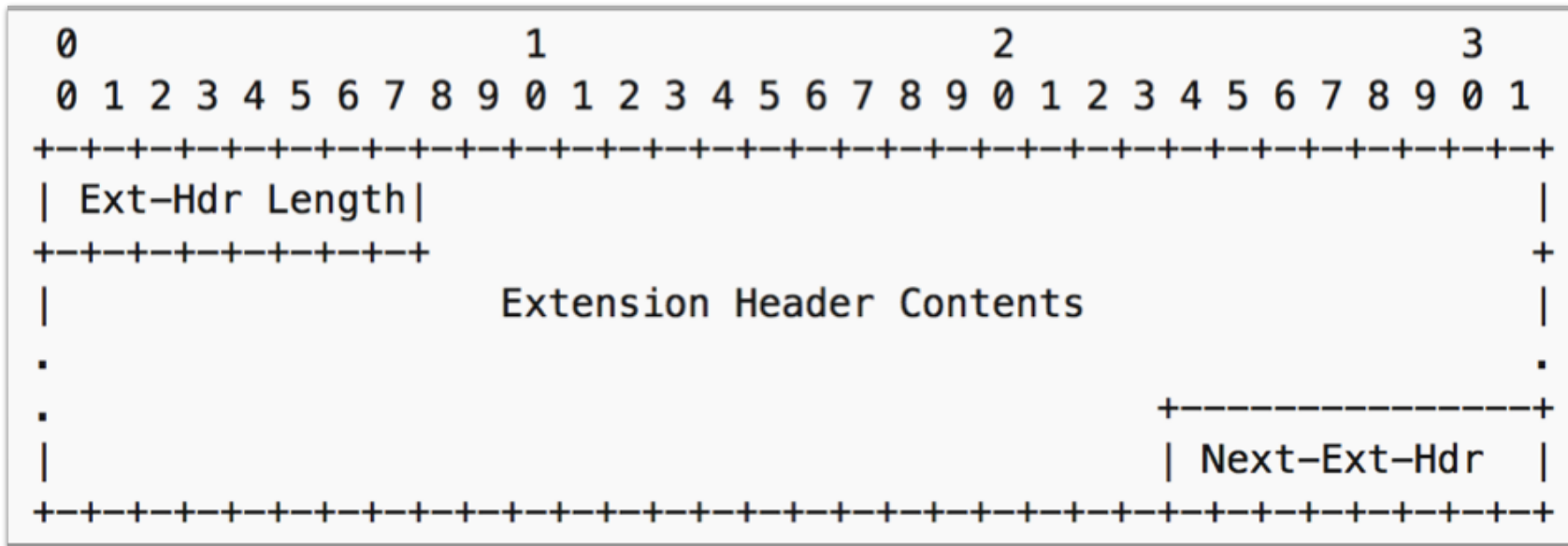
A GTPv1-U peer shall support IPv4 as defined by IETF RFC 791 [10] and should support IPv6 as defined by IETF RFC 2460 [15].

The DSCP marking as defined by IETF RFC 2474 [26] shall be set based on the QCI, and optionally the ARP priority level, of the associated EPS bearer, as described in sub-clause 4.7.3 of 3GPP TS 23.401 [5].

GTPv1-U in IETF-friendly format



GTPv1-U in IETF-friendly format (Extension Header)



GTPv1-U Extension Header Types

- A new 5G specific extension header will be added.

Next Extension Header Field Value ↗	Type of Extension Header ↗
0000 0000 ↗	No more extension headers ↗
0000 0001 ↗	Reserved - Control Plane only. ↗
0000 0010 ↗	Reserved - Control Plane only. ↗
0010 0000 ↗	Service Class Indicator ↗
0100 0000 ↗	UDP Port. Provides the UDP Source Port of the triggering message. ↗
1000 0001 ↗	RAN Container ↗
1000 0010 ↗	Long PDCP PDU Number ↗
1000 0011 ↗	Xw RAN Container ↗
1100 0000 ↗	PDCP PDU Number [4]-[5]. See NOTE 1. ↗
1100 0001 ↗	Reserved - Control Plane only. ↗
1100 0010 ↗	Reserved - Control Plane only. ↗
NOTE 1: As an exception to the comprehension rule specified above, for a G-PDU with a Next Extension Header Field set to the value "1100 0000", the SGW shall consider this corresponding extension header as 'comprehension not required'. ↗	

