

METHODS AND APPARATUSES FOR RECOVERY IN AN INTRA-BS LTM PROCEDURE

TECHNICAL FIELD

[0001] The present disclosure relates to wireless communications, and more specifically to methods and apparatuses for recovery in an intra-BS (base station) lower layer-Triggered Mobility (LTM) procedure. LTM may also be named as a L1/L2 lower layer-Triggered Mobility or the like.

BACKGROUND

[0002] A wireless communications system may include one or multiple network communication devices, such as base stations, which may support wireless communications for one or multiple user communication devices, which may be otherwise known as user equipment (UE), or other suitable terminology. The wireless communications system may support wireless communications with one or multiple user communication devices by utilizing resources of the wireless communication system (e.g. time-domain resources (e.g. symbols, slots, subframes, frames, or the like) or frequency-domain resources (e.g. subcarriers, carriers, or the like). Additionally, the wireless communications system may support wireless communications across various radio access technologies including third generation (3G) radio access technology, fourth generation (4G) radio access technology, fifth generation (5G) radio access technology, among other suitable radio access technologies beyond 5G (e.g. sixth generation (6G)).

SUMMARY

[0003] An article "a" before an element is unrestricted and understood to refer to "at least one" of those elements or "one or more" of those elements. The terms "a," "at least one," "one or more," and "at least one of one or more" may be interchangeable. As used herein, including in the claims, "or" as used in a list of items (e.g. a list of items prefaced by a phrase such as "at least one of" or "one or more of" or "one or both of") indicates an inclusive list such that, for example, a list of at least one of A, B, or C means A or B or C or AB or AC or BC or ABC (i.e., A and B and C). Also, as used herein, the phrase "based on" shall not be construed as a reference to a closed set of conditions. For example, an example step that is described as

"based on condition A" may be based on both a condition A and a condition B without departing from the scope of the present disclosure. In other words, as used herein, the phrase "based on" shall be construed in the same manner as the phrase "based at least in part on." Further, as used herein, including in the claims, a "set" may include one or more elements.

[0004] Some implementations of the present disclosure provide a user equipment (UE). The UE includes at least one memory; and at least one processor coupled to the at least one memory and configured to cause the UE to: receive, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); initiate a radio resource control (RRC) reestablishment procedure based on a failure event and perform a first cell selection procedure; and determine whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

[0005] In some implementations of the UE described herein, the failure event is one of: a radio link failure (RLF); an LTM cell switch failure; a handover failure; a re-configuration with sync failure of the MCG; or a mobility from new radio (NR) failure.

[0006] In some implementations of the UE described herein, if the first cell is the LTM candidate cell, the processor is configured to cause the UE to perform LTM cell switching towards the first cell.

[0007] In some implementations of the UE described herein, to perform the LTM cell switching, the processor is configured to cause the UE to: determine whether a UE measured timing advance (TA) identifier (ID) for the source cell is equal to a UE measured TA ID for the first cell; and if the UE measured TA ID for the source cell is equal to the UE measured TA ID for the first cell, perform RACH-less LTM cell switching towards the first cell.

[0008] In some implementations of the UE described herein, the processor is configured to cause the UE to: perform UE-based TA measurements for the one or more LTM candidate cells in response to starting the first cell selection procedure; or perform the UE-based TA measurements for the first cell after selecting the first cell.

[0009] In some implementations of the UE described herein, to perform the LTM cell switching, the processor is configured to cause the UE to: determine whether a configured grant (CG) resource is configured to the UE for the first cell and determine whether a UE

measured timing advance (TA) identifier (ID) for the source cell is equal to a UE measured TA ID for the first cell; and if the CG resource is configured to the UE and if the UE measured TA ID for the source cell is equal to the UE measured TA ID for the first cell, perform RACH-less LTM cell switching towards the first cell.

[0010] In some implementations of the UE described herein, if one or more CG resources are configured to the UE, the processor is configured to cause the UE to: if a transmission configuration indication (TCI) state associated with at least one CG resource is activated, select one CG resource based on the activated TCI state; or if all TCI states of the one or more CG resources are not activated, determine one beam for the first cell based on measurements of the UE.

[0011] In some implementations of the UE described herein, the processor is configured to cause the UE to transmit an RRC reconfiguration complete message to the first cell, and wherein the RRC reconfiguration complete message includes ID information of the first cell.

[0012] In some implementations of the UE described herein, if the first cell is the LTM candidate cell and both the MCG and a secondary cell group (SCG) are configured to the UE, the processor is configured to cause the UE to perform one of the following: transmitting an RRC reestablishment request message to the first cell; suspending SCG configuration information and performing LTM cell switching towards the first cell; or releasing the SCG configuration information and performing the LTM cell switching towards the first cell.

[0013] In some implementations of the UE described herein, the processor is configured to cause the UE to: determine whether the first cell is a conditional handover (CHO) candidate cell; and if the first cell is the CHO candidate cell, perform CHO towards the first cell.

[0014] In some implementations of the UE described herein, in response to performing the CHO towards the first cell, the processor is configured to cause the UE to keep or release the LTM configuration information related to the one or more LTM candidate cells.

[0015] In some implementations of the UE described herein, the processor is configured to cause the UE to: if the first cell selection procedure is performed while a timer for cell selection is running and if the first cell is the LTM candidate cell, perform LTM cell

switching towards the first cell; and if the LTM cell switching towards the first cell fails, perform a second cell selection procedure.

[0016] In some implementations of the UE described herein, the processor is configured to cause the UE to: if a second cell selected by the second cell selection procedure is a conditional handover (CHO) candidate cell, perform CHO towards the second cell; and if the CHO towards the second cell fails, perform an RRC reestablishment procedure.

[0017] In some implementations of the UE described herein, the processor is configured to cause the UE to: if the first cell selection procedure is performed while a timer for cell selection is running and if the first cell is a conditional handover (CHO) candidate cell, perform CHO towards the first cell; and if the CHO towards the first cell fails, perform a third cell selection procedure.

[0018] In some implementations of the UE described herein, the processor is configured to cause the UE to: if a third cell selected by the third cell selection procedure is an LTM candidate cell, perform LTM cell switching towards the third cell; and if the LTM cell switching towards the third cell fails, perform an RRC reestablishment procedure.

[0019] Some implementations of the present disclosure provide a processor for wireless communication, comprising at least one controller coupled with at least one memory and configured to cause the processor to: receive, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); initiate a radio resource control (RRC) reestablishment procedure based on a failure event and perform a first cell selection procedure; and determine whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

[0020] Some implementations of the present disclosure provide a method performed by a user equipment (UE). The method includes: receiving, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); initiating a radio resource control (RRC) reestablishment procedure based on a failure event and performing a first cell selection procedure; and determining whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

[0021] Some implementations of the present disclosure provide a base station (BS). The BS includes at least one memory; and at least one processor coupled to the at least one memory and configured to cause the BS to: receive a measurement report from a user equipment (UE); and transmit a radio resource control (RRC) reconfiguration message to the UE, wherein the RRC reconfiguration message includes at least one of the following: lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); or conditional handover (CHO) configuration information related to one or more CHO candidate cells.

[0022] In some implementations of the BS described herein, the processor is configured to cause the BS to receive an RRC reconfiguration complete message from the UE, and wherein the RRC reconfiguration complete message includes ID information of a cell selected by the UE via a cell selection procedure.

[0023] Some implementations of the present disclosure provide a processor for wireless communication, comprising at least one controller coupled with at least one memory and configured to cause the processor to: receive a measurement report from a user equipment (UE); and transmit a radio resource control (RRC) reconfiguration message to the UE, wherein the RRC reconfiguration message includes at least one of the following: lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); or conditional handover (CHO) configuration information related to one or more CHO candidate cells.

[0024] Some implementations of the present disclosure provide a method performed by a base station (BS). The method includes: receiving a measurement report from a user equipment (UE); and transmitting a radio resource control (RRC) reconfiguration message to the UE, wherein the RRC reconfiguration message includes at least one of the following: lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); or conditional handover (CHO) configuration information related to one or more CHO candidate cells.

[0025] Some implementations of the present disclosure provide a centralized unit (CU) of a base station (BS). The CU includes at least one memory; and at least one processor coupled to the at least one memory and configured to cause the CU to: receive, from a

candidate distributed unit (DU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the candidate DU, wherein the message includes identifier (ID) information of the candidate cell; and transmit first information to the source DU after receiving the message.

[0026] In some implementations of the CU described herein, the candidate cell is a candidate primary cell (PCell).

[0027] In some implementations of the CU described herein, the message is an access success message.

[0028] In some implementations of the CU described herein, the first information is included in one of: a UE context release command message; or a UE context modification request message.

[0029] In some implementations of the CU described herein, the first information includes at least one of the following: information indicating that the UE has switched from the source cell to the candidate cell; a request for LTM cell switching related information; or a request for SCI resource configuration information for LTM.

[0030] In some implementations of the CU described herein, the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for the LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

[0031] In some implementations of the CU described herein, the request includes at least one of the following: a request for RACH resource information for an early TA acquisition associated with one or more candidate cells configured for the LTM cell switching; a request for at least one early TA value associated with the one or more candidate cells; a request for activated TCI state information associated with one or more candidate cells; or a request for SCI resource configuration information for LTM.

[0032] In some implementations of the CU described herein, the processor is configured to cause the CU to: receive the LTM cell switching related information from the source DU; and transmit the LTM cell switching related information to the candidate DU.

[0033] Some implementations of the present disclosure provide a processor for wireless communication, comprising at least one controller coupled with at least one memory and configured to cause the processor to: receive, from a candidate distributed unit (DU) of a base station (BS), a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the candidate DU, wherein the message includes identifier (ID) information of the candidate cell; and transmit first information to the source DU after receiving the message.

[0034] Some implementations of the present disclosure provide a method performed by a centralized unit (CU) of a base station (BS). The method includes: receiving, from a candidate distributed unit (DU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the candidate DU, wherein the message includes identifier (ID) information of the candidate cell; and transmitting first information to the source DU after receiving the message.

[0035] Some implementations of the present disclosure provide a source distributed unit (DU) of a base station (BS). The source DU includes at least one memory; and at least one processor coupled to the at least one memory and configured to cause the source DU to: receive information from a centralized unit (CU) of the BS, wherein the information includes at least one of the following: information indicating that a user equipment (UE) has switched from a source cell to a candidate cell; or a request for lower layer-triggered mobility (LTM) cell switching related information; and transmit the LTM cell switching related information to the CU.

[0036] In some implementations of the source DU described herein, the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration

indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

[0037] In some implementations of the source DU described herein, the one or more candidate cells are candidate primary cells (PCell)s.

[0038] In some implementations of the source DU described herein, the request includes at least one of the following: a request for RACH resource information for an early TA acquisition associated with one or more candidate cells configured for the LTM cell switching; a request for at least one early TA value associated with the one or more candidate cells; a request for activated TCI state information associated with one or more candidate cells; or a request for SCI resource configuration information for LTM.

[0039] Some implementations of the present disclosure provide a processor for wireless communication, comprising at least one controller coupled with at least one memory and configured to cause the processor to: receive information from a centralized unit (CU) of the BS, wherein the information includes at least one of the following: information indicating that a user equipment (UE) has switched from a source cell to a candidate cell; or a request for lower layer-triggered mobility (LTM) cell switching related information; and transmit the LTM cell switching related information to the CU.

[0040] Some implementations of the present disclosure provide a method performed by a source distributed unit (DU) of a base station (BS). The method includes: receiving information from a centralized unit (CU) of the BS, wherein the information includes at least one of the following: information indicating that a user equipment (UE) has switched from a source cell to a candidate cell; or a request for lower layer-triggered mobility (LTM) cell switching related information; and transmitting the LTM cell switching related information to the CU.

[0041] Some implementations of the present disclosure provide a target distributed unit (DU) of a base station (BS). The target DU includes at least one memory; and at least one processor coupled to the at least one memory and configured to cause the target DU to: transmit, to a centralized unit (CU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the target DU, wherein the message includes identifier

(ID) information of the candidate cell; and receive LTM cell switching related information from the CU, wherein the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

[0042] In some implementations of the target DU described herein, the candidate cell is a candidate primary cell (PCell).

[0043] In some implementations of the target DU described herein, the message is an access success message.

[0044] Some implementations of the present disclosure provide a processor for wireless communication, comprising at least one controller coupled with at least one memory and configured to cause the processor to: transmit, to a centralized unit (CU) of a base station (BS), a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the target DU, wherein the message includes identifier (ID) information of the candidate cell; and receive LTM cell switching related information from the CU, wherein the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

[0045] Some implementations of the present disclosure provide a method performed by a target distributed unit (DU) of a base station (BS). The method includes: transmitting, to a centralized unit (CU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the target DU, wherein the message includes identifier (ID)

information of the candidate cell; and receiving LTM cell switching related information from the CU, wherein the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] Figure 1 illustrates an example of a wireless communications system in accordance with aspects of the present disclosure.

[0047] Figure 2 illustrates an example of a user equipment (UE) 200 in accordance with aspects of the present disclosure.

