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(54) **DYNAMIC CONFIGURATION OF RANDOM ACCESS COMMUNICATIONS**

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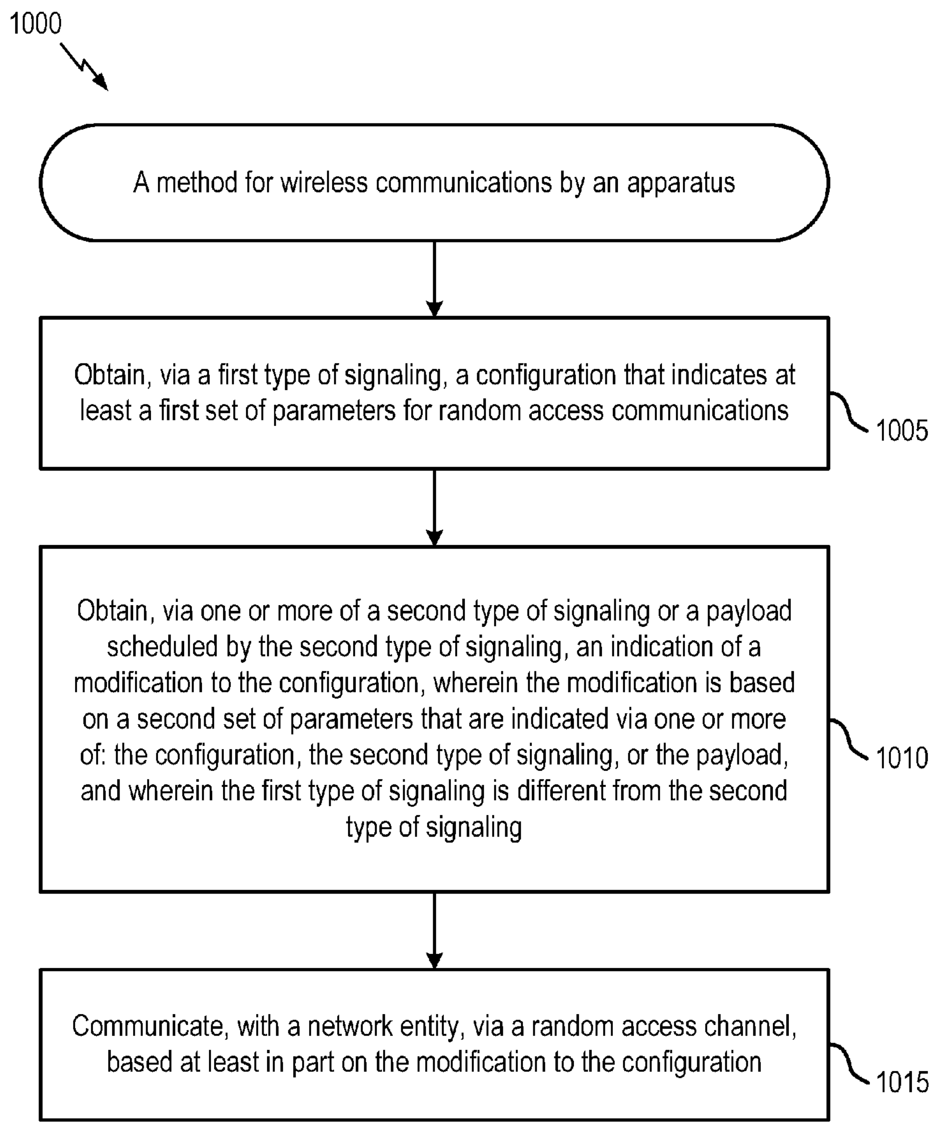
(57) **ABSTRACT**

Certain aspects of the present disclosure provide techniques for dynamic configuration of random access communications. A method for wireless communications by an apparatus includes obtaining, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications; obtaining, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and communicating, with a network entity, via a random access channel, based at least in part on the modification to the configuration.



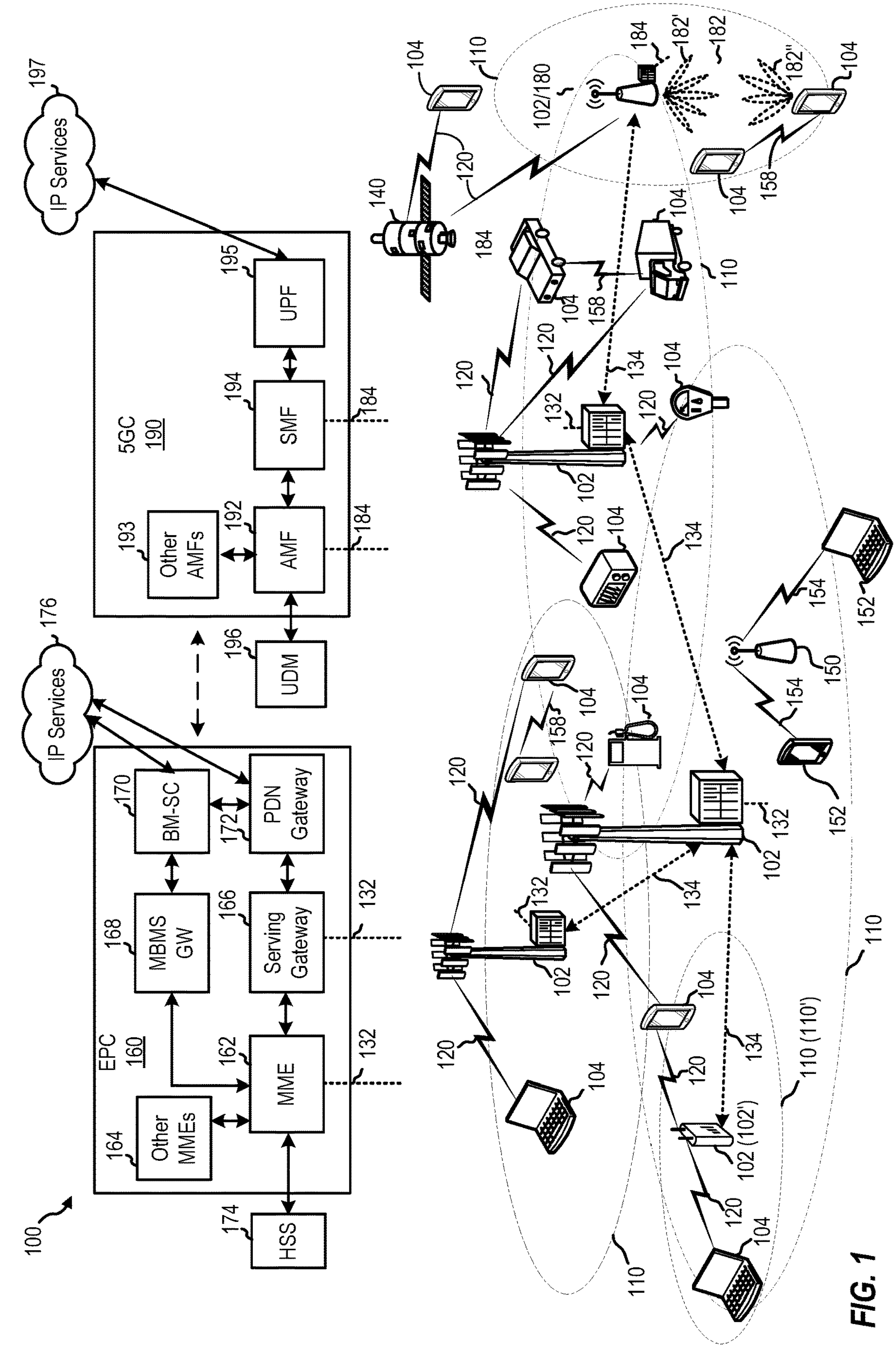

100
HSS
174
Other MMEs
164
MME
162
EPC
160
MBMS GW
168
Serving Gateway
166
BM-SC
170
PDN Gateway
172
132
IP Services
176
UDM
196
5GC
190
Other AMFs
193
AMF
192
SMF
194
UPF
195
184
IP Services
197
102
102 (102')
104
110
110 (110')
120
132
134
140
150
152
154
158
102/180
182
182'
182''
184

FIG. 1

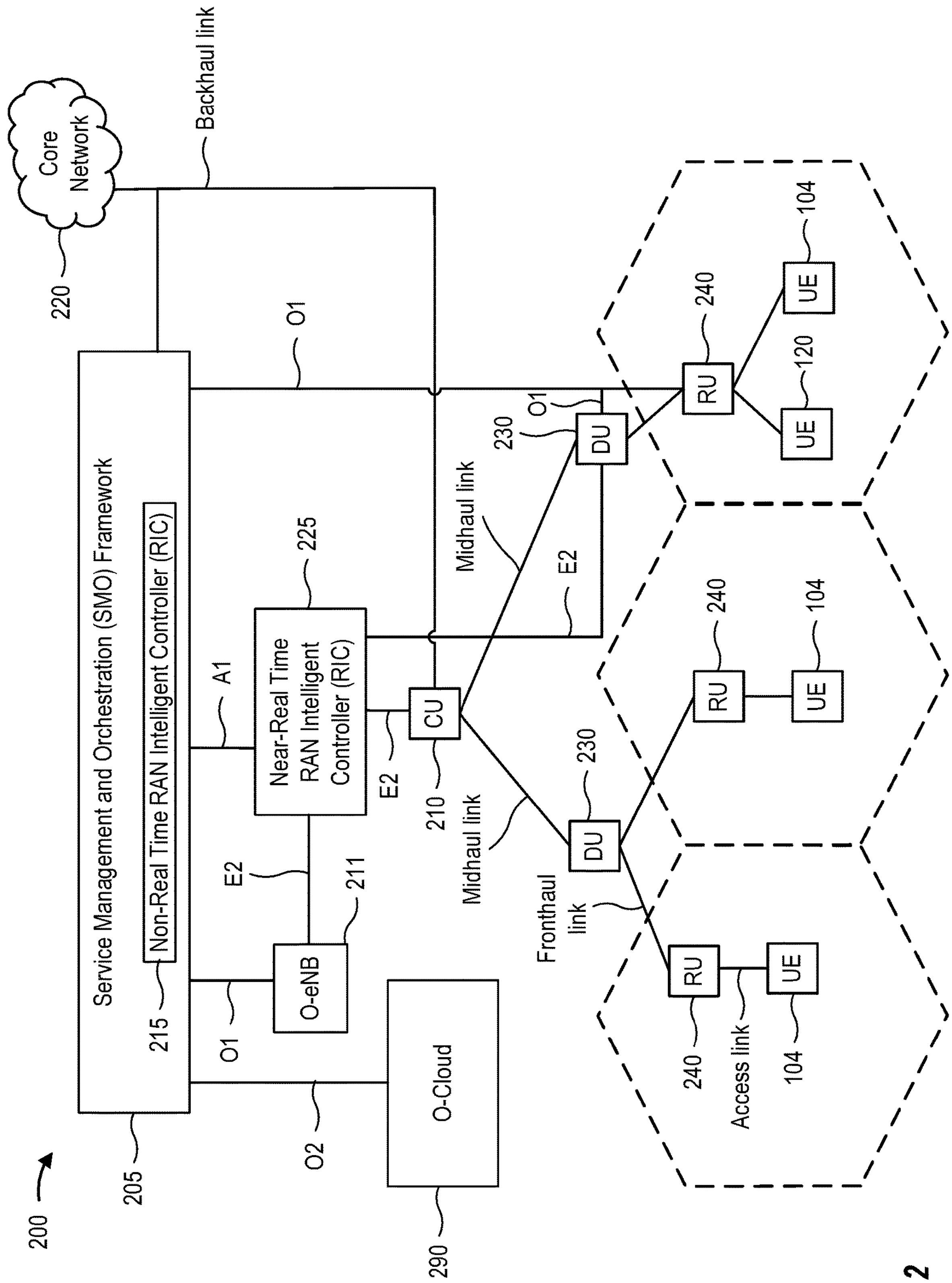
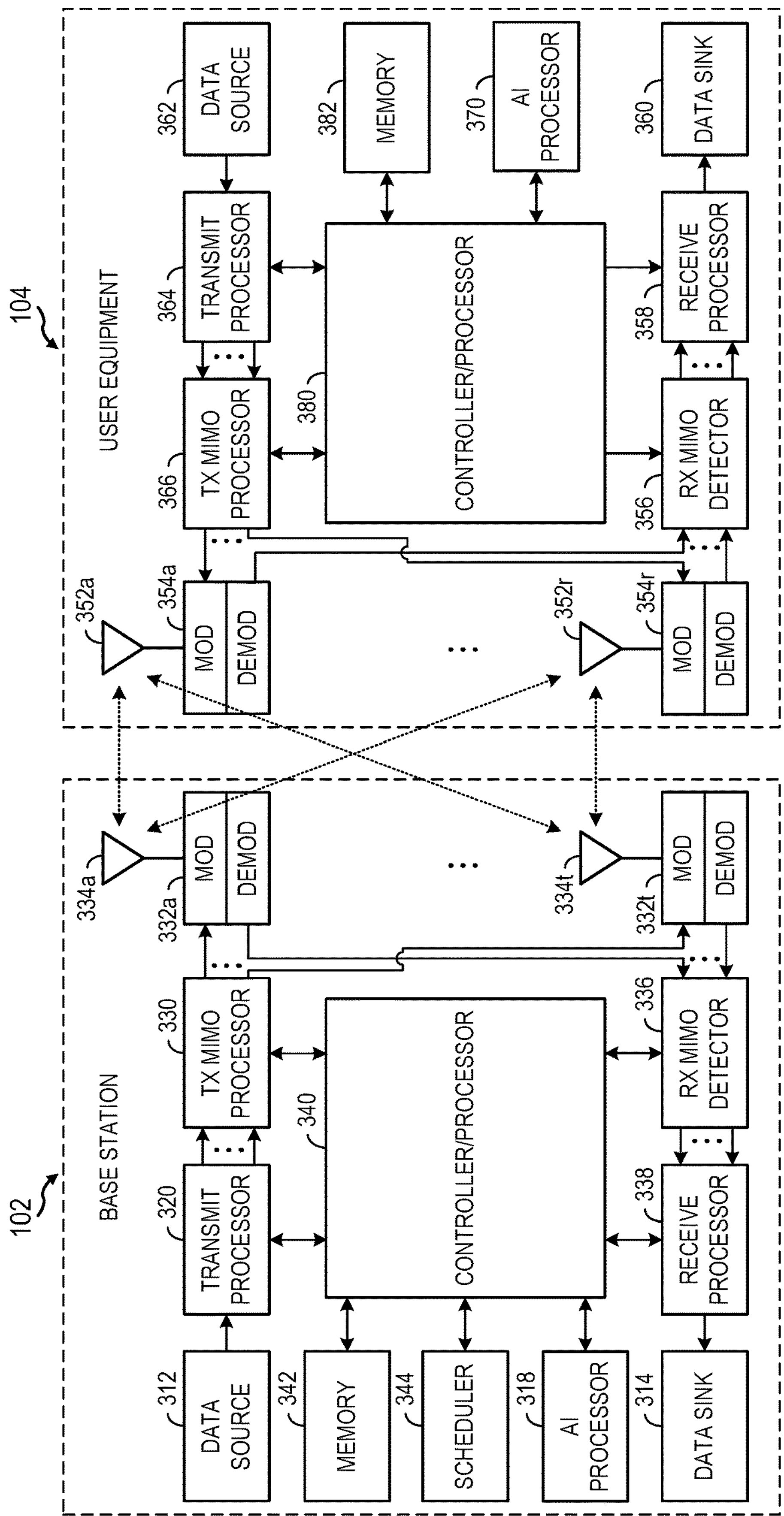

200
Core Network
220
Backhaul link
Service Management and Orchestration (SMO) Framework
Non-Real Time RAN Intelligent Controller (RIC)
205
215
O1
A1
E2
O2
Near-Real Time RAN Intelligent Controller (RIC)
225
O-eNB
211
O-Cloud
290
CU
210
Midhaul link
DU
230
RU
240
UE
104
120
Fronthaul link
Access link

FIG. 2



104
USER EQUIPMENT
362
DATA SOURCE
382
MEMORY
370
AI PROCESSOR
360
DATA SINK
364
TRANSMIT PROCESSOR
380
CONTROLLER/PROCESSOR
358
RECEIVE PROCESSOR
366
TX MIMO PROCESSOR
356
RX MIMO DETECTOR
352a
354a
MOD
DEMOD
352r
354r
MOD
DEMOD
102
BASE STATION
334a
332a
MOD
DEMOD
334t
332t
MOD
DEMOD
330
TX MIMO PROCESSOR
340
CONTROLLER/PROCESSOR
336
RX MIMO DETECTOR
320
TRANSMIT PROCESSOR
338
RECEIVE PROCESSOR
312
DATA SOURCE
342
MEMORY
344
SCHEDULER
318
AI PROCESSOR
314
DATA SINK