GTPv1-U Message Types

Message Type value (Decimal)	Message	Reference	GTP-C	GTP-U	GTP'
1	Echo Request		X	X	x
2	Echo Response		X	X	x
3-25	Reserved in 3GPP TS 32.295 [8] and 3GPP TS 29.060 [6]				
26	Error Indication			X	
27-30	Reserved in 3GPP TS 29.060 [6]				
31	Supported Extension Headers Notification		X	X	
32-253	Reserved in 3GPP TS 29.060 [6]				
254	End Marker			X	
255	G-PDU			X	

Multicast on User Plane

- **GTPv1-U supports multicast w/ C-TEID**

4.2.6 MBMS IP Multicast Distribution of the User Plane Data

GTP-U Multicast Tunnels are used for unidirectional transfer of the encapsulated T-PDUs from one GTP-U Tunnel Endpoint acting as an IP multicast source to multiple GTP-U Tunnel Endpoints acting as IP multicast listeners, as specified in TS 23.246 [18]. The Common Tunnel Endpoint ID (C-TEID) which is present in the GTP header shall indicate which tunnel a particular T-PDU belongs to. The C-TEID value to be used in the TEID field is allocated at the source Tunnel Endpoint and signalled to the destination Tunnel Endpoint using a control plane protocol i.e. GTPv1-C, and RANAP, GTPv2-C and S1-AP. There is one C-TEID allocated per MBMS bearer service.

The destination IP address in the outer GTPv1-U IP header is an address in the multicast address range as specified in IETF RFC 4607 [20].

If the RNC decides to receive IP multicast packets, then the RNC shall join the IP multicast group as specified by IETF RFC 4604 [19] and IETF RFC 4607 [20].

If the eNodeB supports MBMS as specified in TS 23.246 [18], it shall join the IP multicast group as specified in IETF RFC 4604 [19] and IETF RFC 4607 [20].

The characteristics for point-to-multipoint GTP-U Multicast Tunnels used for MBMS are the same as for a point-to-point GTP-U Tunnels unless specified otherwise. The differences are specified in subclause 7.1.

Packet Order Guarantee for User Plane

- **GTP-U has optional sequence number field.**
- **UP node relays seq#, or reorder the packets by seq#**

4.3.1 Handling of Sequence Numbers

This functionality is provided only when the S bit is set to 1 in the GTP-U header.

For PGW, SGW, ePDG, eNodeB, TWAN, MME, gNB, N3IWF, and UPF, the usage of sequence numbers in G-PDUs is optional, but if GTP-U protocol entities in these nodes are relaying G-PDUs to other nodes, then they shall relay the sequence numbers as well. For all other cases, the PGW, SGW, ePDG, eNodeB, TWAN, MME, gNB, N3IWF and UPF should set the "S" flag to 0 in the GTPv1 header which then indicates that the sequence number is not used in the T-PDU.

Summary

- 3GPP CT4 has started User Plane Protocol study.
 - Impact to 5G architecture is not expected at this time.
(i.e: Rel-16 requirements haven't been fixed.)
 - Including IETF protocols in addition to TS29.281 GTPv1-U.
- 3GPP CT4 kindly ask IETF DMM to provide 'any' info on user plane protocol.
 - Candidate protocols in ease to digest format are really appreciated. 😊
 - Be useful to set protocol selection criteria and evaluation.
- Investigating GTPv1-U and Control Plane impacts of the candidates.
 - It should be done to consider replace and/or co-exist with GTPv1-U.
 - Other LS attached documents may help the work in IETF.



I E T F[®]



A GLOBAL INITIATIVE