Export of GTP-U Information in IPFIX
draft-ietf-opsawg-ipfix-gtpu-00

Enabling insights in GTP forwarding plane by adding GTP-U dimensions

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GTP-U @ IPFIX
Draft Status since last review @ IETF119

- Draft is adopted by OPSAWG

- Many thanks Paul Aitken for the IPFIX doctor review.

- IANA assigned IE numbers for GTP fields are available; EI 505-510.

- Added a new section named 'Operational Considerations'

GTP-U @ IPFIX
Data-Plane visibility is missing in GTP

- GTP is the protocol used by network mobile operators for cellular networks.

- Data-Plane visibility is missing in GTP-U and so unable to identify the transport performance of PDU Sessions with specific QoS within a slice or within a group of slices.

3GPP TS 29.281 version 17.4.0 Release 17   **19**   **ETSI TS 129 281 V17.4.0 (2022-10)**

Octets	Bits							
	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Version		PT		(*)	E	S	PN
2	Message Type							
3	Length (1st Octet)							
4	Length (2nd Octet)							
5	Tunnel Endpoint Identifier (1st Octet)							
6	Tunnel Endpoint Identifier (2nd Octet)							
7	Tunnel Endpoint Identifier (3rd Octet)							
8	Tunnel Endpoint Identifier (4th Octet)							
9	Sequence Number (1st Octet)[1) 4)]							
10	Sequence Number (2nd Octet)[1) 4)]							
11	N-PDU Number[2) 4)]							
12	Next Extension Header Type[3) 4)]							

NOTE 0: (*) This bit is a spare bit. It shall be sent as '0'. The receiver shall not evaluate this bit.
NOTE 1: 1) This field shall only be evaluated when indicated by the S flag set to 1.
NOTE 2: 2) This field shall only be evaluated when indicated by the PN flag set to 1.
NOTE 3: 3) This field shall only be evaluated when indicated by the E flag set to 1.
NOTE 4: 4) This field shall be present if and only if any one or more of the S, PN and E flags are set.

Figure 5.1-1: Outline of the GTP-U Header

GTP-U @ IPFIX
IPFIX entities in context of the GTP-U (1)

- **gtpuFlags EI-505**

  8-bit flags field defined in the GTP-U which indicates the version of GTP-U protocol, protocol type and presence of extension header, sequence number and N-PDU number in the GTP-U header.

- **gtpuMsgType EI-506**

  8-bit message type field defined in the GTP-U which indicates the type of GTP-U message.

- **gtpuTEid EI-507**

  32-bit tunnel endpoint identifier field defined in GTP-U which unambiguously identifies a tunnel endpoint in the receiving GTP-U protocol entity for a given UDP/IP endpoint..

- **gtpuSequenceNum EI-508**

  16-bit sequence number field defined in the GTP-U. This field is interpreted based on the corresponding flag value from gtpuFlags
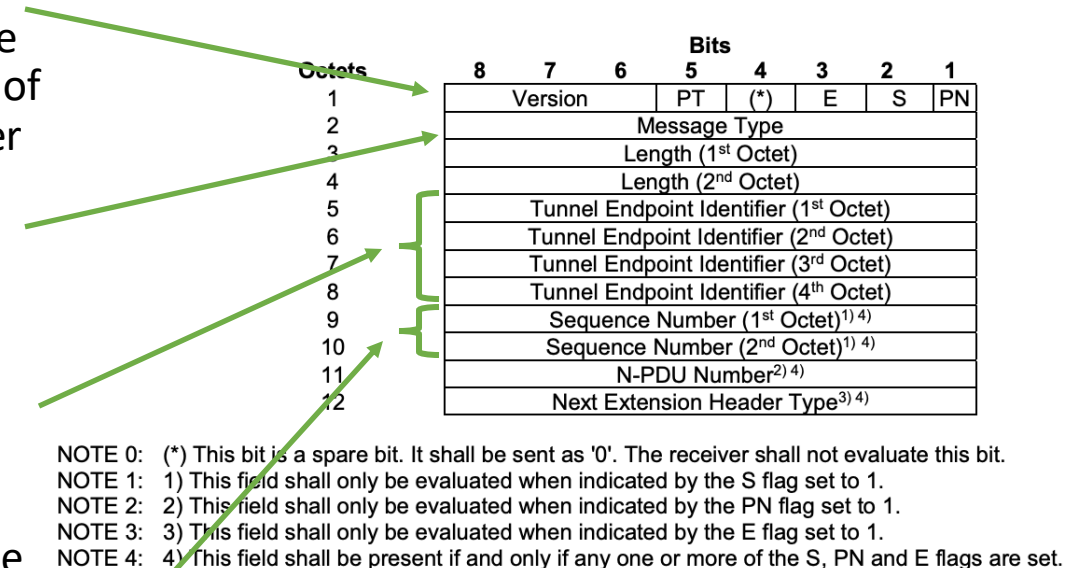