FIG. 3

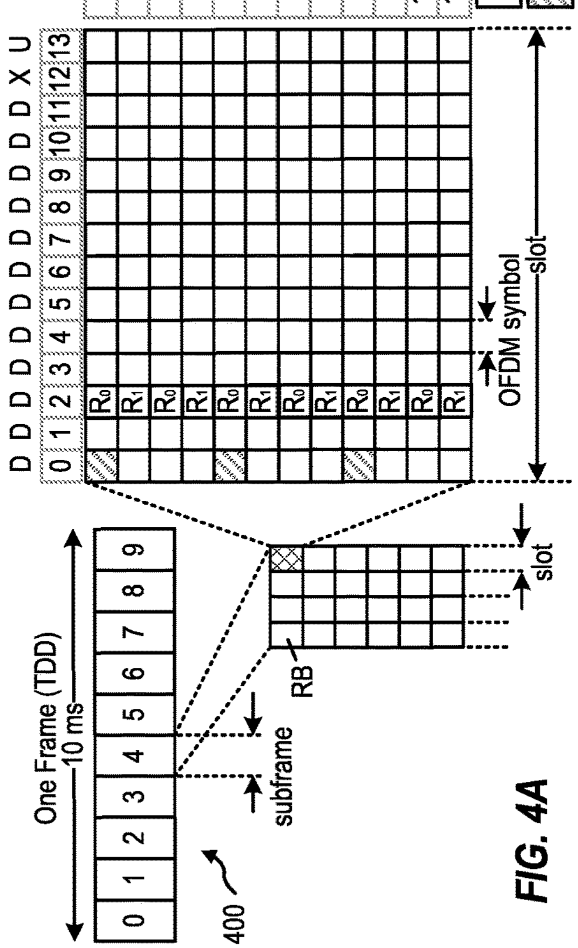


FIG. 4A

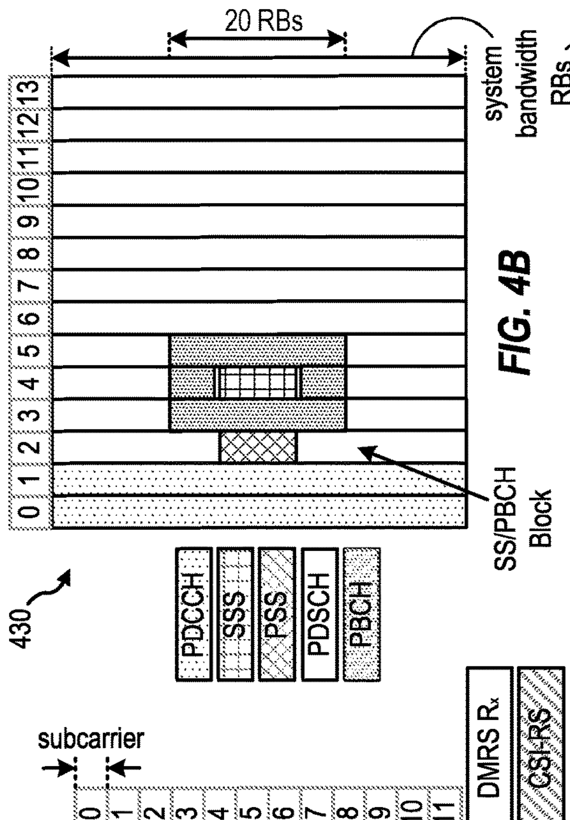


FIG. 4B

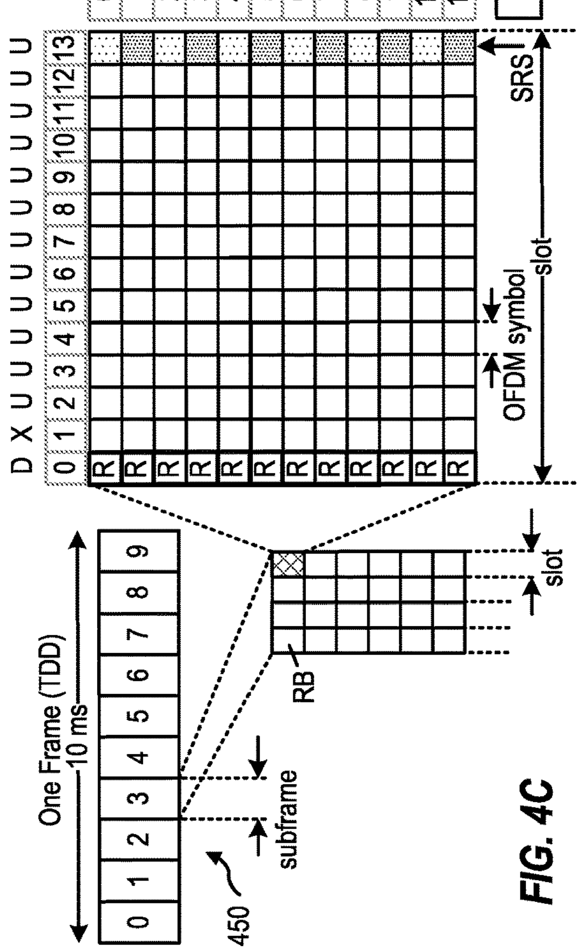


FIG. 4C

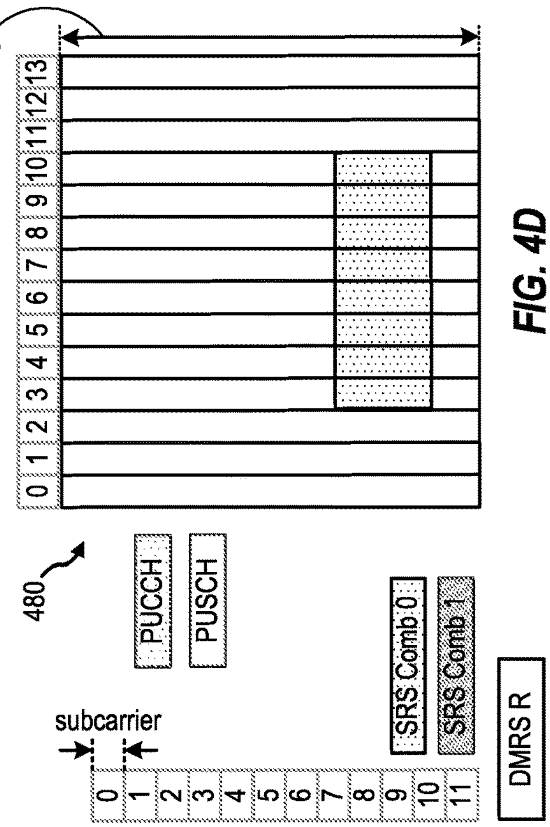


FIG. 4D

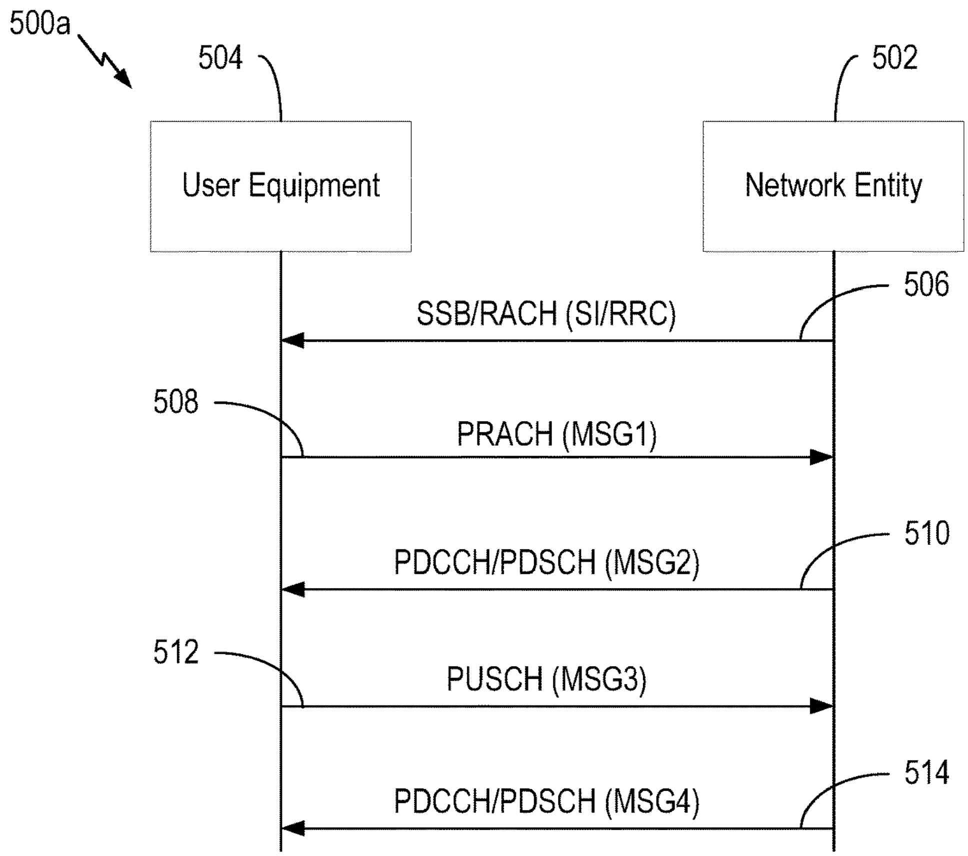

500a
504
502
User Equipment
Network Entity
506
SSB/RACH (SI/RRC)
508
PRACH (MSG1)
510
PDCCH/PDSCH (MSG2)
512
PUSCH (MSG3)
514
PDCCH/PDSCH (MSG4)

FIG. 5A

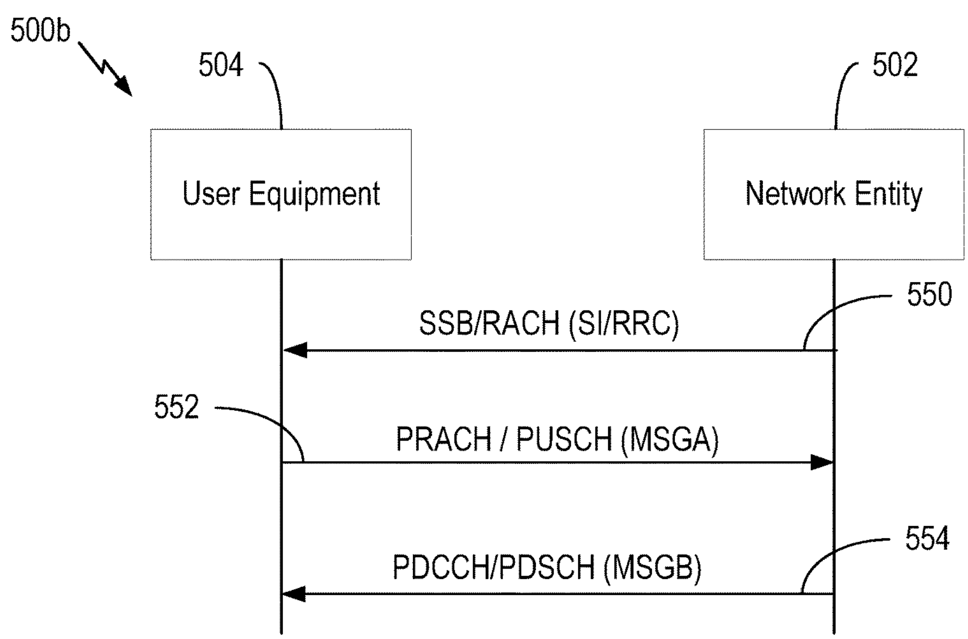

500b
504
502
User Equipment
Network Entity
550
SSB/RACH (SI/RRC)
552
PRACH / PUSCH (MSGA)
554
PDCCH/PDSCH (MSGB)

FIG. 5B

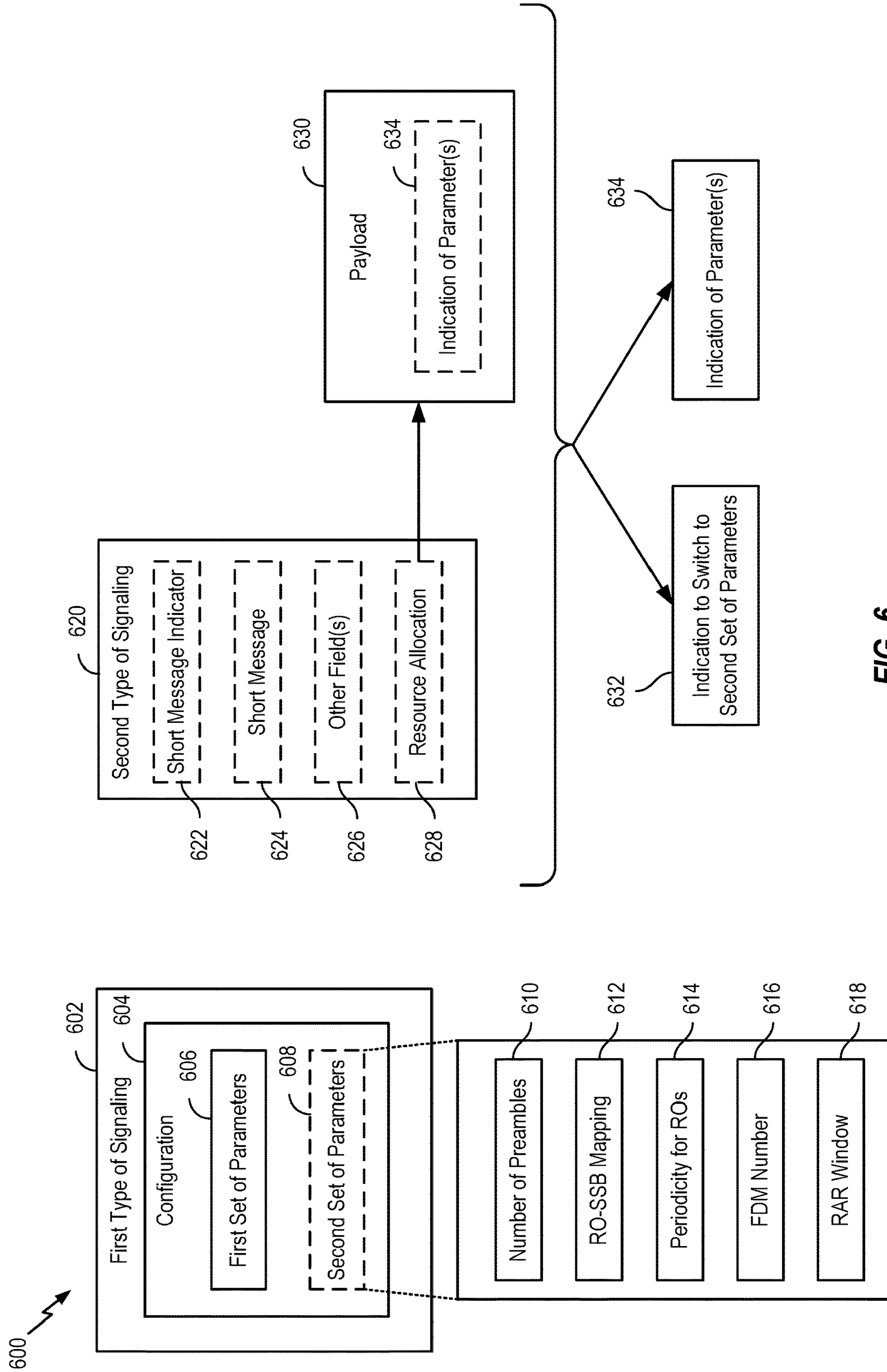

600
602
First Type of Signaling
604
Configuration
606
First Set of Parameters
608
Second Set of Parameters
610
Number of Preambles
612
RO-SSB Mapping
614
Periodicity for ROs
616
FDM Number
618
RAR Window
620
Second Type of Signaling
622
Short Message Indicator
624
Short Message
626
Other Field(s)
628
Resource Allocation
630
Payload
634
Indication of Parameter(s)
632
Indication to Switch to Second Set of Parameters
634
Indication of Parameter(s)

FIG. 6

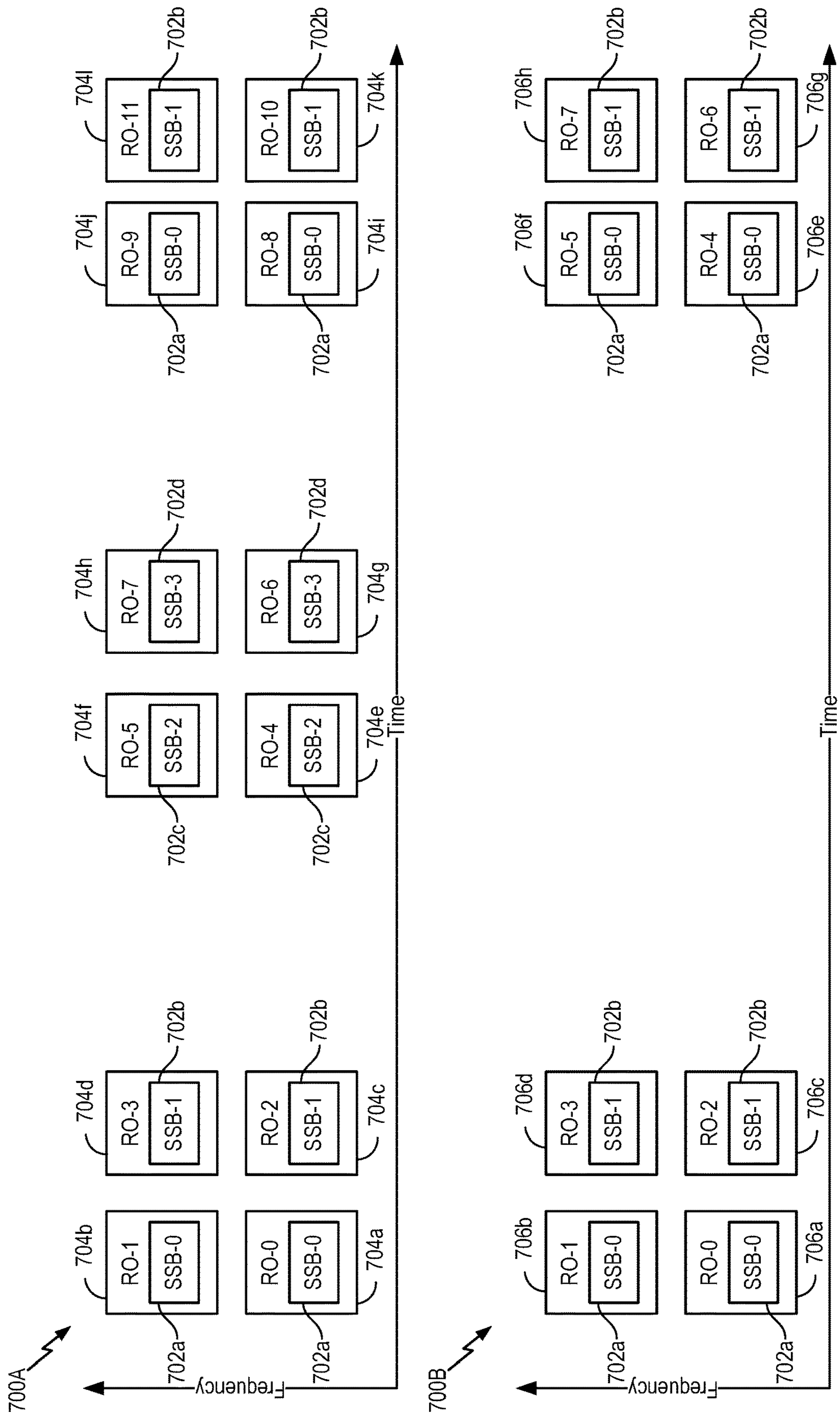
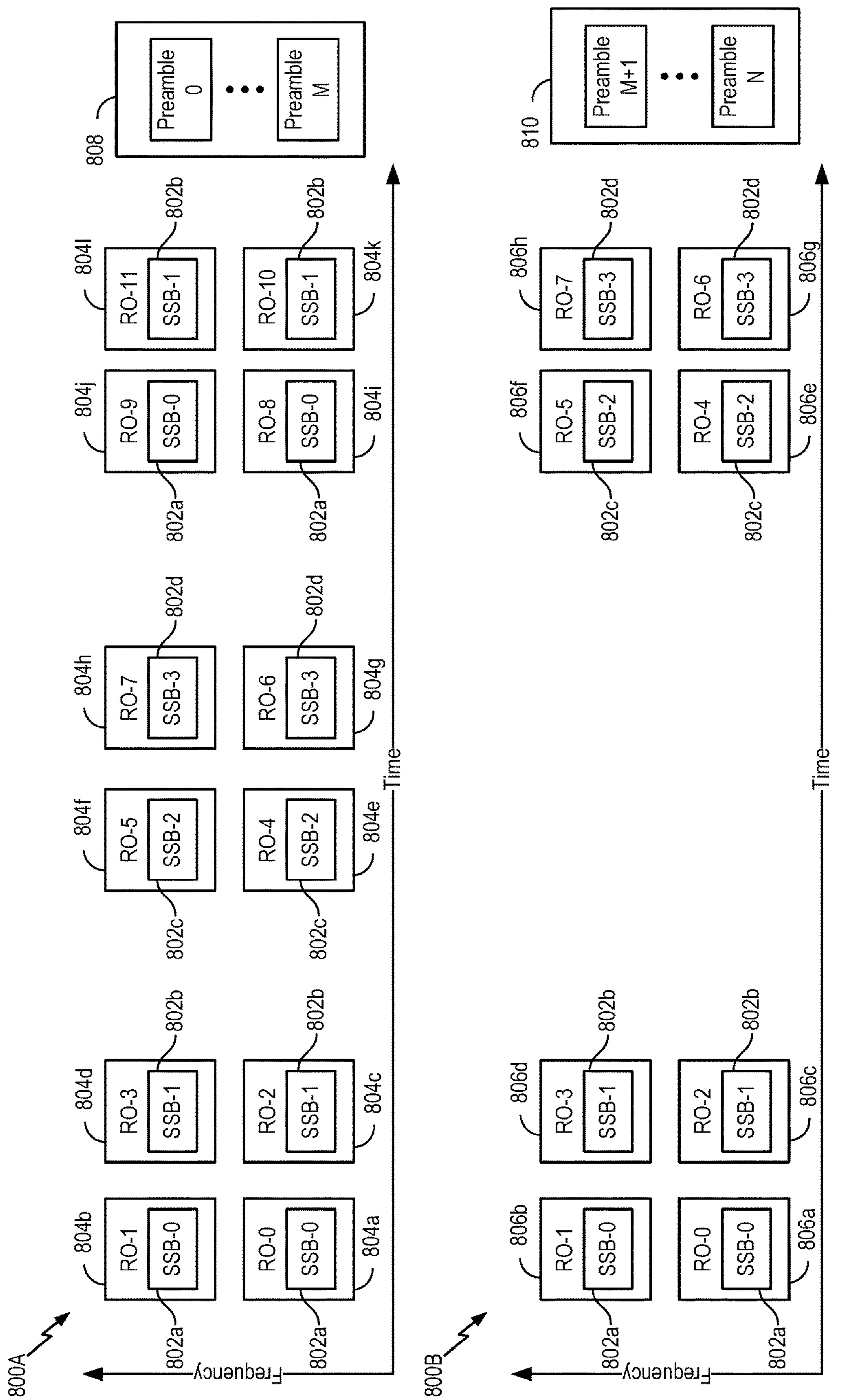

