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(54) SLICE CONTROL OF A WIRELESS COMMUNICATION DEVICE IN A VISITED WIRELESS COMMUNICATION NETWORK

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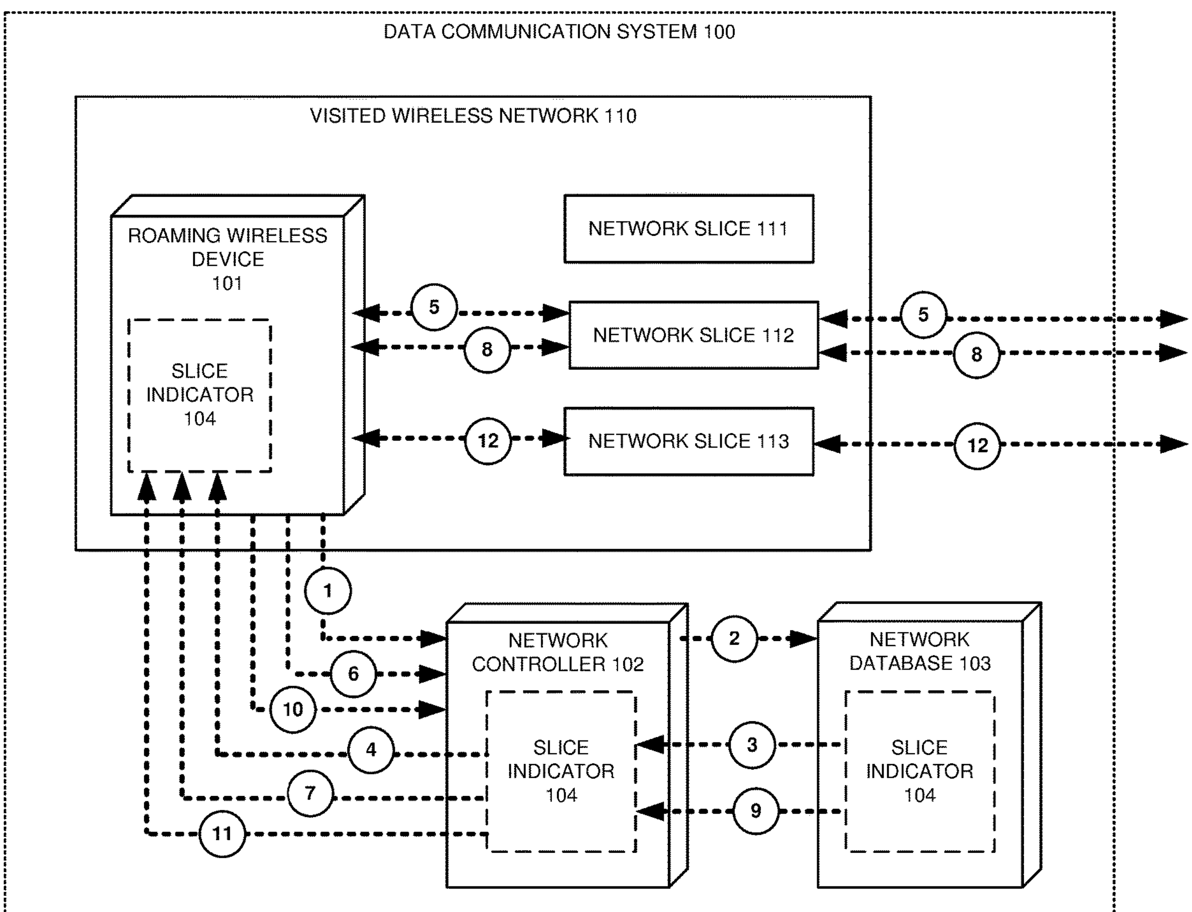
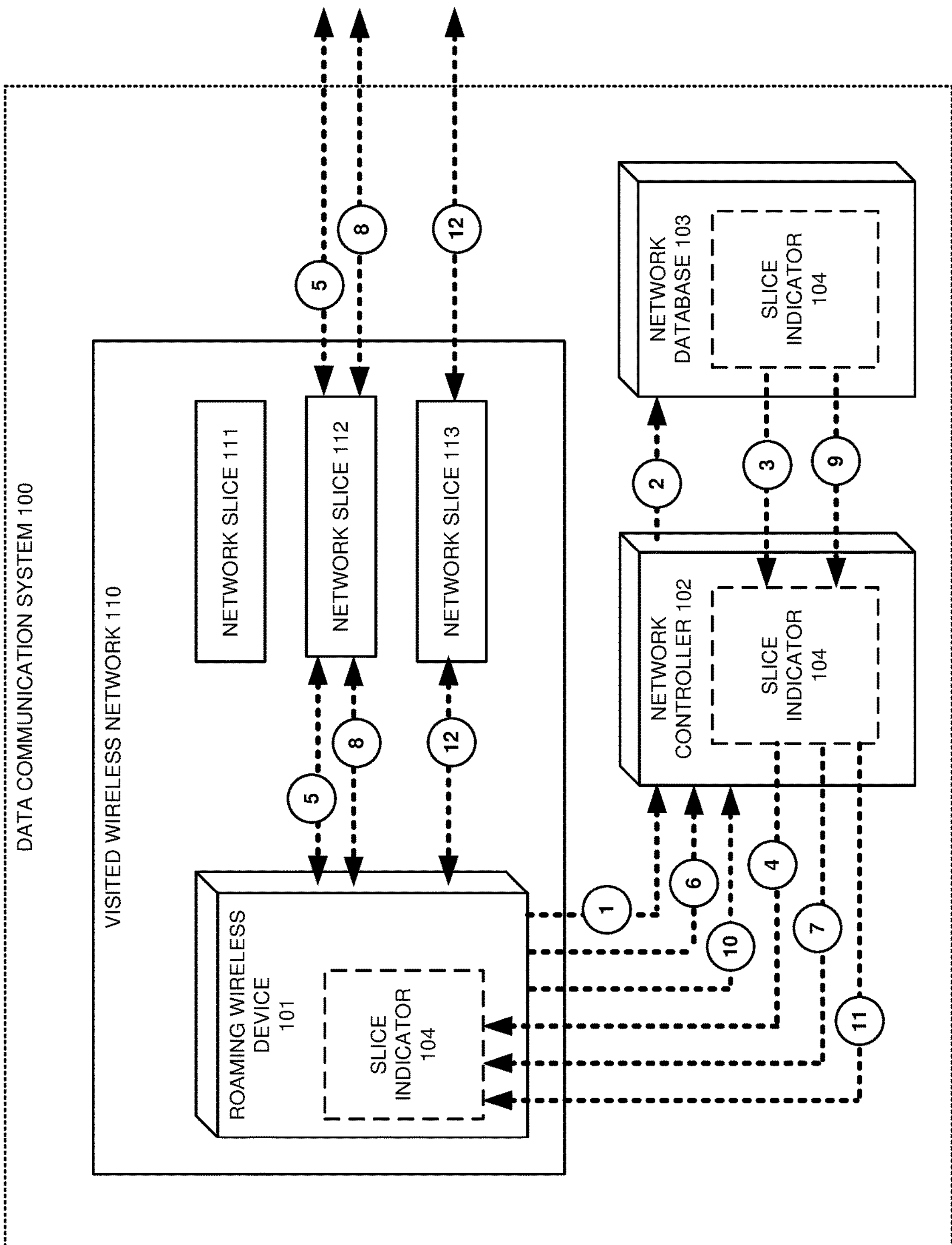
CPC ***H04W 48/16*** (2013.01); *H04W 84/042* (2013.01)

(57) **ABSTRACT**

A wireless communication system controls a wireless communication device in a visited wireless communication network. A network database stores a slice indicator for a visited wireless network slice in the visited wireless communication network. A network controller receives a request from the visited wireless communication network for the wireless communication device, and in response to receiving the request, the network controller retrieves the slice indicator for the visited wireless communication network from the network database and transfers the slice indicator to the wireless communication device over the visited wireless communication network. The wireless communication device communicates using the visited wireless network slice in the visited wireless communication network in response to receiving the slice indicator.





DATA COMMUNICATION SYSTEM 100
VISITED WIRELESS NETWORK 110
NETWORK SLICE 111
NETWORK SLICE 112
NETWORK SLICE 113
ROAMING WIRELESS DEVICE 101
SLICE INDICATOR 104
NETWORK CONTROLLER 102
SLICE INDICATOR 104
NETWORK DATABASE 103
SLICE INDICATOR 104
1
2
3
4
5
6
7
8
9
10
11
12

FIGURE 1

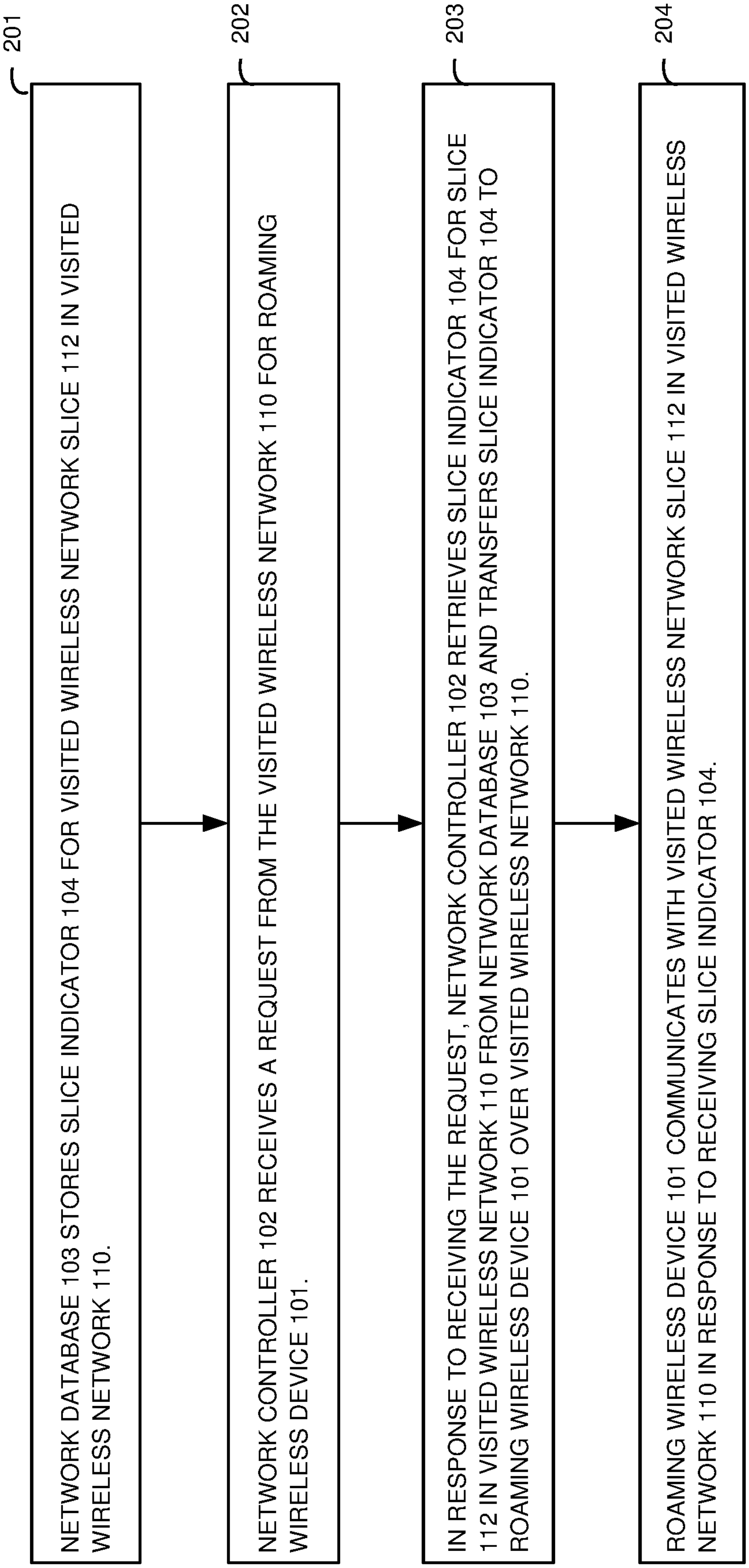

201
NETWORK DATABASE 103 STORES SLICE INDICATOR 104 FOR VISITED WIRELESS NETWORK SLICE 112 IN VISITED WIRELESS NETWORK 110.
202
NETWORK CONTROLLER 102 RECEIVES A REQUEST FROM THE VISITED WIRELESS NETWORK 110 FOR ROAMING WIRELESS DEVICE 101.
203
IN RESPONSE TO RECEIVING THE REQUEST, NETWORK CONTROLLER 102 RETRIEVES SLICE INDICATOR 104 FOR SLICE 112 IN VISITED WIRELESS NETWORK 110 FROM NETWORK DATABASE 103 AND TRANSFERS SLICE INDICATOR 104 TO ROAMING WIRELESS DEVICE 101 OVER VISITED WIRELESS NETWORK 110.
204
ROAMING WIRELESS DEVICE 101 COMMUNICATES WITH VISITED WIRELESS NETWORK SLICE 112 IN VISITED WIRELESS NETWORK 110 IN RESPONSE TO RECEIVING SLICE INDICATOR 104.

