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## (54) Title: FAST RECOVERY FROM LINK FAILURE IN DUAL-CONNECTIVITY SYSTEMS

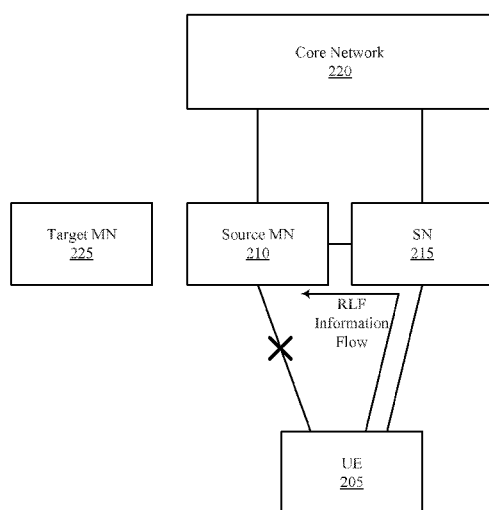


FIG. 2

200

(57) Abstract: Methods, systems, and devices for wireless commu-  
nications are described. A user equipment (UE) may detect a radio  
link failure between the UE and a master node of a dual-connectivi-  
ty configuration. The UE may transmit, to a secondary node in the  
dual-connectivity configuration, an indication that the radio link fail-  
ure has occurred. The secondary node may receive the indication of a  
radio link failure and transmit the indication of the radio link failure  
to the master node of the dual-connectivity configuration. The master  
node may identify a target node for the UE and perform a handover  
procedure of the UE from the master node to the target node.

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**FAST RECOVERY FROM LINK FAILURE IN DUAL-CONNECTIVITY SYSTEMS****BACKGROUND**

[0001] The following relates generally to wireless communications, and more specifically to fast recovery from link failure in dual-connectivity systems.

5 [0002] Wireless communications systems are widely deployed to provide various types of communication content such as voice, video, packet data, messaging, broadcast, and so on. These systems may be capable of supporting communication with multiple users by sharing the available system resources (e.g., time, frequency, and power). Examples of such multiple-access systems include fourth generation (4G) systems such as Long Term Evolution (LTE)  
10 systems, LTE-Advanced (LTE-A) systems, or LTE-A Pro systems, and fifth generation (5G) systems which may be referred to as New Radio (NR) systems. These systems may employ technologies such as code division multiple access (CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), orthogonal frequency division multiple access (OFDMA), or discrete Fourier transform spread orthogonal frequency  
15 division multiplexing (DFT-S-OFDM). A wireless multiple-access communications system may include a number of base stations or network access nodes, each simultaneously supporting communication for multiple communication devices, which may be otherwise known as user equipment (UE).

[0003] Some wireless networks may be configured to operate in a dual-connectivity  
20 configuration, in which a UE maintains simultaneous connections with at least a first base station, referred to as a master node (MN), and a second base station, referred to as a secondary node (SN). In some examples, one or more of the radio links between the UE and the MN and/or between the UE and the SN may experience a radio link failure (RLF). When an RLF is detected, conventional techniques utilize a radio resource control (RRC)  
25 reestablishment procedure to establish a new radio link between the UE and the affected base station (MN and/or SN) or between the UE and a target base station (or target node). However, such conventional techniques are time-consuming, utilize considerable over-the-air resources, and do not leverage the dual-connectivity configuration to reduce the impact associated with an RLF event.

## SUMMARY

[0004] The described techniques relate to improved methods, systems, devices, and apparatuses that support fast recovery from link failure in dual-connectivity systems. Generally, the described techniques provide for a fast recovery procedure that utilizes a secondary cell group (SCG) link to trigger a handover instead of using conventional radio link failure (RLF) recovery procedures, such as a radio resource control (RRC) reestablishment procedure. Generally, the handover procedure provides for fast recovery from the RLF with less interruption of data traffic than such conventional RLF recovery procedures. For example, a user equipment (UE) may be connected to a master node (MN) and a secondary node (SN) by wireless radio links in a dual-connectivity configuration. The UE may detect or otherwise determine that an RLF has occurred between the UE and the MN. In response, the UE may transmit or otherwise provide an indication of the RLF to the SN in the dual-connectivity configuration. The SN may receive the indication of the RLF between the UE and the MN and transmit, forward, or otherwise provide an indication of a RLF to the MN (e.g., via a wireless transmission between the SN and the MN and/or between a backhaul link between the SN and MN). In some aspects, the indication of the RLF may be carried or otherwise conveyed in a measurement report. The MN may receive the indication of the RLF from the SN and identify a target node for the UE, e.g., based at least in part on the measurement report. Accordingly, the MN may initiate or otherwise perform a handover procedure of the UE from the MN to the target node.

[0005] A method of wireless communications at a UE is described. The method may include detecting a RLF between the UE and a MN of a dual-connectivity configuration, transmitting, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred, and performing, based on the RLF indication, a handover procedure from the MN to a target node.

[0006] An apparatus for wireless communications at a UE is described. The apparatus may include a processor, memory in electronic communication with the processor, and instructions stored in the memory. The instructions may be executable by the processor to cause the apparatus to detect a RLF between the UE and a MN of a dual-connectivity configuration, transmit, to a SN in the dual-connectivity configuration, an indication that the

RLF has occurred, and perform, based on the RLF indication, a handover procedure from the MN to a target node.

[0007] Another apparatus for wireless communications at a UE is described. The apparatus may include means for detecting a RLF between the UE and a MN of a dual-connectivity configuration, transmitting, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred, and performing, based on the RLF indication, a handover procedure from the MN to a target node.

[0008] A non-transitory computer-readable medium storing code for wireless communications at a UE is described. The code may include instructions executable by a processor to detect a RLF between the UE and a MN of a dual-connectivity configuration, transmit, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred, and perform, based on the RLF indication, a handover procedure from the MN to a target node.

[0009] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be transmitted to the SN using a split signaling radio bearer.

[0010] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving, prior to the detected RLF, a message from the MN designating the SN as a recipient of the indication of the RLF.

[0011] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, transmitting the indication of the RLF may include operations, features, means, or instructions for indicating a cause of the RLF.

[0012] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the cause of the RLF may include operations, features, means, or instructions for a RLF detection on a master cell group link or a handover failure.

[0013] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be transmitted to the SN using a secondary cell group signaling radio bearer.

[0014] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the target node may be the SN and performing the handover procedure may include operations, features, means, or instructions for configuring the SN as a new MN for the UE in the dual connectivity configuration, and establishing a new connection with a new SN in the dual connectivity configuration, the new SN being different from the SN.

[0015] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the target node may be the SN and performing the handover procedure may include operations, features, means, or instructions for transitioning from the dual connectivity configuration to a single connectivity configuration with the SN.

[0016] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for determining that the handover procedure was unsuccessful, transmitting a RLF recovery request message to the SN, and performing a RLF recover procedure, based on the RLF recovery request message, with the MN.

[0017] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for detecting, after transmitting the indication of the RLF to the SN, a RLF between the UE and the SN, and performing a RRC reestablishment procedure.

[0018] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for detecting, before transmitting the indication of the RLF, a RLF between the UE and the SN, and performing a RRC reestablishment procedure.

[0019] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for detecting the RLF during a SN handover procedure from the SN to a new SN, and transmitting the indication of the RLF to the new SN.

[0020] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for determining, based on a measurement report, that the target node may be unavailable for

performing the handover procedure, and performing the handover procedure from the MN to the SN, where the SN becomes a new MN based on the handover procedure.

[0021] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for transmitting, to each SN of a set of SNs associated with the UE, the indication of the RLF that further indicates a measurement report.

[0022] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for determining that a radio link between the UE and the SN satisfies a performance threshold, where the indication of the RLF may be transmitted to the SN based on the performance metric satisfying the threshold.

[0023] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be transmitted in a RRC master control group link failure notification message, the RRC master control group link failure notification message including a measurement report and a master control group link failure cause.

[0024] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the handover procedure may include operations, features, means, or instructions for an inter-RAT handover procedure or an inter-RAT handover procedure.

[0025] A method of wireless communications at a SN is described. The method may include receiving, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and transmitting an indication of the RLF to the MN of the dual-connectivity configuration.

[0026] An apparatus for wireless communications at a SN is described. The apparatus may include a processor, memory in electronic communication with the processor, and instructions stored in the memory. The instructions may be executable by the processor to cause the apparatus to receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and transmit an indication of the RLF to the MN of the dual-connectivity configuration.

[0027] Another apparatus for wireless communications at a SN is described. The apparatus may include means for receiving, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and transmitting an indication of the RLF to the MN of the dual-connectivity configuration.

5 [0028] A non-transitory computer-readable medium storing code for wireless communications at a SN is described. The code may include instructions executable by a processor to receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and transmit an indication of the RLF to the MN of the dual-connectivity configuration.

10 [0029] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be received using a split signaling radio bearer.

[0030] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be received using a  
15 secondary cell group signaling radio bearer.

[0031] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for configuring the SN as a new MN for the UE in the dual-connectivity configuration.

[0032] Some examples of the method, apparatuses, and non-transitory computer-readable  
20 medium described herein may further include operations, features, means, or instructions for transitioning from the dual-connectivity configuration to a single connectivity configuration with the UE.

[0033] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for  
25 receiving the indication of the RLF in a first message over a signaling radio bearer 1 (SRB1), decoding the first message to determine that the RLF on a master control group radio link may have occurred, and transmitting the indication of the RLF to the MN in a second message.

[0034] Some examples of the method, apparatuses, and non-transitory computer-readable  
30 medium described herein may further include operations, features, means, or instructions for

receiving the indication of the RLF over a signaling radio bearer 3 (SRB3), where transmitting the indication includes encapsulating the indication of the RLF in a backhaul container message for transmitting to the MN.

[0035] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the backhaul container message may be encapsulated according to an Xn or X2 protocol.

[0036] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving, from the UE, a RLF recovery request message indicating that a handover procedure was unsuccessful, and transmitting, to the MN, an indication of the RLF recovery request message.

[0037] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for determining that the MN may be unavailable for transmitting the indication of the RLF, determining that the SN may be configured with a control plane interface with a core network, and performing, based on the control plane interface configuration, a handover procedure of the UE from the MN to the SN, where the SN becomes a new MN of the UE based on the handover procedure.

[0038] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for determining, based on the indication of the RLF, that a target node may be unavailable for performing the handover procedure with the UE, determining that the SN may be configured with a control plane interface with a core network, and performing, based on the control plane interface configuration, a handover procedure of the UE from the MN to the SN, where the SN becomes a new MN of the UE based on the handover procedure.

[0039] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be received in a RRC master control group failure notification message.

[0040] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, a wireless transmission, a backhaul link, or a combination thereof.

5 [0041] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF further indicates a cause for the RLF.

10 [0042] A method of wireless communication at a MN is described. The method may include receiving, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN, identifying, based on the RLF, a target node for the UE, and performing a handover procedure of the UE from the MN to the target node.

15 [0043] An apparatus for wireless communication at a MN is described. The apparatus may include a processor, memory in electronic communication with the processor, and instructions stored in the memory. The instructions may be executable by the processor to cause the apparatus to receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN, identify, based on the RLF, a target node for the UE, and perform a handover procedure of the UE from the MN to the target node.

20 [0044] Another apparatus for wireless communication at a MN is described. The apparatus may include means for receiving, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN, identifying, based on the RLF, a target node for the UE, and performing a handover procedure of the UE from the MN to the target node.

25 [0045] A non-transitory computer-readable medium storing code for wireless communication at a MN is described. The code may include instructions executable by a processor to receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN, identify, based on the RLF, a target node for the UE, and perform a handover procedure of the UE from the MN to the target node.

[0046] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the target node may be different from the MN and the SN.

[0047] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for  
5 determining that the MN operates using a first radio frequency spectrum band, and determining that the target node operates using the first radio frequency spectrum band, where the target node may be identified based on the target node operating using the first radio frequency spectrum band.

[0048] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the SN operates using at least one of the first radio  
10 frequency spectrum band, a second radio frequency spectrum band that may be different from the first radio frequency spectrum band, or a combination thereof.

[0049] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for  
15 determining that the MN operates using a first radio access technology, and determining that the target node operates using the first radio access technology, where the target node may be identified based on the target node operating using the first radio access technology.

[0050] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the SN operates using at least one of the first radio access  
20 technology, a second radio access technology that may be different from the first radio access technology, or a combination thereof.

[0051] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for  
25 decoding a measurement report indicating the RLF, where the target node may be identified based on the measurement report.

[0052] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the target node includes a second distribution unit (DU) of a dual-DU configuration associated with the MN.

[0053] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the indication of the RLF may be received from the SN using a split signaling radio bearer.

5 [0054] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for transmitting, prior to receiving the indication of the RLF, a message to the UE designating the SN as a recipient of the indication of the RLF.

10 [0055] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for configuring the SN as a new MN for the UE in at least one of the dual-connectivity configuration or a single-connectivity configuration.

[0056] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, receiving the indication of the RLF may include operations, features, means, or instructions for receiving a backhaul container message that  
15 may be encapsulated according to an Xn or X2 protocol.

[0057] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for receiving, from the SN, an indication of a RLF recovery request message indicating that the handover procedure was unsuccessful, and performing a RLF recovery procedure with the  
20 UE.

[0058] Some examples of the method, apparatuses, and non-transitory computer-readable medium described herein may further include operations, features, means, or instructions for determining, based on the indication of the RLF, that the target node may be unavailable for performing the handover procedure with the UE, determining that the SN may be configured  
25 with a control plane interface with a core network, and performing, based on the control plane interface configuration, a handover procedure of the UE to the SN, where the SN becomes a new MN of the UE based on the handover procedure.

[0059] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, a wireless transmission, a backhaul link between, or a  
30 combination thereof.

[0060] In some examples of the method, apparatuses, and non-transitory computer-readable medium described herein, the handover procedure may include operations, features, means, or instructions for an inter-RAT handover procedure or an inter-RAT handover procedure.

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## BRIEF DESCRIPTION OF THE DRAWINGS

[0061] FIG. 1 illustrates an example of a system for wireless communications that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

10 [0062] FIG. 2 illustrates an example of a wireless communication system that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0063] FIGs. 3A and 3B illustrate an example of a process that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

15 [0064] FIG. 4 illustrates an example of a process that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0065] FIG. 5 illustrates an example of a process that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

20 [0066] FIGs. 6A and 6B illustrate an example of a process that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0067] FIGs. 7A and 7B illustrate an example of a process that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

25 [0068] FIGs. 8A and 8B illustrates an example of a process that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0069] FIG. 9 illustrates an example of a wireless communication system that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

5 [0070] FIGs. 10 and 11 show block diagrams of devices that support fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0071] FIG. 12 shows a block diagram of a communications manager that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

10 [0072] FIG. 13 shows a diagram of a system including a device that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0073] FIGs. 14 and 15 show block diagrams of devices that support fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

15 [0074] FIG. 16 shows a block diagram of a communications manager that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

[0075] FIG. 17 shows a diagram of a system including a device that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

20 [0076] FIGs. 18 through 20 show flowcharts illustrating methods that support fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure.

## DETAILED DESCRIPTION

25 [0077] Some wireless networks may be configured to operate in a dual-connectivity (DC) configuration. For example, the wireless network may be configured to operate in an evolved universal terrestrial radio access network (E-UTRAN) new radio (NR), which may be referred to as EN-DC, as 5G EN-DC, and/or as a 5G NR dual-connectivity configuration or system. Broadly, the dual-connectivity configuration supports the UE being connected to two base stations (or nodes) at the same time. In some example, one base station (e.g., a master

node (MN)) may be a 5G or NR base station and a second base station (e.g., a secondary node (SN)) may be an LTE base station. In other examples, the MN may be an LTE base station and the SN may be a 5G or NR base station. In even further examples, both the MN and SN may be 5G or NR base stations, or they may both be LTE base stations. The dual-connectivity configuration may be supported when inter-connectivity has been established between the MN and SN base stations, via one or more backhaul links, core network functions, and the like. In some examples, MN may also be referred to as a master cell group (MCG) and the SN may be referred to as a secondary cell group (SCG). Some examples of dual-connectivity may include the UE being simultaneously connected to the LTE and 5G NR base stations and/or the UE utilizing the LTE base station for control plane information and the 5G NR base station for user plane traffic. In some aspects, the dual-connectivity configuration may support direct and/or split radio bearers, a MCG signaling radio bearer (SRB) between the UE and the MN, and/or a SCG SRB between the UE and the SN. Broadly, the dual-connectivity configuration leverages benefits of both LTE and 5G functionalities and capabilities simultaneously to improve overall system performance.

[0078] In some aspects, the UE communicates with the MN and/or the SN over one or more wireless links or radio links, which may also be referred to as MCG link and SCG link. Broadly, the radio links may be sub-6 GHz and/or mmW radio links. In some examples, one or more of the radio links between the UE and the MN and/or the UE and the SN may experience a radio link failure (RLF). Generally, the RLF may occur due to obstruction, link degradation, and the like, such that the radio link becomes unavailable and/or fails to satisfy a performance threshold for continued use. Generally, the UE may perform channel measurements to monitor link performance and identify an RLF based on the channel measurements. When an RLF is detected, conventional techniques typically utilize a radio resource control (RRC) reestablishment procedure and/or may rely on a RLF recovery procedure to establish a radio link between the UE and the affected base station (MN and/or SN) and/or between the UE and a target base station (or target node). However, such conventional techniques are time-consuming, involve considerable signaling exchange, and do not leverage the dual-connectivity configuration to reduce the impact associated with an RLF event.

[0079] Aspects of the disclosure are initially described in the context of a wireless communications system. Generally, the described techniques provide for a fast RLF recovery

procedure that utilizes a SCG link to trigger a handover instead of using conventional RLF recovery procedures, such as a RRC reestablishment procedure. Generally, the handover procedure provides for fast recovery from the RLF with less interruption of data traffic than such conventional RLF recovery procedures. For example, a UE may typically be connected to a MN and a SN by wireless radio links in a dual-connectivity configuration. The UE may detect or otherwise determine that an RLF has occurred between the UE and the MN. In response, the UE may transmit or otherwise provide an indication of the RLF to the SN in the dual-connectivity configuration. The SN may receive the indication of the RLF between the UE in the MN and transmit, forward, or otherwise provide an indication of the RLF to the MN (e.g., via a wireless transmission between the SN and the MN and/or between a backhaul link between the SN and MN). In some aspects, the indication of the RLF may carry or otherwise conveyed the measurement report. The MN may receive the indication of the RLF from the SN and identify a target node for the UE, e.g., based at least in part on the measurement report. Accordingly, the MN may initiate or otherwise perform a handover procedure of the UE from the MN to the target node.

[0080] Aspects of the disclosure are further illustrated by and described with reference to apparatus diagrams, system diagrams, and flowcharts that relate to fast recovery from link failure in dual-connectivity systems.

[0081] FIG. 1 illustrates an example of a wireless communications system 100 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The wireless communications system 100 includes base stations 105, UEs 115, and a core network 130. In some examples, the wireless communications system 100 may be a LTE network, an LTE-Advanced (LTE-A) network, an LTE-A Pro network, or a NR network. In some cases, wireless communications system 100 may support enhanced broadband communications, ultra-reliable (e.g., mission critical) communications, low latency communications, or communications with low-cost and low-complexity devices.

[0082] Base stations 105 may wirelessly communicate with UEs 115 via one or more base station antennas. Base stations 105 described herein may include or may be referred to by those skilled in the art as a base transceiver station, a radio base station, an access point, a radio transceiver, a NodeB, an eNodeB (eNB), a next-generation NodeB or giga-NodeB

(either of which may be referred to as a gNB), a Home NodeB, a Home eNodeB, or some other suitable terminology. Wireless communications system 100 may include base stations 105 of different types (e.g., macro or small cell base stations). The UEs 115 described herein may be able to communicate with various types of base stations 105 and network equipment including macro eNBs, small cell eNBs, gNBs, relay base stations, and the like.

[0083] Each base station 105 may be associated with a particular geographic coverage area 110 in which communications with various UEs 115 is supported. Each base station 105 may provide communication coverage for a respective geographic coverage area 110 via communication links 125, and communication links 125 between a base station 105 and a UE 115 may utilize one or more carriers. Communication links 125 shown in wireless communications system 100 may include uplink transmissions from a UE 115 to a base station 105, or downlink transmissions from a base station 105 to a UE 115. Downlink transmissions may also be called forward link transmissions while uplink transmissions may also be called reverse link transmissions.

[0084] The geographic coverage area 110 for a base station 105 may be divided into sectors making up a portion of the geographic coverage area 110, and each sector may be associated with a cell. For example, each base station 105 may provide communication coverage for a macro cell, a small cell, a hot spot, or other types of cells, or various combinations thereof. In some examples, a base station 105 may be movable and therefore provide communication coverage for a moving geographic coverage area 110. In some examples, different geographic coverage areas 110 associated with different technologies may overlap, and overlapping geographic coverage areas 110 associated with different technologies may be supported by the same base station 105 or by different base stations 105. The wireless communications system 100 may include, for example, a heterogeneous LTE/LTE-A/LTE-A Pro or NR network in which different types of base stations 105 provide coverage for various geographic coverage areas 110.

[0085] The term “cell” refers to a logical communication entity used for communication with a base station 105 (e.g., over a carrier), and may be associated with an identifier for distinguishing neighboring cells (e.g., a physical cell identifier (PCID), a virtual cell identifier (VCID)) operating via the same or a different carrier. In some examples, a carrier may support multiple cells, and different cells may be configured according to different protocol

types (e.g., machine-type communication (MTC), narrowband Internet-of-Things (NB-IoT), enhanced mobile broadband (eMBB), or others) that may provide access for different types of devices. In some cases, the term “cell” may refer to a portion of a geographic coverage area 110 (e.g., a sector) over which the logical entity operates.

5 [0086] UEs 115 may be dispersed throughout the wireless communications system 100, and each UE 115 may be stationary or mobile. A UE 115 may also be referred to as a mobile device, a wireless device, a remote device, a handheld device, or a subscriber device, or some other suitable terminology, where the “device” may also be referred to as a unit, a station, a terminal, or a client. A UE 115 may also be a personal electronic device such as a cellular  
10 phone, a personal digital assistant (PDA), a tablet computer, a laptop computer, or a personal computer. In some examples, a UE 115 may also refer to a wireless local loop (WLL) station, an Internet of Things (IoT) device, an Internet of Everything (IoE) device, or an MTC device, or the like, which may be implemented in various articles such as appliances, vehicles, meters, or the like.

15 [0087] Some UEs 115, such as MTC or IoT devices, may be low cost or low complexity devices, and may provide for automated communication between machines (e.g., via Machine-to-Machine (M2M) communication). M2M communication or MTC may refer to data communication technologies that allow devices to communicate with one another or a base station 105 without human intervention. In some examples, M2M communication or  
20 MTC may include communications from devices that integrate sensors or meters to measure or capture information and relay that information to a central server or application program that can make use of the information or present the information to humans interacting with the program or application. Some UEs 115 may be designed to collect information or enable automated behavior of machines. Examples of applications for MTC devices include smart  
25 metering, inventory monitoring, water level monitoring, equipment monitoring, healthcare monitoring, wildlife monitoring, weather and geological event monitoring, fleet management and tracking, remote security sensing, physical access control, and transaction-based business charging.

[0088] Some UEs 115 may be configured to employ operating modes that reduce power  
30 consumption, such as half-duplex communications (e.g., a mode that supports one-way communication via transmission or reception, but not transmission and reception

simultaneously). In some examples half-duplex communications may be performed at a reduced peak rate. Other power conservation techniques for UEs 115 include entering a power saving “deep sleep” mode when not engaging in active communications, or operating over a limited bandwidth (e.g., according to narrowband communications). In some cases, UEs 115 may be designed to support critical functions (e.g., mission critical functions), and a wireless communications system 100 may be configured to provide ultra-reliable communications for these functions.

[0089] In some cases, a UE 115 may also be able to communicate directly with other UEs 115 (e.g., using a peer-to-peer (P2P) or device-to-device (D2D) protocol). One or more of a group of UEs 115 utilizing D2D communications may be within the geographic coverage area 110 of a base station 105. Other UEs 115 in such a group may be outside the geographic coverage area 110 of a base station 105, or be otherwise unable to receive transmissions from a base station 105. In some cases, groups of UEs 115 communicating via D2D communications may utilize a one-to-many (1:M) system in which each UE 115 transmits to every other UE 115 in the group. In some cases, a base station 105 facilitates the scheduling of resources for D2D communications. In other cases, D2D communications are carried out between UEs 115 without the involvement of a base station 105.

[0090] Base stations 105 may communicate with the core network 130 and with one another. For example, base stations 105 may interface with the core network 130 through backhaul links 132 (e.g., via an S1, N2, N3, or other interface). Base stations 105 may communicate with one another over backhaul links 134 (e.g., via an X2, Xn, or other interface) either directly (e.g., directly between base stations 105) or indirectly (e.g., via core network 130).

[0091] The core network 130 may provide user authentication, access authorization, tracking, Internet Protocol (IP) connectivity, and other access, routing, or mobility functions. The core network 130 may be an evolved packet core (EPC), which may include at least one mobility management entity (MME), at least one serving gateway (S-GW), and at least one Packet Data Network (PDN) gateway (P-GW). The MME may manage non-access stratum (e.g., control plane) functions such as mobility, authentication, and bearer management for UEs 115 served by base stations 105 associated with the EPC. User IP packets may be transferred through the S-GW, which itself may be connected to the P-GW. The P-GW may

provide IP address allocation as well as other functions. The P-GW may be connected to the network operators IP services. The operators IP services may include access to the Internet, Intranet(s), an IP Multimedia Subsystem (IMS), or a Packet-Switched (PS) Streaming Service.

5 [0092] At least some of the network devices, such as a base station 105, may include subcomponents such as an access network entity, which may be an example of an access node controller (ANC). Each access network entity may communicate with UEs 115 through a number of other access network transmission entities, which may be referred to as a radio head, a smart radio head, or a transmission/reception point (TRP). In some configurations,  
10 various functions of each access network entity or base station 105 may be distributed across various network devices (e.g., radio heads and access network controllers) or consolidated into a single network device (e.g., a base station 105).

[0093] Wireless communications system 100 may operate using one or more frequency bands, typically in the range of 300 megahertz (MHz) to 300 gigahertz (GHz). Generally, the  
15 region from 300 MHz to 3 GHz is known as the ultra-high frequency (UHF) region or decimeter band, since the wavelengths range from approximately one decimeter to one meter in length. UHF waves may be blocked or redirected by buildings and environmental features. However, the waves may penetrate structures sufficiently for a macro cell to provide service to UEs 115 located indoors. Transmission of UHF waves may be associated with smaller  
20 antennas and shorter range (e.g., less than 100 km) compared to transmission using the smaller frequencies and longer waves of the high frequency (HF) or very high frequency (VHF) portion of the spectrum below 300 MHz.

[0094] Wireless communications system 100 may also operate in a super high frequency (SHF) region using frequency bands from 3 GHz to 30 GHz, also known as the centimeter  
25 band. The SHF region includes bands such as the 5 GHz industrial, scientific, and medical (ISM) bands, which may be used opportunistically by devices that may be capable of tolerating interference from other users.

[0095] Wireless communications system 100 may also operate in an extremely high frequency (EHF) region of the spectrum (e.g., from 30 GHz to 300 GHz), also known as the  
30 millimeter band. In some examples, wireless communications system 100 may support millimeter wave (mmW) communications between UEs 115 and base stations 105, and EHF

antennas of the respective devices may be even smaller and more closely spaced than UHF antennas. In some cases, this may facilitate use of antenna arrays within a UE 115. However, the propagation of EHF transmissions may be subject to even greater atmospheric attenuation and shorter range than SHF or UHF transmissions. Techniques disclosed herein may be employed across transmissions that use one or more different frequency regions, and designated use of bands across these frequency regions may differ by country or regulating body.

[0096] In some cases, wireless communications system 100 may utilize both licensed and unlicensed radio frequency spectrum bands. For example, wireless communications system 100 may employ License Assisted Access (LAA), LTE-Unlicensed (LTE-U) radio access technology, or NR technology in an unlicensed band such as the 5 GHz ISM band. When operating in unlicensed radio frequency spectrum bands, wireless devices such as base stations 105 and UEs 115 may employ listen-before-talk (LBT) procedures to ensure a frequency channel is clear before transmitting data. In some cases, operations in unlicensed bands may be based on a carrier aggregation configuration in conjunction with component carriers operating in a licensed band (e.g., LAA). Operations in unlicensed spectrum may include downlink transmissions, uplink transmissions, peer-to-peer transmissions, or a combination of these. Duplexing in unlicensed spectrum may be based on frequency division duplexing (FDD), time division duplexing (TDD), or a combination of both.

[0097] In some examples, base station 105 or UE 115 may be equipped with multiple antennas, which may be used to employ techniques such as transmit diversity, receive diversity, multiple-input multiple-output (MIMO) communications, or beamforming. For example, wireless communications system 100 may use a transmission scheme between a transmitting device (e.g., a base station 105) and a receiving device (e.g., a UE 115), where the transmitting device is equipped with multiple antennas and the receiving device is equipped with one or more antennas. MIMO communications may employ multipath signal propagation to increase the spectral efficiency by transmitting or receiving multiple signals via different spatial layers, which may be referred to as spatial multiplexing. The multiple signals may, for example, be transmitted by the transmitting device via different antennas or different combinations of antennas. Likewise, the multiple signals may be received by the receiving device via different antennas or different combinations of antennas. Each of the multiple signals may be referred to as a separate spatial stream, and may carry bits associated

with the same data stream (e.g., the same codeword) or different data streams. Different spatial layers may be associated with different antenna ports used for channel measurement and reporting. MIMO techniques include single-user MIMO (SU-MIMO) where multiple spatial layers are transmitted to the same receiving device, and multiple-user MIMO (MU-MIMO) where multiple spatial layers are transmitted to multiple devices.

[0098] Beamforming, which may also be referred to as spatial filtering, directional transmission, or directional reception, is a signal processing technique that may be used at a transmitting device or a receiving device (e.g., a base station 105 or a UE 115) to shape or steer an antenna beam (e.g., a transmit beam or receive beam) along a spatial path between the transmitting device and the receiving device. Beamforming may be achieved by combining the signals communicated via antenna elements of an antenna array such that signals propagating at particular orientations with respect to an antenna array experience constructive interference while others experience destructive interference. The adjustment of signals communicated via the antenna elements may include a transmitting device or a receiving device applying certain amplitude and phase offsets to signals carried via each of the antenna elements associated with the device. The adjustments associated with each of the antenna elements may be defined by a beamforming weight set associated with a particular orientation (e.g., with respect to the antenna array of the transmitting device or receiving device, or with respect to some other orientation).

