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(54) **SYSTEMS AND METHODS FOR RADIO ACCESS NETWORK-LEVEL ALLOCATION AND RETENTION PRIORITY BASED ON NETWORK SLICING**

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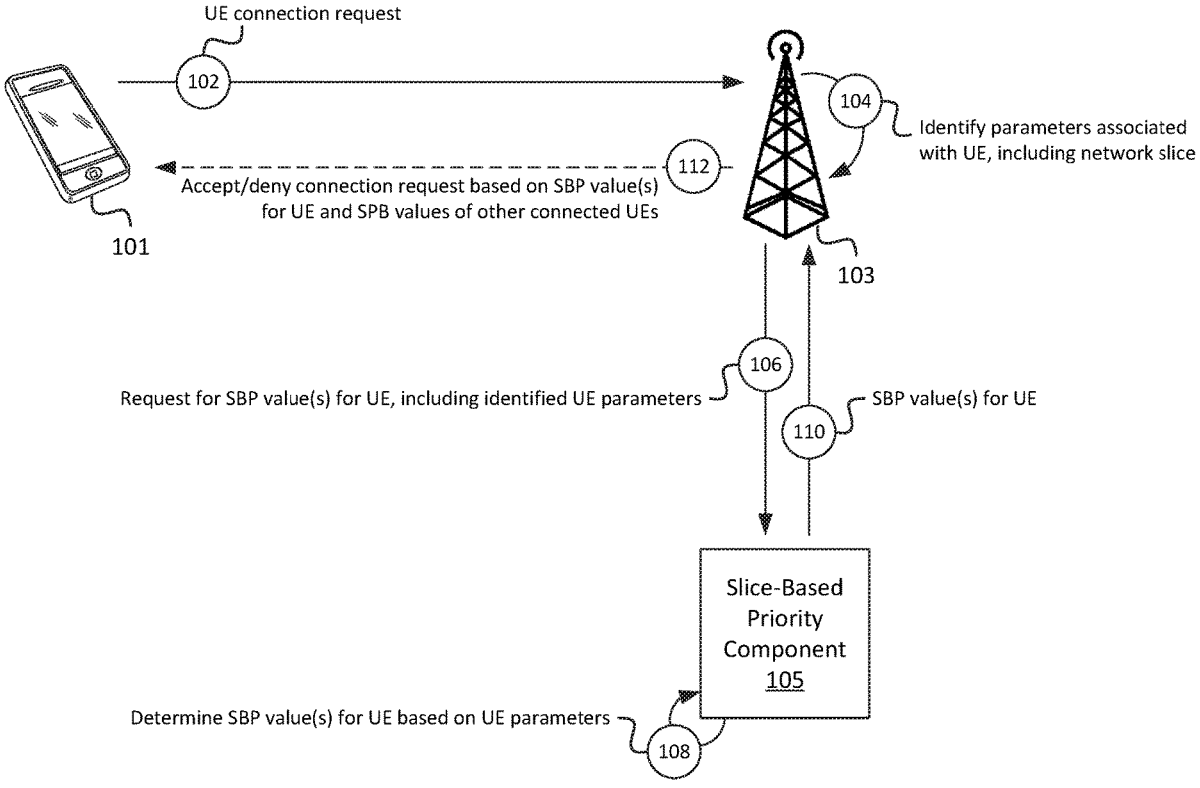
(57) **ABSTRACT**

A system described herein may provide a technique for allocation and/or preemption of radio access network ("RAN") resources in a wireless network based on Quality of Service ("QoS")-related metrics associated with User Equipment ("UEs") that are connected to, and/or are requesting connection to, a RAN. QoS-related metrics may include a network slice, a QoS Flow Identifier ("QFI"), other suitable metrics. A Slice-Based Priority ("SBP") determine one or more priority (e.g., SBP) values for UEs connected to the one or more RANs, and/or for UEs requesting connection to such RANs. In addition to QoS-related metrics priority values may be determined based on RAN-related metrics, such as Allocation and Retention Priority ("ARP") values associated with a UE. RANs may accordingly be able to allocate resources, accept or deny connection requests, and/or perform preemption based at least partly on slice-related QoS metrics, thus preserving end-to-end QoS parameters.



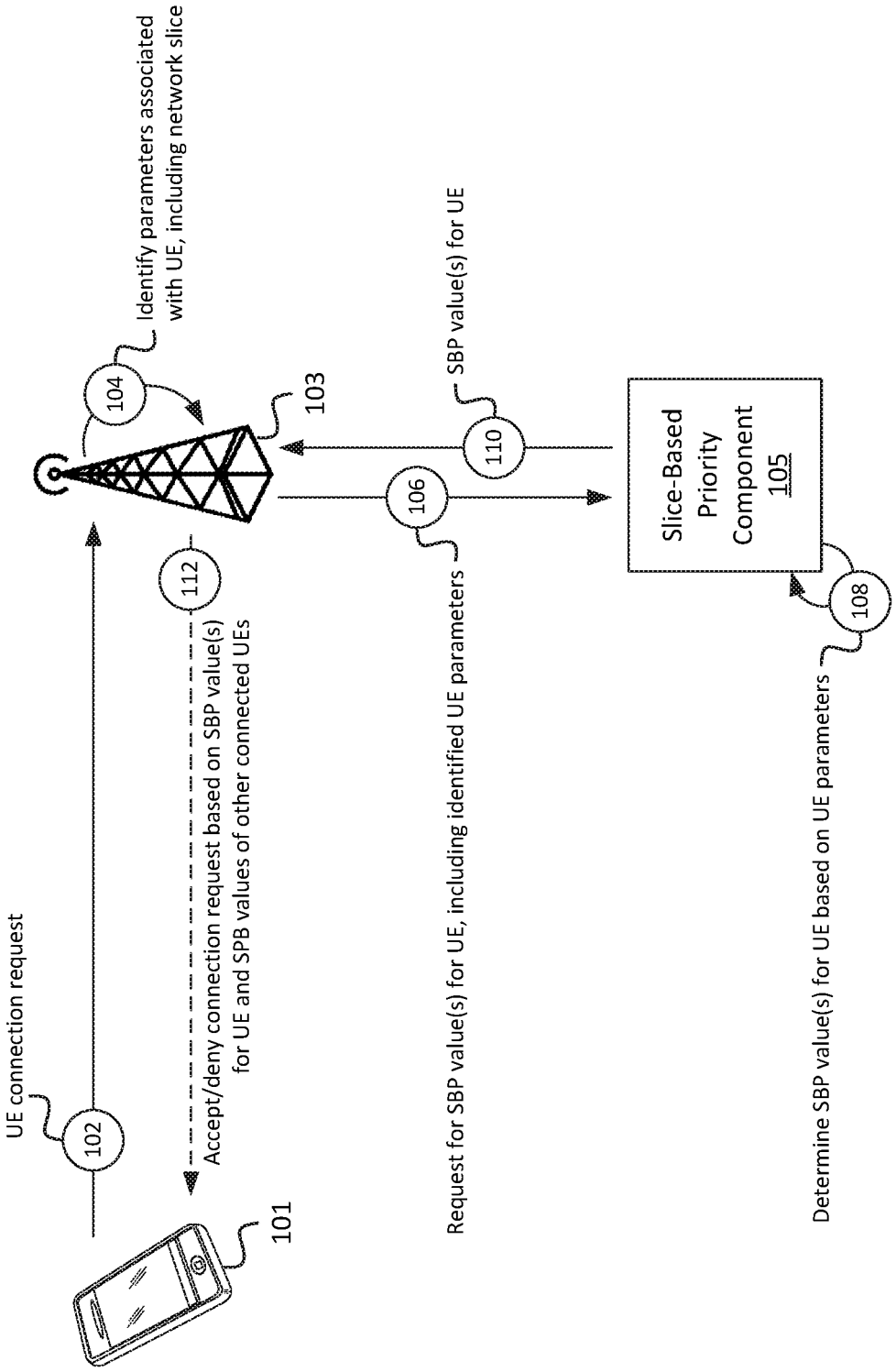

UE connection request
102
Accept/deny connection request based on SBP value(s)
for UE and SPB values of other connected UEs
112
101
Identify parameters associated
with UE, including network slice
104
103
Request for SBP value(s) for UE, including identified UE parameters
106
SBP value(s) for UE
110
Slice-Based
Priority
Component
105
Determine SBP value(s) for UE based on UE parameters
108

FIG. 1

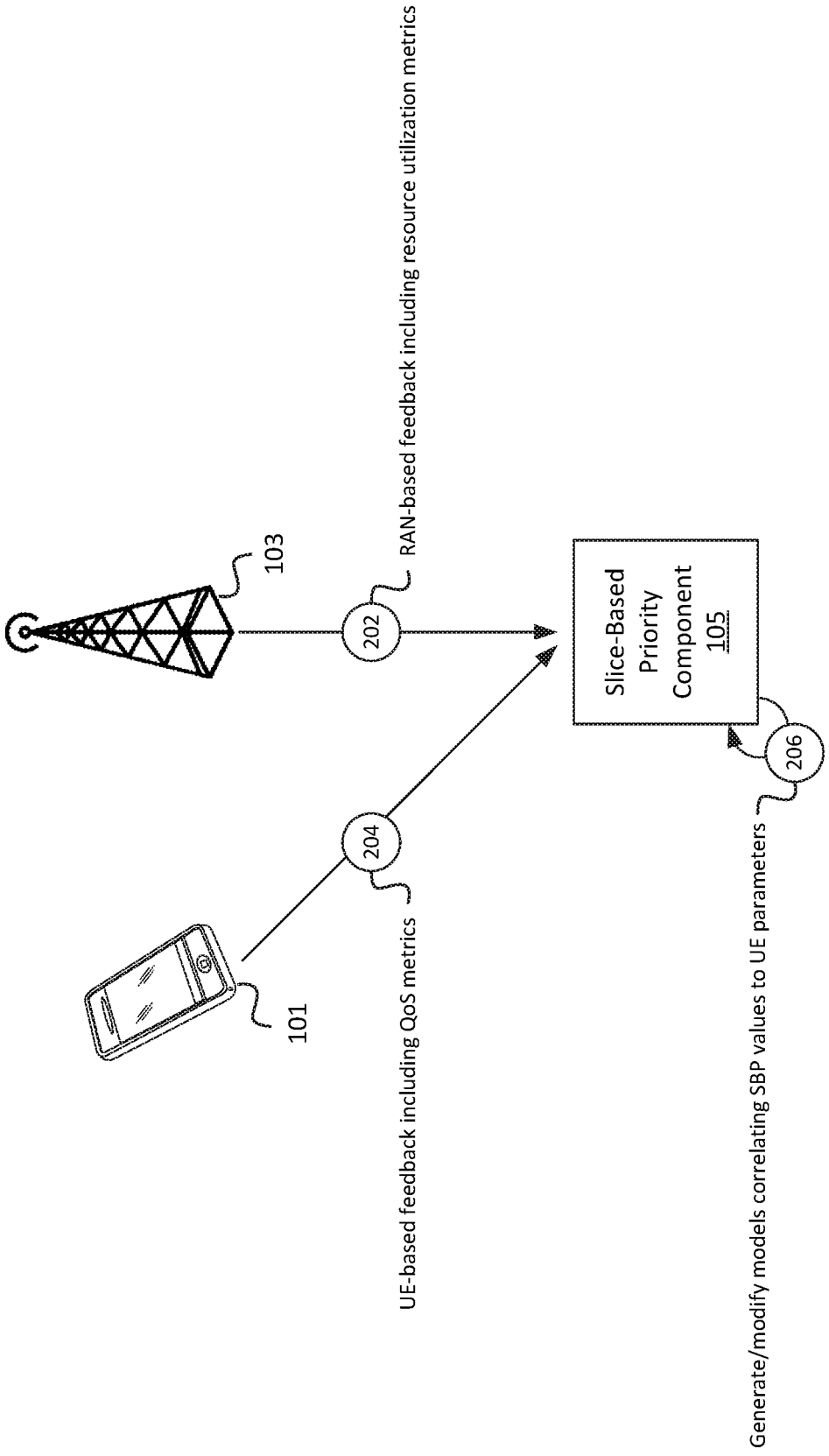

103
101
202
RAN-based feedback including resource utilization metrics
204
UE-based feedback including QoS metrics
Slice-Based Priority Component 105
206
Generate/modify models correlating SBP values to UE parameters