FIGURE 2

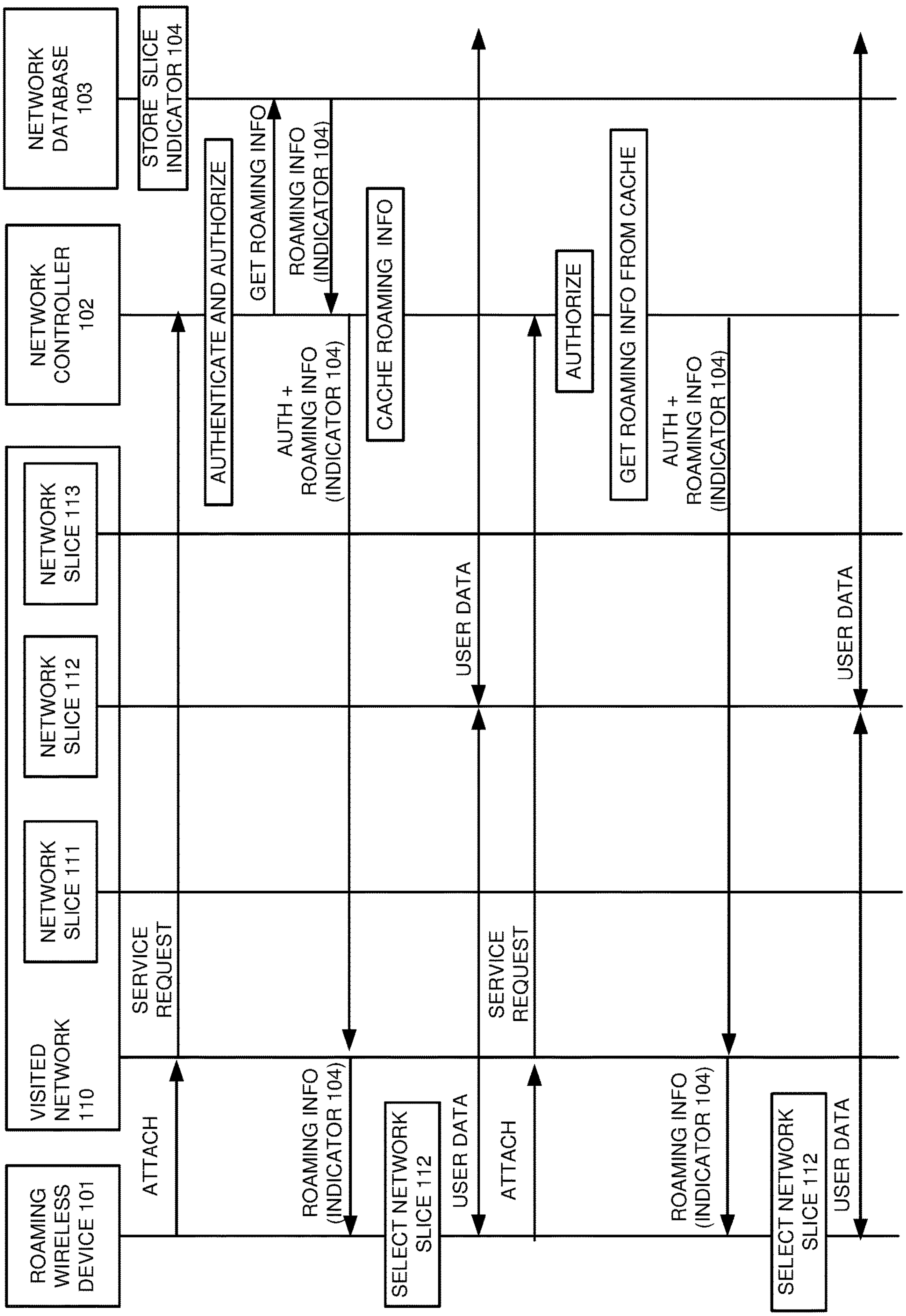

ROAMING WIRELESS DEVICE 101
VISITED NETWORK 110
NETWORK SLICE 111
NETWORK SLICE 112
NETWORK SLICE 113
NETWORK CONTROLLER 102
NETWORK DATABASE 103
STORE SLICE INDICATOR 104
ATTACH
SERVICE REQUEST
AUTHENTICATE AND AUTHORIZE
GET ROAMING INFO
ROAMING INFO (INDICATOR 104)
AUTH + ROAMING INFO (INDICATOR 104)
CACHE ROAMING INFO
ROAMING INFO (INDICATOR 104)
SELECT NETWORK SLICE 112
USER DATA
USER DATA
ATTACH
SERVICE REQUEST
AUTHORIZE
GET ROAMING INFO FROM CACHE
AUTH + ROAMING INFO (INDICATOR 104)
ROAMING INFO (INDICATOR 104)
SELECT NETWORK SLICE 112
USER DATA
USER DATA

FIGURE 3

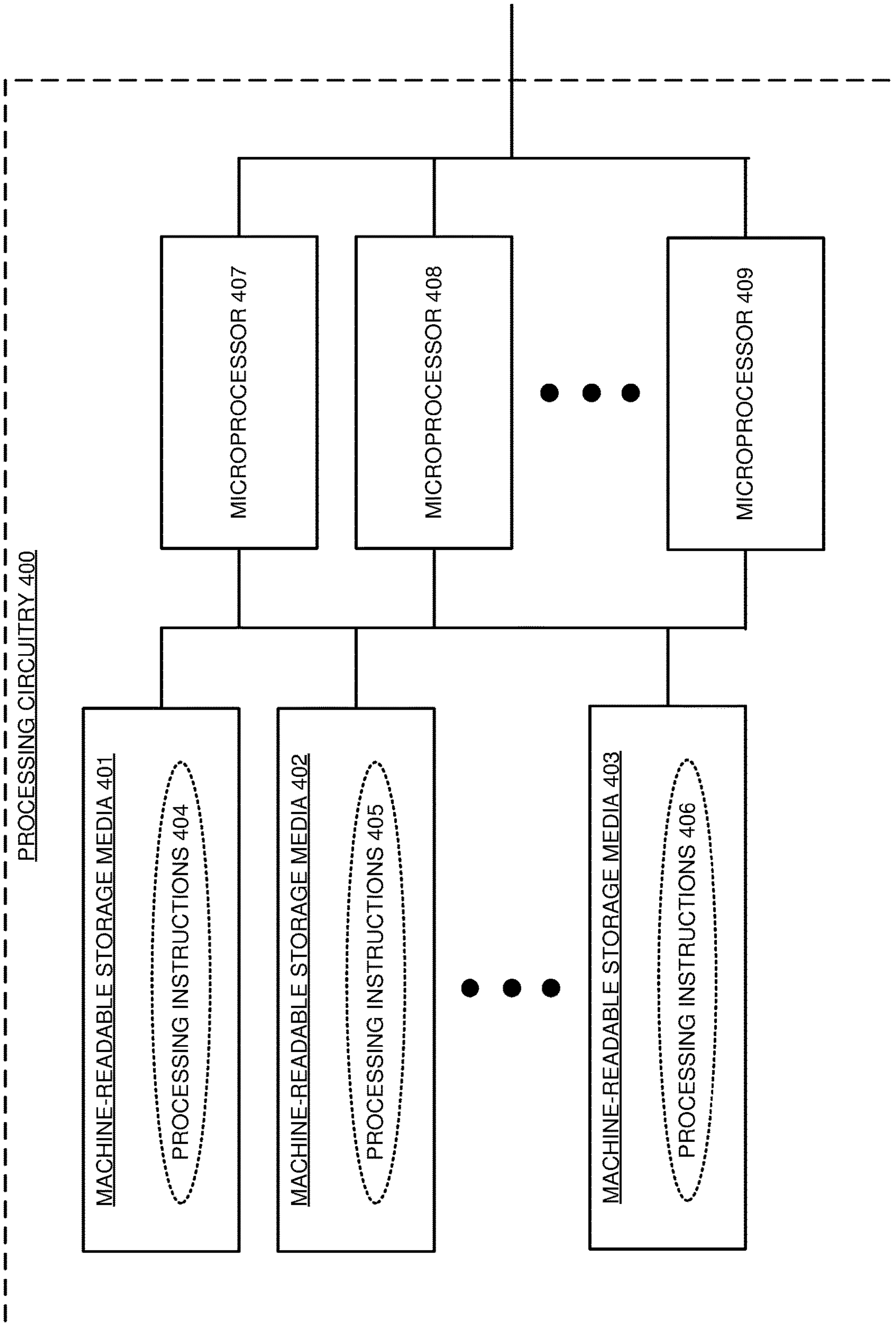

PROCESSING CIRCUITRY 400
MICROPROCESSOR 407
MICROPROCESSOR 408
MICROPROCESSOR 409
MACHINE-READABLE STORAGE MEDIA 401
PROCESSING INSTRUCTIONS 404
MACHINE-READABLE STORAGE MEDIA 402
PROCESSING INSTRUCTIONS 405
MACHINE-READABLE STORAGE MEDIA 403
PROCESSING INSTRUCTIONS 406

FIGURE 4

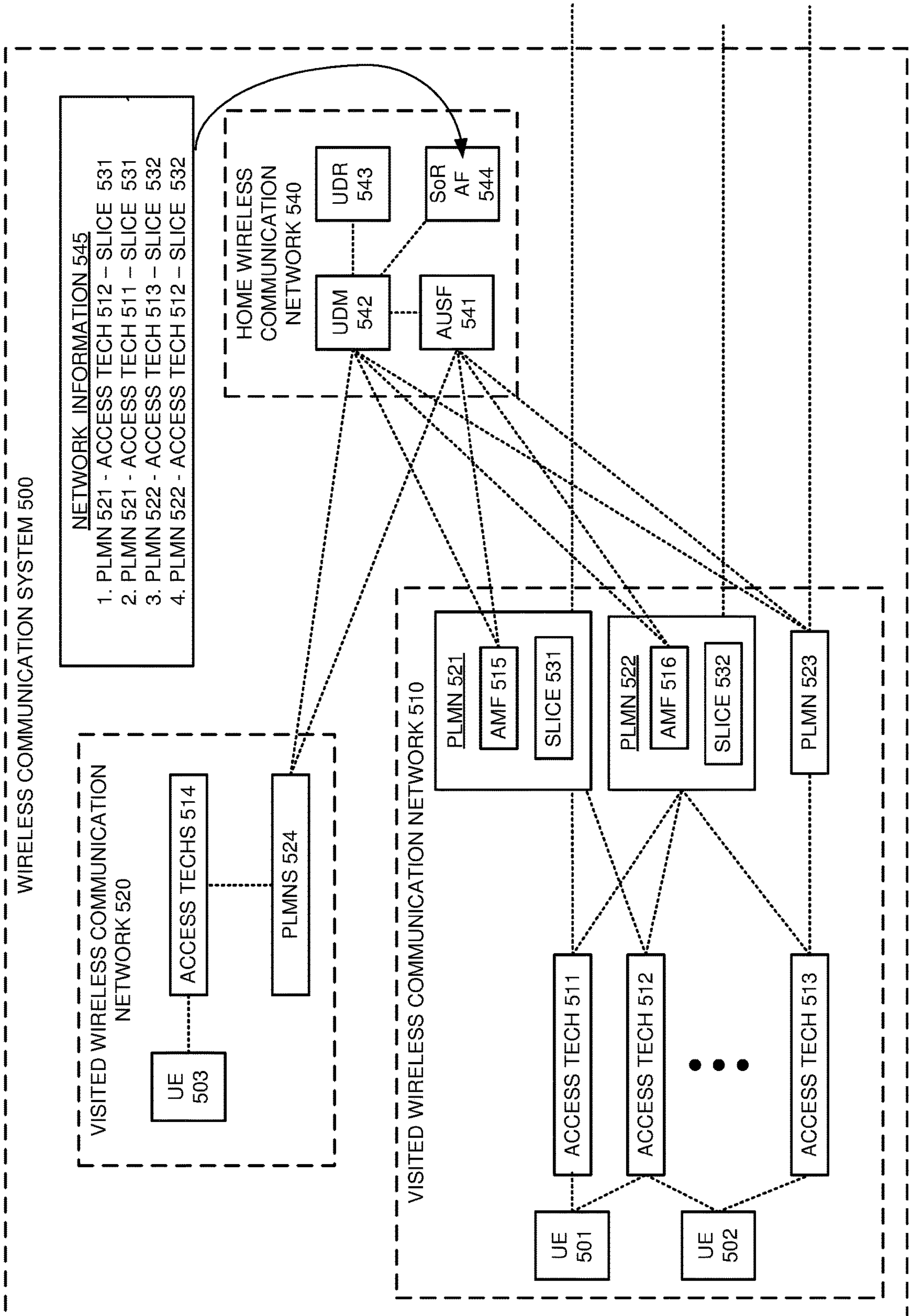

WIRELESS COMMUNICATION SYSTEM 500
NETWORK INFORMATION 545
1. PLMN 521 - ACCESS TECH 512 – SLICE 531
2. PLMN 521 - ACCESS TECH 511 – SLICE 531
3. PLMN 522 - ACCESS TECH 513 – SLICE 532
4. PLMN 522 - ACCESS TECH 512 – SLICE 532
HOME WIRELESS COMMUNICATION NETWORK 540
UDR 543
SoR AF 544
UDM 542
AUSF 541
VISITED WIRELESS COMMUNICATION NETWORK 520
ACCESS TECHS 514
PLMNS 524
UE 503
VISITED WIRELESS COMMUNICATION NETWORK 510
PLMN 521
AMF 515
SLICE 531
PLMN 522
AMF 516
SLICE 532
PLMN 523
ACCESS TECH 511
ACCESS TECH 512
ACCESS TECH 513
UE 501
UE 502

