

User Plane Protocol and Architectural Analysis on 3GPP 5G System

draft-ietf-dmm-5g-uplane-analysis

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Background

- This work was initiated by User Plane Protocol Study in 3GPP CT4.
- Motivations:
 - Unifying understanding of IETF to specifications on U-Plane of 3GPP 5G System
 - Showing to 3GPP that IETF has enough knowledge about 5G specs
- Way to work:
 - Analyzed GTP-U and architectural requirements for 5G user plane
 - GTP-U Specifications (TS29.281)
 - 5GS Architecture Specs (TS23.501, 502, 503, etc.)
 - Provided some evaluate aspects for candidate protocols

History

- 26th Jun. 2018: v00 was published
- 4th & 17th Jul. 2018: Presented at 3GPP CT4#85-bis and IETF 102 meetings
- 27th Jul. 2018: Sent as a part of LS-IN from IETF DMM-WG to 3GPP CT4
- 10th Aug. 2018: Updated for reflecting LS-OUT from 3GPP CT4 (v01)
- 22nd Oct. 2018: Updated for reflecting discussion on ML (v02)
- 6th Jan. 2019: Adopted as WG document
- 11th Mar. 2019: Updated for reflecting feedback on ML (v01)
- 8th Jul. 2019: Updated for reflecting URLLC and PFCP state information (v02)
- 4th Nov. 2019: Updated for reflecting a requirement for QoS monitoring (v03)
- 2nd Nov. 2020: Updated for reflecting the Rel-16 updates on GTP-U and 5GC (v04)

Major Updates

<https://tools.ietf.org/rfcdiff?url2=draft-ietf-dmm-5g-uplane-analysis-04.txt>

Object	Update Details
[Sec3.2] Updated GTP-U protocol specification	<ul style="list-style-type: none">• GTP-U supports the load balancing by dynamic IPv6 flow label• Reference of IPv6 is updated to RFC8200• GTP-U supports UDP zero checksum
[Sec3.5] Updated GTP-U example packet format	<ul style="list-style-type: none">• Added new bit space for QMP and SNP in PDU Session Container field
[Sec4.2] Categorized Arch-Reqs for U-plane protocols	<ul style="list-style-type: none">• Categorized Architectural Requirements for User Plane Protocols into two parts:<ul style="list-style-type: none">• Fundamental Functionaities• Supporting 5G Services
[Sec4.2.2] Analysis of UP requirements on additional 5G services	<ul style="list-style-type: none">• Added analysis of UP requirements on 5G services as below:<ul style="list-style-type: none">• QoS Monitoring for URLLC (@v03)• Time Sensitive Communication(@v04)• Cellular IoT (@v04)

Sec3.2: load balancing by IPv6 flow label

- Load balancing by dynamic IPv6 flow label
 - GTP-U is updated to support the load balancing (ECMP) by IPv6 flow label from Release 16

▪ 4.4.2 UDP header and port numbers↵

▪ 4.4.2.0 General↵

For the GTP-U messages described below (other than the Echo Response message, see clause 4.4.2.2), the UDP Source Port or the Flow Label field (see IETF RFC 6437 [37]) should be set dynamically by the sending GTP-U entity to help balancing the load in the transport network.↵

From section 4.4.2.0 of

<https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=1699>

Sec3.2: IPv6 reference and UDP zero checksum

- The reference to IPv6 protocol is updated to RFC8200
- Added a specification of the UDP zero checksum at the outer UDP header

A negative statement, but in other words, available among supported nodes

When using GTP-U over IPv6 (see IETF RFC 8200 [36]), the UDP checksum shall not be set to zero by the sending GTP-U entity unless it is ensured that the peer GTP-U entity and the path in-between supports UDP zero checksum. ↩

- **NOTE 1:** GTP-U entities complying with an earlier version of the specification or on path IPv6 middleboxes can implement IPv6 as specified in IETF RFC 2460 [15] and discard UDP packets containing a zero checksum. ↩
- **NOTE 2:** How a sending GTP-U entity knows whether the peer GTP-U entity and the path in-between supports UDP zero checksum is out of scope of this specification. ↩

From section 4.4.2.0 of

<https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=1699>

Sec3.5: Updated GTP-U example packet format

- PDU Session Container is updated to support URLLC in Release 16
 - PDU Session Container is a GTP-U Extension Header conveying QFI of PDU
 - Two new flags (QMP and SNP) are added in the Spare field and corresponding fields are added
- In our example packet format, we added these two flags as zero value