700A
Frequency
Time
RO-0
RO-1
RO-2
RO-3
RO-4
RO-5
RO-6
RO-7
RO-8
RO-9
RO-10
RO-11
SSB-0
SSB-1
SSB-2
SSB-3
702a
702b
702c
702d
704a
704b
704c
704d
704e
704f
704g
704h
704i
704j
704k
704l
700B
Frequency
Time
RO-0
RO-1
RO-2
RO-3
RO-4
RO-5
RO-6
RO-7
SSB-0
SSB-1
702a
702b
706a
706b
706c
706d
706e
706f
706g
706h

FIG. 7



800A
800B
Frequency
Time
RO-0
RO-1
RO-2
RO-3
RO-4
RO-5
RO-6
RO-7
RO-8
RO-9
RO-10
RO-11
SSB-0
SSB-1
SSB-2
SSB-3
802a
802b
802c
802d
804a
804b
804c
804d
804e
804f
804g
804h
804i
804j
804k
804l
806a
806b
806c
806d
806e
806f
806g
806h
808
Preamble 0
Preamble M
810
Preamble M+1
Preamble N

FIG. 8

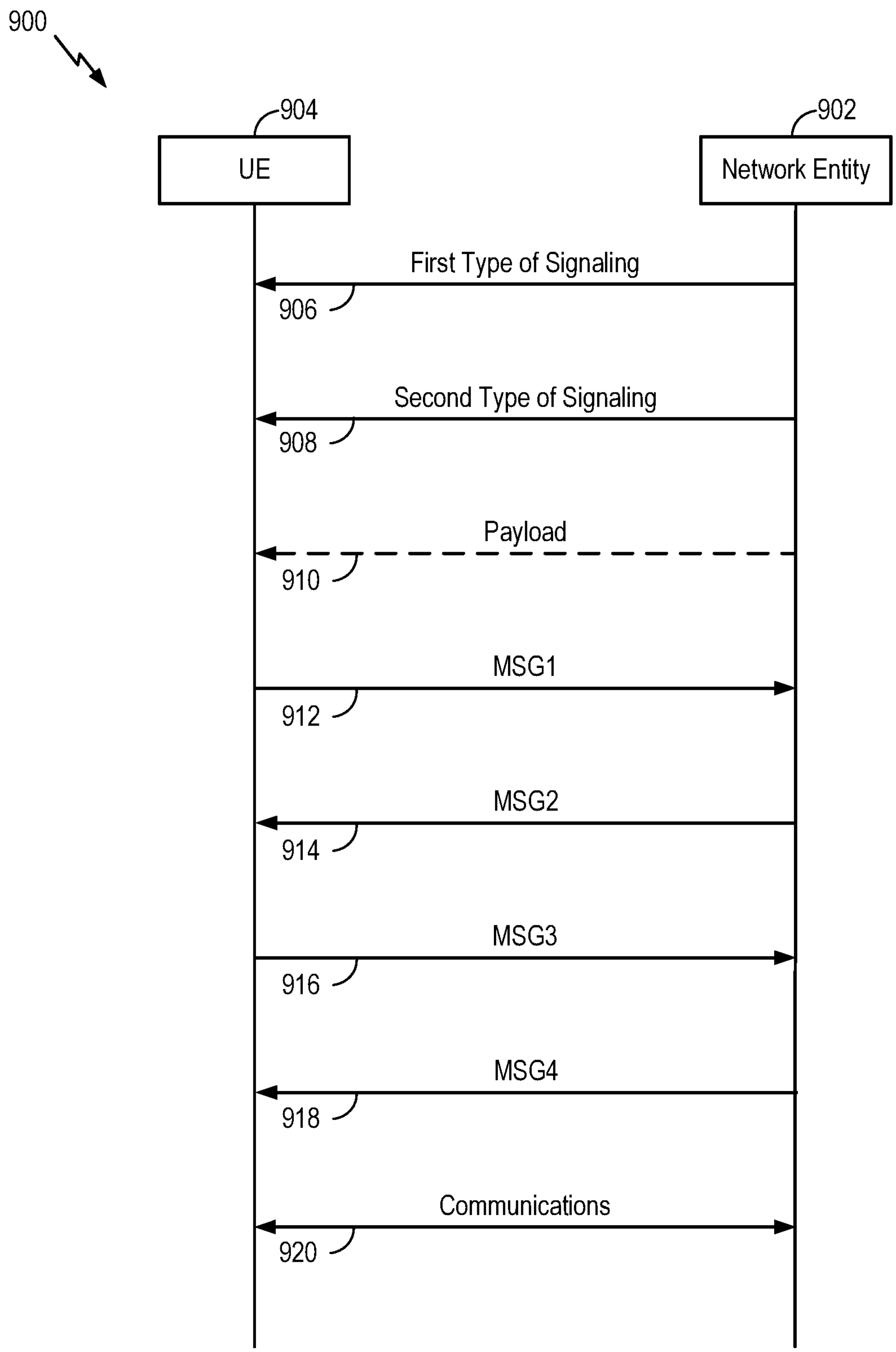

900
904
UE
902
Network Entity
First Type of Signaling
906
Second Type of Signaling
908
Payload
910
MSG1
912
MSG2
914
MSG3
916
MSG4
918
Communications
920

FIG. 9

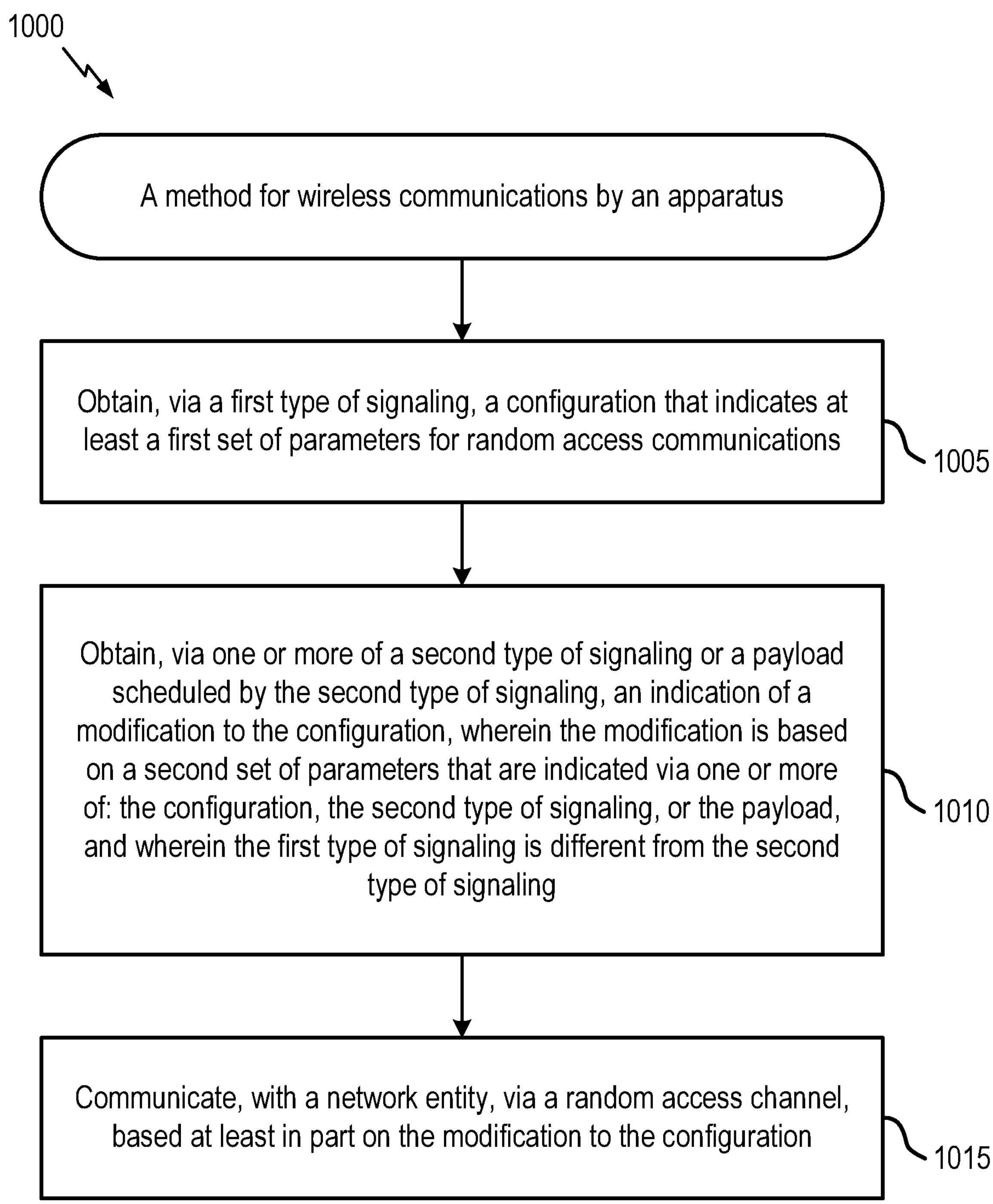

1000
A method for wireless communications by an apparatus
Obtain, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications
1005
Obtain, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling
1010
Communicate, with a network entity, via a random access channel, based at least in part on the modification to the configuration
1015

FIG. 10

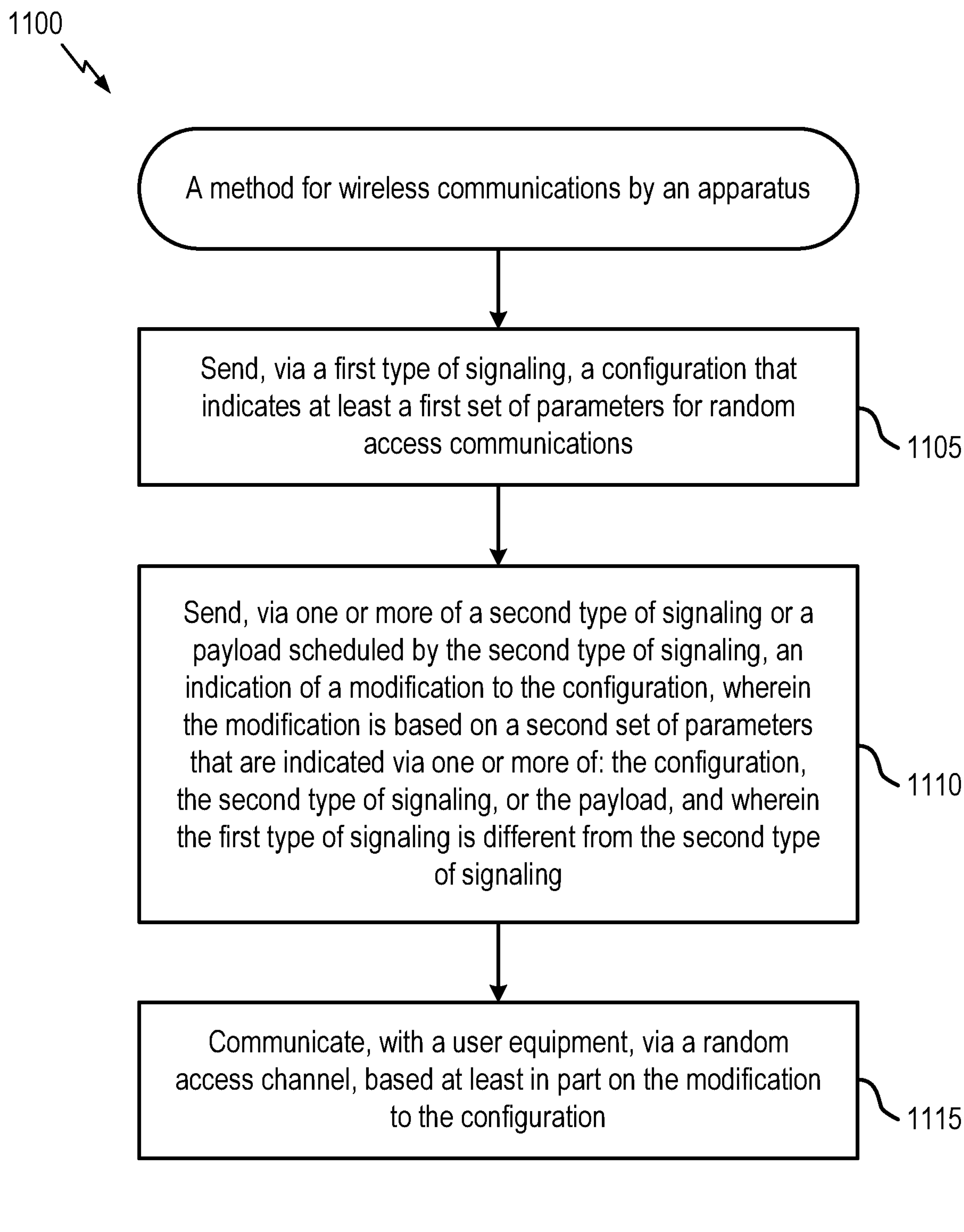

1100
A method for wireless communications by an apparatus
Send, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications
1105
Send, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling
1110
Communicate, with a user equipment, via a random access channel, based at least in part on the modification to the configuration
1115

FIG. 11

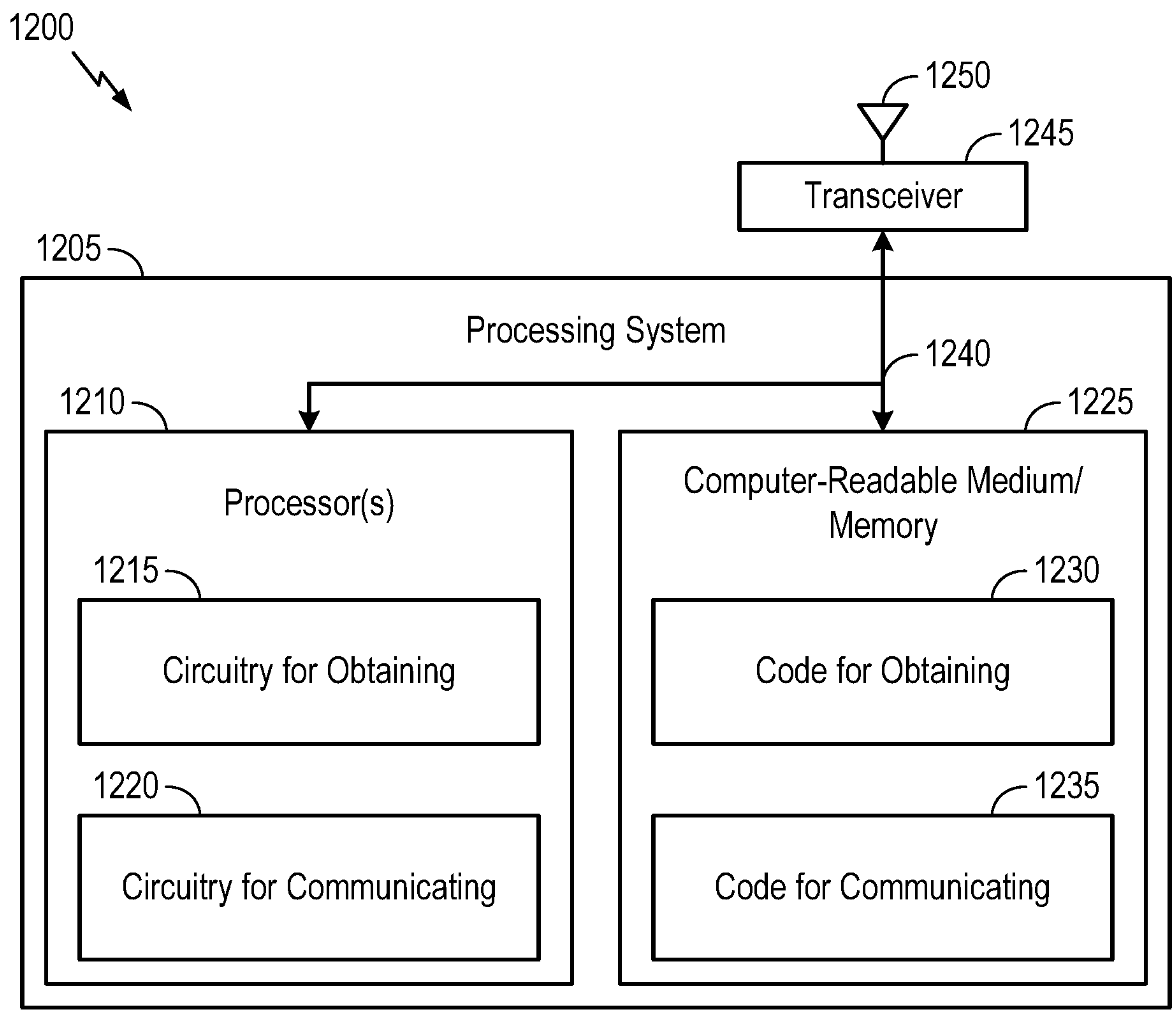

1200
1250
1245
Transceiver
1205
Processing System
1240
1210
1225
Processor(s)
Computer-Readable Medium/
Memory
1215
1230
Circuitry for Obtaining
Code for Obtaining
1220
1235
Circuitry for Communicating
Code for Communicating

FIG. 12

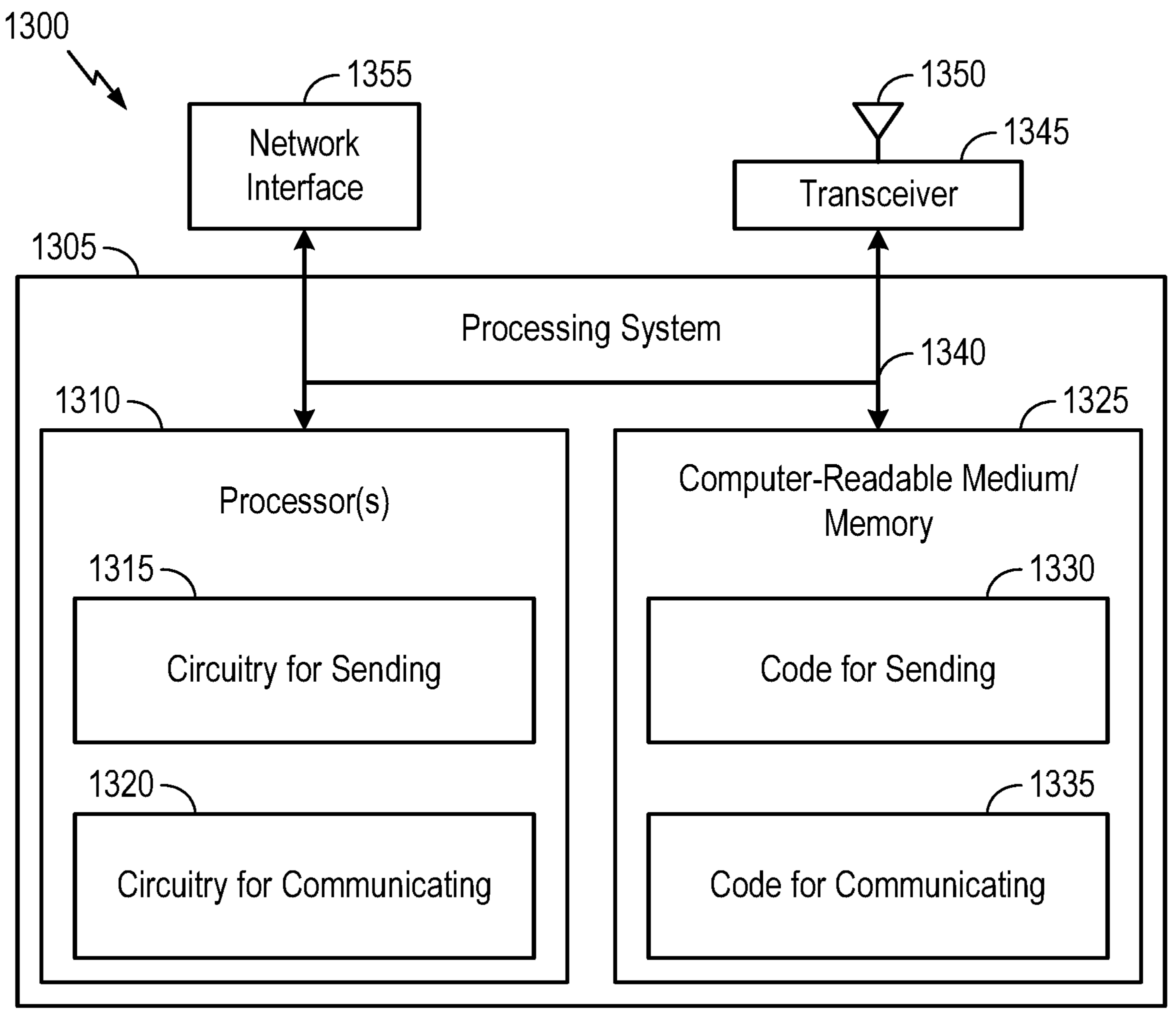

1300
1355
Network Interface
1350
1345
Transceiver
1305
Processing System
1340
1310
1325
Processor(s)
Computer-Readable Medium/ Memory
1315
Circuitry for Sending
1330
Code for Sending
1320
Circuitry for Communicating
1335
Code for Communicating

FIG. 13

DYNAMIC CONFIGURATION OF RANDOM ACCESS COMMUNICATIONS

INTRODUCTION

Field of the Disclosure

[0001] Aspects of the present disclosure relate to wireless communications, and more particularly, to techniques for random access communications.