[0099] In one example, a base station 105 may use multiple antennas or antenna arrays to conduct beamforming operations for directional communications with a UE 115. For instance, some signals (e.g. synchronization signals, reference signals, beam selection signals, or other control signals) may be transmitted by a base station 105 multiple times in different directions, which may include a signal being transmitted according to different beamforming weight sets associated with different directions of transmission. Transmissions in different beam directions may be used to identify (e.g., by the base station 105 or a receiving device, such as a UE 115) a beam direction for subsequent transmission and/or reception by the base station 105.

[0100] Some signals, such as data signals associated with a particular receiving device, may be transmitted by a base station 105 in a single beam direction (e.g., a direction associated with the receiving device, such as a UE 115). In some examples, the beam

direction associated with transmissions along a single beam direction may be determined based at least in part on a signal that was transmitted in different beam directions. For example, a UE 115 may receive one or more of the signals transmitted by the base station 105 in different directions, and the UE 115 may report to the base station 105 an indication of the signal it received with a highest signal quality, or an otherwise acceptable signal quality. Although these techniques are described with reference to signals transmitted in one or more directions by a base station 105, a UE 115 may employ similar techniques for transmitting signals multiple times in different directions (e.g., for identifying a beam direction for subsequent transmission or reception by the UE 115), or transmitting a signal in a single direction (e.g., for transmitting data to a receiving device).

**[0101]** A receiving device (e.g., a UE 115, which may be an example of a mmW receiving device) may try multiple receive beams when receiving various signals from the base station 105, such as synchronization signals, reference signals, beam selection signals, or other control signals. For example, a receiving device may try multiple receive directions by receiving via different antenna subarrays, by processing received signals according to different antenna subarrays, by receiving according to different receive beamforming weight sets applied to signals received at a plurality of antenna elements of an antenna array, or by processing received signals according to different receive beamforming weight sets applied to signals received at a plurality of antenna elements of an antenna array, any of which may be referred to as “listening” according to different receive beams or receive directions. In some examples a receiving device may use a single receive beam to receive along a single beam direction (e.g., when receiving a data signal). The single receive beam may be aligned in a beam direction determined based at least in part on listening according to different receive beam directions (e.g., a beam direction determined to have a highest signal strength, highest signal-to-noise ratio, or otherwise acceptable signal quality based at least in part on listening according to multiple beam directions).

**[0102]** In some cases, the antennas of a base station 105 or UE 115 may be located within one or more antenna arrays, which may support MIMO operations, or transmit or receive beamforming. For example, one or more base station antennas or antenna arrays may be co-located at an antenna assembly, such as an antenna tower. In some cases, antennas or antenna arrays associated with a base station 105 may be located in diverse geographic locations. A base station 105 may have an antenna array with a number of rows and columns of antenna

ports that the base station 105 may use to support beamforming of communications with a UE 115. Likewise, a UE 115 may have one or more antenna arrays that may support various MIMO or beamforming operations.

[0103] In some cases, wireless communications system 100 may be a packet-based network that operate according to a layered protocol stack. In the user plane, communications at the bearer or Packet Data Convergence Protocol (PDCP) layer may be IP-based. A Radio Link Control (RLC) layer may perform packet segmentation and reassembly to communicate over logical channels. A Medium Access Control (MAC) layer may perform priority handling and multiplexing of logical channels into transport channels. The MAC layer may also use hybrid automatic repeat request (HARQ) to provide retransmission at the MAC layer to improve link efficiency. In the control plane, the Radio Resource Control (RRC) protocol layer may provide establishment, configuration, and maintenance of an RRC connection between a UE 115 and a base station 105 or core network 130 supporting radio bearers for user plane data. At the Physical layer, transport channels may be mapped to physical channels.

[0104] In some cases, UEs 115 and base stations 105 may support retransmissions of data to increase the likelihood that data is received successfully. HARQ feedback is one technique of increasing the likelihood that data is received correctly over a communication link 125. HARQ may include a combination of error detection (e.g., using a cyclic redundancy check (CRC)), forward error correction (FEC), and retransmission (e.g., automatic repeat request (ARQ)). HARQ may improve throughput at the MAC layer in poor radio conditions (e.g., signal-to-noise conditions). In some cases, a wireless device may support same-slot HARQ feedback, where the device may provide HARQ feedback in a specific slot for data received in a previous symbol in the slot. In other cases, the device may provide HARQ feedback in a subsequent slot, or according to some other time interval.

[0105] Time intervals in LTE or NR may be expressed in multiples of a basic time unit, which may, for example, refer to a sampling period of  $T_s = 1/30,720,000$  seconds. Time intervals of a communications resource may be organized according to radio frames each having a duration of 10 milliseconds (ms), where the frame period may be expressed as  $T_F = 307,200 T_s$ . The radio frames may be identified by a system frame number (SFN) ranging from 0 to 1023. Each frame may include 10 subframes numbered from 0 to 9, and

each subframe may have a duration of 1 ms. A subframe may be further divided into 2 slots each having a duration of 0.5 ms, and each slot may contain 6 or 7 modulation symbol periods (e.g., depending on the length of the cyclic prefix prepended to each symbol period). Excluding the cyclic prefix, each symbol period may contain 2048 sampling periods. In some cases, a subframe may be the smallest scheduling unit of the wireless communications system 100, and may be referred to as a transmission time interval (TTI). In other cases, a smallest scheduling unit of the wireless communications system 100 may be shorter than a subframe or may be dynamically selected (e.g., in bursts of shortened TTIs (sTTIs) or in selected component carriers using sTTIs).

10 [0106] In some wireless communications systems, a slot may further be divided into multiple mini-slots containing one or more symbols. In some instances, a symbol of a mini-slot or a mini-slot may be the smallest unit of scheduling. Each symbol may vary in duration depending on the subcarrier spacing or frequency band of operation, for example. Further, some wireless communications systems may implement slot aggregation in which multiple slots or mini-slots are aggregated together and used for communication between a UE 115 and a base station 105.

[0107] The term “carrier” refers to a set of radio frequency spectrum resources having a defined physical layer structure for supporting communications over a communication link 125. For example, a carrier of a communication link 125 may include a portion of a radio frequency spectrum band that is operated according to physical layer channels for a given radio access technology. Each physical layer channel may carry user data, control information, or other signaling. A carrier may be associated with a pre-defined frequency channel (e.g., an evolved universal mobile telecommunication system terrestrial radio access (E-UTRA) absolute radio frequency channel number (EARFCN)), and may be positioned according to a channel raster for discovery by UEs 115. Carriers may be downlink or uplink (e.g., in an FDD mode), or be configured to carry downlink and uplink communications (e.g., in a TDD mode). In some examples, signal waveforms transmitted over a carrier may be made up of multiple sub-carriers (e.g., using multi-carrier modulation (MCM) techniques such as orthogonal frequency division multiplexing (OFDM) or discrete Fourier transform spread OFDM (DFT-S-OFDM)).

[0108] The organizational structure of the carriers may be different for different radio access technologies (e.g., LTE, LTE-A, LTE-A Pro, NR). For example, communications over a carrier may be organized according to TTIs or slots, each of which may include user data as well as control information or signaling to support decoding the user data. A carrier may also include dedicated acquisition signaling (e.g., synchronization signals or system information, etc.) and control signaling that coordinates operation for the carrier. In some examples (e.g., in a carrier aggregation configuration), a carrier may also have acquisition signaling or control signaling that coordinates operations for other carriers.

[0109] Physical channels may be multiplexed on a carrier according to various techniques. A physical control channel and a physical data channel may be multiplexed on a downlink carrier, for example, using time division multiplexing (TDM) techniques, frequency division multiplexing (FDM) techniques, or hybrid TDM-FDM techniques. In some examples, control information transmitted in a physical control channel may be distributed between different control regions in a cascaded manner (e.g., between a common control region or common search space and one or more UE-specific control regions or UE-specific search spaces).

[0110] A carrier may be associated with a particular bandwidth of the radio frequency spectrum, and in some examples the carrier bandwidth may be referred to as a “system bandwidth” of the carrier or the wireless communications system 100. For example, the carrier bandwidth may be one of a number of predetermined bandwidths for carriers of a particular radio access technology (e.g., 1.4, 3, 5, 10, 15, 20, 40, or 80 MHz). In some examples, each served UE 115 may be configured for operating over portions or all of the carrier bandwidth. In other examples, some UEs 115 may be configured for operation using a narrowband protocol type that is associated with a predefined portion or range (e.g., set of subcarriers or RBs) within a carrier (e.g., “in-band” deployment of a narrowband protocol type).

[0111] In a system employing MCM techniques, a resource element may consist of one symbol period (e.g., a duration of one modulation symbol) and one subcarrier, where the symbol period and subcarrier spacing are inversely related. The number of bits carried by each resource element may depend on the modulation scheme (e.g., the order of the modulation scheme). Thus, the more resource elements that a UE 115 receives and the higher

the order of the modulation scheme, the higher the data rate may be for the UE 115. In MIMO systems, a wireless communications resource may refer to a combination of a radio frequency spectrum resource, a time resource, and a spatial resource (e.g., spatial layers), and the use of multiple spatial layers may further increase the data rate for communications with a  
5 UE 115.

[0112] Devices of the wireless communications system 100 (e.g., base stations 105 or UEs 115) may have a hardware configuration that supports communications over a particular carrier bandwidth, or may be configurable to support communications over one of a set of carrier bandwidths. In some examples, the wireless communications system 100 may include  
10 base stations 105 and/or UEs 115 that support simultaneous communications via carriers associated with more than one different carrier bandwidth.

[0113] Wireless communications system 100 may support communication with a UE 115 on multiple cells or carriers, a feature which may be referred to as carrier aggregation or multi-carrier operation. A UE 115 may be configured with multiple downlink component  
15 carriers and one or more uplink component carriers according to a carrier aggregation configuration. Carrier aggregation may be used with both FDD and TDD component carriers.

[0114] In some cases, wireless communications system 100 may utilize enhanced component carriers (eCCs). An eCC may be characterized by one or more features including wider carrier or frequency channel bandwidth, shorter symbol duration, shorter TTI duration,  
20 or modified control channel configuration. In some cases, an eCC may be associated with a carrier aggregation configuration or a dual connectivity configuration (e.g., when multiple serving cells have a suboptimal or non-ideal backhaul link). An eCC may also be configured for use in unlicensed spectrum or shared spectrum (e.g., where more than one operator is allowed to use the spectrum). An eCC characterized by wide carrier bandwidth may include  
25 one or more segments that may be utilized by UEs 115 that are not capable of monitoring the whole carrier bandwidth or are otherwise configured to use a limited carrier bandwidth (e.g., to conserve power).

[0115] In some cases, an eCC may utilize a different symbol duration than other component carriers, which may include use of a reduced symbol duration as compared with  
30 symbol durations of the other component carriers. A shorter symbol duration may be associated with increased spacing between adjacent subcarriers. A device, such as a UE 115

or base station 105, utilizing eCCs may transmit wideband signals (e.g., according to frequency channel or carrier bandwidths of 20, 40, 60, 80 MHz, etc.) at reduced symbol durations (e.g., 16.67 microseconds). A TTI in eCC may consist of one or multiple symbol periods. In some cases, the TTI duration (that is, the number of symbol periods in a TTI) may be variable.

[0116] Wireless communications system 100 may be an NR system that may utilize any combination of licensed, shared, and unlicensed spectrum bands, among others. The flexibility of eCC symbol duration and subcarrier spacing may allow for the use of eCC across multiple spectrums. In some examples, NR shared spectrum may increase spectrum utilization and spectral efficiency, specifically through dynamic vertical (e.g., across the frequency domain) and horizontal (e.g., across the time domain) sharing of resources.

[0117] In some aspects, the UE 115 may detect a RLF between the UE 115 and a MN (e.g., a base station 105 configured or otherwise operating as an MN) of a dual-connectivity configuration. The UE 115 may transmit, to a SN (e.g., a base station 105 configured or otherwise operating as an SN) in the dual-connectivity configuration, an indication that the RLF has occurred. The UE 115 may perform, based at least in part on the RLF indication, a handover procedure from the MN to a target node.

[0118] In some aspects, a base station 105 may (when configured or otherwise operating as an SN) receive, from a UE 115, an indication of a RLF for a radio link between the UE 115 and a MN of a dual-connectivity configuration. The base station 105 may transmit an indication of the RLF to the MN of the dual-connectivity configuration.

[0119] In some aspects, a base station 105 may (when configured or otherwise operating as an MN) receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE 115, the RLF being for a radio link between the UE 115 and the MN. The base station 105 may identify, based at least in part on the RLF, a target node for the UE 115. The base station 105 may perform a handover procedure of the UE 115 from the MN to the target node.

[0120] FIG. 2 illustrates an example of a wireless communication system 200 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. In some examples, wireless communication system 200 may implement aspects of wireless communication system 100.

[0121] Generally, wireless communication system 200 may include a UE 205 that is connected to a source MN 210 and SN 215 in a dual-connectivity configuration. Generally, the dual-connectivity configuration may include a network configured according to a 5G EN-DC or 5G NR dual-connectivity configuration. In some examples, the source MN 210 may be associated with a 5G or NR radio access technology (RAT) and the SN 215 may be associated with an LTE RAT. In other examples, both of the source MN 210 and the SN 215 may be associated with a 5G or NR RAT. In other examples, both of the source MN 210 and the SN 215 may be associated with an LTE RAT. Generally, the described techniques may be applied to all multi-RAT dual-connectivity (MR-DC) configurations, which may also include NR-NR DC. Generally, UE 205 may connect to the source MN 210 and/or the SN 215 via one or more wireless radio links, such as an MCG link for source MN 210 and an SCG link for SN 215.

[0122] In some aspects, source MN 210 may be connected to SN 215 in order to exchange information via a wireless link and/or a wired link, such as a backhaul link (e.g., an X2/Xn protocol connection). Source MN 210 and/or SN 215 may also be connected to a core network 220 via backhaul connection(s). Target MN 225 may generally refer to another base station which may be located proximate to UE 205, and may therefore serve as a suitable candidate to be a new MN for UE 205 in the event that source MN 210 becomes unavailable.

[0123] In some aspects, UE 205 may generally experience an RLF for a radio link between UE 205 and source MN 210 and/or between UE 205 and SN 215. For example, UE 205 may perform various channel measurements over the respective wireless links and, based on the channel measurements, determine that the radio link is suddenly unavailable and/or is experiencing performance degradation to the point that the radio link no longer supports wireless communications. In some aspects, UE 205 may also, during and/or based on the channel measurements, identify target MN 225 (e.g., a target node that is a suitable candidate for UE 205 to establish a connection with).

[0124] Conventionally, RLF events are handled via an RRC connection reestablishment procedure. For example, UE 205 may detect an RLF between UE 205 and source MN 210 and perform a cell reselection procedure in response to the RLF. UE 205 would then perform a random access channel (RACH) procedure on the selected cell (e.g., target MN 225). UE 205 may then transmit an RRC connection reestablishment request to target MN 225, with

target MN 225 responding with an RRC connection reestablishment response message being transmitted to UE 205. UE 205 may then resume MCG SRB1 and generate new keys to use for communicating with target MN 225. UE 205 would then transmit an RRC connection reestablishment complete message to target MN 225. UE 205 and target MN 225 would then  
5 need to perform an RRC connection reconfiguration procedure to establish an MCG configuration with UE 205. The data flow may then resume for MCG bearers (e.g., from a S-GW/user-plane function (UPF) of core network 220). UE 205 and SN 215 would then need to perform an SN addition request procedure to once again add SN 215 and establish an SCG configuration with UE 205. Data flow can then resume for the SCG bearers.

10 [0125] However, such RLF recovery procedures using the RRC connection reestablishment consume considerable resources while incurring extended delays in interruptions for wireless communications. For example, the RRC connection reestablishment procedure may involve a two-step procedure to first establish the MCG configuration including data bearers and then the SCG configuration at the UE 205. In the event the RRC  
15 connection reestablishment fails because UE 205 happens to select a cell that is not prepared, UE 205 invokes procedures to establish a new RRC connection that incurs additional signaling delays related to access stratum (AS) security establishment that must be completed before UE 205 can be provided radio configuration. Accordingly, upon detection of the MCG link failure (e.g., the RLF between UE 205 and source MN 210), UE 205 performs a cell  
20 selection procedure, which further contributes to the delay.

[0126] However, aspects of the described techniques provide a fast recovery procedure in the event of an MCG link failure (e.g., an RLF occurs between UE 205 and source MN 210 and/or between UE 205 and SN 215). Although some aspects of the described techniques generally focus on the RLF being in MCG link failure, it is to be understood that the  
25 described techniques are not limited to an MCG link failure, but can also be utilized in the event of an SCG link failure between UE 205 and SN 215, e.g., UE 205 may utilize the MCG link to initiate a handover procedure with a target node as a new SN.

[0127] Broadly, the described techniques may include UE 205 detecting an MCG link failure (e.g., an RLF) between UE 205 and source MN 210. UE 205 may leverage its  
30 connection with SN 215 to resolve the MCG link failure using, for example, a handover procedure of UE 205 from source MN 210 to target MN 225. For example, UE 205 may

transmit or otherwise provide an indication to SN 215 of the RLF. In some aspects, this may include UE 205 transmitting or otherwise providing an RRC MCG failure notification message via SN 215 to source MN 210. This indication may be provided, for example, via a split SRB1 bearer and/or an SRB3 bearer between UE 205 and SN 215. The SN 215 may  
5 transmit or otherwise provide the indication of the RLF to source MN 210 (e.g., over a backhaul link). Upon receiving the MCG failure notification message (e.g., the indication of the RLF), source MN 210 may initiate an inter-MN handover procedure to handover UE 205 to a target node (such as target MN 225). Accordingly, source MN 210 and/or UE 205 may perform a handover procedure of UE 205 to target MN 225.

10 [0128] In some aspects, UE 205 may utilize a split bearer (e.g., a split SRB1) to provide the indication of the RLF to SN 215. For example, source MN 210 may pre-configure UE 205 to provide RLF indication information to SN 215. In some aspects, UE 205 may additionally indicate a cause for the RLF, e.g., an RLF detection on a MCG, a handover failure, and the like. Accordingly, UE 205 may use an SCG SRB to carry or convey the  
15 indication of the RLF to SN 215.

[0129] In some aspects, UE 205 may determine that target MN 225 is unavailable for a handover procedure. For example, UE 205 may perform various channel measurements to monitor performance of the radio links between UE 205 and source MN 210 and/or SN 215. UE 205 may also monitor for, during such channel measurements, candidate nodes that are  
20 suitable for establishing connections with. If network determines that a target node is unavailable, UE 205 may be handed over from source MN 210 to SN 215 when an MCG RLF is detected, with the SN 215 becoming the new MN for UE 205. In that sense, SN 215 would become a new MN for UE 205. In some aspects, this may include configuring SN 215 as a single-connectivity configuration, or configuring SN 215 as a dual-connectivity  
25 configuration where UE 205 may connect to a new SN (not shown) to continue to operate in a dual-connectivity configuration.

[0130] In some aspects, and RLF may also occur for the radio link between UE 205 and SN 215 (e.g., an SCG RLF). If the RLF is detected before UE 205 is able to transmit the indication of the MCG RLF, UE 205 may perform an RRC reestablishment procedure with  
30 source MN 210 and/or SN 215. In some aspects, UE 205 may perform an RRC connection establishment procedure with target MN 225 in the event an MCG RLF and an SCG RLF is

detected. If the SCG RLF is detected after UE 205 transmits the indication of the MCG RLF, UE 205 may attempt to perform an RRC connection reestablishment procedure with source MN 210 and/or SN 215. Again, in some aspects UE 205 may perform an RRC connection establishment procedure with target MN 225 in the event that an MCG RLF and an SCG RLF is detected.

- [0131] In some aspects, the MCG RLF may be detected while UE 205 is involved in a handover procedure from SN 215 to a new SN (not shown). In this event, UE 205 may transmit the indication of the MCG RLF to SN 215 and/or the new SN, e.g., depending upon which phase of the SN handover procedure has been completed.
- 10 [0132] In some aspects, SN 215 may forward the indication of the RLF (e.g., the indication of the MCG RLF) to source MN 210 using a variety of mechanisms. In some aspects, the approach adopted by SN 215 may be dependent upon the mechanism by which UE 205 provides the indication of the RLF to SN 215. For example, when UE 205 utilizes an SRB1 to provide the indication of the RLF, SN 215 may decode the message conveyed over the SRB1 to determine that the MCG RLF is being indicated. In this context, SN 215 may generate a new message (e.g., a second message) for transmitting the indication of the RLF to source MN 210. In another example, UE 205 may utilize an SRB3 for providing the indication of the MCG RLF to SN 215. In this context, SN 215 may encapsulate the indication for forwarding to source MN 210, e.g., according to an Xn and/or X2 protocol.
- 15 [0133] Source MN 210 generally receives the indication of the MCG RLF from SN 215 and performs a handover of UE 205 to target MN 225. In some aspects, source MN 210 may identify the target node (e.g., target MN 225) based on the indication of the RLF. For example, source MN 210 may identify the target node based on measurement report(s) conveyed in the indication, and select the target node (e.g., select target MN 225) based on the measurement report(s). In some aspects, source MN 210 may identify the target node based on whether or not the target node (e.g., target MN 225) operates utilizing the same RAT or a different RAT, the same radio frequency spectrum band or a different radio frequency spectrum band, and the like, as source MN 210. Accordingly, source MN 210 may select a target node that supports continued operation in a dual-connectivity configuration, when available.
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[0134] In some aspects, the target node (e.g., target MN 225) may be associated with the same base station as source MN 210. For example, the base station may have a control unit (CU) that manages one or more distribution units (DUs). Source MN 210 may be a first DU of the base station and target MN 225 may be a second DU of the base station. In this context, the CU may manage one or aspects of performing a handover of UE 205 from the first DU (e.g., source MN 210) to the second DU (e.g., target MN 225) of the base station. In other aspects, target MN 225 (e.g., the target node) may be a separate entity with respect to source MN 210 and/or SN 215.

[0135] Accordingly, aspects of the described techniques provide a mechanism where UE 205 recovers from an MCG RLF (and/or an SCG RLF) by performing a handover procedure rather than the conventional RRC-based and/or RLF recovery-based techniques. The described fast RLF recovery procedure improves the recovery time and minimizes downtime for wireless communications.

[0136] In some aspects, handling of additional scenarios and error cases may also be addressed. For example, in one case where the target MN 225 is connected to a different RAT than the source MN (e.g., change from EN-DC to NR-DC, or source MN 210 is an eNB and target MN 225 is a gNB), an inter-system handover procedure may be invoked. In the situation where an inter-MN handover procedure to the target MN 225 fails because of MCG failure, UE 205 may transmit or otherwise provide an MCG failure information message to the SNs to trigger the described fast recovery procedure. If there is an SCG link failure (e.g., if UE 205 detects SCG RLF) after SN 215 reports MCG failure, then UE 205 may perform an RRC reestablishment procedure. If UE 205 detects simultaneous failure of SCG and MCG links, then UE 205 may initiate an RRC reestablishment procedure. If source MN 210 fails during SN change (e.g., during an SN handover procedure), UE 205 may transmit or otherwise provide an MCG RLF report to the target SN if the related signaling is complete, e.g., target SN receive the reconfiguration complete message. If UE 205 does not succeed in sending reconfiguration complete message to the target SN and MCG RLF occurs, UE 205 may perform a reestablishment procedure.

[0137] FIGs. 3A and 3B illustrate an example of a process 300 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. FIG. 3B is a continuation of FIG. 3A. In some examples, process 300 may

implement aspects of wireless communication systems 100 and/or 200. Aspects of process 300 may be implemented by UE 302, an SN 304, a source MN 306, a target MN 308, the UPF 310, and/or an access and mobility management function (AMF) 312, which may be examples of the corresponding devices described herein. In some aspects, the UPF 310 and/or AMF 312 may be one or more functions operating within a core network. Aspects of process 300 may be implemented or otherwise triggered when UE 302 detects failure of the MCG link. In some aspects, UE 302 may identify or otherwise determine that target MN 308 is available, e.g., based on one or more channel measurements performed by UE 302.

[0138] At 314, UE 302 may detect an RLF. In some aspects, the RLF may refer to an MCG failure or an MCG RLF for a radio link between UE 302 and source MN 306. In some aspects, the RLF may be detected based on one or more channel measurements performed by UE 302.

[0139] At 316, UE 302 may transmit or otherwise provide an indication of the RLF to SN 304. In some aspects, the indication of the RLF may be carried or conveyed in an MCG failure information or notification message. In some aspects, UE 302 may carry or convey an indication of a measurement report and/or an MCG link failure cause to SN 304.

[0140] In some aspects, UE 302 may transmit or otherwise provide the indication of the RLF using a bearer carrying or conveying an RRC MCG failure information or notification message. This may include the message being transmitted over a split SRB1 and/or an SRB3. When a split SRB1 has been established, UE 302 may use this bearer for providing the indication of the RLF. In some aspects, source MN 306 may have indicated or otherwise configured UE 302 (e.g., through previous RRC signaling) that for split SRB1, UE 302 may utilize the SN path in the case of MCG link failure. If SRB3 has been configured, UE 302 may use this bearer as an alternative. If SRB3 is used, SN 304 may encapsulate the message in an X2/Xn message (e.g., new container or message) and then transmit this to source MN 306.

[0141] In some aspects, the indication of the RLF (e.g., the MCG failure information message) may carry or convey a measurement report and/or an MCG link failure cause. Examples of the MCG link failure cause may include, but are not limited to, an RLF detection on the MCG link and/or a handover failure (e.g., expiration of a T304 timer).

[0142] At 318, SN 304 may transmit or otherwise provide an indication of the RLF to source MN 306. At 320, source MN 306 may make a handover decision. In some aspects, source MN 306 may determine or otherwise decide to perform the handover based on the measurement report. Accordingly, source MN 306 may determine to initiate an inter-MN  
5 handover procedure of UE 302.

[0143] At 322, source MN may 306 transmit a handover request message to target MN 308. In some aspects, the handover request message may carry or convey UE configuration information for UE 302, e.g., radio configuration information, quality of service (QoS) requirements, bearer configuration information, and the like. In some aspects, the handover  
10 request message may carry or convey an indication of UE 302 context in the source MN 306 and/or SN 304, SN ID (e.g., an identifier for SN 304), a target cell ID (e.g., an identifier for target MN 308), and/or an SN UE Xn application protocol (XnAP) ID.

[0144] At 324, target MN 308 may perform admission control for the handover. In some aspects, admission control may be performed by the target MN 308, e.g., utilizing the QoS  
15 and/or bearer information carried or conveyed in the handover request message.

[0145] At 326, target MN 308 may transmit or otherwise provide an SN addition request message to SN 304. In some aspects, this may include target MN 308 requesting SN 304 to provide SCG configuration information using the SN addition request message. The SN  
20 addition request message may carry or convey the SN UE XnAP ID as a reference to the UE context with SN 304 that was established by the source MN 306.

[0146] At 328, SN 304 may transmit or otherwise provide an indication of an SN addition request acknowledgment to target MN 308. At 330, target MN 308 may transmit or otherwise provide an indication of a handover request acknowledgment message to source MN 306. In  
25 some aspects, the handover request acknowledgment message may include a container, or otherwise be included in a container, along with an RRC handover message to be sent to UE 302. In some aspects, this may include target MN 308 configuring the handover request acknowledge message to carry or convey the handover command message (e.g., RRCConnectionReconfiguration) to be transmitted by SN 304 to UE 302.

[0147] At 332, source MN 306 may transmit or others provide a handover message to SN  
30 304. In some aspects, the handover message may include a container, or be in a container, along with an RRC message to be sent to the UE 302.

[0148] At 334, source MN 306 may transmit or otherwise provide an indication of an SN release request to SN 304. In some aspects, this may include the SN release request message carrying or conveying an indication that SN 304 shall not release the UE context associated with the target MN 308. At 336, SN 304 may transmit or otherwise provide an indication of an SN release request acknowledgment message to source MN 306.

[0149] At 338, SN 304 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration message to UE 302. In some aspects, the RRCConnectionReconfiguration message may carry or convey an indication of UE MCG and SCG configuration for subsequent communications with target MN 308 and SN 304. In some aspects, the RRCConnectionReconfiguration message may carry or convey an indication of information for UE 302 to use for generating new security keys.

[0150] At 340, UE 302 may perform a RACH procedure on target MN 308. In some aspects, this may include UE 302 obtaining synchronization and access information from the target MN 308.

[0151] At 342, UE 302 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration complete message to target MN 308. In some aspects, the RRCConnectionReconfiguration complete message may carry or convey an indication of a successful handover to target MN 308.

[0152] At 344, target MN 308 may transmit or otherwise provide an indication of an SN reconfiguration complete message to SN 304. In some aspects, this may include target MN 308 indicating success of MCG configuration set up to SN 304 using the SN reconfiguration complete message.

[0153] At 346, source MN 306 may optionally transmit or otherwise provide an indication of an SN status transfer message to target MN 308. In some aspects, for bearers using radio link control (RLC) acknowledgment mode (AM), source MN 306 may provide a PDCP SN status information using the SN status transfer message.

[0154] At 348, UPF 310 may transmit or otherwise perform data forwarding to source MN 306. At 350, source MN 306 may transmit or otherwise perform data forwarding to target MN 308. In some aspects, this may include data transmitted to the source MN 306 being transmitted or otherwise provided to the target MN 308.

[0155] At 352, source MN 306 may transmit or otherwise provide an indication of a PDU session path switch request to AMF 312. At 354, UPF 310 and AMF 312 may perform bearer modifications, e.g., modify bearer(s) based at least in part on the MCG RLF and subsequent handover. At 356, UPF 310 may optionally transmit or otherwise provide an indication of a new path (e.g., a split bearer and/or MCG bearer) to target MN 308. At 358, UPF 310 may optionally transmit or otherwise provide an indication of a new path (e.g., a split bearer and/or MCG bearer) to SN 304. At 360, AMF 312 may transmit or otherwise provide an indication of the PDU session path switch request acknowledgment to target MN 308. In some aspects, this may include a PDU session path switch procedure being carried out in order to switch the data path towards the target MN 308.

[0156] At 362, target MN 308 may transmit or otherwise provide an indication of a UE context release message to source MN 306. In some aspects, this may include target MN 308 initiating the UE context release procedure towards source MN 306.