FIGURE 5

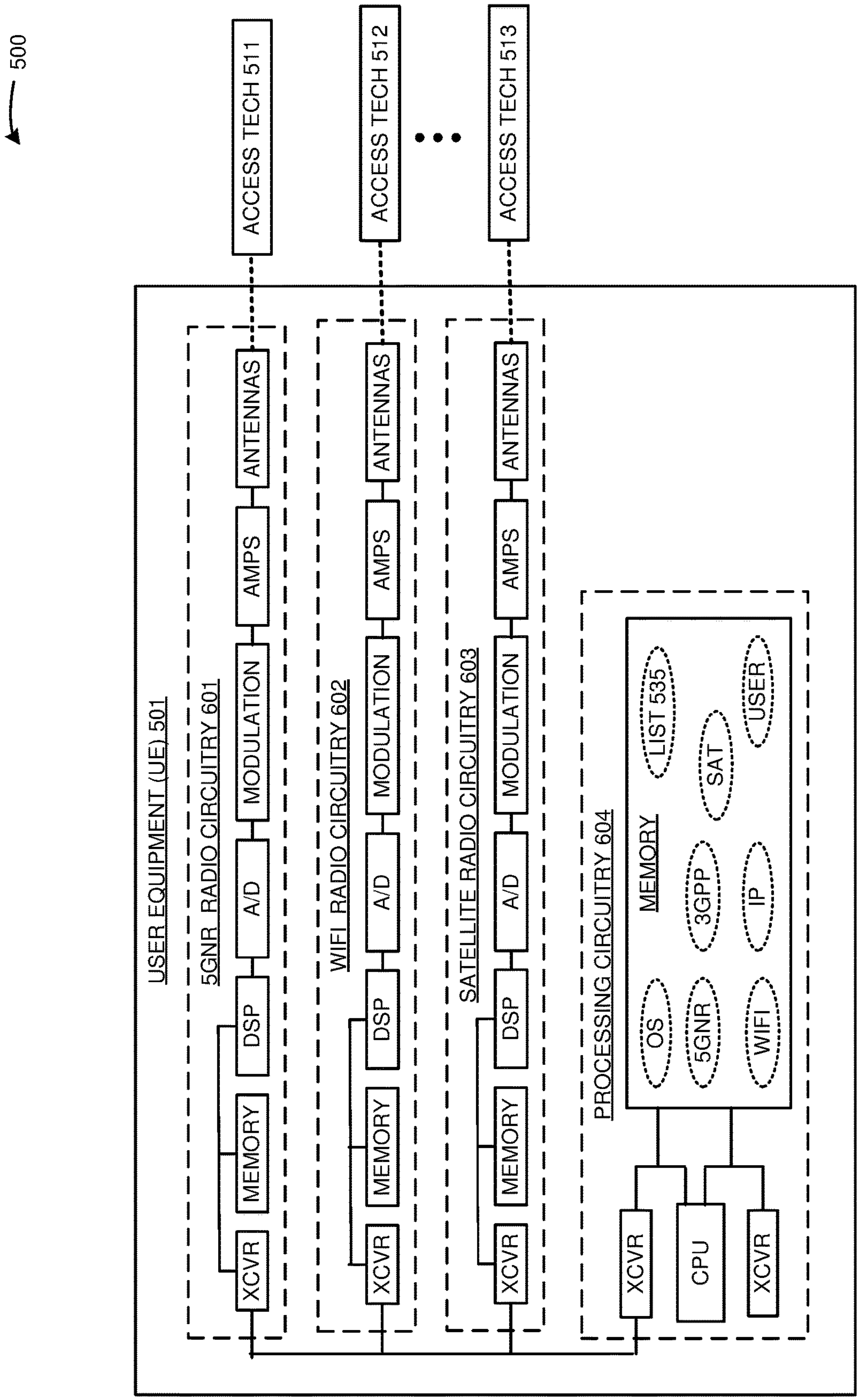

500
ACCESS TECH 511
ACCESS TECH 512
ACCESS TECH 513
USER EQUIPMENT (UE) 501
5GNR RADIO CIRCUITRY 601
WIFI RADIO CIRCUITRY 602
SATELLITE RADIO CIRCUITRY 603
ANTENNAS
AMPS
MODULATION
A/D
DSP
MEMORY
XCVR
PROCESSING CIRCUITRY 604
MEMORY
LIST 535
USER
SAT
3GPP
IP
OS
5GNR
WIFI
CPU
XCVR

FIGURE 6

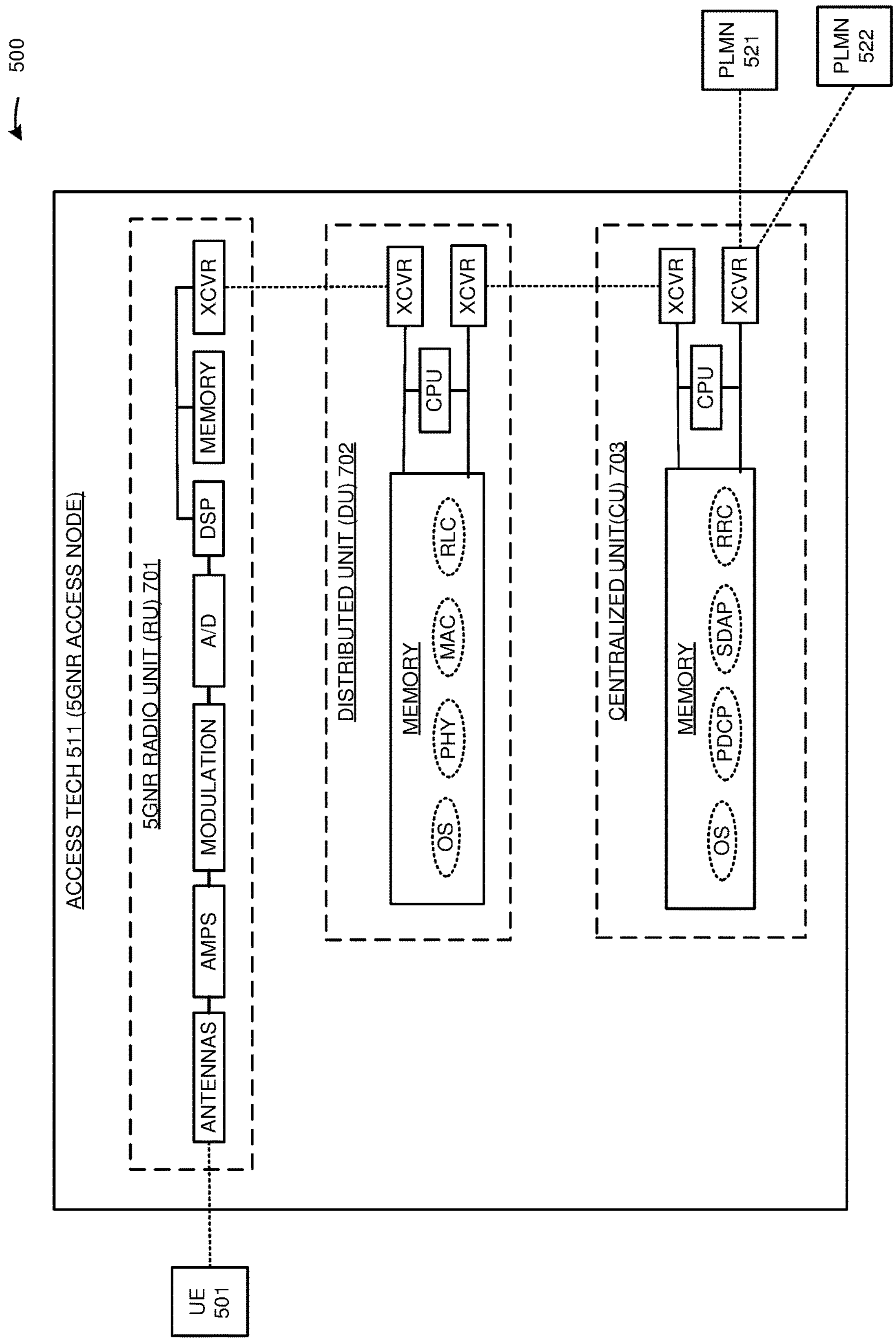

500
ACCESS TECH 511 (5GNR ACCESS NODE)
5GNR RADIO UNIT (RU) 701
ANTENNAS
AMPS
MODULATION
A/D
DSP
MEMORY
XCVR
DISTRIBUTED UNIT (DU) 702
XCVR
CPU
XCVR
MEMORY
OS
PHY
MAC
RLC
CENTRALIZED UNIT(CU) 703
XCVR
CPU
XCVR
MEMORY
OS
PDCP
SDAP
RRC
UE 501
PLMN 521
PLMN 522

FIGURE 7

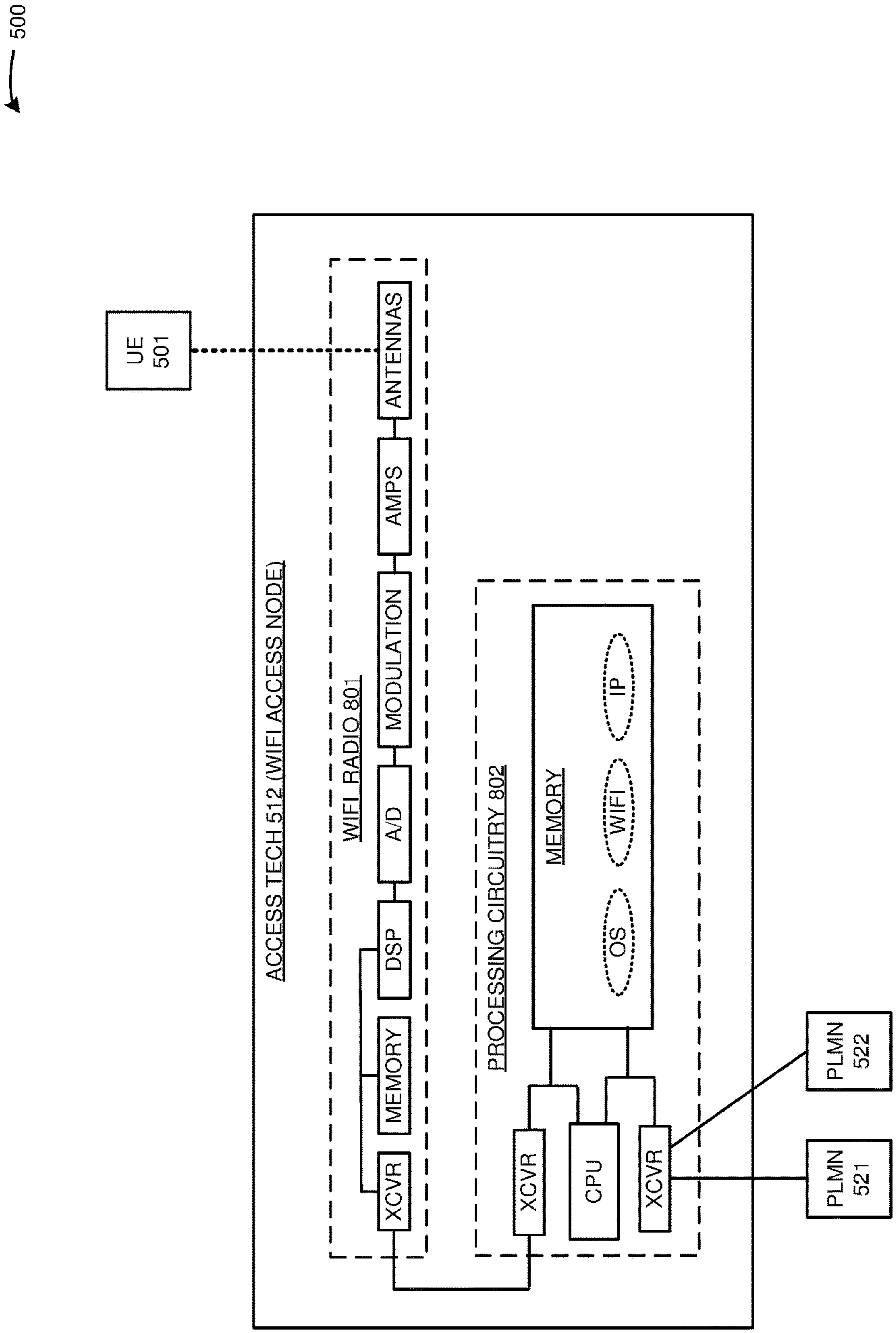

500
UE 501
ACCESS TECH 512 (WIFI ACCESS NODE)
WIFI RADIO 801
ANTENNAS
AMPS
MODULATION
A/D
DSP
MEMORY
XCVR
PROCESSING CIRCUITRY 802
MEMORY
OS
WIFI
IP
XCVR
CPU
XCVR
PLMN 522
PLMN 521

