

MULTICAST OR BROADCAST SERVICE CONTINUITY

TECHNICAL FIELD

[0001] The present disclosure relates to wireless communications, and more specifically to a user equipment (UE), a base station, and methods for multicast or broadcast service continuity.

BACKGROUND

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

[0003] The wireless communication system may comprise one or more satellites which may relay signals or act as base stations, such as in non-terrestrial network (NTN). The NTN can provide services to areas that cannot be covered by terrestrial 5G networks mainly due to cost. On the other hand, new radio (NR) has been proposed to support multicast or broadcast service. The multicast or broadcast service was introduced for the NR to provide point-to-multipoint (PTM) services with substantial improvements regarding efficient resources usage and user experience. However, there is a need to improve service continuity.

SUMMARY

[0004] The present disclosure relates to a UE, a base station, and methods for multicast or broadcast service continuity. With the UE, base station and methods, the multicast or broadcast service continuity can be improved.

[0005] In a first aspect, some implementations of a UE described herein may include a processor; and a transceiver coupled to the processor, wherein the processor is configured to: receive, via the transceiver and from a base station, service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and perform, based on the service area information, at least one mobility procedure for the at least one neighboring cell.

[0006] In some implementations, the service area information comprises a first area parameter, and the first area parameter comprises at least one of the following: information indicating a reference location and a radius for a service area of the neighboring cell; information indicating multiple locations for the service area of the neighboring cell; or an identity for the service area of the neighboring cell.

[0007] In some implementations, the processor is further configured to: determine, based on information indicating a location of the UE and the first area parameter, whether the UE is within or outside the service area of the neighboring cell.

[0008] In some implementations, the service area information comprises a second area parameter, and the second area parameter comprises at least one of the following: an identity of a beam for the neighboring cell; an elevation angle to a radio access network (RAN) node; a horizontal angle to the RAN node; a propagation delay to the RAN node; a distance from the UE to a cell reference location; a tracking area (TA); a RAN notification area (RNA); a terrestrial network (TN) area; or a distance from the UE to a TN area reference location.

[0009] In some implementations, the second area parameter further comprises at least one of the following: one or more thresholds for the elevation angle; one or more thresholds for the horizontal angle; one or more thresholds for the propagation delay; one or more thresholds for the distance to the cell reference location; or one or more thresholds for the distance to the TN area reference location.

[0010] In some implementations, the processor is further configured to determine whether the UE is within or outside the service area based on one of the following: the beam measured or selected by the UE; the elevation angle and the corresponding one or more thresholds; the horizontal angle and the corresponding one or more thresholds; the propagation delay and the corresponding one or more thresholds; the distance to the cell reference location and the corresponding one or more thresholds; the distance to the TN area reference location and the corresponding one or more thresholds; or information indicating a location of the UE and a zone defined by the TA, the RNA or the TN area.

[0011] In some implementations, the service area information is associated to at least one of the following: a broadcast service; a frequency selection area identity (FSAI); a service area identity (SAI) in user service description (USD); a radio frequency; a cell identity; or an available duration.

[0012] In some implementations, the at least one mobility procedure comprises: in a case that the UE is able to receive a broadcast service or a multicast service by camping on a frequency, and the UE is or is to be in a service area associated to the frequency, prioritizing the frequency; in a case that the UE is or is to be in a service area associated to the frequency, prioritizing the frequency; in a case that the UE is not or is not to be in the service area associated to the frequency, preventing from prioritizing the frequency; or in a case that the UE is not or is not to be in the service area associated to the frequency deprioritizing the frequency.

[0013] In some implementations, the at least one mobility procedure further comprises: triggering a neighboring cell measurement for cell reselection, wherein the processor is configured to prioritize the frequency by setting the frequency to have a highest priority, or wherein the processor is configured to deprioritize the frequency by setting the frequency to have a lowest priority.

[0014] In some implementations, the service area information of the at least one neighboring cell is first service area information, and the at least one mobility procedure comprises: transmitting, via the transceiver and to the base station, second service area information of the UE, wherein the second service area information is associated with a service area that the UE is in or is expected or interested to be in.

[0015] In some implementations, the second service area information comprises one of the following: information indicating a service area that the UE is in or entering;

information indicating a location of the UE; a beam measured or selected by the UE; an elevation angle to a RAN node; a horizontal angle to the RAN node; a propagation delay to the RAN node; a distance from the UE to a cell reference location; a distance from the UE to a TN area reference location; a TA of the UE; a RNA of the UE; or a nearest TN area of the UE.

[0016] In some implementations, the second service area information further comprises an available duration of the second service area information.

[0017] In some implementations, the processor is configured to transmit the second service area information based on a trigger condition, and the trigger condition comprises one of the following: a corresponding request is received from a serving cell; the UE enters or leaves any service area; the UE enters or leaves a specific service area indicated by the serving cell; a priority of a frequency for an MBS changes, wherein the frequency is associated to at least one service area; a frequency priority between broadcast and unicast or multicast reception changes since the service area of the UE changes; a measurement report is triggered; or a timer associated to a previous report of the second service area information expires.

[0018] In some implementations, the second service area information is associated to at least one of the following: a broadcast service; a FSAI; a radio frequency; a cell identity; an MBS interest indication; or a measurement report.

[0019] In some implementations, the at least one neighboring cell is provided by a non-terrestrial network.

[0020] In a second aspect, some implementations of a base station described herein may include a processor; and a transceiver coupled to the processor, wherein the processor is configured to: obtain service area information of at least one neighboring cell of a user equipment (UE), wherein the service area information is associated with at least one of a broadcast service or a multicast service; and transmit, via the transceiver and to the UE, the service area information of the at least one neighboring cell.

[0021] In some implementations, the service area information comprises a first area parameter, and the first area parameter comprises at least one of the following: information indicating a reference location and a radius for a service area of the

neighboring cell; information indicating multiple locations for the service area of the neighboring cell; or an identity for the service area of the neighboring cell.

[0022] In some implementations, the service area information comprises a second area parameter, and the second area parameter comprises at least one of the following: an identity of a beam for the neighboring cell; an elevation angle to a radio access network (RAN) node; a horizontal angle to the RAN node; a propagation delay to the RAN node; a distance from the UE to a cell reference location; a tracking area (TA); a RAN notification area (RNA); a terrestrial network (TN) area; or a distance from the UE to a TN area reference location.

[0023] In some implementations, the second area parameter further comprises at least one of the following: one or more thresholds for the elevation angle; one or more thresholds for the horizontal angle; one or more thresholds for the propagation delay; one or more thresholds for the distance to the cell reference location; or one or more thresholds for the distance to the TN area reference location.

[0024] In some implementations, the service area information is associated to at least one of the following: a broadcast service; a frequency selection area identity (FSAI); a service area identity (SAI) in user service description (USD); a radio frequency; a cell identity; or an available duration.

[0025] In some implementations, the processor is configured to obtain the service area information of the at least one neighboring cell from another base station.

[0026] In some implementations, the service area information of the at least one neighboring cell is first service area information, and the processor is further configured to: receive, via the transceiver and from the UE, second service area information of the UE, wherein the second service area information is associated with a service area that the UE is in or is expected or interested to be in.

[0027] In some implementations, the second service area information comprises one of the following: information indicating a service area that the UE is in or entering; information indicating a location of the UE; a beam measured or selected by the UE; an elevation angle to a RAN node; a horizontal angle to the RAN node; a propagation delay to the RAN node; a distance from the UE to a cell reference location; a distance from the

UE to a TN area reference location; a TA of the UE; a RNA of the UE; or a nearest TN area of the UE.

[0028] In some implementations, the second service area information further comprises an available duration of the second service area information.

[0029] In some implementations, the processor is further configured to: transmit, via the transceiver and to the UE, a request for reporting the second service area information of the UE.

[0030] In some implementations, the second service area information is associated to at least one of the following: a broadcast service; a FSAI; a radio frequency; a cell identity; an MBS interest indication; or a measurement report.

[0031] In some implementations, the processor is further configured to: transmit, via the transceiver and to another base station, the second service area information of the UE.