[0048] Figure 3 illustrates an example of a processor 300 in accordance with aspects of the present disclosure.

[0049] Figure 4 illustrates an example of a network equipment (NE) 400 in accordance with aspects of the present disclosure.

[0050] Figure 5A illustrates a schematic diagram of an intra-CU intra-DU mobility scenario in accordance with aspects of the present disclosure.

[0051] Figure 5B illustrates a schematic diagram of an intra-CU inter-DU mobility scenario in accordance with aspects of the present disclosure.

[0052] Figure 5C illustrates a schematic diagram of an inter-CU mobility scenario in accordance with aspects of the present disclosure.

[0053] Figures 6-10 illustrate flowcharts of a method related to an LTM cell switch procedure in accordance with aspects of the present disclosure.

[0054] Figure 11 illustrates a schematic diagram of an MCG LTM based recovery mechanism in accordance with aspects of the present disclosure.

[0055] Figure 12 illustrates another schematic diagram of an MCG LTM based recovery mechanism in accordance with aspects of the present disclosure.

[0056] Figure 13 illustrates a schematic diagram of a CHO based recovery mechanism in accordance with aspects of the present disclosure.

[0057] Figure 14 illustrates a schematic diagram of an intra-CU LTM procedure in accordance with aspects of the present disclosure.

DETAILED DESCRIPTION

[0058] In general, when a UE moves from one cell to another cell, at some point a serving cell change needs to be performed. In the legacy, the serving cell change is done by explicit RRC reconfiguration signalling (e.g. a handover (HO) command) to trigger the synchronization of a target cell based on Layer-3 (L3) measurements report. It leads to longer latency, larger overhead, and longer interruption time than beam level mobility. Therefore, in 3GPP, LTM was approved to change a serving cell via L1/L2 signalling, in order to reduce the latency, overhead and interruption time.

[0059] LTM is a procedure in which a BS receives L1 measurement report(s) from a UE, and on their basis the BS changes UE's serving cell by a cell switch command signaled via a MAC CE. The cell switch command indicates an LTM candidate cell configuration that the BS previously prepared and provided to the UE through RRC signalling. Then the UE switches to the target cell according to the cell switch command. The LTM procedure can be used to reduce the mobility latency.

[0060] In some cases, subsequent LTM may be supported. Subsequent LTM means subsequent LTM cell switch procedures between candidate cells where a UE does not need to be reconfigured by the network in between.

[0061] A supervision timer can be used to detect a failure of an LTM execution or an LTM cell switch procedure, wherein an LTM procedure fails if the LTM supervision timer expires, upon which a UE initiates an RRC connection re-establishment procedure. For example, legacy T304 timer is used as the supervision timer to supervise the LTM cell switch procedure.

[0062] "LTM candidate cell" refers to a candidate cell configured to a UE for LTM. There may be multiple LTM candidate cells prepared for the UE, where the LTM candidate cells may belong to the same or different candidate DUs.

[0063] "LTM candidate cell configuration" refers to a configuration associated with an LTM candidate cell. An LTM candidate cell configuration can be a complete LTM candidate cell configuration or a delta (difference) configuration with respect to an LTM reference configuration. Each LTM candidate cell configuration may be identified by an index, called as LTM candidate cell configuration index, LTM candidate configuration index, or other names. In one example, the LTM candidate cell configuration index is LTM-CandidateId, which is used to identity an LTM candidate cell configuration.

[0064] "LTM Reference Configuration" refers to a configuration provided by the network to the UE that is common to all the configured LTM candidate cells. It is used by the UE to generate a complete LTM candidate cell configuration (i.e., by applying an LTM candidate cell configuration on top of an LTM reference configuration).

[0065] "Complete LTM Candidate Cell Configuration" refers to a configuration that contains all the necessary fields needed to perform an LTM cell switch procedure. This configuration can be an LTM candidate cell configuration itself or be generated by applying an LTM candidate cell configuration on top of an LTM reference configuration.

[0066] MCG LTM is a PCell switch procedure that the network triggers via a medium access control (MAC) control element (CE) based on L1 measurements. SCG LTM is a PSCell switch procedure that the network triggers via a medium access control (MAC) control element (CE) based on L1 measurements. The potential applicable scenarios of LTM include "intra-CU intra-DU LTM" and "intra-CU inter-DU LTM" as shown in Figures 5A, 5B and 5C as described below.

- (1) Intra-CU intra-DU mobility: a UE moves between different cells within a DU.
- (2) Intra-CU inter-DU mobility: a UE moves between different cells belonging to different DUs but within a CU.
- (3) Inter-CU mobility: a UE moves between different cells belonging to different DUs different CUs.

[0067] One objective for mobility enhancements in 3GPP Rel-18 is to specify an LTM procedure (i.e. a PCell or PSCell switch procedure triggered by the network via MAC CE based on L1 measurement). Currently, following issues regarding an LTM procedure need to be considered, including, e.g. if selected cell is an LTM candidate cell, whether or how to ensure a UE to perform a RACH-less LTM cell switching for a recovery purpose; when to perform a TA measurement for an LTM based recovery; if an LTM based recovery is performed, whether should the selected candidate cell be reported to the network; how to retrieve LTM related information after an LTM or CHO based recovery in an intra-BS LTM case; whether or how to support an MCG LTM based recovery in the case that a UE is configured with a DC scenario; and what a UE's behavior after a successful CHO based recovery or after an LTM based recovery fails. Currently, details regarding a recovery mechanism in an intra-BS LTM procedure have not been discussed yet. Embodiments of the present disclosure aim to resolve the abovementioned issues.

[0068] For example, some embodiments of the present disclosure design an RACH-less based LTM cell switching for a recovery purpose. Some embodiments of the present disclosure design when to calculate a TA for RACH-less based LTM recovery. Some embodiments of the present disclosure design a mechanism of retrieving LTM related information after an LTM or CHO based recovery mechanism. Some embodiments of the present disclosure refer to how to handle MCG LTM based recovery in a DC case. In some embodiments of the present disclosure, after successful CHO based recovery, whether to release or keep LTM candidate cell is discussed. In some embodiments of the present disclosure, in the case that both CHO and LTM are configured to a UE, a new recovery mechanism is designed for a fast recovery purpose.

[0069] In some embodiments of the present disclosure, a UE Measured TA ID for a serving cell of a UE may be denoted as "*ltm-ServingCellUE-MeasuredTA-ID*", which is configured in *LTM-Config* information element (IE). This IE is used by the UE to determine on whether UE-based TA measurements should be performed when an LTM cell switch procedure is triggered towards an LTM candidate cell. When the UE receives an LTM cell switch command towards a candidate cell, if the value of *ltm-UE-MeasuredTA-ID* contained within the *LTM-Candidate IE* is equal to the value of *ltm-ServingCellUE-MeasuredTA-ID*. The AS layer of the UE may inform lower layers that the UE should perform UE-based TA

measurements. Otherwise, the UE may replace the value of *ltm-ServingCellUE-MeasuredTA-ID* with the value of *ltm-UE-MeasuredTA-ID* in the *LTM-Candidate*.

[0070] In some embodiments of the present disclosure, a UE Measured TA ID for candidate cell(s) may be denoted as *ltm-UE-MeasuredTA-ID* or the like.

[0071] In some embodiments of the present disclosure, an LTM NoReset operation means that a UE does not perform a L2 reset operation for a candidate cell when the UE performs an LTM cell switching from a source cell to the candidate cell. For example, in some embodiments of the present disclosure, a NoReset ID for a serving cell may be denoted as "*ltm-ServingCellNoResetID*", which is configured in *LTM-Config* IE. This field is used by the UE to determine on whether L2 reset should be performed when an LTM cell switch procedure is triggered towards an LTM candidate cell. When the UE receives an LTM cell switch command towards a candidate cell, if the value of *ltm-NoResetID* contained within the *LTM-Candidate* IE is equal to the value of *ltm-ServingCellNoResetID*, the UE may continue using the current RLC entity. Otherwise, the UE may replace the value of *ltm-ServingCellNoResetID* with the value of *ltm-NoResetID* in the *LTM-Candidate*.

[0072] In some embodiments of the present disclosure, a NoReset ID for candidate cell(s) may be denoted as *ltm-NoResetID* or the like.

[0073] More details of the embodiments of the present disclosure will be illustrated in the following text in combination with the appended drawings.

[0074] Figure 1 illustrates an example of a wireless communications system 100 in accordance with aspects of the present disclosure. The wireless communications system 100 may include one or more NE 102, one or more UE 104, and a core network (CN) 106. The wireless communications system 100 may support various radio access technologies. In some implementations, the wireless communications system 100 may be a 4G network, such as an LTE network or an LTE-Advanced (LTE-A) network. In some other implementations, the wireless communications system 100 may be a NR network, such as a 5G network, a 5G-Advanced (5G-A) network, or a 5G ultrawideband (5G-UWB) network. In other implementations, the wireless communications system 100 may be a combination of a 4G network and a 5G network, or other suitable radio access technology including Institute of Electrical and Electronics Engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE

802.20. The wireless communications system 100 may support radio access technologies beyond 5G, for example, 6G. Additionally, the wireless communications system 100 may support technologies, such as time division multiple access (TDMA), frequency division multiple access (FDMA), or code division multiple access (CDMA), etc.

[0075] The one or more NE 102 may be dispersed throughout a geographic region to form the wireless communications system 100. One or more of the NE 102 described herein may be or include or may be referred to as a network node, a base station, a network element, a network function, a network entity, a radio access network (RAN), a NodeB, an eNodeB (eNB), a next-generation NodeB (gNB), or other suitable terminology. An NE 102 and a UE 104 may communicate via a communication link, which may be a wireless or wired connection. For example, an NE 102 and a UE 104 may perform wireless communication (e.g. receive signaling, transmit signaling) over a Uu interface.

[0076] An NE 102 may provide a geographic coverage area for which the NE 102 may support services for one or more UEs 104 within the geographic coverage area. For example, an NE 102 and a UE 104 may support wireless communication of signals related to services (e.g. voice, video, packet data, messaging, broadcast, etc.) according to one or multiple radio access technologies. In some implementations, an NE 102 may be moveable, for example, a satellite associated with a non-terrestrial network (NTN). In some implementations, different geographic coverage areas 112 associated with the same or different radio access technologies may overlap, but the different geographic coverage areas may be associated with different NE 102.

[0077] The one or more UE 104 may be dispersed throughout a geographic region of the wireless communications system 100. A UE 104 may include or may be referred to as a remote unit, a mobile device, a wireless device, a remote device, a subscriber device, a transmitter device, a receiver device, or some other suitable terminology. In some implementations, the UE 104 may be referred to as a unit, a station, a terminal, or a client, among other examples. Additionally, or alternatively, the UE 104 may be referred to as an Internet-of-Things (IoT) device, an Internet-of-Everything (IoE) device, or machine-type communication (MTC) device, among other examples.

[0078] A UE 104 may be able to support wireless communication directly with other UEs 104 over a communication link. For example, a UE 104 may support wireless communication directly with another UE 104 over a device-to-device (D2D) communication link. In some implementations, such as vehicle-to-vehicle (V2V) deployments, vehicle-to-everything (V2X) deployments, or cellular-V2X deployments, the communication link 114 may be referred to as a sidelink. For example, a UE 104 may support wireless communication directly with another UE 104 over a PC5 interface.

[0079] An NE 102 may support communications with the CN 106, or with another NE 102, or both. For example, an NE 102 may interface with other NE 102 or the CN 106 through one or more backhaul links (e.g. S1, N2, N2, or network interface). In some implementations, the NE 102 may communicate with each other directly. In some other implementations, the NE 102 may communicate with each other or indirectly (e.g. via the CN 106). In some implementations, one or more NE 102 may include subcomponents, such as an access network entity, which may be an example of an access node controller (ANC). An ANC may communicate with the one or more UEs 104 through one or more other access network transmission entities, which may be referred to as a radio heads, smart radio heads, or transmission-reception points (TRPs).

[0080] The CN 106 may support user authentication, access authorization, tracking, connectivity, and other access, routing, or mobility functions. The CN 106 may be an evolved packet core (EPC), or a 5G core (5GC), which may include a control plane entity that manages access and mobility (e.g. a mobility management entity (MME), an access and mobility management functions (AMF)) and a user plane entity that routes packets or interconnects to external networks (e.g. a serving gateway (S-GW), a Packet Data Network (PDN) gateway (P-GW), or a user plane function (UPF)). In some implementations, the control plane entity may manage non-access stratum (NAS) functions, such as mobility, authentication, and bearer management (e.g. data bearers, signal bearers, etc.) for the one or more UEs 104 served by the one or more NE 102 associated with the CN 106.

[0081] The CN 106 may communicate with a packet data network over one or more backhaul links (e.g. via an S1, N2, N2, or another network interface). The packet data network may include an application server. In some implementations, one or more UEs 104 may communicate with the application server. A UE 104 may establish a session (e.g. a

protocol data unit (PDU) session, or the like) with the CN 106 via an NE 102. The CN 106 may route traffic (e.g. control information, data, and the like) between the UE 104 and the application server using the established session (e.g. the established PDU session). The PDU session may be an example of a logical connection between the UE 104 and the CN 106 (e.g. one or more network functions of the CN 106).