FIGURE 8

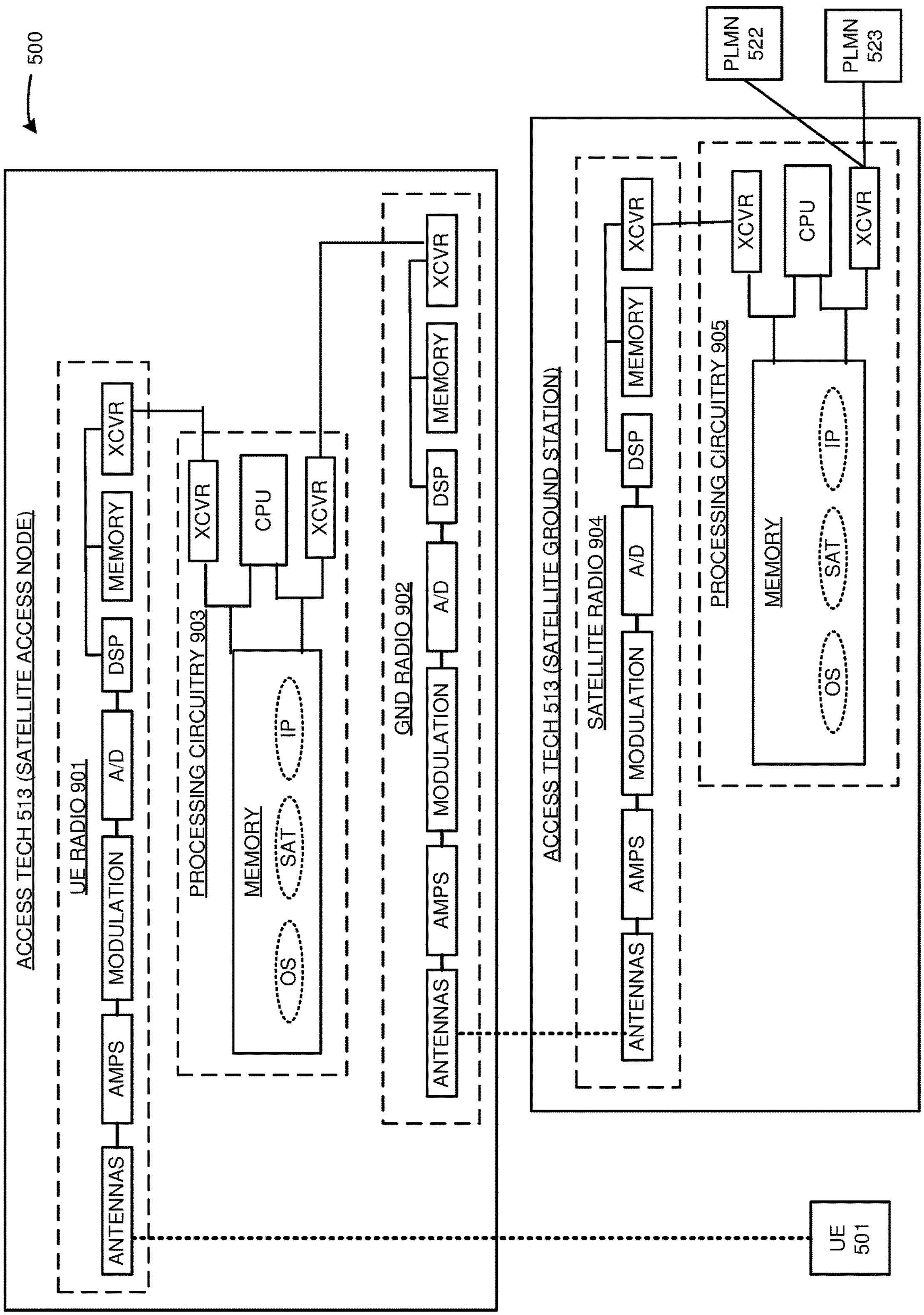

500
ACCESS TECH 513 (SATELLITE ACCESS NODE)
UE RADIO 901
ANTENNAS
AMPS
MODULATION
A/D
DSP
MEMORY
XCVR
PROCESSING CIRCUITRY 903
MEMORY
OS
SAT
IP
XCVR
CPU
XCVR
GND RADIO 902
ANTENNAS
AMPS
MODULATION
A/D
DSP
MEMORY
XCVR
ACCESS TECH 513 (SATELLITE GROUND STATION)
SATELLITE RADIO 904
ANTENNAS
AMPS
MODULATION
A/D
DSP
MEMORY
XCVR
PROCESSING CIRCUITRY 905
MEMORY
OS
SAT
IP
XCVR
CPU
XCVR
PLMN 522
PLMN 523
UE 501

FIGURE 9

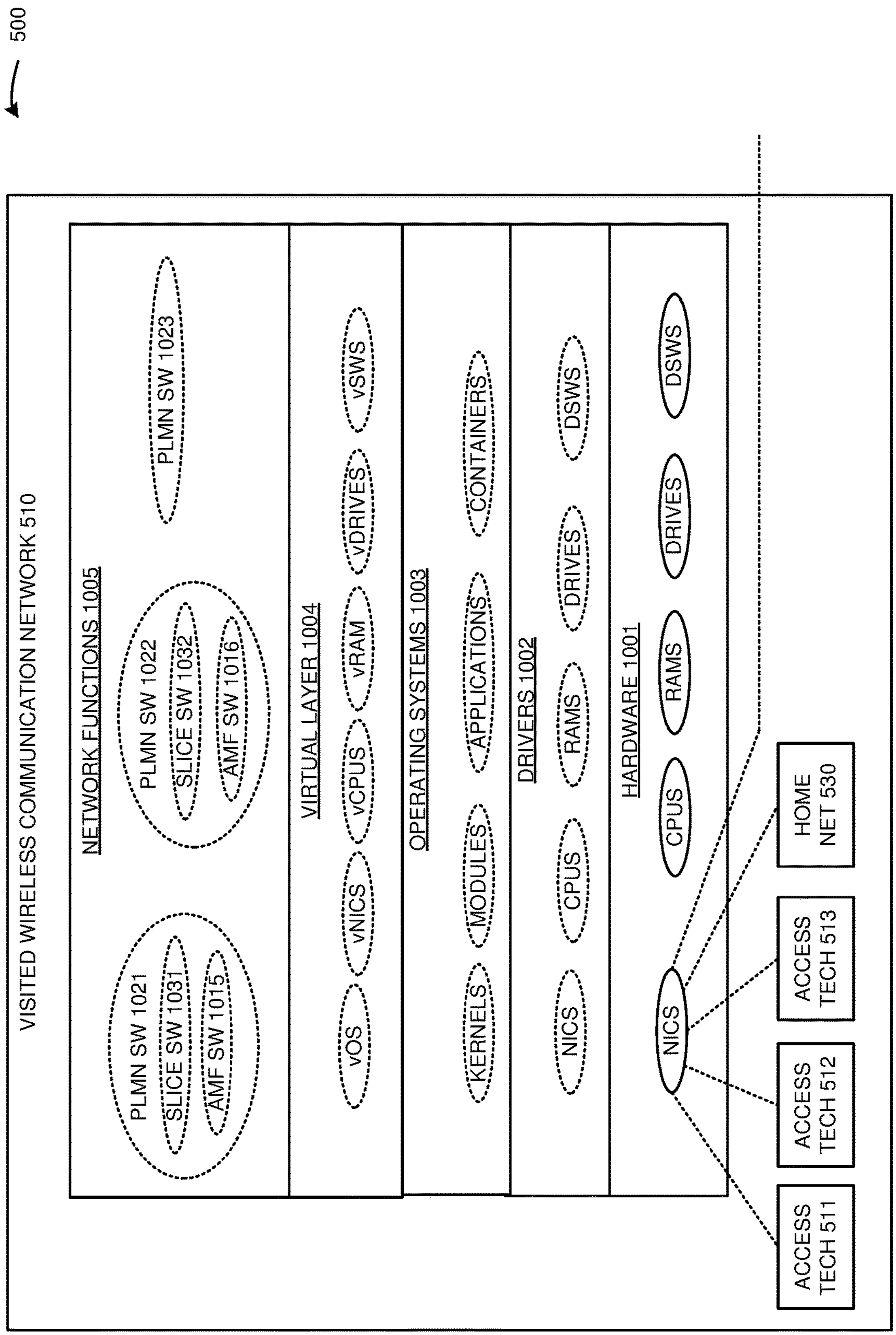

500
VISITED WIRELESS COMMUNICATION NETWORK 510
NETWORK FUNCTIONS 1005
PLMN SW 1021
SLICE SW 1031
AMF SW 1015
PLMN SW 1022
SLICE SW 1032
AMF SW 1016
PLMN SW 1023
VIRTUAL LAYER 1004
vOS
vNICS
vCPUS
vRAM
vDRIVES
vSWS
OPERATING SYSTEMS 1003
KERNELS
MODULES
APPLICATIONS
CONTAINERS
DRIVERS 1002
NICS
CPUS
RAMS
DRIVES
DSWS
HARDWARE 1001
NICS
CPUS
RAMS
DRIVES
DSWS
ACCESS TECH 511
ACCESS TECH 512
ACCESS TECH 513
HOME NET 530

FIGURE 10

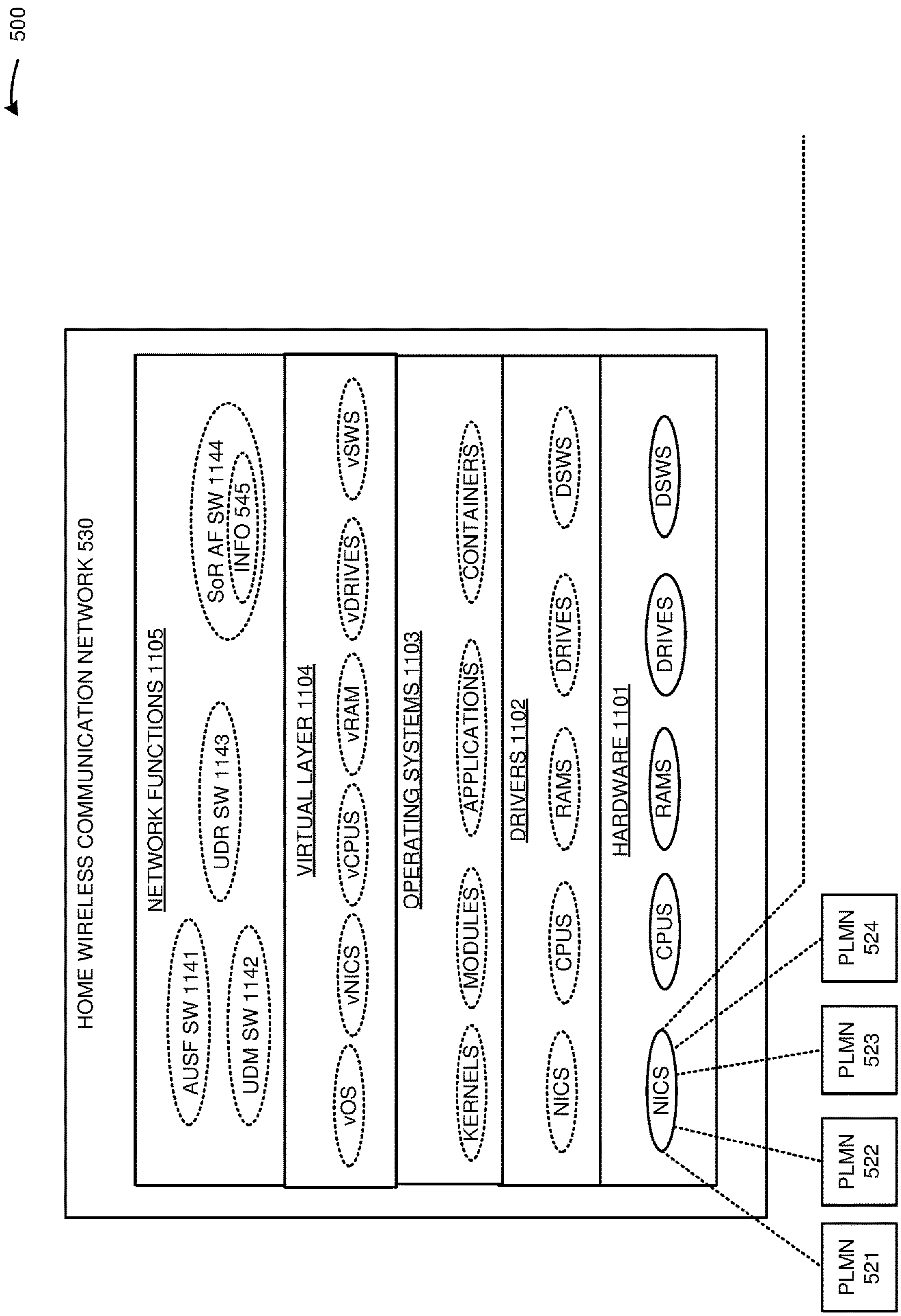

500
HOME WIRELESS COMMUNICATION NETWORK 530
NETWORK FUNCTIONS 1105
AUSF SW 1141
UDM SW 1142
UDR SW 1143
SoR AF SW 1144
INFO 545
VIRTUAL LAYER 1104
vOS
vNICS
vCPUS
vRAM
vDRIVES
vSWS
OPERATING SYSTEMS 1103
KERNELS
MODULES
APPLICATIONS
CONTAINERS
DRIVERS 1102
NICS
CPUS
RAMS
DRIVES
DSWS
HARDWARE 1101
NICS
CPUS
RAMS
DRIVES
DSWS
PLMN 521
PLMN 522
PLMN 523
PLMN 524