FIG. 2

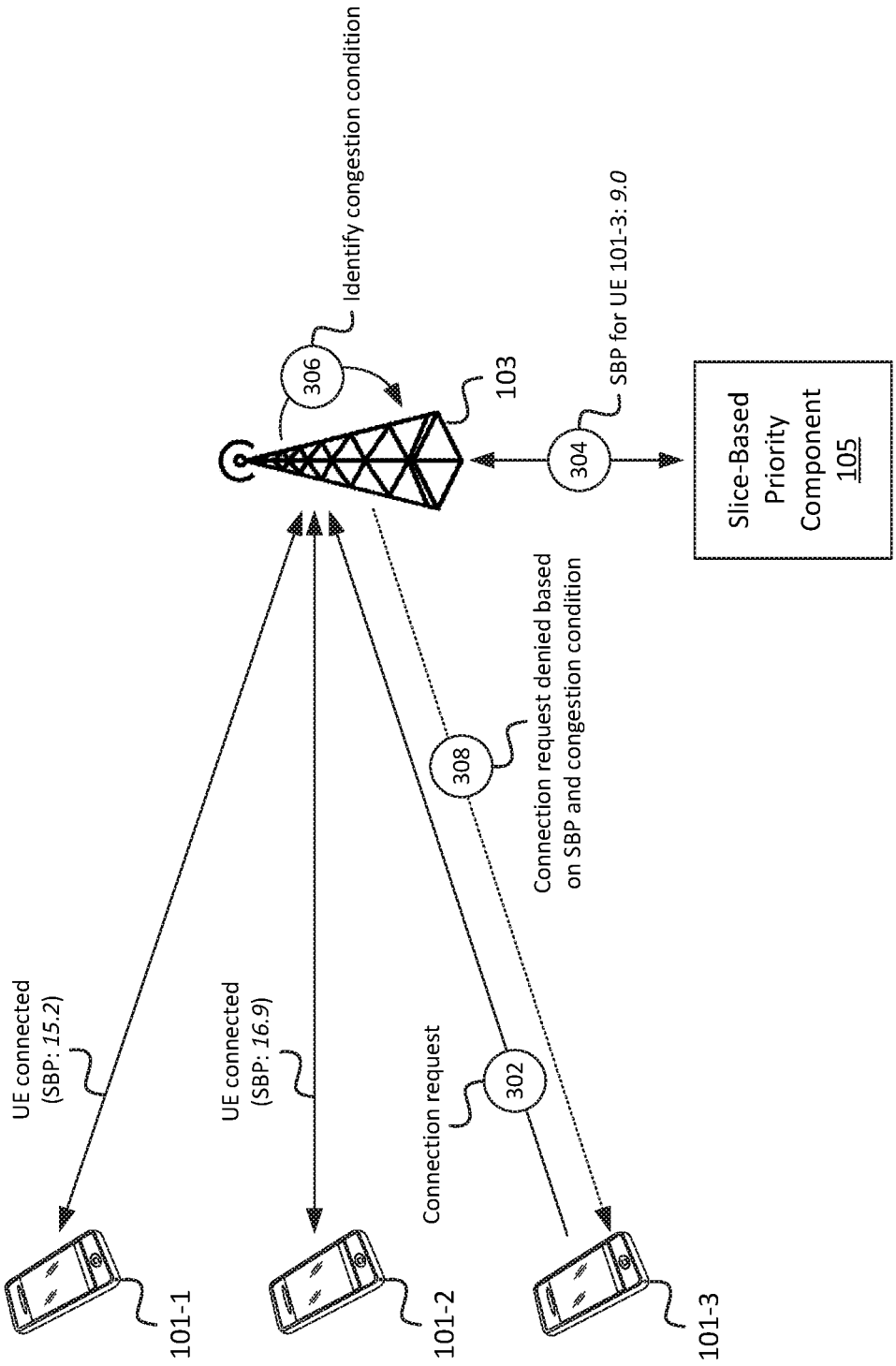

UE connected (SBP: 15.2)
UE connected (SBP: 16.9)
Connection request
302
Connection request denied based on SBP and congestion condition
308
101-1
101-2
101-3
103
306
Identify congestion condition
304
SBP for UE 101-3: 9.0
Slice-Based Priority Component 105

FIG. 3

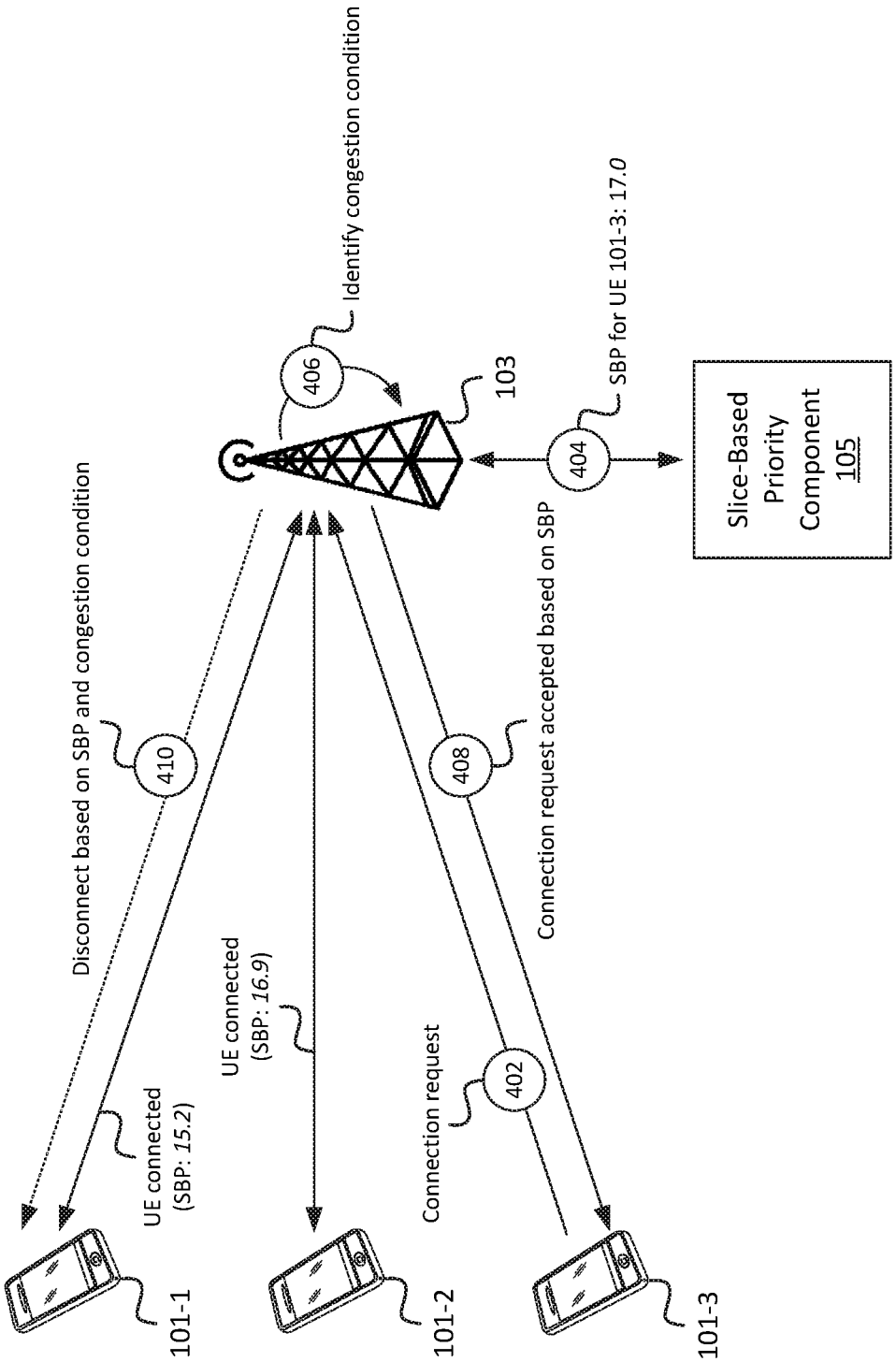

Identify congestion condition
406
103
SBP for UE 101-3: 17.0
404
Slice-Based Priority Component 105
Disconnect based on SBP and congestion condition
410
Connection request accepted based on SBP
408
UE connected (SBP: 16.9)
UE connected (SBP: 15.2)
Connection request
402
101-1
101-2
101-3

FIG. 4

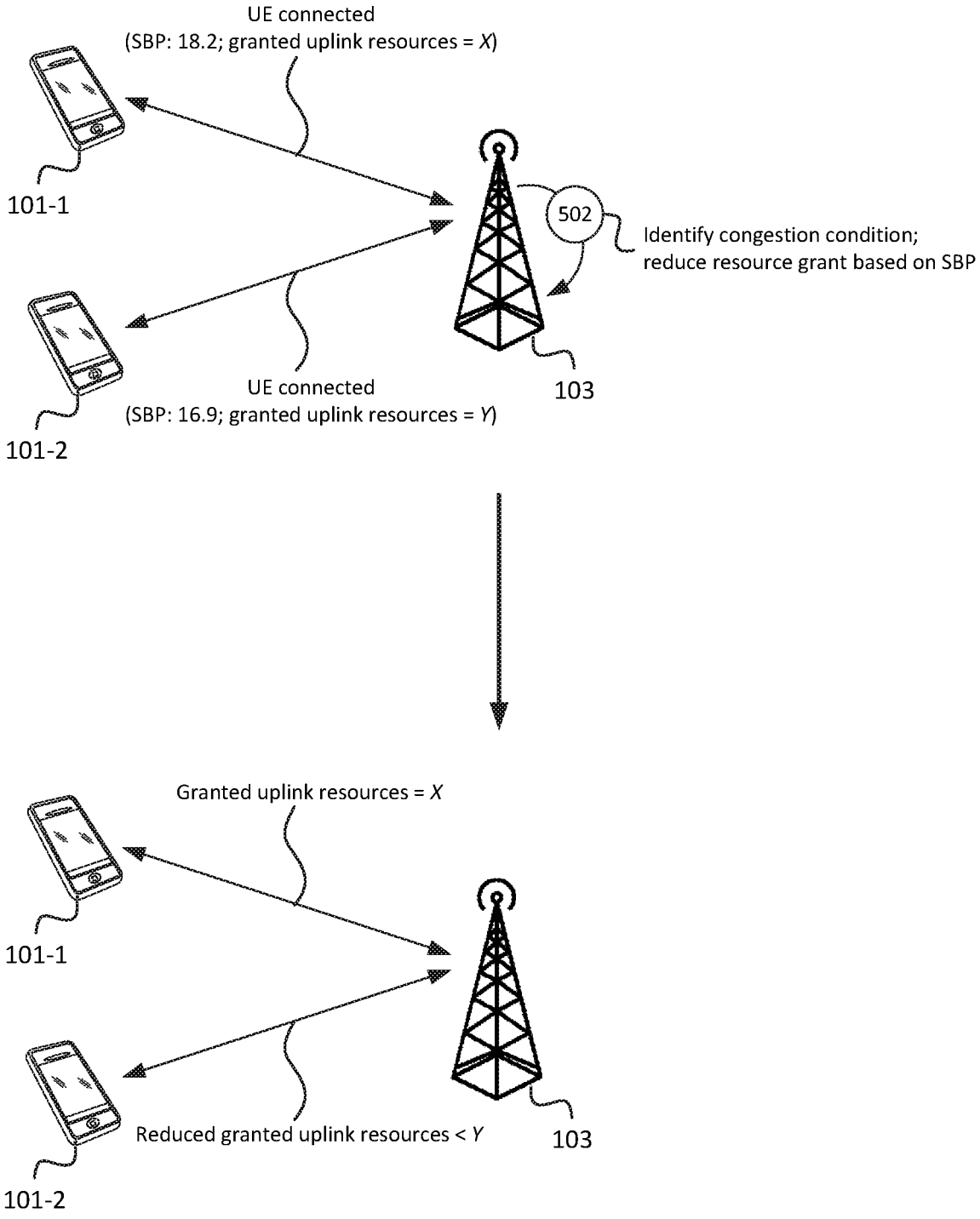

UE connected
(SBP: 18.2; granted uplink resources = X)
101-1
502
Identify congestion condition;
reduce resource grant based on SBP
UE connected
(SBP: 16.9; granted uplink resources = Y)
101-2
103
Granted uplink resources = X
101-1
Reduced granted uplink resources < Y
101-2
103