[0032] In some implementations, the at least one neighboring cell is provided by a non-terrestrial network.

[0033] In a third aspect, some implementations of a method described herein may include: receiving, via a transceiver and from a base station, service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and performing, based on the service area information, at least one mobility procedure for the at least one neighboring cell.

[0034] In a fourth aspect, some implementations of a processor described herein may include at least one memory and a controller coupled with the at least one memory and configured to cause the controller to: receive, via a transceiver and from a base station, service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and perform, based on the service area information, at least one mobility procedure for the at least one neighboring cell.

[0035] In a fifth aspect, some implementations of a method described herein may include: obtaining service area information of at least one neighboring cell of a user equipment (UE), wherein the service area information is associated with at least one of a

broadcast service or a multicast service; and transmitting, via a transceiver and to the UE, the service area information of the at least one neighboring cell.

[0036] It is to be understood that the summary section is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Fig. 1 illustrates an example of a wireless communications system for multicast or broadcast service continuity in accordance with aspects of the present disclosure.

[0038] Fig. 2 illustrates an example of relation between a cell coverage and an MBS area in a terrestrial network.

[0039] Fig. 3 illustrates an example of relation between a cell coverage and an MBS area in a non-terrestrial network.

[0040] Figs. 4A and 4B illustrate a signaling chart of an example process for multicast or broadcast service continuity in accordance with some aspects of the present disclosure, respectively.

[0041] Fig. 5 illustrates an example of a device for multicast or broadcast service continuity in accordance with some aspects of the present disclosure.

[0042] Fig. 6 illustrates an example of a processor for multicast or broadcast service continuity in accordance with aspects of the present disclosure.

[0043] Figs. 7 and 8 illustrate a flowchart of a method for multicast or broadcast service continuity in accordance with aspects of the present disclosure, respectively.

DETAILED DESCRIPTION

[0044] Principles of the present disclosure will now be described with reference to some embodiments. It is to be understood that these embodiments are described only for the purpose of illustration and help those skilled in the art to understand and implement the present disclosure, without suggesting any limitation as to the scope of the disclosure.

The disclosure described herein may be implemented in various manners other than the ones described below.

[0045] In the following description and claims, unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skills in the art to which this disclosure belongs.

[0046] References in the present disclosure to “one implementation,” “an example implementation,” “an implementation,” “some implementations,” and the like indicate that the implementation(s) described may include a particular feature, structure, or characteristic, but it is not necessary that every implementation includes the particular feature, structure, or characteristic. Moreover, such phrases do not necessarily refer to the same implementation(s). Further, when a particular feature, structure, or characteristic is described in connection with an implementation, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other implementations whether or not explicitly described.

[0047] It shall be understood that although the terms “first” and “second” or the like may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another element. For example, a first element could also be termed as a second element, and similarly, a second element could also be termed as a first element, without departing from the scope of implementations. As used herein, the term “and/or” includes any and all combinations of one or more of the listed terms. In some examples, values, procedures, or apparatuses are referred to as “best,” “lowest,” “highest,” “minimum,” “maximum,” or the like. It will be appreciated that such descriptions are intended to indicate that a selection among many used functional alternatives can be made, and such selections need not be better, smaller, higher, or otherwise preferable to other selections.

[0048] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms “a,” “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises,” “comprising,” “has,” “having,” “includes” and/or “including”, when used herein, specify the presence of stated features, elements, and/or components etc., but do not preclude the presence or addition of one or more other features, elements,

components and/ or combinations thereof. For example, the term “includes” and its variants are to be read as open terms that mean “includes, but is not limited to.” The term “based on” is to be read as “based at least in part on.” The term “one implementation” and “an implementation” are to be read as “at least one implementation.” The term “another implementation” is to be read as “at least one other implementation.” The use of an expression such as “A and/or B” can mean either “only A” or “only B” or “both A and B.” Other definitions, explicit and implicit, may be included below.

[0049] Aspects of the present disclosure are described in the context of a wireless communications system.

[0050] Fig. 1 illustrates an example of a wireless communications system 100 for multicast or broadcast service continuity in accordance with aspects of the present disclosure. The wireless communications system 100 may include one or more network entities 102 (also referred to as network equipment (NE)), one or more terminal devices or UEs 104, a core network 106, and a packet data network 108. The wireless communications system 100 may support various radio access technologies. In some implementations, the wireless communications system 100 may be a 4G network, such as an LTE network or an LTE-advanced (LTE-A) network. In some other implementations, the wireless communications system 100 may be a 5G network, such as an NR network. In other implementations, the wireless communications system 100 may be a combination of a 4G network and a 5G network, or other suitable radio access technology including institute of electrical and electronics engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20. The wireless communications system 100 may support radio access technologies beyond 5G. Additionally, the wireless communications system 100 may support technologies, such as time division multiple access (TDMA), frequency division multiple access (FDMA), or code division multiple access (CDMA), etc.

[0051] The one or more network entities 102 may be dispersed throughout a geographic region to form the wireless communications system 100. One or more of the network entities 102 described herein may be or include or may be referred to as a network node, a base station (BS), a network element, a radio access network (RAN) node, a base transceiver station, an access point, a NodeB, an eNodeB (eNB), a next-generation NodeB (gNB), or other suitable terminology. A network entity 102 and a UE 104 may communicate via a communication link 110, which may be a wireless or wired connection.

For example, a network entity 102 and a UE 104 may perform wireless communication (e.g., receive signaling, transmit signaling) over a Uu interface.

[0052] In NTN scenarios, a network entity 102 may be implemented as a satellite. A network entity 102 in form of a satellite can directly communicate to UE 104 using NR/LTE Uu interface. The satellite may be a transparent satellite or a regenerative satellite. For NTN with a transparent satellite, a base station on earth may communicate with a UE via the satellite. For example, a communication link 110 between the satellite and the UE 104, a communication link 110 between the satellite and a base station on earth, and a communication link 116 between the base station on earth and core network 106 may be used for the NTN transparent mode. For NTN with a regenerative satellite, the base station may be on board and directly communicate with the UE. For example, a communication link 110 between the satellite and the UE 104, and a communication link 116 between the satellite (with full or part of an eNB/gNB on board) and core network 106 may be used for the NTN regenerative mode.

[0053] A network entity 102 may provide a geographic coverage area 112 for which the network entity 102 may support services (e.g., voice, video, packet data, messaging, broadcast, etc.) for one or more UEs 104 within the geographic coverage area 112. For example, a network entity 102 and a UE 104 may support wireless communication of signals related to services (e.g., voice, video, packet data, messaging, broadcast, etc.) according to one or multiple radio access technologies. In some implementations, a network entity 102 may be moveable, for example, a satellite associated with a non-terrestrial network. In some implementations, different geographic coverage areas 112 associated with the same or different radio access technologies may overlap, but the different geographic coverage areas 112 may be associated with different network entities 102. 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.

[0054] The one or more UEs 104 may be dispersed throughout a geographic region of the wireless communications system 100. A UE 104 may include or may be referred to as a mobile device, a wireless device, a remote device, a remote unit, a handheld device,

or a subscriber device, or some other suitable terminology. In some implementations, the UE 104 may be referred to as a unit, a station, a terminal, or a client, among other examples. Additionally, or alternatively, the UE 104 may be referred to as an internet-of-things (IoT) device, an internet-of-everything (IoE) device, or machine-type communication (MTC) device, among other examples. In some implementations, a UE 104 may be stationary in the wireless communications system 100. In some other implementations, a UE 104 may be mobile in the wireless communications system 100.

[0055] The one or more UEs 104 may be devices in different forms or having different capabilities. Some examples of UEs 104 are illustrated in Fig. 1. A UE 104 may be capable of communicating with various types of devices, such as the network entities 102, other UEs 104, or network equipment (e.g., the core network 106, the packet data network 108, a relay device, an integrated access and backhaul (IAB) node, or another network equipment), as shown in Fig. 1. Additionally, or alternatively, a UE 104 may support communication with other network entities 102 or UEs 104, which may act as relays in the wireless communications system 100.

