

Alternative of new EPD based solution for further enhancement

Source: Huawei, HiSilicon



Motivation of this paper

- In August 2019 CT1#119 meeting, an agreement was achieved on CIOT CP data transport in 5GS. However, there are many Editorial Notes (EN) were added in the agreed CR to pave a way for further enhancements:

Editor's note: Whether a new EPD can be used in order to further reduce the message header of the message is FFS.

Editor's note: Whether ngKSI can be removed from CPSR message is FFS.

Editor's note: Whether a short or a full MAC will be used to integrity protect the message is FFS.

Editor's note: Whether Control plane service type IE can be removed is FFS.

Editor's note: Whether Data Type field is needed is FFS.

Editor's note: CIoT Control plane data transfer for UE in Connected mode is FFS.

Editor's note: Whether the CIoT small data container IE can be TV format is FFS.

- It was expected a new EPD based solution will be tabled in the Oct. CT1 meeting to resolve one or more of these ENs.
- **The motivation of this paper is: if the new EPD based solution cannot fly and CT1 still thinks further enhancements on the current agreed solution are required in order to shorten the message overhead as far as possible, to improve the UE battery life and signaling efficiency, then an alternative was provided here.**
- This alternative is only touching the uplink direction from the idle mode.

What was agreed in August CT1 meeting

CONTROL PLANE SERVICE REQUEST message coding

IEI	Information Element	Type/Reference	Presence	Format	Length
	Extended protocol discriminator	Extended protocol discriminator 9.2	M	V	1
	Security header type	Security header type 9.3	M	V	1/2
	Spare half octet	Spare half octet 9.5	M	V	1/2
	Control plane service request message identity	Message type 9.7	M	V	1
	Control plane service type	Control plane service type 9.11.3.x	M	V	1/2
	ngKSI	NAS key set identifier 9.11.3.32	M	V	1/2
xx	CIoT small data container	CIoT small data container 9.11.3.z	O	TLV	4-257
8-	Payload container type	Payload container type 9.11.3.40	O	TV	1
7B	Payload container	Payload container 9.11.3.39	O	TLV-E	4-65538
12	PDU session ID	PDU session identity 2 9.11.3.41	C	TV	2
50	PDU session status	PDU session status 9.11.3.44	O	TLV	4-34
F-	Release assistance indication	Release assistance indication 9.11.3.y	O	TV	1
40	Uplink data status	Uplink data status 9.11.3.57	O	TLV	4-34
71	NAS message container	NAS message container 9.11.3.38	O	TLV-E	4-n

- These four IEs are included when the data size is ≥ 255 bytes
- The existing IE codings are reused

For plain CPSR message:

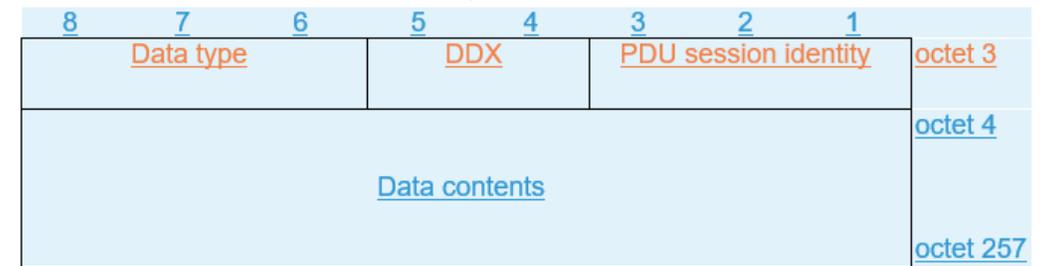
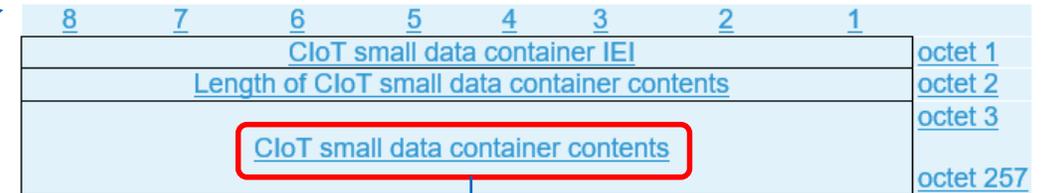
In best cases (often case), the message overhead is 7 bytes;
In worst cases (rare case), the message overhead is 22 bytes.