[0082] In the wireless communications system 100, the NEs 102 and the UEs 104 may use resources of the wireless communications system 100 (e.g. time resources (e.g. symbols, slots, subframes, frames, or the like) or frequency resources (e.g. subcarriers, carriers)) to perform various operations (e.g. wireless communications). In some implementations, the NEs 102 and the UEs 104 may support different resource structures. For example, the NEs 102 and the UEs 104 may support different frame structures. In some implementations, such as in 4G, the NEs 102 and the UEs 104 may support a single frame structure. In some other implementations, such as in 5G and among other suitable radio access technologies, the NEs 102 and the UEs 104 may support various frame structures (i.e., multiple frame structures). The NEs 102 and the UEs 104 may support various frame structures based on one or more numerologies.

[0083] One or more numerologies may be supported in the wireless communications system 100, and a numerology may include a subcarrier spacing and a cyclic prefix. A first numerology (e.g. $\mu=0$) may be associated with a first subcarrier spacing (e.g. 15 kHz) and a normal cyclic prefix. In some implementations, the first numerology (e.g. $\mu=0$) associated with the first subcarrier spacing (e.g. 15 kHz) may utilize one slot per subframe. A second numerology (e.g. $\mu=1$) may be associated with a second subcarrier spacing (e.g. 30 kHz) and a normal cyclic prefix. A third numerology (e.g. $\mu=2$) may be associated with a third subcarrier spacing (e.g. 60 kHz) and a normal cyclic prefix or an extended cyclic prefix. A fourth numerology (e.g. $\mu=3$) may be associated with a fourth subcarrier spacing (e.g. 120 kHz) and a normal cyclic prefix. A fifth numerology (e.g. $\mu=4$) may be associated with a fifth subcarrier spacing (e.g. 240 kHz) and a normal cyclic prefix.

[0084] A time interval of a resource (e.g. a communication resource) may be organized according to frames (also referred to as radio frames). Each frame may have a duration, for example, a 10 millisecond (ms) duration. In some implementations, each frame may include multiple subframes. For example, each frame may include 10 subframes, and each subframe

may have a duration, for example, a 1 ms duration. In some implementations, each frame may have the same duration. In some implementations, each subframe of a frame may have the same duration.

[0085] Additionally or alternatively, a time interval of a resource (e.g. a communication resource) may be organized according to slots. For example, a subframe may include a number (e.g. quantity) of slots. The number of slots in each subframe may also depend on the one or more numerologies supported in the wireless communications system 100. For instance, the first, second, third, fourth, and fifth numerologies (i.e., $\mu=0$, $\mu=1$, $\mu=2$, $\mu=3$, $\mu=4$) associated with respective subcarrier spacings of 15 kHz, 30 kHz, 60 kHz, 120 kHz, and 240 kHz may utilize a single slot per subframe, two slots per subframe, four slots per subframe, eight slots per subframe, and 16 slots per subframe, respectively. Each slot may include a number (e.g. quantity) of symbols (e.g. OFDM symbols). In some implementations, the number (e.g. quantity) of slots for a subframe may depend on a numerology. For a normal cyclic prefix, a slot may include 14 symbols. For an extended cyclic prefix (e.g. applicable for 60 kHz subcarrier spacing), a slot may include 12 symbols. The relationship between the number of symbols per slot, the number of slots per subframe, and the number of slots per frame for a normal cyclic prefix and an extended cyclic prefix may depend on a numerology. It should be understood that reference to a first numerology (e.g. $\mu=0$) associated with a first subcarrier spacing (e.g. 15 kHz) may be used interchangeably between subframes and slots.

[0086] In the wireless communications system 100, an electromagnetic (EM) spectrum may be split, based on frequency or wavelength, into various classes, frequency bands, frequency channels, etc. By way of example, the wireless communications system 100 may support one or multiple operating frequency bands, such as frequency range designations FR1 (410 MHz – 7.125 GHz), FR2 (24.25 GHz – 52.6 GHz), FR3 (7.125 GHz – 24.25 GHz), FR4 (52.6 GHz – 114.25 GHz), FR4a or FR4-1 (52.6 GHz – 71 GHz), and FR5 (114.25 GHz – 300 GHz). In some implementations, the NEs 102 and the UEs 104 may perform wireless communications over one or more of the operating frequency bands. In some implementations, FR1 may be used by the NEs 102 and the UEs 104, among other equipment or devices for cellular communications traffic (e.g. control information, data). In some implementations, FR2 may be used by the NEs 102 and the UEs 104, among other equipment or devices for short-range, high data rate capabilities.

[0087] FR1 may be associated with one or multiple numerologies (e.g. at least three numerologies). For example, FR1 may be associated with a first numerology (e.g. $\mu=0$), which includes 15 kHz subcarrier spacing; a second numerology (e.g. $\mu=1$), which includes 30 kHz subcarrier spacing; and a third numerology (e.g. $\mu=2$), which includes 60 kHz subcarrier spacing. FR2 may be associated with one or multiple numerologies (e.g. at least 2 numerologies). For example, FR2 may be associated with a third numerology (e.g. $\mu=2$), which includes 60 kHz subcarrier spacing; and a fourth numerology (e.g. $\mu=3$), which includes 120 kHz subcarrier spacing.

[0088] Figure 2 illustrates an example of a UE 200 in accordance with aspects of the present disclosure. The UE 200 may include a processor 202, a memory 204, a controller 206, and a transceiver 208. The processor 202, the memory 204, the controller 206, or the transceiver 208, or various combinations thereof or various components thereof may be examples of means for performing various aspects of the present disclosure as described herein. These components may be coupled (e.g. operatively, communicatively, functionally, electronically, electrically) via one or more interfaces.

[0089] The processor 202, the memory 204, the controller 206, or the transceiver 208, or various combinations or components thereof may be implemented in hardware (e.g. circuitry). The hardware may include a processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), or other programmable logic device, or any combination thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure.

[0090] The processor 202 may include an intelligent hardware device (e.g. a general-purpose processor, a DSP, a CPU, an ASIC, an FPGA, or any combination thereof). In some implementations, the processor 202 may be configured to operate the memory 204. In some other implementations, the memory 204 may be integrated into the processor 202. The processor 202 may be configured to execute computer-readable instructions stored in the memory 204 to cause the UE 200 to perform various functions of the present disclosure.

[0091] The memory 204 may include volatile or non-volatile memory. The memory 204 may store computer-readable, computer-executable code including instructions when executed by the processor 202 cause the UE 200 to perform various functions described

herein. The code may be stored in a non-transitory computer-readable medium such the memory 204 or another type of memory. Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer.

[0092] In some implementations, the processor 202 and the memory 204 coupled with the processor 202 may be configured to cause the UE 200 to perform one or more of the functions described herein (e.g. executing, by the processor 202, instructions stored in the memory 204). For example, the UE 200 may be configured to support: a means for receiving, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); initiating a radio resource control (RRC) reestablishment procedure based on a failure event and perform a first cell selection procedure; and determining whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

[0093] The controller 206 may manage input and output signals for the UE 200. The controller 206 may also manage peripherals not integrated into the UE 200. In some implementations, the controller 206 may utilize an operating system such as iOS®, ANDROID®, WINDOWS®, or other operating systems. In some implementations, the controller 206 may be implemented as part of the processor 202.

[0094] In some implementations, the UE 200 may include at least one transceiver 208. In some other implementations, the UE 200 may have more than one transceiver 208. The transceiver 208 may represent a wireless transceiver. The transceiver 208 may include one or more receiver chains 210, one or more transmitter chains 212, or a combination thereof. The means for receiving abovementioned in the processor 202 or the means for transmitting in the processor 202 may be implemented via at least one transceiver 208.

[0095] A receiver chain 210 may be configured to receive signals (e.g. control information, data, packets) over a wireless medium. For example, the receiver chain 210 may include one or more antennas for receive the signal over the air or wireless medium. The receiver chain 210 may include at least one amplifier (e.g. a low-noise amplifier (LNA))

configured to amplify the received signal. The receiver chain 210 may include at least one demodulator configured to demodulate the receive signal and obtain the transmitted data by reversing the modulation technique applied during transmission of the signal. The receiver chain 210 may include at least one decoder for decoding the processing the demodulated signal to receive the transmitted data.

[0096] A transmitter chain 212 may be configured to generate and transmit signals (e.g. control information, data, packets). The transmitter chain 212 may include at least one modulator for modulating data onto a carrier signal, preparing the signal for transmission over a wireless medium. The at least one modulator may be configured to support one or more techniques such as amplitude modulation (AM), frequency modulation (FM), or digital modulation schemes like phase-shift keying (PSK) or quadrature amplitude modulation (QAM). The transmitter chain 212 may also include at least one power amplifier configured to amplify the modulated signal to an appropriate power level suitable for transmission over the wireless medium. The transmitter chain 212 may also include one or more antennas for transmitting the amplified signal into the air or wireless medium.

[0097] Figure 3 illustrates an example of a processor 300 in accordance with aspects of the present disclosure. The processor 300 may be an example of a processor configured to perform various operations in accordance with examples as described herein. The processor 300 may include a controller 302 configured to perform various operations in accordance with examples as described herein. The processor 300 may optionally include at least one memory 304, which may be, for example, an L1/L2/L3 cache. Additionally, or alternatively, the processor 300 may optionally include one or more arithmetic-logic units (ALUs) 306. One or more of these components may be in electronic communication or otherwise coupled (e.g. operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g. buses).

[0098] The processor 300 may be a processor chipset and include a protocol stack (e.g. a software stack) executed by the processor chipset to perform various operations (e.g. receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) in accordance with examples as described herein. The processor chipset may include one or more cores, one or more caches (e.g. memory local to or included in the processor chipset (e.g. the processor 300) or other memory (e.g. random

access memory (RAM), read-only memory (ROM), dynamic RAM (DRAM), synchronous dynamic RAM (SDRAM), static RAM (SRAM), ferroelectric RAM (FeRAM), magnetic RAM (MRAM), resistive RAM (RRAM), flash memory, phase change memory (PCM), and others).

[0099] The controller 302 may be configured to manage and coordinate various operations (e.g. signaling, receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) of the processor 300 to cause the processor 300 to support various operations in accordance with examples as described herein. For example, the controller 302 may operate as a control unit of the processor 300, generating control signals that manage the operation of various components of the processor 300. These control signals include enabling or disabling functional units, selecting data paths, initiating memory access, and coordinating timing of operations.

[0100] The controller 302 may be configured to fetch (e.g. obtain, retrieve, receive) instructions from the memory 304 and determine subsequent instruction(s) to be executed to cause the processor 300 to support various operations in accordance with examples as described herein. The controller 302 may be configured to track memory address of instructions associated with the memory 304. The controller 302 may be configured to decode instructions to determine the operation to be performed and the operands involved. For example, the controller 302 may be configured to interpret the instruction and determine control signals to be output to other components of the processor 300 to cause the processor 300 to support various operations in accordance with examples as described herein. Additionally, or alternatively, the controller 302 may be configured to manage flow of data within the processor 300. The controller 302 may be configured to control transfer of data between registers, arithmetic logic units (ALUs), and other functional units of the processor 300.

[0101] The memory 304 may include one or more caches (e.g. memory local to or included in the processor 300 or other memory, such RAM, ROM, DRAM, SDRAM, SRAM, MRAM, flash memory, etc. In some implementations, the memory 304 may reside within or on a processor chipset (e.g. local to the processor 300). In some other implementations, the memory 304 may reside external to the processor chipset (e.g. remote to the processor 300).

[0102] The memory 304 may store computer-readable, computer-executable code including instructions that, when executed by the processor 300, cause the processor 300 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. The controller 302 and/or the processor 300 may be configured to execute computer-readable instructions stored in the memory 304 to cause the processor 300 to perform various functions. For example, the processor 300 and/or the controller 302 may be coupled with or to the memory 304, the processor 300, the controller 302, and the memory 304 may be configured to perform various functions described herein. In some examples, the processor 300 may include multiple processors and the memory 304 may include multiple memories. One or more of the multiple processors may be coupled with one or more of the multiple memories, which may, individually or collectively, be configured to perform various functions herein.

[0103] The one or more ALUs 306 may be configured to support various operations in accordance with examples as described herein. In some implementations, the one or more ALUs 306 may reside within or on a processor chipset (e.g. the processor 300). In some other implementations, the one or more ALUs 306 may reside external to the processor chipset (e.g. the processor 300). One or more ALUs 306 may perform one or more computations such as addition, subtraction, multiplication, and division on data. For example, one or more ALUs 306 may receive input operands and an operation code, which determines an operation to be executed. One or more ALUs 306 be configured with a variety of logical and arithmetic circuits, including adders, subtractors, shifters, and logic gates, to process and manipulate the data according to the operation. Additionally, or alternatively, the one or more ALUs 306 may support logical operations such as AND, OR, exclusive-OR (XOR), not-OR (NOR), and not-AND (NAND), enabling the one or more ALUs 306 to handle conditional operations, comparisons, and bitwise operations.