[0056] A UE 104 may also be able to support wireless communication directly with other UEs 104 over a communication link 114. For example, a UE 104 may support wireless communication directly with another UE 104 over a device-to-device (D2D) communication link. In some implementations, such as vehicle-to-vehicle (V2V) deployments, vehicle-to-everything (V2X) deployments, or cellular-V2X deployments, the communication link 114 may be referred to as a sidelink. For example, a UE 104 may support wireless communication directly with another UE 104 over a PC5 interface.

[0057] A network entity 102 may support communications with the core network 106, or with another network entity 102, or both. For example, a network entity 102 may interface with the core network 106 through one or more backhaul links 116 (e.g., via an S1, N2, N2, or another network interface). The network entities 102 may communicate with each other over the backhaul links 116 (e.g., via an X2, Xn, or another network interface). In some implementations, the network entities 102 may communicate with each other directly (e.g., between the network entities 102). In some other implementations, the network entities 102 may communicate with each other or indirectly (e.g., via the core network 106). In some implementations, one or more network entities 102 may include subcomponents, such as an access network entity, which may be an

example of an access node controller (ANC). An ANC may communicate with the one or more UEs 104 through one or more other access network transmission entities, which may be referred to as a radio heads, smart radio heads, or transmission-reception points (TRPs).

[0058] In some implementations, a network entity 102 may be configured in a disaggregated architecture, which may be configured to utilize a protocol stack physically or logically distributed among two or more network entities 102, such as an integrated access backhaul (IAB) network, an open radio access network (O-RAN) (e.g., a network configuration sponsored by the O-RAN Alliance), or a virtualized RAN (vRAN) (e.g., a cloud RAN (C-RAN)). For example, a network entity 102 may include one or more of a central unit (CU), a distributed unit (DU), a radio unit (RU), a RAN intelligent controller (RIC) (e.g., a near-real time RIC (Near-RT RIC), a non-real time RIC (Non-RT RIC)), a service management and orchestration (SMO) system, or any combination thereof.

[0059] An RU may also be referred to as a radio head, a smart radio head, a remote radio head (RRH), a remote radio unit (RRU), or a transmission reception point (TRP). One or more components of the network entities 102 in a disaggregated RAN architecture may be co-located, or one or more components of the network entities 102 may be located in distributed locations (e.g., separate physical locations). In some implementations, one or more network entities 102 of a disaggregated RAN architecture may be implemented as virtual units (e.g., a virtual CU (VCU), a virtual DU (VDU), a virtual RU (VRU)).

[0060] Split of functionality between a CU, a DU, and an RU may be flexible and may support different functionalities depending upon which functions (e.g., network layer functions, protocol layer functions, baseband functions, radio frequency functions, and any combinations thereof) are performed at a CU, a DU, or an RU. For example, a functional split of a protocol stack may be employed between a CU and a DU such that the CU may support one or more layers of the protocol stack and the DU may support one or more different layers of the protocol stack. In some implementations, the CU may host upper protocol layer (e.g., a layer 3 (L3), a layer 2 (L2)) functionality and signaling (e.g., radio resource control (RRC), service data adaptation protocol (SDAP), packet data convergence protocol (PDCP)). The CU may be connected to one or more DUs or RUs, and the one or more DUs or RUs may host lower protocol layers, such as a layer 1 (L1) (e.g., physical (PHY) layer) or an L2 (e.g., radio link control (RLC) layer, medium access

control (MAC) layer) functionality and signaling, and may each be at least partially controlled by the CU.

[0061] Additionally, or alternatively, a functional split of the protocol stack may be employed between a DU and an RU such that the DU may support one or more layers of the protocol stack and the RU may support one or more different layers of the protocol stack. The DU may support one or multiple different cells (e.g., via one or more RUs). In some implementations, a functional split between a CU and a DU, or between a DU and an RU may be within a protocol layer (e.g., some functions for a protocol layer may be performed by one of a CU, a DU, or an RU, while other functions of the protocol layer are performed by a different one of the CU, the DU, or the RU).

[0062] A CU may be functionally split further into CU control plane (CU-CP) and CU user plane (CU-UP) functions. A CU may be connected to one or more DUs via a midhaul communication link (e.g., F1, F1-c, F1-u), and a DU may be connected to one or more RUs via a fronthaul communication link (e.g., open fronthaul (FH) interface). In some implementations, a midhaul communication link or a fronthaul communication link may be implemented in accordance with an interface (e.g., a channel) between layers of a protocol stack supported by respective network entities 102 that are in communication via such communication links.

[0063] The core network 106 may support user authentication, access authorization, tracking, connectivity, and other access, routing, or mobility functions. The core network 106 may be an evolved packet core (EPC), or a 5G core (5GC), which may include a control plane entity that manages access and mobility (e.g., a mobility management entity (MME), an access and mobility management functions (AMF)) and a user plane entity that routes packets or interconnects to external networks (e.g., a serving gateway (S-GW), a packet data network (PDN) gateway (P-GW), or a user plane function (UPF)). In some implementations, the control plane entity may manage non-access stratum (NAS) functions, such as mobility, authentication, and bearer management (e.g., data bearers, signal bearers, etc.) for the one or more UEs 104 served by the one or more network entities 102 associated with the core network 106.

[0064] The core network 106 may communicate with the packet data network 108 over one or more backhaul links 116 (e.g., via an S1, N2, N3, or another network interface). The packet data network 108 may include an application server 118. In some

implementations, one or more UEs 104 may communicate with the application server 118. A UE 104 may establish a session (e.g., a protocol data unit (PDU) session, or the like) with the core network 106 via a network entity 102. The core network 106 may route traffic (e.g., control information, data, and the like) between the UE 104 and the application server 118 using the established session (e.g., the established PDU session). The PDU session may be an example of a logical connection between the UE 104 and the core network 106 (e.g., one or more network functions of the core network 106).

[0065] In the wireless communications system 100, the network entities 102 and the UEs 104 may use resources of the wireless communications system 100 (e.g., time resources (e.g., symbols, slots, subframes, frames, or the like) or frequency resources (e.g., subcarriers, carriers)) to perform various operations (e.g., wireless communications). In some implementations, the network entities 102 and the UEs 104 may support different resource structures. For example, the network entities 102 and the UEs 104 may support different frame structures. In some implementations, such as in 4G, the network entities 102 and the UEs 104 may support a single frame structure. In some other implementations, such as in 5G and among other suitable radio access technologies, the network entities 102 and the UEs 104 may support various frame structures (i.e., multiple frame structures). The network entities 102 and the UEs 104 may support various frame structures based on one or more numerologies.

[0066] One or more numerologies may be supported in the wireless communications system 100, and a numerology may include a subcarrier spacing and a cyclic prefix. A first numerology (e.g., $\mu=0$) may be associated with a first subcarrier spacing (e.g., 15 kHz) and a normal cyclic prefix. In some implementations, the first numerology (e.g., $\mu=0$) associated with the first subcarrier spacing (e.g., 15 kHz) may utilize one slot per subframe. A second numerology (e.g., $\mu=1$) may be associated with a second subcarrier spacing (e.g., 30 kHz) and a normal cyclic prefix. A third numerology (e.g., $\mu=2$) may be associated with a third subcarrier spacing (e.g., 60 kHz) and a normal cyclic prefix or an extended cyclic prefix. A fourth numerology (e.g., $\mu=3$) may be associated with a fourth subcarrier spacing (e.g., 120 kHz) and a normal cyclic prefix. A fifth numerology (e.g., $\mu=4$) may be associated with a fifth subcarrier spacing (e.g., 240 kHz) and a normal cyclic prefix.

[0067] A time interval of a resource (e.g., a communication resource) may be organized according to frames (also referred to as radio frames). Each frame may have a duration, for example, a 10 millisecond (ms) duration. In some implementations, each frame may include multiple subframes. For example, each frame may include 10 subframes, and each subframe may have a duration, for example, a 1 ms duration. In some implementations, each frame may have the same duration. In some implementations, each subframe of a frame may have the same duration.