[0157] At 364, source MN 306 may transmit or otherwise provide an indication of the UE context release message to SN 304. In some aspects, upon reception of the UE context release message from source MN 306, SN 304 may release control plane related resources associated with the UE context towards the source MN 306. In some aspects, the functions performed at 320-364 may be considered an inter-MN handover procedure.

[0158] FIG. 4 illustrates an example of a process 400 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. In some examples, process 400 may implement aspects of wireless communication systems 100 and/or 200. Aspects of process 400 may be implemented by UE 402, an SN 404, an MN 406, a mobility management entity (MME) 408, and/or core network (CN) elements 410, which may be examples of the corresponding devices described herein. Aspects of process 400 may be implemented or otherwise triggered when UE 402 detects failure of the MCG link. In some aspects, process 400 illustrates an example case where SN 404 may configure a single connection to itself when an MCG RLF occurs.

[0159] In some aspects, the measurement report provided by UE 402 may indicate that there is no available target node (e.g., no target MN) for MN 406 to perform a handover of UE 402 to. However, SN 404 may be able to configure a single connection to itself if SN 404 supports a control plane interface to the core network (e.g., NG-C/S1-C to AMF/MME), with

all of the control plane interface functionalities. Accordingly, the RLF fast recovery procedure in this context may include UE 402 transmitting the MCG failure information message (e.g., RLF indication) to MN 406 via SN 404 over a split SRB1 or SRB3. MN 406 processes the MCG failure information message and determines that there is no available target MNs, and decides whether or not to handover UE 402 to SN 404. Alternatively, SN 404 may process the MCG failure information message from UE 402 and forward a request for handover to MN 406. If MN 406 decides to perform a handover procedure, it may initiate an X2/Xn handover or inter-system handover to SN 404. The type of handover to be performed may depend on the case or configuration. For example, an inter-system handover from MN 406 SN 404 may be performed for E-UTRA-NR dual connectivity (EN-DC), NR-E-UTRA dual connectivity (NE-DC), and NG-RAN – E-UTRA dual connectivity (NGEN-DC) cases or configurations whereas an X2/Xn handover from MN 406 to SN 404 may be performed for NR-DC and LTE-DC changed from EN-DC to the case where an LTE eNB has user plane and control plane connections to the 5G core network. Process 400 generally illustrates a call flow for the EN-DC case.

[0160] At 412, UE 402 may detect an RLF. In some aspects, the RLF may refer to an MCG failure or an MCG RLF for a radio link between UE 402 and MN 406. In some aspects, the RLF may be detected based on one or more channel measurements performed by UE 402.

[0161] At 414, UE 402 may transmit or otherwise provide an indication of the RLF to SN 404. In some aspects, the indication of the RLF may be carried or conveyed in an MCG failure information or notification message. In some aspects, UE 402 may carry or convey an indication of a measurement report and/or an MCG link failure cause to SN 404.

[0162] In some aspects, UE 402 may transmit or otherwise provide the indication of the RLF using a bearer carrying or conveying an RRC MCG failure information or notification message. This may include the message being transmitted over a split SRB1 and/or an SRB3. When a split SRB1 has been established, UE 302 may use this bearer for providing the indication of the RLF. In some aspects, MN 306 may have indicated or otherwise configured UE 402 (e.g., through previous RRC signaling) that for split SRB1, UE 402 may utilize the SN path in the case of MCG link failure. If SRB3 has been configured, UE 402 may use this bearer as an alternative. If SRB3 is used, SN 404 may encapsulate the message in an X2/Xn message (e.g., new container or message) and then transmit this to MN 406. In some aspects,

the indication of the RLF (e.g., the MCG failure information message) may carry or convey a measurement report and/or an MCG link failure cause.

[0163] At 416, SN 404 may transmit or otherwise provide an indication of the RLF to MN 406. At 418, MN 406 may make a handover decision. In some aspects, MN 406 may determine or otherwise decide to perform the handover based on the measurement report. In this example, the measure report may indicate that there are no target MNs (or target nodes) available to perform a handover procedure. Accordingly, MN 406 may determine to handover UE 402 to SN 404.

[0164] At 420, MN 406, MME 408, and core network elements 410 may perform a handover procedure. In some aspects, a handover procedure may be from an evolved packet system (EPS) to a 5G system (5GS).

[0165] At 422, MME 408 may transmit a handover command message to MN 406. In some aspects, the handover command message may be container, or be included in a container, to be sent to UE 402 as an SN RRC message.

[0166] At 424, MN 406 may transmit or otherwise provide a handover command message to SN 404. Again, in some aspects the handover command message may be container, or be included in a container, to be sent to UE 402 as an RRC message.

[0167] At 426, SN 404 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration message to UE 402. In some aspects, this may carry or convey configuration information to be used by UE 402 for communications with SN 404 upon handover.

[0168] 428, UE 402 may perform a RACH procedure with SN 404. In some aspects, this may include UE 402 obtaining and synchronization and/or other configuration information from SN 404.

[0169] At 430, UE 402 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration complete message to SN 404. At 432, data forwarding from a source MN (e.g., MN 406) to SN 404 may be performed by SN 404, MN 406, MME 408, and/or CN elements 410. At 434, handover procedures may be completed by SN 404, MN 406, MME 408, and/or CN elements 410. In some aspects, the handover procedures may be from EPS to 5GS.

[0170] FIG. 5 illustrates an example of a process 500 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. In some examples, process 500 may implement aspects of wireless communication systems 100 and/or 200. Aspects of process 500 may be implemented by UE 502, an SN 504, an MN 506, an AMF 508, and/or a UPF 510, which may be examples of the corresponding devices described herein. Aspects of process 500 may be implemented or otherwise triggered when UE 502 detects failure of the MCG link. In some aspects, process 500 illustrates an example case where SN 504 may configure a single connection to itself when an MCG RLF occurs.

[0171] In some aspects, the measurement report provided by UE 502 may indicate that there is no available target node (e.g., no target MN) for MN 506 to perform a handover of UE 502 to. However, SN 504 may be able to configure a single connection to itself if SN 504 supports a control plane interface to the core network (e.g., NG-C/S1-C to AMF/MME), with all of the control plane interface functionalities. Accordingly, the RLF fast recovery procedure in this context may include UE 502 transmitting the MCG failure information message to MN 506 via SN 504 over a split SRB1 or SRB3. MN 506 processes the MCG failure information message determines that there is no available target MNs, and decides whether or not to handover UE 502 to SN 504. Alternatively, SN 504 may process the MCG failure information message from UE 502 and forward a request for handover to MN 506. If MN 506 decides to perform a handover procedure, it may initiate an X2/Xn handover or inter-system handover to SN 504. The type of handover to be performed may depend on the case or configuration. For example, an inter-system handover from MN 506 to SN 504 may be performed for EN-DC, NE-DC, and NGEN-DC cases or configurations whereas an X2/Xn handover from MN 506 to SN 504 may be performed for NR-DC and LTE-DC change from NE-DC to the case where an LTE eNB has user plane and control plane connections to the 5G core network. Process 500 generally illustrates a call flow for the NR-DC case.

[0172] At 512, UE 502 may detect an RLF. In some aspects, the RLF may refer to an MCG failure or an MCG RLF for a radio link between UE 502 and MN 506. In some aspects, the RLF may be detected based on one or more channel measurements performed by UE 502.

[0173] At 514, UE 502 may transmit or otherwise provide an indication of the RLF to SN 504. In some aspects, the indication of the RLF may be carried or conveyed in an MCG

failure information or notification message. In some aspects, UE 502 may carry or convey an indication of a measurement report and/or an MCG link failure cause to SN 504.

[0174] In some aspects, UE 502 may transmit or otherwise provide the indication of the RLF using a bearer carrying or conveying an RRC MCG failure information or notification message. This may include the message being transmitted over a split SRB1 and/or an SRB3.

[0175] At 516, SN 504 may transmit or otherwise provide an indication of the RLF to MN 506. At 518, MN 506 may make a handover decision. In some aspects, MN 506 may determine or otherwise decide to perform the handover based on the measurement report. In this example, the measure report may indicate that there are no target MNs (or target nodes) available to perform a handover procedure. Accordingly, MN 506 may determine to handover UE 502 to SN 504, where SN 504 transitions to a single-connectivity configuration.

[0176] At 520, MN 506 may transmit or provide an indication of a handover request message to SN 504. At 522, SN 504 may perform admission control procedures for the handover of UE 502. At 524, SN 504 may transmit or otherwise provide an indication of a handover request acknowledgment message to MN 506.

[0177] At 526, MN 506 may transmit or otherwise provide a handover command message to SN 504. In some aspects, the handover command message may be container, or may include a container, to be sent to UE 502 as an RRC message.

[0178] At 528, SN 504 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration message to UE 502. In some aspects, this may carry or convey configuration information to be used by UE 502 for communications with SN 504 upon handover.

[0179] At 530, UE 502 may perform a RACH procedure with SN 504. In some aspects, this may include UE 502 obtaining synchronization and/or other configuration information from SN 504. At 532, UE 502 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration complete message to SN 504. At 534, MN 506 may transmit or otherwise provide an indication of an SN transfer status message to SN 504.

[0180] At 536, data forwarding from a source MN (e.g., MN 506) to SN 504 may be performed by SN 504, MN 506, AMF 508, and/or UPF 510. At 538, path switch for the PDU session may be completed by SN 504, MN 506, AMF 508, and/or UPF 510. At 540, SN 504

may transmit or otherwise provide an indication of the UE context release message to MN 506.

[0181] FIGs. 6A and 6B illustrate an example of a process 600 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. FIG. 6B is generally a continuation of FIG. 6A. In some examples, process 600 may implement aspects of wireless communication systems 100 and/or 200. Aspects of process 600 may be implemented by UE 602, an SN 604, an MN 606, a target SN 608, a UPF 610, and/or an AMF 612, which may be examples of the corresponding devices described herein. Aspects of process 600 may be implemented or otherwise triggered when UE 602 detects failure of the MCG link. In some aspects, process 600 illustrates an example case where a DC configuration can be configured with SN 604 becoming a new MN and a new node (e.g., target SN 608) added as a new SN for UE 602.

[0182] In some aspects, the measurement report provided by UE 602 may indicate that there is no available target node (e.g., no target MN) for source MN 606 to perform a handover of UE 602 to. However, SN 604 may be able to be configured as a new MN for UE 602 if SN 604 supports the control plane interface to the core network (e.g., NG-C/S1-C to AMF/MME), with all of the control plane interface functionalities. Accordingly, the RLF fast recovery procedure in this context may include UE 602 performing a handover procedure from source MN 606 to SN 604, with SN 604 becoming a new MN for UE 602 and target SN 608 being added as a new SN for UE 602. The type of handover to be performed may depend on the case or configuration. For example, an inter-system handover from MN 606 to SN 604 may be performed for EN-DC to NE-DC or NR-DC and/or for NE-DC to EN-DC or LTE-DC change cases or configurations whereas an X2/Xn handover from MN 606 to SN 604 may be performed for NR-DC to NE-DC or ND-DC change, for NGEN-DC to NE-DC or NR-DC change, and/or for NE-DC to NGEN-DC change cases or configurations. Process 600 generally illustrates a call flow for the case where DC (e.g., dual-connectivity) can be configured with SN 604 becoming a new MN and a new node (e.g., target node 608) being added as a new SN for UE 602. It is to be understood that call flows for the other cases or configurations are similar.

[0183] At 614, UE 602 may detect an RLF. In some aspects, the RLF may refer to an MCG failure or an MCG RLF for a radio link between UE 602 and MN 606. In some aspects, the RLF may be detected based on one or more channel measurements performed by UE 602.

[0184] At 616, UE 602 may transmit or otherwise provide an indication of the RLF to SN 604. In some aspects, the indication of the RLF may be carried or conveyed in an MCG failure information or notification message. In some aspects, UE 602 may carry or convey an indication of a measurement report and/or an MCG link failure cause to SN 604.

[0185] In some aspects, UE 602 may transmit or otherwise provide the indication of the RLF using a bearer carrying or conveying an RRC MCG failure information or notification message. This may include the message being transmitted over a split SRB1 and/or an SRB3.

[0186] At 618, SN 604 may transmit or otherwise provide an indication of the RLF to source MN 606. At 620, source MN 606 may make a handover decision. In some aspects, source MN 606 may determine or otherwise decide to perform the handover based on the measurement report. In this example, the measure report may indicate that there are no target MNs (or target nodes) available to perform a handover procedure. Accordingly, MN 606 may determine to handover UE 602 to SN 604, with SN 604 becoming the new MN for UE 602 after the handover. In some aspects, the measurement report may identify target SN 608 (e.g., the target node in this context) as being available as a new SN for UE 602.

[0187] At 622, source MN 606 may transmit or provide an indication of a handover request message to SN 604. At 624, SN 604 may perform admission control procedures for the handover of UE 602. At 626, SN 604 may transmit or otherwise provide an indication of an SN addition request message to target SN 608. At 628, target SN 608 may transmit or otherwise provide an indication of an SN addition request acknowledgment message to SN 604.

[0188] At 630, SN 604 may transmit or otherwise provide a handover request acknowledgment message to source MN 606. At 632, source MN 606 may transmit or otherwise provide an indication of a handover command message to SN 604. In some aspects, the handover command message may be container, or may include a container, to be sent to UE 602 as an RRC message.

[0189] At 634, SN 604 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration message to UE 602. In some aspects, this may carry or convey configuration information to be used by UE 602 for communications with SN 604 upon handover.

5 [0190] At 636, UE 602 may perform a RACH procedure with SN 604. In some aspects, this may include UE 602 obtaining synchronization and/or other configuration information from SN 604.

[0191] At 638, UE 602 may transmit or otherwise provide an indication of an RRCConnectionReconfiguration complete message to SN 604. At 640, source MN 606 may  
10 transmit or otherwise provide an indication of an SN transfer status message to SN 604.

[0192] At 642, data forwarding from a MN (e.g., source MN 606) to SN 604 may be performed by SN 604, source MN 606, target SN 608, UPF 610, and/or AMF 612. At 644, UE 602 may perform a RACH procedure with target SN 608. In some aspects, this may include UE 602 obtaining synchronization and/or other configuration information for  
15 performing wireless communications with target SN 608 after the handover procedure. At 646, SN 604 may transmit or otherwise provide an indication of an SN reconfiguration complete message to target SN 608.

[0193] At 648, path switch for the PDU session may be completed by SN 604, source MN 606, target SN 608, UPF 610, and/or AMF 612. At 650, SN 604 may transmit or  
20 otherwise provide an indication of the UE context release message to source MN 606.

[0194] FIGs. 7A and 7B illustrate an example of a process 700 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. FIG. 7B is generally a continuation of FIG. 7A. In some examples, process 700 may implement aspects of wireless communication systems 100 and/or 200.  
25 Aspects of process 700 may be implement by UE 702, an SN 704, a source MN-DU 706, a target MN-DU 708, and/or an MN-CU 710, which may be examples of the corresponding devices described herein. Generally, the source MN-DU 706, target MN-DU 708 and/or the MN-CU 710 may be associated with a base station, such as a gNB or MN. Aspects of process 700 may be implemented or otherwise triggered when UE 702 detects failure of the MCG  
30 link. In some aspects, process 700 illustrates an example case for a RAN architecture involving a split gNB, e.g., the source MN-DU 706, target MN-DU 708, and MN-CU 710.

[0195] Broadly, process 700 illustrates an example where UE 702 experiences an RLF on the link to a serving gNB-DU (e.g., source MN-DU 706). Based on the measure report received in the MCG failure information message, MN-CU 710 may determine that UE 702 should be handed over to another GNB-DU (e.g., to target MN-DU 708). Process 700

5 illustrates an example call flow for a NR-DC case, with other cases having similar call flows.

[0196] At 712, UE 702 may detect an RLF. In some aspects, the RLF may refer to an MCG failure or an MCG RLF for a radio link between UE 702 and source MN-DU 706. In some aspects, the RLF may be detected based on one or more channel measurements performed by UE 702.

10 [0197] At 714, UE 702 may transmit or otherwise provide an indication of the RLF to SN 704. In some aspects, the indication of the RLF may be carried or conveyed in an MCG failure information or notification message. In some aspects, UE 702 may carry or convey an indication of a measurement report and/or an MCG link failure cause to MN-CU 710.

15 [0198] In some aspects, UE 702 may transmit or otherwise provide the indication of the RLF using a bearer carrying or conveying an RRC MCG failure information or notification message. This may include the message being transmitted over a split SRB1 and/or an SRB3.

[0199] At 716, SN 704 may transmit or otherwise provide an indication of the RLF to source MN-CU 710. At 718, MN-CU 710 may make a handover decision based on the indication of the RLF, e.g., based on the measurement report, RLF cause, and the like.

20 [0200] At 720, MN-CU 710 may transmit or otherwise provide a UE context setup request message to target MN-DU 708. At 722, target MN-DU 708 may transmit or otherwise provide an indication of the UE context setup response message to MN-CU 710. At 724, MN-CU 710 may transmit or otherwise provide an indication of a UE context modification request message to source MN-DU 706. At 726, MN-CU 710 may transmit or otherwise  
25 provide an indication of an SN addition request message to SN 704. The 728, MN-CU 710 may transmit or otherwise provide an indication of a handover command message to SN 704. Again, the handover command message may be a container, or may include a container, including an indication of an RRC message for UE 702. The 730, SN 704 may transmit or otherwise provides an indication of an RRCConnectionReconfiguration message to UE 702.

[0201] At 732, source MN-DU 706 may transmit or otherwise provide an indication of the downlink data delivery status message to MN-CU 710. At 734, source MN-DU 706 may transmit or otherwise provide an indication of a UE context modification response message to MN-CU 710.

5 [0202] At 736, UE 702 may perform a RACH procedure with target MN-DU 708. In some aspects, this may include UE 702 obtaining synchronization and/or other configuration information for performing wireless communications with target MN-DU 708 after the handover procedure.

[0203] At 738, UE 702 may transmit or otherwise provide an indication of a  
10 RRCConnectionReconfiguration complete message to target MN-DU 708. At 740, MN-CU 710 may transmit or otherwise provide an indication of downlink user data to target MN-DU 708. At 742, target MN-DU 708 may transmit or otherwise provide an uplink RRC transfer message to MN-CU 710. At 744, a data transfer may resume for wireless communications between UE 702 and target MN-DU 708 and/or between UE 702 and SN 704. At 746, UE  
15 context release may be performed between source MN-DU 706, target MN-DU 708, and/or MN-CU 710.

[0204] FIGs. 8A and 8B illustrate an example of a process 800 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. FIG. 8B is generally a continuation of FIG. 8A. In some examples,  
20 process 800 may implement aspects of wireless communication systems 100 and/or 200. Aspects of process 800 may be implemented by UE 802, an SN 804, a source MN-DU 806, a source MN-CU 808, a target MN 810, a UPF 812, and/or an AMF 814, which may be examples of the corresponding devices described herein. Generally, the source MN-DU 806 and/or the source MN-CU 808 may be associated with a base station, such as a gNB or source  
25 MN. Aspects of process 800 may be implemented or otherwise triggered when UE 802 detects failure of the MCG link. In some aspects, process 800 illustrates an example case where for a RAN architecture involves a split gNB.

[0205] Broadly, process 800 illustrates an example where UE 802 experiences an RLF on the link to a serving gNB-DU (e.g., source MN-DU 806). Based on the measure report  
30 received in the MCG failure information message, source MN-CU 808 may determine that UE 802 should be handed over to a target node (e.g., to target MN 810).

[0206] At 816, UE 802 may detect an RLF. In some aspects, the RLF may refer to an MCG failure or an MCG RLF for a radio link between UE 802 and source MN-DU 806. In some aspects, the RLF may be detected based on one or more channel measurements performed by UE 802.

5 [0207] At 818, UE 802 may transmit or otherwise provide an indication of the RLF to SN 804. In some aspects, the indication of the RLF may be carried or conveyed in an MCG failure information or notification message. In some aspects, UE 802 may carry or convey an indication of a measurement report and/or an MCG link failure cause to source MN-CU 808.

10 [0208] In some aspects, UE 802 may transmit or otherwise provide the indication of the RLF using a bearer carrying or conveying an RRC MCG failure information or notification message. This may include the message being transmitted over a split SRB1 and/or an SRB3.

[0209] At 820, SN 804 may transmit or otherwise provide an indication of the RLF to source MN-CU 808. At 822, source MN-CU 808 may make a handover decision based on the indication of the RLF, e.g., based at least in part on the measurement report and/or RLF  
15 cause.

[0210] At 824, source MN-CU 808 may transmit or otherwise provide a UE context modification request message to source MN-DU 806. At 826, source MN-CU 808 may transmit or otherwise provide an indication of a handover request message to target MN 810.

20 [0211] At 828, target MN 810 may transmit or otherwise provide an indication of an SN addition request message to SN 804. At 830, SN 804 may respond by transmitting or otherwise providing an indication of an SN addition request acknowledgment message to target MN 804. At 832, target MN 810 may transmit or otherwise provide an indication of a handover request message to source MN-CU 808. At 832, source MN-CU 808 may transmit or otherwise provide an indication of a handover command message to SN 804. Again, the  
25 handover command message may be a container, or carry a container, conveying an indication of an RRC message for UE 802. At 834, source MN-CU 808 may transmit or otherwise provide an indication of a handover command message to SN 804. Again, the handover command message may be a container, or carry a container, including an indication of an RRC message for UE 802. At 836, SN 804 may transmit or otherwise provides an  
30 indication of an RRCConnectionReconfiguration message to UE 802.

[0212] At 838, source MN-DU 806 may transmit or otherwise provide an indication of the downlink data delivery status message to source MN-CU 808. At 840, source MN-DU 806 may transmit or otherwise provide an indication of a UE context modification request message to source MN-CU 808.

5 [0213] At 842, UE 802 may perform a RACH procedure with target MN 810. In some aspects, this may include UE 802 obtaining synchronization and/or other configuration information for performing wireless communications with target MN 810 after the handover procedure.

[0214] At 844, UE 802 may transmit or otherwise provide an indication of a  
10 RRCConnectionReconfiguration complete message to target MN 810. At 846, target MN 810 may transmit or otherwise provide an indication of SN reconfiguration complete message to SN 804. At 848, data forwarding may be performed from source MN-CU 808 to target MN 810. In some aspects, data forwarding may be accomplished by source MN-CU 808, target MN 810, UPF 812, and/or the AMF 814. At 850, the PDU path session switch may be  
15 performed by source MN-CU 808, target MN 810, UPF 812, and/or AMF 814. At 852, UE context release may be performed between source MN-DU 806, source MN-CU 808, and/or target MN 810.

[0215] FIG. 9 illustrates an example of a wireless communication system 900 that supports fast recovery from link failure in dual-connectivity systems in accordance with  
20 aspects of the present disclosure. In some examples, wireless communication system 900 may implement aspects of wireless communication systems 100 and/or 200 and/or processes 300, 400, 500, 600, 700, and/or 800. Aspects of wireless communication system 900 may be performed by a UE 905, a source MN 910, a first SN 915, a second SN 920, a core network 925, and/or a target MN 930, which may be examples of corresponding devices described  
25 herein. Generally, wireless communication 900 illustrates an example DC with one MN and two or more SNs. In some aspects, the first SN 915 and/or the second SN 920 may be configured for communications with source MN 910 via one or more backhaul links, such as an X2/Xn protocol link.

[0216] As discussed, UE 905 may detect or otherwise determine that an RLF (e.g., an  
30 MCG RLF) has occurred for a radio link between UE 905 and source MN 910. In some aspects, UE 905 may perform one or more channel measurements to detect or otherwise

determine that the RLF has occurred. In some aspects, UE 905 may identify target MN 930 during one or more of the channel measurements and determine that target MN 930 would be a suitable candidate for establishing a radio link with.

[0217] Upon detecting the RLF, UE 905 may generally transmit or otherwise provide an indication of the RLF to an SN (e.g., the first SN 915), for forwarding to the source MN 910. As discussed, the SN may generally transmit the indication by encapsulating it according to an X2/Xn protocol and/or by generating its own message for transmission of the RLF indication to source MN 910. Upon receiving the indication of the RLF, source MN 910 would make a handover decision to perform a handover procedure of UE 905 to target MN 930.

[0218] Broadly, wireless communication system 900 illustrates multiple options for UE 905 to transmit the indication of the RLF (e.g., the failure report message) to source MN 910.

[0219] In the situation where there is at least one SN through which a split SRB1 is configured, UE 905 may transmit the indication of the RLF to each of the SNs with the configured SIB1 (e.g., to both the first SN 915 and the second SN 920). In some aspects, this may improve reliability, but at the cost of increased signaling. In another example, UE 905 may transmit the indication of the RLF to the strongest SN (e.g., the SN having the most reliable and/or capable radio link). In some aspects, this may improve signaling efficiency, but at the cost of reliability.

[0220] In the situation where there is no split SRB1 configured, but there is at least one SN with SRB3 configured, the UE 905 may transmit the indication of the RLF to each of the SNs with the configured SRB3 (e.g., to both of the first SN 915 and the second SN 920). Again, this may improve reliability, but at the cost of increased signaling. In another example, UE 905 may transmit the indication of the RLF to the strongest SN. Also, this may improve signaling efficiency, but at the cost of reliability.

[0221] FIG. 10 shows a block diagram 1000 of a device 1005 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The device 1005 may be an example of aspects of a UE 115 as described herein. The device 1005 may include a receiver 1010, a communications manager 1015, and a transmitter 1020. The device 1005 may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0222] The receiver 1010 may receive information such as packets, user data, or control information associated with various information channels (e.g., control channels, data channels, and information related to fast recovery from link failure in dual-connectivity systems, etc.). Information may be passed on to other components of the device 1005. The receiver 1010 may be an example of aspects of the transceiver 1320 described with reference to FIG. 13. The receiver 1010 may utilize a single antenna or a set of antennas.

[0223] The communications manager 1015 may detect a RLF between the UE and a MN of a dual-connectivity configuration, transmit, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred, and perform, based on the RLF indication, a handover procedure from the MN to a target node. The communications manager 1015 may be an example of aspects of the communications manager 1310 described herein.

[0224] The communications manager 1015, or its sub-components, may be implemented in hardware, code (e.g., software or firmware) executed by a processor, or any combination thereof. If implemented in code executed by a processor, the functions of the communications manager 1015, or its sub-components may be executed by a general-purpose processor, a DSP, an application-specific integrated circuit (ASIC), a FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described in the present disclosure.

[0225] The communications manager 1015, or its sub-components, may be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations by one or more physical components. In some examples, the communications manager 1015, or its sub-components, may be a separate and distinct component in accordance with various aspects of the present disclosure. In some examples, the communications manager 1015, or its sub-components, may be combined with one or more other hardware components, including but not limited to an input/output (I/O) component, a transceiver, a network server, another computing device, one or more other components described in the present disclosure, or a combination thereof in accordance with various aspects of the present disclosure.

[0226] The transmitter 1020 may transmit signals generated by other components of the device 1005. In some examples, the transmitter 1020 may be collocated with a receiver 1010 in a transceiver module. For example, the transmitter 1020 may be an example of aspects of

the transceiver 1320 described with reference to FIG. 13. The transmitter 1020 may utilize a single antenna or a set of antennas.

[0227] FIG. 11 shows a block diagram 1100 of a device 1105 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The device 1105 may be an example of aspects of a device 1005, or a UE 115 as described herein. The device 1105 may include a receiver 1110, a communications manager 1115, and a transmitter 1135. The device 1105 may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0228] The receiver 1110 may receive information such as packets, user data, or control information associated with various information channels (e.g., control channels, data channels, and information related to fast recovery from link failure in dual-connectivity systems, etc.). Information may be passed on to other components of the device 1105. The receiver 1110 may be an example of aspects of the transceiver 1320 described with reference to FIG. 13. The receiver 1110 may utilize a single antenna or a set of antennas.

[0229] The communications manager 1115 may be an example of aspects of the communications manager 1015 as described herein. The communications manager 1115 may include a RLF detection manager 1120, a RLF indication manager 1125, and a HO manager 1130. The communications manager 1115 may be an example of aspects of the communications manager 1310 described herein.

[0230] The RLF detection manager 1120 may detect a RLF between the UE and a MN of a dual-connectivity configuration.

[0231] The RLF indication manager 1125 may transmit, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred.

[0232] The HO manager 1130 may perform, based on the RLF indication, a handover procedure from the MN to a target node.

[0233] The transmitter 1135 may transmit signals generated by other components of the device 1105. In some examples, the transmitter 1135 may be collocated with a receiver 1110 in a transceiver module. For example, the transmitter 1135 may be an example of aspects of the transceiver 1320 described with reference to FIG. 13. The transmitter 1135 may utilize a single antenna or a set of antennas.

[0234] FIG. 12 shows a block diagram 1200 of a communications manager 1205 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The communications manager 1205 may be an example of aspects of a communications manager 1015, a communications manager 1115, or a communications manager 1310 described herein. The communications manager 1205 may include a RLF detection manager 1210, a RLF indication manager 1215, a HO manager 1220, a split SRB manager 1225, a RLF cause manager 1230, a SCG SRB manager 1235, a connectivity configuration manager 1240, a RLF recovery request manager 1245, a RRC reestablishment manager 1250, and a SN handover manager 1255. Each of these modules may communicate, directly or indirectly, with one another (e.g., via one or more buses).

[0235] The RLF detection manager 1210 may detect a RLF between the UE and a MN of a dual-connectivity configuration. In some examples, the RLF detection manager 1210 may determine that a radio link between the UE and the SN satisfies a performance threshold, where the indication of the RLF is transmitted to the SN based on the performance metric satisfying the threshold.

[0236] The RLF indication manager 1215 may transmit, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred. In some examples, the RLF indication manager 1215 may transmit, to each SN of a set of SNs associated with the UE, the indication of the RLF that further indicates a measurement report. In some cases, the indication of the RLF is transmitted in a RRC master control group link failure notification message, the RRC master control group link failure notification message including a measurement report and a master control group link failure cause.

[0237] The HO manager 1220 may perform, based on the RLF indication, a handover procedure from the MN to a target node. In some examples, the HO manager 1220 may configure the SN as a new MN for the UE in the dual connectivity configuration. In some examples, the HO manager 1220 may establish a new connection with a new SN in the dual connectivity configuration, the new SN being different from the SN. In some cases, an inter-RAT handover procedure or an inter-RAT handover procedure.

[0238] The split SRB manager 1225 may receive, prior to the detected RLF, a message from the MN designating the SN as a recipient of the indication of the RLF. In some cases, the indication of the RLF is transmitted to the SN using a split SRB.

[0239] The RLF cause manager 1230 may indicate a cause of the RLF. In some cases, a cause may include an RLF detection on a master cell group link or a handover failure.

