N4 Interface Compliance with 3GPP Specification

This chapter covers the following topics:

Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	5G-UPF
Applicable Platform(s)	VPC-SI
Feature Default Setting	Enabled - Always-on
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
Support is added for Outer Header Removal IE.	2021.04.0
In this release, PFCP library is upgraded to support the latest version of Outer Header IE.	2020.02.5
First introduced.	2020.02.0

Feature Description

In compliance with 3GPP TS 29.244, the User Plane Function (UPF) supports the following IEs:

- Averaging Window
- Paging Policy Indicator (PPI)
- Outer Header Creation
- Outer Header Removal

Averaging Window

Averaging window IE contains the duration over which the GBR and MBR is calculated. It is sent from SMF to UPF with Create QER or Update QER parent IE, if the default pre-configured value under UPF needs to be overridden.

The following format is used for encoding and decoding of the IE:

	Bits							
Octets	8	7	6	5	4	3	2	1
1 to 2	Type = 157 (decimal)							
3 to 4	Length = n							
5 to 8	Averaging Window							
9 to (n+4)	These octet(s) is/are present only if explicitly specified							

NOTE: The value should be in milliseconds.

Paging Policy Indicator

The SMF sends PPI value in Create QER or Update QER, if UPF requires to set Paging Policy Indicator in outgoing packets.

In the case of Network Triggered Service Request and UPF buffering downlink data packet, the UPF includes the DSCP in ToS (IPv4) / TC (IPv6) value from the IP header of the downlink data packet. It also sends an indication of the corresponding QoS Flow in the data notification message to the SMF. When PPD applies, the SMF determines the Paging Policy Indicator (PPI) based on the DSCP received from the UPF.

In the case of Network Triggered Service Request and SMF buffering downlink data packet, when PPD applies, the SMF determines the PPI based on the DSCP in ToS (IPv4) / TC (IPv6) value from the IP header of the received downlink data packet and identifies the corresponding QoS Flow from the QFI of the received downlink data packet.

The following format is used for encoding and decoding of the IE:

	Bits							
Octets	8	7	6	5	4	3	2	1

1 to 2	Type = 158 (decimal)	
3 to 4	Length = n	
5	Spare	PPI value
6 to (n+4)	These octet(s) is/are present only if explicitly specified	

NOTE: The PPI should be encoded as a 3-bit value from 0 through 7.

Outer Header Creation

Per 3GPP TS 29.244 v16.4.0, the Outer Header Creation Description field, when present, is encoded as specified in following table. It takes the form of a bitmask where each bit indicates the outer header to be created in the outgoing packet. Spare bits are ignored by the receiver.

Octet / Bit	Outer Header Created in the Outgoing Packet
5/1	GTP-U/UDP/IPv4
5/2	GTP-U/UDP/IPv6
5/3	UDP/IPv4
5/4	UDP/IPv6
5/5	IPv4
5/6	IPv6
5/7	C-TAG
5/8	S-TAG
6/1	N19 Indication
6/2	N6 Indication
6/3	TCP/IPv4
6/4	TCP/IPv6

NOTE:

- Currently, the UP/UPF doesn't support the following values of Outer Header Creation Description:
  - IPv4
  - IPv6
  - C-TAG
  - S-TAG
  - N19 Indication
  - N6 Indication
- Third and fourth bits of sixth Octet (that is, 6/3 and 6/4) are spare bits (that is, not part of 3GPP TS) used for LI over TCP.

Important If SMF/CP uses older version for Outer Header Creation, then undefined behavior (including crashes) can be seen.

Outer Header Removal

Outer Header Removal feature is used to remove GPRS Tunneling Protocol User Plane (GTP-U) header from the uplink GTP-U packets.

The following format is used for encoding Outer Header Removal Information Element (IE):

	Bits							
Octets	8	7	6	5	4	3	2	1
1–2	Type = 95 (decimal)							
3–4	Length = n							
5	Outer Header Removal Description							
6	GTP-U Extension Header Deletion							
7 to (n+4)	These octets are present only if explicitly specified							

Per 3GPP TS 29.244, the Outer Header Removal Description field, when present, is encoded as specified in the following table.

Table 3: Outer Header Removal Description

Outer Header to be Removed from the Incoming Packet	**Value (Decimal)**
GTP-U/UDP/IPv4 (See Notes 1, 2),	0
GTP-U/UDP/IPv6 (See Notes 1, 2)	1
UDP/IPv4 (See Notes 3, 6)	2
UDP/IPv6 (See Notes 3, 6)	3
IPv4 (See Note 6)	4
IPv6 (See Note 6)	5
GTP-U/UDP/IP (See Note 4)	**6**
VLAN S-TAG (See Note 5)	7
S-TAG and C-TAG (See Note 5)	8
For future use. Not sent. If received, it’s interpreted as value "1".	9–255

NOTES:

1. The SGW-U/I-UPF stores GTP-U extension headers. These headers are forwarded for the packets that aren’t requested to be deleted by the GTP-U Extension Header Deletion field.

2. The SGW-U/I-UPF stores the GTP-U message type for a GTP-U signaling message, which must be forwarded. For example, an End Marker message
3. This value applies to DL packets received by a PGW-U for non-IP PDN connections. These connections use SGi tunneling based on UDP/IP encapsulation.
4. The CP function uses this value for instructing the UP function to remove the GTP-U/UDP/IP header regardless of the IP version (IPv4 or IPv6).
5. This value applies to DL packets received by a UPF over N6 for Ethernet PDU sessions.
6. This value applies to DL packets received by a UPF (PDU Session Anchor) over N6, when explicit N6 traffic routing information is provided to the SMF.

Software Requirements

The software requirements are as follows:

- The feature requires UPF support to identify, encode, and decode the wildcard tunnel type “GTP-U/UDP/IP-6” on N4 interface.
- If IPv4 and IPv6 addresses are received as part of Outer Header Creation (OHC), priority is given to IPv6 endpoint and hence the IPv6 Outer Header Removal (OHR) endpoint is retained by the UPF.
- GTP-U/UDP/IP-6 on N4 interface, can be received over Sx Establishment or Sx Modification request messages. UPF must support type-6 on both cases.
- In Handoff scenarios, for all the PDRs with OHR value- 6, uplink packets are buffered until an appropriate OHC IE is received for PDRs corresponding to the downlink FAR.
- The uplink packets are forwarded only after the appropriate OHR type is set at UPF.

Limitations

- When outer header removal value - 6 is received for uplink PDR, the UPF maintains only IPv6 Outer Header Removal IE for uplink PDR. The UPF maintains it until an appropriate Outer Header Creation IE is received for downlink FAR.
- This feature is applicable to N4 interface only.