[0104] The processor 300 may support wireless communication in accordance with examples as disclosed herein.

[0105] In some implementations, the processor 300 may be configured to support means for performing operations as described with respect to Figure 6. For example, the processor 300 may be configured to or operable to support: a means for receiving, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM

candidate cells associated with a master cell group (MCG); a means for initiating a radio resource control (RRC) reestablishment procedure based on a failure event and a means for performing a first cell selection procedure; and a means for determining whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

[0106] In some implementations, the processor 300 may be configured to support means for performing operations as described with respect to Figure 7. For example, the processor 300 may be configured to or operable to support: a means for receiving, a measurement report from a user equipment (UE); and a means for transmitting a radio resource control (RRC) reconfiguration message to the UE, wherein the RRC reconfiguration message includes at least one of the following: lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG); or conditional handover (CHO) configuration information related to one or more CHO candidate cells.

[0107] In some implementations, the processor 300 may be configured to support means for performing operations as described with respect to Figure 8. For example, the processor 300 may be configured to or operable to support: a means for receiving, from a candidate distributed unit (DU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the candidate DU, wherein the message includes identifier (ID) information of the candidate cell; and a means for transmitting first information to the source DU after receiving the message.

[0108] In some implementations, the processor 300 may be configured to support means for performing operations as described with respect to Figure 9. For example, the processor 300 may be configured to or operable to support: a means for receiving information from a centralized unit (CU) of the BS, wherein the information includes at least one of the following: information indicating that a user equipment (UE) has switched from a source cell to a candidate cell; or a request for lower layer-triggered mobility (LTM) cell switching related information; and a means for transmitting the LTM cell switching related information to the CU.

[0109] In some additional implementations, the processor 300 may be configured to support means for performing operations as described with respect to Figure 10. For example, the processor 300 may be configured to or operable to support: a means for transmitting, to a centralized unit (CU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the target DU, wherein the message includes identifier (ID) information of the candidate cell; and a means for receiving LTM cell switching related information from the CU, wherein the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

[0110] It should be appreciated by persons skilled in the art that the components in exemplary processor 300 may be changed, for example, some of the components in exemplary processor 300 may be omitted or modified or new component(s) may be added to exemplary processor 300, without departing from the spirit and scope of the disclosure. For example, in some embodiments, the processor 300 may not include the ALUs 306.

[0111] Figure 4 illustrates an example of a NE 400 in accordance with aspects of the present disclosure. The NE 400 may include a processor 402, a memory 404, a controller 406, and a transceiver 408. The processor 402, the memory 404, the controller 406, or the transceiver 408, or various combinations thereof or various components thereof may be examples of means for performing various aspects of the present disclosure as described herein. These components may be coupled (e.g. operatively, communicatively, functionally, electronically, electrically) via one or more interfaces.

[0112] The processor 402, the memory 404, the controller 406, or the transceiver 408, or various combinations or components thereof may be implemented in hardware (e.g. circuitry). The hardware may include a processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), or other programmable logic device, or any combination

thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure.

[0113] The processor 402 may include an intelligent hardware device (e.g. a general-purpose processor, a DSP, a CPU, an ASIC, an FPGA, or any combination thereof). In some implementations, the processor 402 may be configured to operate the memory 404. In some other implementations, the memory 404 may be integrated into the processor 402. The processor 402 may be configured to execute computer-readable instructions stored in the memory 404 to cause the NE 400 to perform various functions of the present disclosure.

[0114] The memory 404 may include volatile or non-volatile memory. The memory 404 may store computer-readable, computer-executable code including instructions when executed by the processor 402 cause the NE 400 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such the memory 404 or another type of memory. Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer.

[0115] In some implementations, the processor 402 and the memory 404 coupled with the processor 402 may be configured to cause the NE 400 to perform one or more of the functions described herein (e.g. executing, by the processor 402, instructions stored in the memory 404). For example, the processor 402 may support wireless communication at the NE 400 in accordance with examples as disclosed herein. For example, the NE 400 may be configured to support means for performing the operations as described with respect to Figures 7-10 as described below.

[0116] In some implementations, the NE 400 may be a BS and configured to support: a means for receiving, a measurement report from a user equipment (UE); and a means for transmitting a radio resource control (RRC) reconfiguration message to the UE, wherein the RRC reconfiguration message includes at least one of the following: lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells

associated with a master cell group (MCG); or conditional handover (CHO) configuration information related to one or more CHO candidate cells.

[0117] In some implementations, the NE 400 may be a CU of a BS and configured to support: a means for receiving, from a candidate distributed unit (DU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the candidate DU, wherein the message includes identifier (ID) information of the candidate cell; and a means for transmitting first information to the source DU after receiving the message.

[0118] In some implementations, the NE 400 may be a second DU of a BS and configured to support: a means for receiving information from a centralized unit (CU) of the BS, wherein the information includes at least one of the following: information indicating that a user equipment (UE) has switched from a source cell to a candidate cell; or a request for lower layer-triggered mobility (LTM) cell switching related information; and a means for transmitting the LTM cell switching related information to the CU.

[0119] In some implementations, the NE 400 may be a target DU of a BS and configured to support: a means for transmitting, to a centralized unit (CU) of the BS, a message associated with lower layer-triggered mobility (LTM) cell switching of a user equipment (UE) from a source cell of a source DU of the BS towards a candidate cell of the target DU, wherein the message includes identifier (ID) information of the candidate cell; and a means for receiving LTM cell switching related information from the CU, wherein the LTM cell switching related information includes at least one of the following: random access channel (RACH) resource information for an early timing advance (TA) acquisition associated with one or more candidate cells configured for LTM cell switching; one or more early TA values associated with the one or more candidate cells; activated transmission configuration indication (TCI) state information associated with the one or more candidate cells; or sidelink control information (SCI) resource configuration information for LTM.

[0120] The controller 406 may manage input and output signals for the NE 400. The controller 406 may also manage peripherals not integrated into the NE 400. In some implementations, the controller 406 may utilize an operating system such as iOS®,

ANDROID®, WINDOWS®, or other operating systems. In some implementations, the controller 406 may be implemented as part of the processor 402.

[0121] In some implementations, the NE 400 may include at least one transceiver 408. In some other implementations, the NE 400 may have more than one transceiver 408. The transceiver 408 may represent a wireless transceiver. The transceiver 408 may include one or more receiver chains 410, one or more transmitter chains 412, or a combination thereof. The means for receiving or the means for transmitting abovementioned in the processor 402 may be implemented via at least one transceiver 408.

[0122] A receiver chain 410 may be configured to receive signals (e.g. control information, data, packets) over a wireless medium. For example, the receiver chain 410 may include one or more antennas for receive the signal over the air or wireless medium. The receiver chain 410 may include at least one amplifier (e.g. a low-noise amplifier (LNA)) configured to amplify the received signal. The receiver chain 410 may include at least one demodulator configured to demodulate the receive signal and obtain the transmitted data by reversing the modulation technique applied during transmission of the signal. The receiver chain 410 may include at least one decoder for decoding the processing the demodulated signal to receive the transmitted data.

[0123] A transmitter chain 412 may be configured to generate and transmit signals (e.g. control information, data, packets). The transmitter chain 412 may include at least one modulator for modulating data onto a carrier signal, preparing the signal for transmission over a wireless medium. The at least one modulator may be configured to support one or more techniques such as amplitude modulation (AM), frequency modulation (FM), or digital modulation schemes like phase-shift keying (PSK) or quadrature amplitude modulation (QAM). The transmitter chain 412 may also include at least one power amplifier configured to amplify the modulated signal to an appropriate power level suitable for transmission over the wireless medium. The transmitter chain 412 may also include one or more antennas for transmitting the amplified signal into the air or wireless medium.

[0124] It should be appreciated by persons skilled in the art that the components in exemplary NE 400 may be changed, for example, some of the components in exemplary NE 400 may be omitted or modified or new component(s) may be added to exemplary NE 400,

without departing from the spirit and scope of the disclosure. For example, in some embodiments, the NE 400 may not include the controller 406.

[0125] Figure 5A illustrates a schematic diagram of an intra-CU intra-DU mobility scenario in accordance with aspects of the present disclosure. The wireless communication system in Figure 5A includes a DU, a UE (e.g. UE 101A), and some access nodes (e.g. access node 102A and access node 103A). The access node 102A and access node 103A are controlled by the DU, and provides services for UEs within cell #M and cell #N respectively. Even though there are only one UE and two access nodes in Figure 5A, persons skilled in the art will recognize that any number of UEs and access nodes may be included in the wireless communication system.

[0126] In Figure 5A, UE 101A is moving from cell #M to cell #N, and may perform a handover procedure from cell #M to access to cell #N, which is a handover procedure performed between different cells within a DU. This scenario may be referred to as intra-CU intra-DU mobility. In short, this scenario may be called as intra-DU mobility.

[0127] Figure 5B illustrates a schematic diagram of an intra-CU inter-DU mobility scenario in accordance with aspects of the present disclosure. The wireless communication system in Figure 5B includes a CU, a UE (e.g. UE 101B), and some DUs (e.g. DU #1 and DU #2). DU #1 and DU #2 are controlled by the CU, and provides services for UEs within cell #A and cell #B respectively. Even though there are only one UE and two DUs in Figure 5B, persons skilled in the art will recognize that any number of UEs and DUs may be included in the wireless communication system.

[0128] In Figure 5B, UE 101B is moving from cell #A to cell #B, and may perform a handover procedure from cell #A to access to cell #B, which is a handover procedure performed between different cells belonging to different DUs but within the same CU. This scenario may be referred to as intra-CU inter-DU mobility. In short, this scenario may be called as inter-DU mobility.

[0129] Figure 5C illustrates a schematic diagram of an inter-CU mobility scenario in accordance with aspects of the present disclosure. The wireless communication system in Figure 5C includes some CUs (e.g. CU #1 and CU #2), a UE (e.g. UE 101C), and some DUs (e.g. DU #A and DU #B). DU #A is controlled by CU #1 and provides services for UEs

within cell #X. DU #B is controlled by CU #2 and provides services for UEs within cell #Y. Even though there are only one UE, two DUs, and two CUs in Figure 5C, persons skilled in the art will recognize that any number of UEs, DUs, and CUs may be included in the wireless communication system.

[0130] In Figure 5C, UE 101C is moving from cell #X to cell #Y, and may perform a handover procedure from cell #X to access to cell #Y, which is a handover procedure performed between different cells belonging to different DUs within different CUs. This scenario may be referred to as inter-CU mobility.

[0131] Figure 6 illustrates a flowchart of a method related to an LTM cell switch procedure in accordance with aspects of the present disclosure. The operations of the method may be implemented by a UE as described herein. In some implementations, the UE may execute a set of instructions to control the function elements of the UE to perform the described functions. In some implementations, aspects of operations 602, 604 and 606 may be performed by UE 400 as described with reference to Figure 2. Each of operations 602, 604 and 606 may be performed in accordance with examples as described herein. Specific examples are described in the embodiments of Figures 11-13 as follows.

[0132] At operation 602, the method may include receiving, by a UE from a source cell, LTM configuration information related to one or more LTM candidate cells associated with an MCG.

[0133] At operation 604, the method may include initiating an RRC reestablishment procedure by the UE based on a failure event and performing a cell selection procedure by the UE. In some implementations, the failure event is one of:

- (1) An RLF;
- (2) An LTM cell switch failure;
- (3) A handover failure;
- (4) A re-configuration with sync failure of the MCG.
 - a) In an example, if an LTM cell switching failure occurs, i.e. LTM timer expires, a UE may receive an LTM cell switching command to a candidate cell. The UE may

perform LTM cell switching and starts a timer (e.g., T304). Once the timer expires, the UE may initiate an RRC reestablishment procedure.

- b) In another example, a failure of handover is triggered by the reception of a handover command or a meeting execution condition for CHO. In this example, a UE may receive a handover command associated with a candidate cell, or the execution condition for CHO may be met. The UE may perform a handover and start a timer (e.g., T304). Once the timer expires, the UE may initiate an RRC reestablishment procedure.

(5) A mobility from new radio (NR) failure.

- a) For instance, a mobility from NR command message (e.g., MobilityFromNRCommand message) may be used to command a handover from NR to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD. The network may initiate the mobility from a NR procedure to a UE in RRC_CONNECTED, possibly in response to a measurement report or an MCG failure information message, by sending the mobility from NR command message.

[0134] At operation 606, the method may include determining whether a cell (denoted as "cell #1") selected by the cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

[0135] In some implementations, if cell #1 is the LTM candidate cell, the UE may perform LTM cell switching towards cell #1.

[0136] In some embodiments, to perform the LTM cell switching, the UE may determine whether a UE measured TA ID for the source cell is equal to a UE measured TA ID for cell #1. If the UE measured TA ID for the source cell is equal to the UE measured TA ID for cell #1, the UE may perform RACH-less LTM cell switching towards cell #1.

