

Workgroup: Internet Engineering Task Force

Internet-Draft:

draft-murakami-dmm-user-plane-message-
encoding-04

Published: September 2021

Intended Status: Informational

Expires: 6 March 2022

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User Plane Message Encoding

Abstract

This document defines the encoding of User Plane messages into Segment Routing Header (SRH). The SRH carries the User Plane messages over SRv6 Network.

Status of This Memo

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Table of Contents

- [1. Introduction](#)
- [2. Requirements Language](#)
- [3. Conventions and Terminology](#)
- [4. Motivation](#)
- [5. User Plane Message encoding into SRH](#)
 - [5.1. GTP-U Header format](#)
 - [5.2. Args.Mob.Upmsg](#)
 - [5.3. Encoding of Tags Field](#)
 - [5.4. User Plane message Information Element Support](#)
 - [5.5. SID flavor consideration](#)
- [6. Security Considerations](#)
- [7. IANA Consideration](#)
- [8. Acknowledgements](#)
- [9. References](#)
 - [9.1. Normative References](#)
 - [9.2. Informative References](#)
- [Authors' Addresses](#)

1. Introduction

3GPP defines User Plane function (UPF) and the protocol messages that it supports. The User Plane messages support in-band signalling for path and tunnel management. Currently, User Plane messages are defined in [TS 29.281](#) [[TS29281](#)].

When using SRv6 (Segment Routing IPv6) as a transport protocol for User Plane Function (UPF) of mobile networks, based on [draft-ietf-dmm-srv6-mobile-uplane](#) [[I-D.ietf-dmm-srv6-mobile-uplane](#)]. User Plane messages must be carried over SRv6 network. This document defines which User Plane message must be encoded to SRv6 and also defines how to encode the User Plane messages into SRH.

In addition, SRH is mandatory at the ultimate segment upon carrying the User Plane messages because User Plane message is encoded into SRH. Hence, this document considers how to deal with the encoding of User Plane messages into SRH when PSP is applied that SRH is popped out at the penultimate segment.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

3. Conventions and Terminology

SRv6: Segment Routing IPv6.

GTP-U: GPRS Tunneling Protocol User Plane.

UPF: User Plane Function.

SRH: IPv6 Segment Routing Header.

PSP: Penultimate Segment POP of the SRH.

USP: Ultimate Segment Pop of the SRH.

4. Motivation

3GPP User Plane needs to support the user plane messages associated with a GTP-U tunnel defined in [[TS29281](#)]. In the case of SRv6 User Plane [[I-D.ietf-dmm-srv6-mobile-uplane](#)], those messages are also required when the user plane interworks with GTP-U.

IPv6 Segment Routing Header (SRH) [[RFC8754](#)] is used for SRv6 User Plane. SRH is able to associate additional information to the segments. The Tag field of SRH is capable to indicate different properties within a SID. SRH TLV is capable to provide meta-data to the endpoint node.

The above capability of SRH motivates us to map the user plane messages into it because of the same encapsulation with the packets of carrying client packets. It introduces no additional headers or extension headers to be chained in the packet just for carrying the user plane messages.

5. User Plane Message encoding into SRH

This section defines how to encode the User Plane messages into SRH in order to carry the User Plane messages over SRv6 network.

5.1. GTP-U Header format

3GPP defines GTP-U Header format as shown below.