[0068] Additionally or alternatively, a time interval of a resource (e.g., a communication resource) may be organized according to slots. For example, a subframe may include a number (e.g., quantity) of slots. The number of slots in each subframe may also depend on the one or more numerologies supported in the wireless communications system 100. For instance, the first, second, third, fourth, and fifth numerologies (i.e., $\mu=0$, $\mu=1$, $\mu=2$, $\mu=3$, $\mu=4$) associated with respective subcarrier spacings of 15 kHz, 30 kHz, 60 kHz, 120 kHz, and 240 kHz may utilize a single slot per subframe, two slots per subframe, four slots per subframe, eight slots per subframe, and 16 slots per subframe, respectively. Each slot may include a number (e.g., quantity) of symbols (e.g., OFDM symbols). In some implementations, the number (e.g., quantity) of slots for a subframe may depend on a numerology. For a normal cyclic prefix, a slot may include 14 symbols. For an extended cyclic prefix (e.g., applicable for 60 kHz subcarrier spacing), a slot may include 12 symbols. The relationship between the number of symbols per slot, the number of slots per subframe, and the number of slots per frame for a normal cyclic prefix and an extended cyclic prefix may depend on a numerology. It should be understood that reference to a first numerology (e.g., $\mu=0$) associated with a first subcarrier spacing (e.g., 15 kHz) may be used interchangeably between subframes and slots.

[0069] In the wireless communications system 100, an electromagnetic (EM) spectrum may be split, based on frequency or wavelength, into various classes, frequency bands, frequency channels, etc. By way of example, the wireless communications system 100 may support one or multiple operating frequency bands, such as frequency range designations FR1 (410 MHz – 7.125 GHz), FR2 (24.25 GHz – 52.6 GHz), FR3 (7.125 GHz – 24.25 GHz), FR4 (52.6 GHz – 114.25 GHz), FR4a or FR4-1 (52.6 GHz – 71 GHz), and FR5 (114.25 GHz – 300 GHz). In some implementations, the network entities 102 and the UEs 104 may perform wireless communications over one or more of the operating frequency bands. In some implementations, FR1 may be used by the network entities 102

and the UEs 104, among other equipment or devices for cellular communications traffic (e.g., control information, data). In some implementations, FR2 may be used by the network entities 102 and the UEs 104, among other equipment or devices for short-range, high data rate capabilities.

[0070] FR1 may be associated with one or multiple numerologies (e.g., at least three numerologies). For example, FR1 may be associated with a first numerology (e.g., $\mu=0$), which includes 15 kHz subcarrier spacing; a second numerology (e.g., $\mu=1$), which includes 30 kHz subcarrier spacing; and a third numerology (e.g., $\mu=2$), which includes 60 kHz subcarrier spacing. FR2 may be associated with one or multiple numerologies (e.g., at least 2 numerologies). For example, FR2 may be associated with a third numerology (e.g., $\mu=2$), which includes 60 kHz subcarrier spacing; and a fourth numerology (e.g., $\mu=3$), which includes 120 kHz subcarrier spacing.

[0071] In 3GPP Releases 17 and 18, a multicast and broadcast service (MBS) is introduced for the NR to provide the PTM service with substantial improvements regarding efficient resource usage and user experience. Also, the NTN is specified to support RAN deployment over satellite. The NTN refers to a network or a segment of the network using radio frequency (RF) resources on board the satellite. The satellite in NTN can be a geostationary earth orbiting (GEO) satellite with a fixed location to the Earth, or a low earth orbiting (LEO) satellite orbiting around the Earth.

[0072] The NTN with a large coverage is well suited to support the MBS in providing services to more UEs with higher resource efficiency, and the MBS can provide significant added value for a NR NTN system leveraging the large coverage of the NTN compared to a terrestrial network (TN).

[0073] In Releases 17 and 18, the MBS is designed for the TN, the UE can simply judge whether it is in an MBS area by a cell identity, based on the assumption that the MBS area is larger than a TN cell coverage so that the service area can be mapped to one or more TN cells. For the NTN where the intended service area is expected to be smaller than the coverage of a cell, the UE may not determine whether it is in an MBS area only by a cell identity, and some enhancements need to be done for service continuity. As a result, in the latest 3GPP RAN#102 for Release19, many satellite vendors and operators propose to support the MBS in the NTN of Release 19 and study the potential enhancements. For the MBS in the NTN, the signaling of the intended service area of a

broadcast service (e.g. MBS) via NR NTN may be desired to be specified. Specifically, it may be desirable to specify the SIB signaling to indicate the intended service area in the case that the satellite footprint covers a larger area. The signaling between CN and NG-RAN is necessary to be specified.

[0074] For the case that the coverage of a NTN cell could be larger than a multicast or broadcast service area (e.g. MBS area), the multicast or broadcast service continuity in the NTN may be difficult to be ensured. Specifically, for a UE that is receiving or is interested to receive an MBS, when a neighboring NTN cell coverage is larger than the corresponding service area, how to indicate its service area information to the UE for service continuity is still desirable.

[0075] In addition, for the multicast or broadcast service continuity in the TN, mobility procedures for MBS reception allow the UE to start or continue receiving the service when the cell is changed or when the UE is handed over. For service continuity in RRC_IDLE/INACTIVE, information is broadcast in SIB21 and the UE can determine frequency priority. For example, the gNB may indicate, in SIB21, the mapping between the current and/or neighboring carrier frequencies and a MBS frequency selection area identity (FSAI). The FSAI is derived from the *serviceArea* and *radiofrequency* elements received in a user service description (USD) via NAS signalling from the network. The *serviceArea* element can declare one or more service areas designated by a service area identity (SAI) which is mapped onto one or more cells.

[0076] If the UE is receiving or interested to receive an MBS and can only receive this MBS by camping on a frequency on which it is provided, the UE may consider the frequency to be of the highest priority during a MBS session. The UE may also consider a candidate frequency for cell reselection on which the MBS cannot be received to be of the lowest priority during the MBS session.

[0077] This legacy mechanism works well under the assumption that an MBS area is mapped to one or more TN cells. The UE can simply determine the frequency priority based on the receiving or interested MBS and the associated frequency, and reselect a cell that supports that service within its whole coverage. Considering that a NTN cell coverage could be larger than an MBS area, which cannot be mapped to the cell's whole coverage, the UE cannot simply determine the frequency priority only based on the

relationship between the service and frequency, and thus service area information is needed.

[0078] Now reference can be made to Figs. 2 and 3 for explanation. Differences between the TN and the NTN may be presented in Figs. 2 and 3. More specifically, Fig. 2 shows an example of relation between a cell coverage and an MBS area in the TN. For the TN in Fig. 2, if the UE1 is moved from the Cell #1 to the Cell #2, the UE1 can continue to receive the MBS #A as it is supported in the whole Cell #2, but if the UE2 is moved from the Cell #1 to the Cell #3, the UE2 may not continue to receive the MBS #A as it is not supported in the whole Cell #3, for example, when the UE2 moves out of the MBS #A area. It is observed that for the TN, the SAI is mapped to one or more cells but cannot be mapped to a part of the cell coverage of certain cell.

[0079] Fig. 3 shows an example of relation between a cell coverage and an MBS area in the NTN. For the NTN in Fig. 3, the MBS #A is supported in the partial coverage of Cell #2 or Cell #3, and if the UE1 is moved from the Cell #1 to the Cell #2, the UE1 is expected to continue to receive the MBS #A as the UE1 is still in its service area, while when the UE2 is moved from the Cell #1 to the Cell #3, the UE2 may be expected not to continue to receive the MBS #A as the UE2 may move out its service area. If the legacy mechanism for the TN is applied, the UE2 will also prioritize a frequency associated to the multicast or broadcast service but not be authorized to receive the service as it moves out of the service area (e.g. MBS #A area).

[0080] Therefore, additional service area information (e.g., geography information) for at least one neighboring cell is needed at the UE for service continuity, and how to indicate such information needs to be specified. In view of this, some of implementations described herein are proposed for improving the multicast or broadcast service continuity, especially in the NTN. More details will be described with reference to Figs. 4A and 4B.