[0137] In an embodiment, the UE may perform UE-based TA measurements for the one or more LTM candidate cells in response to starting the cell selection procedure. In some other embodiments, the UE may perform the UE-based TA measurements for cell #1 after selecting cell #1.

[0138] In an example, if a value of a UE Measured TA ID for a candidate cell of the UE (e.g., *ltm-UE-MeasuredTA-ID* contained within the LTM-Candidate IE in *VarLTM-Config*) indicated by lower layers or for the selected cell is equal to a value of a UE Measured TA ID for the serving cell of the UE (e.g., *ltm-ServingCellUE-MeasuredTA-ID* within *VarLTM-ServingCellUE-MeasuredTA-ID*), an RRC layer of the UE may inform lower layers that the UE should perform UE-based TA measurements if an LTM is triggered by an LTM cell switch command.

[0139] In another example, if a no reset ID (i.e., a *NoReset ID*) for the serving cell of the UE (e.g., *ltm-ServingCellNoResetID*) is different from a no reset ID for the candidate cell (e.g., *ltm-NoResetID* related to the candidate cell), the UE may replace the no reset ID for the serving cell with the no reset ID for the candidate cell. If the no reset ID for the serving cell (e.g., *ltm-ServingCellNoResetID*) is equal to the no reset ID for the candidate cell (e.g., *ltm-NoResetID* related to the candidate cell), the UE may continue keeping the current value.

[0140] In some other embodiments, to perform the LTM cell switching, the UE may determine whether a configured grant (CG) resource is configured to the UE for cell #1 and determine whether a UE measured TA ID for the source cell is equal to a UE measured TA ID for cell #1. If the CG resource is configured to the UE and if the UE measured TA ID for the source cell is equal to the UE measured TA ID for cell #1, the UE may perform RACH-less LTM cell switching towards cell #1.

[0141] In an embodiment, if one or more CG resources are configured to the UE, and if a transmission configuration indication (TCI) state associated with at least one CG resource is activated, the UE may select one CG resource based on the activated TCI state. In some other embodiments, if one or more CG resources are configured to the UE, and if all TCI states of the one or more CG resources are not activated, the UE may determine one beam for cell #1 based on measurements of the UE.

[0142] For instance, a CG resource may be associated with beam information, e.g., a synchronization signal block (SSB) index. For example, CG resource #1 is associated with SSB #1; CG resource #2 is associated with SSB #2. If SSB #2 is activated by a candidate cell TCI states activation or deactivation MAC CE, CG resource #2 will be selected for RACH-less based LTM. If all SSB(s) is not activated, e.g., by an MAC CE, the UE itself may

determine one beam, e.g., an SSB index, based on measurement(s) (e.g., based on channel quality). If SSB #2 is a better beam, the related CG resource will be selected by the UE for the LTM cell switching. For example, the UE may transmit an RRC reconfiguration complete message on the selected related CG resource.

[0143] In some implementations, the UE may transmit an RRC reconfiguration complete message to cell #1, and the RRC reconfiguration complete message includes ID information of cell #1.

[0144] In some implementations, if cell #1 is the LTM candidate cell and both the MCG and an SCG are configured to the UE, the UE may perform one of the following in different embodiments:

- (1) transmitting an RRC reestablishment request message to cell #1;
- (2) suspending SCG configuration information and performing LTM cell switching towards cell #1; or
- (3) releasing the SCG configuration information and performing the LTM cell switching towards cell #1.

[0145] In some implementations, the UE may determine whether cell #1 is a CHO candidate cell. If cell #1 is the CHO candidate cell, the UE may perform CHO towards cell #1. In some embodiments, in response to performing the CHO towards cell #1, the UE may keep the LTM configuration information related to the one or more LTM candidate cells. In some other embodiments, the UE may release the LTM configuration information related to the one or more LTM candidate cells.

[0146] In some implementations, if the cell selection procedure in operation 604 is performed while a timer for cell selection (e.g. timer T311) is running and if cell #1 is the LTM candidate cell, the UE may perform LTM cell switching towards cell #1. If the LTM cell switching towards cell #1 fails, the UE may perform another cell selection procedure. In an implementation, if a cell (denoted as "cell #2") selected by this another cell selection procedure is a CHO candidate cell, the UE may perform CHO towards cell #2. If the CHO towards cell #2 fails, the UE may perform an RRC reestablishment procedure.

[0147] In some other implementations, if the cell selection procedure in operation 604 is performed while a timer for cell selection is running and if cell #1 is a CHO candidate cell, the UE may perform CHO towards cell #1. If the CHO towards cell #1 fails, the UE may perform another cell selection procedure. In an implementation, if a cell (denoted as "cell #3") selected by this another cell selection procedure is an LTM candidate cell, the UE may perform LTM cell switching towards cell #3. If the LTM cell switching towards cell #3 fails, perform an RRC reestablishment procedure.

[0148] It should be noted that the method described in Figure 6 describes possible implementations, and that the operations and the steps may be rearranged or otherwise eliminated or modified and that other implementations are possible, without departing from the spirit and scope of the disclosure.

[0149] Figure 7 illustrates a flowchart of a method related to an LTM cell switch procedure in accordance with aspects of the present disclosure. The operations of the method may be implemented by a network node as described herein. In some implementations, the network node may be a BS (e.g. a source BS or a serving BS), and may execute a set of instructions to control the function elements of the BS to perform the described functions. In some implementations, aspects of operations 702 and 704 may be performed by NE 400 as described with reference to Figure 4. Each of operations 702 and 704 may be performed in accordance with examples as described herein. Specific examples are described in the embodiments of Figures 11, 13 and 14 as follows.

[0150] At operation 702, the method may include receiving a measurement report by a BS from a UE. At operation 704, the method may include transmitting an RRC reconfiguration message by the BS to the UE. The RRC reconfiguration message may include at least one of the following:

- (1) LTM configuration information related to one or more LTM candidate cells associated with an MCG; or
- (2) CHO configuration information related to one or more CHO candidate cells.

[0151] In some implementations, the BS may receive an RRC reconfiguration complete message from the UE. For example, the RRC reconfiguration complete message includes ID

information of a cell (e.g., cell #1 as described in the embodiments of Figure 6) selected by the UE via a cell selection procedure. The selected cell may be an LTM cell or a CHO cell.

[0152] It should be noted that the method described in Figure 7 describes possible implementations, and that the operations and the steps may be rearranged or otherwise eliminated or modified and that other implementations are possible, without departing from the spirit and scope of the disclosure.

[0153] Figure 8 illustrates a flowchart of a method related to an LTM cell switch procedure in accordance with aspects of the present disclosure. The operations of the method may be implemented by a network node as described herein. In some implementations, the network node may be a CU of a BS (e.g., a CU in an intra-CU mobility scenario), and may execute a set of instructions to control the function elements of the CU to perform the described functions. In some implementations, aspects of operations 802 and 804 may be performed by NE 400 as described with reference to Figure 4. Each of operations 802 and 804 may be performed in accordance with examples as described herein. Specific examples are described in the embodiments of Figure 14 as follows.

[0154] At operation 802, the method may include receiving, by a CU of a BS from a candidate DU of the BS, a message associated with LTM cell switching of a UE from a source cell of a source DU of the BS towards a candidate cell of the candidate DU. In some implementations, the candidate cell is a candidate PCell. The message may include ID information of the candidate cell. The message may be named as a notification message or the like. For instance, the message is an access success message.

[0155] At operation 804, the method may include transmitting information (denoted as "information #1") by the CU to the source DU after receiving the message in operation 802. In some embodiments, information #1 is included in a UE context release command message. In some other embodiments, information #1 is included in a UE context modification request message.

[0156] In some implementations, information #1 includes at least one of the following:

- (1) information indicating that the UE has switched from the source cell to the candidate cell;
- or

(2) a request (denoted as "request #1") for "LTM cell switching related information". "LTM cell switching related information" may also be named as "LTM related information" or the like. For example, the LTM cell switching related information includes at least one of the following:

- a) RACH resource information for an early TA acquisition associated with one or more candidate cells configured for the LTM cell switching;
- b) one or more early TA values associated with the one or more candidate cells;
- c) activated TCI state information associated with the one or more candidate cells; or
- d) SCI resource configuration information for LTM, e.g., SCI resource configuration information associated with one or more candidate cells.

[0157] In some implementations, request #1 includes at least one of the following:

- (1) a request for RACH resource information for an early TA acquisition associated with one or more candidate cells configured for the LTM cell switching;
 - (2) a request for at least one early TA value associated with the one or more candidate cells;
 - (3) a request for activated TCI state information associated with one or more candidate cells;
- or
- (4) a request for SCI resource configuration information for LTM, e.g., a request for SCI resource configuration information associated with one or more candidate cells.

[0158] In some implementations, the CU may receive the LTM cell switching related information from the source DU, and then transmit the LTM cell switching related information to the candidate DU, for example, as described in the embodiments of Figure 14.

[0159] It should be noted that the method described in Figure 8 describes possible implementations, and that the operations and the steps may be rearranged or otherwise eliminated or modified and that other implementations are possible, without departing from the spirit and scope of the disclosure.

[0160] Figure 9 illustrates a flowchart of a method related to an LTM cell switch procedure in accordance with aspects of the present disclosure. The operations of the method

may be implemented by a network node as described herein. In some implementations, the network node may be a source DU of a BS (e.g., in an intra-CU mobility scenario), and may execute a set of instructions to control the function elements of the source DU to perform the described functions. In some implementations, aspects of operations 902 and 904 may be performed by NE 400 as described with reference to Figure 4. Each of operations 902 and 904 may be performed in accordance with examples as described herein. Specific examples are described in the embodiments of Figure 14 as follows.

[0161] At operation 902, the method may include receiving information by a source DU of a BS from a CU of the BS. The information may include at least one of the following: (1) information indicating that a UE has switched from a source cell to a candidate cell; or (2) a request (e.g., request #1 as described in the embodiments of Figure 8) for LTM cell switching related information.

[0162] At operation 904, the method may include transmitting the LTM cell switching related information to the CU. For example, the LTM cell switching related information includes at least one of the following:

- (1) RACH resource information for an early TA acquisition associated with one or more candidate cells (e.g., candidate PCell(s)) configured for LTM cell switching;
- (2) one or more early TA values associated with the one or more candidate cells;
- (3) activated TCI state information associated with the one or more candidate cells; or
- (4) SCI resource configuration information (e.g., associated with the one or more candidate cells) for LTM.

[0163] In some implementations, the request in operation 902 includes at least one of the following:

- (1) a request for RACH resource information for an early TA acquisition associated with one or more candidate cells configured for the LTM cell switching;
- (2) a request for at least one early TA value associated with the one or more candidate cells (e.g., one or more early TA values stored in the source DU);

- (3) a request for activated TCI state information associated with one or more candidate cells;
or
- (4) a request for SCI resource configuration information (e.g., associated with the one or more candidate cells) for LTM.

[0164] It should be noted that the method described in Figure 9 describes possible implementations, and that the operations and the steps may be rearranged or otherwise eliminated or modified and that other implementations are possible, without departing from the spirit and scope of the disclosure.

[0165] Figure 10 illustrates a flowchart of a method related to an LTM cell switch procedure in accordance with aspects of the present disclosure. The operations of the method may be implemented by a network node as described herein. In some implementations, the network node may be a target DU of a BS (e.g., in an intra-CU mobility scenario), and may execute a set of instructions to control the function elements of the target DU to perform the described functions. In some implementations, aspects of operations 1002 and 1004 may be performed by NE 400 as described with reference to Figure 4. Each of operations 1002 and 1004 may be performed in accordance with examples as described herein. Specific examples are described in the embodiments of Figure 14 as follows.

[0166] At operation 1002, the method may include transmitting, by a target DU of a BS to a CU of the BS, a message associated with LTM cell switching of a UE from a source cell of a source DU of the BS towards a candidate cell of the target DU. In some implementations, the candidate cell is a candidate PCell. The message may include ID information of the candidate cell. The message may be named as a notification message or the like. For example, the message is an access success message.

[0167] At operation 1004, the method may include receiving LTM cell switching related information from the CU. For example, the LTM cell switching related information includes at least one of the following:

- (1) RACH resource information for an early TA acquisition associated with one or more candidate cells configured for LTM cell switching;
- (2) one or more early TA values associated with the one or more candidate cells;

- (3) activated TCI state information associated with the one or more candidate cells; or
- (4) SCI resource configuration information for LTM.

[0168] It should be noted that the method described in Figure 10 describes possible implementations, and that the operations and the steps may be rearranged or otherwise eliminated or modified and that other implementations are possible, without departing from the spirit and scope of the disclosure.

[0169] Figure 11 illustrates a schematic diagram of an MCG LTM based recovery mechanism in accordance with aspects of the present disclosure. Details described in all other embodiments of the present disclosure are applicable for the embodiments shown in Figure 11.

