

HANDLING TRACKING AREA UPDATE REJECT WITHOUT EXTENDED DELAY

FIELD

- 5 [0001] An example embodiment of the present invention relates to the field of mobile wireless communication, particularly to signaling procedures involved in handling of tracking area update (TAU) reject without extended delay.

BACKGROUND

- 10 [0002] When multi-radio user equipment (UE) moves to long term evolution (LTE) (e.g. due to reselection procedure), and does not have Packet Data Protocol (PDP) context but has made a circuit-switched (CS) location update and optionally packet switched (PS) attachment to the operator network (NW), a problematic sequence follows. UE establishes a radio resource control (RRC) connection in order to do a tracking area update (TAU).
- 15 The network (NW) rejects TAU due to the missing PDP context. Then an RRC connection release message is sent to UE. The UE RRC layer will start handling it but it will delay processing the message for 60ms in order to send a confirmation of the message reception to the NW (via radio link control acknowledgement (RLC ACK)). That is when the NW knows that it can release UE contexts in the evolved Node B (eNB) handling the NW to
- 20 UE link.
- [0003] Immediately upon receiving the RRC release message, UE starts an ATTACH procedure in order to obtain PDP context, but because the RRC connection is being released, ATTACH fails. The failure is reported to the non-access stratum (NAS) layer. In the NAS layer, an ATTACH retry timer (T3411, 10 seconds) is started. The fixed 10
- 25 second retry timer causes a greater than 10 second delay in getting service in evolved universal mobile telecommunications service (UMTS) terrestrial radio access network (E-UTRAN).

BRIEF SUMMARY

- 30 [0003a] According to a first aspect of the present invention, there is provided a method comprising receiving a radio resource control (RRC) release signal; awaiting a notification from a lower layer indicating the radio resource control (RRC) connection release is completed; executing a predetermined delay timer; upon one of the predetermined delay

timer expiring or receiving the notification from lower layer indicating RRC connection release is completed, allowing an Attach procedure to start.

[0003b] According to a second aspect of the present invention, there is provided a apparatus comprising at least a processor, a memory associated with said processor and having computer coded instructions stored therein, said instructions when executed by the processor causing the apparatus to perform: receiving a radio resource control (RRC) release signal; awaiting a notification from a lower layer indicating the radio resource control (RRC) connection release is completed; executing a predetermined delay timer; upon one of the predetermined delay timer expiring or receiving the notification from lower layer indicating RRC connection release is completed, allowing an Attach procedure to start.

[0003c] According to a third aspect of the present invention, there is provided an apparatus comprising means for receiving a radio resource control (RRC) release signal; means for awaiting a notification from a lower layer indicating the radio resource control (RRC) connection release is completed; means for executing a predetermined delay timer; upon one of the predetermined delay timer expiring or receiving the notification from lower layer indicating RRC connection release is completed, means for allowing an Attach procedure to start.

[0003d] According to a fourth aspect of the present invention, there is provided a method comprising receiving a wireless network downlink signal commanding radio resource control (RRC) release; sending a wireless network notification that RRC connection release is in progress; receiving a non-access stratum (NAS) message signal during RRC connection release; delaying said message until the RRC connection release is complete; and starting random access signaling.

[0003e] According to a fifth aspect of the present invention, there is provided a method comprising receiving a wireless network downlink signal commanding radio resource control (RRC) release; receiving a wireless network non access stratum (NAS) ATTACH request signal; sending a wireless network notification that radio resource control (RRC) connection release is complete; receiving a new NAS ATTACH signal either without delay or after running a delay timer of predetermined length; and starting random access signaling.

[0003f] According to a sixth aspect of the present invention, there is provided a method comprising receiving a radio resource control (RRC) information downlink from a wireless

network, said information including denial of a tracking area update (TAU) request;
receiving a downlink directing RRC release; initiating RRC release without standard delay.

[0003g] According to a seventh aspect of the present invention, there is provided a method comprising receiving wireless network signal indicating a tracking area update (TAU) request denial; defining a radio resource control (RRC) release cause value to delay initiation of RRC release, wherein the delay is one of a predetermined period or a period chosen when the cause value is defined; and sending an RRC release message including the release cause value.

[0003h] According to an eighth aspect of the present invention, there is provided an apparatus comprising at least a processor, a memory associated with said processor and having computer coded instructions stored therein, said instructions when executed by the processor causing the apparatus to perform: receiving a wireless network downlink signal commanding radio resource control (RRC) release; sending a wireless network notification that RRC connection release is in progress; receiving a non-access stratum (NAS) message signal during RRC connection release; delaying said message until the RRC connection release is complete; and starting random access signaling.

[0003i] According to a ninth aspect of the present invention, there is provided an apparatus comprising at least a processor, a memory associated with said processor and having computer coded instructions stored therein, said instructions when executed by the processor causing the apparatus to perform: receiving a wireless network downlink signal commanding radio resource control (RRC) release; receiving a wireless network non access stratum (NAS) ATTACH request signal; sending a wireless network notification that radio resource control (RRC) connection release is complete; receiving a new NAS ATTACH signal either without delay or after running a delay timer of predetermined length; and starting random access signaling.

[0003j] According to a tenth aspect of the present invention, there is provided an apparatus comprising at least a processor, a memory associated with said processor and having computer coded instructions stored therein, said instructions when executed by the processor causing the apparatus to perform: receiving a radio resource control (RRC) information downlink from a wireless network, said information including denial of a tracking area update (TAU) request; receiving a downlink directing RRC release; initiating RRC release without standard delay.

5 [0003k] According to an eleventh aspect of the present invention, there is provided an apparatus comprising at least a processor, a memory associated with said processor and having computer coded instructions stored therein, said instructions when executed by the processor causing the apparatus to perform: receiving wireless network signal indicating a tracking area update (TAU) request denial; defining a radio resource control (RRC) release cause value to delay initiation of RRC release, wherein the delay is one of a predetermined period or a period chosen when the cause value is defined; and sending an RRC release message including the release cause value.

10 [0003l] According to a twelfth aspect of the present invention, there is provided a computer program product embodied on a distribution medium readable by a computer, the computer program product comprises program instructions which, when loaded into an apparatus, execute the method according to any preceding aspects.

15 [0004] In one embodiment, a method comprises receiving a downlink signal from a network entity indicating that a tracking area update (TAU) was rejected, receiving a downlink signal from a network entity commanding radio resource control (RRC) release, and beginning RRC release. The method may further comprise notifying non access