FIG. 5

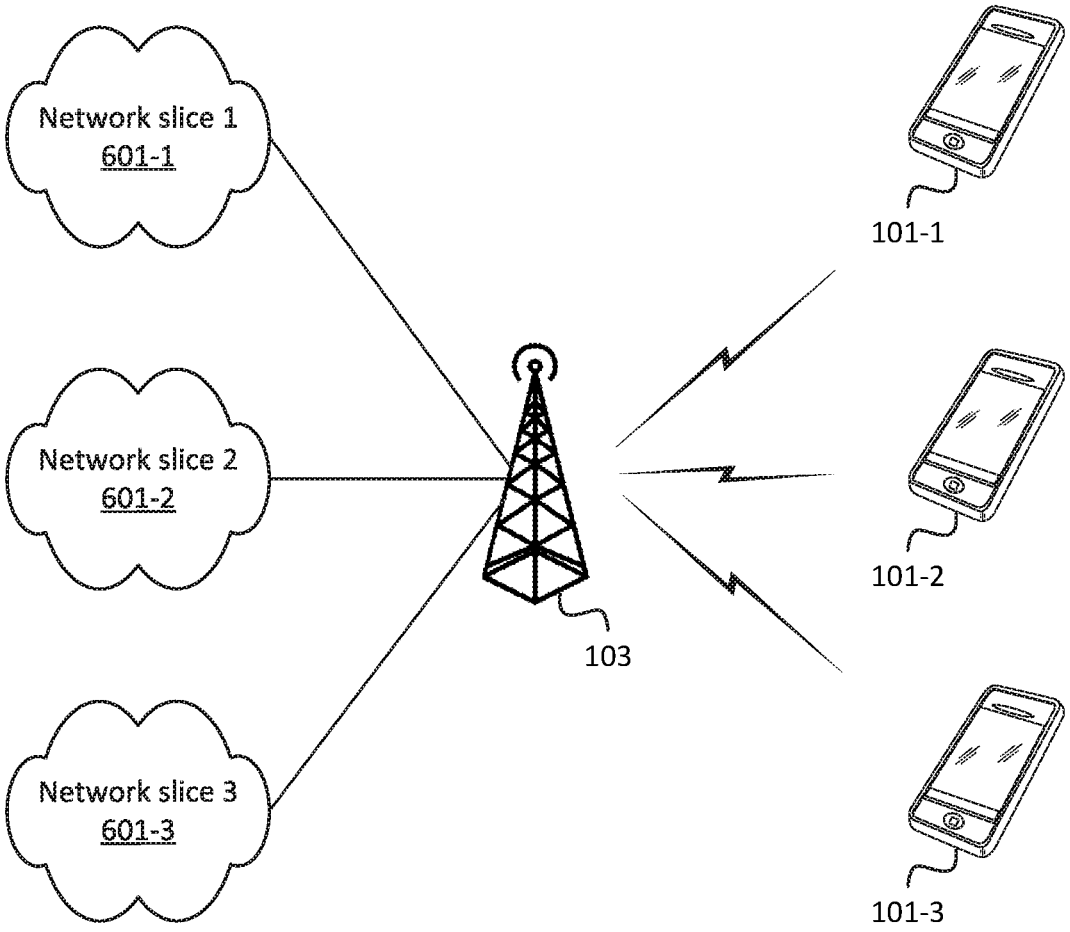

Network slice 1
601-1
Network slice 2
601-2
Network slice 3
601-3
103
101-1
101-2
101-3

FIG. 6A

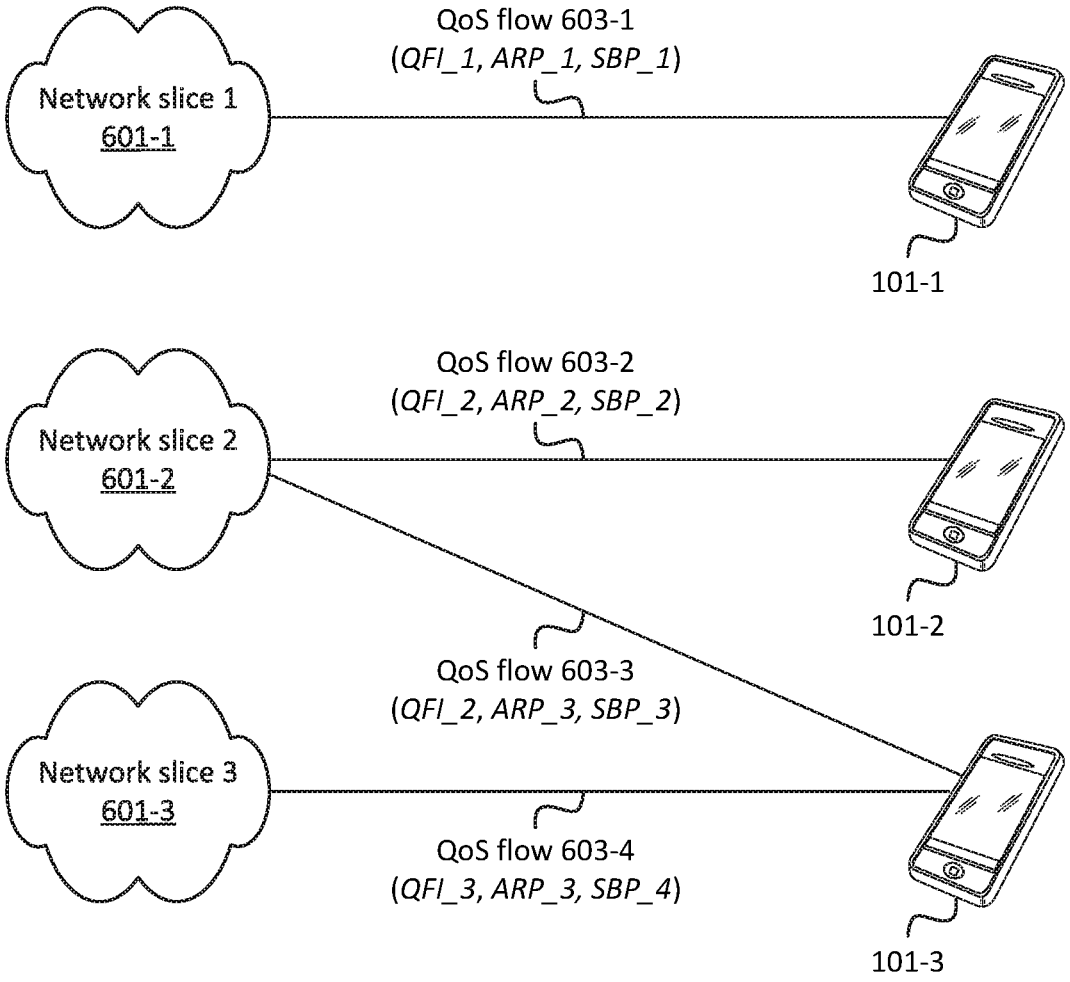

Network slice 1
601-1
QoS flow 603-1
(QFI_1, ARP_1, SBP_1)
101-1
Network slice 2
601-2
QoS flow 603-2
(QFI_2, ARP_2, SBP_2)
101-2
QoS flow 603-3
(QFI_2, ARP_3, SBP_3)
Network slice 3
601-3
QoS flow 603-4
(QFI_3, ARP_3, SBP_4)
101-3

FIG. 6B

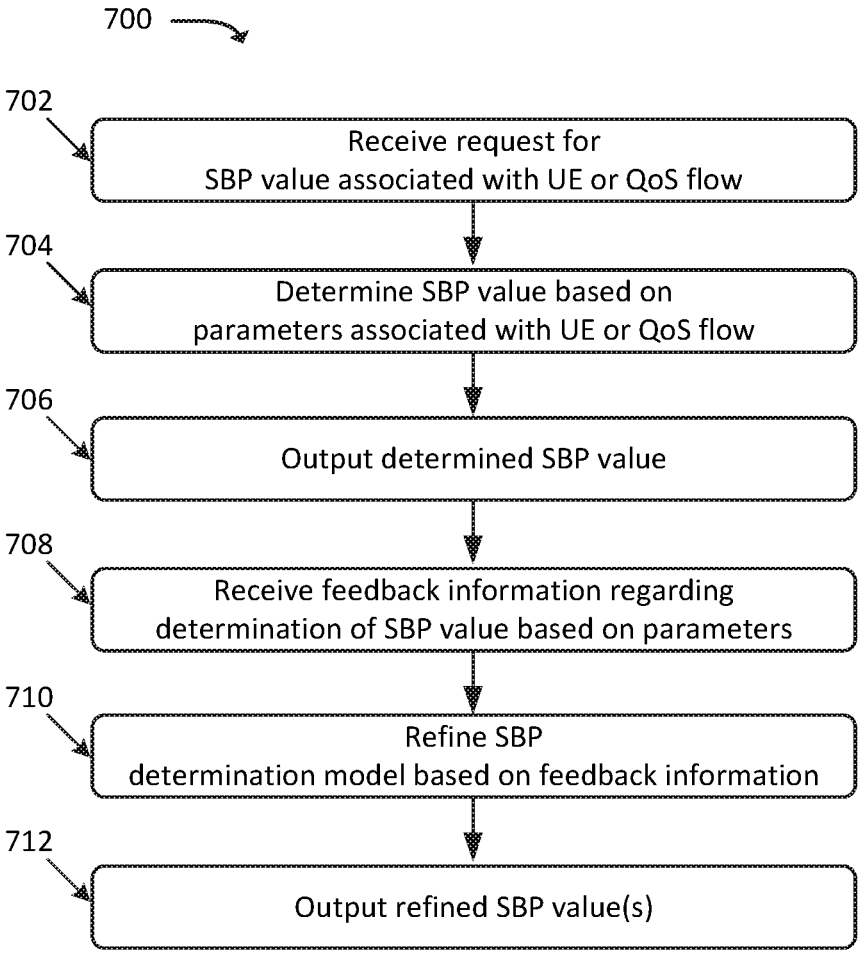

700
702
Receive request for SBP value associated with UE or QoS flow
704
Determine SBP value based on parameters associated with UE or QoS flow
706
Output determined SBP value
708
Receive feedback information regarding determination of SBP value based on parameters
710
Refine SBP determination model based on feedback information
712
Output refined SBP value(s)

FIG. 7

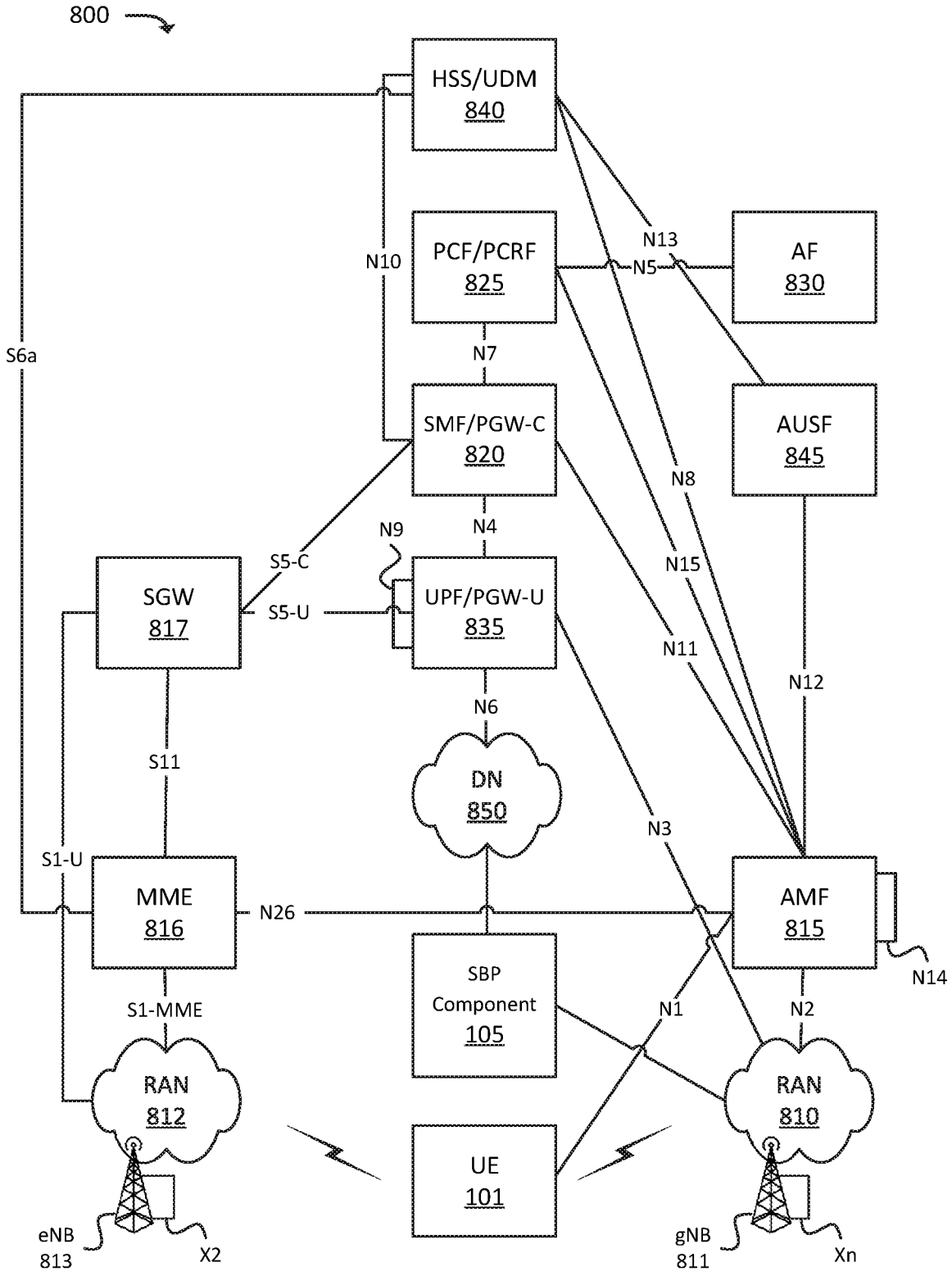

800
HSS/UDM
840
PCF/PCRF
825
AF
830
SMF/PGW-C
820
AUSF
845
SGW
817
UPF/PGW-U
835
DN
850
MME
816
AMF
815
SBP
Component
105
RAN
812
RAN
810
UE
101
eNB
813
gNB
811
S6a
N10
N13
N5
N7
N8
N9
N4
S5-C
S5-U
N15
N11
N12
N6
S11
N3
S1-U
N26
N14
S1-MME
N1
N2
X2
Xn