FIGURE 11

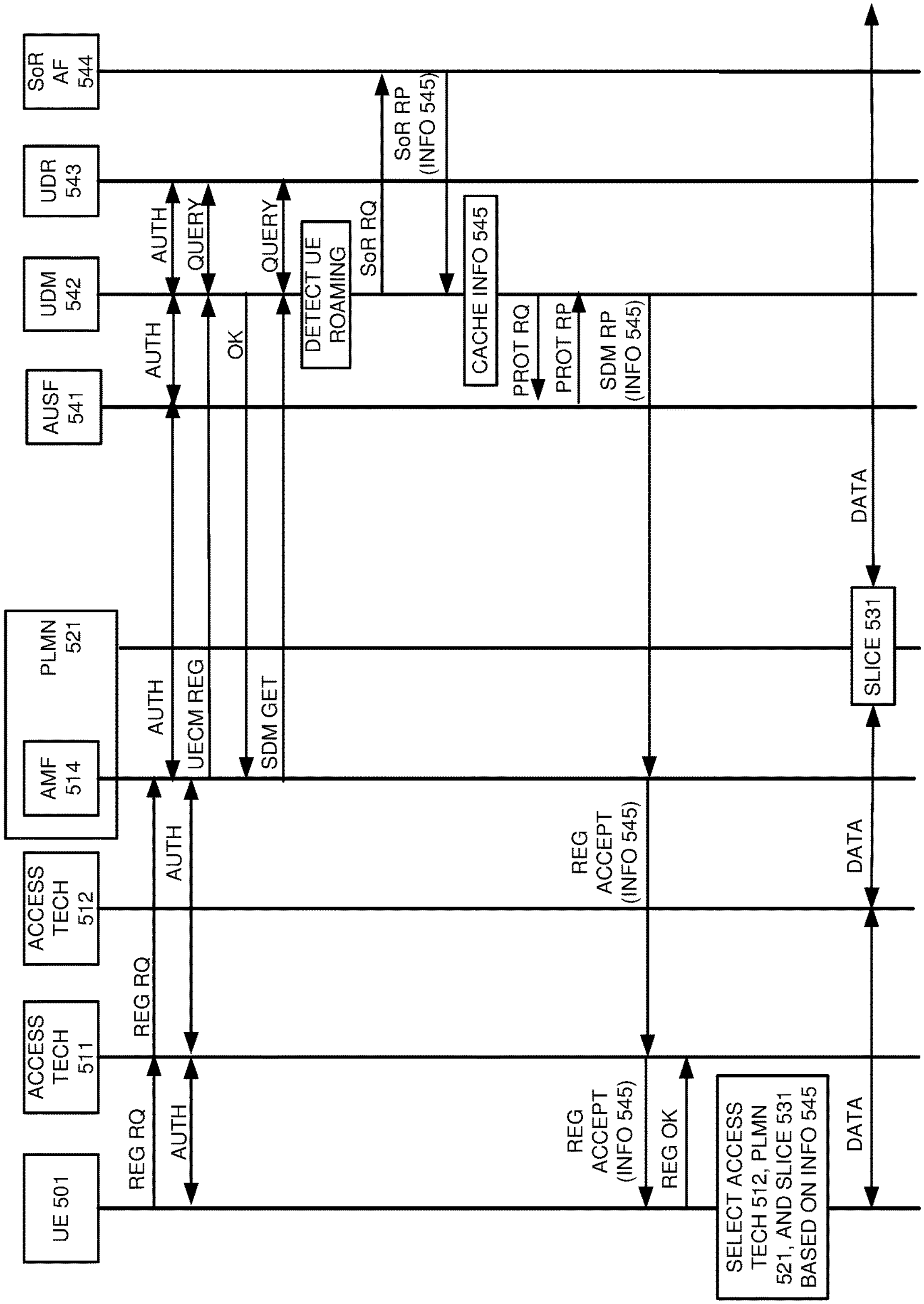

UE 501
ACCESS TECH 511
ACCESS TECH 512
AMF 514
PLMN 521
AUSF 541
UDM 542
UDR 543
SoR AF 544
REG RQ
REG RQ
AUTH
AUTH
AUTH
AUTH
AUTH
UECM REG
QUERY
OK
SDM GET
QUERY
DETECT UE ROAMING
SoR RQ
SoR RP (INFO 545)
CACHE INFO 545
PROT RQ
PROT RP
SDM RP (INFO 545)
REG ACCEPT (INFO 545)
REG ACCEPT (INFO 545)
REG OK
SELECT ACCESS TECH 512, PLMN 521, AND SLICE 531 BASED ON INFO 545
DATA
DATA
DATA
SLICE 531

FIGURE 12

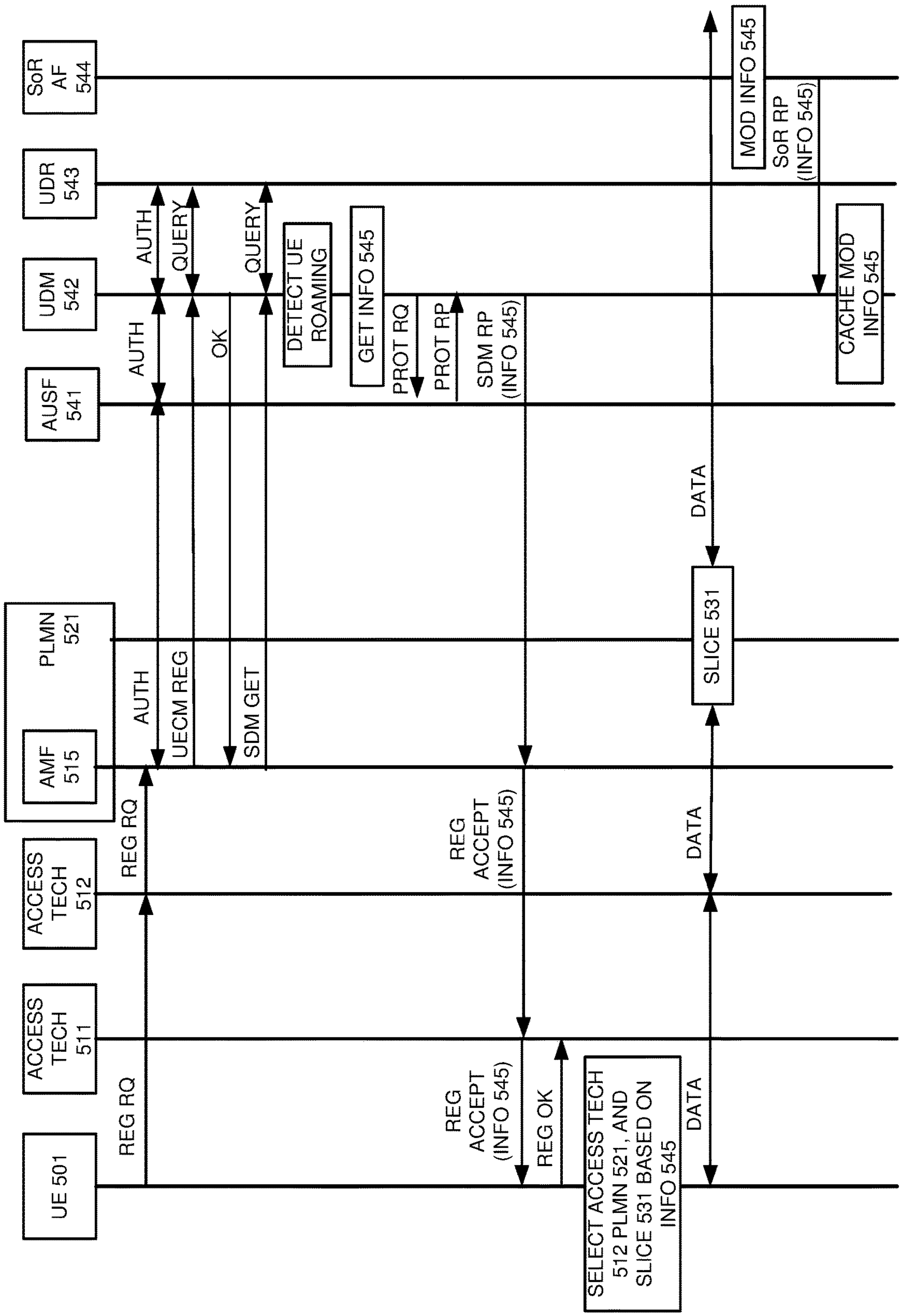

UE 501
ACCESS TECH 511
ACCESS TECH 512
AMF 515
PLMN 521
AUSF 541
UDM 542
UDR 543
SoR AF 544
REG RQ
REG RQ
AUTH
AUTH
AUTH
AUTH
UECM REG
QUERY
OK
SDM GET
QUERY
DETECT UE ROAMING
GET INFO 545
PROT RQ
PROT RP
SDM RP (INFO 545)
REG ACCEPT (INFO 545)
REG ACCEPT (INFO 545)
REG OK
SELECT ACCESS TECH 512 PLMN 521, AND SLICE 531 BASED ON INFO 545
DATA
DATA
SLICE 531
DATA
MOD INFO 545
SoR RP (INFO 545)
CACHE MOD INFO 545

FIGURE 13

SLICE CONTROL OF A WIRELESS COMMUNICATION DEVICE IN A VISITED WIRELESS COMMUNICATION NETWORK

TECHNICAL BACKGROUND

[0001] Wireless communication networks provide wireless data services to wireless communication devices like phones, computers, and other user devices. The wireless data services may include internet-access, data messaging, video conferencing, or some other data communication product. The wireless communication networks comprise wireless access nodes like Wireless Fidelity (WIFI) hotspots, Fifth Generation New Radio (5GNR) cell towers, and satellites in earth orbit. The different types of wireless access nodes represent different access technologies. The wireless communication networks further comprise network elements the process network signaling and handle user data like Access and Mobility Management Functions, User Plane Functions (UPFs), Unified Data Management (UDMs), and Application Functions (AFs). Different sets of wireless access nodes and network elements represent different Public Land Mobile Networks (PLMNs). Thus, a wireless communication network may offer several types of access technologies and several different PLMNs.

[0002] The wireless communication devices are homed to a home wireless communication network. The wireless communication devices use visited wireless communication networks when their home wireless communication network is not available. The visited wireless communication networks communicate with the home wireless communication networks to obtain authorization to serve the visiting wireless communication devices. The visited wireless communication networks also communicate with the home wireless communication networks to obtain instructions on how to serve the visiting wireless communication devices. One such piece of information comprises a network list that instructs the visiting wireless communication devices to select the highest priority access technologies and PLMNs that are available in the visited wireless communication networks. A special network element-called a Steering-of-Roaming AF—is used to serve these network lists to the wireless communication devices over other network elements.

[0003] Wireless network slices comprise network elements like UPFs that are customized for specific user applications and network services. The wireless communication devices request the specific wireless network slice for their current user application and network service. The wireless communication networks then deliver this network service using the requested wireless network slice. For example, a wireless communication device may use a low-latency wireless network slice to serve a low-latency user application.

[0004] Unfortunately, the use of the SoR AF to serve the network lists does not effectively and efficiently indicate wireless network slices. Moreover, the use of the SoR AF to serve the network lists prevents the delivery of wireless communication services from the preferred wireless network slices in the visited wireless communication networks.

TECHNICAL OVERVIEW

[0005] In some examples, a wireless communication device is controlled in a visited wireless communication network. A slice indicator for a visited wireless network slice in the visited wireless communication network is stored. A request is received from the visited wireless communication network for the wireless communication device, and in response to receiving the request, the slice indicator is retrieved for the visited wireless communication network and transferred to the wireless communication device over the visited wireless communication network. The wireless communication device communicates using the visited wireless network slice in the visited wireless communication network in response to receiving the slice indicator.

[0006] In some examples, a wireless communication device is controlled in a visited Public Land Mobile Network (PLMN). A Steering-of-Roaming Application Function (SoR-AF) stores a slice indicator for a visited wireless network slice in the visited PLMN. A Unified Data Management (UDM) receives a request from the visited PLMN for the wireless communication device, and in response to receiving the request, the UDM retrieves the slice indicator for the visited PLMN from the SoR-AF and transfers the slice indicator to the wireless communication device over the visited PLMN. The wireless communication device communicates using the visited wireless network slice in the visited PLMN in response to receiving the slice indicator.

[0007] In some examples, a wireless communication system controls a wireless communication device in a visited wireless communication network. A network database stores a slice indicator for a visited wireless network slice in the visited wireless communication network. A network controller receives a request from the visited wireless communication network for the wireless communication device, and in response to receiving the request, the network controller retrieves the slice indicator for the visited wireless communication network from the network database and transfers the slice indicator to the wireless communication device over the visited wireless communication network. The wireless communication device communicates using the visited wireless network slice in the visited wireless communication network in response to receiving the slice indicator.

DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** illustrates an exemplary data communication system to control a roaming wireless device in a visited wireless network.

[0009] FIG. **2** illustrates an exemplary operation of the data communication system to control the roaming wireless device in the visited wireless network.

[0010] FIG. **3** illustrates an exemplary operation of the data communication system to control the roaming wireless device in the visited wireless network.

[0011] FIG. **4** illustrates exemplary processing circuitry to control roaming wireless devices visited wireless networks.

[0012] FIG. **5** illustrates an exemplary wireless communication system to control roaming wireless User Equipment (UEs) in visited wireless communication networks.