[0081] Figs. 4A illustrates a signaling chart of an example process 400-1 for improving multicast or broadcast service continuity in accordance with aspects of the present disclosure. Fig. 4B illustrates a signaling chart of an example process 400-2 for improving multicast or broadcast service continuity in accordance with aspects of the present disclosure. For the purpose of discussion, the processes 400-1 and 400-2 may involve the UE 104 and the BSs (or the network entity) 102-1 and 102-2 (collectively referred to as 102). The processes 400-1 and 400-2 may be applied to the wireless

communications system 100 with reference to Fig. 1. It would be appreciated that the processes 400-1 and 400-2 may be applied to other communication scenarios, which will not be described in detail.

[0082] As shown in Figs. 4A and 4B, the UE 104 receives 410 service area information of at least one neighboring cell, for example, MBS broadcast service area information of neighboring cell(s), from the BS 102. The service area information is transmitted 410 from the BS 102-1 (e.g. serving BS or gNB) and associated with at least one of a broadcast service or a multicast service. On the BS side, the BS 102-1 obtains 420 the service area information of the at least one neighboring cell of the UE. For example, the BS 102-1 may receive 420 the MBS broadcast service area information of belonging cell(s) from the BS 102-2 (e.g. neighboring BS or gNB) or the core network. In some implementations, one or both of a serving cell and the neighboring cell(s) of the UE 104 may be provided by the NTN. The MBS broadcast service area information of neighboring cell(s) may include explicit area parameters and implicit association to other parameters.

[0083] In some implementations, the indicated service area information may include explicit area parameter(s), i.e., first area parameter. In an example, the explicit area parameter may include information indicating a reference location and a radius for a service area of the neighboring cell(s). In another example, the explicit area parameter may include information indicating multiple locations for the service area of the neighboring cell(s), for example, in a regular or irregular shape. In yet another example, the explicit area parameter may include an identity for the service area of the neighboring cell(s). The area information associated to this identity may be also provided for a serving cell of the UE 104, or pre-configured in other manners. This identity may be the reused identity of service area, or a new identity created for the above purpose herein. In this way, an MBS area or a non-MBS area can be indicated by the BS 102 to the UE 104. It is to be understood that the explicit area parameter(s) may indicate any combination of the above mentioned information and identity.

[0084] In some implementations, based on information indicating a location of the UE 104 and the explicit area parameter(s), the UE 104 may determine 430 whether the UE 104 is within or outside the service area of the neighboring cell(s). Also, as shown in the process 400-2, the UE 104 may determine 430 whether the UE 104 is in an MBS

broadcast service area. For example, if position coordinates of the UE 104 is located within the service area indicated by the reference location and the radius, or the zone defined by these area parameters, the UE 104 may determine that it is within the service area. Other implementations can be provided based on other explicit area parameter(s), which will be not described repeatedly here. Additionally, the UE 104 may consider the available duration of the indicated service area information (if provided) during the determining process.

[0085] Additionally or alternatively, the indicated service area information may include implicit area parameter(s), i.e., second area parameter. The implicit area parameter(s) may be, indicate, or include an identity of a beam for the neighboring cell, an elevation angle of the UE 104 to a radio access network (RAN) node, a horizontal angle of the UE 104 to the RAN node, a propagation delay to the RAN node, a distance from the UE to a cell reference location such as a reference location for the neighboring cell, a tracking area (TA), a RAN notification area (RNA), a terrestrial network (TN) area, a distance from the UE to a TN area reference location; or any combination thereof. The propagation delay to the RAN node may be the propagation delay from the UE 104 to the BS 102, or the propagation delay from the UE 104 to the satellite 102. The RAN node may refer to a base station or an entity of antenna unit. The cell reference location, TA, RNA, TN area, and TN area reference location may be configured by the network. In this way, an MBS area or a non-MBS area also can be indicated by the BS 102 to the UE 104.

[0086] Further, the implicit area parameter(s) may include the respective threshold(s) for the foregoing, for example, one or more thresholds for the elevation angle; one or more thresholds for the horizontal angle; one or more thresholds for the propagation delay; one or more thresholds for the distance to the cell reference location; one or more thresholds for the distance to the TN area reference location, or any combination thereof.

[0087] In some implementations, the UE 104 may determine 430 whether the UE 104 is within or outside the service area of the neighboring cell(s) based on the implicit area parameter(s). For example, if the beam measured or selected by the UE 104 is determined to be the beam for the multicast or broadcast service based on the identity of the beam for the neighboring cell, the UE 104 may determine that it is within the service area. If the elevation angle indicated by the BS 102 satisfies the corresponding threshold(s), the UE 104 may determine that it is within the service area, and vice versa. If position coordinates

of the UE 104 is located within the zone defined by the TA, RNA, or TN area, the UE 104 may determine that it is within the service area. Likewise, other implementations can be provided based on other implicit area parameter(s), which will be not described repeatedly here.

[0088] In some implementations, the BS 102 may indicate the service area information to the UE 104 via Uu signaling, for example, system information or dedicated signaling. For the system information broadcast, e.g., SIB21, the indicated service area information may be associated to one or more of a broadcast service (e.g. MBS), a frequency selection area identity (FSAI), a service area identity (SAI) in user service description (USD), a radio frequency, and a cell identity (such as an identity of the neighboring cell). For the dedicated signaling, e.g., *mbsBroadcastConfiguration*, *MCCH-Message* or *MBS-SessionInfoList*, the indicated service area information may also be associated to one or more of the broadcast service (e.g. MBS), the frequency selection area identity (FSAI), the service area identity (SAI) in user service description (USD), the radio frequency, and the cell identity. Additionally or alternatively, the indicated service area information may be associated to an available duration of the indicated information. In this way, a better service can be implemented.

[0089] Continuing with reference to Fig. 4, based on the indicated service area information, the UE 104 perform 440 one or more mobility procedures for the neighboring cell(s). The mobility procedures will be further described below.

[0090] For the TN, the legacy mechanism also works well under the assumption that an MBS area is mapped to one or more TN cells. It is observed that, due to the assumption that the TN cell coverage is smaller than the MBS area, the SIB21 as well as the frequency priority handling are based on only considering the MBS and frequency, while geography information is not included. In the case that an NTN cell coverage could be larger than an MBS area, the priority handling also is desired to consider the indicated service area information of the neighboring cell(s).

[0091] For the UE that is receiving or is interested to receive an MBS, when the service area information of the neighboring cell(s) is indicated to UE, how to handle the corresponding frequency priority is provided herein. Upon the indication of the service area information of the neighboring cell(s) to the UE 104, a subsequent step of the corresponding frequency priority handling 450 for service continuity is provided herein.

[0092] In some implementations, the UE 104 may determine frequency priority for cell reselection or MBS interest indication reporting based on the indicated service area information of the neighboring cell(s). Also, as shown in Fig. 4B, the UE 104 may perform 450 frequency priority handling for cell reselection based on neighboring cell MBS broadcast service area information. More specifically, in an implementation, if the UE 104 is able to receive a broadcast service or a multicast service by camping on a frequency, and the UE 104 is or is to be in a service area associated to the frequency, the UE 104 may prioritize the frequency.

[0093] Alternatively, if the UE 104 is or is to be in a service area associated to the frequency, the UE 104 may prioritize the frequency. For example, the UE 104 is allowed to set a frequency to the highest priority if it can only receive the receiving or interested MBS broadcast service(s) camping on the frequency and/or the UE 104 is (or will be) in the MBS area associated to the frequency. In this case, the UE 104 may also trigger neighboring cell measurement(s), e.g., for cell reselection.

[0094] As another example, the UE 104 is allowed to set a frequency to the highest priority if it can receive the receiving or interested MBS(s) camping on the frequency and the UE 104 is (or will be) in the same MBS area associated to the frequency for both serving and neighboring cells. As yet another example, the UE 104 is allowed to set a frequency to the highest priority if it can receive the interested MBS broadcast service(s) camping on the frequency and the UE 104 is (or will be) in the MBS area associated to the frequency for a neighboring cell. In this case, the UE 104 may also trigger neighboring cell measurement(s), e.g., for cell reselection.

