



UAS parameters in PDN CONNECTIVITY
REQUEST and ESM INFORMATION
RESPONSE, of IP based PDN connection in
WB-S1 mode

IP based PDN connection in WB-S1 mode

Baseline principles

- › Principle-1: For IP based PDN connection in WB-S1 mode, protocol configuration options are transported in PCO IE (NOT in ePCO IE) of PDN CONNECTIVITY REQUEST and EMS INFORMATION RESPONSE.
 - the above is true regardless whether the PDN CONNECTION REQUEST is (a) sent in ATTACH REQUEST or (b) after completion of attach procedure.
 - NOTE: EMS INFORMATION RESPONSE is used only during attach procedure.

- › Principle-2: A PCO parameter with length of two octets can be included in ePCO IE only when receiving entity has indicated the support of receiving of the particular PCO parameter with the length of two octets.

24.301 subclause 6.6.1.1

Baseline text related to Principle-1

The UE and the PDN-GW can exchange protocol configuration options via the dedicated ESM information request procedure or via other ESM procedures.¶

If supported by the network and UE end-to-end for a PDN connection, protocol configuration options shall be exchanged via the extended protocol configuration options IE. Otherwise the protocol configuration options IE is used.¶

- NOTE 1: → In this version of the protocol inter-system mobility to and from NB-S1 mode is supported. During inter-system mobility from NB-S1 mode to WB-S1 mode the end-to-end support of the extended protocol configuration options IE can be lost, e.g. if the new MME does not support the extended protocol configuration options IE.¶

For the UE, the extended protocol configuration options is supported by the network and the UE end-to-end for a PDN connection if¶

- → the UE is in NB-S1 mode;¶
- → the PDN Type requested for the PDN connection is non-IP or Ethernet; or¶
- → the network has indicated support of the extended protocol configuration options IE in the last ATTACH ACCEPT or TRACKING AREA UPDATING ACCEPT message and the network has included the extended protocol configuration options IE in at least one EPS session management message received by the UE for this PDN connection.¶

For the MME, the extended protocol configuration options is supported by the network and the UE end-to-end for a PDN connection if¶

- → the UE is in NB-S1 mode;¶
- → the PDN Type requested for the PDN connection is non-IP or Ethernet; or¶
- → the UE has indicated support of the extended protocol configuration options IE in the last ATTACH REQUEST or TRACKING AREA UPDATING REQUEST message, and the MME has received the extended protocol configuration options IE in at least one message sent by the PDN-GW towards the UE for this PDN connection (for details see 3GPP TS 29.274 [16D]).¶
- NOTE 2: → For the PDN-GW, the extended protocol configuration options is supported by the network and the UE end-to-end for a PDN connection if the last support indication received from the MME or S-GW indicates that extended protocol configuration options is supported for this PDN connection (for details see 3GPP TS 29.274 [16D]).¶

24.008 Table 10.5.154/3GPP TS 24.008

Baseline text related to Principle-2

When the *container-identifier* indicates QoS flow descriptions with the length of two octets, the *container-identifier contents* field contains the QoS flow descriptions for the QoS flow corresponding to the EPS bearer of the PDN connection if the MS has indicated the support of receiving QoS flow descriptions with the length of two octets. The QoS flow descriptions with the length of two octets is coded as the value part of QoS flow descriptions information element as specified in subclause 9.11.4.12 of 3GPP TS 24.501 [167]. The usage of the QoS flow descriptions is specified in 3GPP TS 24.501 [167]. See NOTE 2.

IP based PDN connection in WB-S1 mode

Implication of possible breaking of Principle-1 for ID_UAS

- › Enabling protocol configuration options carrying UAS parameters to be transported in ePCO IE of PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode, would imply:
 - the following new standardization impact:
 - › MMEs serving an area where UAS services can be used, needs to handle ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode. The MME would need to forward to P-GW the ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode, rather than considering it as an unexpected IE.
 - the new standardization impact implies that operator needs to upgrade all MMEs serving an area where UAS services can be used.
 - if the UE happens to be served by the MME not upgraded to handle ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode, UAS services are not possible.
 - if the UE provides protocol configuration options carrying UAS parameters in ePCO IE of PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode, sent during initial attach, and the UE happens to be served by the MME not upgraded to handle ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode, the MME will consider ePCO IE as an unexpected IE, ignore it and not send it to P-GW for UAS services, which will reject the PDN connection due to missing UAS parameters. Furthermore, the MME will consider the UE as misbehaving UE.
 - if the UE is configured with incorrect APN for UAS services, if the UE provides protocol configuration options carrying UAS parameters in ePCO IE of PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode, sent during or after initial attach, the MME upgraded to handle ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE might forward the ePCO IE to a P-GW serving the APN, which does not support ePCO IE. Such P-GW will reject or accept the PDN connection without protocol configuration options.
 - if the UE attempts to establish PDN connection for an APN other than APN for UAS services, the UE would also need to insert protocol configuration options in ePCO IE of PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode. The MME upgraded to handle ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE might forward the ePCO IE to a P-GW, which does not support ePCO IE. Such P-GW will reject or accept the PDN connection without protocol configuration options.