- If **QMP** bit is 1, the PDU Session Container contains the **QoS monitoring** related information
- If **SNP** bit is 1, the PDU Session Container contains **sequence number** information



Bits								Number of Octets
7	6	5	4	3	2	1	0	
PDU Type (=0)				QMP	SNP	Spare		1
PPP	RQI	QoS Flow Identifier						1
PPI			Spare					0 or 1
DL Sending Time Stamp								0 or 8
DL QFI Sequence Number								0 or 3
Padding								0-3

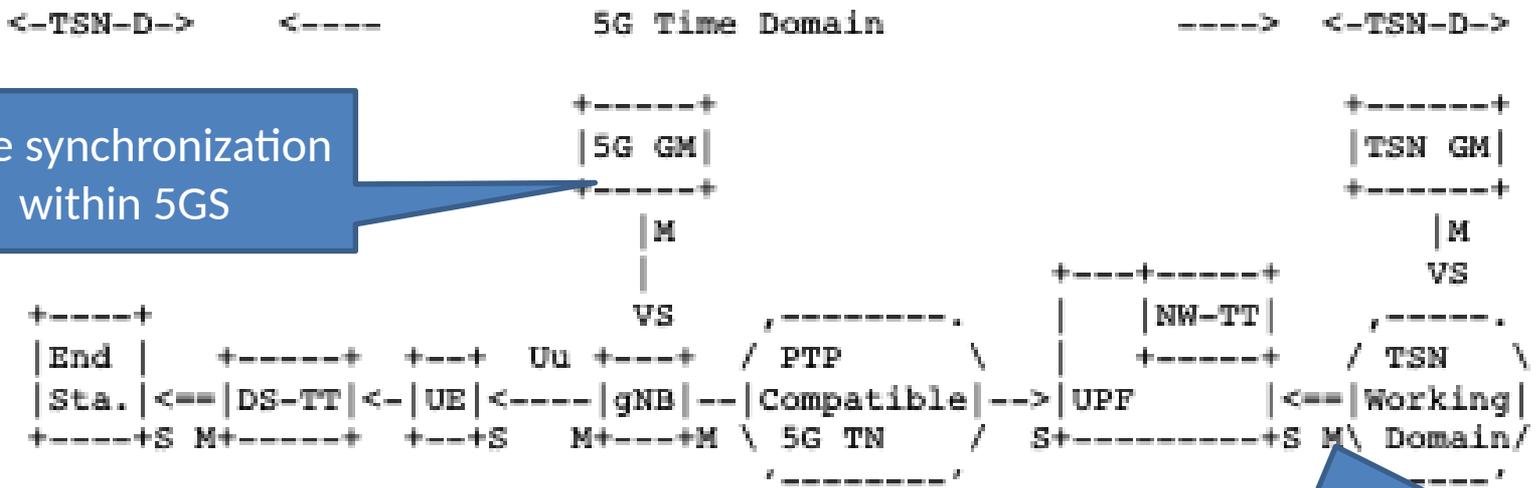
Figure 5.5.2.1-1: DL PDU SESSION INFORMATION (PDU Type 0) Format

From section 5.5.2 of <https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3440>

Sec4.2.2 Time Sensitive Communication

- Support TSN (IEEE Std. 802.1AS) for real time communication
 - Time synchronization within 5GS
 - Implementation of NW-TT at UPF

Time synchronization within 5GS



Interwork with external TSN domain

Sec4.2.2 Cellular IoT Communication

- Support various machine types communication:
 - Non IP Data Delivery: applicable to unstructured data units
 - Reliable Data Service:
reachability confirmation sequence for unstructured data
 - High Latency Communication:
buffering of down-link data for idle state UEs
 - Small Data Rate Communication:
limiting the number of packets per time unit in uplink/downlink
 - User Plane CloT 5GS Optimization:
enabling transfer of UP data without service request procedure
 - Etc.

Status & Next Steps

- Updates at v04
 - Updated Release16-updated GTP-U specification
 - Added U-Plane related 5G services (TSN integration and Cellular IoT)
- Any other Release 16 added features related to U-Plane?
- Appreciated further review, feedback, and comment!

Questions / Comments?