Export of GTP-U Information in IPFIX
draft-voyersriram-opsawg-ipfix-gtpu-04

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

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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)

		Bits						
Octets	**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 (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.
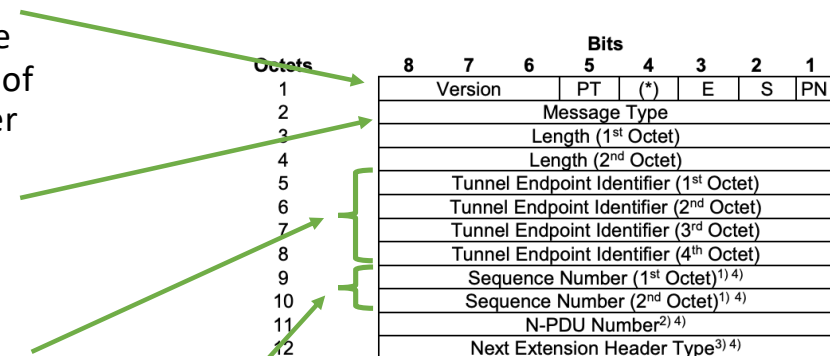
- **gtpuMsgType**

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

- **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..

- **gtpuSequenceNum**

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

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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)							

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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**

  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**

  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

```
Frame 24: 514 bytes on wire (4112 bits), 514 bytes captured (4112 bits)
Ethernet II, Src: 02:52:b0:a0:ae:ea (02:52:b0:a0:ae:ea), Dst: MS-NLB-PhysServer-32_12:50:04:cf:1a (02:32:50:04:cf:1a)
Internet Protocol Version 4, Src: 1.1.1.1, Dst: 1.1.1.10
User Datagram Protocol, Src Port: 51737, Dst Port: 2055
Cisco NetFlow/IPFIX
        Version: 10
        Length: 472
    Timestamp: Mar  5, 2024 17:19:55.000000000 IST
        FlowSequence: 3
        Observation Domain Id: 16
    Set 1 [id=2] (Data Template): 351
        FlowSet Id: Data Template (V10 [IPFIX]) (2)
        FlowSet Length: 224
      Template (Id = 351, Count = 54)
            Template Id: 351
            Field Count: 54
        Field (1/54): PKTS
        Field (2/54): BYTES
        Field (3/54): INPUT_SNMP
        Field (4/54): OUTPUT_SNMP
        Field (5/54): FIRST_SWITCHED
        Field (6/54): LAST_SWITCHED
        Field (7/54): FORWARDING_STATUS
        Field (8/54): DIRECTION
        Field (9/54): selectorId
        Field (10/54): ingressVRFID
        Field (11/54): egressVRFID
        Field (12/54): DST_TOS
        Field (13/54): SRC_MAC
        Field (14/54): DESTINATION_MAC
        Field (15/54): ethernetType
        Field (16/54): dot1qVlanId
        Field (17/54): dot1qCustomerVlanId
        Field (18/54): dot1qPriority
        Field (19/54): IPV6_SRC_ADDR
        Field (20/54): IPV6_DST_ADDR
        Field (21/54): IPV6_DST_MASK
        Field (22/54): IPV6_SRC_MASK
        Field (23/54): FLOW_LABEL
        Field (24/54): IP_TOS
        Field (25/54): SRC_AS
        Field (26/54): DST_AS
        Field (27/54): BGP_NEXT_HOP
        Field (28/54): BGP_IPV6_NEXT_HOP
        Field (29/54): IP_NEXT_HOP
        Field (30/54): IPV6_NEXT_HOP
        Field (31/54): Unknown(602)
            0... .... .... .... = Pen provided: No         ①
            .000 0010 0101 1010 = Type: Unknown (602)
            Length: 1
        Field (32/54): Unknown(603)
            0... .... .... .... = Pen provided: No         ②
            .000 0010 0101 1011 = Type: Unknown (603)
            Length: 1
        Field (33/54): Unknown(604)
            0... .... .... .... = Pen provided: No         ③
            .000 0010 0101 1100 = Type: Unknown (604)
            Length: 4
        Field (34/54): Unknown(605)
            0... .... .... .... = Pen provided: No         ④
            .000 0010 0101 1101 = Type: Unknown (605)
            Length: 2
        Field (35/54): Unknown(606)
            0... .... .... .... = Pen provided: No         ⑤
            .000 0010 0101 1110 = Type: Unknown (606)
            Length: 1
        Field (36/54): Unknown(607)
            0... .... .... .... = Pen provided: No         ⑥
            .000 0010 0101 1111 = Type: Unknown (607)
            Length: 1
        Field (37/54): IP_SRC_ADDR
        Field (38/54): IP_DST_ADDR
```

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.

- **During the IETF week, we will be requesting for IPFIX IANA allocation.**

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

- Call for adoption at OPSAWG at IETF 119.