FIG. 8

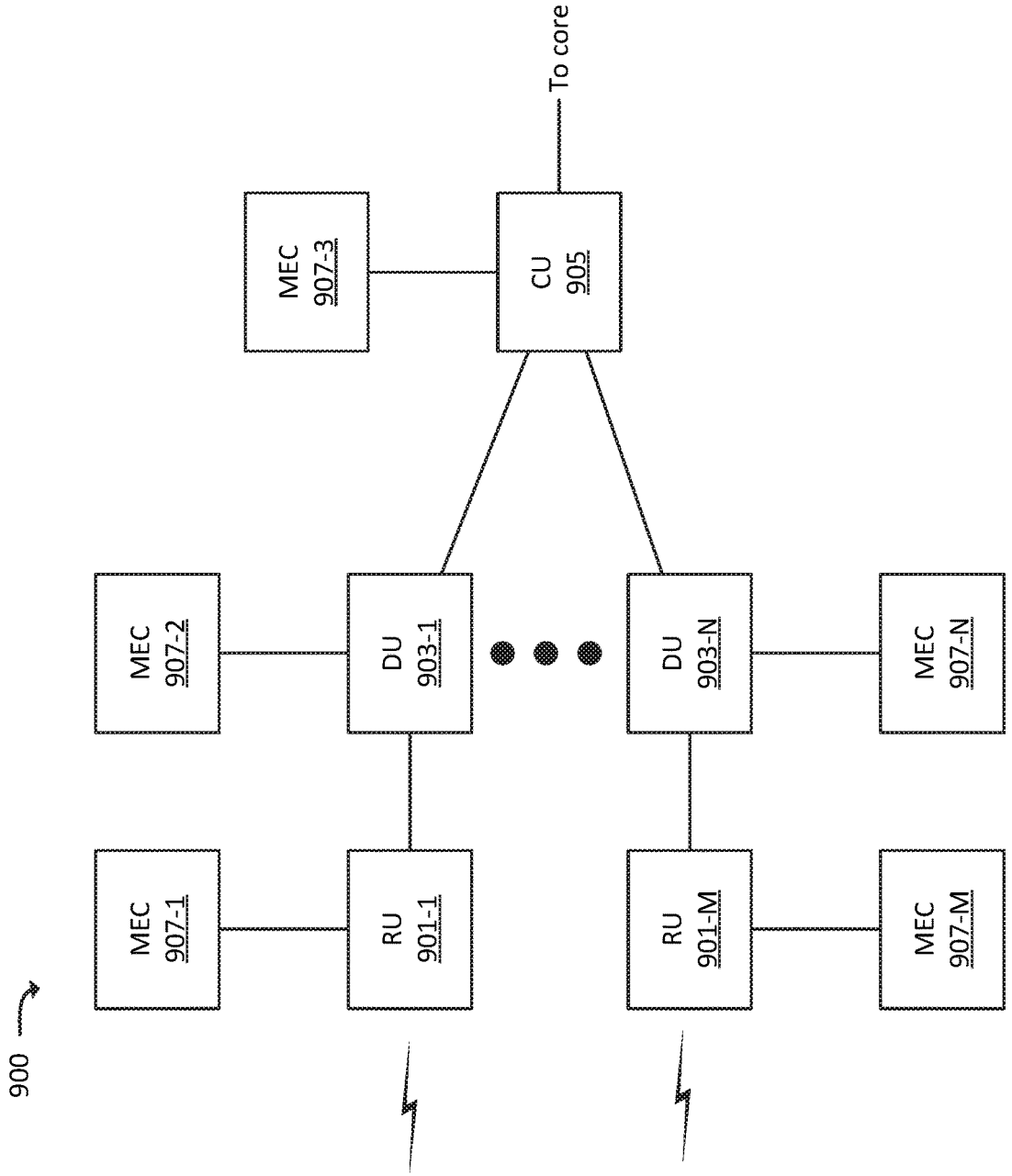

900
MEC 907-1
MEC 907-2
MEC 907-3
RU 901-1
DU 903-1
CU 905
To core
RU 901-M
DU 903-N
MEC 907-N
MEC 907-M

FIG. 9

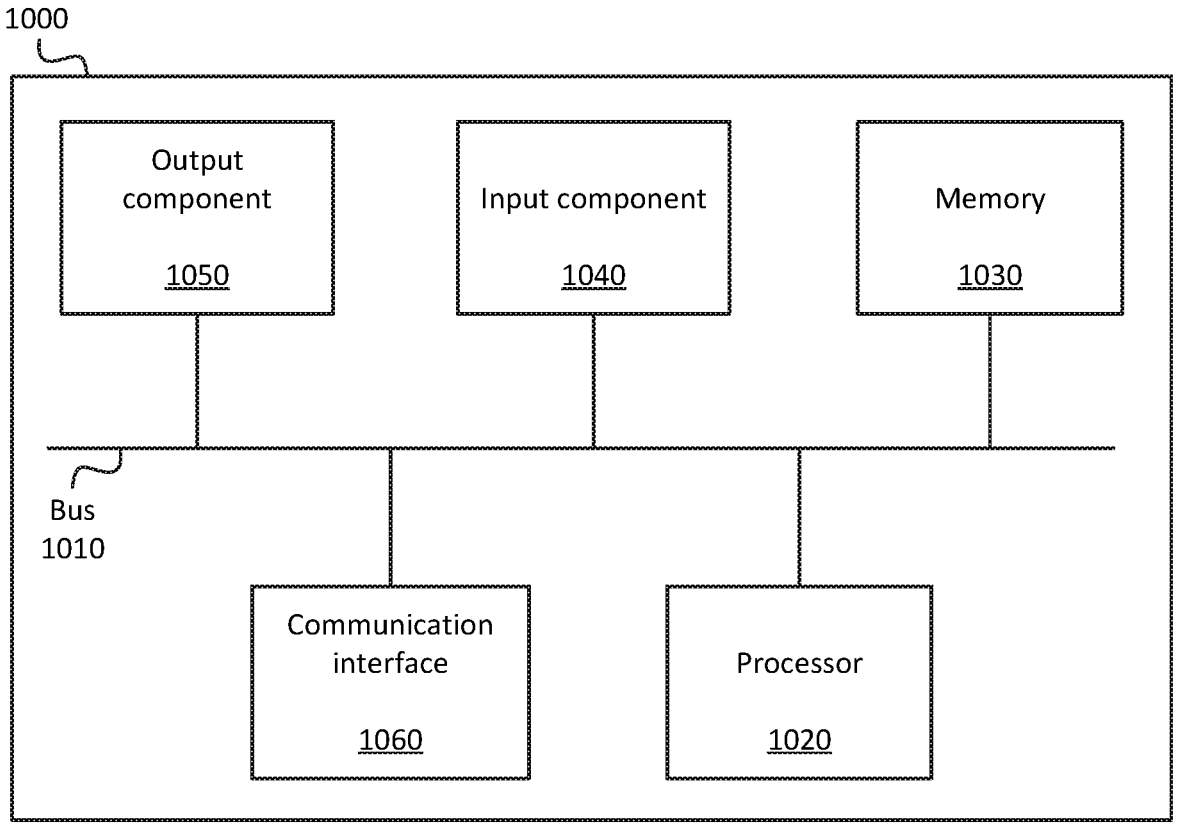

1000
Output component
1050
Input component
1040
Memory
1030
Bus
1010
Communication interface
1060
Processor
1020

FIG. 10

SYSTEMS AND METHODS FOR RADIO ACCESS NETWORK-LEVEL ALLOCATION AND RETENTION PRIORITY BASED ON NETWORK SLICING

BACKGROUND

[0001] Wireless networks, such as Fifth Generation ("5G") wireless networks, may utilize various techniques for ensuring Quality of Service ("QoS") treatment for traffic associated with user equipment ("UEs"), such as mobile telephones that are connected to such wireless networks. For example, a 5G core ("5GC") may be implemented via multiple instances or "slices," where different slices implement the same or similar network functions but provide differing levels of service. A radio access network ("RAN") that is communicatively coupled to a core network may use allocation and retention ("ARP") techniques to accept or reject incoming connection requests for UEs in situations where the RAN has limited resources.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. **1** illustrates an example of a base station of a RAN determining a Slice-Based Priority value associated with a UE and accepting or denying a connection request for the UE based on the SBP value, in accordance with some embodiments;

[0003] FIG. **2** illustrates an example of using machine learning techniques to generate and/or refine a model based on which SBP values may be identified for UEs;

[0004] FIG. **3** illustrates an example of a base station denying a connection request for a UE based on identifying a RAN congestion condition and further based on determining that an SBP value of the UE is lower than SBP values of connected UEs;

[0005] FIG. **4** illustrates an example of a base station disconnecting a UE with an existing connection based on identifying a RAN congestion condition and further based on determining that an SBP value of the UE is lower than SBP values of a UE for which an incoming connection request has been received;

[0006] FIG. **5** illustrates an example of resource modification associated with a UE based on based on identifying a RAN congestion condition and further based on determining an SBP value of the UE is lower than SBP values of one or more other connected UEs;

[0007] FIG. **6**A illustrates an example of a base station of a RAN communicatively coupled to multiple network slices and to multiple UEs;

[0008] FIG. **6**B illustrates example QoS flows that may be associated with different network slices and UEs, as well as corresponding SBP values for such QoS flows;

[0009] FIG. **7** illustrates an example process for determining and refining SBP values for a given UE and/or QoS flow in accordance with some embodiments;

[0010] FIG. **8** illustrates an example environment in which one or more embodiments, described herein, may be implemented;

[0011] FIG. **9** illustrates an example arrangement of a radio access network ("RAN"), in accordance with some embodiments; and

[0012] FIG. **10** illustrates example components of one or more devices, in accordance with one or more embodiments described herein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The following detailed description refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements.

[0014] Embodiments described herein provide for allocation and/or preemption of RAN resources based on QoS-related metrics associated with UEs that are connected to, and/or are requesting connection to, a RAN. For example, in some embodiments, the QoS-related metrics may include a network slice (e.g., as indicated by a Network Slice Selection Assistance Information ("NSSAI"), a Single-NSSAI ("S-NSSAI"), or the like) associated with a UE, a QoS Flow Identifier ("QFI") associated with one or more QoS flows associated with the UE, a Slice/Service Type ("SST") associated with the UE, and/or other suitable metrics. For example, in accordance with some embodiments, a SBP component may be communicatively coupled to one or more base stations (e.g., Next Generation Node Bs ("gNBs")) of one or more RANs (e.g., one or more 5G RANs), and may determine one or more SBP values for UEs connected to the one or more RANs, and/or for UEs requesting connection to such RANs.