[0240] The SCG SRB manager 1235 may manage one or more aspects of the indication of the RLF being transmitted to the SN using a secondary cell group SRB.

5 [0241] The connectivity configuration manager 1240 may transition from the dual connectivity configuration to a single connectivity configuration with the SN.

[0242] The RLF recovery request manager 1245 may determine that the handover procedure was unsuccessful. In some examples, the RLF recovery request manager 1245 may transmit a RLF recovery request message to the SN. In some examples, the RLF recovery  
10 request manager 1245 may perform a RLF recover procedure, based on the RLF recovery request message, with the MN.

[0243] The RRC reestablishment manager 1250 may detect, after transmitting the indication of the RLF to the SN, a RLF between the UE and the SN. In some examples, the RRC reestablishment manager 1250 may perform a RRC reestablishment procedure. In some  
15 examples, the RRC reestablishment manager 1250 may detect, before transmitting the indication of the RLF, a RLF between the UE and the SN. In some examples, the RRC reestablishment manager 1250 may perform a RRC reestablishment procedure.

[0244] The SN handover manager 1255 may detect the RLF during a SN handover procedure from the SN to a new SN. In some examples, the SN handover manager 1255 may  
20 transmit the indication of the RLF to the new SN. In some examples, the SN handover manager 1255 may determine, based on a measurement report, that the target node is unavailable for performing the handover procedure. In some examples, the SN handover manager 1255 may perform the handover procedure from the MN to the SN, where the SN becomes a new MN based on the handover procedure.

25 [0245] FIG. 13 shows a diagram of a system 1300 including a device 1305 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The device 1305 may be an example of or include the components of device 1005, device 1105, or a UE 115 as described herein. The device 1305 may include components for bi-directional voice and data communications including components for  
30 transmitting and receiving communications, including a communications manager 1310, an

I/O controller 1315, a transceiver 1320, an antenna 1325, memory 1330, and a processor 1340. These components may be in electronic communication via one or more buses (e.g., bus 1345).

[0246] The communications manager 1310 may detect a RLF between the UE and a MN of a dual-connectivity configuration, transmit, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred, and perform, based on the RLF indication, a handover procedure from the MN to a target node.

[0247] The I/O controller 1315 may manage input and output signals for the device 1305. The I/O controller 1315 may also manage peripherals not integrated into the device 1305. In some cases, the I/O controller 1315 may represent a physical connection or port to an external peripheral. In some cases, the I/O controller 1315 may utilize an operating system such as iOS®, ANDROID®, MS-DOS®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system. In other cases, the I/O controller 1315 may represent or interact with a modem, a keyboard, a mouse, a touchscreen, or a similar device. In some cases, the I/O controller 1315 may be implemented as part of a processor. In some cases, a user may interact with the device 1305 via the I/O controller 1315 or via hardware components controlled by the I/O controller 1315.

[0248] The transceiver 1320 may communicate bi-directionally, via one or more antennas, wired, or wireless links as described above. For example, the transceiver 1320 may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver 1320 may also include a modem to modulate the packets and provide the modulated packets to the antennas for transmission, and to demodulate packets received from the antennas.

[0249] In some cases, the wireless device may include a single antenna 1325. However, in some cases the device may have more than one antenna 1325, which may be capable of concurrently transmitting or receiving multiple wireless transmissions.

[0250] The memory 1330 may include RAM and ROM. The memory 1330 may store computer-readable, computer-executable code 1335 including instructions that, when executed, cause the processor to perform various functions described herein. In some cases, the memory 1330 may contain, among other things, a BIOS which may control basic

hardware or software operation such as the interaction with peripheral components or devices.

[0251] The processor 1340 may include an intelligent hardware device, (e.g., a general-purpose processor, a DSP, a CPU, a microcontroller, an ASIC, an FPGA, a programmable logic device, a discrete gate or transistor logic component, a discrete hardware component, or any combination thereof). In some cases, the processor 1340 may be configured to operate a memory array using a memory controller. In other cases, a memory controller may be integrated into the processor 1340. The processor 1340 may be configured to execute computer-readable instructions stored in a memory (e.g., the memory 1330) to cause the device 1305 to perform various functions (e.g., functions or tasks supporting fast recovery from link failure in dual-connectivity systems).

[0252] The code 1335 may include instructions to implement aspects of the present disclosure, including instructions to support wireless communications. The code 1335 may be stored in a non-transitory computer-readable medium such as system memory or other type of memory. In some cases, the code 1335 may not be directly executable by the processor 1340 but may cause a computer (e.g., when compiled and executed) to perform functions described herein.

[0253] FIG. 14 shows a block diagram 1400 of a device 1405 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The device 1405 may be an example of aspects of a base station 105 as described herein. The device 1405 may include a receiver 1410, a communications manager 1415, and a transmitter 1420. The device 1405 may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

[0254] The receiver 1410 may receive information such as packets, user data, or control information associated with various information channels (e.g., control channels, data channels, and information related to fast recovery from link failure in dual-connectivity systems, etc.). Information may be passed on to other components of the device 1405. The receiver 1410 may be an example of aspects of the transceiver 1720 described with reference to FIG. 17. The receiver 1410 may utilize a single antenna or a set of antennas.

[0255] The communications manager 1415 may receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and

transmit an indication of the RLF to the MN of the dual-connectivity configuration. The communications manager 1415 may also receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN, identify, based on the RLF, a target node for the UE, and perform a  
5 handover procedure of the UE from the MN to the target node. The communications manager 1415 may be an example of aspects of the communications manager 1710 described herein.

[0256] The communications manager 1415, or its sub-components, may be implemented in hardware, code (e.g., software or firmware) executed by a processor, or any combination thereof. If implemented in code executed by a processor, the functions of the communications  
10 manager 1415, or its sub-components may be executed by a general-purpose processor, a DSP, an application-specific integrated circuit (ASIC), a FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described in the present disclosure.

[0257] The communications manager 1415, or its sub-components, may be physically  
15 located at various positions, including being distributed such that portions of functions are implemented at different physical locations by one or more physical components. In some examples, the communications manager 1415, or its sub-components, may be a separate and distinct component in accordance with various aspects of the present disclosure. In some examples, the communications manager 1415, or its sub-components, may be combined with  
20 one or more other hardware components, including but not limited to an input/output (I/O) component, a transceiver, a network server, another computing device, one or more other components described in the present disclosure, or a combination thereof in accordance with various aspects of the present disclosure.

[0258] The transmitter 1420 may transmit signals generated by other components of the  
25 device 1405. In some examples, the transmitter 1420 may be collocated with a receiver 1410 in a transceiver module. For example, the transmitter 1420 may be an example of aspects of the transceiver 1720 described with reference to FIG. 17. The transmitter 1420 may utilize a single antenna or a set of antennas.

[0259] FIG. 15 shows a block diagram 1500 of a device 1505 that supports fast recovery  
30 from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The device 1505 may be an example of aspects of a device 1405, or a base station

105 as described herein. The device 1505 may include a receiver 1510, a communications manager 1515, and a transmitter 1535. The device 1505 may also include a processor. Each of these components may be in communication with one another (e.g., via one or more buses).

5 [0260] The receiver 1510 may receive information such as packets, user data, or control information associated with various information channels (e.g., control channels, data channels, and information related to fast recovery from link failure in dual-connectivity systems, etc.). Information may be passed on to other components of the device 1505. The receiver 1510 may be an example of aspects of the transceiver 1720 described with reference  
10 to FIG. 17. The receiver 1510 may utilize a single antenna or a set of antennas.

[0261] The communications manager 1515 may be an example of aspects of the communications manager 1415 as described herein. The communications manager 1515 may include a RLF indication manager 1520, a target node manager 1525, and a HO manager 1530. The communications manager 1515 may be an example of aspects of the  
15 communications manager 1710 described herein.

[0262] The RLF indication manager 1520 may receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and transmit an indication of the RLF to the MN of the dual-connectivity configuration. The RLF indication manager 1520 may receive, from a SN of a dual-connectivity configuration, an  
20 indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN.

[0263] The target node manager 1525 may identify, based on the RLF, a target node for the UE.

[0264] The HO manager 1530 may perform a handover procedure of the UE from the MN to the target node.

25 [0265] The transmitter 1535 may transmit signals generated by other components of the device 1505. In some examples, the transmitter 1535 may be collocated with a receiver 1510 in a transceiver module. For example, the transmitter 1535 may be an example of aspects of the transceiver 1720 described with reference to FIG. 17. The transmitter 1535 may utilize a single antenna or a set of antennas.

[0266] FIG. 16 shows a block diagram 1600 of a communications manager 1605 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The communications manager 1605 may be an example of aspects of a communications manager 1415, a communications manager 1515, or a communications manager 1710 described herein. The communications manager 1605 may include a RLF indication manager 1610, a SN handover manager 1615, a connectivity configuration manager 1620, a SRB1 manager 1625, a SRB3 manager 1630, a RLF recovery request manager 1635, a RLF cause manager 1640, a target node manager 1645, a HO manager 1650, and a SN configuration manager 1655. Each of these modules may communicate, directly or indirectly, with one another (e.g., via one or more buses).

[0267] The RLF indication manager 1610 may receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration. In some examples, the RLF indication manager 1610 may transmit an indication of the RLF to the MN of the dual-connectivity configuration. In some examples, the RLF indication manager 1610 may receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN. In some examples, the RLF indication manager 1610 may receive a backhaul container message that is encapsulated according to an Xn or X2 protocol. In some cases, the indication of the RLF is received using a split SRB. In some cases, the indication of the RLF is received using a secondary cell group SRB. In some cases, the indication of the RLF is received in a RRC master control group failure notification message. In some cases, a wireless transmission, a backhaul link, or a combination thereof. In some cases, the indication of the RLF is received from the SN using a split SRB. In some cases, a wireless transmission, a backhaul link between, or a combination thereof.

[0268] The target node manager 1645 may identify, based on the RLF, a target node for the UE. In some examples, the target node manager 1645 may decode a measurement report indicating the RLF, where the target node is identified based on the measurement report.

[0269] The HO manager 1650 may perform a handover procedure of the UE from the MN to the target node. In some examples, the HO manager 1650 may determine that the MN operates using a first radio frequency spectrum band. In some examples, the HO manager 1650 may determine that the target node operates using the first radio frequency spectrum

band, where the target node is identified based on the target node operating using the first radio frequency spectrum band. In some examples, the HO manager 1650 may determine that the MN operates using a first radio access technology. In some examples, the HO manager 1650 may determine that the target node operates using the first radio access technology, where the target node is identified based on the target node operating using the first radio access technology. In some cases, the target node is different from the MN and the SN. In some cases, the SN operates using at least one of the first radio frequency spectrum band, a second radio frequency spectrum band that is different from the first radio frequency spectrum band, or a combination thereof. In some cases, the SN operates using at least one of the first radio access technology, a second radio access technology that is different from the first radio access technology, or a combination thereof. In some cases, an inter-RAT handover procedure or an inter-RAT handover procedure.

[0270] The SN handover manager 1615 may configure the SN as a new MN for the UE in the dual-connectivity configuration. In some examples, the SN handover manager 1615 may determine that the MN is unavailable for transmitting the indication of the RLF. In some examples, the SN handover manager 1615 may determine that the SN is configured with a control plane interface with a core network. In some examples, the SN handover manager 1615 may perform, based on the control plane interface configuration, a handover procedure of the UE from the MN to the SN, where the SN becomes a new MN of the UE based on the handover procedure. In some examples, the SN handover manager 1615 may determine, based on the indication of the RLF, that a target node is unavailable for performing the handover procedure with the UE.

[0271] The connectivity configuration manager 1620 may transition from the dual-connectivity configuration to a single connectivity configuration with the UE. In some examples, the connectivity configuration manager 1620 may configure the SN as a new MN for the UE in at least one of the dual-connectivity configuration or a single-connectivity configuration. In some cases, the target node includes a second DU of a dual-DU configuration associated with the MN.

[0272] The SRB1 manager 1625 may receive the indication of the RLF in a first message over a SRB1. In some examples, the SRB1 manager 1625 may decode the first message to determine that the RLF on a master control group radio link has occurred. In some examples,

the SRB1 manager 1625 may transmit the indication of the RLF to the MN in a second message.

[0273] The SRB3 manager 1630 may receive the indication of the RLF over a SRB3, where transmitting the indication includes encapsulating the indication of the RLF in a backhaul container message for transmitting to the MN. In some cases, the backhaul container message is encapsulated according to an Xn or X2 protocol.

[0274] The RLF recovery request manager 1635 may receive, from the UE, a RLF recovery request message indicating that a handover procedure was unsuccessful. In some examples, the RLF recovery request manager 1635 may transmit, to the MN, an indication of the RLF recovery request message. In some examples, the RLF recovery request manager 1635 may receive, from the SN, an indication of a RLF recovery request message indicating that the handover procedure was unsuccessful. In some examples, the RLF recovery request manager 1635 may perform a RLF recovery procedure with the UE.

[0275] The RLF cause manager 1640 may manage one or more aspects of the indication of the RLF further indicating a cause for the RLF.

[0276] The SN configuration manager 1655 may transmit, prior to receiving the indication of the RLF, a message to the UE designating the SN as a recipient of the indication of the RLF. In some examples, the SN configuration manager 1655 may determine, based on the indication of the RLF, that the target node is unavailable for performing the handover procedure with the UE. In some examples, the SN configuration manager 1655 may determine that the SN is configured with a control plane interface with a core network. In some examples, the SN configuration manager 1655 may perform, based on the control plane interface configuration, a handover procedure of the UE to the SN, where the SN becomes a new MN of the UE based on the handover procedure.

[0277] FIG. 17 shows a diagram of a system 1700 including a device 1705 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The device 1705 may be an example of or include the components of device 1405, device 1505, or a base station 105 as described herein. The device 1705 may include components for bi-directional voice and data communications including components for transmitting and receiving communications, including a communications manager 1710, a network communications manager 1715, a transceiver 1720, an antenna 1725, memory 1730,

a processor 1740, and an inter-station communications manager 1745. These components may be in electronic communication via one or more buses (e.g., bus 1750).

- [0278] The communications manager 1710 may receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration and  
5 transmit an indication of the RLF to the MN of the dual-connectivity configuration. The communications manager 1710 may also receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the UE and the MN, identify, based on the RLF, a target node for the UE, and perform a handover procedure of the UE from the MN to the target node.
- 10 [0279] The network communications manager 1715 may manage communications with the core network (e.g., via one or more wired backhaul links). For example, the network communications manager 1715 may manage the transfer of data communications for client devices, such as one or more UEs 115.
- [0280] The transceiver 1720 may communicate bi-directionally, via one or more  
15 antennas, wired, or wireless links as described above. For example, the transceiver 1720 may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver 1720 may also include a modem to modulate the packets and provide the modulated packets to the antennas for transmission, and to demodulate packets received from the antennas.
- 20 [0281] In some cases, the wireless device may include a single antenna 1725. However, in some cases the device may have more than one antenna 1725, which may be capable of concurrently transmitting or receiving multiple wireless transmissions.
- [0282] The memory 1730 may include RAM, ROM, or a combination thereof. The memory 1730 may store computer-readable code 1735 including instructions that, when  
25 executed by a processor (e.g., the processor 1740) cause the device to perform various functions described herein. In some cases, the memory 1730 may contain, among other things, a BIOS which may control basic hardware or software operation such as the interaction with peripheral components or devices.
- [0283] The processor 1740 may include an intelligent hardware device, (e.g., a general-  
30 purpose processor, a DSP, a CPU, a microcontroller, an ASIC, an FPGA, a programmable

logic device, a discrete gate or transistor logic component, a discrete hardware component, or any combination thereof). In some cases, the processor 1740 may be configured to operate a memory array using a memory controller. In some cases, a memory controller may be integrated into processor 1740. The processor 1740 may be configured to execute computer-readable instructions stored in a memory (e.g., the memory 1730) to cause the device 1705 to perform various functions (e.g., functions or tasks supporting fast recovery from link failure in dual-connectivity systems).

[0284] The inter-station communications manager 1745 may manage communications with other base station 105, and may include a controller or scheduler for controlling communications with UEs 115 in cooperation with other base stations 105. For example, the inter-station communications manager 1745 may coordinate scheduling for transmissions to UEs 115 for various interference mitigation techniques such as beamforming or joint transmission. In some examples, the inter-station communications manager 1745 may provide an X2 interface within an LTE/LTE-A wireless communication network technology to provide communication between base stations 105.

[0285] The code 1735 may include instructions to implement aspects of the present disclosure, including instructions to support wireless communications. The code 1735 may be stored in a non-transitory computer-readable medium such as system memory or other type of memory. In some cases, the code 1735 may not be directly executable by the processor 1740 but may cause a computer (e.g., when compiled and executed) to perform functions described herein.

[0286] FIG. 18 shows a flowchart illustrating a method 1800 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The operations of method 1800 may be implemented by a UE 115 or its components as described herein. For example, the operations of method 1800 may be performed by a communications manager as described with reference to FIGs. 10 through 13. In some examples, a UE may execute a set of instructions to control the functional elements of the UE to perform the functions described below. Additionally or alternatively, a UE may perform aspects of the functions described below using special-purpose hardware.

[0287] At 1805, the UE may detect a RLF between the UE and a MN of a dual-connectivity configuration. The operations of 1805 may be performed according to the

methods described herein. In some examples, aspects of the operations of 1805 may be performed by a RLF detection manager as described with reference to FIGs. 10 through 13.

[0288] At 1810, the UE may transmit, to a SN in the dual-connectivity configuration, an indication that the RLF has occurred. The operations of 1810 may be performed according to the methods described herein. In some examples, aspects of the operations of 1810 may be performed by a RLF indication manager as described with reference to FIGs. 10 through 13.

[0289] At 1815, the UE may perform, based on the RLF indication, a handover procedure from the MN to a target node. The operations of 1815 may be performed according to the methods described herein. In some examples, aspects of the operations of 1815 may be performed by a HO manager as described with reference to FIGs. 10 through 13.

[0290] FIG. 19 shows a flowchart illustrating a method 1900 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present disclosure. The operations of method 1900 may be implemented by a base station 105 or its components as described herein. For example, the operations of method 1900 may be performed by a communications manager as described with reference to FIGs. 14 through 17. In some examples, a base station may execute a set of instructions to control the functional elements of the base station to perform the functions described below. Additionally or alternatively, a base station may perform aspects of the functions described below using special-purpose hardware.

[0291] At 1905, the base station may receive, from a UE, an indication of a RLF for a radio link between the UE and a MN of a dual-connectivity configuration. The operations of 1905 may be performed according to the methods described herein. In some examples, aspects of the operations of 1905 may be performed by a RLF indication manager as described with reference to FIGs. 14 through 17.

[0292] At 1910, the base station may transmit an indication of the RLF to the MN of the dual-connectivity configuration. The operations of 1910 may be performed according to the methods described herein. In some examples, aspects of the operations of 1910 may be performed by a RLF indication manager as described with reference to FIGs. 14 through 17.

[0293] FIG. 20 shows a flowchart illustrating a method 2000 that supports fast recovery from link failure in dual-connectivity systems in accordance with aspects of the present

disclosure. The operations of method 2000 may be implemented by a base station 105 or its components as described herein. For example, the operations of method 2000 may be performed by a communications manager as described with reference to FIGs. 14 through 17. In some examples, a base station may execute a set of instructions to control the functional elements of the base station to perform the functions described below. Additionally or  
5 alternatively, a base station may perform aspects of the functions described below using special-purpose hardware.

[0294] At 2005, the base station may receive, from a SN of a dual-connectivity configuration, an indication of a RLF from a UE, the RLF being for a radio link between the  
10 UE and the MN. The operations of 2005 may be performed according to the methods described herein. In some examples, aspects of the operations of 2005 may be performed by a RLF indication manager as described with reference to FIGs. 14 through 17.

[0295] At 2010, the base station may identify, based on the RLF, a target node for the UE. The operations of 2010 may be performed according to the methods described herein. In  
15 some examples, aspects of the operations of 2010 may be performed by a target node manager as described with reference to FIGs. 14 through 17.

[0296] At 2015, the base station may perform a handover procedure of the UE from the MN to the target node. The operations of 2015 may be performed according to the methods described herein. In some examples, aspects of the operations of 2015 may be performed by a  
20 HO manager as described with reference to FIGs. 14 through 17.

[0297] It should be noted that the methods described herein describe possible implementations, and that the operations and the steps may be rearranged or otherwise modified and that other implementations are possible. Further, aspects from two or more of the methods may be combined.

[0298] Techniques described herein may be used for various wireless communications systems such as code division multiple access (CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), orthogonal frequency division multiple access (OFDMA), single carrier frequency division multiple access (SC-FDMA), and other systems. A CDMA system may implement a radio technology such as CDMA2000,  
25 Universal Terrestrial Radio Access (UTRA), etc. CDMA2000 covers IS-2000, IS-95, and IS-856 standards. IS-2000 Releases may be commonly referred to as CDMA2000 1X, 1X, etc.  
30

IS-856 (TIA-856) is commonly referred to as CDMA2000 1xEV-DO, High Rate Packet Data (HRPD), etc. UTRA includes Wideband CDMA (WCDMA) and other variants of CDMA. A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM).

5 [0299] An OFDMA system may implement a radio technology such as Ultra Mobile Broadband (UMB), Evolved UTRA (E-UTRA), Institute of Electrical and Electronics Engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM, etc. UTRA and E-UTRA are part of Universal Mobile Telecommunications System (UMTS). LTE, LTE-A, and LTE-A Pro are releases of UMTS that use E-UTRA. UTRA, E-UTRA,  
10 UMTS, LTE, LTE-A, LTE-A Pro, NR, and GSM are described in documents from the organization named “3rd Generation Partnership Project” (3GPP). CDMA2000 and UMB are described in documents from an organization named “3rd Generation Partnership Project 2” (3GPP2). The techniques described herein may be used for the systems and radio technologies mentioned herein as well as other systems and radio technologies. While aspects  
15 of an LTE, LTE-A, LTE-A Pro, or NR system may be described for purposes of example, and LTE, LTE-A, LTE-A Pro, or NR terminology may be used in much of the description, the techniques described herein are applicable beyond LTE, LTE-A, LTE-A Pro, or NR applications.

[0300] A macro cell generally covers a relatively large geographic area (e.g., several  
20 kilometers in radius) and may allow unrestricted access by UEs with service subscriptions with the network provider. A small cell may be associated with a lower-powered base station, as compared with a macro cell, and a small cell may operate in the same or different (e.g., licensed, unlicensed, etc.) frequency bands as macro cells. Small cells may include pico cells, femto cells, and micro cells according to various examples. A pico cell, for example, may  
25 cover a small geographic area and may allow unrestricted access by UEs with service subscriptions with the network provider. A femto cell may also cover a small geographic area (e.g., a home) and may provide restricted access by UEs having an association with the femto cell (e.g., UEs in a closed subscriber group (CSG), UEs for users in the home, and the like). An eNB for a macro cell may be referred to as a macro eNB. An eNB for a small cell may be  
30 referred to as a small cell eNB, a pico eNB, a femto eNB, or a home eNB. An eNB may support one or multiple (e.g., two, three, four, and the like) cells, and may also support communications using one or multiple component carriers.

[0301] The wireless communications systems described herein may support synchronous or asynchronous operation. For synchronous operation, the base stations may have similar frame timing, and transmissions from different base stations may be approximately aligned in time. For asynchronous operation, the base stations may have different frame timing, and transmissions from different base stations may not be aligned in time. The techniques described herein may be used for either synchronous or asynchronous operations.

[0302] Information and signals described herein may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0303] The various illustrative blocks and modules described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a DSP, an ASIC, an FPGA, or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices (e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration).

[0304] The functions described herein may be implemented in hardware, software executed by a processor, firmware, or any combination thereof. If implemented in software executed by a processor, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Other examples and implementations are within the scope of the disclosure and appended claims. For example, due to the nature of software, functions described herein can be implemented using software executed by a processor, hardware, firmware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations.

[0305] 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 can be accessed by a general purpose or special purpose computer. By way of example, and not limitation, non-transitory computer-readable media may include random-access memory (RAM), read-only memory (ROM), electrically erasable programmable ROM (EEPROM), flash memory, compact disk (CD) ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transitory medium that can be used to carry or store desired program code means in the form of instructions or data structures and that can be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, include CD, laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above are also included within the scope of computer-readable media.

[0306] 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”) 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 exemplary 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.”

[0307] In the appended figures, similar components or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If just the first reference label is used in the specification, the description

is applicable to any one of the similar components having the same first reference label irrespective of the second reference label, or other subsequent reference label.

[0308] The description set forth herein, in connection with the appended drawings, describes example configurations and does not represent all the examples that may be  
5 implemented or that are within the scope of the claims. The term “exemplary” used herein means “serving as an example, instance, or illustration,” and not “preferred” or “advantageous over other examples.” The detailed description includes specific details for the purpose of providing an understanding of the described techniques. These techniques, however, may be practiced without these specific details. In some instances, well-known  
10 structures and devices are shown in block diagram form in order to avoid obscuring the concepts of the described examples.

[0309] The description herein is provided to enable a person skilled in the art to make or use the disclosure. Various modifications to the disclosure will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other variations  
15 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 is:**

- 1                   1.       A method for wireless communications at a user equipment (UE),  
2   comprising:  
3                    detecting a radio link failure between the UE and a master node of a dual-  
4   connectivity configuration;  
5                    transmitting, to a secondary node in the dual-connectivity configuration, an  
6   indication that the radio link failure has occurred; and  
7                    performing, based at least in part on the radio link failure indication, a  
8   handover procedure from the master node to a target node.
- 1                   2.       The method of claim 1, wherein the indication of the radio link failure  
2   is transmitted to the secondary node using a split signaling radio bearer.
- 1                   3.       The method of claim 2, further comprising:  
2                    receiving, prior to the detected radio link failure, a message from the master  
3   node designating the secondary node as a recipient of the indication of the radio link failure.
- 1                   4.       The method of claim 1, wherein transmitting the indication of the radio  
2   link failure comprises:  
3                    indicating a cause of the radio link failure.
- 1                   5.       The method of claim 4, wherein the cause of the radio link failure  
2   comprises one or more of:  
3                    a radio link failure detection on a master cell group link or a handover failure.
- 1                   6.       The method of claim 1, wherein the indication of the radio link failure  
2   is transmitted to the secondary node using a secondary cell group signaling radio bearer.
- 1                   7.       The method of claim 1, wherein the target node is the secondary node  
2   and performing the handover procedure comprises:  
3                    configuring the secondary node as a new master node for the UE in the dual  
4   connectivity configuration; and

5                establishing a new connection with a new secondary node in the dual  
6                connectivity configuration, the new secondary node being different from the secondary node.

1                8.        The method of claim 1, wherein the target node is the secondary node  
2                and performing the handover procedure comprises:  
3                               transitioning from the dual connectivity configuration to a single connectivity  
4                configuration with the secondary node.

1                9.        The method of claim 1, further comprising:  
2                               determining that the handover procedure was unsuccessful;  
3                               transmitting a radio link failure recovery request message to the secondary  
4                node; and  
5                               performing a radio link failure recover procedure, based at least in part on the  
6                radio link failure recovery request message, with the master node.

1                10.      The method of claim 1, further comprising:  
2                               detecting, after transmitting the indication of the radio link failure to the  
3                secondary node, a radio link failure between the UE and the secondary node; and  
4                               performing a radio resource control reestablishment procedure.

1                11.      The method of claim 1, further comprising:  
2                               detecting, before transmitting the indication of the radio link failure, a radio  
3                link failure between the UE and the secondary node; and  
4                               performing a radio resource control reestablishment procedure.

1                12.      The method of claim 1, further comprising:  
2                               detecting the radio link failure during a secondary node handover procedure  
3                from the secondary node to a new secondary node; and  
4                               transmitting the indication of the radio link failure to the new secondary node.

1                13.      The method of claim 1, further comprising:  
2                               determining, based at least in part on a measurement report, that the target  
3                node is unavailable for performing the handover procedure; and

4 performing the handover procedure from the master node to the secondary  
5 node, wherein the secondary node becomes a new master node based at least in part on the  
6 handover procedure.

1 14. The method of claim 1, further comprising:  
2 transmitting, to each secondary node of a plurality of secondary nodes  
3 associated with the UE, the indication of the radio link failure that further indicates a  
4 measurement report.

1 15. The method of claim 1, further comprising:  
2 determining that a radio link between the UE and the secondary node satisfies  
3 a performance threshold, wherein the indication of the radio link failure is transmitted to the  
4 secondary node based at least in part on the performance metric satisfying the threshold.

1 16. The method of claim 1, wherein the indication of the radio link failure  
2 is transmitted in a radio resource control master control group link failure notification  
3 message, the radio resource control master control group link failure notification message  
4 comprising a measurement report and a master control group link failure cause.

1 17. The method of claim 1, wherein the handover procedure comprises at  
2 least one of: an inter-radio access technology (RAT) handover procedure or an inter-RAT  
3 handover procedure.

1 18. A method for wireless communications at a secondary node,  
2 comprising:  
3 receiving, from a user equipment (UE), an indication of a radio link failure for  
4 a radio link between the UE and a master node of a dual-connectivity configuration; and  
5 transmitting an indication of the radio link failure to the master node of the  
6 dual-connectivity configuration.

1 19. The method of claim 18, wherein the indication of the radio link failure  
2 is received using a split signaling radio bearer.

1 20. The method of claim 18, wherein the indication of the radio link failure  
2 is received using a secondary cell group signaling radio bearer.

- 1                   21.    The method of claim 18, further comprising:  
2                    configuring the secondary node as a new master node for the UE in the dual-  
3   connectivity configuration.
- 1                   22.    The method of claim 18, further comprising:  
2                    transitioning from the dual-connectivity configuration to a single connectivity  
3   configuration with the UE.
- 1                   23.    The method of claim 18, further comprising:  
2                    receiving the indication of the radio link failure in a first message over a  
3   signaling radio bearer 1 (SRB1);  
4                    decoding the first message to determine that the radio link failure on a master  
5   control group radio link has occurred; and  
6                    transmitting the indication of the radio link failure to the master node in a  
7   second message.
- 1                   24.    The method of claim 18, further comprising:  
2                    receiving the indication of the radio link failure over a signaling radio bearer 3  
3   (SRB3), wherein transmitting the indication comprises encapsulating the indication of the  
4   radio link failure in a backhaul container message for transmitting to the master node.
- 1                   25.    The method of claim 24, wherein the backhaul container message is  
2   encapsulated according to an Xn or X2 protocol.
- 1                   26.    The method of claim 18, further comprising:  
2                    receiving, from the UE, a radio link failure recovery request message  
3   indicating that a handover procedure was unsuccessful; and  
4                    transmitting, to the master node, an indication of the radio link failure  
5   recovery request message.
- 1                   27.    The method of claim 18, further comprising:  
2                    determining that the master node is unavailable for transmitting the indication  
3   of the radio link failure;  
4                    determining that the secondary node is configured with a control plane  
5   interface with a core network; and

6 performing, based at least in part on the control plane interface configuration,  
7 a handover procedure of the UE from the master node to the secondary node, wherein the  
8 secondary node becomes a new master node of the UE based at least in part on the handover  
9 procedure.