DESCRIPTION OF RELATED ART

[0002] Wireless communications systems are widely deployed to provide various telecommunication services such as telephony, video, data, messaging, broadcasts, or other similar types of services. These wireless communications systems may employ multiple-access technologies capable of supporting communications with multiple users by sharing available wireless communications system resources with those users.

[0003] Although wireless communications systems have made great technological advancements over many years, challenges still exist. For example, complex and dynamic environments can still attenuate or block signals between wireless transmitters and wireless receivers. Accordingly, there is a continuous desire to improve the technical performance of wireless communications systems, including, for example: improving speed and data carrying capacity of communications, improving efficiency of the use of shared communications mediums, reducing power used by transmitters and receivers while performing communications, improving reliability of wireless communications, avoiding redundant transmissions and/or receptions and related processing, improving the coverage area of wireless communications, increasing the number and types of devices that can access wireless communications systems, increasing the ability for different types of devices to intercommunicate, increasing the number and type of wireless communications mediums available for use, and the like. Consequently, there exists a need for further improvements in wireless communications systems to overcome the aforementioned technical challenges and others.

SUMMARY

[0004] One aspect provides a method for wireless communications by an apparatus. The method includes obtaining, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications; obtaining, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and communicating, with a network entity, via a random access channel, based at least in part on the modification to the configuration.

[0005] Another aspect provides a method for wireless communications by an apparatus. The method includes sending, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications; sending, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and communicating, with a user equipment, via a random access channel, based at least in part on the modification to the configuration.

[0006] Other aspects provide: one or more apparatuses operable, configured, or otherwise adapted to perform any portion of any method described herein (e.g., such that performance may be by only one apparatus or in a distributed fashion across multiple apparatuses); one or more non-transitory, computer-readable media comprising instructions that, when executed by one or more processors of one or more apparatuses, cause the one or more apparatuses to perform any portion of any method described herein (e.g., such that instructions may be included in only one computer-readable medium or in a distributed fashion across multiple computer-readable media, such that instructions may be executed by only one processor or by multiple processors in a distributed fashion, such that each apparatus of the one or more apparatuses may include one processor or multiple processors, and/or such that performance may be by only one apparatus or in a distributed fashion across multiple apparatuses); one or more computer program products embodied on one or more computer-readable storage media comprising code for performing any portion of any method described herein (e.g., such that code may be stored in only one computer-readable medium or across computer-readable media in a distributed fashion); and/or one or more apparatuses comprising one or more means for performing any portion of any method described herein (e.g., such that performance would be by only one apparatus or by multiple apparatuses in a distributed fashion). By way of example, an apparatus may comprise a processing system, a device with a processing system, or processing systems cooperating over one or more networks. An apparatus may comprise one or more memories; and one or more processors configured to cause the apparatus to perform any portion of any method described herein. In some examples, one or more of the processors may be preconfigured to perform various functions or operations described herein without requiring configuration by software.

[0007] The following description and the appended figures set forth certain features for purposes of illustration.

BRIEF DESCRIPTION OF DRAWINGS

[0008] The appended figures depict certain features of the various aspects described herein and are not to be considered limiting of the scope of this disclosure.

[0009] FIG. **1** depicts an example wireless communications network.

[0010] FIG. **2** depicts an example disaggregated base station architecture.

[0011] FIG. **3** depicts aspects of an example base station and an example user equipment (UE).

[0012] FIGS. **4**A, **4**B, **4**C, and **4**D depict various example aspects of data structures for a wireless communications network.

[0013] FIG. **5**A depicts an example four-step random access procedure.

[0014] FIG. **5**B depicts an example two-step random access procedure.

[0015] FIG. **6** depicts an example architecture for dynamic configuration of random access communications.

[0016] FIG. **7** depicts example mappings of synchronization signal blocks (SSBs) to random access occasions (ROs) in time-frequency domains for sets of random access parameters.

[0017] FIG. **8** illustrates other example mappings of SSBs to ROs in time-frequency domains for sets of random access parameters.

[0018] FIG. **9** depicts a process flow for dynamic configuration of random access communications.

[0019] FIG. **10** depicts a method for wireless communications.

[0020] FIG. **11** depicts another method for wireless communications.

[0021] FIG. **12** depicts aspects of an example communications device.

[0022] FIG. **13** depicts aspects of an example communications device.

DETAILED DESCRIPTION

[0023] Aspects of the present disclosure provide apparatuses, methods, processing systems, and computer-readable mediums for dynamic configuration of random access communications.

[0024] In certain wireless communication systems (e.g., 5G New Radio systems and/or any future wireless communications system), a user equipment (UE) may communicate with a network entity (e.g., a base station) using a random access procedure, for example, for initial access to the network entity, for beam failure recovery, to obtain timing information (e.g., a timing advance), to request uplink communication resources, to request system information, etc. An example random access procedure may begin with the UE sending a random access preamble on a physical random access channel (PRACH) in a random access occasion (RO), which may include one or more time-frequency resources. Upon successful reception of the preamble, the network entity sends a response to the preamble in a random access response (RAR) window. The response may include an uplink scheduling grant. On receiving the response, the UE may send a request to setup a connection with the network entity, and then, the network entity may reply with a contention resolution response.

[0025] In certain cases, a UE obtains a configuration for random access communications via system information that is broadcast by the network entity. The configuration may identify certain parameters for random access communications, such as a set of preambles, a periodicity for the ROs, and/or a duration for the RAR window. Certain aspects associated with random access communications are further described herein, for example, with respect to FIGS. **5**A and **5**B.

[0026] Technical problems for random access communications include, for example, effectively communicating, to UE(s), a reconfiguration for random access communications. In certain cases, a network entity may decide to reconfigure the configuration for random access communications, for example, in response to time varying traffic levels or network capacity. As an example, the network entity may decide to reconfigure the configuration for random access communications in order to enable certain energy savings, for example, when the traffic level is relatively low. The network entity may increase the periodicity for the ROs, reduce the duration for the RAR window, and/or reduce the number of frequency division multiplexed ROs per time instance of an RO in order to reduce the power consumption associated with random access communications.

[0027] As discussed, random access communications may be configured via system information. Such system information is communicated by a network entity on a periodic basis, for example, with a periodicity that can be as long as 160 milliseconds (ms). In certain cases, the network entity may notify UEs via downlink control information (DCI) that the system information, which includes the configuration for random access communication, has been modified. This notification may trigger a UE to obtain the updated system information in the next transmission occasion for the system information, which can be as long as 160 milliseconds. Accordingly, updating the configuration for random access communications may use a non-trivial amount of time due to the updating procedure depending on the periodicity of system information to convey the updated configuration.

[0028] In certain cases, the network entity may update the system information without notifying the UEs about the update relying on the UEs to occasionally check the system information being broadcast by the network entity. However, some UEs may refrain from checking for updated system information once the system information is initially received at the UE. Accordingly, some UEs may attempt to communicate with the network entity via a random access channel using an obsolete configuration for random access communications.

[0029] Aspects described herein overcome the aforementioned technical problem(s) by providing dynamic configuration of random access communications. In certain aspects, a UE may be configured with multiple configurations for random access communications, and the UE may obtain, from a network entity, an indication to switch to a specific configuration among the multiple configurations. In certain aspects, the UE may obtain an indication of an updated set of parameter to a configuration for random access communications, for example, via DCI and/or a payload scheduled via the DCI. Accordingly, such schemes for communicating a reconfiguration for random access communications enable reduced latency in signaling the reconfiguration to a UE.

[0030] The techniques for dynamic configuration of random access communications as described herein may provide various beneficial technical effects and/or advantages. The techniques for dynamic configuration of random access communications may enable reduced latency in modifying random access parameter(s) at a UE. The techniques for dynamic configuration of random access communications may provide an effective technique for switching between sets of random access parameters in response to various conditions, such as changes in wireless traffic levels and/or network loads over time. The dynamic configuration may allow a network entity to switch to random access parameters that enable energy savings at the network entity and/or UE, for example, when traffic levels and/or network loads are low.

Introduction to Wireless Communications Networks

[0031] The techniques and methods described herein may be used for various wireless communications networks. While aspects may be described herein using terminology commonly associated with 3G, 4G, 5G, 6G, and/or other generations of wireless technologies, aspects of the present disclosure may likewise be applicable to other communications systems and standards not explicitly mentioned herein.

[0032] FIG. **1** depicts an example of a wireless communications network **100**, in which aspects described herein may be implemented.

[0033] Generally, wireless communications network **100** includes various network entities (alternatively, network elements or network nodes). A network entity is generally a communications device and/or a communications function performed by a communications device (e.g., a user equipment (UE), a base station (BS), a component of a BS, a server, etc.). As such communications devices are part of wireless communications network **100**, and facilitate wireless communications, such communications devices may be referred to as wireless communications devices. For example, various functions of a network as well as various devices associated with and interacting with a network may be considered network entities. Further, wireless communications network **100** includes terrestrial aspects, such as ground-based network entities (e.g., BSs **102**), and non-terrestrial aspects (also referred to herein as non-terrestrial network entities), such as satellite **140** and/or aerial or spaceborne platform(s), which may include network entities on-board (e.g., one or more BSs) capable of communicating with other network elements (e.g., terrestrial BSs) and UEs.

[0034] In the depicted example, wireless communications network **100** includes BSs **102**, UEs **104**, and one or more core networks, such as an Evolved Packet Core (EPC) 160 and 5G Core (5GC) network **190**, which interoperate to provide communications services over various communications links, including wired and wireless links.

[0035] FIG. **1** depicts various example UEs **104**, which may more generally include: a cellular phone, smart phone, session initiation protocol (SIP) phone, laptop, personal digital assistant (PDA), satellite radio, global positioning system, multimedia device, video device, digital audio player, camera, game console, tablet, smart device, wearable device, vehicle, electric meter, gas pump, large or small kitchen appliance, healthcare device, implant, sensor/actuator, display, internet of things (IoT) devices, always on (AON) devices, edge processing devices, data centers, or other similar devices. UEs **104** may also be referred to more generally as a mobile device, a wireless device, a station, a mobile station, a subscriber station, a mobile subscriber station, a mobile unit, a subscriber unit, a wireless unit, a remote unit, a remote device, an access terminal, a mobile terminal, a wireless terminal, a remote terminal, a handset, and others.

[0036] BSs **102** wirelessly communicate with (e.g., transmit signals to or receive signals from) UEs **104** via communications links **120**. The communications links **120** between BSs **102** and UEs **104** may include uplink (UL) (also referred to as reverse link) transmissions from a UE **104** to a BS **102** and/or downlink (DL) (also referred to as forward link) transmissions from a BS **102** to a UE **104**. The communications links **120** may use multiple-input and multiple-output (MIMO) antenna technology, including spatial multiplexing, beamforming, and/or transmit diversity in various aspects.

[0037] BSs **102** may generally include: a NodeB, enhanced NodeB (eNB), next generation enhanced NodeB (ng-eNB), next generation NodeB (gNB or gNodeB), access point, base transceiver station, radio base station, radio transceiver, transceiver function, transmission reception point, and/or others. Each of BSs **102** may provide communications coverage for a respective coverage area **110**, which may sometimes be referred to as a cell, and which may overlap in some cases (e.g., small cell **102'** may have a coverage area **110'** that overlaps the coverage area **110** of a macro cell). A BS may, for example, provide communications coverage for a macro cell (covering relatively large geographic area), a pico cell (covering relatively smaller geographic area, such as a sports stadium), a femto cell (relatively smaller geographic area (e.g., a home)), and/or other types of cells.

[0038] Generally, a cell may refer to a portion, partition, or segment of wireless communication coverage served by a network entity within a wireless communication network. A cell may have geographic characteristics, such as a geographic coverage area, as well as radio frequency characteristics, such as time and/or frequency resources dedicated to the cell. For example, a specific geographic coverage area may be covered by multiple cells employing different frequency resources (e.g., bandwidth parts) and/or different time resources. As another example, a specific geographic coverage area may be covered by a single cell. In some contexts (e.g., a carrier aggregation scenario and/or multi-connectivity scenario), the terms “cell” or “serving cell” may refer to or correspond to a specific carrier frequency (e.g., a component carrier) used for wireless communications, and a “cell group” may refer to or correspond to multiple carriers used for wireless communications. As examples, in a carrier aggregation scenario, a UE may communicate on multiple component carriers corresponding to multiple (serving) cells in the same cell group, and in a multi-connectivity (e.g., dual connectivity) scenario, a UE may communicate on multiple component carriers corresponding to multiple cell groups.

[0039] While BSs **102** are depicted in various aspects as unitary communications devices, BSs **102** may be implemented in various configurations. For example, one or more components of a base station may be disaggregated, including a central unit (CU), one or more distributed units (DUs), one or more radio units (RUs), a Near-Real Time (Near-RT) RAN Intelligent Controller (RIC), or a Non-Real Time (Non-RT) RIC, to name a few examples. In another example, various aspects of a base station may be virtualized. More generally, a base station (e.g., BS **102**) may include components that are located at a single physical location or components located at various physical locations. In examples in which a base station includes components that are located at various physical locations, the various components may each perform functions such that, collectively, the various components achieve functionality that is similar to a base station that is located at a single physical location. In some aspects, a base station including components that are located at various physical locations may be referred to as a disaggregated radio access network architecture, such as an Open RAN (O-RAN) or Virtualized RAN (VRAN) architecture. FIG. **2** depicts and describes an example disaggregated base station architecture.

[0040] Different BSs **102** within wireless communications network **100** may also be configured to support different radio access technologies, such as 3G, 4G, and/or 5G. For example, BSs **102** configured for 4G LTE (collectively referred to as Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network

(E-UTRAN)) may interface with the EPC **160** through first backhaul links **132** (e.g., an S1 interface). BSs **102** configured for 5G (e.g., 5G NR or Next Generation RAN (NG-RAN)) may interface with 5GC **190** through second backhaul links **184**. BSs **102** may communicate directly or indirectly (e.g., through the EPC **160** or 5GC **190**) with each other over third backhaul links **134** (e.g., X2 interface), which may be wired or wireless.

[0041] Wireless communications network **100** may subdivide the electromagnetic spectrum into various classes, bands, channels, or other features. In some aspects, the subdivision is provided based on wavelength and frequency, where frequency may also be referred to as a carrier, a subcarrier, a frequency channel, a tone, or a subband. For example, 3GPP currently defines Frequency Range 1 (FR1) as including 410 MHz-7125 MHz, which is often referred to (interchangeably) as "Sub-6 GHz". Similarly, 3GPP currently defines Frequency Range 2 (FR2) as including 24,250 MHz-71,000 MHZ, which is sometimes referred to (interchangeably) as a "millimeter wave" ("mm W" or "mmWave"). In some cases, FR2 may be further defined in terms of sub-ranges, such as a first sub-range FR2-1 including 24,250 MHz-52,600 MHz and a second sub-range FR2-2 including 52,600 MHz-71,000 MHz. A base station configured to communicate using mm Wave/near mm Wave radio frequency bands (e.g., a mmWave base station such as BS **180**) may utilize beamforming (e.g., **182**) with a UE (e.g., **104**) to improve path loss and range.

[0042] The communications links **120** between BSs **102** and, for example, UEs **104**, may be through one or more carriers, which may have different bandwidths (e.g., 5, 10, 15, 20, 100, 400, and/or other MHz), and which may be aggregated in various aspects. Carriers may or may not be adjacent to each other. Allocation of carriers may be asymmetric with respect to DL and UL (e.g., more or fewer carriers may be allocated for DL than for UL).

[0043] Communications using higher frequency bands may have higher path loss and a shorter range compared to lower frequency communications. Accordingly, certain base stations (e.g., **180** in FIG. **1**) may utilize beamforming **182** with a UE **104** to improve path loss and range. For example, BS **180** and the UE **104** may each include a plurality of antennas, such as antenna elements, antenna panels, and/or antenna arrays to facilitate the beamforming. In some cases, BS **180** may transmit a beamformed signal to UE **104** in one or more transmit directions **182'**. UE **104** may receive the beamformed signal from the BS **180** in one or more receive directions **182"**. UE **104** may also transmit a beamformed signal to the BS **180** in one or more transmit directions **182"**. BS **180** may also receive the beamformed signal from UE **104** in one or more receive directions **182'**. BS **180** and UE **104** may then perform beam training to determine the best receive and transmit directions for each of BS **180** and UE **104**. Notably, the transmit and receive directions for BS **180** may or may not be the same. Similarly, the transmit and receive directions for UE **104** may or may not be the same.

[0044] Wireless communications network **100** further includes a Wi-Fi AP **150** in communication with Wi-Fi stations (STAs) **152** via communications links **154** in, for example, a 2.4 GHz and/or 5 GHz unlicensed frequency spectrum.

[0045] Certain UEs **104** may communicate with each other using device-to-device (D2D) communications link **158**. D2D communications link **158** may use one or more sidelink channels, such as a physical sidelink broadcast channel (PSBCH), a physical sidelink discovery channel (PSDCH), a physical sidelink shared channel (PSSCH), a physical sidelink control channel (PSCCH), and/or a physical sidelink feedback channel (PSFCH).

[0046] EPC **160** may include various functional components, including: a Mobility Management Entity (MME) **162**, other MMEs **164**, a Serving Gateway **166**, a Multimedia Broadcast Multicast Service (MBMS) Gateway **168**, a Broadcast Multicast Service Center (BM-SC) **170**, and/or a Packet Data Network (PDN) Gateway **172**, such as in the depicted example. MME **162** may be in communication with a Home Subscriber Server (HSS) **174**. MME **162** is the control node that processes the signaling between the UEs **104** and the EPC **160**. Generally, MME **162** provides bearer and connection management.