[0170] As shown in Figure 11, BS 1105 is in CU-DU architecture, and includes source DU 1102, candidate DU 1103 and CU 1104. In the embodiments of Figure 11, a cell switching operation performed by UE 1101 may refer to an Intra-CU mobility scenario in which a source cell and a target cell are in the same CU. For instance, source DU 1102 and candidate DU 1103 are managed by the same CU 1104. The cell switching operation performed by UE 1101 may also refer to an Inter-CU mobility scenario in which a source cell and a target cell are located at different CUs (e.g. CU 1104 and another CU not shown in Figure 11). For instance, source DU 1102 and candidate DU 1103 are managed by different CUs.

[0171] In the exemplary flowchart 1100 as shown in Figure 11 in operation 111, UE 1101 may access the serving BS (e.g. BS 1105) via an MCG. UE 1101 may send a measurement report to the serving BS. The serving BS may include a CU (e.g. gNB-CU) and one or more DUs (e.g. gNB-DUs). A serving cell is associated with a CU and a DU. There is an F1 interface between the DU and the CU. For example, in some embodiments of Figure 11 related to an MCG LTM procedure, BS 1105 is an MCG BS (e.g. MCG gNB) and includes CU 1104, source DU 1102, and candidate DU 1103. BS 1105 may include one or more other candidate DUs (not shown in Figure 11). In some implementations, UE 1101 may send the measurement report to CU 1104 via source DU 1102.

[0172] In operation 112, source CU 1104 of serving BS 1105 (MCG or SCG) may determine to initiate a L1/L2 based inter-cell mobility configuration procedure, i.e., making a L1/L2 based inter-cell mobility configuration decision.

[0173] In operation 113, in an Intra-CU LTM case (i.e., Intra-CU mobility scenario), source CU 1104 may send a request message, e.g. UE CONTEXT SETUP REQUEST, which includes the ID information of candidate cell(s), to the candidate (target) DU (e.g. candidate DU 1103) of the same BS, e.g., via an F1 interface. The request for a RACH resource for an early TA acquisition may also be included in the request message transmitted to the candidate (target) DU. A candidate cell may also be named as a candidate (target) cell.

[0174] Alternatively, in an Inter-CU LTM case (i.e., Inter-CU mobility scenario), the source CU (e.g. source CU 1104 of BS 1105) may send a request message e.g. a Handover (HO) request, which includes the ID information of candidate cell(s), to a candidate (target) CU (not shown in Figure 11). The request for a RACH resource for an early TA acquisition may also be included in the request message transmitted to the candidate (target) CU. Then, the candidate (target) CU may send a request message, e.g. UE CONTEXT SETUP REQUEST, including the ID information of candidate cell(s), to a candidate (target) DU. The request for a RACH resource for an early TA acquisition may also be included in the request message transmitted to the candidate (target) DU.

[0175] In operation 114, if the candidate (target) DU (e.g. candidate DU 1103) decides to accept the request of LTM configuration related to a candidate cell, it responds to the CU (e.g. source CU 1104) including the RRC configuration for the accepted candidate (target) cell. For instance, the response message could be a HANDOVER REQUEST ACKNOWLEDGE message for an Inter-CU LTM case or a UE CONTEXT SETUP RESPONSE message for an Intra-CU LTM case. A RACH resource for early TA acquisition may be included in the response message transmitted to the serving CU (e.g. source CU 1104).

[0176] In operation 115, CU 1104 transmits LTM candidate cell configuration(s) for one or more candidate cells to UE 1101 via source DU 1102. "LTM candidate cell configuration(s)" may also be named as "candidate cell configuration(s) for LTM" or the like. For example, CU 1104 may transmit LTM candidate cell configuration(s) that BS 1105 previously prepared and provided to UE 1101 through RRC signaling.

[0177] In operation 115, CU 1104 may also transmit RACH resource(s) for early TA acquisition to source DU 1102.

[0178] In some implementations, CU 1104 may generate an RRC reconfiguration message based on the configuration(s) from the candidate cell(s) and transmit the RRC reconfiguration message to UE 1101 via source DU 1102. For instance, the RRC reconfiguration message includes LTM candidate cell configuration(s) and/or RACH resource(s) for early TA acquisition.

[0179] In operation 116, UE 1101 may receive, from source DU 1102, the RRC reconfiguration message including LTM candidate cell configuration(s) for one or more candidate cells.

[0180] In operation 117 (Optional), source DU 1102 transmits a TCI state activation MAC CE to UE 1101. In some implementations, source DU 1102 may activate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Activation MAC CE. In some other implementations, source DU 1102 may deactivate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Deactivation MAC CE.

[0181] In operation 118, in response to detecting a radio link failure (RLF) of the MCG, an LTM cell switch failure, a handover failure, a re-configuration with sync failure of the MCG, or a mobility from NR failure, UE 1101 may initiate an RRC reestablishment procedure and perform a cell selection procedure.

[0182] In an example, a re-configuration with sync failure of the MCG is a LTM cell switching failure, i.e., LTM timer expires. After UE 1101 receive an LTM cell switching command to a candidate cell, UE 1101 performs LTM cell switching and starts a timer (e.g., T304). Once the timer expires, UE 1101 initiates an RRC reestablishment procedure.

[0183] In another example, a re-configuration with sync failure of the MCG is a failure of handover triggered by the reception of a handover command or meeting an execution condition for CHO. If UE 1101 receives a handover command associated with a candidate cell or the execution condition for CHO is met, UE 1101 performs a handover and starts a timer (e.g., T304). Once the timer expires, UE 1101 initiates an RRC reestablishment procedure.

[0184] Regarding a mobility from NR failure, a MobilityFromNRCommand message may be used to command a handover from a NR procedure to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD. The network may initiate the mobility from the NR procedure to a UE (e.g. UE 1101) in an RRC connected state, possibly in response to a measurement report or an MCG failure information message, by sending a MobilityFromNRCommand message.

[0185] In operation 119, if UE 1101 selects a suitable cell, UE 1101 stops the timer (e.g., T311). If the selected cell (e.g., cell #1 as described in the embodiments of Figure 6) is an LTM candidate cell and an LTM based recovery is allowed, UE 1101 may perform LTM cell switching towards the selected cell. For example, if an indication of attempt LTM cell switching is configured to UE 1101, an LTM based recovery is allowed.

[0186] In operation 120, there may be following three options in different embodiments, i.e., Option #1, Option #2 or Option #3 as below.

[0187] Option #1: UE 1101 performs a RACH based LTM cell switching. Namely, UE 1101 does not perform RACH less LTM during recovery procedure. UE 1101 continues keeping the LTM candidate cell configuration(s) after the LTM cell switching is successfully completed. UE 1101 needs to update a UE Measured TA ID for the serving cell and a no reset ID for the serving cell.

[0188] In some embodiments, in Option #1, a UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) can be set to the value of a UE measured TA ID for the candidate cell (e.g., cell #1) (e.g., ltm-UE-MeasuredTA-ID contained within the LTM-Candidate IE). Specifically, if the UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) is different from the UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID related to the candidate cell), UE 1101 may replace the UE measured TA ID for the serving cell with the UE measured TA ID for the candidate cell. If UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) is equal to the UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID related to the candidate cell), UE 1101 may continue keeping the current value.

[0189] In some embodiments, in Option #1, a No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) can be set to the value of no reset ID for the candidate cell (e.g., ltm-NoResetID contained within the LTM-Candidate IE). Specifically, if the No reset ID for the

serving cell (e.g., ltm-ServingCellNoResetID) is different from the No reset ID for the candidate cell (e.g., ltm-NoResetID related to the candidate cell), UE 1101 may replace the No reset ID for the serving cell with the No reset ID for the candidate cell. If the No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) is equal to the No reset ID for the candidate cell (e.g., ltm-NoResetID related to the candidate cell), UE 1101 may continue keeping the current value.

[0190] Option #2: UE 1101 performs a RACH-less LTM cell switching if a UE measured TA ID for the serving cell and a UE measured TA ID for the selected cell are the same. There may be following two options in different embodiments, i.e., Option #A or Option #B as below.

- Option #A: When one candidate cell configured with LTM configuration(s) is selected by UE 1101 via a cell selection, UE 1101 may perform a TA measurement for the selected candidate cell.

- Option #B: When UE 1101 starts a cell selection for recovery, UE 1101 may perform TA measurements for all the one or more candidate cells.

[0191] For example, in Option #2, if a No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) is equal to a No reset ID for the candidate cell, UE 1101 may perform LTM cell switching with no L2 reset. No L2 reset means that UE 1101 does not perform a RLC reestablishment or PDCP recovery during the LTM cell switching.

[0192] In some embodiments, in Option #2, a UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) can be set to the value of a UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID contained within the LTM-Candidate IE). Specifically, if the UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) is different from the UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID related to the candidate cell), UE 1101 may replace the UE measured TA ID for the serving cell with the UE measured TA ID for the candidate cell. If the UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) is equal to the UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID related to the candidate cell), UE 1101 may continue keeping the current value.

[0193] In some embodiments, in Option #2, a No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) can be set to the value of a No reset ID for the candidate cell e.g., ltm-NoResetID contained within the LTM-Candidate IE. Specifically, if the No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) is different from the No reset ID for the candidate cell (e.g., ltm-NoResetID related to the candidate cell), UE 1101 may replace the No reset ID for the serving cell with the No reset ID for the candidate cell. If the No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) is equal to the No reset ID for the candidate cell (e.g., ltm-NoResetID related to the candidate cell), UE 1101 may continue keeping the current value.

[0194] Option #3: If CG resource(s) is configured to UE 1101 for LTM cell switching and a UE measured TA ID for the candidate cell is equal to a UE measured TA ID for the serving cell, UE 1101 is allowed to perform a RACH-less LTM cell switching during a recovery procedure.

[0195] For example, in Option #3, UE 1101 may perform LTM cell switching with no L2 reset, if the No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) is equal to a No reset ID for the candidate cell. No L2 reset means that UE 1101 does not perform RLC re-establishment or PDCP recovery during LTM cell switching.

[0196] In some embodiments, in Option #3, a UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) can be set to the value of a UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID) contained within the LTM-Candidate IE. Specifically, if the UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) is different from the UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID related to the candidate cell), UE 1101 may replace the UE measured TA ID for the serving cell with the UE measured TA ID for the candidate cell. If the UE measured TA ID for the serving cell (e.g., ltm-ServingCellUE-MeasuredTA-ID) is equal to the UE measured TA ID for the candidate cell (e.g., ltm-UE-MeasuredTA-ID related to the candidate cell), UE1101 may continue keeping the current value.

[0197] In some embodiments, in Option #3, a No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) can be set to the value of a No reset ID for the candidate cell (e.g., ltm-NoResetID contained within the LTM-Candidate IE). Specifically, if the No reset ID for

the serving cell (e.g., ltm-ServingCellNoResetID) is different from the No reset ID for the candidate cell (e.g., ltm-NoResetID related to the candidate cell), UE 1101 may replace the No reset ID for the serving cell with the No reset ID for the candidate cell. If the No reset ID for the serving cell (e.g., ltm-ServingCellNoResetID) is equal to the No reset ID for the candidate cell (e.g., ltm-NoResetID related to the candidate cell), UE 1101 may continue keeping the current value.

[0198] In some embodiments, in Option #3, if one or more CG resources associated with beam information (e.g., SSB index) are configured to UE, and some TCI state(s) has been activated, UE 1101 can select the CG based on the activated TCI state. For example, CG #1 is associated with SSB #1; CG #2 is associated with SSB #2; if SSB #2 is activated by Candidate Cell TCI States Activation MAC CE in operation 117, CG #2 will be selected by UE 1101 for RACH-less based LTM. If all SSB(s) is not activated by a MAC CE, UE 1101 itself can determine one beam (e.g., SSB index) based on UE 1101's measurement (e.g., of channel quality). If SSB #2 is a better beam, the related CG will be selected by UE 1101 for LTM cell switching.

[0199] After any of Option #1, Option #2 and Option #3, in operation 120, UE 1101 may transmit an RRC reconfiguration complete message to the selected cell (i.e., a target cell). The selected cell ID is included in the RRC reconfiguration complete message.

[0200] Figure 12 illustrates another schematic diagram of an MCG LTM based recovery mechanism in accordance with aspects of the present disclosure. Details described in all other embodiments of the present disclosure are applicable for the embodiments shown in Figure 12.

[0201] As shown in Figure 12, BS 1205 is in CU-DU architecture, and includes a CU (e.g. gNB-CU) and one or more DUs (e.g. gNB-DUs). There is an F1 interface between the DU and the CU. As shown in Figure 12, BS 1205 includes source DU 1202, candidate DU 1203 and CU 1204. In the embodiments of Figure 12, a cell switching operation performed by UE 1201 may refer to an Intra-CU mobility scenario in which a source cell and a target cell are in the same CU. For instance, source DU 1202 and candidate DU 1203 are managed by the same CU 1204. Some embodiments of Figure 12 related to an MCG LTM based recovery procedure.

[0202] In the exemplary flowchart 1200 as shown in Figure 12 in operation 121, UE 1201 may access the serving BS (e.g. BS 1205) via an MCG. UE 1201 may send a measurement report to the serving BS. SCG may also be configured to UE 1201. In some implementations, UE 1201 may send the measurement report to CU 1204 via source DU 1202.