[0013] FIG. **6** illustrates an exemplary UE in the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0014] FIG. **7** illustrates an exemplary Fifth Generation New Radio (5GNR) access node in the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0015] FIG. **8** illustrates an exemplary Wireless Fidelity (WIFI) access node in the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0016] FIG. **9** illustrates an exemplary satellite access node and ground station in the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0017] FIG. **10** illustrates an exemplary visited wireless communication network in the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0018] FIG. **11** illustrates an exemplary home wireless communication network in the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0019] FIG. **12** illustrates an exemplary operation of the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

[0020] FIG. **13** illustrates an exemplary operation of the wireless communication system to control the roaming wireless UEs in the visited wireless communication networks.

DETAILED DESCRIPTION

[0021] FIG. **1** illustrates exemplary data communication system **100** to control roaming wireless device **101** in visited wireless network **110**. Data communication system **100** comprises network controller **102**, network database **103**, and visited wireless network **110**. Visited wireless network **110** comprises roaming wireless device **101** and wireless network slices **111-113**. Roaming wireless device **101** comprises a phone, computer, vehicle, sensor, or some other data communication apparatus. Network controller **102** comprises one or more network elements that control the delivery of wireless communication services to user devices like roaming wireless device **101**. In some examples, network controller **102** comprises a Unified Data Management (UDM). Network database **103** comprises one or more network elements that store data like slice list **104** to support network controller **102**. In some examples, network database **103** comprises a Steering-of-Roaming Application Function (SoR-AF). Network slices **111-113** comprise one or more network elements that process user data for roaming wireless device **101**. In some examples, network slices **111-113** comprise User Plane Functions (UPFs). The amount of wireless devices, wireless networks, and network slices that are shown on FIG. **1** has been simplified for clarity of illustration, and is not intended to be limiting.

[0022] In some examples, network database **103** stores slice indicator **104** for visited wireless network slice **112** in visited wireless network **110**. Slice indicator **104** may comprise a slice type, slice name, slice code, or some other information that roaming wireless device **101** can use to select network slices. Network controller **102** receives a request from the visited wireless network **110** for roaming wireless device **101** (arrow #1). In response to receiving the request, network controller **102** retrieves slice indicator **104** for slice **112** in visited wireless network **110** from network database **103** (arrows #2-3). Network controller **102** transfers slice indicator **104** to roaming wireless device **101** over visited wireless network **110** (arrow #4). Roaming wireless device **101** communicates using visited wireless network slice **112** in visited wireless network **110** in response to receiving slice indicator **104** (arrows #5).

[0023] Network controller **102** caches slice indicator **104** for visited wireless network **110** in a controller memory. In response to receiving another request (arrow #6), network controller **102** retrieves cached slice indicator **104** for visited wireless network **110** from the controller memory and transfers cached slice indicator **104** to roaming wireless device **101** over the visited wireless network **110** (arrow #7). Roaming wireless device **101** communicates using wireless network slice **112** in visited wireless network **110** in response to receiving cached slice indicator **104** (arrows #8).

[0024] Network database **103** then modifies slice indicator **104** for the visited wireless network **110**. For example, old slice indicator **104** that indicates network slice **112** may be changed to indicate network slice **113**. In response to the modification, network database **103** transfers modified slice indicator **104** for visited wireless network **110** to network controller **102** (arrow #9). Network controller **102** caches modified slice indicator **104** for visited wireless network **110** in the controller memory. In response to receiving another request (arrow #10), network controller **102** retrieves modified slice indicator **104** for visited wireless network **110** from the controller memory and transfers modified slice indicator to roaming wireless device **101** over the visited wireless network **110** (arrow #11). Roaming wireless device **101** now communicates using wireless network slice **113** in visited wireless network **110** in response to receiving modified slice indicator **104** (arrows #12).

[0025] In some examples, network database **103** stores a Public Land Mobile Network Identifier (PLMN ID) for visited wireless network **110** and stores slice indicator **104** in association with the PLMN ID. Network controller **102** receives the request that indicates the PLMN ID from visited wireless network **110**. Network controller **102** retrieves slice indicator **104** based on the PLMN ID in the request and the association of the PLMN ID and slice indicator **104** in network database **103**.

[0026] In some examples, network database **103** stores a user application indicator for visited wireless network **110** and stores slice indicator **104** in association with the user application indicator. The user application indicator is for a user application executing in roaming wireless device **101**. Network controller **102** receives the request that indicates the user application indicator from visited wireless network **110**. Network controller **102** retrieves slice indicator **104** based on the user application indicator in the request and the association of the user application indicator and slice indicator **104** in network database **103**.

[0027] In some examples, network database **103** stores an access technology indicator for visited wireless network **110** and stores slice indicator **104** in association with the access technology indicator. The access technology indicator is for network access in visited wireless network **110** like Fifth Generation New Radio (5GNR), Wireless Fidelity (WIFI), communication satellites, and the like. Network controller **102** receives the request that indicates the access technology indicator from visited wireless network **110**. Network controller **102** retrieves slice indicator **104** based on the access technology indicator in the request and the association of the access technology indicator and slice indicator **104** in network database **103**.

[0028] In some examples, network database **103** stores a prioritized slice list that includes slice indicator **104** and additional slice indicators in a priority order. Network controller **102** retrieves the prioritized slice list and transfers the prioritized slice list **104** to roaming wireless device **101** in response to receiving the request. Roaming wireless device **101** then selects and uses the highest-priority network slices based on the prioritized slice list.

[0029] Roaming wireless device **101** and visited wireless network **110** comprise radios that wirelessly communicate using wireless protocols like Wireless Fidelity (WIFI), Fifth Generation New Radio (5GNR), Long Term Evolution (LTE), Low-Power Wide Area Network (LP-WAN), Near-Field Communications (NFC), Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), and satellite data communications. Roaming wireless device **101**, network controller **102**, network database **103**, visited wireless network **110**, and network slices **111-113** comprise microprocessors, software, memories, transceivers, bus circuitry, and/or some other data processing components. The microprocessors comprise Digital Signal Processors (DSP), Central Processing Units (CPU), Graphical Processing Units (GPU), Application-Specific Integrated Circuits (ASIC), and/or some other data processing hardware. The memories comprise Random Access Memory (RAM), flash circuitry, disk drives, and/or some other type of data storage. The memories store software like operating systems, utilities, protocols, applications, and functions. The microprocessors retrieve the software from the memories and execute the software to drive the operation of data communication system **100** as described herein.

[0030] FIG. **2** illustrates an exemplary operation of data communication system **100** to control roaming wireless device **101** in visited wireless network **110**. The operation may vary in other examples. Network database **103** stores slice indicator **104** for visited wireless network slice **112** in visited wireless network **110** (**201**). Network controller **102** receives a request from the visited wireless network **110** for roaming wireless device **101** (**202**). In response to receiving the request, network controller **102** retrieves slice indicator **104** for slice **112** in visited wireless network **110** from network database **103** and transfers slice indicator **104** to roaming wireless device **101** over visited wireless network **110** (**203**). Roaming wireless device **101** communicates using visited wireless network slice **112** in visited wireless network **110** in response to receiving slice indicator **104** (**204**).

[0031] FIG. **3** illustrates an exemplary operation of data communication system **100** to control roaming wireless device **101** in visited wireless network **110**. The operation may vary in other examples. Network database **103** stores slice indicator **104** for visited wireless network slice **112** in visited wireless network **110**. Roaming user device **101** attaches to visited wireless network **110**. Visited wireless network **110** transfers a service request to network controller **102** for roaming wireless device **101**. In response to receiving the request, network controller **102** authenticates and authorizes roaming wireless device **101**. Network controller **102** retrieves roaming information for visited wireless network **110** from network database **103**. The roaming information includes slice indicator **104** and typically other data like preferred networks and access technologies. Network controller **110** transfers an authorization (AUTH) and the roaming information which includes slice indicator **104** to visited wireless network **110**. Visited wireless network **110** transfers the roaming information which includes slice indicator **104** to roaming wireless device **101**. Roaming wireless device **101** selects wireless network slice **112** based on slice indicator **104**. Roaming wireless device **101** communicates using visited wireless network slice **112** in visited wireless network **110** in response to receiving slice indicator **104**. Network controller also caches the roaming information which includes slice indicator **104** in a controller cache memory.

[0032] Roaming user device **101** subsequently attaches to visited wireless network **110**. Visited wireless network **110** transfers a service request to network controller **102** for roaming wireless device **101**. In response to receiving the request, network controller **102** authenticates and authorizes roaming wireless device **101**. Network controller **102** retrieves roaming information for visited wireless network **110** from its cache memory and not from network database **103**. The roaming information includes slice indicator **104** and typically other data like preferred networks and access technologies. Network controller **110** transfers an authorization and the roaming information which includes slice indicator **104** to visited wireless network **110**. Visited wireless network **110** transfers the roaming information which includes slice indicator **104** to roaming wireless device **101**. Roaming wireless device **101** selects wireless network slice **112** based on slice indicator **104**. Roaming wireless device **101** communicates using visited wireless network slice **112** in visited wireless network **110** in response to receiving slice indicator **104**.

[0033] Advantageously, network controller **102** serves network list **104** that effectively and efficiently indicates wireless network slices. Moreover, the use of network list **104** enables the delivery of wireless communication services from the preferred network slices in the visited wireless communication network **110**.

[0034] FIG. **4** illustrates exemplary processing circuitry **400** to control roaming wireless devices in visited wireless networks. Processing circuitry **400** comprises an example of roaming wireless device **101**, network controller **102**, network database **103**, and visited wireless network **110**, although device **101**, controller **110**, database **103**, and network **110** may differ. Processing circuitry **400** comprises machine-readable storage media **401-403** and microprocessors **407-409** that are communicatively coupled. Machine-readable storage media **401-403** store processing instructions **404-406** in a non-transitory manner. Microprocessors **407-409** comprise DSPs, CPUs, GPUs, ASICs, and/or some other data processing hardware. Machine-readable storage media **401-403** comprises RAM, flash circuitry, disk drives, and/or some other type of data storage apparatus. Microprocessors **407-409** retrieve processing instructions **404-406** from non-transitory machine-readable storage media **401-403**. Microprocessors **407-409** execute processing instructions **404-406** to control roaming wireless devices in visited wireless networks as described above for data communication system **100** and as described below for wireless communication network **500**. The amount of storage media, microprocessors, processing instructions that are shown in FIG. **4** may vary in other examples.

[0035] FIG. **5** illustrates exemplary wireless communication system **500** to control roaming wireless User Equipment (UEs) **501-503** in visited wireless communication networks **510** and **520**. Wireless communication system **500** comprises an example of data communication system **100** and processing circuitry **400**, although system **100** and circuitry **400** may differ. Wireless communication system **500** comprises visited wireless communication network **510**, visited wireless communication network **520**, and home wireless communication network **530**. Visited wireless communication network **510** comprises User Equipment (UE) **501-502**, access technologies **511-513**, and Public Land Mobile Networks (PLMNs) **521-523**. PLMN **521** comprises Access and Mobility Management Function (AMF) **515** and slice **531**. PLMN **522** comprises AMF **516** and slice **532**. Home wireless communication network **530** comprises Authorization Server Function (AUSF) **541**, Unified Data Management (UDM) **542**, Unified Data Repository (UDR) **543**, and Steering-of-Roaming Application Function (SoR AF) **544**. Visited wireless communication network **520** comprises UE **503**, access technologies **514** and PLMNs **524**. PLMNs **521-524** comprise additional slices for selection by UEs **501-503**, but the amount of slices shown on FIG. **5** is simplified for clarity of illustration, and is not intended to be limiting.

[0036] SoR AF **544** stores network information (NET INFO) **545** for visited wireless communication network **510** and home wireless communication network **530**. Network information **545** indicates prioritized networks, access technologies, and slices for UEs that are homed to home wireless communication network **530** but that are visiting visited wireless communication network **510**. PLMN **521**, access technology **512**, and slice **531** have the highest priority. PLMN **521**, access technology **511**, and slice **531** have the second highest priority. PLMN **522**, access technology **513**, and slice **532** have the third highest priority. PLMN **522**, access technology **512**, and slice **532** have the fourth highest priority.

[0037] UE **501** is visiting wireless communication network **510** and is homed to wireless communication network **530**. UE **501** initially attaches to access technology **511** (a 5GNR access node). UE **501** transfers a registration request to AMF **515** over access technology **511**. AMF **515** transfers an authentication request to AUSF **541**. AUSF **541** transfers the authentication request to UDM **542** which interacts with UDR **543** to obtain and generate authentication data for UE **501**. UDM **542** transfers the authentication data to AUSF **541**. AUSF **541** transfers the authentication data to AMF **515**. AMF **515** and UE **501** perform an authentication session over access technology **511**.

[0038] After UE authentication, AMF **515** transfers a User Equipment Context Management (UECM) registration to UDM **542**. UDM **542** queries UDR **543** for context for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. AMF **515** transfers a Subscriber Data Management GET message to UDM **542**. UDM **542** queries UDR **543** for subscriber data for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. UDM **542** detects that UE **501** is roaming on PLMN **521** in network **510** based on these SDM interactions, and in response, transfers Steering-of-Roaming request to SoR AF **544**. SoR AF **544** identifies SoR information for visited wireless communication network **510** which includes network information **545**. SoR AF **544** transfers an SoR response to UDM **542** that incudes network information **545**. UDM **542** caches network information **545** for PLMN **521** in visited wireless communication network **510**.