[0015] As discussed below, the SBP values may be determined based on slice-related QoS metrics associated with such UEs (e.g., NSSAI, QFI, SST, etc.). Additionally, or alternatively, SBP values may be determined based on RAN-related QoS or priority metrics or parameters, such as Allocation and Retention Priority ("ARP") values. In accordance with embodiments described herein, RANs may accordingly be able to allocate resources, accept or deny connection requests, and/or perform preemption (e.g., disconnect connected UEs) based at least partly on slice-related QoS metrics. In this manner, end-to-end QoS parameters may be better preserved and may be less complex to implement than implementations that perform such resource allocation and/or preemption based solely on RAN-level parameters, such as ARP alone.

[0016] For example, as shown in FIG. **1**, UE **101** may output (at **102**) a connection request to base station **103**. The connection request may include identifying information for the UE (e.g., an International Mobile Subscriber Identity ("IMSI") value, an International Mobile Station Equipment Identity ("IMEI") value, and/or other suitable identifying information), a requested service type (e.g., voice, data, emergency call, and/or some other type of service), and/or other suitable information.

[0017] Base station **103** may identify (at **104**) parameters associated with UE **101**, which may include identifying QoS parameters associated with UE **101** and/or the requested service type. For example, different UEs **101** may be associated with different QoS parameters (e.g., a first responder or emergency type of UE **101** may be associated with a relatively higher set of QoS parameters than another type of UE **101**), and/or different service types may be associated with different QoS parameters (e.g., an emergency voice call may be associated with a relatively higher set of QoS parameters than a non-emergency voice call or a data connection).

[0018] In some embodiments, base station **103** may identify a particular network slice associated with UE **101** and/or the requested service type. For example, a first network slice may be associated with emergency voice calls and/or a

particular set of UE subscriber types (e.g., first responder or emergency UEs **101**), a second network slice may be associated with non-emergency voice calls and/or another set of UE subscriber types (e.g., enterprise or priority UEs **101**), a third network slice may be associated with Guaranteed Bit Rate ("GBR") data services, a fourth network slice may be associated with non-GBR data services, and so on.

[0019] In some embodiments, base station **103** may identify an ARP associated with UE **101** and/or the requested service type. For example, a given service type for a first UE **101** may be associated with a first ARP value, while the same service type for a second UE **101** may be associated with a second ARP value. As another example, a first service type for a given UE **101** may be associated with one ARP value, while a second service type for the same UE **101** may be associated with a different ARP value.

[0020] In some embodiments, base station **103** may identify one or more other types of parameters associated with UE **101** and/or base station **103**, such as a geographic location of UE **101**, a Tracking Area Identifier ("TAI") associated with UE **101** and/or base station **103**, a Public Land Mobile Network identifier ("PLMN ID") associated with UE **101** and/or base station **103**, and/or other parameters associated with UE and/or base station **103**.

[0021] For the sake of brevity, unless otherwise noted, the examples provided herein are in the context of given UEs **101** each being associated with a single set of QoS parameters (e.g., a single QoS flow, a single service type, a single ARP value, etc.). In practice, similar concepts may apply in situations where a given UE **101** is associated with multiple QoS flows, multiple service types, multiple ARP values, etc. For example, in examples where a given UE **101** is described as being disconnected from base station **103**, such disconnection may be a disconnection of one QoS flow associated with UE **101**, while one or more other QoS flows associated with UE **101** may not be disconnected.

[0022] Returning to FIG. **1**, base station **103** may output (at **106**) a request to SBP component **105**, for one or more SBP values associated with UE **101**. In some embodiments, base station **103** may be communicatively coupled to SBP component **105** via an application programming interface ("API") or some other suitable communication pathway. In some embodiments, the same device or system that implements some or all of the functionality of base station **103** may implement some or all of the functionality of SBP component **105**. In some embodiments, SBP component **105** may be communicatively coupled to multiple base stations **103**. The request (at **106**) for SBP values may include some or all of the parameters (identified at **104**) associated with UE **101**, including the requested service type, the associated network slice, an identifier of UE **101**, the ARP value associated with UE **101**, etc.

[0023] SBP component **105** may determine (at **108**) an SBP value associated with UE **101** based on the received parameters. For example, SBP component **105** may maintain one or more models, mappings, etc. that may be used to correlate the received parameters to a particular SBP. Additionally, or alternatively, SBP component **105** may perform one or more suitable functions to calculate an SBP for UE **101** based on the received parameters. In some embodiments, as discussed below, the SBP component **105** may use machine learning, artificial intelligence ("AI"), and/or one or more other suitable techniques to generate and/or refine the models, mappings, functions, etc. based on which SBP component **105** determines the SBP value for UE **101**.

[0024] SBP component **105** may provide (at **110**) the SBP value for UE **101** to base station **103**. As discussed below, base station **103** may use (at **112**) the SBP value to determine whether to accept or deny the connection request for UE **101**. For example, as discussed below, base station **103** may compare the SBP value to SBP values of other UEs **101** connected to, or within communication range of, base station **103**. In some embodiments, base station **103** may only deny incoming connection requests (e.g., using SBP values) in situations where base station **103** is congested, overloaded, or the like (e.g., where available physical radio frequency ("RF") resources of base station **103** are below a threshold level), and may otherwise accept incoming connection requests regardless of SBP values. In some embodiments, base station **103** may accept or deny incoming connection requests based on SBP values of UEs **101** from which such connection requests are received and one or more other criteria in addition to, or in lieu of, SBP values of other connected UEs **101**. For example, if the SBP value of a particular UE **101** from which a connection request is received is below a threshold SBP value and the request is received at a time of day that base station **103** has historically exhibited or experienced congestion, base station **103** may deny the connection request.

[0025] As noted above, and as shown in FIG. **2**, SBP component **105** may use machine learning, AI, and/or other suitable techniques to generate and/or refine a model, mapping, etc., based on which SBP values may be identified for UEs **101**. For example, SBP component **105** may receive (at **202**) RAN-based feedback from base station **103** and/or some other device or system (e.g., one or more Access and Mobility Management Functions ("AMFs"), a Network Exposure Function ("NEF"), and/or some other suitable device or system). The RAN-based feedback may include metrics such as resource utilization associated with base station **103** (e.g., a percentage or proportion of utilized Physical Resource Blocks ("PRBs") compared to unutilized PRBs), an indication of load and/or congestion of RF resources associated with base station **103**, and/or other metrics associated with resources of base station **103**. In some embodiments, base station **103** may provide (at **202**) the feedback information to SBP component **105** on an ongoing basis, such as a periodic and/or intermittent basis. In some embodiments, base station **103** may provide the feedback information in real time or in near-real time. In some embodiments, base station **103** may provide the feedback information based on the occurrence of one or more triggering events (e.g., after disconnecting a particular UE **101**, after accepting a connection request from a particular UE **101**, and/or other triggering events).

[0026] In some embodiments, SBP component **105** may receive (at **204**) UE-based feedback from UE **101**. For example, UE **101** may implement an API via which UE **101** may communicate with SBP component **105**. Additionally, or alternatively, UE **101** may communicate with one or more other devices or systems (e.g., an application server that provides requested services to UE **101**) that may provide such feedback information to SBP component **105**.

[0027] In some embodiments, the feedback from UE **101** may include QoS-related metrics, such as latency, jitter, throughput, or other suitable metrics. In some embodiments, the feedback from UE **101** may include feedback from a user

of UE **101**. For example, UE **101** and/or the user of UE **101** may be presented with a survey requesting satisfaction with the performance of UE **101**. Feedback based on such a survey may include a score (e.g., on a scale of 1-100 or some other suitable scale), a star rating (e.g., 1 through 5 stars), one or more keywords (e.g., "good," "bad," "slow," etc.), and/or other types of suitable feedback.

[0028] SBP component **105** may accordingly generate and/or modify (at **206**) one or more models, mappings, functions, etc. that are used to correlate SBP values (e.g., as determined at **108**) to UE parameters (e.g., as received at **106**). For example, SBP component **105** may use machine learning, AI, and/or some other suitable technique to iteratively refine such models, mappings, functions, etc. in order to improve, or balance the improvement of, RAN-based metrics (e.g., as received at **202**) and UE-based metrics (e.g., as received at **204**).

[0029] In some embodiments, the modification of the models, mappings, functions, etc. may be performed to cause the RAN-based metrics and/or UE-based metrics more closely match expected or threshold values. For example, if a given QoS flow for a particular UE **101** should be associated with a particular minimum latency, and the UE-based feedback (received at **204**) indicates that the particular minimum latency is not met, SBP component **105** may modify (at **206**) a model, mapping, function, etc. to increase (e.g., in embodiments where an "increased" SBP indicates a higher priority level) the SBP value that is determined based on the particular set of parameters associated with the particular UE **101**.

[0030] As another example, if the threshold resource utilization of base station **103** is 85% (e.g., where at least 85% of allocated PRBs are used for user plane traffic) and a current model, mapping, function, etc. yields 70% resource utilization, SBP component **105** may increase SBP values of UEs **101** that are associated with relatively lower SBP values and/or may decrease SBP values of UEs **101** that are associated with relatively higher values. Such modification of the SBP values (e.g., modification of the models, mappings, functions, etc. based on which the SBP values are determined) may accordingly affect the resource utilization of base station **103**. SBP component **105** may commit or proceed with changes to the models, mappings, functions, etc. that increase the resource utilization of base station **103**, and may discard changes that reduce or do not affect the resource utilization of base station **103**.

[0031] FIG. **3** illustrates an example of base station **103** denying a connection request for a particular UE **101** based on identifying a RAN congestion condition and further based on determining that an SBP value of UE **101** is lower than SBP values of connected UEs **101**. For example, as shown, UE **101-1** may be connected to base station **103**, and an example SBP value of 15.2 may have been determined for UE **101-1**. As further shown, UE **101-2** may be connected to base station **103** with an SBP value of 16.9. Base station **103** may receive (at **302**) a connection request from UE **101-3**, and may obtain (at **304**) an SBP value for UE **101-3** in a manner similar to that described above. For example, base station **103** may provide parameters associated with UE **101-3** and/or a requested service type to SBP component **105**, SBP component **105** may calculate, determine, etc. an SBP value of 9.0 based on the received information, and may provide the SBP value to base station **103**.

[0032] In this example, further assume that base station **103** has identified (at **306**) a congestion condition. For example, base station **103** may have determined that a quantity of connected UEs exceeds a threshold quantity, that an amount of available RF resources (e.g., PRBs) associated with base station **103** is below a threshold amount of RF resources, may detect a congestion condition that prevents the connection of additional UEs **101** to base station **103**, and/or may otherwise determine that new connections to base station **103** should be limited.

[0033] Accordingly, base station **103** may deny (at **308**) the connection request from UE **101-3**. For example, based on identifying (at **306**) the congestion condition, base station **103** may evaluate incoming connection requests based on SBP values, and may deny connection requests for UEs **101** or QoS flows that are associated with lower SBP values than UEs **101** that are currently connected to base station **103** and/or QoS flows that are already established via base station **103**. In this example, as the SBP value for UE **101-3** is 9.0 (i.e., lower than the SBP values of 15.2 and 16.9 for UEs **101-1** and **101-2**, respectively), base station **103** may deny (at **308**) the connection request from UE **101-3**.

[0034] As another example, as shown in FIG. **4**, base station **103** may receive (at **402**) a connection request from UE **101-3**, and may obtain (at **404**) a SBP value of 17.0 for UE **101-3**. As similarly discussed above, base station **103** may also identify (at **406**) a congestion condition in this example. As the SBP value for UE **101-3** (i.e., 17.0) is higher than the SBP value of at least one of the connected UEs **101**, base station **103** may accept (at **408**) the connection request from UE **101-3**. Specifically, as shown, the SBP value of 17.0, for UE **101-3**, is higher than the example SBP value of 15.2 for UE **101-1**.

[0035] Since UE **101-1** is associated with the lowest of the SBP values of UEs **101** connected to base station **103** in this example, base station **103** may disconnect (at **410**) UE **101-1**, and/or may cease allocating resources (e.g., PRBs) to traffic associated with UE **101-1**. Additionally, or alternatively, base station **103** may tear down one or more QoS flows associated with UE **101** (e.g., one or more QoS flows associated with the SBP value of 15.2). For example, in situations where UE **101-1** is associated with multiple QoS flows (e.g., QoS flows associated with multiple service types, such as a first QoS flow for voice call traffic and a second QoS flow for data traffic) having different SBP values, base station **103** may tear down the first QoS flow associated with UE **101-1** (e.g., a QoS flow selected based on being associated with a lower or lowest SBP value) without tearing down the second QoS flow associated with UE **101**.

