[0005] In the current disclosure, the “always-on” property is not considered as an attribute of a PDU session. Examples of existing PDU session attributes are: SSC mode, PDU session type, DNN, S-NSSAI. The commonality should be maximized among these attributes. More specifically, the UE should be able to indicate to the network whether it requests a PDU session to be always-on or not via the PDU session establishment request message because the number of user’s subscription check for deciding the always-on property can be minimized. That is, if the always-on property is not requested and the DNN is internet, an SMF can be configured to decide the PDU session to be non-always-on PDU session without checking user’s subscription. However, it should not be misunderstood that the network can decide a PDU session to be always-on. The always-on determination may be made only if the UE has requested so. However, whether a PDU session can be an always-on PDU session or not, is decided by the network. Because an always-on PDU session is likely to require session continuity during an inter-system change, interworking aspects need to be specified. The current disclosure lacks those interworking aspects.

[0006] A method, apparatus and computer program product are provided in accordance with an example embodiment in order to provide and/or utilize an always-on as an attribute of a Protocol Data Unit (PDU) session and to provide interworking aspects with respect to an always-on PDU session. Moreover, a method, apparatus and computer program product are provided for providing functionality enabling the determination of whether a PDU session can be an always-on PDU session or not to be decided by the network.

[0007] In an example, a method for performing a service request procedure may be provided, the method comprising: receiving, from user equipment (UE), a protocol data unit (PDU) session establishment request message, the PDU session establishment request message configured to indicate a request to establish a new PDU session, the PDU session establishment request message comprise an always-on PDU session requested information element (IE), the always-on PDU session requested IE set to a value indicative of a request to establish a new-always on PDU session or the PDU session establishment request message does not comprise the always-on PDU session requested IE; and determining, based on local policies or configurations and in an instance in which the always-on PDU session requested IE is available, the always-on PDU session requested IE, whether the requested PDU session shall be established as an always-on PDU session.

In an example, method comprising: including an always-on protocol data unit (PDU) session requested information element (IE) in a PDU session establishment request message configured to indicate a request to establish a PDU session; setting the always-on PDU session requested IE in the PDU session establishment request message to a value indicative of a request to establish the PDU session as an always-on PDU session; causing transmission of the PDU session establishment request message; and receiving a PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a value indicative of "Always-on PDU session required" or to a value indicative of "Always-on PDU session not allowed". In an aspect, method comprising: receiving, from user equipment (UE), a protocol data unit (PDU) session modification request message, the PDU session modification request message configured to indicate a request to modify a PDU session corresponding to a PDN connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode, the PDU session modification request message comprising an information element (IE) set to a value indicative of a request for the PDU session to be an always-on protocol data unit (PDU) session; and based on local policies or configurations in a session management function (SMF) and, in an instance in which the always-on PDU session requested IE is available, the always-on PDU session requested IE, determining whether to modify the requested PDU session to be an always-on PDU session. In an aspect, there is a method comprising: including into a protocol data unit (PDU) session modification request message, an information element (IE) configured to indicate a request for the PDU session to be modified to be an always-on PDU session, the PDU session corresponding to a packet data network (PDN) connection established when in S1 mode, after the first inter-system change from S1 mode to N1 mode; setting the IE in the PDU session modification request message to a value indicative of the request for the PDU session to be modified to be an always-on PDU session; causing transmission of the PDU session modification request message; and receiving a PDU session modification command message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a value indicative of "Always-on PDU session required" or to a value indicative of "Always-on PDU session not allowed".

In an aspect, there is a method for performing a service request procedure, the method comprising:

receiving, from user equipment (UE), a protocol data unit (PDU) session establishment request message, the PDU session establishment request message configured to indicate a request to establish a PDU session, the PDU session establishment request message comprising an always-on PDU session requested information element (IE), the always-on PDU session requested IE indicative of whether the UE requests the PDU session be established as an always-on PDU session;

in an instance in which the always-on PDU session requested IE in the PDU session establishment request message is set to a first value indicative of a request to establish the PDU session as an always-on PDU session, determining whether to establish the PDU session as an always-on PDU session;

upon determining to establish the PDU session as an always-on PDU session, causing transmission of a PDU session establishment accept message towards the UE, the PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a second value indicating that the PDU session is to be established as an always-on PDU session; and

upon determining not to establish the PDU session as an always-on PDU session, causing transmission of the PDU session establishment accept message towards the UE.

In an aspect, there is an apparatus for performing a service request procedure, the apparatus comprising:

at least one processor; and

at least one memory storing program codes, the at least one memory and the program codes being configured, with the at least one processor, to cause the apparatus at least to:

receive, from user equipment (UE), a protocol data unit (PDU) session establishment request message, the PDU session establishment request message configured to indicate a request to establish a PDU session, the PDU session establishment request message comprising an always-on PDU session requested information element (IE), the always-on PDU session requested IE indicative of whether the UE requests the PDU session be established as an always-on PDU session;

in an instance in which the always-on PDU session requested IE in the PDU session establishment request message is set to a first value indicative of a request to establish the PDU session as an always-on PDU session, determining whether to establish the PDU session as an always-on PDU session;

upon determining to establish the PDU session as an always-on PDU session, causing transmission of a PDU session establishment accept message towards the UE, the PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a second value indicating that the PDU session is to be established as an always-on PDU session; and

upon determining not to establish the PDU session as an always-on PDU session, causing transmission of the PDU session establishment accept message towards the UE.

In an aspect, there is at least one non-transitory computer-readable storage medium for performing a service request procedure, the at least one non-transitory computer-readable storage medium having computer-executable program code instructions stored therein, the computer-executable program code instructions comprising program code instructions for carrying out the method above.