[0203] In operation 122, source CU 1204 of serving BS 1205 (MCG or SCG) may determine to initiate a L1/L2 based inter-cell mobility configuration procedure, i.e., making a L1/L2 based inter-cell mobility configuration decision.

[0204] In operation 123, in an Intra-CU LTM case (i.e., Intra-CU mobility scenario), source CU 1204 may send a request message, e.g. UE CONTEXT SETUP REQUEST, which includes the ID information of candidate cell(s), to the candidate (target) DU (e.g. candidate DU 1203) of the same BS, e.g., via an F1 interface. The request for a RACH resource for an early TA acquisition may also be included in the request message transmitted to the candidate (target) DU. A candidate cell may also be named as a candidate (target) cell.

[0205] In operation 124, if the candidate (target) DU (e.g. candidate DU 1203) decides to accept the request of LTM configuration related to a candidate cell, it responds to the CU (e.g. source CU 1204) including the RRC configuration for the accepted candidate (target) cell. For instance, the response message could be a UE CONTEXT SETUP RESPONSE message for an Intra-CU LTM case. A RACH resource for early TA acquisition may be included in the response message transmitted to the serving CU (e.g. source CU 1204).

[0206] In operation 125, CU 1204 transmits LTM candidate cell configuration(s) for one or more candidate cells to UE 1201 via source DU 1202. "LTM candidate cell configuration(s)" may also be named as "candidate cell configuration(s) for LTM" or the like. For example, CU 1204 may transmit LTM candidate cell configuration(s) that BS 1205 previously prepared and provided to UE 1201 through RRC signaling.

[0207] In operation 125, CU 1204 may also transmit RACH resource(s) for early TA acquisition to source DU 1202.

[0208] In some implementations, CU 1204 may generate an RRC reconfiguration message based on the configuration(s) from the candidate cell(s) and transmit the RRC reconfiguration message to UE 1201 via source DU 1202. For instance, the RRC

reconfiguration message includes LTM candidate cell configuration(s) and/or RACH resource(s) for early TA acquisition.

[0209] In operation 126, UE 1201 may receive, from source DU 1202, the RRC reconfiguration message including LTM candidate cell configuration(s) for one or more candidate cells.

[0210] In operation 127 (Optional), source DU 1202 transmits a TCI state activation MAC CE to UE 1201. In some implementations, source DU 1202 may activate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Activation MAC CE. In some other implementations, source DU 1202 may deactivate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Deactivation MAC CE.

[0211] In operation 128, in response to detecting a radio link failure (RLF) of the MCG, an LTM cell switch failure, a handover failure, a re-configuration with sync failure of the MCG, or a mobility from NR failure, UE 1201 may initiate an RRC reestablishment procedure and perform a cell selection procedure.

[0212] In an example, a re-configuration with sync failure of the MCG is a LTM cell switching failure, i.e., LTM timer expires. After UE 1201 receive an LTM cell switching command to a candidate cell, UE 1201 performs LTM cell switching and starts a timer (e.g., T304). Once the timer expires, UE 1201 initiates an RRC reestablishment procedure.

[0213] In another example, a re-configuration with sync failure of the MCG is a failure of handover triggered by the reception of a handover command or meeting an execution condition for CHO. If UE 1201 receives a handover command associated with a candidate cell or the execution condition for CHO is met, UE 1201 performs a handover and starts a timer (e.g., T304). Once the timer expires, UE 1201 initiates an RRC reestablishment procedure.

[0214] Regarding a mobility from NR failure, a MobilityFromNRCommand message may be used to command a handover from a NR procedure to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD. The network may initiate the mobility from the NR procedure to a UE (e.g., UE 1201) in an RRC connected state, possibly in response to a measurement report or an MCG failure information message, by sending a MobilityFromNRCommand message.

[0215] In operation 129, if UE 1201 selects a suitable cell, UE 1201 stops the timer (e.g., T311).

[0216] In operation 130, there may be following two options in different embodiments, i.e., Option #X or Option #Y as below.

[0217] Option #X: If the selected cell (e.g., cell #1 as described in the embodiments of Figure 6) is an LTM candidate cell and an LTM based recovery is allowed, UE 1201 performs LTM cell switching towards the selected cell. For example, if an indication of attempt LTM cell switching is configured to UE 1101, an LTM based recovery is allowed.

[0218] In some embodiments of Option #X, if a DC is configured to UE 1201 (i.e., both a MCG and a SCG are configured to UE 1201), UE 1201 may suspend the SCG configuration information during the LTM cell switching for recovery.

[0219] In some other embodiments of Option #X, if a DC is configured to UE 1201, UE 1201 may autonomously release the SCG configuration information during the LTM cell switching for recovery.

[0220] Option #Y: If the selected cell (e.g., cell #1 as described in the embodiments of Figure 6) is an LTM candidate cell but a DC is configured to UE 1201, an LTM based recovery is not applied. Namely, UE 1201 may transmit an RRC reestablishment request message to the selected cell.

[0221] Figure 13 illustrates a schematic diagram of a CHO based recovery mechanism in accordance with aspects of the present disclosure. Details described in all other embodiments of the present disclosure are applicable for the embodiments shown in Figure 13.

[0222] As shown in Figure 13, BS 1305 is in CU-DU architecture, and includes a CU (e.g. gNB-CU) and one or more DUs (e.g. gNB-DUs). There is an F1 interface between the DU and the CU. As shown in Figure 13, BS 1305 includes source DU 1302, candidate DU 1303 and CU 1304. In the embodiments of Figure 13, a cell switching operation performed by UE 1301 may refer to an Intra-CU mobility scenario in which a source cell and a target cell are in the same CU. For instance, source DU 1302 and candidate DU 1303 are managed

by the same CU 1304. Some embodiments of Figure 13 related to a CHO based recovery procedure.

[0223] In the exemplary flowchart 1300 as shown in Figure 13 in operation 131, UE 1301 may access the serving BS (e.g. BS 1305) via an MCG. UE 1301 may send a measurement report to the serving BS. SCG may also be configured to UE 1301. In some implementations, UE 1301 may send the measurement report to CU 1304 via source DU 1302.

[0224] In operation 132, source CU 1304 of serving BS 1305 (MCG or SCG) may determine to initiate a L1/L2 based inter-cell mobility configuration procedure, i.e., making a L1/L2 based inter-cell mobility configuration decision.

[0225] In operation 133, in an Intra-CU LTM case (i.e., Intra-CU mobility scenario), source CU 1304 may send a request message, e.g. UE CONTEXT SETUP REQUEST, which includes the ID information of candidate cell(s), to the candidate (target) DU (e.g. candidate DU 1303) of the same BS, e.g., via an F1 interface. The request for a RACH resource for an early TA acquisition may also be included in the request message transmitted to the candidate (target) DU. A candidate cell may also be named as a candidate (target) cell.

[0226] In operation 134, if the candidate (target) DU (e.g. candidate DU 1303) decides to accept the request of LTM configuration related to a candidate cell, it responds to the CU (e.g. source CU 1304) including the RRC configuration for the accepted candidate (target) cell. For instance, the response message could be a UE CONTEXT SETUP RESPONSE message for an Intra-CU LTM case. A RACH resource for early TA acquisition may be included in the response message transmitted to the serving CU (e.g. source CU 1304).

[0227] In operation 135, CU 1304 transmits LTM candidate cell configuration(s) for one or more candidate cells to UE 1301 via source DU 1302. "LTM candidate cell configuration(s)" may also be named as "candidate cell configuration(s) for LTM" or the like. For example, CU 1304 may transmit LTM candidate cell configuration(s) that BS 1305 previously prepared and provided to UE 1301 through RRC signaling.

[0228] In operation 135, CU 1304 may also transmit RACH resource(s) for early TA acquisition to source DU 1302.

[0229] In some implementations, CU 1304 may generate an RRC reconfiguration message based on the configuration(s) from the candidate cell(s) and transmit the RRC reconfiguration message to UE 1301 via source DU 1302. For instance, the RRC reconfiguration message includes LTM candidate cell configuration(s) and/or RACH resource(s) for early TA acquisition.

[0230] In operation 136, UE 1301 may receive, from source DU 1302, the RRC reconfiguration message including LTM candidate cell configuration(s) for one or more candidate cells.

[0231] In operation 137 (Optional), source DU 1302 transmits a TCI state activation MAC CE to UE 1301. In some implementations, source DU 1302 may activate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Activation MAC CE. In some other implementations, source DU 1302 may deactivate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Deactivation MAC CE.

[0232] In operation 138, in response to detecting a radio link failure (RLF) of the MCG, an LTM cell switch failure, a handover failure, a re-configuration with sync failure of the MCG, or a mobility from NR failure, UE 1301 may initiate an RRC reestablishment procedure and perform a cell selection procedure.

[0233] In an example, a re-configuration with sync failure of the MCG is a LTM cell switching failure, i.e., LTM timer expires. After UE 1301 receive an LTM cell switching command to a candidate cell, UE 1301 performs LTM cell switching and starts a timer (e.g., T304). Once the timer expires, UE 1301 initiates an RRC reestablishment procedure.

[0234] In another example, a re-configuration with sync failure of the MCG is a failure of handover triggered by the reception of a handover command or meeting an execution condition for CHO. If UE 1301 receives a handover command associated with a candidate cell or the execution condition for CHO is met, UE 1301 performs a handover and starts a timer (e.g., T304). Once the timer expires, UE 1301 initiates an RRC reestablishment procedure.

[0235] Regarding a mobility from NR failure, a MobilityFromNRCommand message may be used to command a handover from a NR procedure to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD. The network may initiate the mobility from the NR procedure to a UE (e.g.

UE 1301) in an RRC connected state, possibly in response to a measurement report or an MCG failure information message, by sending a MobilityFromNRCommand message.

[0236] In operation 139, there may be following three options in different embodiments, i.e., Option #M, Option #N, or Option #K as below.

[0237] Option #M: If UE 1301 selects a suitable cell via a cell selection procedure, UE 1301 stops the timer (e.g., T311). If the selected cell (e.g., cell #1 as described in the embodiments of Figure 6) is a CHO candidate cell and a CHO based recovery is allowed, UE 1301 performs CHO towards the selected cell.

[0238] In some embodiments of Option #M, UE 1301 may continue keeping the LTM candidate cell configuration(s) after or when UE 1301 performs the CHO towards the selected cell.

[0239] In some other embodiments of Option #M, UE 1301 may release the LTM candidate cell configuration(s) after or when UE 1301 performs the CHO towards the selected cell.

[0240] In Option #M, if the selected candidate cell is an LTM candidate cell and a CHO candidate cell, in some embodiments, UE 1301 performs the LTM cell switching to the selected cell in priority, while in some other embodiments, UE 1301 performs CHO to the selected cell in priority.

[0241] Option #N: When a cell selection is performed by UE 1301 while a timer for cell selection (e.g. timer T311) is running, if the selected cell (e.g., cell #1) is associated with LTM, UE 1301 may perform LTM cell switching to the selected cell. If the LTM cell switching fails, UE 1301 may perform cell selection again (i.e., another cell selection procedure). If another cell (e.g., cell #2) selected by this another cell selection procedure is configured with a CHO, UE 1301 may perform CHO to this another cell. Then, if the CHO fails, UE 1301 may perform an RRC reestablishment procedure.

[0242] Option #K: When a cell selection is performed by UE 1301 while a timer for cell selection (e.g. timer T311) is running, if the selected cell (e.g., cell #1) is associated with CHO, UE 1301 may perform CHO to the selected cell. If the CHO fails, UE 1301 may perform cell selection again (i.e., another cell selection procedure). If another cell (e.g., cell

#2) selected by this another cell selection procedure is configured with LTM, UE 1301 may perform LTM cell switching to this another cell. Then, if the LTM cell switching fails, UE 1301 may perform an RRC reestablishment procedure.

[0243] Figure 14 illustrates a schematic diagram of an intra-CU LTM procedure in accordance with aspects of the present disclosure. Details described in all other embodiments of the present disclosure are applicable for the embodiments shown in Figure 14.

[0244] As shown in Figure 14, BS 1405 is in CU-DU architecture, and includes a CU (e.g. gNB-CU) and one or more DUs (e.g. gNB-DUs). There is an F1 interface between the DU and the CU. As shown in Figure 14, BS 1405 includes source DU 1402, candidate DU 1403 and CU 1404. In the embodiments of Figure 14, a cell switching operation performed by UE 1401 may refer to an Intra-CU mobility scenario in which a source cell and a target cell are in the same CU. For instance, source DU 1402 and candidate DU 1403 are managed by the same CU 1404. Some embodiments of Figure 14 related to a CHO based recovery procedure.

[0245] In the exemplary flowchart 1400 as shown in Figure 14 in operation 141, UE 1401 may access the serving BS (e.g. BS 1405) via an MCG. UE 1401 may send a measurement report to the serving BS. In some implementations, UE 1401 may send the measurement report to CU 1404 via source DU 1402.