[0036] In the manner described above with respect to the example situations shown in FIGS. **3** and **4**, base station **103** may use SBP values to perform preemption on existing connections and/or QoS flows, and/or to determine whether to accept new connections or requests to establish new QoS flows. As SBP values may be determined based on network slice (e.g., NSSAI) and/or other QoS-related parameters, the use of SBP values to perform such preemption may provide a closer end-to-end QoS experience than relying on RAN-level parameters alone, such as ARP. Further, as noted above, the techniques for determining SBP values may be refined on an ongoing basis, thus providing an enhanced level of dynamism and granularity as compared to relying on ARP alone.

[0037] FIG. **5** illustrates an example of resource modification associated with a given UE **101** based on based on identifying a RAN congestion condition and further based on determining an SBP value of the given UE **101** is lower than SBP values of one or more other connected UEs **101**. For example, as shown, UEs **101-1** and **101-2** may be connected to base station **103**. Base station **103** may allocate, or grant, a set of RF resources (e.g., PRBs) that may be used by UEs **101-1** and **101-2** for uplink traffic (e.g., traffic sent to base station **103** from UEs **101-1** and **101-2**). In this example, the amount of allocated resources (e.g., PRBs) granted by base station **103** to UE **101-1** for uplink traffic is denoted as X resources, and the amount of allocated resources granted to UE **101-2** for uplink traffic is denoted as Y resources. While different values (e.g., X and Y) are used in this example, in practice, UE **101-1** and UE **101-2** may be granted the same amount of resources for uplink traffic.

[0038] As further shown, base station **103** may identify (at **502**) a congestion condition, which may include a determination that a quantity of available resources associated with base station **103** has fallen below a threshold, a quantity of UEs **101** connected to base station **103** exceeds a threshold, a condition based on which base station **103** may determine that additional resources are needed, and/or some other condition based on which base station **103** may determine that resources allocated to one or more UEs **101** should be reduced.

[0039] In this example, base station **103** may determine that such resources should be removed from the resources granted to UE **101-2**. For example, in accordance with some embodiments, base station **103** make such a determination on the basis of SBP values associated with UEs **101** connected to base station **103** (e.g., UEs **101-1** and **101-2**, in this example). As shown, since UE **101-2** has a lower SBP value than UE **101-1** (e.g., 16.9 as compared to 18.2) base station **103** may reduce a granted amount of resources to UE **101-2** from Y to a value less than Y (denoted in the figure as "<Y").

[0040] FIG. **6**A illustrates an example of base station **103** communicatively coupled to multiple network slices **601** and to multiple UEs **101**. For example, base station **103** may provide a wireless interface for traffic to and/or from UEs **101-1**, **101-2**, and **101-3**. Base station **103** may, for example, provide uplink traffic received from UEs **101** to a given network slice **601** (e.g., a particular network slice associated with a QoS flow with which the traffic is associated). Base station **103** may further provide downlink traffic received from a particular network slice **601** to a particular UE **101** to which the traffic is destined. As noted above, each network slice **601** may include a partial or complete instance of a core network, which may serve as an interface between UEs **101** and one or more external networks (e.g., the Internet).

[0041] As shown in FIG. **6**B, UEs **101** may be associated with one or more QoS flows **603**, which may be associated with a particular network slice **601**. In this manner, a given network slice **601** may communicate with multiple UEs **101** (e.g., via base station **103**), a given UE **101** may communicate with a single network slice **601**, and/or a given UE **101** may communicate with multiple network slices **601**. For example, as shown, QoS flow **603-1** may be associated with UE **101-1** and with network slice **601-1**. Thus, traffic sent to and/or from UE **101-1** may be sent to and/or from network slice **601-1**, via QoS flow **603-1**. As further shown, QoS flow **603-1** may be associated with a first QFI value (shown as "QFI_1"). In some scenarios, network slice **601-1** may have been selected to serve QoS flow **603-1** based on the QFI value (e.g., base station **103** or some other device or system may identify the QFI based on an identifier of UE **101-1**, a type of service requested by UE **101-1**, and/or one or more other factors).

[0042] Additionally, or alternatively, network slice **601-1** may have been selected to serve QoS flow **603-1** based on Internet Protocol ("IP") information associated with particular traffic sent by or received from UE **101-1** via QoS flow **603-1**. For example, UE **101-1** may send traffic to a particular IP address, such as an IP address of an application server associated with a particular web-based service (e.g., an augmented reality/virtual reality ("AR/VR") service) or content (e.g., streaming content). Base station **103** and/or some other component may determine that the web-based service or content (e.g., the AR/VR service) is associated with particular network slice **601-1**. For example, base station **103** may determine, based on IP information (e.g., information included in an IP header of traffic, such as a source or a destination IP address) that particular traffic and/or a particular QoS flow **603-1** is associated with particular network slice **601-1**. For example, network slice **601-1** may be selected from the set of network slices that includes network slices **601-1** through **601-3** based on a mapping or other suitable information that corresponds the particular IP information to particular network slice **601-1**. In some embodiments, network slice **601** may be selected based on other information in addition to, or in lieu of, IP information associated with traffic sent to or from UE **101-1**.

[0043] Further, QoS flow **603-1** may be associated with a particular ARP value (shown as "ARP_1"), which may be selected by base station **103** or some other device or system based on an identifier of UE **101-1**, a type of service requested (e.g., data service, voice service, emergency call service, etc.), or other information. For example, the ARP may be selected based on parameters included in registration messages, such as Non-Access Stratum ("NAS") messages communicated between UE **101-1**, base station **103**, and/or one or more other devices or systems (e.g., an AMF communicatively coupled to base station **103** and/or some other device or system that performs or facilitates registration of UE **101-1** with base station **103**).

[0044] In some embodiments, the identification or selection of the ARP value may be independent of the QFI value and/or selected network slice **601**. In some situations, different ARP values (e.g., associated with different QoS flows **603** for the same UE **101**, and/or associated with different UEs **101**) may correspond to QoS flows **603** that are associated with the same network slice **601**. In some situations, the same ARP value may correspond to QoS flows **603** that are associated with different network slices **601**. Further, in some situations, different ARP values may correspond to QoS flows **603** that are associated with different network slices **601**.

[0045] As similarly noted above, QoS flow **603-1** may further be associated with a particular SBP value (shown as "SBP_1"). The SBP value may have been determined (e.g., by SBP component **105**, as discussed above) based on a slice identifier of network slice **601-1** (e.g., NSSAI), the ARP value associated with UE **101**, a geographic location of UE **101**, a TAI associated with UE **101** and/or base station **103**, a PLMN ID associated with UE **101** and/or base station **103**,

and/or one or more other factors. As further noted above, the SBP value may have been generated or refined using machine learning, AI, and/or some other suitable technique.

[0046] As further shown in FIG. **6**B, UE **101-2** may be associated with QoS flow **603-2**, which may be associated with network slice **601-2**. QoS flow **603-2** may further be associated with a QFI value of "QFI_**2**," an ARP value of "ARP_**2**," and an SBP value of "SBP_**2**" (e.g., where the SBP value was determined or calculated based on the ARP value, the SBP value, and/or some other suitable factor associated with UE **101-2** and/or base station **103**).

[0047] As additionally shown, UE **101-3** may be associated with two QoS flows **603-3** and **603-4**. QoS flows **603-3** and **603-4** may be concurrently active. For example, the two different QoS flows **603-3** and **603-4** may be associated with different QFI values, different service types, and/or some other differentiating factor. Thus, while QoS flows **603-3** and **603-4** are both associated with the same UE **101-3**, such QoS flows **603-3** and **603-4** may have differing SBP values (e.g., "SBP_**3**" for QoS flow **603-3** and "SBP_**4**" for QoS flow **603-4**). As noted above, traffic associated with the different QoS flows **603-3** and **603-4** for UE **101-3** may be treated differently in certain situations, such as when base station **103** has detected a congestion condition. For example, in some situations, base station **103** may tear down QoS flow **603-3** while leaving QoS flow **603-4** active, may reduce a downlink bitrate of traffic associated with QoS flow **603-3** without reducing the bitrate of traffic associated with QoS flow **603-4** (and/or may reduce a bitrate of QoS flow **603-4** by a lesser amount or proportion), may reduce an amount of granted uplink resources associated with QoS flow **603-3** without reducing the granted uplink resources associated with QoS flow **603-4** (and/or may reduce the granted uplink resources associated with QoS flow **603-4** by a lesser amount or proportion), and/or may otherwise differentially treat QoS flows **603-3** and **603-4**.

[0048] FIG. **7** illustrates an example process **700** for determining and refining SBP values for a given UE **101** and/or QoS flow **603**. In some embodiments, some or all of process **700** may be performed by SBP component **105**. In some embodiments, one or more other devices may perform some or all of process **700** in concert with, and/or in lieu of, SBP component **105** (e.g., base station **103**).

[0049] As shown, process **700** may include receiving (at **702**) a request for a SBP value associated with a given UE **101** and/or QoS flow **603**. For example, SBP component **105** may receive such a request from base station **103** based on UE **101** requesting a connection to base station **103** and/or the establishment of one or more QoS flows **603** (e.g., based on one or more service or Packet Data Network ("PDN") requests from UE **101**). The request may include parameters associated with UE **101**, base station **103**, QoS flow **603**, and/or network slice **601**. For example, the request may include one or more QFI values associated with UE **101** and/or a requested service type, one or more ARP values associated with UE **101**, a NS SAI or other identifier of network slice **601**, a geographic location or TAI associated with UE **101** and/or base station **103**, a PLMN ID associated with UE **101** and/or base station **103**, and/or one or more other parameters or values.

[0050] Process **700** may further include determining (at **704**) a particular SBP value based on the received parameters associated with UE **101** and/or QoS flow **603**. For example, SBP component **105** may maintain one or more models correlating particular parameters or sets of parameters to particular SBP values. Additionally, or alternatively, SBP component **105** may perform a suitable function to calculate the SBP value, where some or all of the received parameters are inputs to the function.

[0051] Process **700** may additionally include outputting (at **706**) the SBP value. For example, SBP component **105** may output, to base station **103**, the determined, identified, calculated, etc. SBP value. As discussed above, base station **103** may accordingly use the SBP value for resource allocation and/or preemption of UEs **101** and/or QoS flows **603**.

[0052] Process **700** may also include receiving (at **708**) feedback information regarding the determination or calculation of the SBP value based on the parameters (received with the request at **702**). For example, as discussed above, SBP component **105** may receive (e.g., from base station **103**, UE **101**, and/or some other device or system) RAN-based feedback information such as utilization of resources associated with base station **103** (e.g., which may indicate resources that were allocated by base station **103** and were either used or unused for traffic), availability of resources associated with base station **103** (e.g., resources of base station **103** which were available for allocation), load or congestion information associated with base station **103**, and/or other RAN-based metrics. In some embodiments, SBP component **105** may receive performance-based information, such as latency, jitter, packet loss, packet error rate, throughput, and/or other suitable information associated with performance-based metrics exhibited or experienced by UE **101**. Such RAN-based metrics and/or performance-based metrics associated with UE **101** and/or base station **103** may result from, and/or may otherwise be correlated with, the determined SBP values.

[0053] Process **700** may further include refining (at **710**) a SBP determination model based on the feedback information. For example, as discussed above, SBP component **105** may use machine learning, AI, and/or other suitable techniques to refine the calculation or determination of SBP values based on particular parameters or sets of parameters, in order to increase the likelihood that feedback received in response to the determination of SBP values meets one or more thresholds and/or advances one or more QoS-based objectives (e.g., reducing latency, improving throughput, improving RAN resource utilization, reducing RAN resource load, etc.). As noted above, the refinement (at **710**) of the determination or calculation of SBP values may be performed iteratively using machine learning and/or some other suitable process, in order to continually increase the likelihood that feedback based on SBP values meets the thresholds and/or advances the QoS-based objectives.

[0054] Process **700** may additionally include outputting (at **712**) refined SBP values. For example, in situations where, based on the received feedback, SBP component **105** determines a different SBP value for the received (at **702**) set of parameters, SBP component **105** may output the refined SBP values to base station **103**. In this manner, base station **103** may be kept up-to-date regarding the updated SBP values, and may treat UEs **101** and/or associated QoS flows **603** in accordance with the updated SBP values.