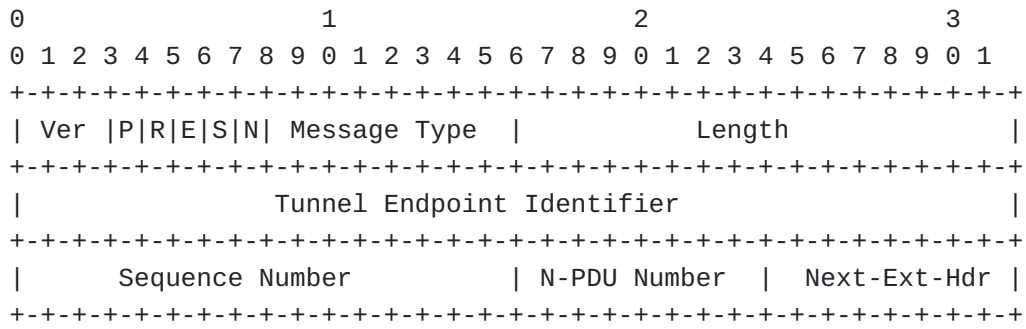


Figure 1: GTP-U Header format

User Plane message type is encoded in Message Type field of GTP-U Header. The following User Plane messages must be carried over SRv6 network at least. The value of each User Plane message type is defined as shown below.

Echo Request: 1

Echo Reply: 2

Error Indication: 26

End Marker: 254

5.2. Args.Mob.Upmsg

[draft-ietf-dmm-srv6-mobile-uplane](#) [I-D.ietf-dmm-srv6-mobile-uplane] defines the format of Args.Mob.Session argument which is used in SRv6 SID Mobility Functions in order to carry the PDU Session identifier. The format of Args.Mobs.Session is defined as shown below.

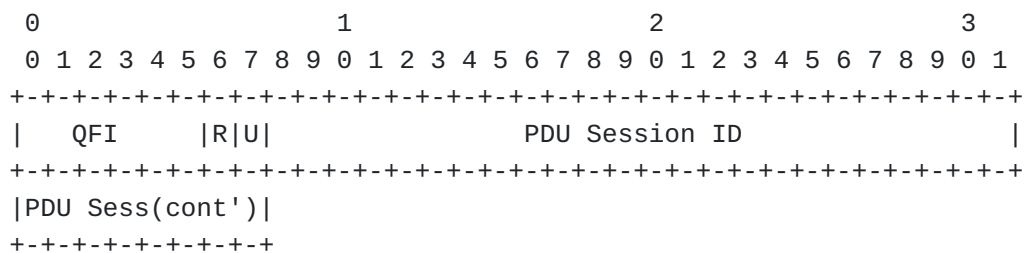


Figure 2: Args.Mob.Session format

In case of Echo Request, Echo Reply and Error Indication, Sequence Number in GTP-U header needs to be carried. Similar to [draft-ietf-dmm-srv6-mobile-uplane](#) [I-D.ietf-dmm-srv6-mobile-uplane], the new arguments to carry Sequence number for Echo Request, Echo Reply and Error Indication message needs to be defined. For this, the

following Args.Mobs.Upmsg should be defined newly to carry Sequence number.

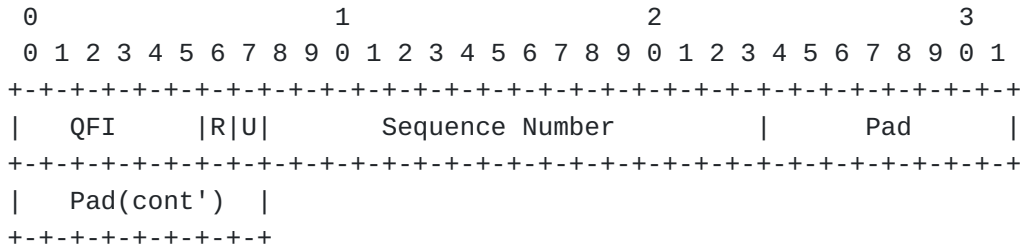


Figure 3: Args.Mob.Upmsg format for Echo Request, Echo Reply and Error Indication

QFI bit, R bit, U bit and 16-bit Sequence Number is encoded in Args.Mobs.Upmsg. The remaining bits followed by Sequence Number must be padded in 0.

In case of End Marker, TEID shall be used as PDU Session ID same as [draft-ietf-dmm-srv6-mobile-uplane](#) [I-D.ietf-dmm-srv6-mobile-uplane]. Hence, for End Marker, Args.Mobs.Session should be used to carry TEID as PDU Session ID.