[0047] Generally, user Internet protocol (IP) packets are transferred through Serving Gateway **166**, which itself is connected to PDN Gateway **172**. PDN Gateway **172** provides UE IP address allocation as well as other functions. PDN Gateway **172** and the BM-SC **170** are connected to IP Services **176**, which may include, for example, the Internet, an intranet, an IP Multimedia Subsystem (IMS), a Packet Switched (PS) streaming service, and/or other IP services.

[0048] BM-SC **170** may provide functions for MBMS user service provisioning and delivery. BM-SC **170** may serve as an entry point for content provider MBMS transmission, may be used to authorize and initiate MBMS Bearer Services within a public land mobile network (PLMN), and/or may be used to schedule MBMS transmissions. MBMS Gateway **168** may be used to distribute MBMS traffic to the BSs **102** belonging to a Multicast Broadcast Single Frequency Network (MBSFN) area broadcasting a particular service, and/or may be responsible for session management (start/stop) and for collecting eMBMS related charging information.

[0049] 5GC **190** may include various functional components, including: an Access and Mobility Management Function (AMF) **192**, other AMFs **193**, a Session Management Function (SMF) **194**, and a User Plane Function (UPF) **195**. AMF **192** may be in communication with Unified Data Management (UDM) **196**.

[0050] AMF **192** is a control node that processes signaling between UEs **104** and 5GC **190**. AMF **192** provides, for example, quality of service (QOS) flow and session management.

[0051] Internet protocol (IP) packets are transferred through UPF **195**, which is connected to the IP Services **197**, and which provides UE IP address allocation as well as other functions for 5GC **190**. IP Services **197** may include, for example, the Internet, an intranet, an IMS, a PS streaming service, and/or other IP services.

[0052] In various aspects, a network entity or network node can be implemented as an aggregated base station, as a disaggregated base station, a component of a base station, an integrated access and backhaul (IAB) node, a relay node, a sidelink node, to name a few examples.

[0053] FIG. **2** depicts an example disaggregated base station **200** architecture. The disaggregated base station **200** architecture may include one or more central units (CUs) **210** that can communicate directly with a core network **220** via a backhaul link, or indirectly with the core network **220** through one or more disaggregated base station units (such as a Near-Real Time (Near-RT) RAN Intelligent Controller

(RIC) **225** via an E2 link, or a Non-Real Time (Non-RT) RIC **215** associated with a Service Management and Orchestration (SMO) Framework **205**, or both). A CU **210** may communicate with one or more distributed units (DUs) **230** via respective midhaul links, such as an F1 interface. The DUs **230** may communicate with one or more radio units (RUs) **240** via respective fronthaul links. The RUs **240** may communicate with respective UEs **104** via one or more radio frequency (RF) access links. In some implementations, the UE **104** may be simultaneously served by multiple RUs **240**.

[0054] Each of the units, e.g., the CUS **210**, the DUs **230**, the RUs **240**, as well as the Near-RT RICs **225**, the Non-RT RICs **215** and the SMO Framework **205**, may include one or more interfaces or be coupled to one or more interfaces configured to receive or transmit signals, data, or information (collectively, signals) via a wired or wireless transmission medium. Each of the units, or an associated processor or controller providing instructions to the communications interfaces of the units, can be configured to communicate with one or more of the other units via the transmission medium. For example, the units can include a wired interface configured to receive or transmit signals over a wired transmission medium to one or more of the other units. Additionally or alternatively, the units can include a wireless interface, which may include a receiver, a transmitter or transceiver (such as a radio frequency (RF) transceiver), configured to receive or transmit signals, or both, over a wireless transmission medium to one or more of the other units.

[0055] In some aspects, the CU **210** may host one or more higher layer control functions. Such control functions can include radio resource control (RRC), packet data convergence protocol (PDCP), service data adaptation protocol (SDAP), or the like. Each control function can be implemented with an interface configured to communicate signals with other control functions hosted by the CU **210**. The CU **210** may be configured to handle user plane functionality (e.g., Central Unit-User Plane (CU-UP)), control plane functionality (e.g., Central Unit-Control Plane (CU-CP)), or a combination thereof. In some implementations, the CU **210** can be logically split into one or more CU-UP units and one or more CU-CP units. The CU-UP unit can communicate bidirectionally with the CU-CP unit via an interface, such as the E1 interface when implemented in an O-RAN configuration. The CU **210** can be implemented to communicate with the DU **230**, as necessary, for network control and signaling.

[0056] The DU **230** may correspond to a logical unit that includes one or more base station functions to control the operation of one or more RUs **240**. In some aspects, the DU **230** may host one or more of a radio link control (RLC) layer, a medium access control (MAC) layer, and one or more high physical (PHY) layers (such as modules for forward error correction (FEC) encoding and decoding, scrambling, modulation and demodulation, or the like) depending, at least in part, on a functional split, such as those defined by the 3rd Generation Partnership Project (3GPP). In some aspects, the DU **230** may further host one or more low PHY layers. Each layer (or module) can be implemented with an interface configured to communicate signals with other layers (and modules) hosted by the DU **230**, or with the control functions hosted by the CU **210**.

[0057] Lower-layer functionality can be implemented by one or more RUs **240**. In some deployments, an RU **240**, controlled by a DU **230**, may correspond to a logical node that hosts RF processing functions, or low-PHY layer functions (such as performing fast Fourier transform (FFT), inverse FFT (iFFT), digital beamforming, physical random access channel (PRACH) extraction and filtering, or the like), or both, based at least in part on the functional split, such as a lower layer functional split. In such an architecture, the RU(s) **240** can be implemented to handle over the air (OTA) communications with one or more UEs **104**. In some implementations, real-time and non-real-time aspects of control and user plane communications with the RU(s) **240** can be controlled by the corresponding DU **230**. In some scenarios, this configuration can enable the DU(s) **230** and the CU **210** to be implemented in a cloud-based RAN architecture, such as a vRAN architecture.

[0058] The SMO Framework **205** may be configured to support RAN deployment and provisioning of non-virtualized and virtualized network elements. For non-virtualized network elements, the SMO Framework **205** may be configured to support the deployment of dedicated physical resources for RAN coverage requirements which may be managed via an operations and maintenance interface (such as an O1 interface). For virtualized network elements, the SMO Framework **205** may be configured to interact with a cloud computing platform (such as an open cloud (O-Cloud) **290**) to perform network element life cycle management (such as to instantiate virtualized network elements) via a cloud computing platform interface (such as an O2 interface). Such virtualized network elements can include, but are not limited to, CUs **210**, DUs **230**, RUs **240** and Near-RT RICs **225**. In some implementations, the SMO Framework **205** can communicate with a hardware aspect of a 4G RAN, such as an open eNB (O-eNB) **211**, via an O1 interface. Additionally, in some implementations, the SMO Framework **205** can communicate directly with one or more DUs **230** and/or one or more RUs **240** via an O1 interface. The SMO Framework **205** also may include a Non-RT RIC **215** configured to support functionality of the SMO Framework **205**.

[0059] The Non-RT RIC **215** may be configured to include a logical function that enables non-real-time control and optimization of RAN elements and resources, Artificial Intelligence/Machine Learning (AI/ML) workflows including model training and updates, or policy-based guidance of applications/features in the Near-RT RIC **225**. The Non-RT RIC **215** may be coupled to or communicate with (such as via an A1 interface) the Near-RT RIC **225**. The Near-RT RIC **225** may be configured to include a logical function that enables near-real-time control and optimization of RAN elements and resources via data collection and actions over an interface (such as via an E2 interface) connecting one or more CUs **210**, one or more DUs **230**, or both, as well as an O-eNB, with the Near-RT RIC **225**.

[0060] In some implementations, to generate AI/ML models to be deployed in the Near-RT RIC **225**, the Non-RT RIC **215** may receive parameters or external enrichment information from external servers. Such information may be utilized by the Near-RT RIC **225** and may be received at the SMO Framework **205** or the Non-RT RIC **215** from non-network data sources or from network functions. In some examples, the Non-RT RIC **215** or the Near-RT RIC **225** may be configured to tune RAN behavior or performance. For example, the Non-RT RIC **215** may monitor long-term trends and patterns for performance and employ AI/ML models to perform corrective actions through the SMO Framework **205** (such as reconfiguration via O1) or via creation of RAN management policies (such as A1 policies).

[0061] FIG. **3** depicts aspects of an example BS **102** and a UE **104**.

[0062] Generally, BS **102** includes various processors (e.g., **318**, **320**, **330**, **338**, and **340**), antennas **334***a-t* (collectively **334**), transceivers **332***a-t* (collectively **332**), which include modulators and demodulators, and other aspects, which enable wireless transmission of data (e.g., data source **312**) and wireless reception of data (e.g., data sink **314**). For example, BS **102** may send and receive data between BS **102** and UE **104**. BS **102** includes controller/processor **340**, which may be configured to implement various functions described herein related to wireless communications. Note that the BS **102** may have a disaggregated architecture as described herein with respect to FIG. **2**.

[0063] Generally, UE **104** includes various processors (e.g., **358**, **364**, **366**, **370**, and **380**), antennas **352***a-r* (collectively **352**), transceivers **354***a-r* (collectively **354**), which include modulators and demodulators, and other aspects, which enable wireless transmission of data (e.g., retrieved from data source **362**) and wireless reception of data (e.g., provided to data sink **360**). UE **104** includes controller/processor **380**, which may be configured to implement various functions described herein related to wireless communications.

[0064] In regards to an example downlink transmission, BS **102** includes a transmit processor **320** that may receive data from a data source **312** and control information from a controller/processor **340**. The control information may be for the physical broadcast channel (PBCH), physical control format indicator channel (PCFICH), physical hybrid automatic repeat request (HARQ) indicator channel (PHICH), physical downlink control channel (PDCCH), group common PDCCH (GC PDCCH), and/or others. The data may be for the physical downlink shared channel (PDSCH), in some examples.

[0065] Transmit processor **320** may process (e.g., encode and symbol map) the data and control information to obtain data symbols and control symbols, respectively. Transmit processor **320** may also generate reference symbols, such as for the primary synchronization signal (PSS), secondary synchronization signal (SSS), PBCH demodulation reference signal (DMRS), and channel state information reference signal (CSI-RS).

[0066] Transmit (TX) multiple-input multiple-output (MIMO) processor **330** may perform spatial processing (e.g., precoding) on the data symbols, the control symbols, and/or the reference symbols, if applicable, and may provide output symbol streams to the modulators (MODs) in transceivers **332***a*-**332***t*. Each modulator in transceivers **332***a*-**332***t* may process a respective output symbol stream to obtain an output sample stream. Each modulator may further process (e.g., convert to analog, amplify, filter, and upconvert) the output sample stream to obtain a downlink signal. Downlink signals from the modulators in transceivers **332***a*-**332***t* may be transmitted via the antennas **334***a*-**334***t*, respectively.

[0067] In order to receive the downlink transmission, UE **104** includes antennas **352***a*-**352***r* that may receive the downlink signals from the BS **102** and may provide received signals to the demodulators (DEMODs) in transceivers **354***a*-**354***r*, respectively. Each demodulator in transceivers **354***a*-**354***r* may condition (e.g., filter, amplify, downconvert, and digitize) a respective received signal to obtain input samples. Each demodulator may further process the input samples to obtain received symbols.

[0068] RX MIMO detector **356** may obtain received symbols from all the demodulators in transceivers **354***a*-**354***r*, perform MIMO detection on the received symbols if applicable, and provide detected symbols. Receive processor **358** may process (e.g., demodulate, deinterleave, and decode) the detected symbols, provide decoded data for the UE **104** to a data sink **360**, and provide decoded control information to a controller/processor **380**.

[0069] In regards to an example uplink transmission, UE **104** further includes a transmit processor **364** that may receive and process data (e.g., for the PUSCH) from a data source **362** and control information (e.g., for the physical uplink control channel (PUCCH)) from the controller/processor **380**. Transmit processor **364** may also generate reference symbols for a reference signal (e.g., for the sounding reference signal (SRS)). The symbols from the transmit processor **364** may be precoded by a TX MIMO processor **366** if applicable, further processed by the modulators in transceivers **354***a*-**354***r* (e.g., for SC-FDM), and transmitted to BS **102**.

[0070] At BS **102**, the uplink signals from UE **104** may be received by antennas **334***a-t*, processed by the demodulators in transceivers **332***a*-**332***t*, detected by a RX MIMO detector **336** if applicable, and further processed by a receive processor **338** to obtain decoded data and control information sent by UE **104**. Receive processor **338** may provide the decoded data to a data sink **314** and the decoded control information to the controller/processor **340**.

[0071] Memories **342** and **382** may store data and program codes for BS **102** and UE **104**, respectively.

[0072] Scheduler **344** may schedule UEs for data transmission on the downlink and/or uplink.

[0073] In various aspects, BS **102** may be described as transmitting and receiving various types of data associated with the methods described herein. In these contexts, "transmitting" may refer to various mechanisms of outputting data, such as outputting data from data source **312**, scheduler **344**, memory **342**, transmit processor **320**, controller/processor **340**, TX MIMO processor **330**, transceivers **332***a-t*, antenna **334***a-t*, and/or other aspects described herein. Similarly, "receiving" may refer to various mechanisms of obtaining data, such as obtaining data from antennas **334***a-t*, transceivers **332***a-t*, RX MIMO detector **336**, controller/processor **340**, receive processor **338**, scheduler **344**, memory **342**, and/or other aspects described herein.

[0074] In various aspects, UE **104** may likewise be described as transmitting and receiving various types of data associated with the methods described herein. In these contexts, "transmitting" may refer to various mechanisms of outputting data, such as outputting data from data source **362**, memory **382**, transmit processor **364**, controller/processor **380**, TX MIMO processor **366**, transceivers **354***a-t*, antenna **352***a-t*, and/or other aspects described herein. Similarly, "receiving" may refer to various mechanisms of obtaining data, such as obtaining data from antennas **352***a-t*, transceivers **354***a-t*, RX MIMO detector **356**, controller/processor **380**, receive processor **358**, memory **382**, and/or other aspects described herein.

[0075] In some aspects, a processor may be configured to perform various operations, such as those associated with the methods described herein, and transmit (output) to or receive (obtain) data from another interface that is configured to transmit or receive, respectively, the data.

[0076] In various aspects, artificial intelligence (AI) processors **318** and **370** may perform AI processing for BS **102** and/or UE **104**, respectively. The AI processor **318** may include AI accelerator hardware or circuitry such as one or more neural processing units (NPUs), one or more neural network processors, one or more tensor processors, one or more deep learning processors, etc. The AI processor **370** may likewise include AI accelerator hardware or circuitry. As an example, the AI processor **370** may perform AI-based beam management, AI-based channel state feedback (CSF), AI-based antenna tuning, and/or AI-based positioning (e.g., non-line of sight positioning prediction). In some cases, the AI processor **318** may process feedback from the UE **104** (e.g., CSF) using hardware accelerated AI inferences and/or AI training. The AI processor **318** may decode compressed CSF from the UE **104**, for example, using a hardware accelerated AI inference associated with the CSF. In certain cases, the AI processor **318** may perform certain RAN-based functions including, for example, network planning, network performance management, energy-efficient network operations, etc.

[0077] FIGS. **4**A, **4**B, **4**C, and **4**D depict aspects of data structures for a wireless communications network, such as wireless communications network **100** of FIG. **1**.

[0078] In particular, FIG. **4**A is a diagram **400** illustrating an example of a first subframe within a 5G (e.g., 5G NR) frame structure, FIG. **4**B is a diagram **430** illustrating an example of DL channels within a 5G subframe, FIG. **4**C is a diagram **450** illustrating an example of a second subframe within a 5G frame structure, and FIG. **4**D is a diagram **480** illustrating an example of UL channels within a 5G subframe.

[0079] Wireless communications systems may utilize orthogonal frequency division multiplexing (OFDM) with a cyclic prefix (CP) on the uplink and downlink. Such systems may also support half-duplex operation using time division duplexing (TDD). OFDM and single-carrier frequency division multiplexing (SC-FDM) partition the system bandwidth (e.g., as depicted in FIGS. **4**B and **4**D) into multiple orthogonal subcarriers. Each subcarrier may be modulated with data. Modulation symbols may be sent in the frequency domain with OFDM and/or in the time domain with SC-FDM.

[0080] A wireless communications frame structure may be frequency division duplex (FDD), in which, for a particular set of subcarriers, subframes within the set of subcarriers are dedicated for either DL or UL. Wireless communications frame structures may also be time division duplex (TDD), in which, for a particular set of subcarriers, subframes within the set of subcarriers are dedicated for both DL and UL.

[0081] In FIGS. **4**A and **4**C, the wireless communications frame structure is TDD where D is DL, U is UL, and X is flexible for use between DL/UL. UEs may be configured with a slot format through a received slot format indicator (SFI) (dynamically through DL control information (DCI), or semi-statically/statically through radio resource control (RRC) signaling). In the depicted examples, a 10 ms frame is divided into 10 equally sized 1 ms subframes. Each subframe may include one or more time slots. In some examples, each slot may include 12 or 14 symbols, depending on the cyclic prefix (CP) type (e.g., 12 symbols per slot for an extended CP or 14 symbols per slot for a normal CP). Subframes may also include mini-slots, which generally have fewer symbols than an entire slot. Other wireless communications technologies may have a different frame structure and/or different channels.

[0082] In certain aspects, the number of slots within a subframe (e.g., a slot duration in a subframe) is based on a numerology, which may define a frequency domain subcarrier spacing and symbol duration as further described herein. In certain aspects, given a numerology μ, there are 2^μ slots per subframe. Thus, numerologies (μ) 0 to 6 may allow for 1, 2, 4, 8, 16, 32, and 64 slots, respectively, per subframe. In some cases, the extended CP (e.g., 12 symbols per slot) may be used with a specific numerology, e.g., numerology 2 allowing for 4 slots per subframe. The subcarrier spacing and symbol length/duration are a function of the numerology. The subcarrier spacing may be equal to $2^\mu \times 15$ kHz, where μ is the numerology 0 to 6. As an example, the numerology $u=0$ corresponds to a subcarrier spacing of 15 kHz, and the numerology $u=6$ corresponds to a subcarrier spacing of 960 kHz. The symbol length/duration is inversely related to the subcarrier spacing. FIGS. **4**A, **4**B, **4**C, and **4**D provide an example of a slot format having 14 symbols per slot (e.g., a normal CP) and a numerology $\mu=2$ with 4 slots per subframe. In such a case, the slot duration is 0.25 ms, the subcarrier spacing is 60 kHz, and the symbol duration is approximately 16.67 μs.

[0083] As depicted in FIGS. **4**A, **4**B, **4**C, and **4**D, a resource grid may be used to represent the frame structure. Each time slot includes a resource block (RB) (also referred to as physical RBs (PRBs)) that extends, for example, 12 consecutive subcarriers. The resource grid is divided into multiple resource elements (REs). The number of bits carried by each RE depends on the modulation scheme including, for example, quadrature phase shift keying (QPSK) or quadrature amplitude modulation (QAM).

[0084] As illustrated in FIG. **4**A, some of the REs carry reference (pilot) signals (RS) for a UE (e.g., UE **104** of FIGS. **1** and **3**). The RS may include demodulation RS (DMRS) and/or channel state information reference signals (CSI-RS) for channel estimation at the UE. The RS may also include beam measurement RS (BRS), beam refinement RS (BRRS), and/or phase tracking RS (PT-RS).

[0085] FIG. **4**B illustrates an example of various DL channels within a subframe of a frame. The physical downlink control channel (PDCCH) carries DCI within one or more control channel elements (CCEs), each CCE including, for example, nine RE groups (REGs), each REG including, for example, four consecutive REs in an OFDM symbol.