[0055] FIG. **8** illustrates an example environment **800**, in which one or more embodiments may be implemented. In some embodiments, environment **800** may correspond to a 5G network, and/or may include elements of a 5G network. In some embodiments, environment **800** may correspond to

a 5G Non-Standalone ("NSA") architecture, in which a 5G radio access technology ("RAT") may be used in conjunction with one or more other RATs (e.g., a Long-Term Evolution ("LTE") RAT), and/or in which elements of a 5G core network may be implemented by, may be communicatively coupled with, and/or may include elements of another type of core network (e.g., an evolved packet core ("EPC")). As shown, environment **800** may include UE **101**, RAN **810** (which may include one or more gNBs) **811**), RAN **812** (which may include one or more one or more evolved Node Bs ("eNBs") **813**), and various network functions such as AMF **815**, Mobility Management Entity ("MME") **816**, Serving Gateway ("SGW") **817**, Session Management Function ("SMF")/Packet Data Network ("PDN") Gateway ("PGW")-Control plane function ("PGW-C") **820**, Policy Control Function ("PCF")/Policy Charging and Rules Function ("PCRF") **825**, Application Function ("AF") **830**, User Plane Function ("UPF")/PGW-User plane function ("PGW-U") **835**, Home Subscriber Server ("HSS")/Unified Data Management ("UDM") **840**, Authentication Server Function ("AUSF") **845**, and SBP component **105**. Environment **800** may also include one or more networks, such as Data Network ("DN") **850**.

[0056] The example shown in FIG. **8** illustrates one example of each network component or function (e.g., one instance of SMF/PGW-C **820**, PCF/PCRF **825**, UPF/PGW-U **835**, HSS/UDM **840**, and/or **845**. In practice, environment **800** may include multiple instances of such components or functions. For example, in some embodiments, environment **800** may include multiple "slices" of a core network, where each slice includes a discrete set of network functions (e.g., one slice may include a first instance of SMF/PGW-C **820**, PCF/PCRF **825**, UPF/PGW-U **835**, HSS/UDM **840**, and/or **845**, while another slice may include a second instance of SMF/PGW-C **820**, PCF/PCRF **825**, UPF/PGW-U **835**, HSS/UDM **840**, and/or **845**). The different slices may provide differentiated levels of service, such as service in accordance with different QoS parameters.

[0057] The quantity of devices and/or networks, illustrated in FIG. **8**, is provided for explanatory purposes only. In practice, environment **800** may include additional devices and/or networks, fewer devices and/or networks, different devices and/or networks, or differently arranged devices and/or networks than illustrated in FIG. **8**. For example, while not shown, environment **800** may include devices that facilitate or enable communication between various components shown in environment **800**, such as routers, modems, gateways, switches, hubs, etc. Alternatively, or additionally, one or more of the devices of environment **800** may perform one or more network functions described as being performed by another one or more of the devices of environment **800**. Devices of environment **800** may interconnect with each other and/or other devices via wired connections, wireless connections, or a combination of wired and wireless connections. In some implementations, one or more devices of environment **800** may be physically integrated in, and/or may be physically attached to, one or more other devices of environment **800**.

[0058] UE **101** may include a computation and communication device, such as a wireless mobile communication device that is capable of communicating with RAN **810**, RAN **812**, and/or DN **850**. UE **101** may be, or may include, a radiotelephone, a personal communications system ("PCS") terminal (e.g., a device that combines a cellular radiotelephone with data processing and data communications capabilities), a personal digital assistant ("PDA") (e.g., a device that may include a radiotelephone, a pager, Internet/intranet access, etc.), a smart phone, a laptop computer, a tablet computer, a camera, a personal gaming system, an IoT device (e.g., a sensor, a smart home appliance, or the like), a wearable device, an Internet of Things ("IoT") device, a Mobile-to-Mobile ("M2M") device, or another type of mobile computation and communication device. UE **101** may send traffic to and/or receive traffic (e.g., user plane traffic) from DN **850** via RAN **810**, RAN **812**, and/or UPF/PGW-U **835**.

[0059] RAN **810** may be, or may include, a 5G RAN that includes one or more base stations (e.g., one or more gNBs **811**), via which UE **101** may communicate with one or more other elements of environment **800**. UE **101** may communicate with RAN **810** via an air interface (e.g., as provided by gNB **811**). For instance, RAN **810** may receive traffic (e.g., voice call traffic, data traffic, messaging traffic, signaling traffic, etc.) from UE **101** via the air interface, and may communicate the traffic to UPF/PGW-U **835**, and/or one or more other devices or networks. Similarly, RAN **810** may receive traffic intended for UE **101** (e.g., from UPF/PGW-U **835**, AMF **815**, and/or one or more other devices or networks) and may communicate the traffic to UE **101** via the air interface. In some embodiments, gNB **811** may include, may implement, and/or may be an instance of base station **103**.

[0060] RAN **812** may be, or may include, a LTE RAN that includes one or more base stations (e.g., one or more eNBs **813**), via which UE **101** may communicate with one or more other elements of environment **800**. UE **101** may communicate with RAN **812** via an air interface (e.g., as provided by eNB **813**). For instance, RAN **810** may receive traffic (e.g., voice call traffic, data traffic, messaging traffic, signaling traffic, etc.) from UE **101** via the air interface, and may communicate the traffic to UPF/PGW-U **835**, and/or one or more other devices or networks. Similarly, RAN **810** may receive traffic intended for UE **101** (e.g., from UPF/PGW-U **835**, SGW **817**, and/or one or more other devices or networks) and may communicate the traffic to UE **101** via the air interface.

[0061] AMF **815** may include one or more devices, systems, Virtualized Network Functions ("VNFs"), etc., that perform operations to register UE **101** with the 5G network, to establish bearer channels associated with a session with UE **101**, to hand off UE **101** from the 5G network to another network, to hand off UE **101** from the other network to the 5G network, manage mobility of UE **101** between RANs **810** and/or gNBs **811**, and/or to perform other operations. In some embodiments, the 5G network may include multiple AMFs **815**, which communicate with each other via the N14 interface (denoted in FIG. **8** by the line marked "N14" originating and terminating at AMF **815**).

[0062] MME **816** may include one or more devices, systems, VNFs, etc., that perform operations to register UE **101** with the EPC, to establish bearer channels associated with a session with UE **101**, to hand off UE **101** from the EPC to another network, to hand off UE **101** from another network to the EPC, manage mobility of UE **101** between RANs **812** and/or eNBs **813**, and/or to perform other operations.

[0063] SGW **817** may include one or more devices, systems, VNFs, etc., that aggregate traffic received from one or more eNBs **813** and send the aggregated traffic to an external

network or device via UPF/PGW-U **835**. Additionally, SGW **817** may aggregate traffic received from one or more UPF/PGW-Us **835** and may send the aggregated traffic to one or more eNBs **813**. SGW **817** may operate as an anchor for the user plane during inter-eNB handovers and as an anchor for mobility between different telecommunication networks or RANs (e.g., RANs **810** and **812**).

[0064] SMF/PGW-C **820** may include one or more devices, systems, VNFs, etc., that gather, process, store, and/or provide information in a manner described herein. SMF/PGW-C **820** may, for example, facilitate in the establishment of communication sessions on behalf of UE **101**. In some embodiments, the establishment of communications sessions may be performed in accordance with one or more policies provided by PCF/PCRF **825**.

[0065] PCF/PCRF **825** may include one or more devices, systems, VNFs, etc., that aggregate information to and from the 5G network and/or other sources. PCF/PCRF **825** may receive information regarding policies and/or subscriptions from one or more sources, such as subscriber databases and/or from one or more users (such as, for example, an administrator associated with PCF/PCRF **825**).

[0066] AF **830** may include one or more devices, systems, VNFs, etc., that receive, store, and/or provide information that may be used in determining parameters (e.g., quality of service parameters, charging parameters, or the like) for certain applications.

[0067] UPF/PGW-U **835** may include one or more devices, systems, VNFs, etc., that receive, store, and/or provide data (e.g., user plane data). For example, UPF/PGW-U **835** may receive user plane data (e.g., voice call traffic, data traffic, etc.), destined for UE **101**, from DN **850**, and may forward the user plane data toward UE **101** (e.g., via RAN **810**, SMF/PGW-C **820**, and/or one or more other devices). In some embodiments, multiple UPFs **835** may be deployed (e.g., in different geographical locations), and the delivery of content to UE **101** may be coordinated via the N9 interface (e.g., as denoted in FIG. **8** by the line marked "N9" originating and terminating at UPF/PGW-U **835**). Similarly, UPF/PGW-U **835** may receive traffic from UE **101** (e.g., via RAN **810**, SMF/PGW-C **820**, and/or one or more other devices), and may forward the traffic toward DN **850**. In some embodiments, UPF/PGW-U **835** may communicate (e.g., via the N4 interface) with SMF/PGW-C **820**, regarding user plane data processed by UPF/PGW-U **835**.

[0068] HSS/UDM **840** and AUSF **845** may include one or more devices, systems, VNFs, etc., that manage, update, and/or store, in one or more memory devices associated with AUSF **845** and/or HSS/UDM **840**, profile information associated with a subscriber. AUSF **845** and/or HSS/UDM **840** may perform authentication, authorization, and/or accounting operations associated with the subscriber and/or a communication session with UE **101**.

[0069] SBP component **105** may include one or more devices, systems, VNFs, etc., that perform one or more operations described above. For example, SBP component **105** may determine, calculate, and/or otherwise provide SBP values to elements of RAN **810** (e.g., gNB **811**), based on which such elements may prioritize, preempt, and/or allocate resources for UE **101**. Further, as noted above, SBP component **105** may use machine learning or other suitable techniques to refine one or more mappings, models, functions, etc. based on which SBP values are determined for UEs **101** and/or QoS flows **603** associated with UEs **101**.

[0070] DN **850** may include one or more wired and/or wireless networks. For example, DN **850** may include an IP-based PDN, a wide area network ("WAN") such as the Internet, a private enterprise network, and/or one or more other networks. UE **101** may communicate, through DN **850**, with data servers, other UEs **101**, and/or to other servers or applications that are coupled to DN **850**. DN **850** may be connected to one or more other networks, such as a public switched telephone network ("PSTN"), a public land mobile network ("PLMN"), and/or another network. DN **850** may be connected to one or more devices, such as content providers, applications, web servers, and/or other devices, with which UE **101** may communicate.

[0071] FIG. **9** illustrates an example Distributed Unit ("DU") network **900**, which may be included in and/or implemented by one or more RANs (e.g., RAN **810**). In some embodiments, a particular RAN may include one DU network **900**. In some embodiments, a particular RAN may include multiple DU networks **900**. In some embodiments, DU network **900** may correspond to a particular gNB **811** of a 5G RAN (e.g., RAN **810**). In some embodiments, DU network **900** may correspond to multiple gNBs **811**. In some embodiments, DU network **900** may correspond to one or more other types of base stations of one or more other types of RANs. As shown, DU network **900** may include Central Unit ("CU") **905**, one or more Distributed Units ("DUs") **903-1** through **903**-N (referred to individually as "DU **903**," or collectively as "DUs **903**"), and one or more Radio Units ("RUs") **901-1** through **901**-M (referred to individually as "RU **901**," or collectively as "RUs **901**").

[0072] CU **905** may communicate with a core of a wireless network (e.g., may communicate with one or more of the devices or systems described above with respect to FIG. **8**, such as AMF **815** and/or UPF/PGW-U **835**). In the uplink direction (e.g., for traffic from UEs **101** to a core network), CU **905** may aggregate traffic from DUs **903**, and forward the aggregated traffic to the core network. In some embodiments, CU **905** may receive traffic according to a given protocol (e.g., Radio Link Control ("RLC")) from DUs **903**, and may perform higher-layer processing (e.g., may aggregate/process RLC packets and generate Packet Data Convergence Protocol ("PDCP") packets based on the RLC packets) on the traffic received from DUs **903**.

[0073] In accordance with some embodiments, CU **905** may receive downlink traffic (e.g., traffic from the core network) for a particular UE **101**, and may determine which DU(s) **903** should receive the downlink traffic. DU **903** may include one or more devices that transmit traffic between a core network (e.g., via CU **905**) and UE **101** (e.g., via a respective RU **901**). DU **903** may, for example, receive traffic from RU **901** at a first layer (e.g., physical ("PHY") layer traffic, or lower PHY layer traffic), and may process/aggregate the traffic to a second layer (e.g., upper PHY and/or RLC). DU **903** may receive traffic from CU **905** at the second layer, may process the traffic to the first layer, and provide the processed traffic to a respective RU **901** for transmission to UE **101**.

[0074] RU **901** may include hardware circuitry (e.g., one or more RF transceivers, antennas, radios, and/or other suitable hardware) to communicate wirelessly (e.g., via an RF interface) with one or more UEs **101**, one or more other DUs **903** (e.g., via RUs **901** associated with DUs **903**), and/or any other suitable type of device. In the uplink direction, RU **901** may receive traffic from UE **101** and/or

another DU **903** via the RF interface and may provide the traffic to DU **903**. In the downlink direction, RU **901** may receive traffic from DU **903**, and may provide the traffic to UE **101** and/or another DU **903**.