[0039] UDM **542** transfers an SoR protection request to AUSF **541**, and AUSF **541** returns an SoR protection response. After SoR protection is established, UDM **542** transfers an SoR response to AMF **515** that includes network information **545**. AMF **515** transfers a registration accept message that includes network information **545** to UE **501** over access technology **511**. UE **501** selects the highest priority network and access based on network information **545**—access technology **512**, PLMN **521**, and slice **531**. UE **501** establishes service and exchanges data over access technology **512**, PLMN **521**, and slice **531**.

[0040] Subsequently, UE **501** attaches to access technology **512**. UE **501** transfers a registration request to AMF **515** over access technology **512**. AMF **515** transfers an authentication request to AUSF **541**. AUSF **541** transfers the authentication request to UDM **542** which interacts with UDR **543** to obtain and generate authentication data for UE **501**. UDM **542** transfers the authentication data to AUSF **541**. AUSF **541** transfers the authentication data to AMF **515**. AMF **515** and UE **501** perform an authentication session over access technology **512**.

[0041] After UE authentication, AMF **515** transfers a UECM registration to UDM **542**. UDM **542** queries UDR **543** for context for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. AMF **515** transfers an SDM GET message to UDM **542**. UDM **542** queries UDR **543** for subscriber data for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. UDM **542** detects that UE **501** is roaming on PLMN **521** in visited network **510** based on the SDM interactions, and in response, retrieves network information **545** for PLMN **521** in visited network **510** from its cache. Note that UDM **542** does not need retrieve network information **545** from SoR AF **544**.

[0042] UDM **542** transfers an SoR protection request to AUSF **541**, and AUSF **541** returns an SoR protection response. After SoR protection is established, UDM **542** transfers an SoR response to AMF **515** that includes network information **545**. AMF **515** transfers a registration accept message that includes network information **545** to UE **501** over access technology **512**. UE **501** selects the highest priority network, access technology, and slice based on network information **545**—access tech **512**, PLMN **521**, and slice **531**. UE **501** establishes service and exchanges data over access technology **512**, PLMN **521**, and slice **531**.

[0043] Subsequently, network information **545** is modified in SoR AF **544**. For example, network information **545** may be modified to list PLMN **522** and slice **532** as higher priorities than PLMN **521** and slice **531**. In response to the modification, SoR AF **544** transfers modified network information **545** to UDM **542**. UDM **542** caches modified network information **545** for PLMN **521** in visited wireless network **510** in place of old network information **545**. As described above for old network information **545**, UDM **542** will retrieve modified network information **545** from its cache without accessing SoR AF **544** and will transfer modified network information **545** to UE **501** when UE **501** visits PLMN **521** in wireless communication network **510**. UE **501** will use modified network information **545** to select the highest priority PLMN, slice, and access technology. In this example, UE **501** will use modified network information **545** to switch to PLMN **522** and slice **532** instead of PLMN **521** and slice **531**.

[0044] UE **502** is also in visited wireless communication network **510** and is homed to home wireless communication network **530**. The above operation that was used above for

UE **501** would also be used for UE **502**—except that UDM **542** would use cached network information **545** from its cache for UE **502** if network information **545** is already available in the cache.

[0045] UE **503** is in visited wireless communication network **520** and is homed to home wireless communication network **530**. The above operation that was used above for UE **501** would also be used for UE **503** except that UDM **542** typically uses different network information for PLMNs **524** visited wireless communication network **520**.

[0046] FIG. **6** illustrates exemplary UE **501** in wireless communication system **500** to control roaming wireless UEs **501-503** in visited wireless communication networks **510** and **520**. UE **501** comprises an example of roaming wireless device **101**, although device **101** may differ. UEs **502-503** could be similar. UE **501** comprises Fifth Generation New Radio (5GNR) radio circuitry **601**, Wireless Fidelity (WIFI) radio circuitry **602**, satellite radio circuitry **603**, and processing circuitry **604**. Radio circuitry **601-603** comprises antennas, amplifiers, filters, modulation, analog-to-digital interfaces, DSPs, memories, and transceivers (XCVRs) that are coupled over bus circuitry. Processing circuitry **604** comprises one or more CPUs, one or more memories, and one or more transceivers that are coupled over bus circuitry. The one or more memories in processing circuitry **604** store software like an Operating System (OS), 5GNR Application (5GNR), 3GPP Application (3GPP), WIFI Application (WIFI), Satellite Application (SAT), Internet Protocol application (IP), and eventually, network information **545**. The antennas in radio circuitry **601-603** exchange wireless signals with access technologies **511-513**. Transceivers in radio circuitry **601-603** are coupled to transceivers in processing circuitry **604**. In processing circuitry **604**, the one or more CPUs retrieve the software from the one or more memories and execute the software to direct the operation of UE **501** as described herein. For example, the CPU may execute the 3GPP app along with network information **545** to select the highest priority PLMNs, slices, and access technologies for visited wireless communication network **510**.

[0047] FIG. **7** illustrates exemplary access technology **511** (a Fifth Generation New Radio (5GNR) access node) in wireless communication system **500** to control roaming wireless UEs **501-503** in visited wireless communication networks **510** and **520**. The 5GNR access node comprises an example of visited wireless network **110** and processing circuitry **400**, although network **110** and circuitry **400** may differ. The 5GNR access node comprises 5GNR Radio Unit (RU) **701**, Distributed Unit (DU) **702**, and Centralized Unit (CU) **703**. 5GNR RU **701** comprises antennas, amplifiers, filters, modulation, analog-to-digital interfaces, DSP, memory, radio applications, and transceivers that are coupled over bus circuitry. DU **702** comprises memory, CPU, user interfaces and components, and transceivers that are coupled over bus circuitry. The memory in DU **702** stores operating system and 5GNR network applications for Physical Layer (PHY), Media Access Control (MAC), and Radio Link Control (RLC). CU **703** comprises memory, CPU, and transceivers that are coupled over bus circuitry. The memory in CU **703** stores an operating system and 5GNR network applications for Packet Data Convergence Protocol (PDCP), Service Data Adaption Protocol (SDAP), and Radio Resource Control (RRC). The antennas in 5GNR RU **701** are wirelessly coupled to UE **501** over 5GNR links. Transceivers in 5GNR RU **701** are coupled to transceivers in DU **702**. Transceivers in DU **702** are coupled to transceivers in CU **703**. Transceivers in CU **703** are coupled to transceivers in PLMNs **521-522**. The DSP and CPU in RU **701**, DU **702**, and CU **703** execute the radio applications, operating systems, and network applications to exchange data and signaling between UE **501** and PLMNs **521-522** as described herein.

[0048] FIG. **8** illustrates exemplary access technology **512** (a Wireless Fidelity (WIFI) access node) in wireless communication system **500** to control roaming wireless UEs **501-503** in visited wireless communication networks **510** and **520**. The WIFI access node comprises an example of visited wireless network **110** and processing circuitry **400**, although network **110** and circuitry **400** may differ. The WIFI access node comprises WIFI radio **801** and processing circuitry **802**. Radio **801** comprises antennas, amplifiers, filters, modulation, analog-to-digital interfaces, DSPs, memories, and transceivers that are coupled over bus circuitry. Processing circuitry **802** comprises one or more CPUs, one or more memories, and one or more transceivers that are coupled over bus circuitry. The one or more memories in processing circuitry **802** store software like an Operating System (OS), WIFI application (WIFI), and IP application (IP). The antennas in WIFI radio **801** exchange WIFI signals with UE **501**. Transceivers in radio **801** are coupled to transceivers in processing circuitry **802**. Transceivers in processing circuitry **802** are coupled to transceivers in PLMNs **521-522**. In processing circuitry **802**, the one or more CPUs retrieve the software from the one or more memories and execute the software to exchange data and signaling between UE **501** and PLMNs **521-522** as described herein.

[0049] FIG. **9** illustrates exemplary access technology **513** (a satellite access node and satellite ground station) in wireless communication system **500** to control roaming wireless UEs **501-503** in visited wireless communication networks **510** and **520**. The satellite access node and satellite ground station comprise examples of visited wireless network **110** and processing circuitry **400**, although network **110** and circuitry **400** may differ. The satellite access node comprises UE radio **901**, GND radio **902** and processing circuitry **903**. The satellite ground station comprises satellite radio **904** and processing circuitry **905**. Radios **901-902** and **904** comprise antennas, amplifiers, filters, modulation, analog-to-digital interfaces, DSPs, memories, and transceivers that are coupled over bus circuitry. Processing circuitry **903** and **905** comprise one or more CPUs, one or more memories, and one or more transceivers that are coupled over bus circuitry. The one or more memories in processing circuitry **903** and **905** store software like an Operating System (OS), Satellite Application (SAT), and IP Application (IP). The antennas in UE radio **901** exchange satellite signals with UE **501**. Transceivers in UE radio **901** are coupled to transceivers in processing circuitry **903**. Transceivers in processing circuitry **903** are coupled to transceivers in GND radio **902**. The antennas in GND radio **902** exchange satellite signals with antennas in satellite radio **904**, and the antennas in satellite radio **904** exchange the satellite signals with GND radio **902**. Transceivers in satellite radio **904** are coupled to transceivers in processing circuitry **905**. Transceivers in processing circuitry **905** are coupled to transceivers in PLMNs **522-523**. In processing circuitry **903** and **905**, the one or more CPUs retrieve the software from the one or more memories and execute the software to exchange data and signaling between UE **501** and PLMNs **522-523** as described herein.

[0050] FIG. **10** illustrates exemplary visited wireless communication network **510** in wireless communication system **500** to control roaming wireless UEs **501-503** in visited wireless communication networks **510** and **520**. Visited wireless communication network **510** comprises an example of visited wireless communication network **110** and processing circuitry **400**, although network **110** and circuitry **400** may differ. Visited wireless communication network **520** could be similar to network **510**. Visited wireless communication network **510** includes Network Function Virtualization Infrastructure (NFVI) equipment that comprises hardware **1001**, hardware drivers **1002**, operating systems **1003**, virtual layer **1004**, and network functions **1005**. Hardware **1001** comprises Network Interface Cards (NICS), CPUS, RAM, Flash/Disk Drives (DRIVES), and Data Switches (DSWS). Hardware drivers **1002** comprise software that is resident in the NICS, CPUS, RAM, DRIVES, and DSWS. Operating systems **1003** comprise kernels, modules, applications, and containers. Virtual layer **1004** comprises virtual Operating Systems (vOS), vNICS, vCPUS, vRAM, vDRIVES, and vSWS. Network Functions **1005** comprises PLMN SW **1021**, PLMN SW **1022**, and PLMN SW **1023**. PLMN SW **1021** comprises AMF SW **1015**, slice SW **1031**, and other network functions. PLMN SW **1022** comprises AMF SW **1016**, slice SW **1032**, and other network functions. The NICS in hardware **1001** are coupled to access technologies **511-513**, home network **530**, and external systems. Hardware **1001** executes hardware drivers **1002**, operating systems **1003**, virtual layer **1004**, and network functions **1005** to form and operate PLMNs **1021-1023**. Visited wireless communication network **510** comprises one or more microprocessors and one or more non-transitory machine-readable storage media that store processing instructions that direct visited wireless communication network **510** to exchange data and signaling between access technologies **511-513**, home network **530**, and external systems as described herein. Visited wireless communication network **510** may be located at a single site or be distributed across multiple geographic locations.

[0051] FIG. **11** illustrates exemplary home wireless communication network **530** in wireless communication system **500** to control roaming wireless UEs **501-503** in visited wireless communication networks **510** and **520**. Home wireless communication network **530** comprises an example of network controller **102**, network database **103**, and processing circuitry **400**, although controller **102**, database **103**, and circuitry **400** may differ. Home wireless communication network **530** includes NFVI equipment that comprises hardware **1101**, hardware drivers **1102**, operating systems **1103**, virtual layer **1104**, and network functions **1105**. Hardware **1101** comprises Network Interface Cards (NICS), CPUS, RAM, Flash/Disk Drives (DRIVES), and Data Switches (DSWS). Hardware drivers **1102** comprise software that is resident in the NICS, CPUS, RAM, DRIVES, and DSWS. Operating systems **1103** comprise kernels, modules, applications, and containers. Virtual layer **1104** comprises virtual Operating Systems (vOS), vNICS, vCPUS, vRAM, vDRIVES, and vSWS. Network Functions **1105** comprise AUSF SW **1141**, UDM SW **1142**, UDR SW **1143**, and SoR AF SW **1144**. The NICS in hardware **1001** are coupled to PLMNs **521-524** and external systems. Hardware **1101** executes hardware drivers **1102**, operating systems **1103**, virtual layer **1104**, and network functions **1105** to form and operate AUSF **541**, UDR **543**, UDR **543**, and SoR AF **544** as described herein. Home wireless communication network **530** includes NFVI equipment that comprises one or more microprocessors and one or more non-transitory machine-readable storage media that store processing instructions that direct home wireless communication network **530** to exchange data and signaling between PLMNs **521-524**, home network **530**, and external systems as described herein. Home wireless communication network **530** may be located at a single site or be distributed across multiple geographic locations.

[0052] FIG. **12** illustrates an exemplary operation of wireless communication system **500** to control roaming wireless UE **501** in visited wireless communication network **510**. The following operation may vary in other examples. UE **501** attaches to access technology **511** (a 5GNR access node). UE **501** transfers a registration request (REG RQ) to AMF **515** over access technology **511**. AMF **515** transfers an authentication request to AUSF **541**. AUSF **541** transfers the authentication request to UDM **542** which interacts with UDR **543** to obtain and generate authentication data for UE **501**. UDM **542** transfers the authentication data to AUSF **541**. AUSF **541** transfers the authentication data to AMF **515**. AMF **515** and UE **501** perform an authentication session over access technology **511**.