1 28. The method of claim 18, further comprising:  
2 determining, based at least in part on the indication of the radio link failure,  
3 that a target node is unavailable for performing the handover procedure with the UE;  
4 determining that the secondary node is configured with a control plane  
5 interface with a core network; and  
6 performing, based at least in part on the control plane interface configuration,  
7 a handover procedure of the UE from the master node to the secondary node, wherein the  
8 secondary node becomes a new master node of the UE based at least in part on the handover  
9 procedure.

1 29. The method of claim 18, wherein the indication of the radio link failure  
2 is received in a radio resource control master control group failure notification message.

1 30. The method of claim 18, wherein the indication of the radio link failure  
2 is transmitted over at least one of: a wireless transmission, a backhaul link, or a combination  
3 thereof.

1 31. The method of claim 18, wherein the indication of the radio link failure  
2 further indicates a cause for the radio link failure.

1 32. A method for wireless communication at a master node, comprising:  
2 receiving, from a secondary node of a dual-connectivity configuration, an  
3 indication of a radio link failure from a user equipment (UE), the radio link failure being for a  
4 radio link between the UE and the master node;  
5 identifying, based at least in part on the radio link failure, a target node for the  
6 UE; and  
7 performing a handover procedure of the UE from the master node to the target  
8 node.

1                   33.     The method of claim 32, wherein the target node is different from the  
2     master node and the secondary node.

1                   34.     The method of claim 33, further comprising:  
2                   determining that the master node operates using a first radio frequency  
3     spectrum band; and  
4                   determining that the target node operates using the first radio frequency  
5     spectrum band, wherein the target node is identified based at least in part on the target node  
6     operating using the first radio frequency spectrum band.

1                   35.     The method of claim 34, wherein the secondary node operates using at  
2     least one of the first radio frequency spectrum band, a second radio frequency spectrum band  
3     that is different from the first radio frequency spectrum band, or a combination thereof.

1                   36.     The method of claim 33, further comprising:  
2                   determining that the master node operates using a first radio access  
3     technology; and  
4                   determining that the target node operates using the first radio access  
5     technology, wherein the target node is identified based at least in part on the target node  
6     operating using the first radio access technology.

1                   37.     The method of claim 36, wherein the secondary node operates using at  
2     least one of the first radio access technology, a second radio access technology that is  
3     different from the first radio access technology, or a combination thereof.

1                   38.     The method of claim 32, further comprising:  
2                   decoding a measurement report indicating the radio link failure, wherein the  
3     target node is identified based at least in part on the measurement report.

1                   39.     The method of claim 32, wherein the target node comprises a second  
2     distribution unit (DU) of a dual-DU configuration associated with the master node.

1                   40.     The method of claim 32, wherein the indication of the radio link failure  
2     is received from the secondary node using a split signaling radio bearer.

1                   41.     The method of claim 32, further comprising:  
2                   transmitting, prior to receiving the indication of the radio link failure, a  
3                   message to the UE designating the secondary node as a recipient of the indication of the radio  
4                   link failure.

1                   42.     The method of claim 32, further comprising:  
2                   configuring the secondary node as a new master node for the UE in at least  
3                   one of the dual-connectivity configuration or a single-connectivity configuration.

1                   43.     The method of claim 32, wherein receiving the indication of the radio  
2                   link failure comprises:  
3                   receiving a backhaul container message that is encapsulated according to an  
4                   Xn or X2 protocol.

1                   44.     The method of claim 32, further comprising:  
2                   receiving, from the secondary node, an indication of a radio link failure  
3                   recovery request message indicating that the handover procedure was unsuccessful; and  
4                   performing a radio link failure recovery procedure with the UE.

1                   45.     The method of claim 32, further comprising:  
2                   determining, based at least in part on the indication of the radio link failure,  
3                   that the target node is unavailable for performing the handover procedure with the UE;  
4                   determining that the secondary node is configured with a control plane  
5                   interface with a core network; and  
6                   performing, based at least in part on the control plane interface configuration,  
7                   a handover procedure of the UE to the secondary node, wherein the secondary node becomes  
8                   a new master node of the UE based at least in part on the handover procedure.

1                   46.     The method of claim 32, wherein the indication of the radio link failure  
2                   is received over at least one of: a wireless transmission, a backhaul link between, or a  
3                   combination thereof.

1                   47.     The method of claim 32, wherein the handover procedure comprises at  
2                   least one of: an inter-radio access technology (RAT) handover procedure or an inter-RAT  
3                   handover procedure.

1                   48.     An apparatus for wireless communications at a user equipment (UE),  
2     comprising:  
3                   a processor,  
4                   memory in electronic communication with the processor; and  
5                   instructions stored in the memory and executable by the processor to cause the  
6     apparatus to:  
7                   detect a radio link failure between the UE and a master node of a dual-  
8     connectivity configuration;  
9                   transmit, to a secondary node in the dual-connectivity configuration, an  
10     indication that the radio link failure has occurred; and  
11                   perform, based at least in part on the radio link failure indication, a  
12     handover procedure from the master node to a target node.

1                   49.     The apparatus of claim 48, wherein the indication of the radio link  
2     failure is transmitted to the secondary node using a split signaling radio bearer.

1                   50.     The apparatus of claim 49, wherein the instructions are further  
2     executable by the processor to cause the apparatus to:  
3                   receive, prior to the detected radio link failure, a message from the master  
4     node designating the secondary node as a recipient of the indication of the radio link failure.

1                   51.     The apparatus of claim 48, wherein the instructions to transmit the  
2     indication of the radio link failure are executable by the processor to cause the apparatus to:  
3                   indicate a cause of the radio link failure.

1                   52.     The apparatus of claim 51, wherein the cause of the radio link failure  
2     comprises one or more of: comprises:  
3                   a radio link failure detection on a master cell group link or a handover failure.

1                   53.     The apparatus of claim 48, wherein the indication of the radio link  
2     failure is transmitted to the secondary node using a secondary cell group signaling radio  
3     bearer.

1                   54.     The apparatus of claim 48, wherein the target node is the secondary  
2     node and performing the handover procedure comprises:

3               configure the secondary node as a new master node for the UE in the dual  
4   connectivity configuration; and  
5               establish a new connection with a new secondary node in the dual connectivity  
6   configuration, the new secondary node being different from the secondary node.

1               55.    The apparatus of claim 48, wherein the target node is the secondary  
2   node and performing the handover procedure comprises:  
3               transition from the dual connectivity configuration to a single connectivity  
4   configuration with the secondary node.

1               56.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3               determine that the handover procedure was unsuccessful;  
4               transmit a radio link failure recovery request message to the secondary node;  
5   and  
6               perform a radio link failure recover procedure, based at least in part on the  
7   radio link failure recovery request message, with the master node.

1               57.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3               detect, after transmitting the indication of the radio link failure to the  
4   secondary node, a radio link failure between the UE and the secondary node; and  
5               perform a radio resource control reestablishment procedure.

1               58.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3               detect, before transmitting the indication of the radio link failure, a radio link  
4   failure between the UE and the secondary node; and  
5               perform a radio resource control reestablishment procedure.

1               59.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3               detect the radio link failure during a secondary node handover procedure from  
4   the secondary node to a new secondary node; and  
5               transmit the indication of the radio link failure to the new secondary node.

1                   60.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3                   determine, based at least in part on a measurement report, that the target node  
4   is unavailable for performing the handover procedure; and  
5                   perform the handover procedure from the master node to the secondary node,  
6   wherein the secondary node becomes a new master node based at least in part on the  
7   handover procedure.

1                   61.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3                   transmit, to each secondary node of a plurality of secondary nodes associated  
4   with the UE, the indication of the radio link failure that further indicates a measurement  
5   report.

1                   62.    The apparatus of claim 48, wherein the instructions are further  
2   executable by the processor to cause the apparatus to:  
3                   determine that a radio link between the UE and the secondary node satisfies a  
4   performance threshold, wherein the indication of the radio link failure is transmitted to the  
5   secondary node based at least in part on the performance metric satisfying the threshold.

1                   63.    The apparatus of claim 48, wherein the indication of the radio link  
2   failure is transmitted in a radio resource control master control group link failure notification  
3   message, the radio resource control master control group link failure notification message  
4   comprising a measurement report and a master control group link failure cause.

1                   64.    The apparatus of claim 48, wherein the handover procedure comprises  
2   at least one of: comprises an inter-radio access technology (RAT) handover procedure or an  
3   inter-RAT handover procedure.

1                   65.    An apparatus for wireless communications at a secondary node,  
2   comprising:  
3                   a processor,  
4                   memory in electronic communication with the processor; and

5 instructions stored in the memory and executable by the processor to cause the  
6 apparatus to:  
7 receive, from a user equipment (UE), an indication of a radio link  
8 failure for a radio link between the UE and a master node of a dual-connectivity  
9 configuration; and  
10 transmit an indication of the radio link failure to the master node of the  
11 dual-connectivity configuration.

1 66. The apparatus of claim 65, wherein the indication of the radio link  
2 failure is received using a split signaling radio bearer.

1 67. The apparatus of claim 65, wherein the indication of the radio link  
2 failure is received using a secondary cell group signaling radio bearer.

1 68. The apparatus of claim 65, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3 configure the secondary node as a new master node for the UE in the dual-  
4 connectivity configuration.

1 69. The apparatus of claim 65, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3 transition from the dual-connectivity configuration to a single connectivity  
4 configuration with the UE.

1 70. The apparatus of claim 65, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3 receive the indication of the radio link failure in a first message over a  
4 signaling radio bearer 1 (SRB1);  
5 decode the first message to determine that the radio link failure on a master  
6 control group radio link has occurred; and  
7 transmit the indication of the radio link failure to the master node in a second  
8 message.

1 71. The apparatus of claim 65, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:

the instructions to receive the indication of the radio link failure over a signaling radio bearer 3 (SRB3), wherein transmitting the indication are executable by the processor to cause the apparatus to encapsulate the indication of the radio link failure in a backhaul container message for transmitting to the master node.

72. The apparatus of claim 71, wherein the backhaul container message is encapsulated according to an Xn or X2 protocol.

73. The apparatus of claim 65, wherein the instructions are further executable by the processor to cause the apparatus to:

- receive, from the UE, a radio link failure recovery request message indicating that a handover procedure was unsuccessful; and
- transmit, to the master node, an indication of the radio link failure recovery request message.

74. The apparatus of claim 65, wherein the instructions are further executable by the processor to cause the apparatus to:

- determine that the master node is unavailable for transmitting the indication of the radio link failure;
- determine that the secondary node is configured with a control plane interface with a core network; and
- perform, based at least in part on the control plane interface configuration, a handover procedure of the UE from the master node to the secondary node, wherein the secondary node becomes a new master node of the UE based at least in part on the handover procedure.

75. The apparatus of claim 65, wherein the instructions are further executable by the processor to cause the apparatus to:

- determine, based at least in part on the indication of the radio link failure, that a target node is unavailable for performing the handover procedure with the UE;
- determine that the secondary node is configured with a control plane interface with a core network; and
- perform, based at least in part on the control plane interface configuration, a handover procedure of the UE from the master node to the secondary node, wherein the

9 secondary node becomes a new master node of the UE based at least in part on the handover  
10 procedure.

1 76. The apparatus of claim 65, wherein the indication of the radio link  
2 failure is received in a radio resource control master control group failure notification  
3 message.

1 77. The apparatus of claim 65, wherein the indication of the radio link  
2 failure is transmitted over at least one of a wireless transmission, a backhaul link, or a  
3 combination thereof.

1 78. The apparatus of claim 65, wherein the indication of the radio link  
2 failure further indicates a cause for the radio link failure.

1 79. An apparatus for wireless communication at a master node,  
2 comprising:  
3 a processor,  
4 memory in electronic communication with the processor; and  
5 instructions stored in the memory and executable by the processor to cause the  
6 apparatus to:  
7 receive, from a secondary node of a dual-connectivity configuration,  
8 an indication of a radio link failure from a user equipment (UE), the radio link failure  
9 being for a radio link between the UE and the master node;  
10 identify, based at least in part on the radio link failure, a target node for  
11 the UE; and  
12 perform a handover procedure of the UE from the master node to the  
13 target node.

1 80. The apparatus of claim 79, wherein the target node is different from  
2 the master node and the secondary node.

1 81. The apparatus of claim 80, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3 determine that the master node operates using a first radio frequency spectrum  
4 band; and

5                   determine that the target node operates using the first radio frequency  
6 spectrum band, wherein the target node is identified based at least in part on the target node  
7 operating using the first radio frequency spectrum band.

1                   82.     The apparatus of claim 81, wherein the secondary node operates using  
2 at least one of the first radio frequency spectrum band, a second radio frequency spectrum  
3 band that is different from the first radio frequency spectrum band, or a combination thereof.

1                   83.     The apparatus of claim 80, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3                   determine that the master node operates using a first radio access technology;  
4 and  
5                   determine that the target node operates using the first radio access technology,  
6 wherein the target node is identified based at least in part on the target node operating using  
7 the first radio access technology.

1                   84.     The apparatus of claim 83, wherein the secondary node operates using  
2 at least one of the first radio access technology, a second radio access technology that is  
3 different from the first radio access technology, or a combination thereof.

1                   85.     The apparatus of claim 79, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3                   decode a measurement report indicating the radio link failure, wherein the  
4 target node is identified based at least in part on the measurement report.

1                   86.     The apparatus of claim 79, wherein the target node comprises a second  
2 distribution unit (DU) of a dual-DU configuration associated with the master node.

1                   87.     The apparatus of claim 79, wherein the indication of the radio link  
2 failure is received from the secondary node using a split signaling radio bearer.

1                   88.     The apparatus of claim 79, wherein the instructions are further  
2 executable by the processor to cause the apparatus to:  
3                   transmit, prior to receiving the indication of the radio link failure, a message to  
4 the UE designating the secondary node as a recipient of the indication of the radio link  
5 failure.

1                   89.     The apparatus of claim 79, wherein the instructions are further  
2     executable by the processor to cause the apparatus to:  
3                   configure the secondary node as a new master node for the UE in at least one  
4     of the dual-connectivity configuration or a single-connectivity configuration.

1                   90.     The apparatus of claim 79, wherein the instructions to receive the  
2     indication of the radio link failure are executable by the processor to cause the apparatus to:  
3                   receive a backhaul container message that is encapsulated according to an Xn  
4     or X2 protocol.

1                   91.     The apparatus of claim 79, wherein the instructions are further  
2     executable by the processor to cause the apparatus to:  
3                   receive, from the secondary node, an indication of a radio link failure recovery  
4     request message indicating that the handover procedure was unsuccessful; and  
5                   perform a radio link failure recovery procedure with the UE.

1                   92.     The apparatus of claim 79, wherein the instructions are further  
2     executable by the processor to cause the apparatus to:  
3                   determine, based at least in part on the indication of the radio link failure, that  
4     the target node is unavailable for performing the handover procedure with the UE;  
5                   determine that the secondary node is configured with a control plane interface  
6     with a core network; and  
7                   perform, based at least in part on the control plane interface configuration, a  
8     handover procedure of the UE to the secondary node, wherein the secondary node becomes a  
9     new master node of the UE based at least in part on the handover procedure.

1                   93.     The apparatus of claim 79, wherein the indication of the radio link  
2     failure is received over at least one of a wireless transmission, a backhaul link between, or a  
3     combination thereof.

1                   94.     The apparatus of claim 79, wherein the handover procedure comprises  
2     at least one of: comprises an inter-radio access technology (RAT) handover procedure or an  
3     inter-RAT handover procedure.

1                   95.    An apparatus for wireless communications at a user equipment (UE),  
2    comprising:  
3                    means for detecting a radio link failure between the UE and a master node of a  
4    dual-connectivity configuration;  
5                    means for transmitting, to a secondary node in the dual-connectivity  
6    configuration, an indication that the radio link failure has occurred; and  
7                    means for performing, based at least in part on the radio link failure indication,  
8    a handover procedure from the master node to a target node.

1                   96.    The apparatus of claim 95, wherein the indication of the radio link  
2    failure is transmitted to the secondary node using a split signaling radio bearer.

1                   97.    The apparatus of claim 96, further comprising:  
2                    means for receiving, prior to the detected radio link failure, a message from  
3    the master node designating the secondary node as a recipient of the indication of the radio  
4    link failure.

1                   98.    The apparatus of claim 95, wherein the means for transmitting the  
2    indication of the radio link failure comprises:  
3                    means for indicating a cause of the radio link failure.

1                   99.    The apparatus of claim 98, wherein the cause of the radio link failure  
2    comprises one or more of: comprises:  
3                    a radio link failure detection on a master cell group link or a handover failure.

1                   100.   The apparatus of claim 95, wherein the indication of the radio link  
2    failure is transmitted to the secondary node using a secondary cell group signaling radio  
3    bearer.

1                   101.   The apparatus of claim 95, wherein the target node is the secondary  
2    node and performing the handover procedure comprises:  
3                    means for configuring the secondary node as a new master node for the UE in  
4    the dual connectivity configuration; and

5 means for establishing a new connection with a new secondary node in the  
6 dual connectivity configuration, the new secondary node being different from the secondary  
7 node.

1 102. The apparatus of claim 95, wherein the target node is the secondary  
2 node and performing the handover procedure comprises:

3 means for transitioning from the dual connectivity configuration to a single  
4 connectivity configuration with the secondary node.

1 103. The apparatus of claim 95, further comprising:

2 means for determining that the handover procedure was unsuccessful;

3 means for transmitting a radio link failure recovery request message to the  
4 secondary node; and

5 means for performing a radio link failure recover procedure, based at least in  
6 part on the radio link failure recovery request message, with the master node.

1 104. The apparatus of claim 95, further comprising:

2 means for detecting, after transmitting the indication of the radio link failure to  
3 the secondary node, a radio link failure between the UE and the secondary node; and

4 means for performing a radio resource control reestablishment procedure.

1 105. The apparatus of claim 95, further comprising:

2 means for detecting, before transmitting the indication of the radio link failure,  
3 a radio link failure between the UE and the secondary node; and

4 means for performing a radio resource control reestablishment procedure.

1 106. The apparatus of claim 95, further comprising:

2 means for detecting the radio link failure during a secondary node handover  
3 procedure from the secondary node to a new secondary node; and

4 means for transmitting the indication of the radio link failure to the new  
5 secondary node.

1 107. The apparatus of claim 95, further comprising:

2 means for determining, based at least in part on a measurement report, that the  
3 target node is unavailable for performing the handover procedure; and

4 means for performing the handover procedure from the master node to the  
5 secondary node, wherein the secondary node becomes a new master node based at least in  
6 part on the handover procedure.

1 108. The apparatus of claim 95, further comprising:  
2 means for transmitting, to each secondary node of a plurality of secondary  
3 nodes associated with the UE, the indication of the radio link failure that further indicates a  
4 measurement report.

1 109. The apparatus of claim 95, further comprising:  
2 means for determining that a radio link between the UE and the secondary  
3 node satisfies a performance threshold, wherein the indication of the radio link failure is  
4 transmitted to the secondary node based at least in part on the performance metric satisfying  
5 the threshold.

1 110. The apparatus of claim 95, wherein the indication of the radio link  
2 failure is transmitted in a radio resource control master control group link failure notification  
3 message, the radio resource control master control group link failure notification message  
4 comprising a measurement report and a master control group link failure cause.

1 111. The apparatus of claim 95, wherein the handover procedure comprises  
2 at least one of: comprises an inter-radio access technology (RAT) handover procedure or an  
3 inter-RAT handover procedure.

1 112. An apparatus for wireless communications at a secondary node,  
2 comprising:  
3 means for receiving, from a user equipment (UE), an indication of a radio link  
4 failure for a radio link between the UE and a master node of a dual-connectivity  
5 configuration; and  
6 means for transmitting an indication of the radio link failure to the master  
7 node of the dual-connectivity configuration.

1 113. The apparatus of claim 112, wherein the indication of the radio link  
2 failure is received using a split signaling radio bearer.

1                   114. The apparatus of claim 112, wherein the indication of the radio link  
2 failure is received using a secondary cell group signaling radio bearer.

1                   115. The apparatus of claim 112, further comprising:  
2 means for configuring the secondary node as a new master node for the UE in  
3 the dual-connectivity configuration.

1                   116. The apparatus of claim 112, further comprising:  
2 means for transitioning from the dual-connectivity configuration to a single  
3 connectivity configuration with the UE.

1                   117. The apparatus of claim 112, further comprising:  
2 means for receiving the indication of the radio link failure in a first message  
3 over a signaling radio bearer 1 (SRB1);  
4 means for decoding the first message to determine that the radio link failure on  
5 a master control group radio link has occurred; and  
6 means for transmitting the indication of the radio link failure to the master  
7 node in a second message.

1                   118. The apparatus of claim 112, further comprising:  
2 means for receiving the indication of the radio link failure over a signaling  
3 radio bearer 3 (SRB3), wherein transmitting the indication comprises encapsulating the  
4 indication of the radio link failure in a backhaul container message for transmitting to the  
5 master node.

1                   119. The apparatus of claim 118, wherein the backhaul container message is  
2 encapsulated according to an Xn or X2 protocol.

1                   120. The apparatus of claim 112, further comprising:  
2 means for receiving, from the UE, a radio link failure recovery request  
3 message indicating that a handover procedure was unsuccessful; and  
4 means for transmitting, to the master node, an indication of the radio link  
5 failure recovery request message.

1                   121. The apparatus of claim 112, further comprising:

2 means for determining that the master node is unavailable for transmitting the  
3 indication of the radio link failure;

4 means for determining that the secondary node is configured with a control  
5 plane interface with a core network; and

6 means for performing, based at least in part on the control plane interface  
7 configuration, a handover procedure of the UE from the master node to the secondary node,  
8 wherein the secondary node becomes a new master node of the UE based at least in part on  
9 the handover procedure.

1 122. The apparatus of claim 112, further comprising:

2 means for determining, based at least in part on the indication of the radio link  
3 failure, that a target node is unavailable for performing the handover procedure with the UE;

4 means for determining that the secondary node is configured with a control  
5 plane interface with a core network; and

6 means for performing, based at least in part on the control plane interface  
7 configuration, a handover procedure of the UE from the master node to the secondary node,  
8 wherein the secondary node becomes a new master node of the UE based at least in part on  
9 the handover procedure.

1 123. The apparatus of claim 112, wherein the indication of the radio link  
2 failure is received in a radio resource control master control group failure notification  
3 message.

1 124. The apparatus of claim 112, wherein the indication of the radio link  
2 failure is transmitted over at least one of a wireless transmission, a backhaul link, or a  
3 combination thereof.

1 125. The apparatus of claim 112, wherein the indication of the radio link  
2 failure further indicates a cause for the radio link failure.

1 126. An apparatus for wireless communication at a master node,  
2 comprising:

3 means for receiving, from a secondary node of a dual-connectivity  
4 configuration, an indication of a radio link failure from a user equipment (UE), the radio link  
5 failure being for a radio link between the UE and the master node;

6 means for identifying, based at least in part on the radio link failure, a target  
7 node for the UE; and  
8 means for performing a handover procedure of the UE from the master node to  
9 the target node.

1 127. The apparatus of claim 126, wherein the target node is different from  
2 the master node and the secondary node.

1 128. The apparatus of claim 127, further comprising:  
2 means for determining that the master node operates using a first radio  
3 frequency spectrum band; and  
4 means for determining that the target node operates using the first radio  
5 frequency spectrum band, wherein the target node is identified based at least in part on the  
6 target node operating using the first radio frequency spectrum band.

1 129. The apparatus of claim 128, wherein the secondary node operates  
2 using at least one of the first radio frequency spectrum band, a second radio frequency  
3 spectrum band that is different from the first radio frequency spectrum band, or a  
4 combination thereof.

1 130. The apparatus of claim 127, further comprising:  
2 means for determining that the master node operates using a first radio access  
3 technology; and  
4 means for determining that the target node operates using the first radio access  
5 technology, wherein the target node is identified based at least in part on the target node  
6 operating using the first radio access technology.

1 131. The apparatus of claim 130, wherein the secondary node operates  
2 using at least one of the first radio access technology, a second radio access technology that is  
3 different from the first radio access technology, or a combination thereof.

1 132. The apparatus of claim 126, further comprising:  
2 means for decoding a measurement report indicating the radio link failure,  
3 wherein the target node is identified based at least in part on the measurement report.

1                   133. The apparatus of claim 126, wherein the target node comprises a  
2 second distribution unit (DU) of a dual-DU configuration associated with the master node.

1                   134. The apparatus of claim 126, wherein the indication of the radio link  
2 failure is received from the secondary node using a split signaling radio bearer.

1                   135. The apparatus of claim 126, further comprising:  
2 means for transmitting, prior to receiving the indication of the radio link  
3 failure, a message to the UE designating the secondary node as a recipient of the indication of  
4 the radio link failure.

1                   136. The apparatus of claim 126, further comprising:  
2 means for configuring the secondary node as a new master node for the UE in  
3 at least one of the dual-connectivity configuration or a single-connectivity configuration.

1                   137. The apparatus of claim 126, wherein the means for receiving the  
2 indication of the radio link failure comprises:  
3 means for receiving a backhaul container message that is encapsulated  
4 according to an Xn or X2 protocol.

1                   138. The apparatus of claim 126, further comprising:  
2 means for receiving, from the secondary node, an indication of a radio link  
3 failure recovery request message indicating that the handover procedure was unsuccessful;  
4 and  
5 means for performing a radio link failure recovery procedure with the UE.

1                   139. The apparatus of claim 126, further comprising:  
2 means for determining, based at least in part on the indication of the radio link  
3 failure, that the target node is unavailable for performing the handover procedure with the  
4 UE;  
5 means for determining that the secondary node is configured with a control  
6 plane interface with a core network; and  
7 means for performing, based at least in part on the control plane interface  
8 configuration, a handover procedure of the UE to the secondary node, wherein the secondary  
9 node becomes a new master node of the UE based at least in part on the handover procedure.

1                   140. The apparatus of claim 126, wherein the indication of the radio link  
2 failure is received over at least one of a wireless transmission, a backhaul link between, or a  
3 combination thereof.

1                   141. The apparatus of claim 126, wherein the handover procedure  
2 comprises at least one of: comprises an inter-radio access technology (RAT) handover  
3 procedure or an inter-RAT handover procedure.

1                   142. A non-transitory computer-readable medium storing code for wireless  
2 communications at a user equipment (UE), the code comprising instructions executable by a  
3 processor to:

4                   detect a radio link failure between the UE and a master node of a dual-  
5 connectivity configuration;

6                   transmit, to a secondary node in the dual-connectivity configuration, an  
7 indication that the radio link failure has occurred; and

8                   perform, based at least in part on the radio link failure indication, a handover  
9 procedure from the master node to a target node.

1                   143. The non-transitory computer-readable medium of claim 142, wherein  
2 the indication of the radio link failure is transmitted to the secondary node using a split  
3 signaling radio bearer.

1                   144. The non-transitory computer-readable medium of claim 143, wherein  
2 the instructions are further executable to:

3                   receive, prior to the detected radio link failure, a message from the master  
4 node designating the secondary node as a recipient of the indication of the radio link failure.

1                   145. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions to transmit the indication of the radio link failure are executable to:

3                   indicate a cause of the radio link failure.

1                   146. The non-transitory computer-readable medium of claim 145, wherein  
2 the cause of the radio link failure comprises one or more of: comprises:

3                   a radio link failure detection on a master cell group link or a handover failure.

1                   147. The non-transitory computer-readable medium of claim 142, wherein  
2 the indication of the radio link failure is transmitted to the secondary node using a secondary  
3 cell group signaling radio bearer.

1                   148. The non-transitory computer-readable medium of claim 142, wherein  
2 the target node is the secondary node and performing the handover procedure comprises:  
3                   configure the secondary node as a new master node for the UE in the dual  
4 connectivity configuration; and  
5                   establish a new connection with a new secondary node in the dual connectivity  
6 configuration, the new secondary node being different from the secondary node.

1                   149. The non-transitory computer-readable medium of claim 142, wherein  
2 the target node is the secondary node and performing the handover procedure comprises:  
3                   transition from the dual connectivity configuration to a single connectivity  
4 configuration with the secondary node.

1                   150. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3                   determine that the handover procedure was unsuccessful;  
4                   transmit a radio link failure recovery request message to the secondary node;  
5 and  
6                   perform a radio link failure recover procedure, based at least in part on the  
7 radio link failure recovery request message, with the master node.

1                   151. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3                   detect, after transmitting the indication of the radio link failure to the  
4 secondary node, a radio link failure between the UE and the secondary node; and  
5                   perform a radio resource control reestablishment procedure.

1                   152. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3                   detect, before transmitting the indication of the radio link failure, a radio link  
4 failure between the UE and the secondary node; and

5 perform a radio resource control reestablishment procedure.

1 153. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3 detect the radio link failure during a secondary node handover procedure from  
4 the secondary node to a new secondary node; and  
5 transmit the indication of the radio link failure to the new secondary node.

1 154. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3 determine, based at least in part on a measurement report, that the target node  
4 is unavailable for performing the handover procedure; and  
5 perform the handover procedure from the master node to the secondary node,  
6 wherein the secondary node becomes a new master node based at least in part on the  
7 handover procedure.

1 155. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3 transmit, to each secondary node of a plurality of secondary nodes associated  
4 with the UE, the indication of the radio link failure that further indicates a measurement  
5 report.

1 156. The non-transitory computer-readable medium of claim 142, wherein  
2 the instructions are further executable to:  
3 determine that a radio link between the UE and the secondary node satisfies a  
4 performance threshold, wherein the indication of the radio link failure is transmitted to the  
5 secondary node based at least in part on the performance metric satisfying the threshold.

1 157. The non-transitory computer-readable medium of claim 142, wherein  
2 the indication of the radio link failure is transmitted in a radio resource control master control  
3 group link failure notification message, the radio resource control master control group link  
4 failure notification message comprising a measurement report and a master control group link  
5 failure cause.

1                   158. The non-transitory computer-readable medium of claim 142, wherein  
2 the handover procedure comprises at least one of: comprises an inter-radio access technology  
3 (RAT) handover procedure or an inter-RAT handover procedure.