For security protected CPSR message:

In best cases (often case), the message overhead is 14(7+7) bytes;
In worst cases (rare case), the message overhead is 29(22+7) bytes.

This IE is only included when the data size < 255 bytes, and no other optional IE to be sent

CIoT small data container IE coding



This IE is only used for PDU session status synchronization between the UE and the network

This IE is only used for requesting the CP-to-UP switching

This IE is only used for ciphering the optional IEs other than ClIoT small data container

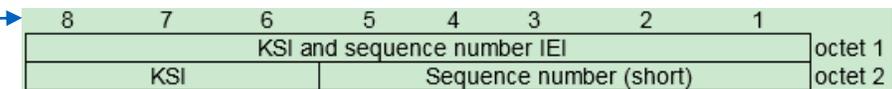
Where the idea of this alternative comes from

- Back to Rel-8 when developing the 4G NAS protocol, based on RAN2 request on carrying the Service Request message in the Msg3 over RRC layer, CT1 has defined a non-standard L3 NAS message SERVICE REQUEST (SR) with shortest message header.
- The 4G SR message has a unique and special message format which does not follow what specified in TS 24.301 sub 9.1.
- As a dedicated security header type is defined for SR message only, message ID is not needed. This saves 1 octet.
- As the short MAC was used, this saves 2 octets.
- As the security protection was directly applied, this saves 1 octet (double PD + security header type is avoided).

Table 8.2.25.1: SERVICE REQUEST message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	Protocol discriminator	Protocol discriminator 9.2	M	V	1/2
	Security header type	Security header type 9.3.1	M	V	1/2
	KSI and sequence number	KSI and sequence number 9.9.3.19	M	V	1
	Message authentication code (short)	Short MAC 9.9.3.28	M	V	2

Non-standard L3 message:
1 1 0 0 Security header for the SERVICE REQUEST message



Enhanced message coding of CPSR

- A non-standard L3 NAS message CONTROL PLANE SERVICE REQUEST (CPSR) was defined with shortest message header.
- The message header format is very similar as 4G SR message with only difference is half-octet PD was replaced by 1 octet EPD (see green part below). Other header IE codings are the same as 4G SR message.
- The message body format is the same as the current CPSR message in the spec and all optional IE codings are the same (see yellow part below).
- CP service type can rely on the RRC cause value provided by the lower layers, similar as done for 4G SR message.

IEI	Information Element	Type/Reference	Presence	Format	Length
	Extended protocol discriminator	Extended protocol discriminator 9.2	M	V	1
	Security header type	Security header type 9.3	M	V	1/2
	Spare half octet	Spare half octet 9.5	M	V	1/2
	ngKSI and sequence number	KSI and sequence number 9.9.3.x	M	V	1
	Message authentication code (short)	Short MAC 9.9.3.28	M	V	2
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The EPD is still 5GMM

1 1 0 0 Non-standard L3 message:
Security header for the CONTROL PLANE SERVICE REQUEST message

For security protected CPSR message:
In best cases (often case), the message overhead is 8 bytes;
In worst cases (rare case), the message overhead is 23 bytes.

Benefits of this alternative

- As 4G SR message can work well, then this CPSR message should work well in 5GS as well.
- There is no much work required for going this alternative as only the message header format is different from the current CPSR message in the spec. All optional IEs in the message body are the same. Hence, Minor updates are foreseen for the procedure part.
- **The main benefit of this alternative comparing to the current spec is always saving 6 octets message overhead in all cases.**

Cases	Security protected message overhead in the current spec	Security protected message overhead of this alternative	Octets saved
Best cases	14	8	6
Worst cases	29	23	6

NOTE: As CPSR message shall always be security protected, hence it is reasonable to only cover security protected message for compare

Proposal

- It proposes CT1 to discuss and decide that in case of new EPD based solution cannot fly, whether further enhancements on the current solution in the spec are required to save 6 octets message overhead.

Thank you.

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