IP based PDN connection in WB-S1 mode

Implication of possible breaking of Principle-2 for ID_UAS

- › Enabling a UE to include service-level-AA container with length of two octets in ePCO IE when the UE does not know whether the P-GW supports receiving of the service-level-AA container with the length of two octets, would imply:
 - if the P-GW happens to support ePCO IE but not support the service-level-AA container with the length of two octets, the P-GW decodes the service-level-AA container with the length of two octets as an unknown PCO parameter with length of one octet. Remaining part of the value of the service-level-AA container with the length of two octets will be decoded as additional PCO parameters. As a result, P-GW handling will reject or accept the PDU session with unpredictable protocol configuration options.
 - Thus, if the UE is configured with incorrect APN for UAS services, the UE provides service-level-AA container with length of two octets carrying UAS parameters as part of protocol configuration options in ePCO IE of PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE, of IP based PDN connection in WB-S1 mode. MME upgraded to handle ePCO IE in PDN CONNECTIVITY REQUEST and ESM INFORMATION RESPONSE might forward the ePCO IE to a P-GW supporting ePCO but not supporting the service-level-AA container with length of two octets. Such P-GW decodes the service-level-AA container with the length of two octets as an unknown PCO parameter with length of one octet. Remaining part of the value of the service-level-AA container with the length of two octets will be decoded as additional PCO parameters. As a result, P-GW handling will reject or accept the PDU session with unpredictable protocol configuration options.

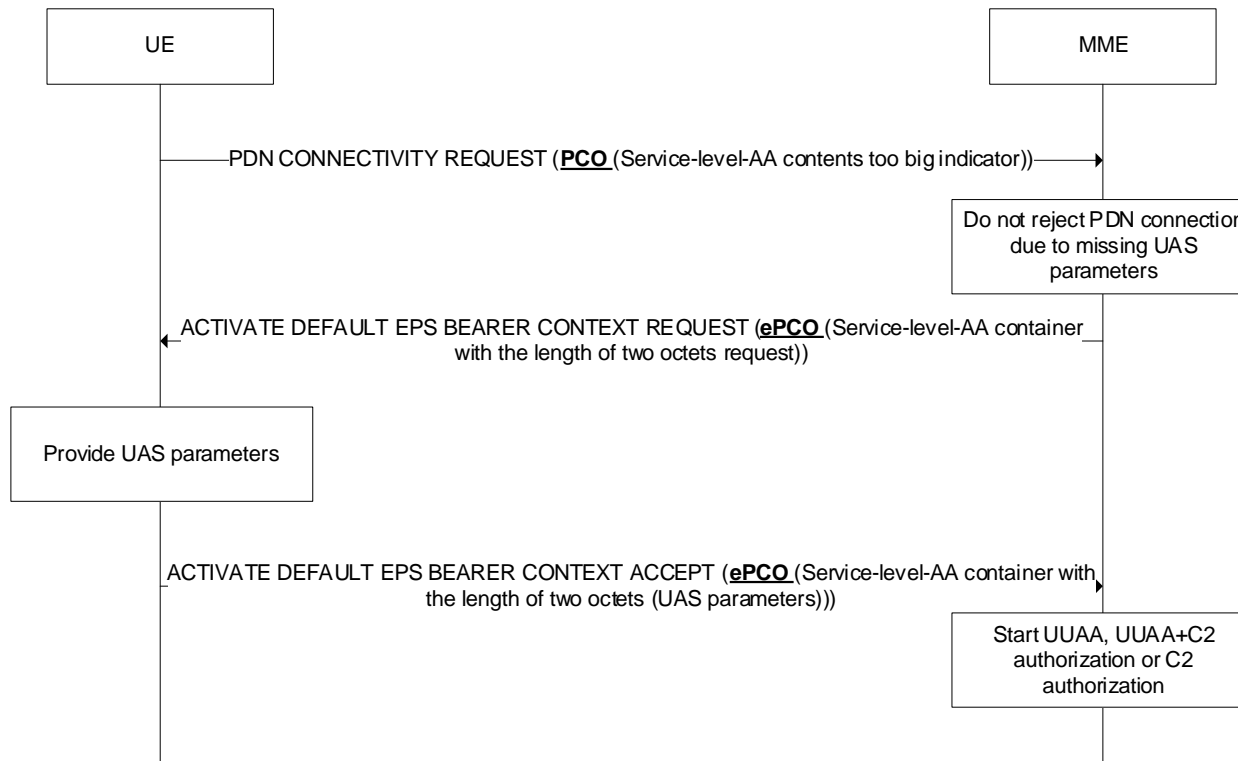
Ericsson's solution (1)