3GPP TS 29.281 version 17.4.0 Release 17   19   ETSI TS 129 281 V17.4.0 (2022-10)

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Version			PT	(*)	E	S	PN
2	Message Type							
3	Length (1st Octet)							
4	Length (2nd Octet)							
5	Tunnel Endpoint Identifier (1st Octet)							
6	Tunnel Endpoint Identifier (2nd Octet)							
7	Tunnel Endpoint Identifier (3rd Octet)							
8	Tunnel Endpoint Identifier (4th Octet)							
9	Sequence Number (1st Octet)[1)] [4)]							
10	Sequence Number (2nd Octet)[1)] [4)]							
11	N-PDU Number[2)] [4)]							
12	Next Extension Header Type[3)] [4)]							

NOTE 0: (*) This bit is a spare bit. It shall be sent as '0'. The receiver shall not evaluate this bit.
NOTE 1: 1) This field shall only be evaluated when indicated by the S flag set to 1.
NOTE 2: 2) This field shall only be evaluated when indicated by the PN flag set to 1.
NOTE 3: 3) This field shall only be evaluated when indicated by the E flag set to 1.
NOTE 4: 4) This field shall be present if and only if any one or more of the S, PN and E flags are set.

Figure 5.1-1: Outline of the GTP-U Header

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GTP-U @ IPFIX
IPFIX entities in context of the GTP-U (2)

- **gtpuQFI EI-509**

  8-bit QoS flow identifier field defined in PDU Session Container extension header of GTP-U. This is defined in section 5.5.3 of PDU session spec [TS.38415]. This is used to determine the QoS flow and QoS profile which are associated with the received packet.

- **gtpuPduType EI-510**

  8-bit PDU type field defined in PDU Session Container extension header of GTP-U. This is defined in section 5.5.3 of PDU session spec [TS.38415]. This field indicates the structure of the PDU session UP frame..

Bits								Number of Octets
7	6	5	4	3	2	1	0	
PDU Type (=0)				QMP	SNP	MSNP	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
DL MBS QFI Sequence Number								0 or 4
Padding								0-3

GTP-U @ IPFIX – Cisco IOS-XR Implementation status
IPFIX Records exposed

1. gtpuFlags

8-bit flags field defined in the GTP-U which indicates the version of GTP-U protocol, protocol type and presence of extension header, sequence number and N-PDU number in the GTP-U header.

2. gtpuMsgType

8-bit message type field defined in the GTP-U which indicates the type of GTP-U message.

3. gtpuTEid

32-bit tunnel endpoint identifier field defined in GTP-U which unambiguously identifies a tunnel endpoint in the receiving GTP-U protocol entity for a given UDP/IP endpoint..