[0095] In another implementation, if the UE 104 is not or is not to be in the service area associated to the frequency, the UE 104 may prevent from prioritizing the frequency. For example, the UE 104 may not prioritize a frequency providing the MBS(s) if the UE 104 is not (or will not be) in the MBS area associated to the frequency.

[0096] In yet another implementation, if the UE 104 is not or is not to be in the service area associated to the frequency, the UE 104 may deprioritize the frequency. For example, the UE 104 may consider a cell reselection candidate frequency to be of the lowest priority if the UE 104 is not (or will not be) in the MBS area associated to the frequency.

[0097] In addition, for service continuity in RRC_CONNECTED, the UE 104 may send an MBS interest indication to its serving gNB for mobility preparation and

configuration. For example, for the MBS continuity in the TN, the UE 104 in RRC_CONNECTED state may send MBS interest indication to the gNB 102, the MBS interest indication including a list of MBS frequencies and interested services, as well as frequency priorities. The gNB 102 may use this indication when handover configuration is provided to allow the UE 104 to receive the MBS(s) that the UE 104 is interested to. Due to the same assumption that an MBS area is mapped to one or more TN cells, the UE 104 does not need to provide its current or expected MBS area information in the MBS interest indication. It is observed that since the TN cell coverage is smaller than the MBS area, the MBS interest indication only considers the MBS and frequency, while geography information is not included. When considering that an NTN cell coverage could be larger than an MBS area, the UE's current/expected MBS area information is necessary at the gNB for further handover decisions, e.g., to judge whether the UE 104 is staying in/moving into or moving out of an MBS broadcast service area and configure an appropriate target cell.

[0098] In view of this, for a UE that is receiving or is interested to receive an MBS, when a neighboring NTN cell is larger than the corresponding service area, how to provide UE's current/expected MBS area information to the gNB for service continuity is provided herein.

[0099] In some implementations, as shown in the process 400-2, the UE 104 may trigger 460 report of UE's MBS broadcast service area information, and may further transmit or report 470 its service area information (i.e. second service area information, for example, MBS area information) to the network, e.g., base station for service continuity. Here, the reported service area information is associated with a service area that the UE is in or is expected or interested to be in.

[0100] In some implementations, the reported service area information may include one of information indicating a service area that the UE 104 is in or entering (e.g. an identify of this service area), information indicating a location of the UE 104, a beam measured or selected by the UE 104, an elevation angle of the UE 104 to a RAN node (gNB or antenna unit), a horizontal angle of the UE 104 to the RAN node, a propagation delay from the UE 104 to the RAN node, a distance from the UE 104 to a cell reference location, a distance from the UE 104 to a TN area reference location, a TA of the UE 104; a RNA of the UE 104, a nearest TN area of the UE 104, and among others. Optionally,

the reported service area information may include an available duration of this report or this information. Here, the respective definitions for the elevation angle, horizontal angle, propagation delay, cell reference location, TN area reference location, TA, RNA, TN area in the reported service area information can refer to those in the indicated service area information.

[0101] In some implementations, the UE 104 may transmit or report 470 its service area information based on a trigger condition. For example, as shown in Fig. 4B, the UE 104 may transmit 470 UE's MBS broadcast service area information to the serving BS. As an implementation, if a corresponding request is received from a serving cell, the UE 104 may transmit or report its service area information. For example, upon the request transmitted from the BS 102-1, the UE 104 may trigger 460 the reporting. Alternatively, if the UE 104 enters or leaves any service area, the UE 104 may transmit or report its service area information. Alternatively, if the UE 104 enters or leaves a specific service area indicated by the network, e.g. serving cell, the UE 104 may transmit or report its service area information.

[0102] Alternatively, if any frequency priority for an MBS changes, the UE 104 may transmit or report its service area information. Here, the frequency is associated to one or more service areas. Alternatively, if a frequency priority between broadcast and unicast or multicast reception changes since the service area of the UE 104 changes, the UE 104 may transmit or report its service area information. Alternatively, if a measurement report is triggered, the UE 104 may transmit or report its service area information. Alternatively, if a timer associated to a previous report of this service area information expires, the UE 104 may transmit or report its service area information.

[0103] In some implementations, the UE's service (MBS) area information may be reported via Uu signaling, for example, an MBS interest indication or measurement report. The reported service (MBS) area information may be associated to one or more of a broadcast service, a FSAI, a radio frequency, a cell identity (e.g. an identity of the serving or neighboring cell(s) of the UE 104), an MBS interest indication, and a measurement report.

[0104] On the BS side, the BS 102-1 may receive the reported service area information from the UE 104. Further, the reported service area information of the UE 104 may be exchanged between gNBs. For example, the serving BS 102-1 may transmit

480 the reported service area information of the UE 104, e.g., the MBS broadcast service area information of UE to the neighboring BS 102-2. It is to noted that the MBS area information of the neighboring cell(s) described above and/or the MBS area information of the UE 104 described here can be exchanged between gNBs, e.g., source and target gNB for handover. The exchange for area information may leverage an signalling or procedure over the interface between gNBs (XnAP), e.g., Xn Setup, handover preparation, retrieve UE context, NG-RAN node configuration update.

[0105] Fig. 5 illustrates an example of a device 500 for multicast or broadcast service continuity in accordance with aspects of the present disclosure. The device 500 may be an example of a network entity 102 or a UE 104 as described herein. The device 500 may support wireless communication with one or more network entities 102, UEs 104, or any combination thereof. The device 500 may include components for bi-directional communications including components for transmitting and receiving communications, such as a processor 502, a memory 504, a transceiver 506, and, optionally, an I/O controller 508. These components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g., buses).

[0106] The processor 502, the memory 504, the transceiver 506, or various combinations thereof or various components thereof may be examples of means for performing various aspects of the present disclosure as described herein. For example, the processor 502, the memory 504, the transceiver 506, or various combinations or components thereof may support a method for performing one or more of the operations described herein.

[0107] In some implementations, the processor 502, the memory 504, the transceiver 506, or various combinations or components thereof may be implemented in hardware (e.g., in communications management circuitry). The hardware may include a processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA) or other programmable logic device, a discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure. In some implementations, the processor 502 and the memory 504 coupled with

the processor 502 may be configured to perform one or more of the functions described herein (e.g., executing, by the processor 502, instructions stored in the memory 504).

[0108] For example, the processor 502 may support wireless communication at the device 500 in accordance with examples as disclosed herein. The processor 502 may be configured to or operable to support: a means for receiving service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and a means for performing, based on the service area information, at least one mobility procedure for the at least one neighboring cell. In addition, the processor 502 may be configured to or operable to support means for performing various other operations of a UE as described above in connection with Figs. 1 to 4B.

[0109] Alternatively, in some implementations, the processor 502 may be configured to or operable to support: a means for obtaining service area information of at least one neighboring cell of a UE, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and a means for transmitting the service area information of the at least one neighboring cell. In addition, the processor 502 may be configured to or operable to support means for performing various other operations of a base station as described above in connection with Figs. 1 to 4B.

[0110] The processor 502 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 implementations, the processor 502 may be configured to operate a memory array using a memory controller. In some other implementations, a memory controller may be integrated into the processor 502. The processor 502 may be configured to execute computer-readable instructions stored in a memory (e.g., the memory 504) to cause the device 500 to perform various functions of the present disclosure.

[0111] The memory 504 may include random access memory (RAM) and read-only memory (ROM). The memory 504 may store computer-readable, computer-executable code including instructions that, when executed by the processor 502 cause the device 500 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory.

In some implementations, the code may not be directly executable by the processor 502 but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some implementations, the memory 504 may include, among other things, a basic I/O system (BIOS) which may control basic hardware or software operation such as the interaction with peripheral components or devices.

[0112] The I/O controller 508 may manage input and output signals for the device 500. The I/O controller 508 may also manage peripherals not integrated into the device 500. In some implementations, the I/O controller 508 may represent a physical connection or port to an external peripheral. In some implementations, the I/O controller 508 may utilize an operating system such as iOS®, ANDROID®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system. In some implementations, the I/O controller 508 may be implemented as part of a processor, such as the processor 506. In some implementations, a user may interact with the device 500 via the I/O controller 508 or via hardware components controlled by the I/O controller 508.