1                   159. A non-transitory computer-readable medium storing code for wireless  
2 communications at a secondary node, the code comprising instructions executable by a  
3 processor to:  
4                   receive, from a user equipment (UE), an indication of a radio link failure for a  
5 radio link between the UE and a master node of a dual-connectivity configuration; and  
6                   transmit an indication of the radio link failure to the master node of the dual-  
7 connectivity configuration.

1                   160. The non-transitory computer-readable medium of claim 159, wherein  
2 the indication of the radio link failure is received using a split signaling radio bearer.

1                   161. The non-transitory computer-readable medium of claim 159, wherein  
2 the indication of the radio link failure is received using a secondary cell group signaling radio  
3 bearer.

1                   162. The non-transitory computer-readable medium of claim 159, wherein  
2 the instructions are further executable to:  
3                   configure the secondary node as a new master node for the UE in the dual-  
4 connectivity configuration.

1                   163. The non-transitory computer-readable medium of claim 159, wherein  
2 the instructions are further executable to:  
3                   transition from the dual-connectivity configuration to a single connectivity  
4 configuration with the UE.

1                   164. The non-transitory computer-readable medium of claim 159, wherein  
2 the instructions are further executable to:  
3                   receive the indication of the radio link failure in a first message over a  
4 signaling radio bearer 1 (SRB1);  
5                   decode the first message to determine that the radio link failure on a master  
6 control group radio link has occurred; and

7                   transmit the indication of the radio link failure to the master node in a second  
8   message.

1                   165.   The non-transitory computer-readable medium of claim 159, wherein  
2   the instructions are further executable to:

3                   the instructions to receive the indication of the radio link failure over a  
4   signaling radio bearer 3 (SRB3), wherein transmitting the indication are executable by the  
5   processor to cause the apparatus to encapsulate the indication of the radio link failure in a  
6   backhaul container message for transmitting to the master node.

1                   166.   The non-transitory computer-readable medium of claim 165, wherein  
2   the backhaul container message is encapsulated according to an Xn or X2 protocol.

1                   167.   The non-transitory computer-readable medium of claim 159, wherein  
2   the instructions are further executable to:

3                   receive, from the UE, a radio link failure recovery request message indicating  
4   that a handover procedure was unsuccessful; and  
5                   transmit, to the master node, an indication of the radio link failure recovery  
6   request message.

1                   168.   The non-transitory computer-readable medium of claim 159, wherein  
2   the instructions are further executable to:

3                   determine that the master node is unavailable for transmitting the indication of  
4   the radio link failure;

5                   determine that the secondary node is configured with a control plane interface  
6   with a core network; and

7                   perform, based at least in part on the control plane interface configuration, a  
8   handover procedure of the UE from the master node to the secondary node, wherein the  
9   secondary node becomes a new master node of the UE based at least in part on the handover  
10   procedure.

1                   169.   The non-transitory computer-readable medium of claim 159, wherein  
2   the instructions are further executable to:

3                   determine, based at least in part on the indication of the radio link failure, that  
4   a target node is unavailable for performing the handover procedure with the UE;

5                   determine that the secondary node is configured with a control plane interface  
6   with a core network; and  
7                   perform, based at least in part on the control plane interface configuration, a  
8   handover procedure of the UE from the master node to the secondary node, wherein the  
9   secondary node becomes a new master node of the UE based at least in part on the handover  
10   procedure.

1                   170.   The non-transitory computer-readable medium of claim 159, wherein  
2   the indication of the radio link failure is received in a radio resource control master control  
3   group failure notification message.

1                   171.   The non-transitory computer-readable medium of claim 159, wherein  
2   the indication of the radio link failure is transmitted over at least one of a wireless  
3   transmission, a backhaul link, or a combination thereof.

1                   172.   The non-transitory computer-readable medium of claim 159, wherein  
2   the indication of the radio link failure further indicates a cause for the radio link failure.

1                   173.   A non-transitory computer-readable medium storing code for wireless  
2   communication at a master node, the code comprising instructions executable by a processor  
3   to:  
4                   receive, from a secondary node of a dual-connectivity configuration, an  
5   indication of a radio link failure from a user equipment (UE), the radio link failure being for a  
6   radio link between the UE and the master node;  
7                   identify, based at least in part on the radio link failure, a target node for the  
8   UE; and  
9                   perform a handover procedure of the UE from the master node to the target  
10   node.

1                   174.   The non-transitory computer-readable medium of claim 173, wherein  
2   the target node is different from the master node and the secondary node.

1                   175.   The non-transitory computer-readable medium of claim 174, wherein  
2   the instructions are further executable to:

3                   determine that the master node operates using a first radio frequency spectrum  
4 band; and

5                   determine that the target node operates using the first radio frequency  
6 spectrum band, wherein the target node is identified based at least in part on the target node  
7 operating using the first radio frequency spectrum band.

1                   176. The non-transitory computer-readable medium of claim 175, wherein  
2 the secondary node operates using at least one of the first radio frequency spectrum band, a  
3 second radio frequency spectrum band that is different from the first radio frequency  
4 spectrum band, or a combination thereof.

1                   177. The non-transitory computer-readable medium of claim 174, wherein  
2 the instructions are further executable to:

3                   determine that the master node operates using a first radio access technology;  
4 and

5                   determine that the target node operates using the first radio access technology,  
6 wherein the target node is identified based at least in part on the target node operating using  
7 the first radio access technology.

1                   178. The non-transitory computer-readable medium of claim 177, wherein  
2 the secondary node operates using at least one of the first radio access technology, a second  
3 radio access technology that is different from the first radio access technology, or a  
4 combination thereof.

1                   179. The non-transitory computer-readable medium of claim 173, wherein  
2 the instructions are further executable to:

3                   decode a measurement report indicating the radio link failure, wherein the  
4 target node is identified based at least in part on the measurement report.

1                   180. The non-transitory computer-readable medium of claim 173, wherein  
2 the target node comprises a second distribution unit (DU) of a dual-DU configuration  
3 associated with the master node.

1                   181. The non-transitory computer-readable medium of claim 173, wherein  
2 the indication of the radio link failure is received from the secondary node using a split  
3 signaling radio bearer.

1                   182. The non-transitory computer-readable medium of claim 173, wherein  
2 the instructions are further executable to:  
3                   transmit, prior to receiving the indication of the radio link failure, a message to  
4 the UE designating the secondary node as a recipient of the indication of the radio link  
5 failure.

1                   183. The non-transitory computer-readable medium of claim 173, wherein  
2 the instructions are further executable to:  
3                   configure the secondary node as a new master node for the UE in at least one  
4 of the dual-connectivity configuration or a single-connectivity configuration.

1                   184. The non-transitory computer-readable medium of claim 173, wherein  
2 the instructions to receive the indication of the radio link failure are executable to:  
3                   receive a backhaul container message that is encapsulated according to an Xn  
4 or X2 protocol.

1                   185. The non-transitory computer-readable medium of claim 173, wherein  
2 the instructions are further executable to:  
3                   receive, from the secondary node, an indication of a radio link failure recovery  
4 request message indicating that the handover procedure was unsuccessful; and  
5                   perform a radio link failure recovery procedure with the UE.

1                   186. The non-transitory computer-readable medium of claim 173, wherein  
2 the instructions are further executable to:  
3                   determine, based at least in part on the indication of the radio link failure, that  
4 the target node is unavailable for performing the handover procedure with the UE;  
5                   determine that the secondary node is configured with a control plane interface  
6 with a core network; and

7                   perform, based at least in part on the control plane interface configuration, a  
8   handover procedure of the UE to the secondary node, wherein the secondary node becomes a  
9   new master node of the UE based at least in part on the handover procedure.

1                   187.   The non-transitory computer-readable medium of claim 173, wherein  
2   the indication of the radio link failure is received over at least one of a wireless transmission,  
3   a backhaul link between, or a combination thereof.

1                   188.   The non-transitory computer-readable medium of claim 173, wherein  
2   the handover procedure comprises at least one of: comprises an inter-radio access technology  
3   (RAT) handover procedure or an inter-RAT handover procedure.

1

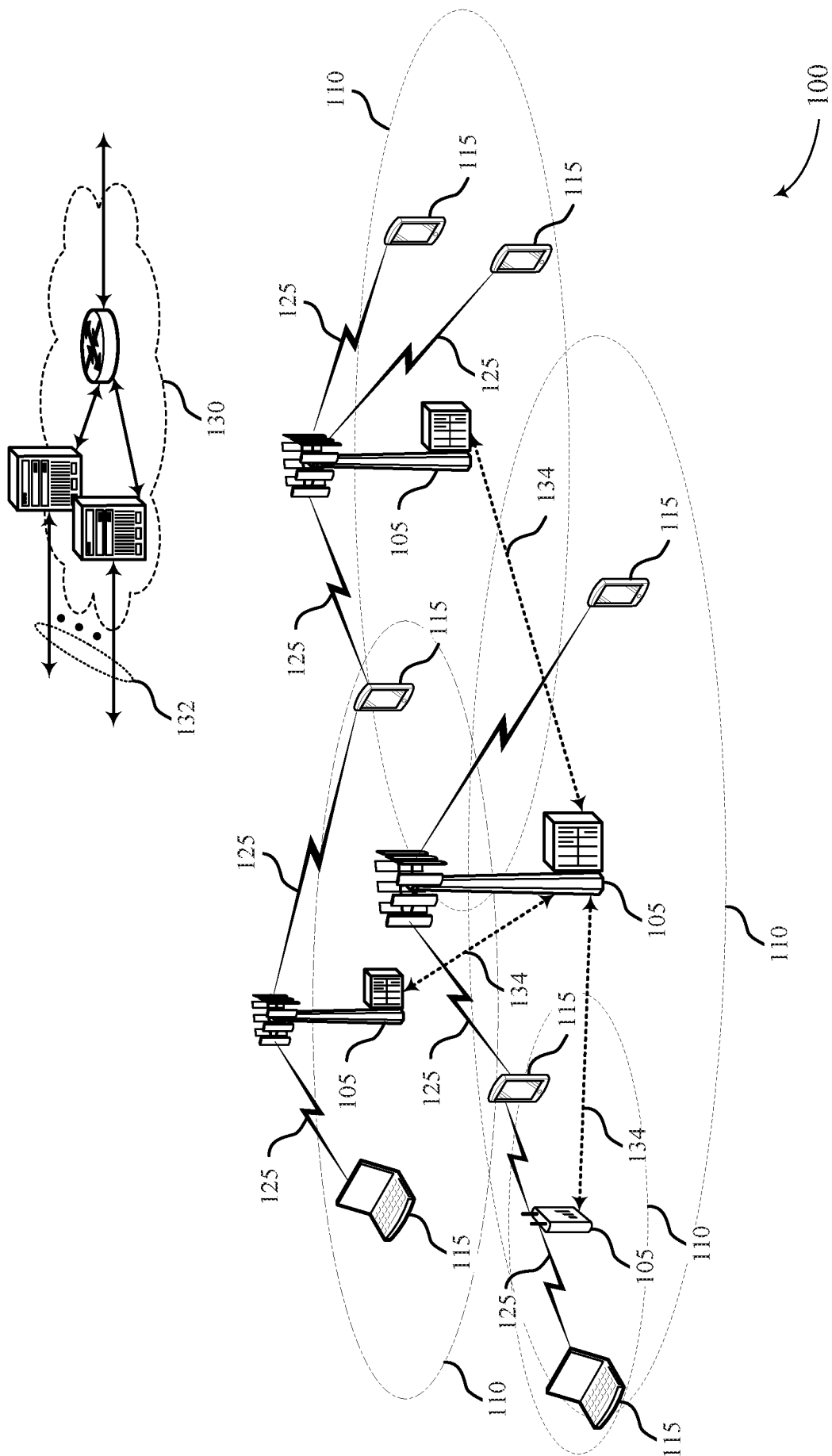
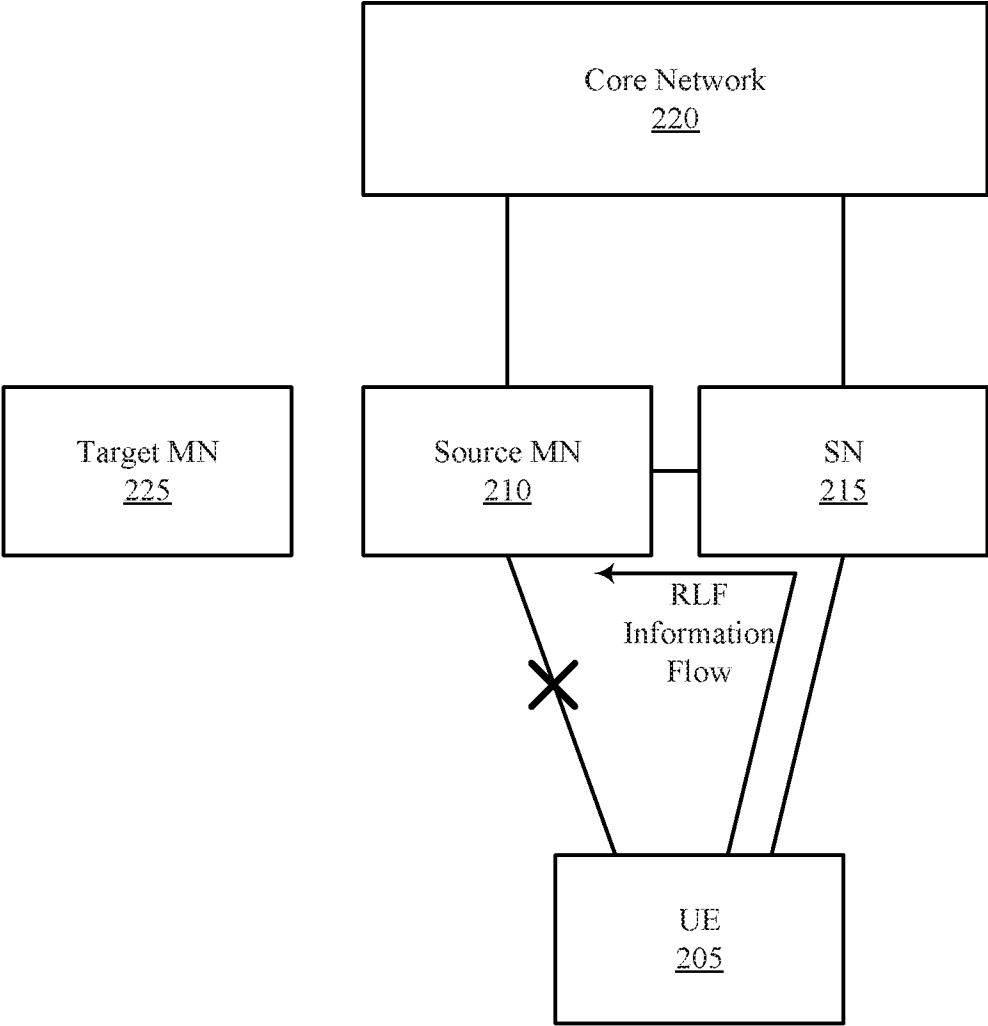
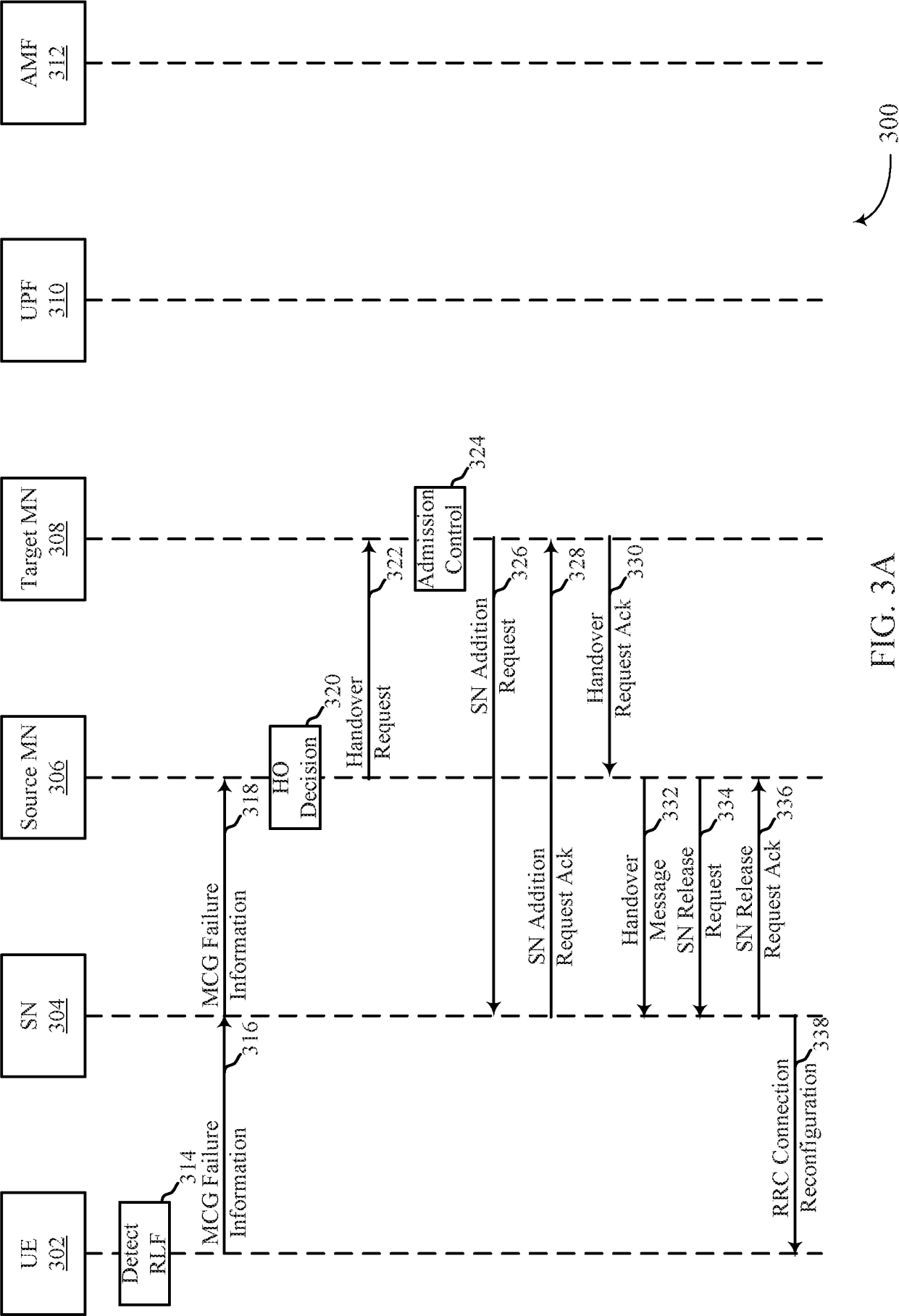


FIG. 1



200

FIG. 2



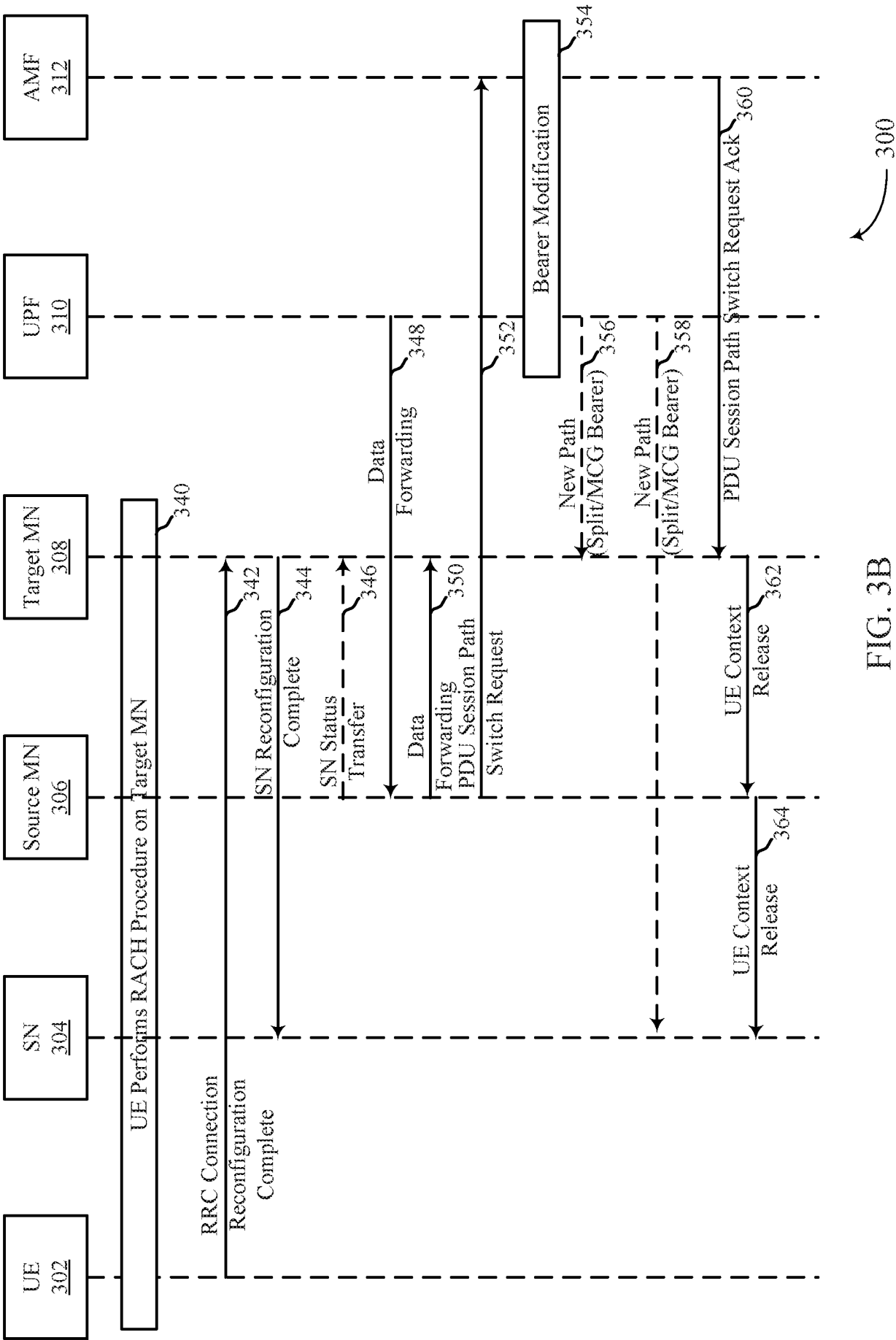


FIG. 3B

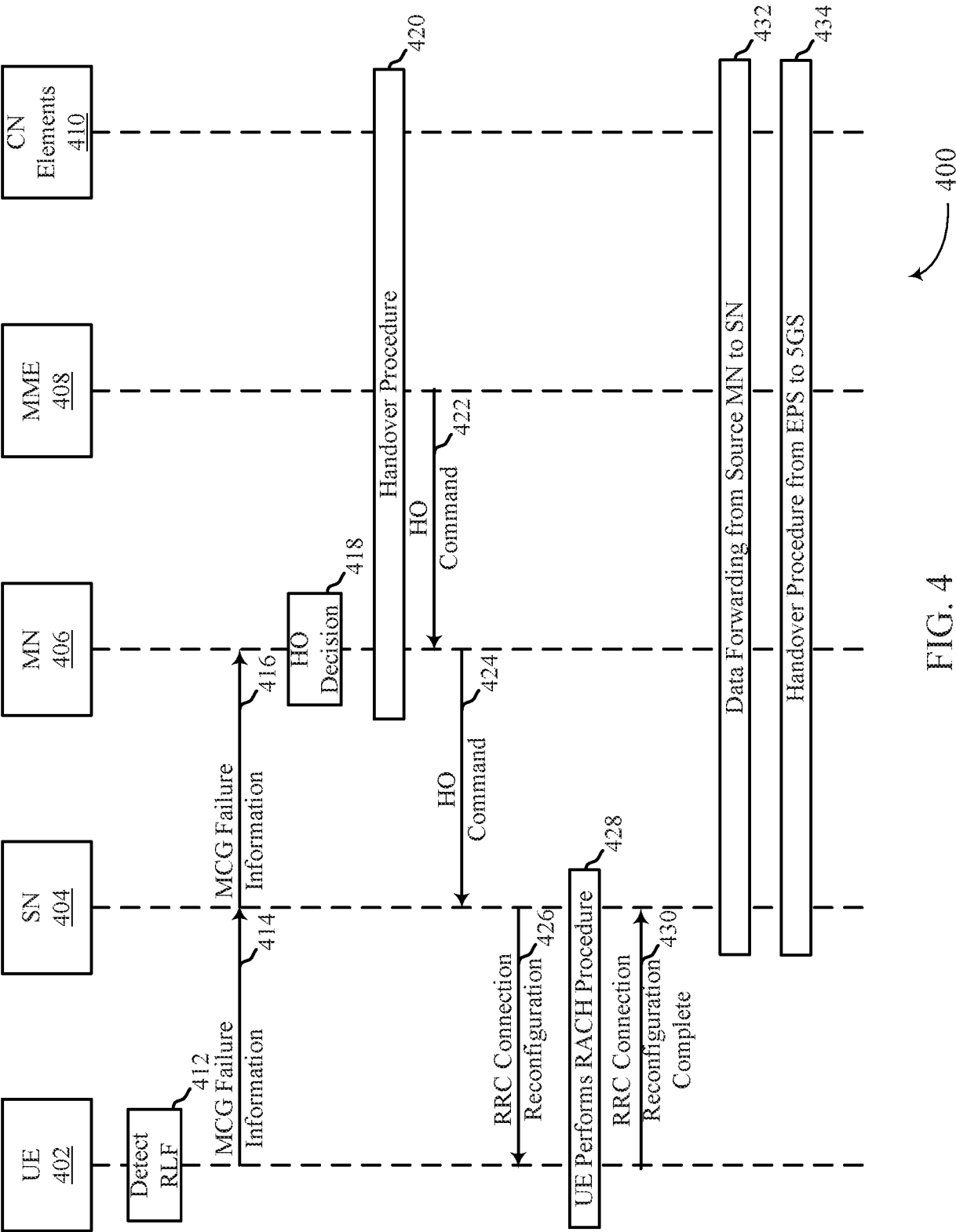
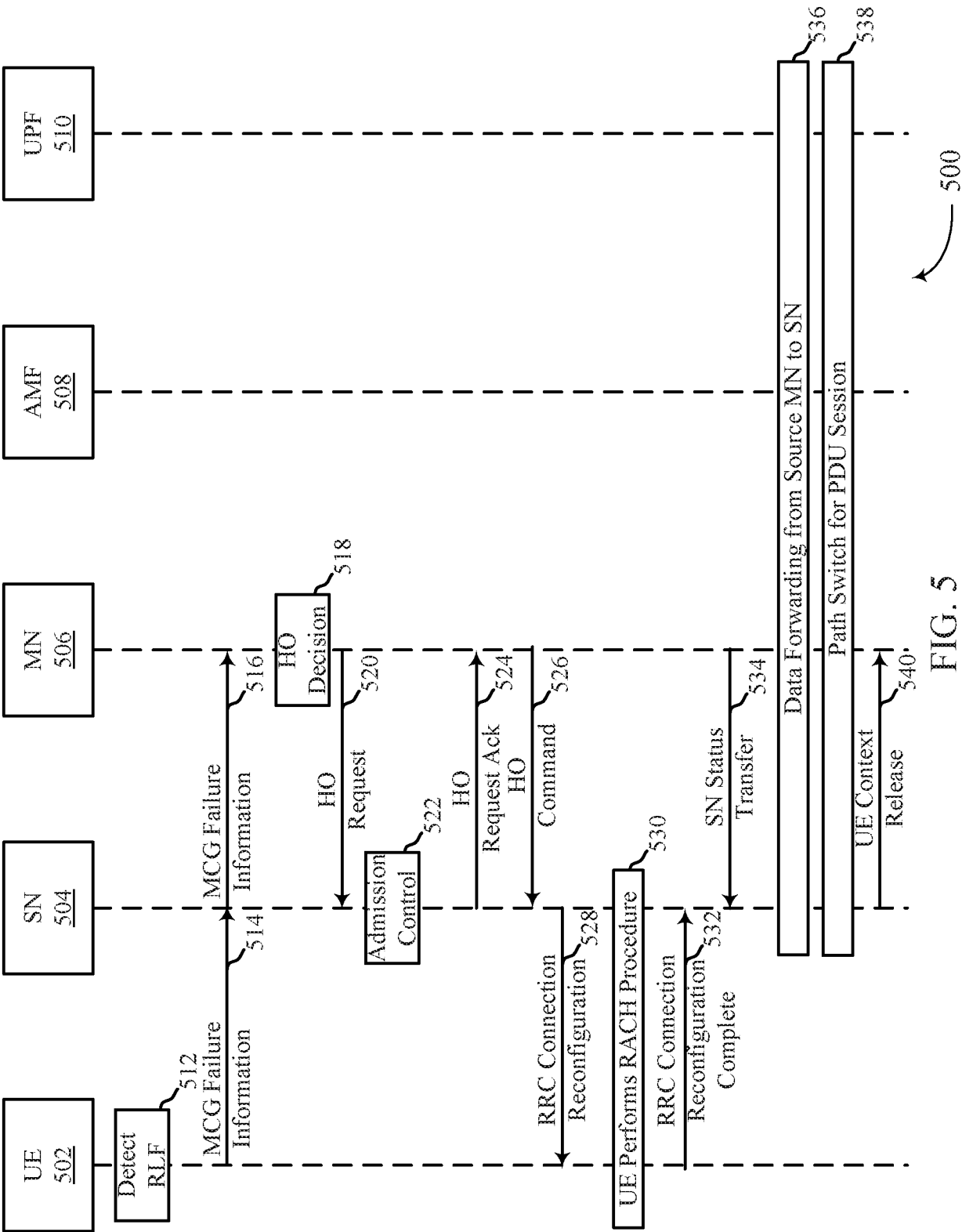