[0086] A primary synchronization signal (PSS) may be within symbol **2** of particular subframes of a frame. The PSS is used by a UE (e.g., **104** of FIGS. **1** and **3**) to determine subframe/symbol timing and a physical layer identity.

[0087] A secondary synchronization signal (SSS) may be within symbol **4** of particular subframes of a frame. The SSS is used by a UE to determine a physical layer cell identity group number and radio frame timing.

[0088] Based on the physical layer identity and the physical layer cell identity group number, the UE can determine a physical cell identifier (PCI). Based on the PCI, the UE can determine the locations of the aforementioned DMRS. The physical broadcast channel (PBCH), which carries a master information block (MIB), may be logically grouped with the PSS and SSS to form a synchronization signal (SS)/PBCH block (SSB), and in some cases, referred to as a synchronization signal block (SSB). The MIB provides a number of RBs in the system bandwidth and a system frame number (SFN). The physical downlink shared channel (PDSCH) carries user data, broadcast system information not transmitted through the PBCH such as system information blocks (SIBs), and/or paging messages.

[0089] As illustrated in FIG. **4**C, some of the REs carry DMRS (indicated as R for one particular configuration, but other DMRS configurations are possible) for channel estimation at the base station. The UE may transmit DMRS for the PUCCH and DMRS for the PUSCH. The PUSCH DMRS may be transmitted, for example, in the first one or two symbols of the PUSCH. The PUCCH DMRS may be transmitted in different configurations depending on whether short or long PUCCHs are transmitted and depending on the particular PUCCH format used. UE **104** may transmit sounding reference signals (SRS). The SRS may be transmitted, for example, in the last symbol of a subframe. The SRS may have a comb structure, and a UE may transmit SRS on one of the combs. The SRS may be used by a base station for channel quality estimation to enable frequency-dependent scheduling on the UL.

[0090] FIG. **4**D illustrates an example of various UL channels within a subframe of a frame. The PUCCH may be located as indicated in one configuration. The PUCCH carries uplink control information (UCI), such as scheduling requests, a channel quality indicator (CQI), a precoding matrix indicator (PMI), a rank indicator (RI), and HARQ ACK/NACK feedback. The PUSCH carries data, and may additionally be used to carry a buffer status report (BSR), a power headroom report (PHR), and/or UCI.

Example Random Access Procedures

[0091] Certain wireless communication systems (e.g., a 5G NR system and/or any future wireless communications system) may provide a specified channel for random access, such as a random access channel (RACH), and corresponding random access procedures. A random access procedure may be performed for any of various events including, for example, initial access from an idle state (e.g., RRC idle), RRC connection re-establishment, handover, downlink (DL) and/or uplink (UL) data arrival (e.g., when the UE is in an idle state), or device positioning.

[0092] FIG. **5**A depicts a process flow diagram of an example four-step RACH procedure **500***a* performed between a UE **504** and a network entity **502**. In some aspects, the UE **504** is the UE **104** depicted and described with respect to FIGS. **1** and **3**, and the network entity **502** is the base station **102** depicted and described with respect to FIGS. **1** and **3** or a disaggregated base station depicted and described with respect to FIG. **2**.

[0093] The RACH procedure **500***a* may optionally begin at **506**, where the network entity **502** broadcasts and the UE **504** receives a random access configuration, for example, in system information within a synchronization signal block, or within an RRC message. The random access configuration may indicate or include one or more parameters for random access communications, such as defining the RACH, the number of random access preambles (e.g., preamble sequences) available for random access, power ramping parameters, response window size (duration), etc. In certain aspects, the UE **504** may obtain an indication of a modification to the random access configuration, for example, as further described herein with respect to FIGS. **6-9**.

[0094] At **508**, the UE **504** sends a first message (MSG1) to the network entity **502** on a physical random access channel (PRACH). In certain aspects, MSG1 may indicate or include a RACH preamble. The RACH preamble may be or include a preamble sequence (e.g., a Zaddoff Chu sequence). For contention-based random access, the preamble sequence may be randomly selected among a set of preamble sequences (e.g., up to 64 sequences, in some cases). The preamble sequence may be used to identify the UE **504** for scheduling communications (e.g., MSG2 and MSG3) with the network entity. In certain aspects, terms such as "RACH preamble," "random access preamble," "preamble," "preamble sequence," "sequence," and the like may be used interchangeably.

[0095] At **510**, the network entity **502** may respond with a random access response (RAR) message (MSG2). For example, the network entity **502** may send a PDCCH communication including downlink control information (DCI) that schedules the RAR on the PDSCH. The RAR may include, for example, certain parameters used for an uplink transmission such as a random access (RA) preamble identifier (RAPID), a timing advance, an uplink (UL) grant (e.g., indicating one or more time-frequency resources for an uplink transmission), cell radio network temporary identifier (C-RNTI), and/or a backoff parameter value. The RAPID may correspond to the preamble sequence and indicate that the RAR is for the UE **504** that transmitted MSG1 at **506**. The backoff parameter value may be used to determine a RACH occasion (RO) for sending a subsequent RACH transmission (e.g., a preamble transmission). A RACH occasion may correspond to one or more time-frequency resources available for transmitting a preamble in a RACH.

[0096] At **512**, in response to MSG2, the UE **504** transmits a third message (MSG3) to the network entity **502** on the PUSCH. In some aspects, MSG3 may include an RRC connection request, a tracking area update (e.g., for UE mobility), and/or a scheduling request (for an UL transmission). As an example, MSG3 is communicated in the time-frequency resource(s) indicated in the UL grant of the RAR.

[0097] At **514**, the network entity **502** may send a contention resolution message (MSG4) in response to MSG3. In certain cases, multiple UEs may send the same preamble in the same RO. As the network entity **502** may not be able to identify which UE sent which preamble, the network entity **502** may reply with a single RAR associated with the preamble. The MSG3 may include or indicate a specific UE identity associated with the UE **504**, such as a radio network temporary identifier (RNTI) or a temporary mobile subscriber identity (TMSI). The network entity **502** may decode MSG3 and determine the UE identity associated with at least one of the UEs (e.g., UE **504**). MSG4 may be addressed to the UE identity (e.g., the RNTI or an RNTI based on the TMSI) associated with the MSG3 that the network entity was able to successfully decode. For example, the MSG4 may be scrambled by the RNTI associated with the MSG3. If the UE **504** obtains the same identity sent in MSG3, the UE **504** concludes that the random procedure succeeded. In some cases, if the UE **504** is unable to obtain or decode MSG3 and/or MSG4, the UE **504** may repeat the RACH procedure, such as the four-step RACH procedure **500***a*.

[0098] In some cases, to reduce the latency associated with random access, a two-step RACH procedure may be used. As the name implies, the two-step RACH procedure may effectively consolidate the four messages of the four-step RACH procedure into two messages.

[0099] FIG. **5**B depicts a process flow diagram of an example two-step RACH procedure **500***b* performed between the UE **504** and the network entity **502**.

[0100] The procedure **500***b* may optionally begin at **550**, where the network entity **502** broadcasts and the UE **504** receives a random access configuration, for example in system information within a synchronization signal block, or within an RRC message.

[0101] At **552**, the UE **504** sends a first message (MSGA) to the network entity **502**, which may effectively combine MSG1 and MSG3 described above with respect to FIG. **5**A. In some aspects, MSGA includes a RACH preamble for random access and a payload. For example, the payload may include a UE-ID and other signaling information, such as a buffer status report or scheduling request. The RACH preamble of MSGA may be transmitted over the RACH, and the payload of MSGA may be transmitted over the PUSCH, for example.

[0102] At **554**, the network entity **502** may send a random access response message (MSGB), which may effectively combine MSG2 and MSG4 described above. For example, MSGB may include a RAPID, a timing advance, a backoff parameter value, a contention resolution message, an uplink and/or downlink grant, and transmit power control commands.

Aspects Related to Dynamic Configuration of Random Access Communications

[0103] Aspects of the present disclosure provide dynamic configuration of random access communications. As an example, a UE may obtain a reconfiguration for random access parameters via paging signaling, which may be broadcast or multicast to multiple UEs. In certain aspects, the reconfiguration may indicate to switch to preconfigured parameters, for example, communicated in system information. In certain aspects, the reconfiguration may carry the modified parameters in the paging signaling and/or a payload scheduled by the paging signaling.

[0104] FIG. **6** illustrates an example architecture **600** for dynamic configuration of random access communications. In this example, a UE may obtain, from a network entity via a first type of signaling **602**, a configuration **604** that indicates or includes at least a first set of parameters **606** for random access communications. A "set" as discussed herein may include one or more elements. In certain aspects, the first type of signaling **602** may indicate that the first set of parameters **606** are default parameter(s) for random access communications and/or indicate that the first set of parameters **606** are the active set of parameters being used currently at or by the network entity. In some cases, the configuration **604** may further indicate or include a second set of parameters **608** for random access communications. The first type of signaling **602** may indicate that the second set of parameters **608** are an alternative set of parameters that can be activated or triggered for use as further described herein. The first type of signaling **602** may be or include system information, such as SIB1. As an example, the configuration may be or include a RACH configuration (e.g., RACH-ConfigCommon) used to specify cell specific random-access parameter(s).

[0105] The second set of parameters **608** may be or include certain random access parameter(s). In certain aspects, the second set of parameters **608** may be configured to enable energy savings for random access communications. For example, the network entity may use or activate the second set of parameters when there is a low level of traffic, for example, during the night; whereas the network entity may use or activate the first set of parameters, when there is an increased level of traffic, for example, during the day. The second set of parameters **608** may be or include one or more of: a total number of random access preambles **610** available for random access communications; an indication of a mapping of a set of random access occasions (ROs) to one or more synchronization signal blocks (SSBs) (RO-SSB mapping) **612**; a periodicity **614** for the set of ROs (e.g., based on a PRACH configuration index); a total number of one or more ROs that can be frequency division multiplexed (FDM) in a time instance associated with a single RO (hereinafter "the FDM number **616**"); or a duration of a random access response (RAR) window **618**. In certain aspects, the second set of parameters **608** may be configured to adjust (e.g., reduce or increase) the random access communications activity of the network entity and/or one or more UEs with respect to the first set of parameters **606**. For example, the second set of parameters **608** may increase the periodicity for the set of ROs **614**, reduce the total number of preambles **610**, reduce the FDM number **616**, and/or reduce the RAR window **618**. Note that other parameter(s) may be included in the second set of parameters in addition to or instead of those discussed above, such as a number of RACH slots per radio frame and/or a PRACH configuration index.

[0106] In certain aspects, one or more look-up tables may define various sets of random access parameters, and a PRACH configuration index may be used to identify a specific set of parameter(s) in the look-up table(s). The PRACH configuration index may be associated with a particular row of parameter(s) in the look-up table(s). As an example, the PRACH configuration index may indicate certain parameters that define the time-domain position of RO(s) including, for example, the periodicity for the set of ROs **614** based on the radio frame(s) and/or the subframe(s) that include RO(s) defined by the PRACH configuration index. In some cases, the PRACH configuration index may indicate that every radio frame includes RO(s). In certain cases, the PRACH configuration index may indicate that every other radio frame includes ROs. As an example, the PRACH configuration index may indicate that there is a single RO every 160 ms. As another example, the PRACH configuration index may indicate that there are 24 time multiplexed ROs every 20 ms. The FDM number may allow for multiple ROs to be multiplexed in the frequency domain per RO in the corresponding radio frames and subframes configured with time domain positions for RO(s). Accordingly, the periodicity and/or other parameter(s) for random access communications may be indicated with respect to a PRACH configuration index, and the second set of parameters **608** may indicate or include a PRACH configuration index.

[0107] In certain aspects, the second set of parameters **608** may adjust the RO(s) available for random access communications based on the arrangement of RO(s) configured by the first set of parameters **606**, or vice versa. In certain cases, the second set of parameters **608** may identify a subset of the

RO(s) configured by the first set of parameters **606**. The RO(s) available for random access communications based on the second set of parameters **608** may be a sub-selection of RO(s) configured based on the first set of parameters **606**. In some cases, the RO(s) available for random access communications based on the first set of parameters **606** may be a sub-selection of RO(s) configured based on the second set of parameters **608**. Accordingly, the PRACH configuration index associated with the second set of parameters **608** may be a value that allows for a sub-selection of RO(s) configured based on the first set of parameters **606**, or vice versa.

[0108] After obtaining the first type of signaling **602**, the UE may obtain, from the network entity, a second type of signaling **620** that indicates to switch from the first set of parameters **606** to the second set of parameters **608** (e.g., a first indication **632** to switch to the second set of parameters **608**) and/or indicates at least one parameter of the second set of parameters **608** (e.g., a second indication **634** of at least one parameter of the second set of parameters **608**). The first indication **632** may be or include an index or a specific value that indicates or selects the second set of parameters **608**. The second indication **634** may be or include a parameter value and/or an index of a parameter value associated with at least one parameter of the second set of parameters. As an example, the second indication **634** may be or include a value for the number of preambles **610**, an index for the RO-SSB mapping **612**, a duration for the periodicity **614**, a value for the FDM number **616**, and/or a duration for the RAR window **618**.

[0109] The second type of signaling **620** may be a different type of signaling than the first type of signaling **602**. For example, where the first type of signaling **602** may be system information, such as a SIB, the second type of signaling **620** may be a different signaling than SIB, such as DCI. In certain aspects, the second type of signaling **620** may indicate to toggle to the second set of parameters **608** for random access communications. In certain aspects, the second type of signaling **620** may indicate setting(s) for the second set of parameters **608**. In certain aspects, the second type of signaling **620** may be communicated via DCI. The second type of signaling **620** may be broadcast or groupcast to one or more UEs via a common or shared radio network temporary identifier (RNTI), such as a paging RNTI (P-RNTI). For example, the second type of signaling **620** may be scrambled using the common or shared RNTI (e.g., a CRC scrambled by the common or shared RNTI).

[0110] In certain aspects, the second type of signaling **620** may include a paging DCI (e.g., a DCI scrambled using the P-RNTI), a paging early indicator (PEI), and/or a DCI designated or dedicated to indicating reconfiguration parameter(s) for random access communications (e.g., the second set of parameters). In certain aspects, the DCI designated for indicating reconfiguration parameter(s) for random access communications may be specific to a cell. For example, the DCI may be communicated using a cell specific RNTI. In certain aspects, the DCI designated for indicating reconfiguration parameter(s) for random access communications may be communicated in a PEI occasion or a paging occasion, for example, when PEI and/or paging is periodically scheduled for being communicated.

[0111] In certain aspects, the second type of signaling **620** may include one or more fields that indicate to switch from the first set of parameters **606** to the second set of parameters **608** (e.g., the first indication **632**) and/or that indicate at least one parameter of the second set of parameters **608** (e.g., the second indication **634**). For example, the second type of signaling **620** may include a short message indicator **622** that is set to a specific value (e.g., '00' which may otherwise be a reserved value) that indicates to switch from the first set of parameters **606** to the second set of parameters **608** and/or indicates at least one parameter of the second set of parameters **608** (e.g., a parameter value and/or an index of a parameter value).

[0112] In some cases, the short message indicator **622** may indicate that a short message **624** is carried in the second type of signaling **620**. The short message **624** may be or include a bitmap with one or more bits that indicate to switch from the first set of parameters **606** to the second set of parameters **608** and/or that indicate at least one parameter of the second set of parameters. For example, the short message **624** may have a size of eight bits, and any one or more of bits **5-8** in the short message **624** may be used to indicate to switch from the first set of parameters **606** to the second set of parameters **608** and/or indicate at least one parameter of the second set of parameters **608** (e.g., a parameter value and/or an index of a parameter value).

[0113] In certain aspects, the short message indicator **622** and one or more other fields **626** (hereinafter "the other field(s) **626**") may be used to indicate to switch from the first set of parameters **606** to the second set of parameters **608** and/or indicate at least one parameter of the second set of parameters **608**. For example, the short message indicator **622** may be set to a specific value (e.g., '00' which may otherwise be a reserved value) that indicates the other field(s) **626** carry information related to the second set of parameters **608**, and the other field(s) **626** may indicate to switch from the first set of parameters **606** to the second set of parameters **608** and/or indicate at least one parameter of the second set of parameters **608**. In certain aspects, the other field(s) **626** may include, for example, a frequency domain resource allocation field, a time domain resource allocation field, a modulation and coding scheme field, etc. As an example, the other field(s) **626** may be or include a resource allocation **628** and/or any other suitable field in the second type of signaling.

[0114] In certain aspects, the second type of signaling **620** may include scheduling for a payload **630**, which may be communicated via a data channel, a control channel, and/or a shared data and control channel, for example, the PDSCH. As shown, the second type of signaling **620** may indicate or include a resource allocation **628** for communicating the payload **630**, for example, in the PDSCH. The resource allocation **628** may include or indicate time-frequency resource(s) for communicating the payload **630**. The payload **630** may indicate to switch from the first set of parameters **606** to the second set of parameters **608** and/or indicate or include at least one parameter of the second set of parameters **608**.

[0115] Accordingly, the second type of signaling **620** and/or the payload **630** may indicate a modification to the configuration **604** based on the second set of parameters **608**. The second type of signaling **620** and/or the payload **630** may carry a first indication **632** to switch to the second set of parameters **608** and/or a second indication **634** of at least one parameter of the second set of parameters **608**. In some cases, the second type of signaling **620** and/or the payload **630** may indicate to switch from the first set of parameters

606 to the second set of parameters **608**. In certain cases, the second type of signaling **620** and/or the payload **630** may indicate at least one parameter of the second set of parameters **608**. Note that the second type of signaling **620** and/or the payload **630** may be used to trigger reconfiguration from the second set of parameters **608** to the first set of parameters **606**, for example, using any of the techniques described herein.

[0116] The enhanced signaling described herein with respect to FIG. **6** may enable reduced latency in triggering reconfiguration of random access parameters. The enhanced signaling may also be communicated to multiple UEs via paging signaling (e.g., DCI scrambled with P-RNTI). Accordingly, the enhanced signaling may ensure that multiple UEs are quickly configured for random access parameters that enable energy savings, for example, through a longer periodicity for ROs, a shorter RAR window, and/or a reduced FDM number (among other settings), when traffic levels and/or network loads decrease. The enhanced signaling may enable switching to a configuration that increases random access communication activities, when traffic levels or network loads increase.

Aspects Related to SSB to RO Mapping Random Access Configurations

[0117] In certain aspects, an RO (and/or a preamble) is associated with a specific SSB, for example, to help distribute random access communications across the ROs. As an example, a UE may measure the signal strength associated with multiple SSBs and select an SSB that has a signal strength above a certain threshold (e.g., a threshold reference signal received power (RSRP)). If none of the SSBs have a signal strength above the threshold, the UE may select any SSB among the candidate SSBs. Then, the UE may select a preamble belonging to (or associated with) the selected SSB. For example, a subset of preambles may be associated with a specific SSB. Thus, the preamble may indicate the SSB selected by the UE. Further, every SSB communicated by a network entity may be mapped to (or associated with) a specific RO. In some cases, multiples SSBs may be mapped to a single RO. The UE selects an RO associated with the selected SSB, and the UE may send the preamble in the selected RO as discussed herein with respect to FIGS. **5**A and **5**B. Accordingly, the SSB selection distributes preamble transmissions across the candidate ROs as the RO selection depends on the SSB selection. The association between an RO/preamble and an SSB allows a network entity to apply the same transmit beamforming as the SSB when sending the MSG2 transmission as discussed herein with respect to FIGS. **5**A and **5**B. Thus, the indication of the SSB selection with the preamble transmission conveys transmit beamforming information to the network entity.