That which is claimed:

1. A method for performing a service request procedure, the method comprising:

receiving, from user equipment (UE), a protocol data unit (PDU) session establishment request message, the PDU session establishment request message configured to indicate a request to establish a PDU session, the PDU session establishment request message comprising an always-on PDU session requested information element (IE), the always-on PDU session requested IE indicative of whether the UE requests the PDU session be established as an always-on PDU session;

in an instance in which the always-on PDU session requested IE in the PDU session establishment request message is set to a first value indicative of a request to establish the PDU session as an always-on PDU session, determining whether to establish the PDU session as an always-on PDU session;

upon determining to establish the PDU session as an always-on PDU session, causing transmission of a PDU session establishment accept message towards the UE, the PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a second value indicating that the PDU session is to be established as an always-on PDU session; and

upon determining not to establish the PDU session as an always-on PDU session, causing transmission of the PDU session establishment accept message towards the UE.

2. The method of claim 1, further comprising:

establishing the PDU session in either N1 mode or S1 mode;

in an instance in which the PDU session is established as an always-on PDU session in N1 mode, upon an inter-system change from N1 mode to S1 mode, maintaining the always-on PDU session indication; and

in an instance in which the PDU session is established as an always-on PDU session in S1 mode, determining, based on the always-on PDU session indication, whether the PDU session transferred from Evolved Packed System (EPS) is an always-on PDU session.

3. The method according to claim 1, further comprising:

upon determining not to establish the PDU session as an always-on PDU session:

refraining from adding the always-on PDU session indication IE to the PDU session establishment accept message, and

causing transmission of the PDU session establishment accept message towards the UE.

4. The method according to claim 1, further comprising:

in an instance in which the UE included the always-on PDU session requested IE in the PDU session establishment request message including a value indicative of the request to establish the PDU session as an always-on PDU session, and upon determining not to establish the PDU session as an always-on PDU session, causing transmission of a PDU session establishment accept message towards the UE, the PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a value indicative of “Always-on PDU session not allowed”.

5. The method according to claim 1, further comprising:

upon an inter-system change from N1 mode to S1 mode, maintaining the always-on PDU session indication.

6. The method according to claim 5, further comprising:

upon an inter-system change from S1 mode to N1 mode, determining, based on the always-on PDU session indication, whether the PDU session transferred from Evolved Packed System (EPS) is an always-on PDU session.

7. An apparatus for performing a service request procedure, the apparatus comprising:

at least one processor; and

at least one memory storing program codes, the at least one memory and the program codes being configured, with the at least one processor, to cause the apparatus at least to:

receive, from user equipment (UE), a protocol data unit (PDU) session establishment request message, the PDU session establishment request message configured to indicate a request to establish a PDU session, the PDU session establishment request message comprising an always-on PDU session requested information element (IE), the always-on PDU session requested IE indicative of whether the UE requests the PDU session be established as an always-on PDU session;

in an instance in which the always-on PDU session requested IE in the PDU session establishment request message is set to a first value indicative of a request to establish the PDU session as an always-on PDU session, determining whether to establish the PDU session as an always-on PDU session;

upon determining to establish the PDU session as an always-on PDU session, causing transmission of a PDU session establishment accept message towards the UE, the PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a second value indicating that the PDU session is to be established as an always-on PDU session; and

upon determining not to establish the PDU session as an always-on PDU session, causing transmission of the PDU session establishment accept message towards the UE.

8. The apparatus of claim 7, wherein the at least one memory and the program codes are further configured, with the at least one processor, to cause the apparatus at least to:

establish the PDU session in either N1 mode or S1 mode;

in an instance in which the PDU session is established as an always-on PDU session in N1 mode, upon an inter-system change from N1 mode to S1 mode, maintain the always-on PDU session indication; and

in an instance in which the PDU session is established as an always-on PDU session in S1 mode, determine, based on the always-on PDU session indication, whether the PDU session transferred from Evolved Packed System (EPS) is an always-on PDU session.

9. The apparatus according to claim 7, wherein the at least one memory and the program codes are further configured, with the at least one processor, to cause the apparatus at least to:

upon determining not to establish the PDU session as an always-on PDU session:

refrain from adding the always-on PDU session indication IE to the PDU session establishment accept message, and

cause transmission of the PDU session establishment accept message towards the UE.

10. The apparatus according to claim 7, wherein the at least one memory and the program codes are further configured, with the at least one processor, to cause the apparatus at least to:

in an instance in which the UE included the always-on PDU session requested IE in the PDU session establishment request message including a value indicative of the request to establish the PDU session as an always-on PDU session, and upon determining not to establish the PDU session as an always-on PDU session, cause transmission of a PDU session establishment accept message towards the UE, the PDU session establishment accept message comprising an always-on PDU session indication IE, wherein the always-on PDU session indication IE is set to a value indicative of "Always-on PDU session not allowed".

11. The apparatus according to claim 7, wherein the at least one memory and the program codes are further configured, with the at least one processor, to cause the apparatus at least to:
upon an inter-system change from N1 mode to S1 mode, maintain the always-on PDU session indication.

12. The apparatus according to claim 11, wherein the at least one memory and the program codes are further configured, with the at least one processor, to cause the apparatus at least to:

upon an inter-system change from S1 mode to N1 mode, determine, based on the always-on PDU session indication, whether the PDU session transferred from Evolved Packed System (EPS) is an always-on PDU session.

13. At least one non-transitory computer-readable storage medium for performing a service request procedure, the at least one non-transitory computer-readable storage medium having computer-executable program code instructions stored therein, the computer-executable program code instructions comprising program code instructions for carrying out the method of any one of claims 1-6.