[0246] In operation 142, source CU 1404 of serving BS 1405 (MCG or SCG) may determine to initiate a L1/L2 based inter-cell mobility configuration procedure, i.e., making a L1/L2 based inter-cell mobility configuration decision.

[0247] In operation 143, in an Intra-CU LTM case (i.e., Intra-CU mobility scenario), source CU 1404 may send a request message, e.g. UE CONTEXT SETUP REQUEST, which includes the ID information of candidate cell(s), to the candidate (target) DU (e.g. candidate DU 1403) of the same BS, e.g., via an F1 interface. The request for a RACH resource for an early TA acquisition may also be included in the request message transmitted to the candidate (target) DU. A candidate cell may also be named as a candidate (target) cell.

[0248] In operation 144, if the candidate (target) DU (e.g. candidate DU 1403) decides to accept the request of LTM configuration related to a candidate cell, it responds to the CU (e.g. source CU 1404) including the RRC configuration for the accepted candidate (target)

cell. For instance, the response message could be a UE CONTEXT SETUP RESPONSE message for an Intra-CU LTM case. A RACH resource for early TA acquisition may be included in the response message transmitted to the serving CU (e.g. source CU 1404).

[0249] In operation 145, source CU 1404 sends a UE CONTEXT MODIFICATION REQUEST message to source DU 1402 including the collected RS configuration(s), TCI state configuration(s) and RACH configuration(s) for the accepted target candidate cell(s) in other DUs.

[0250] In operation 146, source DU 1402 responds to source CU 1404 with a UE CONTEXT MODIFICATION RESPONSE message which may include the RS configuration(s) of the source cell, prepared candidate cell(s) and the generated CSI report configuration(s).

[0251] In operation 147, CU 1404 transmits LTM candidate cell configuration(s) for one or more candidate cells to UE 1401 via source DU 1402. "LTM candidate cell configuration(s)" may also be named as "candidate cell configuration(s) for LTM" or the like. For example, CU 1404 may transmit LTM candidate cell configuration(s) that BS 1405 previously prepared and provided to UE 1401 through RRC signaling.

[0252] In operation 147, CU 1404 may also transmit RACH resource(s) for early TA acquisition to source DU 1402.

[0253] In some implementations, CU 1404 may generate an RRC reconfiguration message based on the configuration(s) from the candidate cell(s) and transmit the RRC reconfiguration message to UE 1401 via source DU 1402. For instance, the RRC reconfiguration message includes LTM candidate cell configuration(s) and/or RACH resource(s) for early TA acquisition.

[0254] In operation 148, UE 1401 may receive, from source DU 1402, the RRC reconfiguration message including LTM candidate cell configuration(s) for one or more candidate cells.

[0255] In operation 149 (Optional), source DU 1402 transmits a TCI state activation MAC CE to UE 1401. In some implementations, source DU 1402 may activate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Activation MAC

CE. In some other implementations, source DU 1402 may deactivate the TCI states of LTM candidate cell(s) by sending the Candidate Cell TCI States Deactivation MAC CE.

[0256] In operation 150, in response to detecting a radio link failure (RLF) of the MCG, an LTM cell switch failure, a handover failure, a re-configuration with sync failure of the MCG, or a mobility from NR failure, UE 1401 may initiate an RRC reestablishment procedure and perform a cell selection procedure.

[0257] In an example, a re-configuration with sync failure of the MCG is a LTM cell switching failure, i.e., LTM timer expires. After UE 1401 receive an LTM cell switching command to a candidate cell, UE 1401 performs LTM cell switching and starts a timer (e.g., T304). Once the timer expires, UE 1401 initiates an RRC reestablishment procedure.

[0258] In another example, a re-configuration with sync failure of the MCG is a failure of handover triggered by the reception of a handover command or meeting an execution condition for CHO. If UE 1401 receives a handover command associated with a candidate cell or the execution condition for CHO is met, UE 1401 performs a handover and starts a timer (e.g., T304). Once the timer expires, UE 1401 initiates an RRC reestablishment procedure.

[0259] Regarding a mobility from NR failure, a MobilityFromNRCommand message may be used to command a handover from a NR procedure to E-UTRA/EPC, E-UTRA/5GC or UTRA-FDD. The network may initiate the mobility from the NR procedure to a UE (e.g. UE 1401) in an RRC connected state, possibly in response to a measurement report or an MCG failure information message, by sending a MobilityFromNRCommand message.

[0260] In operation 151, if UE 1401 selects a suitable cell, UE 1401 stops the timer (e.g., T311). If the selected cell is an LTM candidate cell, UE 1401 may perform an LTM cell switching towards the selected cell.

[0261] In operation 152, candidate DU 1403 (i.e., the target DU) sends a message (e.g., a notification message), e.g., an ACCESS SUCCESS message, to CU 1404 with the ID information of the target cell via F1 interface. The purpose of the access success procedure is to enable the target DU to inform the CU of which cell UE 1401 has successfully accessed during the LTM cell switching. For example, the candidate cell ID which UE 1401 has accessed can be included in the message.

[0262] In operation 153, CU 1404 may send a request (e.g., request #1 as described in the embodiments of Figure 8) to source DU 1402 to release the resources of prepared cells. The request may be an F1 message (e.g., a UE CONTEXT RELEASE COMMAND message or a UE CONTEXT MODIFICATION REQUEST message). For example, the request may indicate source DU 1402 to provide LTM related information. The request could include a common indication or separate indications for each resource or configuration. The indication(s) may be included in a UE CONTEXT RELEASE COMMAND message or a UE CONTEXT MODIFICATION REQUEST message.

[0263] For example, the request in operation 153 includes at least one of the following:

- (1) An indication to indicate source DU 1402 to provide the LTM related information.
- (2) An indication to indicate that UE 1401 has accessed a candidate cell via LTM cell switching.
- (3) Separate indications for different resources or configurations. For example, an indication to request source DU 1402 to provide RACH resource(s) for an early TA acquisition, an indication to request source DU 1402 to provide early TA value(s) stored in source DU 1402.

[0264] In operation 154, source DU 1402 responds with a response message, e.g., a UE CONTEXT RELEASE COMPLETE message. At least one of the following information (e.g., LTM cell switching related information) may be included in the response message:

- (1) RACH resource(s) for early TA acquisition.
- (2) Early TA value(s) stored in source DU.
- (3) Activated TCI state(s) (if UE 1401 can keep it after cell switching).
- (4) LTM CSI resource configuration(s).
- (5) SCI resource configuration information for LTM.

[0265] In operation 155, after CU 1404 receives the information (e.g., the LTM cell switching related information) from source DU 1402, CU 1404 will transmit at least one of the following information to target DU 1403:

- (1) RACH resource for early TA acquisition.
- (2) Early TA value stored in source DU.
- (3) Activated TCI state (if UE 1401 can keep it after cell switching).
- (4) LTM CSI resource configuration(s).
- (5) SCI resource configuration information for LTM.

[0266] The description herein is provided to enable a person having ordinary skill in the art to make or use the disclosure. Various modifications to the disclosure will be apparent to a person having ordinary skill in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

CLAIMS

What is claimed:

1. A user equipment (UE), comprising:
 - at least one memory; and
 - at least one processor coupled to the at least one memory and configured to cause the UE to:
 - receive, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG);
 - initiate a radio resource control (RRC) reestablishment procedure based on a failure event and perform a first cell selection procedure; and
 - determine whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.
2. The UE of Claim 1, wherein the failure event is one of:
 - a radio link failure (RLF);
 - an LTM cell switch failure;
 - a handover failure;
 - a re-configuration with sync failure of the MCG; or
 - a mobility from new radio (NR) failure.
3. The UE of Claim 1, if the first cell is the LTM candidate cell, the processor is configured to cause the UE to perform LTM cell switching towards the first cell.
4. The UE of Claim 3, to perform the LTM cell switching, the processor is configured to cause the UE to:
 - determine whether a UE measured timing advance (TA) identifier (ID) for the source cell is equal to a UE measured TA ID for the first cell; and
 - if the UE measured TA ID for the source cell is equal to the UE measured TA ID for the first cell, perform RACH-less LTM cell switching towards the first cell.
5. The UE of Claim 4, wherein the processor is configured to cause the UE to:
 - perform UE-based TA measurements for the one or more LTM candidate cells in response to starting the first cell selection procedure; or

perform the UE-based TA measurements for the first cell after selecting the first cell.

6. The UE of Claim 3, to perform the LTM cell switching, the processor is configured to cause the UE to:

determine whether a configured grant (CG) resource is configured to the UE for the first cell and determine whether a UE measured timing advance (TA) identifier (ID) for the source cell is equal to a UE measured TA ID for the first cell; and

if the CG resource is configured to the UE and if the UE measured TA ID for the source cell is equal to the UE measured TA ID for the first cell, perform RACH-less LTM cell switching towards the first cell.

7. The UE of Claim 6, if one or more CG resources are configured to the UE, the processor is configured to cause the UE to:

if a transmission configuration indication (TCI) state associated with at least one CG resource is activated, select one CG resource based on the activated TCI state; or

if all TCI states of the one or more CG resources are not activated, determine one beam for the first cell based on measurements of the UE.

8. The UE of Claim 1, wherein the processor is configured to cause the UE to transmit an RRC reconfiguration complete message to the first cell, and wherein the RRC reconfiguration complete message includes ID information of the first cell.

9. The UE of Claim 1, if the first cell is the LTM candidate cell and both the MCG and a secondary cell group (SCG) are configured to the UE, the processor is configured to cause the UE to perform one of the following:

transmitting an RRC reestablishment request message to the first cell;

suspending SCG configuration information and performing LTM cell switching towards the first cell; or

releasing the SCG configuration information and performing the LTM cell switching towards the first cell.

10. The UE of Claim 1, wherein the processor is configured to cause the UE to:

determine whether the first cell is a conditional handover (CHO) candidate cell; and

if the first cell is the CHO candidate cell, perform CHO towards the first cell.

11. The UE of Claim 10, in response to performing the CHO towards the first cell, the processor is configured to cause the UE to keep or release the LTM configuration information related to the one or more LTM candidate cells.
12. The UE of Claim 1, wherein the processor is configured to cause the UE to:
 - if the first cell selection procedure is performed while a timer for cell selection is running and if the first cell is the LTM candidate cell, perform LTM cell switching towards the first cell; and
 - if the LTM cell switching towards the first cell fails, perform a second cell selection procedure.
13. The UE of Claim 12, wherein the processor is configured to cause the UE to:
 - if a second cell selected by the second cell selection procedure is a conditional handover (CHO) candidate cell, perform CHO towards the second cell; and
 - if the CHO towards the second cell fails, perform an RRC re-establishment procedure.
14. The UE of Claim 1, wherein the processor is configured to cause the UE to:
 - if the first cell selection procedure is performed while a timer for cell selection is running and if the first cell is a conditional handover (CHO) candidate cell, perform CHO towards the first cell; and
 - if the CHO towards the first cell fails, perform a third cell selection procedure.
15. The UE of Claim 14, wherein the processor is configured to cause the UE to:
 - if a third cell selected by the third cell selection procedure is an LTM candidate cell, perform LTM cell switching towards the third cell; and
 - if the LTM cell switching towards the third cell fails, perform an RRC re-establishment procedure.
16. A base station (BS), comprising:
 - at least one memory; and
 - at least one processor coupled to the at least one memory and configured to cause the BS to:
 - receive a measurement report from a user equipment (UE); and

transmit a radio resource control (RRC) reconfiguration message to the UE, wherein the RRC reconfiguration message includes at least one of the following:

lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG);

or

conditional handover (CHO) configuration information related to one or more CHO candidate cells.

17. The BS of Claim 16, wherein the processor is configured to cause the BS to receive an RRC reconfiguration complete message from the UE, and wherein the RRC reconfiguration complete message includes ID information of a cell selected by the UE via a cell selection procedure.

18. A processor for wireless communication, comprising:

at least one controller coupled with at least one memory and configured to cause the processor to:

receive, from a source cell, lower layer-triggered mobility (LTM) configuration information related to one or more LTM candidate cells associated with a master cell group (MCG);

initiate a radio resource control (RRC) reestablishment procedure based on a failure event and perform a first cell selection procedure; and

determine whether a first cell selected by the first cell selection procedure is an LTM candidate cell within the one or more LTM candidate cells.

19. The processor of Claim 18, wherein the failure event is one of:

a radio link failure (RLF);

an LTM cell switch failure;

a handover failure;

a re-configuration with sync failure of the MCG; or

a mobility from new radio (NR) failure.

20. A processor for wireless communication, comprising:

at least one controller coupled with at least one memory and configured to cause the processor to:

receive a measurement report from a user equipment (UE); and
transmit a radio resource control (RRC) reconfiguration message to the UE,
wherein the RRC reconfiguration message includes at least one of the following:
 lower layer-triggered mobility (LTM) configuration information related to
 one or more LTM candidate cells associated with a master cell group (MCG);
or
 conditional handover (CHO) configuration information related to one or
more CHO candidate cells.