[0113] In some implementations, the device 500 may include a single antenna 510. However, in some other implementations, the device 500 may have more than one antenna 510 (i.e., multiple antennas), including multiple antenna panels or antenna arrays, which may be capable of concurrently transmitting or receiving multiple wireless transmissions. The transceiver 506 may communicate bi-directionally, via the one or more antennas 510, wired, or wireless links as described herein. For example, the transceiver 506 may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver 506 may also include a modem to modulate the packets, to provide the modulated packets to one or more antennas 510 for transmission, and to demodulate packets received from the one or more antennas 510. The transceiver 506 may include one or more transmit chains, one or more receive chains, or a combination thereof.

[0114] A transmit chain may be configured to generate and transmit signals (e.g., control information, data, packets). The transmit chain may include at least one modulator for modulating data onto a carrier signal, preparing the signal for transmission over a wireless medium. The at least one modulator may be configured to support one or more techniques such as amplitude modulation (AM), frequency modulation (FM), or digital

modulation schemes like phase-shift keying (PSK) or quadrature amplitude modulation (QAM). The transmit chain may also include at least one power amplifier configured to amplify the modulated signal to an appropriate power level suitable for transmission over the wireless medium. The transmit chain may also include one or more antennas 510 for transmitting the amplified signal into the air or wireless medium.

[0115] A receive chain may be configured to receive signals (e.g., control information, data, packets) over a wireless medium. For example, the receive chain may include one or more antennas 510 for receive the signal over the air or wireless medium. The receive chain may include at least one amplifier (e.g., a low-noise amplifier (LNA)) configured to amplify the received signal. The receive chain may include at least one demodulator configured to demodulate the receive signal and obtain the transmitted data by reversing the modulation technique applied during transmission of the signal. The receive chain may include at least one decoder for decoding the processing the demodulated signal to receive the transmitted data.

[0116] Fig. 6 illustrates an example of a processor 600 for multicast or broadcast service continuity in accordance with aspects of the present disclosure. The processor 600 may be an example of a processor configured to perform various operations in accordance with examples as described herein. The processor 600 may include a controller 602 configured to perform various operations in accordance with examples as described herein. The processor 600 may optionally include at least one memory 604, such as L1/L2/L3 cache. Additionally, or alternatively, the processor 600 may optionally include one or more arithmetic-logic units (ALUs) 606. One or more of these components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g., buses).

[0117] The processor 600 may be a processor chipset and include a protocol stack (e.g., a software stack) executed by the processor chipset to perform various operations (e.g., receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) in accordance with examples as described herein. The processor chipset may include one or more cores, one or more caches (e.g., memory local to or included in the processor chipset (e.g., the processor 600) or other memory (e.g., random access memory (RAM), read-only memory (ROM), dynamic RAM (DRAM), synchronous dynamic RAM (SDRAM), static RAM (SRAM),

ferroelectric RAM (FeRAM), magnetic RAM (MRAM), resistive RAM (RRAM), flash memory, phase change memory (PCM), and others).

[0118] The controller 602 may be configured to manage and coordinate various operations (e.g., signaling, receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) of the processor 600 to cause the processor 600 to support various operations in accordance with examples as described herein. For example, the controller 602 may operate as a control unit of the processor 600, generating control signals that manage the operation of various components of the processor 600. These control signals include enabling or disabling functional units, selecting data paths, initiating memory access, and coordinating timing of operations.

[0119] The controller 602 may be configured to fetch (e.g., obtain, retrieve, receive) instructions from the memory 604 and determine subsequent instruction(s) to be executed to cause the processor 600 to support various operations in accordance with examples as described herein. The controller 602 may be configured to track memory address of instructions associated with the memory 604. The controller 602 may be configured to decode instructions to determine the operation to be performed and the operands involved. For example, the controller 602 may be configured to interpret the instruction and determine control signals to be output to other components of the processor 600 to cause the processor 600 to support various operations in accordance with examples as described herein. Additionally, or alternatively, the controller 602 may be configured to manage flow of data within the processor 600. The controller 602 may be configured to control transfer of data between registers, arithmetic logic units (ALUs), and other functional units of the processor 600.

[0120] The memory 604 may include one or more caches (e.g., memory local to or included in the processor 600 or other memory, such RAM, ROM, DRAM, SDRAM, SRAM, MRAM, flash memory, etc. In some implementation, the memory 604 may reside within or on a processor chipset (e.g., local to the processor 600). In some other implementations, the memory 604 may reside external to the processor chipset (e.g., remote to the processor 600).

[0121] The memory 604 may store computer-readable, computer-executable code including instructions that, when executed by the processor 600, cause the processor 600

to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. The controller 602 and/or the processor 600 may be configured to execute computer-readable instructions stored in the memory 604 to cause the processor 600 to perform various functions. For example, the processor 600 and/or the controller 602 may be coupled with or to the memory 604, the processor 600, the controller 602, and the memory 604 may be configured to perform various functions described herein. In some examples, the processor 600 may include multiple processors and the memory 604 may include multiple memories. One or more of the multiple processors may be coupled with one or more of the multiple memories, which may, individually or collectively, be configured to perform various functions herein.

[0122] The one or more ALUs 606 may be configured to support various operations in accordance with examples as described herein. In some implementation, the one or more ALUs 606 may reside within or on a processor chipset (e.g., the processor 600). In some other implementations, the one or more ALUs 606 may reside external to the processor chipset (e.g., the processor 600). One or more ALUs 606 may perform one or more computations such as addition, subtraction, multiplication, and division on data. For example, one or more ALUs 606 may receive input operands and an operation code, which determines an operation to be executed. One or more ALUs 606 be configured with a variety of logical and arithmetic circuits, including adders, subtractors, shifters, and logic gates, to process and manipulate the data according to the operation. Additionally, or alternatively, the one or more ALUs 606 may support logical operations such as AND, OR, exclusive-OR (XOR), not-OR (NOR), and not-AND (NAND), enabling the one or more ALUs 606 to handle conditional operations, comparisons, and bitwise operations.

[0123] The processor 600 may support wireless communication in accordance with examples as disclosed herein. The processor 600 may be configured to or operable to support: a means for receiving service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and a means for performing, based on the service area information, at least one mobility procedure for the at least one neighboring cell. In addition, the processor 600 may be configured to or operable to support means for performing various other operations of a UE as described above in connection with Figs. 1 to 4B.

[0124] Alternatively, in some implementations, the processor 600 may be configured to or operable to support: a means for obtaining service area information of at least one neighboring cell of a UE, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and a means for transmitting the service area information of the at least one neighboring cell. In addition, the processor 600 may be configured to or operable to support means for performing various other operations of a base station as described above in connection with Figs. 1 to 4B.

[0125] Fig. 7 illustrates a flowchart of a method 700 for multicast or broadcast service continuity in accordance with aspects of the present disclosure. The operations of the method 700 may be implemented by a device or its components as described herein. For example, the operations of the method 700 may be performed by the UE 104 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0126] At 710, the method may include receiving service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service. The operations of 710 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 710 may be performed by a device as described with reference to Fig. 1.

[0127] At 720, the method may include performing, based on the service area information, at least one mobility procedure for the at least one neighboring cell. The operations of 720 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 720 may be performed by a device as described with reference to Fig. 1.

[0128] Fig. 8 illustrates a flowchart of a method 800 for multicast or broadcast service continuity in accordance with aspects of the present disclosure. The operations of the method 800 may be implemented by a device or its components as described herein. For example, the operations of the method 800 may be performed by the UE 104 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or

alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0129] At 810, the method may include obtaining service area information of at least one neighboring cell of a UE, wherein the service area information is associated with at least one of a broadcast service or a multicast service. The operations of 810 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 810 may be performed by a device as described with reference to Fig. 1.

[0130] At 820, the method may include transmitting the service area information of the at least one neighboring cell. The operations of 820 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 820 may be performed by a device as described with reference to Fig. 1.