FIG. 4



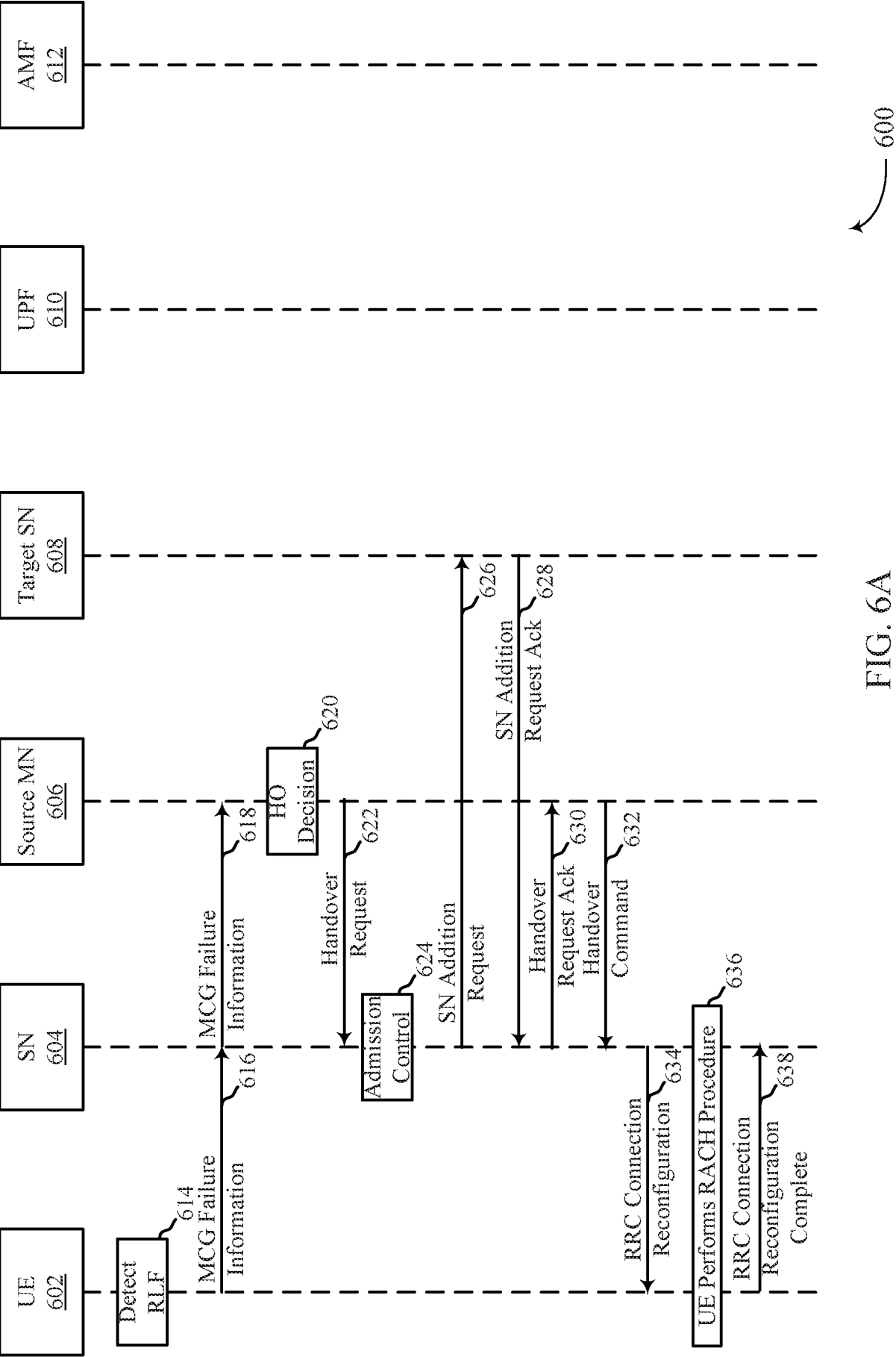


FIG. 6A

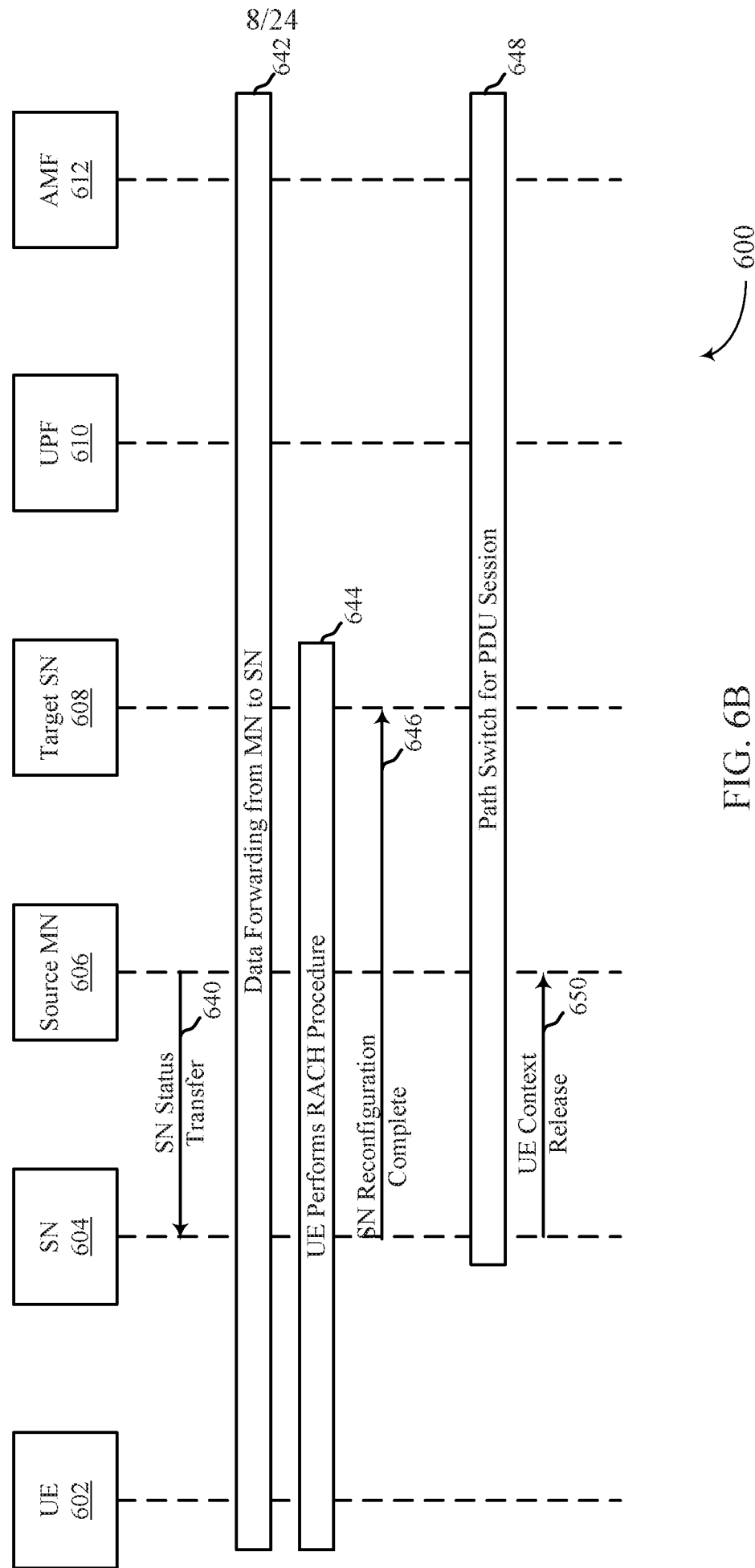


FIG. 6B

9/24

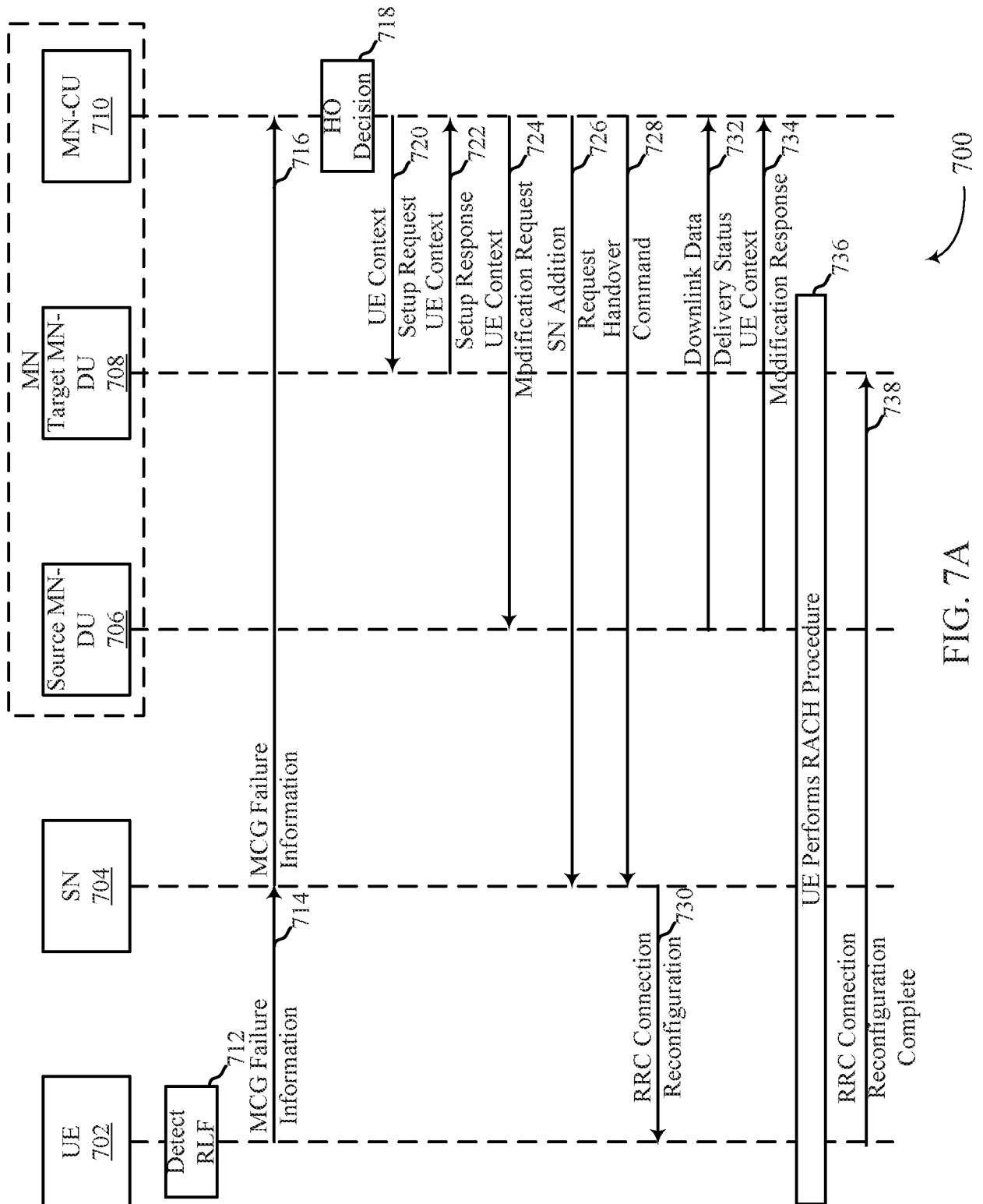


FIG. 7A

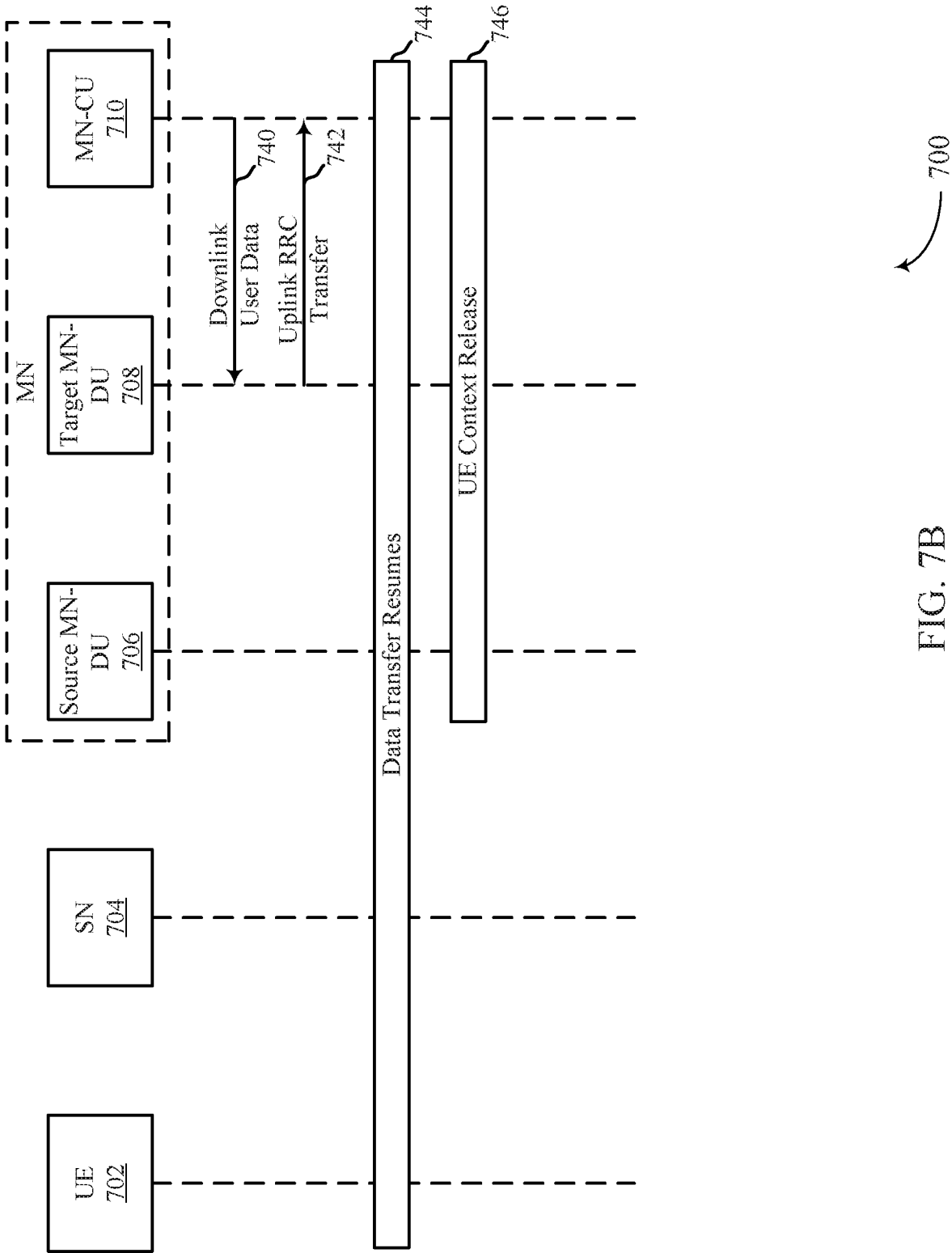


FIG. 7B

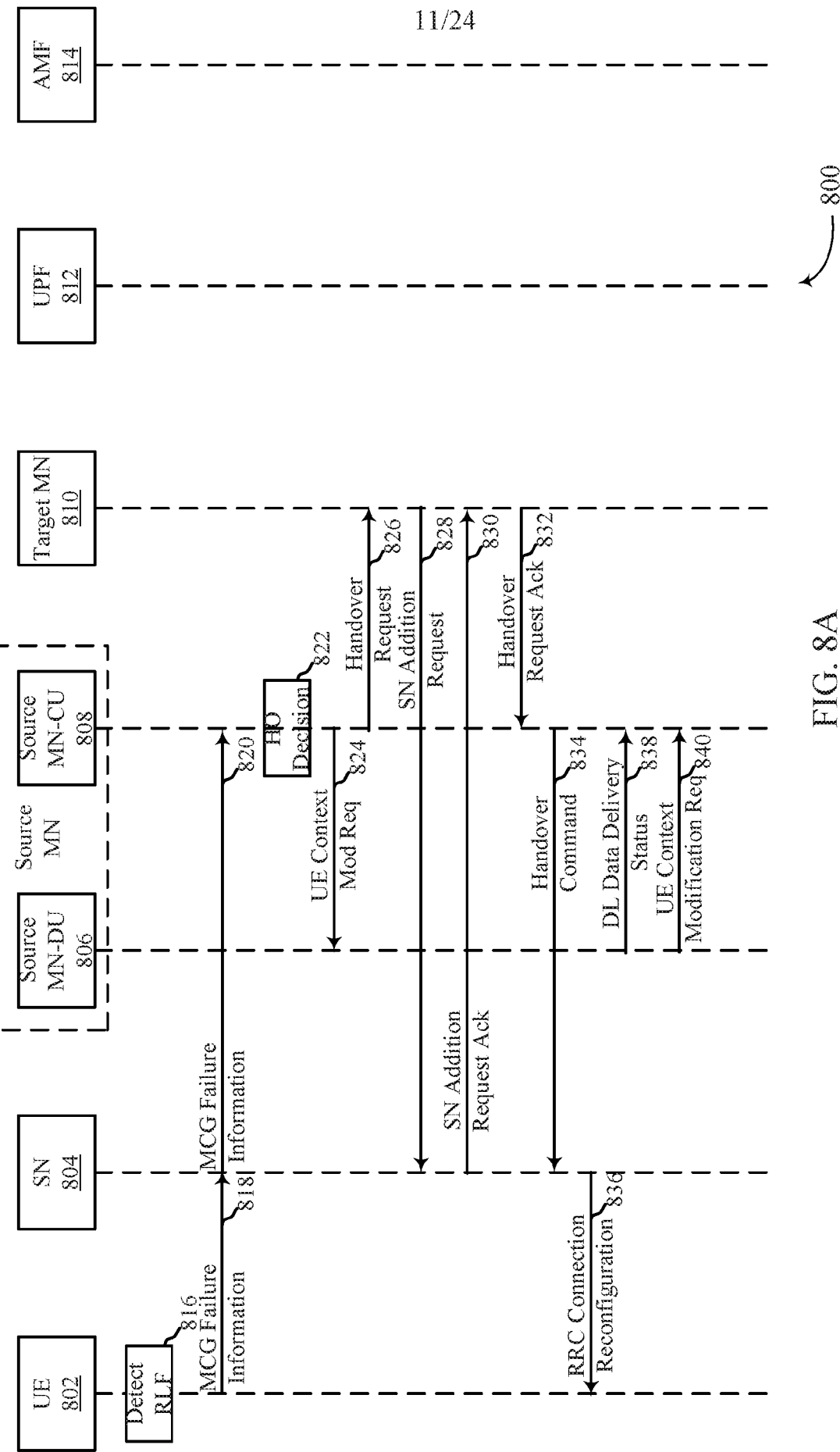


FIG. 8A

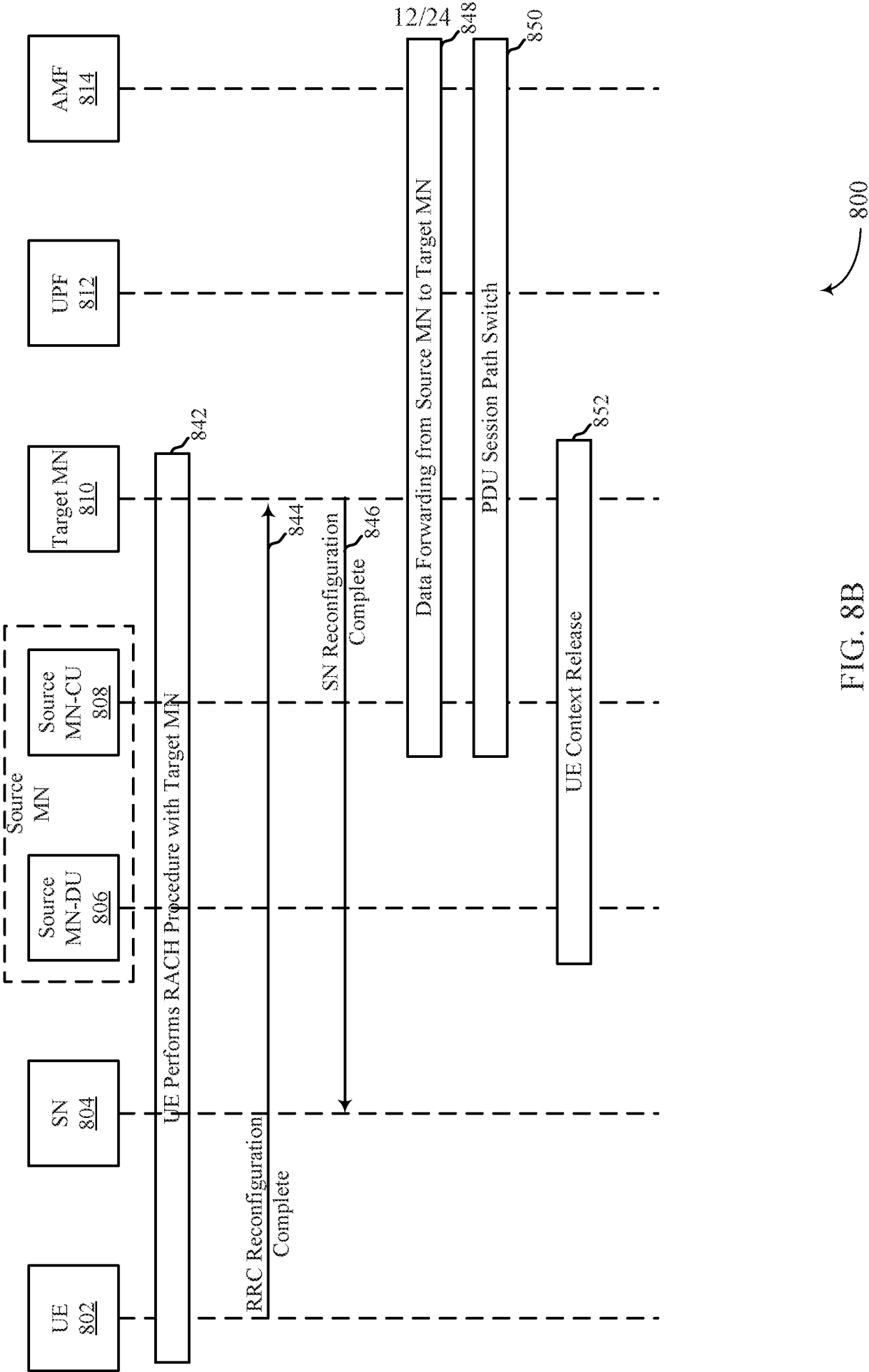
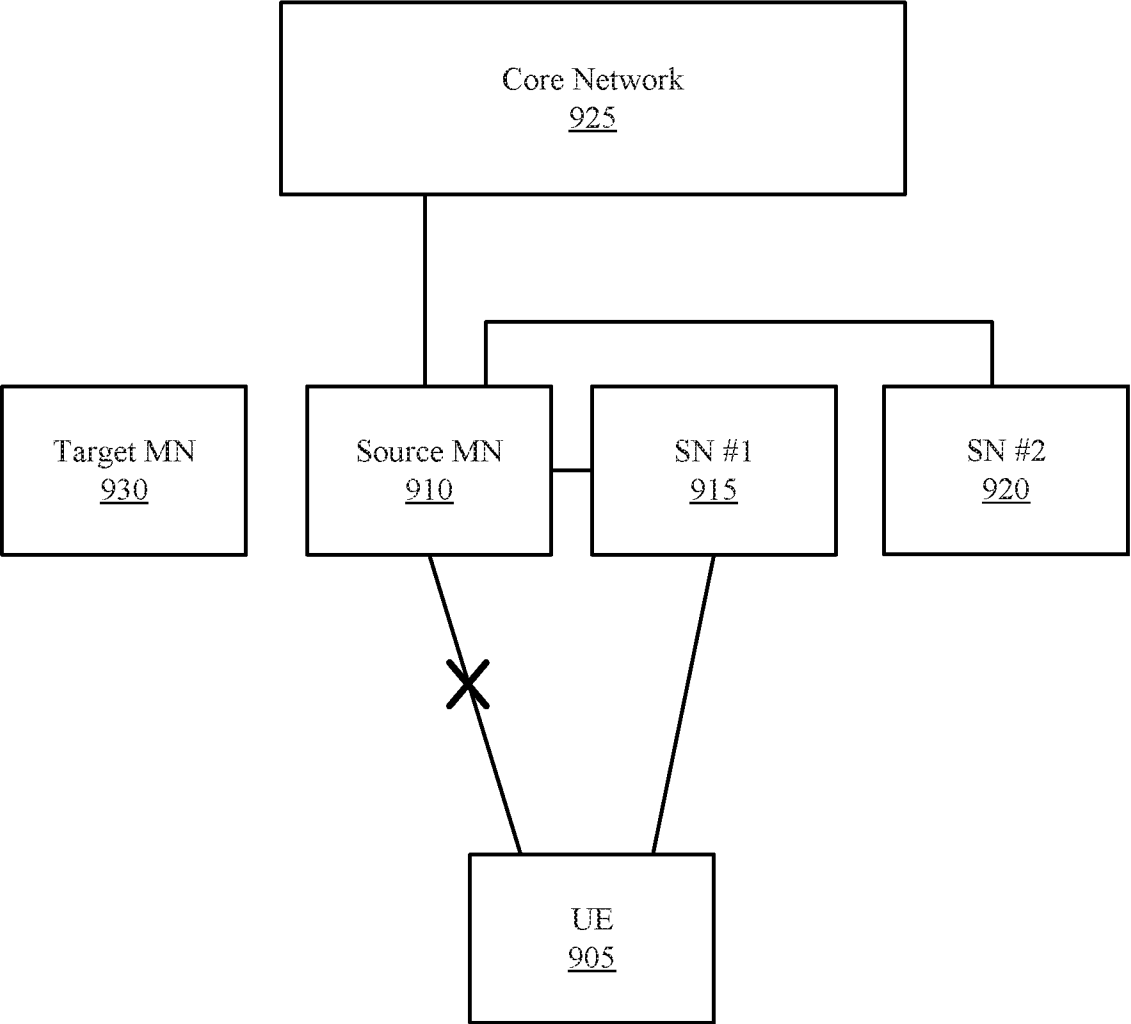