[0118] In certain aspects, the first set of parameters and the second set of parameters may indicate an SSB to RO mapping. For example, each of the first set of parameters and the second set of parameters may include or indicate a random access configuration index (e.g., prach-ConfigurationIndex) that indicates a specific row of parameters in one or more look-up tables that define multiple SSB to RO mappings, where each row of parameters may indicate a different SSB to RO mapping.

[0119] FIG. **7** illustrates example mappings **700**A, **700**B of SSBs to ROs for a first set of parameters (e.g., the first set of parameters **606**) and a second set of parameters (e.g., the second set of parameters **608**) in the time-frequency domains, respectively. In this example, there are a total of four SSBs **702***a-d* communicated by a network entity, and the FDM number is set to two, which allocates two FDM ROs in a time instance of a single RO. The second set of parameters are configured to allow certain ROs associated with the second set of parameters to overlap in time and frequency resources with a subset of the ROs associated with the first set of parameters.

[0120] The first mapping **700**A has a total of twelve ROs **704***a*-**1**, and the second mapping **700**B has a total of eight ROs **706***a-h*. The first mapping **700**A maps the first SSB **702***a* to the first RO **704***a* and the second RO **704***b*. The second SSB **702***b* is mapped to the third RO **704***c* and the fourth RO **704***d*, and so on for the subsequent SSBs **702***c*, **702***d* and the ROs **704***e*-**1**.

[0121] The second mapping **700**B may follow the first mapping **700**A where the respective ROs overlap in time-frequency resources. For example, the first four ROs **706***a-d* of the second mapping **700**B may have the same SSB to RO mapping as the first mapping **700**A in the first four ROs **704***a-d*. The second mapping **700**B lacks ROs that overlap with the fifth RO **704***e* through the eighth RO **704***h* of the first mapping **700**A. The fifth RO **706***e* of the second mapping **700**B may follow the SSB to RO mapping of the ninth RO **704***i* of the first mapping **700**A, and so on for the sixth RO **706***f* through the eighth RO **706***h* of the second mapping **700**B. For example, the sixth RO **706***f* through the eighth RO **706***h* of the second mapping **700**B may apply the same SSB to RO mapping as the ninth RO **704***i* through the twelfth RO **7041** of the first mapping **700**A, respectively. That is, the second mapping **700**B may apply, for each of the ROs **706***a-g*, the same SSB to RO mapping as an RO of the first mapping **700**A that overlaps in time and frequency with the respective RO **706***a-g* of the second mapping **700**B. In other words, the second mapping **700**B may be considered to apply the same SSB to RO mapping as the first mapping **700**A. However, the second mapping **700**B may effectively use virtual ROs that are not used for communications and fill in any missing ROs with respect to the first set of parameters for purposes of forming an SSB to RO mapping for the second set of parameters that follows the SSB to RO mapping for first set of parameters. Accordingly, the first set of parameters may effectively indicate the SSB to RO mapping (e.g., the second mapping **700**B) for the second set of parameters. For example, the first set of parameters may indicate a mapping (e.g., the second mapping **700**B) that indicates the first RO **706***a* is associated with the first SSB **702***a*, and so on for the other ROs **706***b-h* and SSBs **702***a-d*.

[0122] FIG. **8** illustrates other example mappings **800**A, **800**B of SSBs to ROs for a first set of parameters (e.g., the first set of parameters **606**) and a second set of parameters (e.g., the second set of parameters **608**) in the time-frequency domains, respectively. In this example, there are a total of four SSBs **802***a-d* communicated by a network entity, and the FDM number is set to two, which allocates two FDM ROs in a time instance of a single RO. The second set of parameters are configured to allow certain ROs associated with the second set of parameters to overlap in time and frequency with a subset of the ROs associated with the first set of parameters.

[0123] As shown, the first mapping **800**A may apply the same mapping as described herein with respect to the first mapping **700**A of FIG. **7**. The second mapping **800**B may apply a separate SSB to RO mapping from the first mapping **800**A. The second mapping **800**B may map the SSBs **802***a-d* to the ROs **806***a-h* without taking into account any of the missing ROs with respect to the first mapping **800**A. For example, the first SSB **802***a* is mapped to the first RO **806***a* and the second RO **806***b*; the second SSB **802***b* is mapped to the third RO **806***c* and the fourth RO **806***d*; the third SSB **802***c* is mapped to the fifth RO **806***e* and the sixth RO **806***f*; and so on for the subsequent ROs associated with the second set of parameters. Accordingly, the second set of parameters may indicate the SSB to RO mapping (e.g., the second mapping **800**B) for the second set of parameters. For example, the second set of parameters may indicate a mapping (e.g., the second mapping **800**B) that indicates the first RO **806***a* is associated with the first SSB **802***a*, and so on for the other ROs **806***b-h* and SSBs **802***a-d*.

[0124] In order to distinguish the ROs **804***a*-**1** of the first mapping **800**A from the ROs **806***a-h* of the second mapping **800**B, a first set of preambles **808** may be assigned to (or reserved for) random access communications based on the first set of parameters, and a second set of preambles **810** may be assigned to (or reserved for) random access communications based on the second set of parameters. The second set of preambles **810** may include one or more preambles that are different from the first set of preambles **808**. In certain aspects, each of the first set of preambles **808** and the second set of preambles **810** may be a different subset of preambles from a common pool of preambles. For example, the first set of preambles **808** may include a preamble index of 0 through preamble index of M, and the second set of preambles **810** may include a preamble index of M+1 through a preamble index of N.

[0125] As an example, suppose a UE is configured to communicate random access communications based on the first set of parameters. If the UE selects the first SSB **802***a* in a random access procedure (for example, as discussed above, based on the RSRP), the UE may send a preamble from the first set of preambles **808** in the first RO **804***a* or the second RO **804***b* associated with the first set of parameters. Thus, the preamble from the first set of preambles **808** may indicate to a network entity that the UE is applying the first mapping **800**A.

[0126] As another example, suppose a UE is configured to communicate random access communications based on the second set of parameters. If the UE selects the first SSB **802***a* in a random access procedure, the UE may send a preamble from the second set of preambles **810** in the first RO **806***a* or the second RO **806***b* associated with the second set of parameters. Thus, the preamble from the first second of preambles **810** may indicate to a network entity that the UE is applying the second mapping **800**B.

[0127] Note that the mappings depicted in FIGS. **7** and **8** are examples. Other suitable SSB to RO mappings may be applied to the first set of parameters and/or the second set of parameters to enable dynamic configuration of random access communications.

[0128] In certain aspects, certain UEs may be unaware of the reconfiguration associated with the second set of parameters for random access communications, for example, due to the UEs not supporting the enhanced signaling described herein with respect to FIG. **6**. In order to enable efficient channel usage for random access communications among a first set of UEs that support the enhanced signaling and a second set of UEs that do not support the enhanced signaling, the network entity may configure the second set of parameters such that the ROs associated with the second set of parameters overlap in time-frequency resources with a subset of ROs associated with the first set of parameters. As an example, the second set of parameters may increase the periodicity of the ROs such that the ROs associated with the second set of parameter coincide with a subset of ROs associated with the first set of parameters, for example, as depicted in FIGS. **7** and **8**.

Example Operations of Dynamic Configuration of Random Access Communications

[0129] FIG. **9** depicts a process flow **900** for dynamic configuration of random access communications in a system between a network entity **902** and a user equipment (UE) **904**. In some aspects, the network entity **902** may be an example of the BS **102** depicted and described with respect to FIGS. **1** and **3** or a disaggregated base station depicted and described with respect to FIG. **2**. Similarly, the UE **904** may be an example of UE **104** depicted and described with respect to FIGS. **1** and **3**. However, in other aspects, UE **904** may be another type of wireless communications device and network entity **902** may be another type of network entity or network node, such as those described herein. Note that any operations or signaling illustrated with dashed lines indicates that that operation or signaling may be an optional or alternative example.

[0130] At **906**, the UE **904** obtains, from the network entity **902** via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications, for example, as described herein with respect to FIG. **6**. In certain aspects, the configuration may also indicate a second set of parameters for random access communications. The first set of parameters may be used during normal traffic levels and/or network loads, whereas the second set of parameters may be used during reduced traffic levels and/or network loads, for example, to enable energy savings at the network entity **902** and/or UE **904**. The first type of signaling may be or include system information (e.g., SIB1).

[0131] At **908**, the UE **904** obtains, from the network entity **902** via a second type of signaling, an indication of a modification to the configuration obtained at **906**. As an example, the network entity **902** may determine that a traffic level is below a threshold, for example, the UE **904** may be in an idle state. The network entity **902** may decide to switch to the second set of parameters for random access communications to enable reduced power consumption associated with monitoring ROs, decoding or attempting to decode random access preambles in the ROs, and/or sending RARs. The modification to the configuration may be based on the second set of parameters. At least one parameter of the second set of parameters may be different than a corresponding parameter of the first set of parameters. For example, the periodicity of a set of ROs associated with the second set of parameters may have a longer duration than a corresponding periodicity associated with the first set of parameters. In certain aspects, the second type of signaling may indicate to switch from the first set of parameters to the second set of parameters. In certain aspects, the second type of signaling may indicate at least one parameter of the second set of parameters. In certain aspects, the second type of signaling may schedule a payload for transmission. In certain aspects, the second type of signaling may be or include control signaling, such as DCI, which may include a paging DCI and/or PEI.

[0132] At **910**, the UE **904** obtains, from the network entity **902**, the payload scheduled by the second type of signaling. The payload may be communicated via a PDSCH. The payload may indicate to switch from the first set of parameters to the second set of parameters. The payload may indicate at least one parameter of the second set of parameters.

[0133] At **912**, the UE **904** sends, to the network entity **902**, a random access preamble (MSG1) in a RACH based at least in part on the modification to the configuration. For example, the periodicity of the ROs and/or the FDM number may be modified by the second set of parameters, and thus, the second set of parameters may configure different locations for the ROs over time and/or frequency resources. The UE **904** may send the random access preamble in an RO that is allocated based on the modification to the configuration. In certain aspects, the UE may communicate the preamble using the SSB to RO mapping associated with the second set of parameters. As an example, the SSB to RO mapping associated with the second set of parameters may apply any of the second mappings described herein with respect to FIGS. **7** and **8**.

[0134] At **914**, the UE **904** obtains, from the network entity **902**, a random access response (RAR) associated with the preamble transmission. In certain aspects, the UE **904** may obtain the RAR based at least in part on the modification to the configuration. For example, the duration of the RAR window in which the RAR is communicated may be modified by the second set of parameters. In some cases, the duration of the RAR window may be reduced by the second set of parameters. The RAR may also be referred to as MSG2. In certain aspects, the RAR may be communicated via a PDCCH and PDSCH transmission. For example, the UE **904** may obtain, from the network entity **902**, a PDCCH transmission (e.g., DCI) scheduling the RAR on a PDSCH, and then the UE **904** may obtain, from the network entity **902**, a PDSCH transmission carrying the RAR (e.g., a medium access control (MAC) protocol data unit (PDU) with a RAR payload associated with the preamble) in accordance with the scheduling indicated in the DCI. The RAR payload may indicate or include an UL grant for MSG3.

[0135] At **916**, the UE **904** sends, from the network entity **902**, MSG3 via a PUSCH in accordance with the UL grant indicated in the RAR. As an example, MSG3 may indicate or include an RRC connection request, a tracking area update, and/or a scheduling request (for an UL transmission).

[0136] At **918**, the UE **904** obtains, from the network entity **902**, a contention resolution message (MSG4) in response to MSG3. In some cases, the MSG4 may include an RRC connection setup message in response to the RRC connection request and/or an UL grant in response to the scheduling request, for example.

[0137] At **920**, the UE **904** communicates with the network entity **902** based on the RACH communications. As an example, the UE **904** may apply any configuration for the communication link between the UE **904** and the network entity **902** as indicated or included in the RRC connection setup message. The RRC connection setup message may indicate or include various configurations, such as configuration(s) for control signaling (e.g., a PDCCH or a control resource set), PUSCH, PUCCH, PDSCH, transmit power control(s), channel state feedback reporting (e.g., CSI reporting), SRS, antenna configuration, and/or scheduling requests. In certain aspects, the configuration provided in the RRC connection setup message may facilitate the reception of subsequent configurations. In some cases, the UE **904** may transmit an UL signal in accordance with the UL grant provided in MSG4.

[0138] Note that the process flow **900** is an example of a contention based random access (CBRA) procedure. Other signaling may be used in addition to or instead of those illustrated in the process flow **900**, such as signaling associated with a contention-free random access (CFRA) procedure and/or a two-step RACH procedure, for example, as described herein with respect to FIG. **5**B. As an example, for CFRA, the UE **904** may obtain DCI that schedules the preamble transmission at **912**, as described herein.

Example Operations

[0139] FIG. **10** shows a method **1000** for wireless communications by an apparatus, such as UE **104** of FIGS. **1** and **3**.

[0140] Method **1000** begins at block **1005** with obtaining, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications. In certain aspects, the first type of signaling comprises system information.

[0141] Method **1000** then proceeds to block **1010** with obtaining, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling. In certain aspects, the second type of signaling comprises DCI; and the payload is communicated via a PDSCH.

[0142] In certain aspects, the second set of parameters comprise one or more of: a total number of random access preambles; an indication of a mapping of a set of ROs to one or more SSBs; a periodicity for the set of ROs; a total number of one or more ROs that are frequency division multiplexed in a time instance associated with a single RO; or a duration of a random access response window. In certain aspects, the first set of parameters indicates a first periodicity for a set of ROs; the second set of parameters indicates a second periodicity for the set of ROs; and the second periodicity is different (e.g., longer or shorter) in duration than the first periodicity.

[0143] Method **1000** then proceeds to block **1015** with communicating, with a network entity, via a random access channel, based at least in part on the modification to the configuration, for example, as described herein with respect to FIG. **9**. As an example, the apparatus may send a preamble in an RO allocated in time-frequency resource(s) indicated by the second set of parameters. As another example, the apparatus may monitor for a RAR in a RAR window having a duration indicated by the second set of parameters.

[0144] In certain aspects, the DCI includes a short message field having a specific value that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0145] In certain aspects, the DCI includes a short message indicator field that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0146] In certain aspects, the DCI includes: a short message indicator field having a specific value that indicates to switch from the first set of parameters to the second set of parameters; and one or more fields that indicate at least one parameter of the second set of parameters.

[0147] In certain aspects, the DCI includes scheduling that indicates the payload is communicated via the PDSCH; and the PDSCH includes an indication of at least one parameter of the second set of parameters.

[0148] In certain aspects, the DCI includes a PEI that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0149] In certain aspects, the DCI is designated for indicating one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters. In certain aspects, the second type of signaling is specific to a cell. In certain aspects, block **1010** includes obtaining the second type of signaling in one or more of: a PEI occasion or a paging occasion.

[0150] In certain aspects, block **1015** includes sending a message in a RO associated with a SSB, wherein the first set of parameters indicate a mapping that indicates the RO is associated with the SSB, for example, as described herein with respect to FIG. **7**.

[0151] In certain aspects, block **1015** includes sending a message in a RO associated with a SSB, the message comprising a first preamble of a first set of preambles reserved for random access communications based on the second set of parameters. In certain aspects, the second set of parameters indicates a mapping that indicates the RO is associated with the SSB, for example, as described herein with respect to FIG. **8**. In certain aspects, the first set of parameters indicate a second set of preambles reserved for random access communications based on the first set of parameters.

[0152] In certain aspects, method **1000**, or any aspect related to it, may be performed by an apparatus, such as communications device **1200** of FIG. **12**, which includes various components operable, configured, or adapted to perform the method **1000**. Communications device **1200** is described below in further detail.

[0153] Note that FIG. **10** is just one example of a method, and other methods including fewer, additional, or alternative operations are possible consistent with this disclosure.

[0154] FIG. **11** shows a method **1100** for wireless communications by an apparatus, such as BS **102** of FIGS. **1** and **3**, or a disaggregated base station as discussed with respect to FIG. **2**.

[0155] Method **1100** begins at block **1105** with sending, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications. In certain aspects, the first type of signaling comprises system information.

[0156] Method **1100** then proceeds to block **1110** with sending, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling. In certain aspects, the second type of signaling comprises DCI; and the payload is communicated via a PDSCH. In certain aspects, the second set of parameters comprise one or more of: a total number of random access preambles; an indication of a mapping of a set of ROs to one or more SSBs; a periodicity for the set of Ros; a total number of one or more ROs that are frequency division multiplexed in a time instance associated with a single RO; or a duration of a random access response window. In certain aspects, the first set of parameters indicates a first periodicity for a set of ROs the second set of parameters indicates a second periodicity for the set of ROs; and the second periodicity is different (e.g., longer or shorter) in duration than the first periodicity.

[0157] Method **1100** then proceeds to block **1115** with communicating, with a user equipment, via a random access channel, based at least in part on the modification to the configuration, for example, as described herein with respect to FIG. **9**. As an example, the apparatus may obtain a preamble in an RO allocated in time-frequency resource(s) as indicated by the second set of parameters. As another example, the apparatus may send a RAR in a RAR window having a duration indicated by the second set of parameters.

[0158] In certain aspects, the DCI includes a short message field having a specific value that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0159] In certain aspects, the DCI includes a short message indicator field that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0160] In certain aspects, the DCI includes: a short message indicator field having a specific value that indicates to switch from the first set of parameters to the second set of parameters; and one or more fields that indicate at least one parameter of the second set of parameters.

[0161] In certain aspects, the DCI includes scheduling that indicates the payload is communicated via the PDSCH; and the PDSCH includes an indication of at least one parameter of the second set of parameters.

[0162] In certain aspects, the DCI includes a PEI that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0163] In certain aspects, the DCI is designated for indicating one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters. In certain aspects, the second type of signaling is specific to a cell. In certain aspects, block **1110** includes sending the second type of signaling in one or more of: a PEI occasion or a paging occasion.

[0164] In certain aspects, block **1115** includes obtaining a message in a RO associated with a SSB, wherein the first set of parameters indicate a mapping that indicates the RO is associated with the SSB, for example, as described herein with respect to FIG. **7**.

[0165] In certain aspects, block **1115** includes obtaining a message in a RO associated with a SSB, the message comprising a first preamble of a first set of preambles reserved for random access communications based on the second set of parameters. In certain aspects, the second set of parameters indicates a mapping that indicates the RO is associated with the SSB, for example, as described herein with respect to FIG. **8**. In certain aspects, the first set of parameters indicate a second set of preambles reserved for random access communications based on the first set of parameters.

[0166] In certain aspects, method **1100**, or any aspect related to it, may be performed by an apparatus, such as communications device **1300** of FIG. **13**, which includes various components operable, configured, or adapted to perform the method **1100**. Communications device **1300** is described below in further detail.

[0167] Note that FIG. **11** is just one example of a method, and other methods including fewer, additional, or alternative operations are possible consistent with this disclosure.

Example Communications Devices

[0168] FIG. **12** depicts aspects of an example communications device **1200**. In some aspects, communications device **1200** is a user equipment, such as UE **104** described above with respect to FIGS. **1** and **3**.

[0169] The communications device **1200** includes a processing system **1205** coupled to a transceiver **1245** (e.g., a transmitter and/or a receiver). The transceiver **1245** is configured to transmit and receive signals for the communications device **1200** via an antenna **1250**, such as the various signals as described herein. The processing system **1205** may be configured to perform processing functions for the communications device **1200**, including processing signals received and/or to be transmitted by the communications device **1200**.

[0170] The processing system **1205** includes one or more processors **1210**. In various aspects, the one or more processors **1210** may be representative of one or more of receive processor **358**, transmit processor **364**, TX MIMO processor **366**, and/or controller/processor **380**, as described with respect to FIG. **3**. The one or more processors **1210** are coupled to a computer-readable medium/memory **1225** via a bus **1240**. In certain aspects, the computer-readable medium/memory **1225** is configured to store instructions (e.g., computer-executable code) that when executed by the one or more processors **1210**, enable and cause the one or more processors **1210** to perform the method **1000** described with respect to FIG. **10**, or any aspect related to it, including any operations described in relation to FIG. **10**. Note that reference to a processor performing a function of communications device **1200** may include one or more processors performing that function of communications device **1200**, such as in a distributed fashion.