UAS parameters small enough to fit into PCO IE

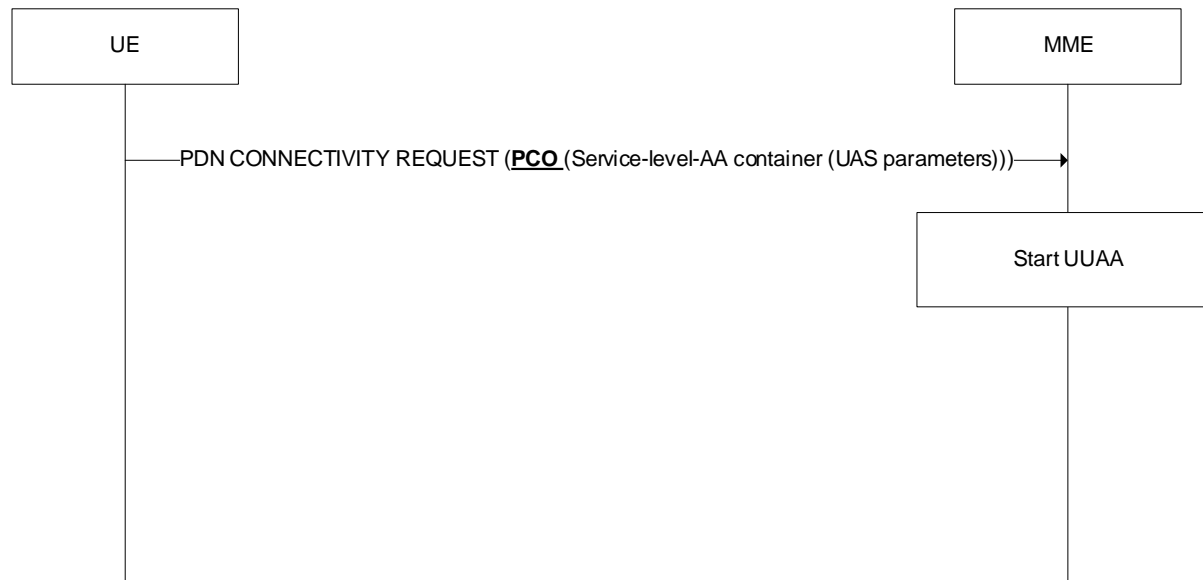


Ericsson's solution (2)

UAS parameters too big to fit into PCO IE



Lenovo's solution, based on C1-216134



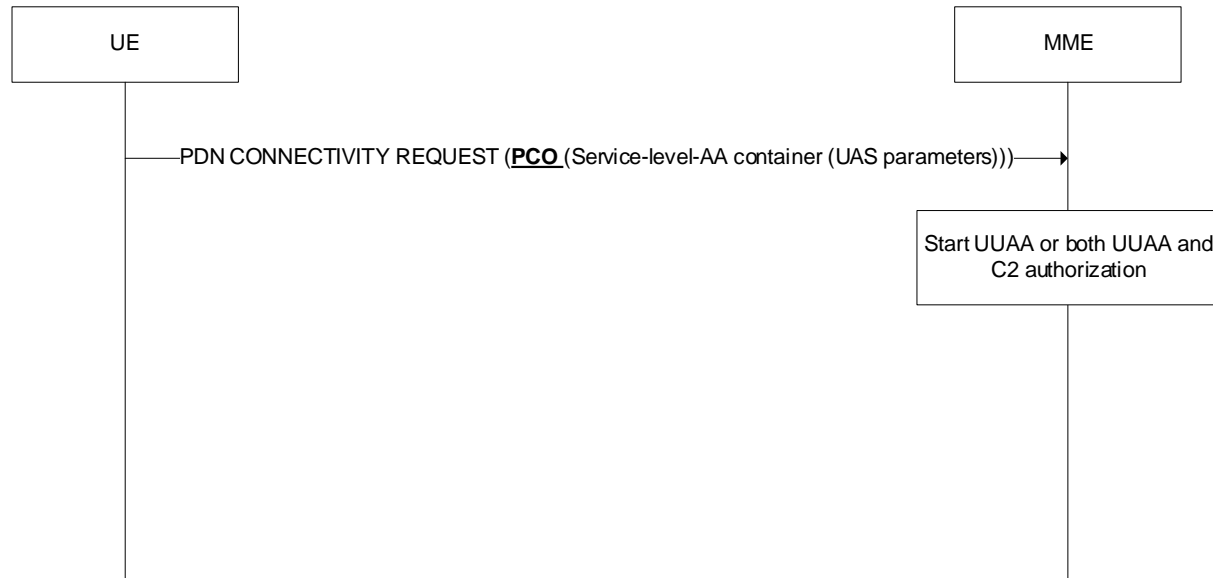
C1-216134 enables transport of CAA-level UAV ID and enables transport of USS address, if CAA-level UAV ID and USS address are small enough to fit into PCO IE, during attach procedure.