[0075] RUs **901** may, in some embodiments, be communicatively coupled to one or more Multi-Access/Mobile Edge Computing ("MEC") devices, referred to sometimes herein simply as ("MECs") **907**. For example, RU **901-1** may be communicatively coupled to MEC **907-1**, RU **901**-M may be communicatively coupled to MEC **907**-M, DU **903-1** may be communicatively coupled to MEC **907-2**, DU **903**-N may be communicatively coupled to MEC **907**-N, CU **905** may be communicatively coupled to MEC **907-3**, and so on. MECs **907** may include hardware resources (e.g., configurable or provisionable hardware resources) that may be configured to provide services and/or otherwise process traffic to and/or from UE **101**, via a respective RU **901**.

[0076] For example, RU **901-1** may route some traffic, from UE **101**, to MEC **907-1** instead of to a core network (e.g., via DU **903** and CU **905**). MEC **907-1** may process the traffic, perform one or more computations based on the received traffic, and may provide traffic to UE **101** via RU **901-1**. In this manner, ultra-low latency services may be provided to UE **101**, as traffic does not need to traverse DU **903**, CU **905**, and an intervening backhaul network between DU network **900** and the core network. In some embodiments, MEC **907** may include, and/or may implement some or all of the functionality described above with respect to SBP component **105**.

[0077] FIG. **10** illustrates example components of device **1000**. One or more of the devices described above may include one or more devices **1000**. Device **1000** may include bus **1010**, processor **1020**, memory **1030**, input component **1040**, output component **1050**, and communication interface **1060**. In another implementation, device **1000** may include additional, fewer, different, or differently arranged components.

[0078] Bus **1010** may include one or more communication paths that permit communication among the components of device **1000**. Processor **1020** may include a processor, microprocessor, or processing logic that may interpret and execute instructions. Memory **1030** may include any type of dynamic storage device that may store information and instructions for execution by processor **1020**, and/or any type of non-volatile storage device that may store information for use by processor **1020**.

[0079] Input component **1040** may include a mechanism that permits an operator to input information to device **1000** and/or other receives or detects input from a source external to **1040**, such as a touchpad, a touchscreen, a keyboard, a keypad, a button, a switch, a microphone or other audio input component, etc. In some embodiments, input component **1040** may include, or may be communicatively coupled to, one or more sensors, such as a motion sensor (e.g., which may be or may include a gyroscope, accelerometer, or the like), a location sensor (e.g., a Global Positioning System ("GPS")-based location sensor or some other suitable type of location sensor or location determination component), a thermometer, a barometer, and/or some other type of sensor. Output component **1050** may include a mechanism that outputs information to the operator, such as a display, a speaker, one or more light emitting diodes ("LEDs"), etc.

[0080] Communication interface **1060** may include any transceiver-like mechanism that enables device **1000** to communicate with other devices and/or systems. For example, communication interface **1060** may include an Ethernet interface, an optical interface, a coaxial interface, or the like. Communication interface **1060** may include a wireless communication device, such as an infrared ("IR") receiver, a Bluetooth® radio, or the like. The wireless communication device may be coupled to an external device, such as a remote control, a wireless keyboard, a mobile telephone, etc. In some embodiments, device **1000** may include more than one communication interface **1060**. For instance, device **1000** may include an optical interface and an Ethernet interface.

[0081] Device **1000** may perform certain operations relating to one or more processes described above. Device **1000** may perform these operations in response to processor **1020** executing software instructions stored in a computer-readable medium, such as memory **1030**. A computer-readable medium may be defined as a non-transitory memory device. A memory device may include space within a single physical memory device or spread across multiple physical memory devices. The software instructions may be read into memory **1030** from another computer-readable medium or from another device. The software instructions stored in memory **1030** may cause processor **1020** to perform processes described herein. Alternatively, hardwired circuitry may be used in place of or in combination with software instructions to implement processes described herein. Thus, implementations described herein are not limited to any specific combination of hardware circuitry and software.

[0082] The foregoing description of implementations provides illustration and description, but is not intended to be exhaustive or to limit the possible implementations to the precise form disclosed. Modifications and variations are possible in light of the above disclosure or may be acquired from practice of the implementations.

[0083] For example, while series of blocks and/or signals have been described above (e.g., with regard to FIGS. **1-7**), the order of the blocks and/or signals may be modified in other implementations. Further, non-dependent blocks and/or signals may be performed in parallel. Additionally, while the figures have been described in the context of particular devices performing particular acts, in practice, one or more other devices may perform some or all of these acts in lieu of, or in addition to, the above-mentioned devices.

[0084] The actual software code or specialized control hardware used to implement an embodiment is not limiting of the embodiment. Thus, the operation and behavior of the embodiment has been described without reference to the specific software code, it being understood that software and control hardware may be designed based on the description herein.

[0085] Even though particular combinations of features are recited in the claims and/or disclosed in the specification, these combinations are not intended to limit the disclosure of the possible implementations. In fact, many of these features may be combined in ways not specifically recited in the claims and/or disclosed in the specification. Although each dependent claim listed below may directly depend on only one other claim, the disclosure of the possible implementations includes each dependent claim in combination with every other claim in the claim set.

[0086] Further, while certain connections or devices are shown, in practice, additional, fewer, or different, connections or devices may be used. Furthermore, while various

devices and networks are shown separately, in practice, the functionality of multiple devices may be performed by a single device, or the functionality of one device may be performed by multiple devices. Further, multiple ones of the illustrated networks may be included in a single network, or a particular network may include multiple networks. Further, while some devices are shown as communicating with a network, some such devices may be incorporated, in whole or in part, as a part of the network.

[0087] To the extent the aforementioned implementations collect, store, or employ personal information provided by individuals, it should be understood that such information shall be collected, stored, and used in accordance with all applicable laws concerning protection of personal information. Additionally, the collection, storage, and use of such information may be subject to consent of the individual to such activity (for example, through "opt-in" or "opt-out" processes, as may be appropriate for the situation and type of information). Storage and use of personal information may be in an appropriately secure manner reflective of the type of information, for example, through various encryption and anonymization techniques for particularly sensitive information.

[0088] No element, act, or instruction used in the present application should be construed as critical or essential unless explicitly described as such. An instance of the use of the term "and," as used herein, does not necessarily preclude the interpretation that the phrase "and/or" was intended in that instance. Similarly, an instance of the use of the term "or," as used herein, does not necessarily preclude the interpretation that the phrase "and/or" was intended in that instance. Also, as used herein, the article "a" is intended to include one or more items, and may be used interchangeably with the phrase "one or more." Where only one item is intended, the terms "one," "single," "only," or similar language is used. Further, the phrase "based on" is intended to mean "based, at least in part, on" unless explicitly stated otherwise.

What is claimed is:

1. A device, comprising:

one or more processors configured to:

receive a request for a priority value associated with a particular Quality of Service ("QoS") flow associated with a User Equipment ("UE"), the particular QoS flow further being associated with a particular network slice out of a plurality of network slices associated with a core of a wireless network, the request including an identifier of the particular network slice;

determine the priority value based on the identifier of the particular network slice; and

output the priority value to a base station associated with a radio access network ("RAN") of the wireless network, wherein the base station uses the priority value to determine an allocation of resources of the RAN to the particular QoS flow.

2. The device of claim **1**, wherein the particular QoS flow is a first QoS flow associated with the UE, wherein the UE is further associated with a second QoS flow that is active concurrently with the first QoS flow, wherein the priority value is a first priority value, wherein the particular network slice is a first network slice, wherein the one or more processors are further configured to:

determine a second priority value for the second QoS flow, the second QoS flow further being associated with a second network slice associated with the core of the wireless network; and

output the second priority value to the base station, wherein the base station uses the second priority value to determine an allocation of resources of the RAN to the second QoS flow.

3. The device of claim **1**, wherein the one or more processors are further configured to:

receive an Allocation and Retention Priority ("ARP") value associated with the particular QoS flow or the UE, wherein the priority value is determined further based on the ARP value.

4. The device of claim **1**, wherein the one or more processors are further configured to:

receive feedback information; and

refine, based on the received feedback information, one or more models or functions used to determine the priority value based on the identifier of the particular network slice.

5. The device of claim **4**, wherein the feedback information includes information indicating utilization of radio frequency ("RF") resources associated with the RAN after the priority value has been outputted to the base station of the RAN.

6. The device of claim **4**, wherein the feedback information includes information indicating performance metrics associated with the particular QoS flow or the UE.

7. The device of claim **1**, wherein determining the priority value is further based on at least one of:

a geographical location of the UE,

a geographical location of the base station,

a tracking area in which the UE is located, or

a tracking area in which the base station is located.

8. A non-transitory computer-readable medium, storing a plurality of processor-executable instructions to:

receive a request for a priority value associated with a particular Quality of Service ("QoS") flow associated with a User Equipment ("UE"), the particular QoS flow further being associated with a particular network slice out of a plurality of network slices associated with a core of a wireless network, the request including an identifier of the particular network slice;

determine the priority value based on the identifier of the particular network slice; and

output the priority value to a base station associated with a radio access network ("RAN") of the wireless network, wherein the base station uses the priority value to determine an allocation of resources of the RAN to the particular QoS flow.

9. The non-transitory computer-readable medium of claim **8**, wherein the particular QoS flow is a first QoS flow associated with the UE, wherein the UE is further associated with a second QoS flow that is active concurrently with the first QoS flow, wherein the priority value is a first priority value, wherein the particular network slice is a first network slice, wherein the plurality of processor-executable instructions further include processor-executable instructions to:

determine a second priority value for the second QoS flow, the second QoS flow further being associated with a second network slice associated with the core of the wireless network; and

output the second priority value to the base station, wherein the base station uses the second priority value to determine an allocation of resources of the RAN to the second QoS flow.

10. The non-transitory computer-readable medium of claim **8**, wherein the plurality of processor-executable instructions further include processor-executable instructions to:

receive an Allocation and Retention Priority ("ARP") value associated with the particular QoS flow or the UE, wherein the priority value is determined further based on the ARP value.

11. The non-transitory computer-readable medium of claim **8**, wherein the plurality of processor-executable instructions further include processor-executable instructions to:

receive feedback information; and

refine, based on the received feedback information, one or more models or functions used to determine the priority value based on the identifier of the particular network slice.

12. The non-transitory computer-readable medium of claim **11**, wherein the feedback information includes information indicating utilization of radio frequency ("RF") resources associated with the RAN after the priority value has been outputted to the base station of the RAN.

13. The non-transitory computer-readable medium of claim **11**, wherein the feedback information includes information indicating performance metrics associated with the particular QoS flow or the UE.

14. The non-transitory computer-readable medium of claim **8**, wherein determining the priority value is further based on at least one of:

a geographical location of the UE,

a geographical location of the base station,

a tracking area in which the UE is located, or

a tracking area in which the base station is located.

15. A method, comprising:

receiving a request for a priority value associated with a particular Quality of Service ("QoS") flow associated with a User Equipment ("UE"), the particular QoS flow further being associated with a particular network slice out of a plurality of network slices associated with a core of a wireless network, the request including an identifier of the particular network slice;

determining the priority value based on the identifier of the particular network slice; and

outputting the priority value to a base station associated with a radio access network ("RAN") of the wireless network, wherein the base station uses the priority value to determine an allocation of resources of the RAN to the particular QoS flow.

16. The method of claim **15**, wherein the particular QoS flow is a first QoS flow associated with the UE, wherein the UE is further associated with a second QoS flow that is active concurrently with the first QoS flow, wherein the priority value is a first priority value, wherein the particular network slice is a first network slice, the method further comprising:

determining a second priority value for the second QoS flow, the second QoS flow further being associated with a second network slice associated with the core of the wireless network; and

outputting the second priority value to the base station, wherein the base station uses the second priority value to determine an allocation of resources of the RAN to the second QoS flow.

17. The method of claim **15**, the method further comprising:

receiving an Allocation and Retention Priority ("ARP") value associated with the particular QoS flow or the UE, wherein the priority value is determined further based on the ARP value.

18. The method of claim **15**, the method further comprising:

receiving feedback information; and

refining, based on the received feedback information, one or more models or functions used to determine the priority value based on the identifier of the particular network slice.

19. The method of claim **18**, wherein the feedback information includes:

information indicating utilization of radio frequency ("RF") resources associated with the RAN after the priority value has been outputted to the base station of the RAN, and

information indicating performance metrics associated with the particular QoS flow or the UE.

20. The method of claim **15**, wherein determining the priority value is further based on at least one of:

a geographical location of the UE,

a geographical location of the base station,

a tracking area in which the UE is located, or

a tracking area in which the base station is located.

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