[0171] In the depicted example, computer-readable medium/memory **1225** stores code for obtaining **1230** and code for communicating **1235**. Processing of the code **1230** and **1235** may enable and cause the communications device **1200** to perform the method **1000** described with respect to FIG. **10**, or any aspect related to it.

[0172] The one or more processors **1210** include circuitry configured to implement (e.g., execute) the code stored in the computer-readable medium/memory **1225**, including circuitry for obtaining **1215** and circuitry for communicating **1220**. Processing with circuitry **1215** and **1220** may enable and cause the communications device **1200** to perform the method **1000** described with respect to FIG. **10**, or any aspect related to it.

[0173] More generally, means for communicating, transmitting, sending or outputting for transmission may include the transceivers **354**, antenna(s) **352**, transmit processor **364**, TX MIMO processor **366**, AI processor **370**, and/or controller/processor **380** of the UE **104** illustrated in FIG. **3**, transceiver **1245** and/or antenna **1250** of the communications device **1200** in FIG. **12**, and/or one or more processors **1210** of the communications device **1200** in FIG. **12**. Means for communicating, receiving or obtaining may include the transceivers **354**, antenna(s) **352**, receive processor **358**, AI processor **370**, and/or controller/processor **380** of the UE **104** illustrated in FIG. **3**, transceiver **1245** and/or antenna **1250** of the communications device **1200** in FIG. **12**, and/or one or more processors **1210** of the communications device **1200** in FIG. **12**.

[0174] FIG. **13** depicts aspects of an example communications device **1300**. In some aspects, communications device **1300** is a network entity, such as BS **102** of FIGS. **1** and **3**, or a disaggregated base station as discussed with respect to FIG. **2**.

[0175] The communications device **1300** includes a processing system **1305** coupled to a transceiver **1345** (e.g., a transmitter and/or a receiver) and/or a network interface **1355**. The transceiver **1345** is configured to transmit and receive signals for the communications device **1300** via an antenna **1350**, such as the various signals as described herein. The network interface **1355** is configured to obtain and send signals for the communications device **1300** via communications link(s), such as a backhaul link, midhaul link, and/or fronthaul link as described herein, such as with respect to FIG. **2**. The processing system **1305** may be configured to perform processing functions for the communications device **1300**, including processing signals received and/or to be transmitted by the communications device **1300**.

[0176] The processing system **1305** includes one or more processors **1310**. In various aspects, one or more processors **1310** may be representative of one or more of receive processor **338**, transmit processor **320**, TX MIMO processor **330**, and/or controller/processor **340**, as described with respect to FIG. **3**. The one or more processors **1310** are coupled to a computer-readable medium/memory **1325** via a bus **1340**. In certain aspects, the computer-readable medium/memory **1325** is configured to store instructions (e.g., computer-executable code) that when executed by the one or more processors **1310**, enable and cause the one or more processors **1310** to perform the method **1100** described with respect to FIG. **11**, or any aspect related to it, including any operations described in relation to FIG. **11**. Note that reference to a processor of communications device **1300** performing a function may include one or more processors of communications device **1300** performing that function, such as in a distributed fashion.

[0177] In the depicted example, the computer-readable medium/memory **1325** stores code for sending **1330** and code for communicating **1335**. Processing of the code **1330** and **1335** may enable and cause the communications device **1300** to perform the method **1100** described with respect to FIG. **11**, or any aspect related to it.

[0178] The one or more processors **1310** include circuitry configured to implement (e.g., execute) the code stored in the computer-readable medium/memory **1325**, including circuitry for sending **1315** and circuitry for communicating **1320**. Processing with circuitry **1315** and **1320** may enable and cause the communications device **1300** to perform the method **1100** described with respect to FIG. **11**, or any aspect related to it.

[0179] More generally, means for communicating, transmitting, sending or outputting for transmission may include the transceivers **332**, antenna(s) **334**, transmit processor **320**, TX MIMO processor **330**, AI processor **318**, and/or controller/processor **340** of the BS **102** illustrated in FIG. **3**, transceiver **1345**, antenna **1350**, and/or network interface **1355** of the communications device **1300** in FIG. **13**, and/or one or more processors **1310** of the communications device **1300** in FIG. **13**. Means for communicating, receiving or obtaining may include the transceivers **332**, antenna(s) **334**, receive processor **338**, AI processor **318**, and/or controller/processor **340** of the BS **102** illustrated in FIG. **3**, transceiver **1345**, antenna **1350**, and/or network interface **1355** of the communications device **1300** in FIG. **13**, and/or one or more processors **1310** of the communications device **1300** in FIG. **13**.

Example Clauses

[0180] Implementation examples are described in the following numbered clauses:

[0181] Clause 1: A method for wireless communications by an apparatus comprising: obtaining, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications; obtaining, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and communicating, with a network entity, via a random access channel, based at least in part on the modification to the configuration.

[0182] Clause 2: The method of Clause 1, wherein the second set of parameters comprise one or more of: a total number of random access preambles; an indication of a mapping of a set of ROs to one or more SSBs; a periodicity for the set of ROs; a total number of one or more ROs that are frequency division multiplexed in a time instance associated with a single RO; or a duration of a random access response window.

[0183] Clause 3: The method of any one of Clauses 1-2, wherein: the first set of parameters indicates a first periodicity for a set of ROs; the second set of parameters indicates a second periodicity for the set of ROs; and the second periodicity is different (e.g., longer or shorter) in duration than the first periodicity.

[0184] Clause 4: The method of any one of Clauses 1-3, wherein: the second type of signaling comprises DCI; and the payload is communicated via a PDSCH.

[0185] Clause 5: The method of Clause 4, wherein the DCI includes a short message field having a specific value that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0186] Clause 6: The method of Clause 4 or 5, wherein the DCI includes a short message indicator field that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0187] Clause 7: The method of any one of Clauses 4-6, wherein the DCI includes: a short message indicator field having a specific value that indicates to switch from the first set of parameters to the second set of parameters; and one or more fields that indicate at least one parameter of the second set of parameters.

[0188] Clause 8: The method of any one of Clauses 4-7, wherein: the DCI includes scheduling that indicates the payload is communicated via the PDSCH; and the PDSCH includes an indication of at least one parameter of the second set of parameters.

[0189] Clause 9: The method of any one of Clauses 4-8, wherein the DCI includes a PEI that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0190] Clause 10: The method of any one of Clauses 4-9, wherein the DCI is designated for indicating one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0191] Clause 11: The method of any one of Clauses 1-10, wherein the second type of signaling is specific to a cell.

[0192] Clause 12: The method of any one of Clauses 1-11, wherein obtaining the indication comprises obtaining the second type of signaling in one or more of: a PEI occasion or a paging occasion.

[0193] Clause 13: The method of any one of Clauses 1-12, wherein communicating via the random access channel comprises sending a message in a RO associated with a SSB, wherein the first set of parameters indicate a mapping that indicates the RO is associated with the SSB.

[0194] Clause 14: The method of any one of Clauses 1-13, wherein communicating via the random access channel comprises sending a message in a RO associated with a SSB, the message comprising a first preamble of a first set of preambles reserved for random access communications based on the second set of parameters.

[0195] Clause 15: The method of Clause 14, wherein the second set of parameters indicates a mapping that indicates the RO is associated with the SSB.

[0196] Clause 16: The method of Clause 15, wherein the first set of parameters indicate a second set of preambles reserved for random access communications based on the first set of parameters.

[0197] Clause 17: The method of any one of Clauses 1-16, wherein the first type of signaling comprises system information.

[0198] Clause 18: A method for wireless communications by an apparatus comprising: sending, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications; sending, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and communicating, with a user equipment, via a random access channel, based at least in part on the modification to the configuration.

[0199] Clause 19: The method of Clause 18, wherein the second set of parameters comprise one or more of: a total number of random access preambles; an indication of a mapping of a set of ROs to one or more SSBs; a periodicity for the set of ROs; a total number of one or more ROs that are frequency division multiplexed in a time instance associated with a single RO; or a duration of a random access response window.

[0200] Clause 20: The method of any one of Clauses 18-19, wherein: the first set of parameters indicates a first periodicity for a set of ROs; the second set of parameters indicates a second periodicity for the set of ROs; and the second periodicity is different (e.g., longer or shorter) in duration than the first periodicity.

[0201] Clause 21: The method of any one of Clauses 18-20, wherein: the second type of signaling comprises DCI; and the payload is communicated via a PDSCH.

[0202] Clause 22: The method of Clause 21, wherein the DCI includes a short message field having a specific value that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0203] Clause 23: The method of Clause 21 or 22, wherein the DCI includes a short message indicator field that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0204] Clause 24: The method of any one of Clauses 21-23, wherein the DCI includes: a short message indicator field having a specific value that indicates to switch from the first set of parameters to the second set of parameters; and one or more fields that indicate at least one parameter of the second set of parameters.

[0205] Clause 25: The method of any one of Clauses 21-24, wherein: the DCI includes scheduling that indicates the payload is communicated via the PDSCH; and the PDSCH includes an indication of at least one parameter of the second set of parameters.

[0206] Clause 26: The method of any one of Clauses 21-25, wherein the DCI includes a PEI that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0207] Clause 27: The method of any one of Clauses 21-26, wherein the DCI is designated for indicating one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

[0208] Clause 28: The method of any one of Clauses 18-27, wherein the second type of signaling is specific to a cell.

[0209] Clause 29: The method of any one of Clauses 18-28, wherein sending the indication comprises sending the second type of signaling in one or more of: a PEI occasion or a paging occasion.

[0210] Clause 30: The method of any one of Clauses 18-29, wherein communicating via the random access channel comprises obtaining a message in a RO associated with a SSB, wherein the first set of parameters indicate a mapping that indicates the RO is associated with the SSB.

[0211] Clause 31: The method of any one of Clauses 18-30, wherein communicating via the random access channel comprises obtaining a message in a RO associated with a SSB, the message comprising a first preamble of a first set of preambles reserved for random access communications based on the second set of parameters.

[0212] Clause 32: The method of Clause 31, wherein the second set of parameters indicates a mapping that indicates the RO is associated with the SSB.

[0213] Clause 33: The method of Clause 32, wherein the first set of parameters indicate a second set of preambles reserved for random access communications based on the first set of parameters.

[0214] Clause 34: The method of any one of Clauses 18-33, wherein the first type of signaling comprises system information.

[0215] Clause 35: One or more apparatuses, comprising: one or more memories comprising executable instructions; and one or more processors configured to execute the executable instructions and cause the one or more apparatuses to perform a method in accordance with any one of Clauses 1-34.

[0216] Clause 36: One or more apparatuses, comprising: one or more memories; and one or more processors, coupled to the one or more memories, configured to cause the one or more apparatuses to perform a method in accordance with any one of Clauses 1-34.

[0217] Clause 37: One or more apparatuses, comprising: one or more memories; and one or more processors, coupled to the one or more memories, configured to perform a method in accordance with any one of Clauses 1-34.

[0218] Clause 38: One or more apparatuses, comprising means for performing a method in accordance with any one of Clauses 1-34.

[0219] Clause 39: One or more non-transitory computer-readable media comprising executable instructions that, when executed by one or more processors of one or more apparatuses, cause the one or more apparatuses to perform a method in accordance with any one of Clauses 1-34.

[0220] Clause 40: One or more computer program products embodied on one or more computer-readable storage media comprising code for performing a method in accordance with any one of Clauses 1-34.

[0221] Clause 41: A user equipment (UE), comprising: a processing system that includes processor circuitry and memory circuitry that stores code and is coupled with the processor circuitry, the processing system configured to cause the UE to perform a method in accordance with any one of Clauses 1-17.

[0222] Clause 42: A network entity, comprising: a processing system that includes processor circuitry and memory circuitry that stores code and is coupled with the processor circuitry, the processing system configured to cause the network entity to perform a method in accordance with any one of Clauses 18-34.

Additional Considerations

[0223] The preceding description is provided to enable any person skilled in the art to practice the various aspects described herein. The examples discussed herein are not limiting of the scope, applicability, or aspects set forth in the claims. Various modifications to these aspects will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other aspects. For example, changes may be made in the function and arrangement of elements discussed without departing from the scope of the disclosure. Various examples may omit, substitute, or add various procedures or components as appropriate. For instance, the methods described may be performed in an order different from that described, and various actions may be added, omitted, or combined. Also, features described with respect to some examples may be combined in some other examples. For example, an apparatus may be implemented or a method may be practiced using any number of the aspects set forth herein. In addition, the scope of the disclosure is intended to cover such an apparatus or method that is practiced using other structure, functionality, or structure and functionality in addition to, or other than, the various aspects of the disclosure set forth herein. It should be understood that any aspect of the disclosure disclosed herein may be embodied by one or more elements of a claim.

[0224] The various illustrative logical blocks, modules and circuits described in connection with the present disclosure may be implemented or performed with a general purpose processor, an AI processor, a digital signal processor (DSP), an ASIC, a field programmable gate array (FPGA) or other programmable logic device (PLD), 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 commercially available 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, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, a system on a chip (SoC), or any other such configuration.

[0225] As used herein, a phrase referring to “at least one of” a list of items refers to any combination of those items, including single members. As an example, “at least one of: a, b, or c” is intended to cover a, b, c, a-b, a-c, b-c, and a-b-c, as well as any combination with multiples of the same element (e.g., a-a, a-a-a, a-a-b, a-a-c, a-b-b, a-c-c, b-b, b-b-b, b-b-c, c-c, and c-c-c or any other ordering of a, b, and c).

[0226] As used herein, the term “determining” encompasses a wide variety of actions. For example, “determining” may include calculating, computing, processing, deriving, investigating, looking up (e.g., looking up in a table, a database or another data structure), ascertaining and the like. Also, “determining” may include receiving (e.g., receiving information), accessing (e.g., accessing data in a memory) and the like. Also, “determining” may include resolving, selecting, choosing, establishing and the like.

[0227] As used herein, “coupled to” and “coupled with” generally encompass direct coupling and indirect coupling (e.g., including intermediary coupled aspects) unless stated otherwise. For example, stating that a processor is coupled to a memory allows for a direct coupling or a coupling via an intermediary aspect, such as a bus.

[0228] The methods disclosed herein comprise one or more actions for achieving the methods. The method actions may be interchanged with one another without departing from the scope of the claims. In other words, unless a specific order of actions is specified, the order and/or use of specific actions may be modified without departing from the scope of the claims. Further, the various operations of methods described above may be performed by any suitable means capable of performing the corresponding functions. The means may include various hardware and/or software component(s) and/or module(s), including, but not limited to a circuit, an application specific integrated circuit (ASIC), or processor.

[0229] The following claims are not intended to be limited to the aspects shown herein, but are to be accorded the full scope consistent with the language of the claims. Reference to an element in the singular is not intended to mean only one unless specifically so stated, but rather “one or more.” The subsequent use of a definite article (e.g., “the” or “said”) with an element (e.g., “the processor”) is not intended to invoke a singular meaning (e.g., “only one”) on the element unless otherwise specifically stated. For example, reference to an element (e.g., “a processor,” “a controller,” “a memory,” “a transceiver,” “an antenna,” “the processor,” “the controller,” “the memory,” “the transceiver,” “the antenna,” etc.), unless otherwise specifically stated, should be understood to refer to one or more elements (e.g., “one or more processors,” “one or more controllers,” “one or more memories,” “one more transceivers,” etc.). The terms “set” and “group” are intended to include one or more elements, and may be used interchangeably with “one or more.” Where reference is made to one or more elements performing functions (e.g., steps of a method), one element may perform all functions, or more than one element may collectively perform the functions. When more than one element collectively performs the functions, each function need not be performed by each of those elements (e.g., different functions may be performed by different elements) and/or each function need not be performed in whole by only one element (e.g., different elements may perform different sub-functions of a function). Similarly, where reference is made to one or more elements configured to cause another element (e.g., an apparatus) to perform functions, one element may be configured to cause the other element to perform all functions, or more than one element may collectively be configured to cause the other element to perform the functions. Unless specifically stated otherwise, the term “some” refers to one or more. All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims.

What is claimed is:

1. An apparatus configured for wireless communications, comprising:

one or more memories; and

one or more processors coupled to the one or more memories, the one or more processors being configured to cause the apparatus to:

obtain, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications;

obtain, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and communicate, with a network entity, via a random access channel, based at least in part on the modification to the configuration.

2. The apparatus of claim **1**, wherein:

the first set of parameters indicates a first periodicity for a set of random access occasions (ROs);

the second set of parameters indicates a second periodicity for the set of ROs; and

the second periodicity is different in duration than the first periodicity.

3. The apparatus of claim **1**, wherein:

the second type of signaling comprises downlink control information (DCI); and

the payload is communicated via a physical downlink control channel (PDSCH).

4. The apparatus of claim **3**, wherein the DCI includes a short message field having a specific value that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

5. The apparatus of claim **3**, wherein the DCI includes a short message indicator field that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

6. The apparatus of claim **3**, wherein the DCI includes a paging early indicator (PEI) that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

7. The apparatus of claim **3**, wherein the DCI is designated for indicating one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

8. The apparatus of claim **1**, wherein to communicate via the random access channel, the one or more processors are configured to cause the apparatus to send a message in a random access occasion (RO) associated with a synchronization signal block (SSB), wherein the first set of parameters indicate a mapping that indicates the RO is associated with the SSB.

9. The apparatus of claim **1**, wherein to communicate via the random access channel, the one or more processors are configured to cause the apparatus to send a message in a random access occasion (RO) associated with a synchronization signal block (SSB), the message comprising a first preamble of a first set of preambles reserved for random access communications based on the second set of parameters.

10. The apparatus of claim **9**, wherein the second set of parameters indicates a mapping that indicates the RO is associated with the SSB.

11. The apparatus of claim **10**, wherein the first set of parameters indicate a second set of preambles reserved for random access communications based on the first set of parameters.

12. The apparatus of claim **1**, wherein the first type of signaling comprises system information.

13. An apparatus configured for wireless communications, comprising:

one or more memories; and

one or more processors coupled to the one or more memories, the one or more processors being configured to cause the apparatus to:

send, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications;

send, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and

communicate, with a user equipment, via a random access channel, based at least in part on the modification to the configuration.

14. The apparatus of claim **13**, wherein:

the first set of parameters indicates a first periodicity for a set of random access occasions (ROs);

the second set of parameters indicates a second periodicity for the set of ROs; and

the second periodicity is different in duration than the first periodicity.

15. The apparatus of claim **13**, wherein:

the second type of signaling comprises downlink control information (DCI); and

the payload is communicated via a physical downlink control channel (PDSCH).

16. The apparatus of claim **15**, wherein the DCI includes a short message field having a specific value that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

17. The apparatus of claim **15**, wherein the DCI includes a short message indicator field that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

18. The apparatus of claim **15**, wherein the DCI includes a paging early indicator (PEI) that indicates one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

19. The apparatus of claim **15**, wherein the DCI is designated for indicating one or more of (i) at least one parameter of the second set of parameters or (ii) to switch from the first set of parameters to the second set of parameters.

20. A method for wireless communications by an apparatus, comprising:

obtaining, via a first type of signaling, a configuration that indicates at least a first set of parameters for random access communications;

obtaining, via one or more of a second type of signaling or a payload scheduled by the second type of signaling, an indication of a modification to the configuration, wherein the modification is based on a second set of parameters that are indicated via one or more of: the configuration, the second type of signaling, or the payload, and wherein the first type of signaling is different from the second type of signaling; and

communicating, with a network entity, via a random access channel, based at least in part on the modification to the configuration.

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