4. gtpuSequenceNum

16-bit sequence number field defined in the GTP-U. This field is interpreted based on the corresponding flag value from gtpuFlags

5. gtpuQFI

8-bit QoS flow identifier field defined in PDU Session Container extension header of GTP-U. This is defined in section 5.5.3 of PDU session spec [TS.38415]. This is used to determine the QoS flow and QoS profile which are associated with the received packet

6. gtpuPduType

8-bit PDU type field defined in PDU Session Container extension header of GTP-U. This is defined in section 5.5.3 of PDU session spec [TS.38415]. This field indicates the structure of the PDU session UP frame

```
∨ Cisco NetFlow/IPFIX
    Version: 10
    Length: 456
  > Timestamp: Oct 24, 2024 13:38:05.000000000 IST
    FlowSequence: 1
    Observation Domain Id: 16
  ∨ Set 1 [id=2] (Data Template): 349
       FlowSet Id: Data Template (V10 [IPFIX]) (2)
       FlowSet Length: 216
    ∨ Template (Id = 349, Count = 52)
         Template Id: 349
         Field Count: 52
       > Field (1/52): PKTS
       > Field (2/52): BYTES
       > Field (3/52): INPUT_SNMP
       > Field (4/52): OUTPUT_SNMP
       > Field (5/52): FIRST_SWITCHED
       > Field (6/52): LAST_SWITCHED
       > Field (7/52): FORWARDING_STATUS
       > Field (8/52): DIRECTION
       > Field (9/52): selectorId
       > Field (10/52): ingressVRFID
       > Field (11/52): egressVRFID
       > Field (12/52): SRC_MAC
       > Field (13/52): DESTINATION_MAC
       > Field (14/52): ethernetType
       > Field (15/52): dot1qVlanId
       > Field (16/52): dot1qCustomerVlanId
       > Field (17/52): dot1qPriority
       > Field (18/52): IP_SRC_ADDR
       > Field (19/52): IP_DST_ADDR
       > Field (20/52): SRC_MASK
       > Field (21/52): DST_MASK
       > Field (22/52): IP_TOS
       > Field (23/52): SRC_AS
       > Field (24/52): DST_AS
       > Field (25/52): BGP_NEXT_HOP
       > Field (26/52): BGP_IPV6_NEXT_HOP
       > Field (27/52): IP_NEXT_HOP
       > Field (28/52): IPV6_NEXT_HOP
       ∨ Field (29/52): Unknown(505)
            0... .... .... .... = Pen provided: No
            .000 0001 1111 1001 = Type: Unknown (505)      ①
            Length: 1
       ∨ Field (30/52): Unknown(506)
            0... .... .... .... = Pen provided: No
            .000 0001 1111 1010 = Type: Unknown (506)      ②
            Length: 1
       ∨ Field (31/52): Unknown(507)
            0... .... .... .... = Pen provided: No
            .000 0001 1111 1011 = Type: Unknown (507)      ③
            Length: 4
       ∨ Field (32/52): Unknown(508)
            0... .... .... .... = Pen provided: No
            .000 0001 1111 1100 = Type: Unknown (508)      ④
            Length: 2
       ∨ Field (33/52): Unknown(509)
            0... .... .... .... = Pen provided: No
            .000 0001 1111 1101 = Type: Unknown (509)      ⑤
            Length: 1
       ∨ Field (34/52): Unknown(510)
            0... .... .... .... = Pen provided: No
            .000 0001 1111 1110 = Type: Unknown (510)      ⑥
            Length: 1
       > Field (35/52): IP_SRC_ADDR
```

GTP-U @ IPFIX
IANA assigned IE numbers

ElementID	Name	Abstract Data Type	Data Type Semantics
505	gtpuFlags	unsigned8	flags
506	gtpuMsgType	unsigned8	identifier
507	gtpuTEid	unsigned32	identifier
508	gtpuSequenceNum	unsigned16	identifier
509	gtpuQFI	unsigned8	identifier
510	gtpuPduType	unsigned8	identifier

GTP-U @ IPFIX
Next Steps

- Data-Plane visibility is missing in GTP.

- Authors want to avoid private enterprise code points being used in GTP 5G deployments.

- This draft could progress to document the use cases and will be helpful for 3GPP references also.