5.3. Encoding of Tags Field

The Segment Routing Header is defined in [IPv6 Segment Routing Header \(SRH\)](#) [RFC8754]. This draft defines 16 bits Tag field but does not define the format or use of this Tag field in the Segment Routing Header.

The User Plane message type encoding is defined in [TS 29.281](#) [TS29281]. Based on this definition, the User Plane message type must be encoded into the Tag field in the Segment Routing Header in order to indicate the type of the user plane messages for at least Echo Request, Echo Reply, Error Indication or End Marker.

Only UPF must process the Tag field where the user plane message is encoded. In addition, when the user plane message is encoded in the Tag field, the UPF should not encode any segments in the Segment Routing Header whose function modifies the Tag field value. Any other transport router implementing SRv6 must ignore the Tag field upon processing the Segment Routing Header.

The user plane messages must be encoded into the Tag field as shown below.

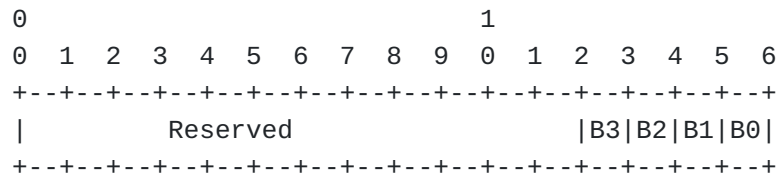


Figure 4: Tag Field Encoding

Bit 0 [B0]: End Marker

Bit 1 [B1]: Error Indication

Bit 2 [B2]: Echo Request

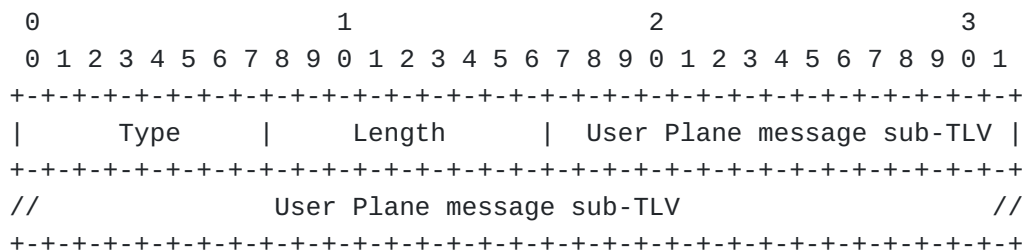
Bit 3 [B3]: Echo Reply

End Marker, Echo Request and Echo reply messages do not require any additional information elements. However, Error Indication message requires the additional information elements like Tunnel Endpoint Identifier Data IE, GSN Address, etc. These additional information elements can be encoded into the SRH TLV that is defined in the next section.

5.4. User Plane message Information Element Support

End Maker, Echo Request and Echo Reply messages do not require any additional information elements. However, Error Indication message requires additional 3GPP IEs (Information Element). These additional information elements must be carried over SRv6 network as well. However SRv6 SID has limited space only. Hence it cannot carry a lot of information elements.

In order to carry more information elements, SRH TLV shall be leveraged. SRH TLV is defined in [IPv6 Segment Routing Header \(SRH\) \[RFC8754\]](#) in order to carry the meta-data for the segment processing. In order to carry additional User Plane messages like 3GPP IEs, the new type named as "User Plane Container" must be defined as the new SRH TLV. The "User Plane Container" can carry additional User Plane messages which includes multiple 3GPP IEs with 1 sub-TLV.



6. Security Considerations

This document does not raise any additional security issues. This document just define the mechanisms for mapping between user plane message (GTP-U message) and SRH in SRv6. Basically, since this document is using SRH defined in [RFC8754] to carry user plane message, same security consideration stated in [RFC8754] shall be applied.

7. IANA Consideration

The type value of SRH TLV for User Plane Container must be assigned by IANA.

8. Acknowledgements

9. References

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