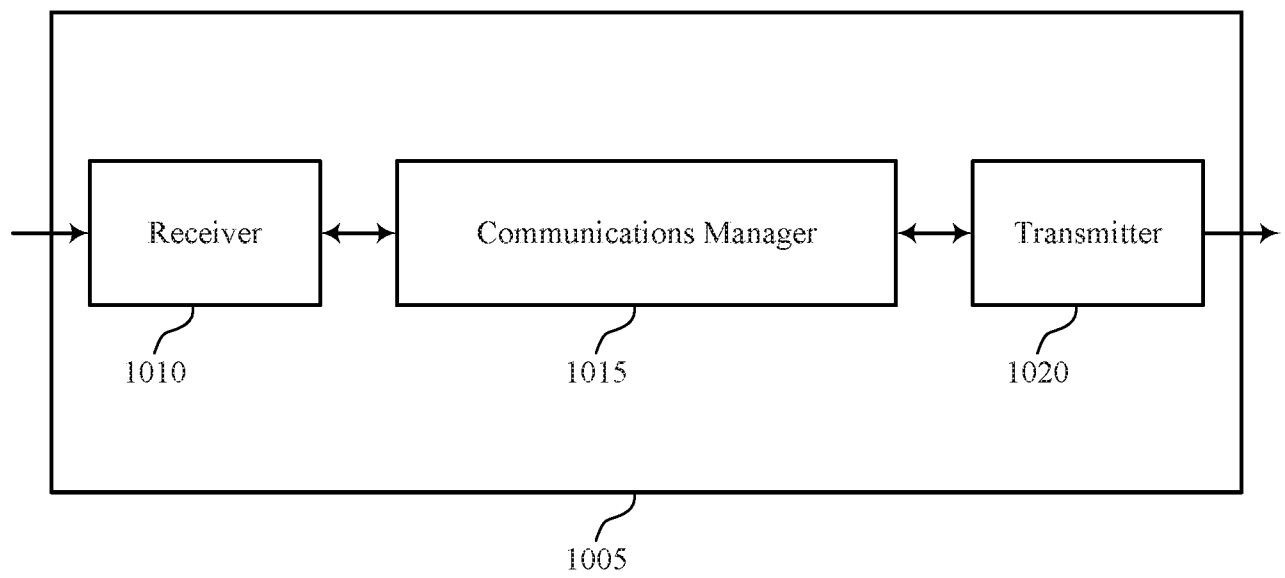
FIG. 8B



900

FIG. 9

14/24



1000

FIG. 10

15/24

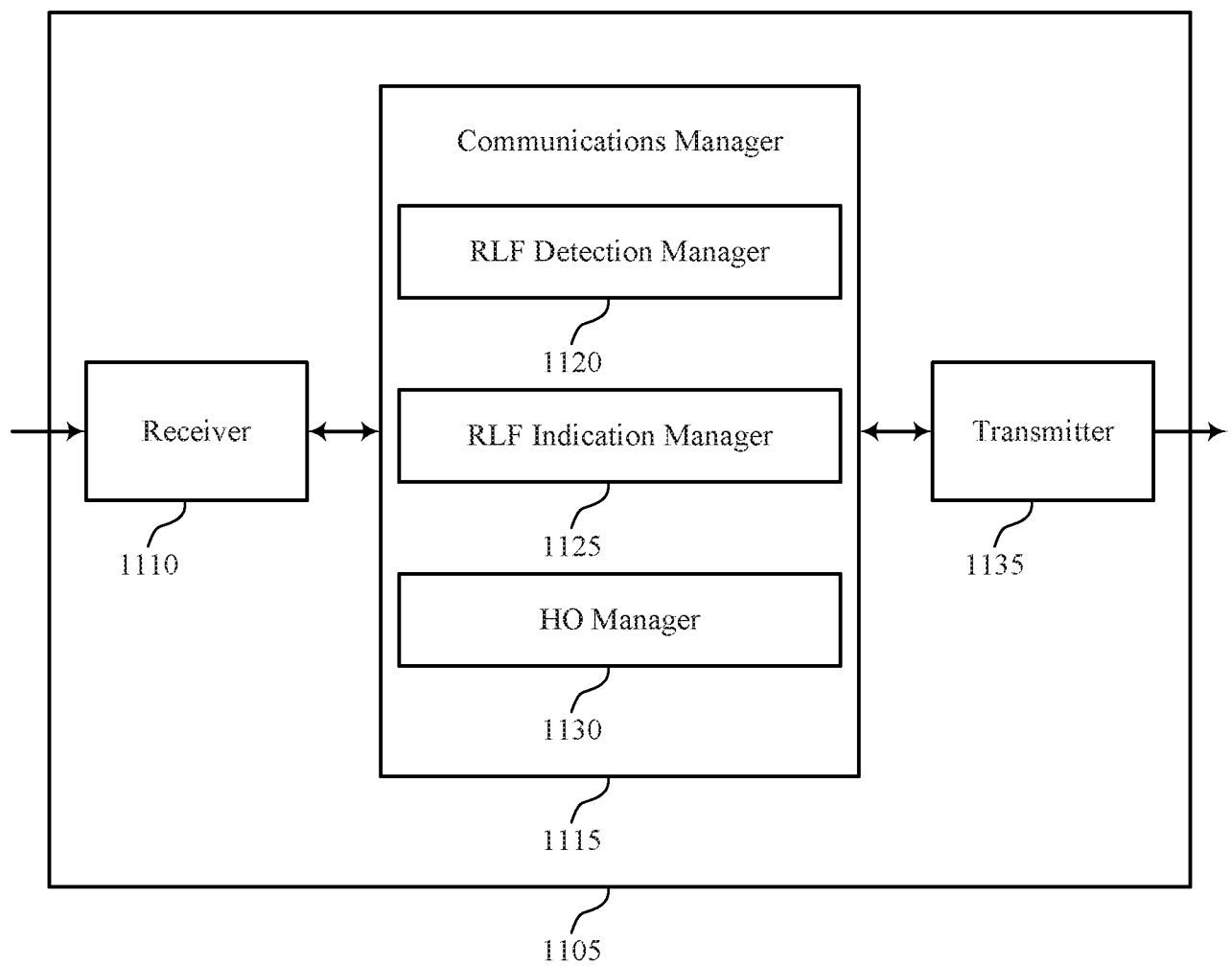


FIG. 11

16/24

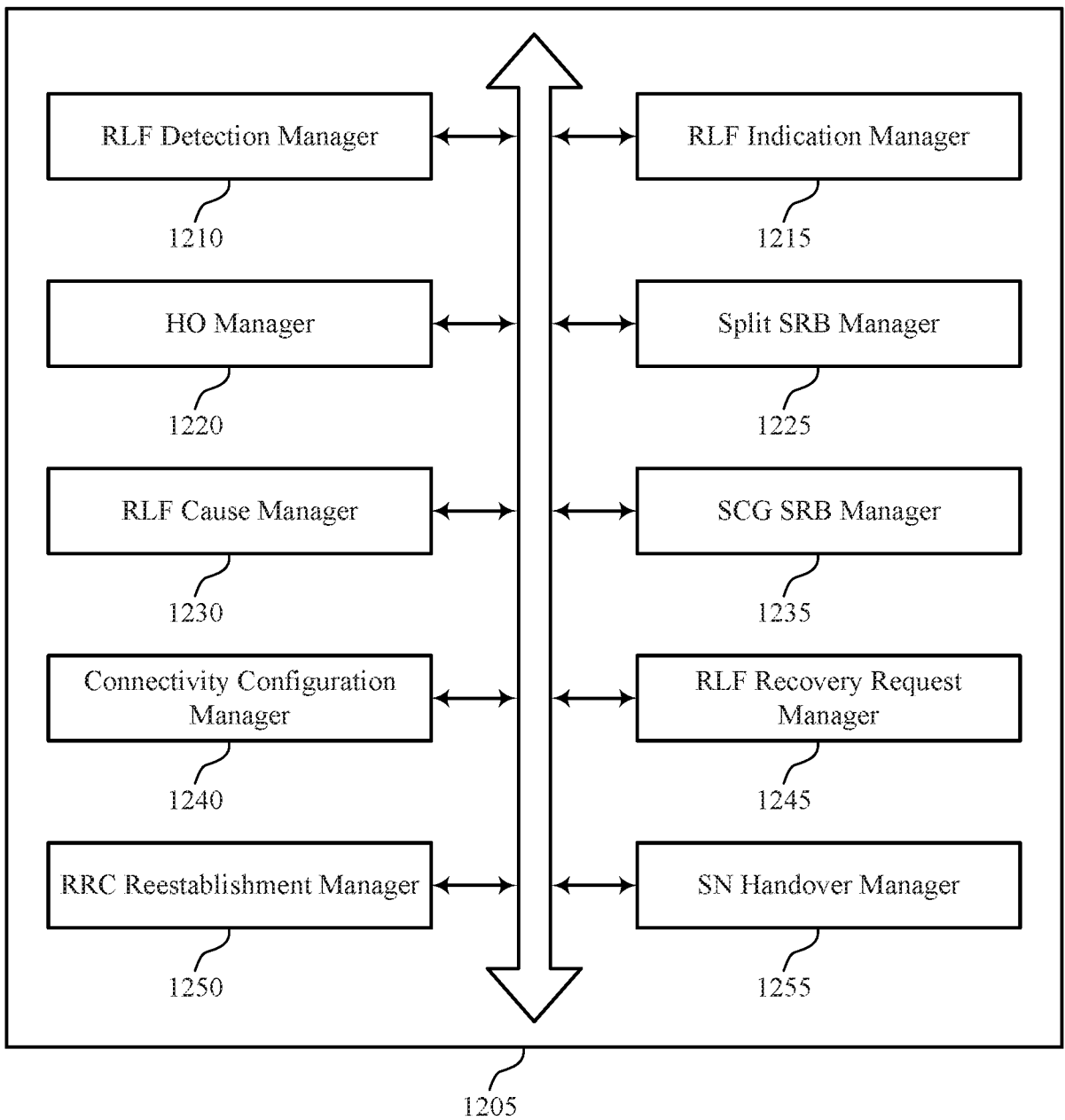


FIG. 12

17/24

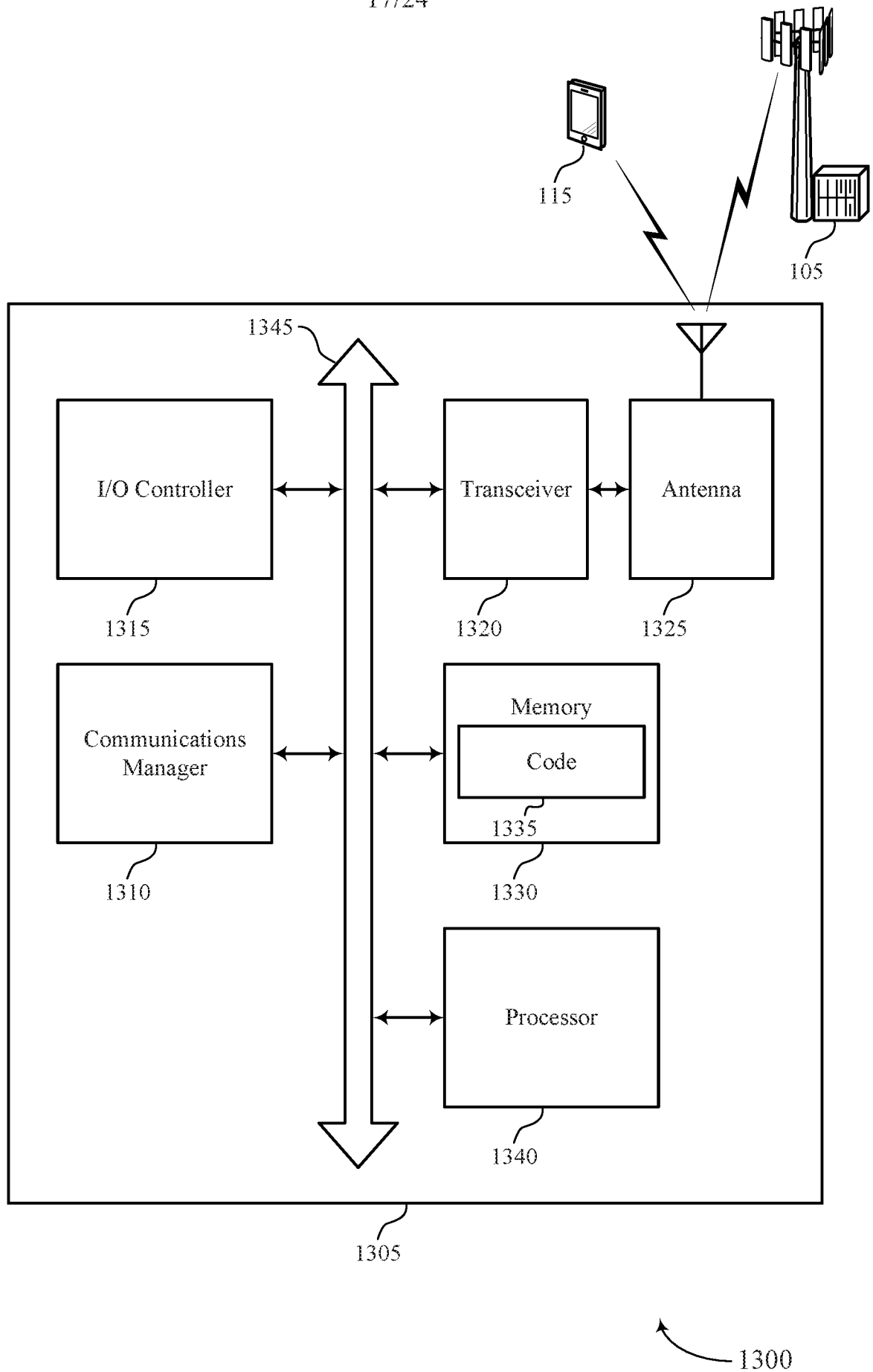
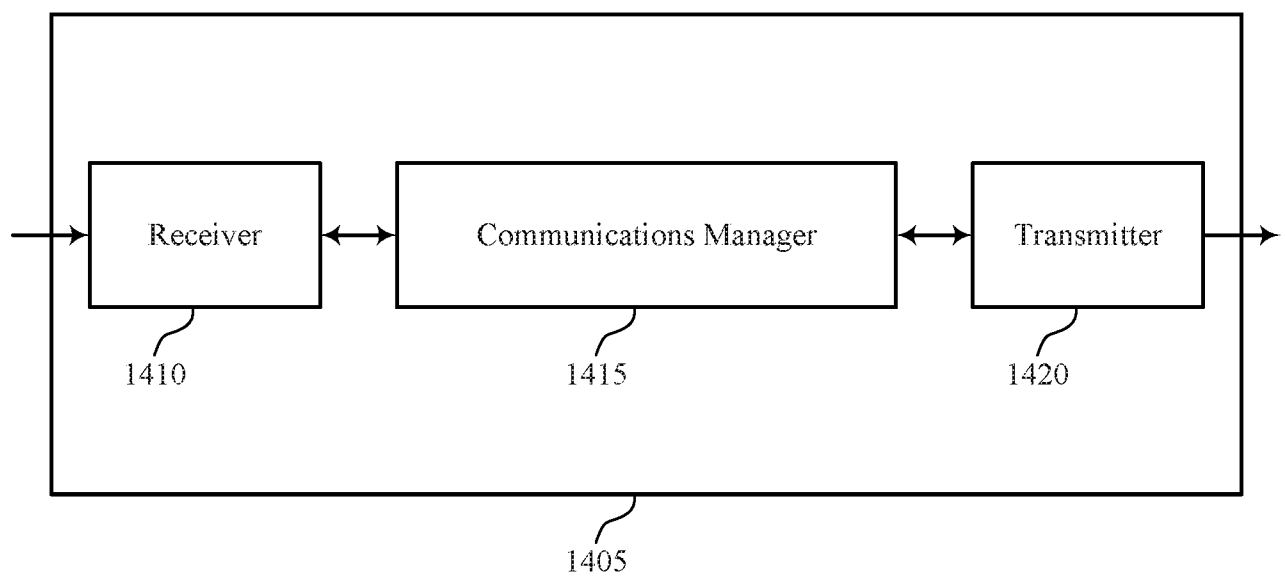


FIG. 13

18/24



1400

FIG. 14

19/24

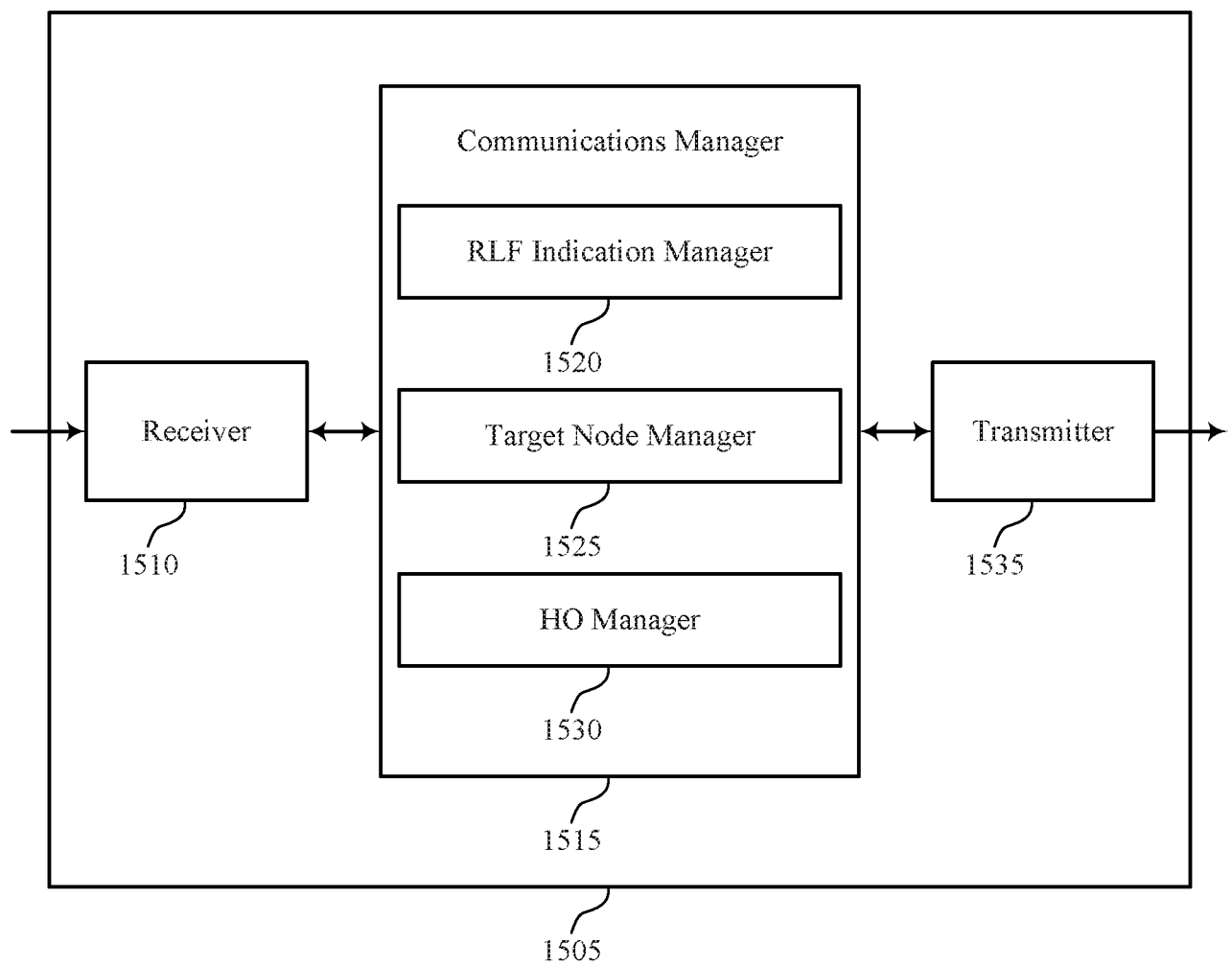


FIG. 15

20/24

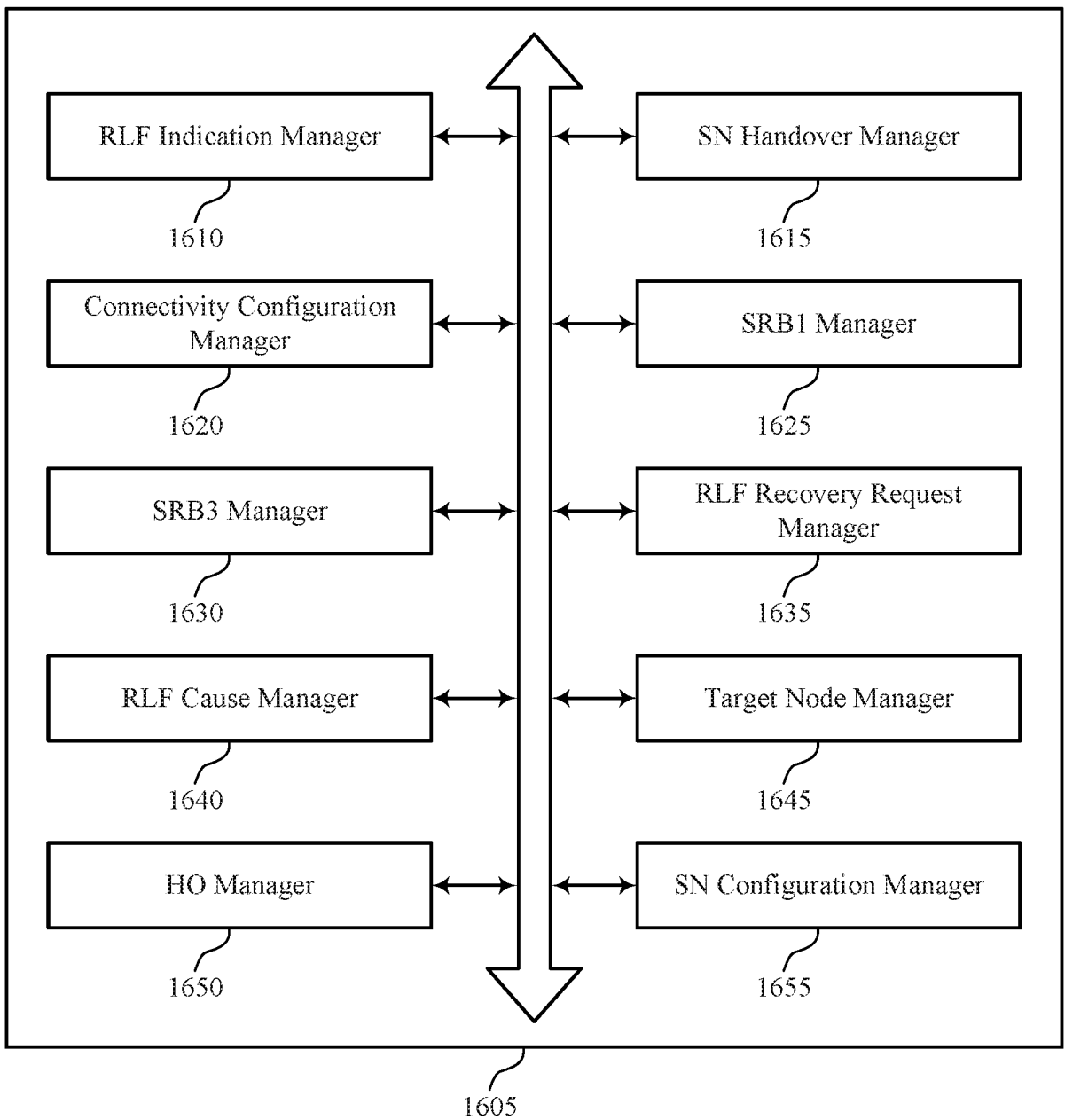


FIG. 16

21/24

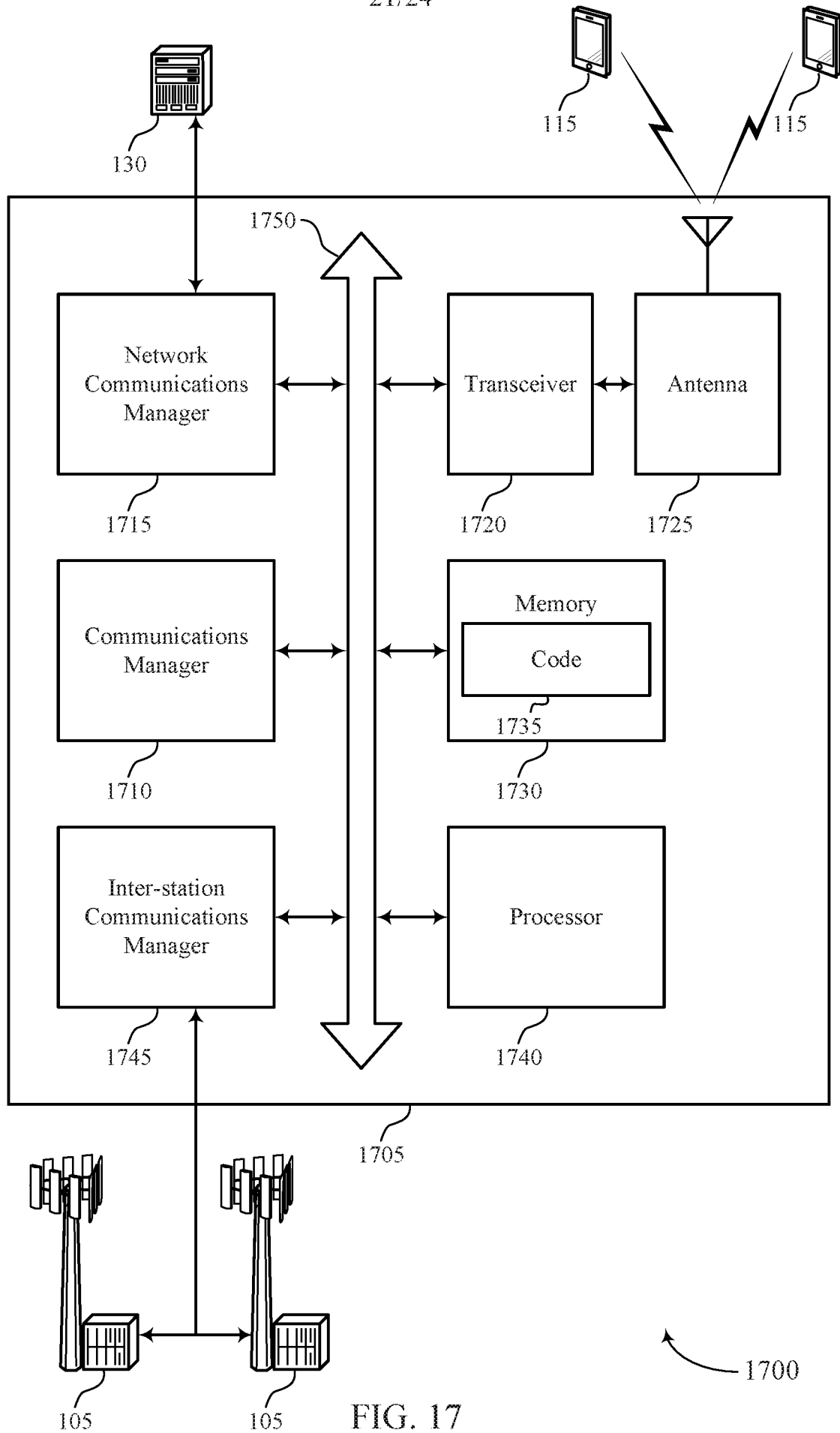


FIG. 17

22/24

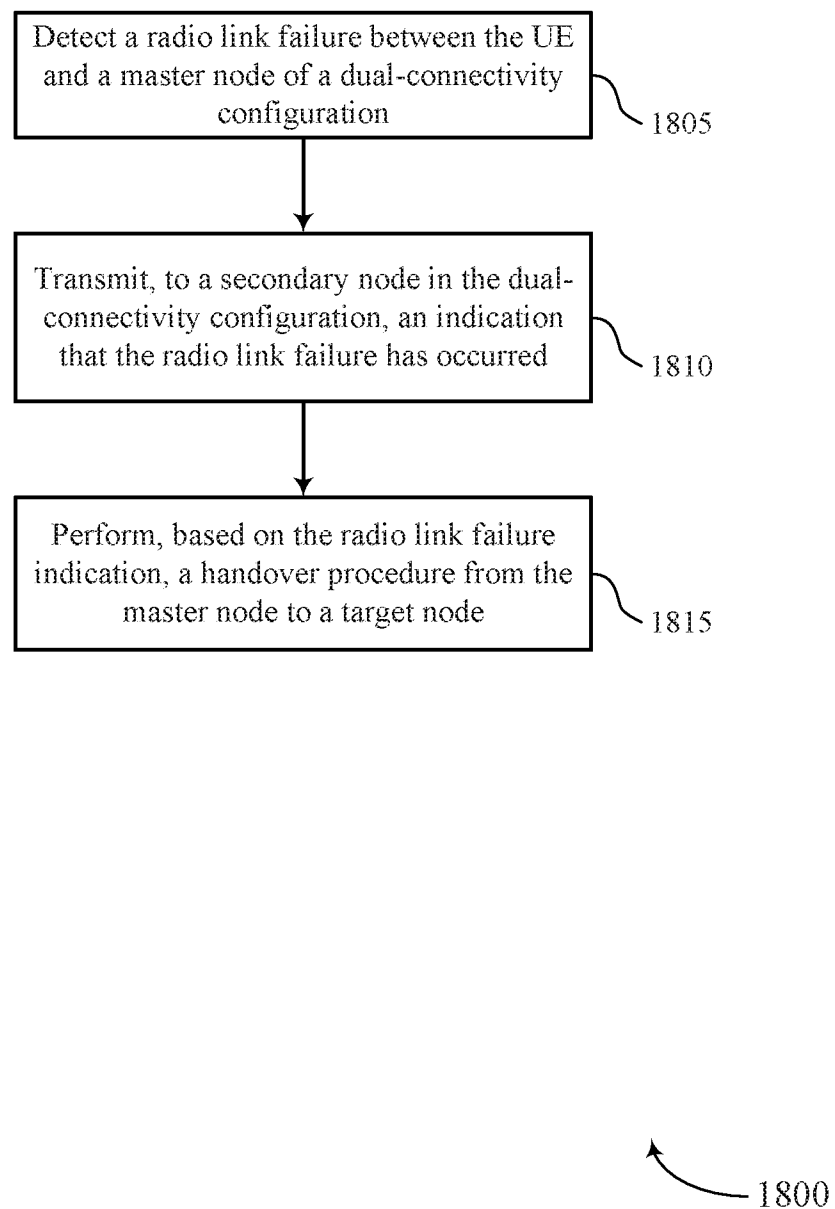
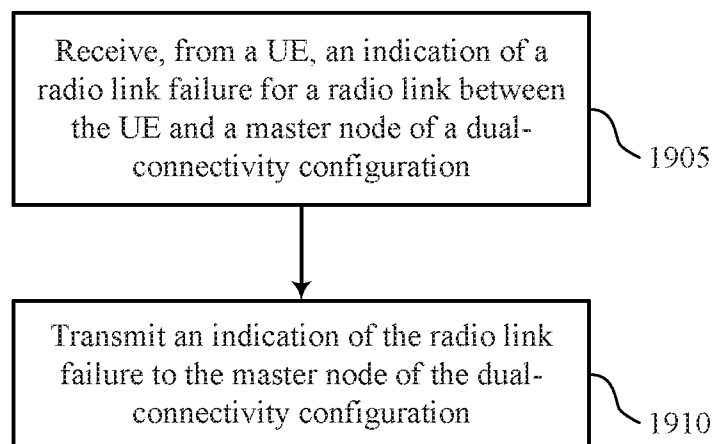


FIG. 18

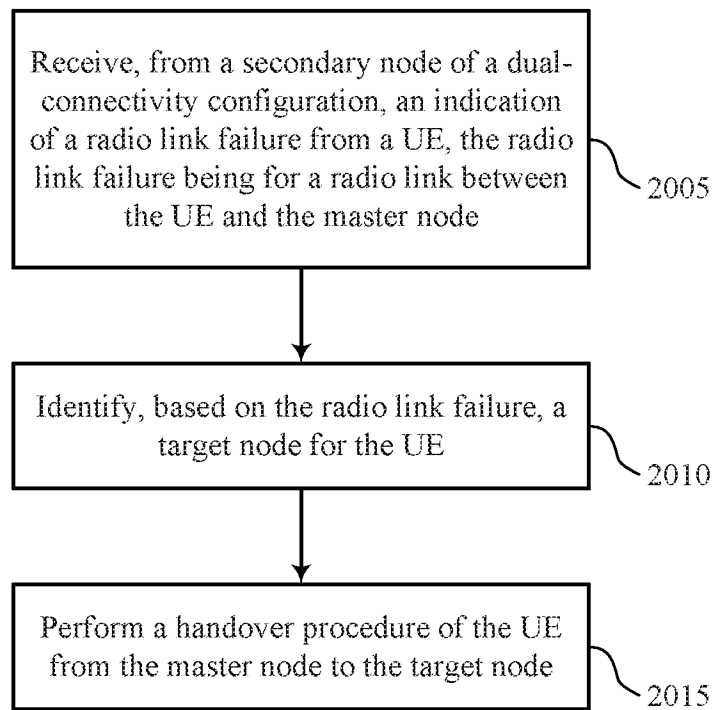
23/24



1900

FIG. 19

24/24



2000

FIG. 20

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/118898

**A. CLASSIFICATION OF SUBJECT MATTER**

H04W 76/18(2018.01)i; H04W 76/19(2018.01)i; H04W 76/15(2018.01)n; H04W 76/25(2018.01)n

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

H04W H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT,WPI,EPODOC,CNKI,3GPP:master,dual,connectivity, RLF, handover,switchover, MeNB,secondary,srb,x2,rat, inter,backhaul,spectrum,access,measurement report, DU,split

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 2016242226 A1 (KDDI CORP.) 18 August 2016 (2016-08-18)<br>description, paragraphs 0037, 0059-0073, and FIGS.6-10               | 1-188                 |
| A         | CN 105960772 A (QUALCOMM INCORPORATED) 21 September 2016 (2016-09-21)<br>the whole document                                       | 1-188                 |
| A         | CN 105101253 A (ALCATEL LUCENT SHANGHAI BELL CO., LTD. ET AL) 25<br>November 2015 (2015-11-25)<br>the whole document              | 1-188                 |
| A         | ERICSSON et al. "Way forward with control plane architecture selection"<br>R2-132700, 23 August 2013 (2013-08-23),<br>section 2.5 | 1-188                 |

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 May 2019

Date of mailing of the international search report

03 July 2019

Name and mailing address of the ISA/CN

National Intellectual Property Administration, PRC  
6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing  
100088  
China

Authorized officer

ZHANG, Jiakai

Facsimile No. (86-10)62019451

Telephone No. 86-(10)-53961760

**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/CN2018/118898**

| Patent document<br>cited in search report |            |    | Publication date<br>(day/month/year) | Patent family member(s) |             |    | Publication date<br>(day/month/year) |
|-------------------------------------------|------------|----|--------------------------------------|-------------------------|-------------|----|--------------------------------------|
| US                                        | 2016242226 | A1 | 18 August 2016                       | WO                      | 2015059899  | A1 | 30 April 2015                        |
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