C1-216134 does NOT address transport of USS address, if CAA-level UAV ID and USS address are too big to fit into PCO IE, during attach procedure.

C1-216134 does NOT address transport of the UAV-C pairing information, for UUAA + C2 authorization during attach procedure.

C1-216134 does NOT address C2 authorization after completion of attach procedure.

Huawei's solution, based on slide#3 of "Huawei inputs on ID_UAS CC" (1) UAS parameters in 1st PDN connection

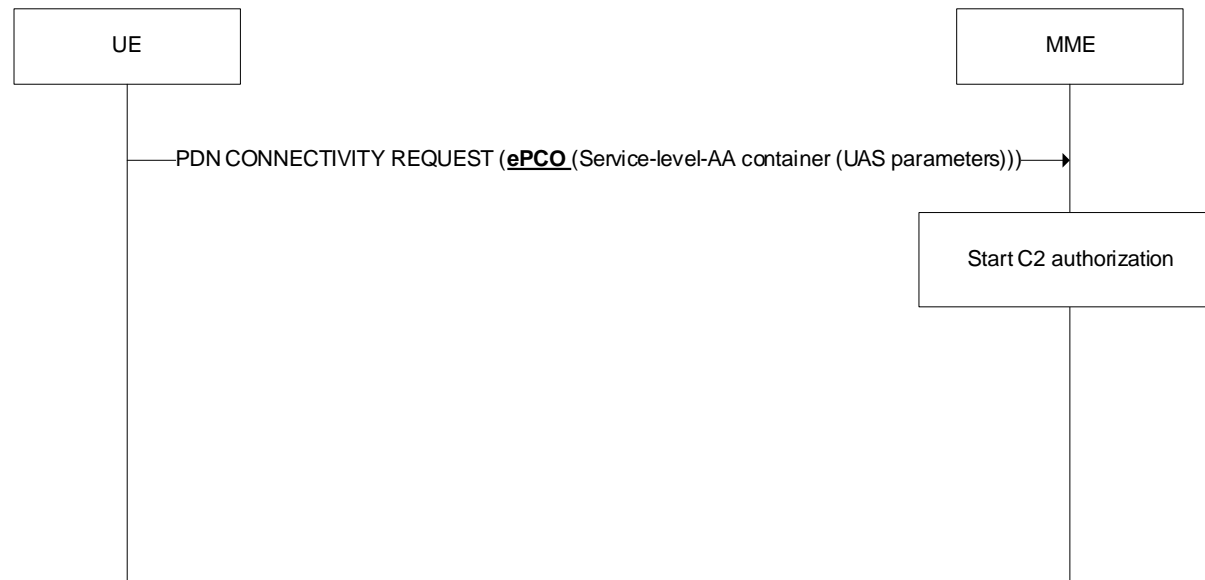


Solution enables transport of CAA-level UAV during attach procedure.

Solution does NOT address transport of USS address, during attach procedure.

Solution does NOT address transport of the UAV-C pairing information, for UUAA + C2 authorization during attach procedure.

Huawei's solution, based on slide#3 of "Huawei inputs on ID_UAS CC" (2) UAS parameters in 2nd and later PDN connection



Solution requires changes of MME to consider ePCO IE of PDN CONNECTIVITY REQUEST, of IP based PDN connection in WB-S1 mode, as valid IE and handle it accordingly

Solution comparison

	Ericsson's solution	Lenovo's solution	Huawei's solution
Enables transport of all UAS parameters required in stage-2	yes	no	no
UAS services possible when served by MME supporting ePCO IE according to baseline (e.g. MME supporting inter-system change with 5GS according to baseline)	yes	unclear, as this solution does not enable transport of all parameters expected in stage-2.	no
UE considered as well-behaved UE when served by MME supporting ePCO IE according to baseline (e.g. MME supporting inter-system change with 5GS according to baseline)	yes	unclear, as this solution does not enable transport of all parameters expected in stage-2.	no
Protocol configuration options transported correctly for non-UAS APNs served by P-GW not supporting ePCO IE	yes	unclear, as this solution does not enable transport of all parameters expected in stage-2.	unclear, as detailed solution is not available.
ePCO IE decoding issues if misconfigured APN provided by UE	ePCO IE decoding issues do not occur	unclear, as this solution does not enable transport of all parameters expected in stage-2.	ePCO IE decoding issues can occur