[0053] After UE authentication, AMF **515** transfers a User Equipment Context Management (UECM) registration to UDM **542**. UDM **542** queries UDR **543** for context for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. AMF **515** transfers a Subscriber Data Management (SDM) GET message to UDM **542**. UDM **542** queries UDR **543** for subscriber data for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. UDM **542** detects that UE **501** is roaming on PLMN **521** in visited network **510** based on the SDM interactions, and in response, transfers Steering-of-Roaming Request (SoR RQ) to SoR AF **544**. SoR AF **544** identifies SoR information for PLMN **521** in visited wireless communication network **510** which includes network information **545**. SoR AF **544** transfers an SoR Response (RP) to UDM **542** that incudes network information **545**. UDM **542** caches network information **545** for PLMN **521** in visited wireless communication network **510**.

[0054] UDM **542** transfers an SoR protection request to AUSF **541**, and AUSF **541** returns an SoR protection response. After SoR protection is established, UDM **542** transfers an SoR response to AMF **515** that includes network information **545**. AMF **515** transfers a registration accept message that includes network information **545** to UE **501** over access technology **511**. Network information **545** has access technology **512** (a WIFI access node), PLMN **521**, and slice **531** as the highest priority for UE **501** when visiting PLMN **521** in network **510**. UE **501** selects access technology **512**, PLMN **521**, and slice **531** based on network information **545**. UE **501** establishes service and exchanges data over access technology **512**, PLMN **521**, and slice **531**. The operation continues on FIG. **13**.

[0055] FIG. **13** illustrates an exemplary operation of wireless communication system **500** to control roaming wireless UE **501** in visited wireless communication network **510**. The following operation is continued from FIG. **12** may vary in other examples. UE **501** attaches to access technology **512**.

UE **501** transfers a registration request to AMF **515** over access technology **512**. AMF **515** transfers an authentication request to AUSF **541**. AUSF **541** transfers the authentication request to UDM **542** which interacts with UDR **543** to obtain and generate authentication data for UE **501**. UDM **542** transfers the authentication data to AUSF **541**. AUSF **541** transfers the authentication data to AMF **515**. AMF **515** and UE **501** perform an authentication session over access technology **512**.

[0056] After UE authentication, AMF **515** transfers a UECM registration to UDM **542**. UDM **542** queries UDR **543** for context for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. AMF **515** transfers an SDM GET message to UDM **542**. UDM **542** queries UDR **543** for subscriber data for UE **501**. UDM **542** transfers a UECM registration OK message to AMF **515**. UDM **542** detects that UE **501** is roaming on PLMN **521** in network **510** based on the SDM interactions, and in response, retrieves network information **545** from its cache, but does not retrieve network information **545** from SoR AF **544**.

[0057] UDM **542** transfers an SoR protection request to AUSF **541**, and AUSF **541** returns an SoR protection response. After SoR protection is established, UDM **542** transfers an SoR response to AMF **515** that includes network information **545**. AMF **515** transfers a registration accept message that includes network information **545** to UE **501** over access technology **512**. UE **501** selects access tech **512**, PLMN **521**, and slice **531** based on network information **545**. UE **501** establishes service and exchanges data over access technology **512**, PLMN **521**, and slice **531**.

[0058] Subsequently, network information **545** is modified in SoR AF **544**. For example, network information **545** may be modified to list PLMN **522** and slice **532** as higher priorities than PLMN **521** and slice **531**. In response to the modification, SoR AF **544** transfers modified network information **545** to UDM **542**. UDM **542** caches modified network information **545** for visited wireless network **510** in place of old network information **545**. As described above for old network information **545**, UDM **542** will retrieve modified network information **545** from its cache without accessing SoR AF **544** and will transfer modified network information **545** to UE **501** when it visits PLMN **521** in wireless network **510**. UE **501** will use modified network information **545** to select the highest priority access technology, PLMN, and slice-which means UE **501** will switch to PLMN **522** and slice **532** instead of using PLMN **521** and slice **531**.

[0059] Although not shown on FIGS. **12-13**, other roaming UEs on PLMN **521** in visited wireless communication network **510** that are homed to home wireless communication network **530** may use cached network information **545** in a similar manner to UE **501** without requiring UDM **542** to retrieve network information **545** from SoR AF **544**. In other visited wireless communication networks, UE **501** may use other cached network lists in a similar manner to network information **545** without requiring UDM **542** to retrieve the other network lists from SOR AF **544**.

[0060] Advantageously, UDM **542** serves network information **545** without excessive signaling with SoR AF **544** to conserve network resources. Moreover, UDM **542** serves network information **545** which reduces delay and speeds the delivery of wireless network slices **531-532** in visited wireless communication networks **510** and **520**.

[0061] The wireless communication system circuitry described above comprises computer hardware and software that form special-purpose data communication circuitry system to control roaming wireless UEs in visited wireless communication networks. The computer hardware comprises processing circuitry like CPUs, DSPs, GPUs, transceivers, bus circuitry, and memory. To form these computer hardware structures, semiconductors like silicon or germanium are positively and negatively doped to form transistors. The doping comprises ions like boron or phosphorus that are embedded within the semiconductor material. The transistors and other electronic structures like capacitors and resistors are arranged and metallically connected within the semiconductor to form devices like logic circuitry and storage registers. The logic circuitry and storage registers are arranged to form larger structures like control units, logic units, and Random-Access Memory (RAM). In turn, the control units, logic units, and RAM are metallically connected to form CPUs, DSPs, GPUs, transceivers, bus circuitry, and memory.

[0062] In the computer hardware, the control units drive data between the RAM and the logic units, and the logic units operate on the data. The control units also drive interactions with external memory like flash drives, disk drives, and the like. The computer hardware executes machine-level software to control and move data by driving machine-level inputs like voltages and currents to the control units, logic units, and RAM. The machine-level software is typically compiled from higher-level software programs. The higher-level software programs comprise operating systems, utilities, user applications, and the like. Both the higher-level software programs and their compiled machine-level software are stored in memory and retrieved for compilation and execution. On power-up, the computer hardware automatically executes physically-embedded machine-level software that drives the compilation and execution of the other computer software components which then assert control. Due to this automated execution, the presence of the higher-level software in memory physically changes the structure of the computer hardware machines into special-purpose data communication circuitry system to control roaming wireless UEs in visited wireless communication networks.

[0063] The above description and associated figures teach the best mode of the invention. The following claims specify the scope of the invention. Note that some aspects of the best mode may not fall within the scope of the invention as specified by the claims. Those skilled in the art will appreciate that the features described above can be combined in various ways to form multiple variations of the invention. Thus, the invention is not limited to the specific embodiments described above, but only by the following claims and their equivalents.

What is claimed is:

1. A method to control a wireless communication device in a visited wireless communication network, the method comprising:

storing a slice indicator for a visited wireless network slice in the visited wireless communication network;

receiving a request from the visited wireless communication network for the wireless communication device; and

in response to receiving the request, retrieving the slice indicator for the visited wireless communication network and transferring the slice indicator to the wireless communication device over the visited wireless communication network, wherein the wireless communication device communicates using the visited wireless network slice in the visited wireless communication network in response to receiving the slice indicator.

2. The method of claim **1** further comprising:

storing a Public Land Mobile Network (PLMN) Identifier (ID) for the visited wireless communication network; and wherein

storing the slice indicator comprises storing the slice indicator in association with the PLMN ID; and

retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the PLMN ID in the request.

3. The method of claim **1** further comprising:

storing a user application indicator for the visited wireless communication network; and wherein

storing the slice indicator comprises storing the slice indicator in association with the user application indicator; and

retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the user application indicator in the request.

4. The method of claim **1** further comprising:

storing an access technology indicator for the visited wireless communication network; and wherein

storing the slice indicator comprises storing the slice indicator in association with the access technology indicator; and

retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the access technology indicator in the request.

5. The method of claim **1** wherein:

storing the slice indicator comprises storing a prioritized slice list that includes the slice indicator and additional slice indicators in a priority order;

retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the prioritized slice list that includes the slice indicator and the additional slice indicators in the priority order and transferring the prioritized slice list to the wireless communication device in response to receiving the request.

6. The method of claim **1** wherein the slice indicator comprises a slice type.

7. The method of claim **1** wherein:

receiving the request from the visited wireless communication network for the wireless communication device comprises receiving a Subscriber Data Management GET message from the visited wireless communication network for the wireless communication device; and

retrieving the slice indicator for the visited wireless communication network and transferring the slice indicator to the wireless communication device over the visited wireless communication network in response to receiving the request comprises retrieving the slice indicator for the visited wireless communication network and transferring the slice indicator to the wireless communication device over the visited wireless communication network in response to receiving the Subscriber Data Management GET message.

8. A method to control a wireless communication device in a visited Public Land Mobile Network (PLMN), the method comprising:

a Steering-of-Roaming Application Function (SoR-AF) storing a slice indicator for a visited wireless network slice in the visited PLMN;

a Unified Data Management (UDM) receiving a request from the visited PLMN for the wireless communication device; and

in response to receiving the request, the UDM retrieving the slice indicator for the visited PLMN from the SoR-AF and transferring the slice indicator to the wireless communication device over the visited PLMN, wherein the wireless communication device communicates using the visited wireless network slice in the visited PLMN in response to receiving the slice indicator.

9. The method of claim **8** further comprising:

the UDM caching the slice indicator for the visited PLMN in a UDM memory; and

in response to receiving another request, the UDM retrieving the slice indicator for the visited PLMN from the UDM memory and transferring the slice indicator to the wireless communication device over the visited PLMN.

10. The method of claim **8** further comprising:

the SoR-AF modifying the slice indicator for the visited PLMN, and in response, transferring the modified slice indicator for the visited PLMN to the UDM;

the UDM caching the modified slice indicator for the visited PLMN in the UDM memory; and

in response to receiving another request, the UDM retrieving the modified slice indicator for the visited PLMN from the UDM memory and transferring the modified slice indicator to the wireless communication device over the visited PLMN, wherein the wireless communication device communicates using a different visited wireless network slice in the visited PLMN in response to receiving the modified slice indicator.

11. The method of claim **8** further comprising:

the SoR-AF storing a user application indicator for the visited PLMN; and wherein

the SoR-AF storing the slice indicator comprises storing the slice indicator in association with the user application indicator; and

the UDM retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the user application indicator in the request.

12. The method of claim **8** further comprising:
the SoR-AF storing an access technology indicator for the visited PLMN; and wherein
the SoR-AF storing the slice indicator comprises storing the slice indicator in association with the access technology indicator; and
the UDM retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the access technology indicator in the request.

13. The method of claim **8** wherein:
the SoR-AF storing the slice indicator comprises storing a prioritized slice list that includes the slice indicator and additional slice indicators in a priority order;
the UDM retrieving the slice indicator and transferring the slice indicator to the wireless communication device in response to receiving the request comprises retrieving the prioritized slice list that includes the slice indicator and the additional slice indicators in the priority order and transferring the prioritized slice list to the wireless communication device in response to receiving the request.

14. A wireless communication system to control a wireless communication device in a visited wireless communication network, the wireless communication system comprising:
a network database store a slice indicator for a visited wireless network slice in the visited wireless communication network;
a network controller to receive a request from the visited wireless communication network for the wireless communication device; and
in response to receiving the request, the network controller to retrieve the slice indicator for the visited wireless communication network from the network database and transfer the slice indicator to the wireless communication device over the visited wireless communication network, wherein the wireless communication device is to communicate with the visited wireless network slice in the visited wireless communication network in response to receiving the slice indicator.

15. The wireless communication system of claim **14** further comprising:
the network database to store a Public Land Mobile Network (PLMN) Identifier (ID) for the visited wireless communication network; and wherein
the network database is to store the slice indicator in association with the PLMN ID; and
the network controller is to retrieve the slice indicator and transfer the slice indicator to the wireless communication device in response to receiving the PLMN ID in the request.

16. The wireless communication system of claim **14** further comprising:
the network database to store a user application indicator for the visited wireless communication network; and wherein
the network database is to store the slice indicator in association with the user application indicator; and
the network controller is to retrieve the slice indicator and transfer the slice indicator to the wireless communication device in response to receiving the user application indicator in the request.

17. The wireless communication system of claim **14** further comprising:
the network database to store an access technology indicator for the visited wireless communication network; and wherein
the network database is to store the slice indicator in association with the access technology indicator; and
the network controller is to retrieve the slice indicator and transfer the slice indicator to the wireless communication device in response to receiving the access technology indicator in the request.

18. The wireless communication system of claim **14** wherein:
the network database is to store a prioritized slice list that includes the slice indicator and additional slice indicators in a priority order;
the network controller is to retrieve the prioritized slice list that includes the slice indicator and the additional slice indicators in the priority order and transfer the prioritized slice list to the wireless communication device in response to receiving the request.

19. The wireless communication system of claim **14** wherein the slice indicator comprises a slice type.

20. The wireless communication system of claim **14** wherein:
the network controller is to receive a Subscriber Data Management GET message from the visited wireless communication network for the wireless communication device to receive the request; and
the network controller is to retrieve the slice indicator for the visited wireless communication network and transfer the slice indicator to the wireless communication device over the visited wireless communication network in response to receiving the Subscriber Data Management GET message.

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