[0131] It shall be noted that implementations of the present disclosure which have been described with reference to Figs. 1 to 4B are also applicable to the device 500, the processor 600 and the methods 700, 800.

[0132] It should be noted that the methods described herein describes 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.

[0133] The various illustrative blocks and components described in connection with the disclosure herein may be implemented or performed with a general-purpose processor, a DSP, an ASIC, a CPU, 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 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).

[0134] 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 may 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.

[0135] Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer. By way of example, non-transitory computer-readable media may include RAM, 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 may be used to carry or store desired program code means in the form of instructions or data structures and that may be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor.

[0136] As used herein, including in the claims, an article “a” before an element is unrestricted and understood to refer to “at least one” of those elements or “one or more” of those elements. The terms “a,” “at least one,” “one or more,” and “at least one of one or more” may be interchangeable. As used herein, including in the claims, “or” as used in a list of items (e.g., a list of items prefaced by a phrase such as “at least one of” or “one or more of” or “one or both of”) indicates an inclusive list such that, for example, a list of at least one of A, B, or C means A or B or C or AB or AC or BC or ABC (i.e., A and B and C). Also, as used herein, the phrase “based on” shall not be construed as a reference to a closed set of conditions. For example, an example step that is described as “based on condition A” may be based on both a condition A and a condition B without departing from the scope of the present disclosure. In other words, as used herein, the phrase “based on” shall be construed in the same manner as the phrase “based at least in part on. Further, as used herein, including in the claims, a “set” may include one or more elements.

[0137] The description herein is provided to enable a person having ordinary skill in the art to make or use the disclosure. Various modifications to the disclosure will be apparent to a person having ordinary skill in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

1. A user equipment (UE), comprising:
a processor; and
a transceiver coupled to the processor,
wherein the processor is configured to:
receive, via the transceiver and from a base station, service area information of
at least one neighboring cell, wherein the service area information is associated with at
least one of a broadcast service or a multicast service; and
perform, based on the service area information, at least one mobility procedure
for the at least one neighboring cell.
2. The UE of claim 1, wherein the service area information comprises a first area
parameter, and the first area parameter comprises at least one of the following:
information indicating a reference location and a radius for a service area of the
neighboring cell;
information indicating multiple locations for the service area of the neighboring cell;
or
an identity for the service area of the neighboring cell.
3. The UE of claim 1, wherein the service area information comprises a second area
parameter, and the second area parameter comprises at least one of the following:
an identity of a beam for the neighboring cell;
an elevation angle to a radio access network (RAN) node;
a horizontal angle to the RAN node;
a propagation delay to the RAN node;
a distance from the UE to a cell reference location;
a tracking area (TA);
a RAN notification area (RNA);
a terrestrial network (TN) area; or
a distance from the UE to a TN area reference location.
4. The UE of claim 1, wherein the service area information is associated to at least
one of the following:

- a broadcast service;
- a frequency selection area identity (FSAI);
- a service area identity (SAI) in user service description (USD);
- a radio frequency;
- a cell identity; or
- an available duration.

5. The UE of claim 1, wherein the at least one mobility procedure comprises:

- in a case that the UE is able to receive a broadcast service or a multicast service by camping on a frequency, and the UE is or is to be in a service area associated to the frequency, prioritizing the frequency;

- in a case that the UE is or is to be in a service area associated to the frequency, prioritizing the frequency;

- in a case that the UE is not or is not to be in the service area associated to the frequency, preventing from prioritizing the frequency; or

- in a case that the UE is not or is not to be in the service area associated to the frequency deprioritizing the frequency.

6. The UE of claim 5, wherein the at least one mobility procedure further comprises:

- triggering a neighboring cell measurement for cell reselection,

- wherein the processor is configured to prioritize the frequency by setting the frequency to have a highest priority, or

- wherein the processor is configured to deprioritize the frequency by setting the frequency to have a lowest priority.

7. The UE of claim 1, wherein the service area information of the at least one neighboring cell is first service area information, and the at least one mobility procedure comprises:

- transmitting, via the transceiver and to the base station, second service area information of the UE, wherein the second service area information is associated with a service area that the UE is in or is expected or interested to be in.

8. The UE of claim 7, wherein the second service area information comprises one of the following:

- information indicating a service area that the UE is in or entering;
- information indicating a location of the UE;
- a beam measured or selected by the UE;
- an elevation angle to a RAN node;
- a horizontal angle to the RAN node;
- a propagation delay to the RAN node;
- a distance from the UE to a cell reference location;
- a distance from the UE to a TN area reference location;
- a TA of the UE;
- a RNA of the UE; or
- a nearest TN area of the UE.

9. The UE of claim 7, wherein the processor is configured to transmit the second service area information based on a trigger condition, and the trigger condition comprises one of the following:

- a corresponding request is received from a serving cell;
- the UE enters or leaves any service area;
- the UE enters or leaves a specific service area indicated by the serving cell;
- a priority of a frequency for an MBS changes, wherein the frequency is associated to at least one service area;
- a frequency priority between broadcast and unicast or multicast reception changes since the service area of the UE changes;
- a measurement report is triggered; or
- a timer associated to a previous report of the second service area information expires.

10. The UE of claim 7, wherein the second service area information is associated to at least one of the following:

- a broadcast service;
- a FSAI;
- a radio frequency;
- a cell identity;
- an MBS interest indication; or
- a measurement report.

11. A base station, comprising:

a processor; and

a transceiver coupled to the processor,

wherein the processor is configured to:

obtain service area information of at least one neighboring cell of a user equipment (UE), wherein the service area information is associated with at least one of a broadcast service or a multicast service; and

transmit, via the transceiver and to the UE, the service area information of the at least one neighboring cell.

12. The base station of claim 11, wherein the service area information comprises a first area parameter, and the first area parameter comprises at least one of the following:

information indicating a reference location and a radius for a service area of the neighboring cell;

information indicating multiple locations for the service area of the neighboring cell;

or

an identity for the service area of the neighboring cell.

13. The base station of claim 11, wherein the service area information comprises a second area parameter, and the second area parameter comprises at least one of the following:

an identity of a beam for the neighboring cell;

an elevation angle to a radio access network (RAN) node;

a horizontal angle to the RAN node;

a propagation delay to the RAN node;

a distance from the UE to a cell reference location;

a tracking area (TA);

a RAN notification area (RNA);

a terrestrial network (TN) area; or

a distance from the UE to a TN area reference location.

14. The base station of claim 11, wherein the service area information is associated to at least one of the following:

a broadcast service;

- a frequency selection area identity (FSAI);
- a service area identity (SAI) in user service description (USD);
- a radio frequency;
- a cell identity; or
- an available duration.

15. The base station of claim 11, wherein the processor is configured to obtain the service area information of the at least one neighboring cell from another base station.

16. The base station of claim 11, wherein the service area information of the at least one neighboring cell is first service area information, and the processor is further configured to:

- receive, via the transceiver and from the UE, second service area information of the UE, wherein the second service area information is associated with a service area that the UE is in or is expected or interested to be in.

17. The base station of claim 16, wherein the second service area information comprises one of the following:

- information indicating a service area that the UE is in or entering;
- information indicating a location of the UE;
- a beam measured or selected by the UE;
- an elevation angle to a RAN node;
- a horizontal angle to the RAN node;
- a propagation delay to the RAN node;
- a distance from the UE to a cell reference location;
- a distance from the UE to a TN area reference location;
- a TA of the UE;
- a RNA of the UE; or
- a nearest TN area of the UE.

18. The base station of claim 16, wherein the second service area information is associated to at least one of the following:

- a broadcast service;
- a FSAI;

- a radio frequency;
- a cell identity;
- an MBS interest indication; or
- a measurement report.

19. The base station of claim 16, wherein the processor is further configured to:
transmit, via the transceiver and to another base station, the second service area information of the UE.

20. A processor for wireless communication, comprising:
at least one memory; and
a controller coupled with the at least one memory and configured to cause the controller to:
receive, via a transceiver and from a base station, service area information of at least one neighboring cell, wherein the service area information is associated with at least one of a broadcast service or a multicast service; and
perform, based on the service area information, at least one mobility procedure for the at least one neighboring cell.