



(51) International Patent Classification:

H04W 48/18 (2009.01) *H04W 48/16* (2009.01)
H04W 60/04 (2009.01)

(21) International Application Number:

PCT/IN2024/051253

(22) International Filing Date:

15 July 2024 (15.07.2024)

(25) Filing Language:

English

(26) Publication Language:

English

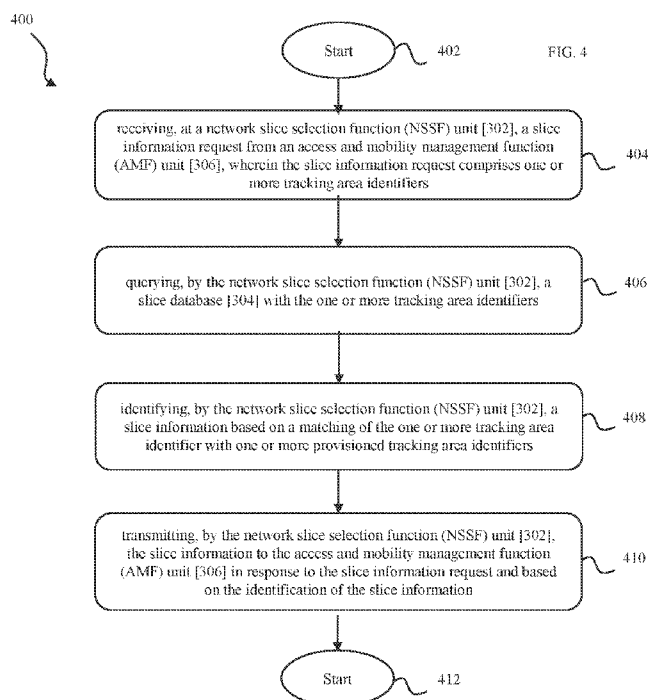
(30) Priority Data:

202321048132 17 July 2023 (17.07.2023) IN

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(54) Title: METHOD AND SYSTEM FOR PROVISIONING SLICE INFORMATION IN A COMMUNICATION NETWORK



(57) Abstract: The present disclosure relates to a method and a system for provisioning slice information in a communication network. The method includes: (1) receiving, at network slice selection function (NSSF) unit [302], slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises tracking area identifiers (TAIs); (2) querying, by NSSF unit [302], a slice database [304] with the TAIs; (3) identifying, by NSSF unit [302], a slice information based on a successful matching of the TAIs with at least one from a list of TAIs provisioned in the slice database [304]; (4) transmitting, by NSSF unit [302], the slice information to the AMF unit [306] in response to the slice information request and based on the identification of the slice information.

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(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

METHOD AND SYSTEM FOR PROVISIONING SLICE INFORMATION IN A COMMUNICATION NETWORK

FIELD OF INVENTION

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[0001] Embodiments of the present disclosure generally relate to wireless communication networks. More particularly, embodiments of the present disclosure relate to provisioning slice information in a communication network.

10 BACKGROUND

[0002] The following description of the related art is intended to provide background information pertaining to the field of the disclosure. This section may include certain aspects of the art that may be related to various features of the present disclosure. However, it should be appreciated that
15 this section is used only to enhance the understanding of the reader with respect to the present disclosure, and not as admissions of the prior art.

[0003] Wireless communication technology has rapidly evolved over the past few decades, with each generation bringing significant improvements and advancements. The first generation of
20 wireless communication technology was based on analog technology and offered only voice services. However, with the advent of the second-generation (2G) technology, digital communication and data services became possible, and text messaging was introduced. Third generation (3G) technology marked the introduction of high-speed internet access, mobile video calling, and location-based services. The fourth generation (4G) technology revolutionized
25 wireless communication with faster data speeds, better network coverage, and improved security. Currently, the fifth-generation (5G) technology is being deployed, promising even faster data speeds, low latency, and the ability to connect multiple devices simultaneously. With each generation, wireless communication technology has become more advanced, sophisticated, and capable of delivering more services to its users. Further, reducing call drops and latency is of
30 paramount importance in the telecommunications industry. Call drops can be frustrating for users, and they can also result in lost revenue for service providers. Latency, on the other hand, refers to the time it takes for data to travel from one device to another and can cause delays and disruptions in communication. The introduction of 5G technology promises to address these issues by delivering ultra-low latency and high-speed data transmission. With 5G, call drops are going to be
35 minimized, and users are going to experience seamless, uninterrupted communication.

Additionally, 5G technology may enable the development of new applications and services that require high-speed, low-latency communication, such as remote surgeries, autonomous vehicles, and virtual reality. The reduction of call drops and latency is crucial in ensuring that users have access to reliable and efficient communication services, and the 5G technology is a significant step towards achieving this goal.

[0004] In the 5G communication system, several functional modules are provided, for example an Access and Mobility Management Function (AMF), a Network Slice Selection Function (NSSF), and/or a Network Repository Function (NRF), etc., one or more of which interacts with each other to implement multiple operations of the 5G communication system. NSSF is one of the key components of a 5G communication system. One such operation relates to assigning of slice to a user equipment (UE) in the 5G wireless communication. Notably, the NSSF is an important network function in the 5G wireless communication system. The NSSF is provided to select different slices (for different service types), as per the requirement of different UEs. The 5G communication system can deploy multiple Network Slice Instances delivering exactly the same features for different groups of UEs. The NSSF offers services to the AMF and NSSF in a different PLMN via the NSSF service-based interface. Following are the key Network Slice Selection Function (NSSF) functionalities:

- Authorize the set of network slice instances for AMF Availability (Registration).
- Determining the Allowed Network Slice Selection Assistance Information (NSSAI) for selection of Slice.
- Determining the AMF Set /Candidate list to be used to serve the UE based on the AMF Availability registration.

[0005] In other words, the NSSF communicates with one or more of the AMF and the NRF, for enabling selection of the slice for the UE. In some embodiment, the NSSF communicates with only the AMF to select the slice to the UE. Accordingly, the NSSF employs an NSSF storage unit that is required to store slice data, which may be accessed to enable selection of the slice for the UE.

[0006] Network slicing enables the creation of separate virtualized sub-networks that can be tailored to meet the specific requirements of different applications. In network slicing, a network is divided into multiple logical partitions or slices, where the multiple logical network partitions are optimised for specific uses, service operations, or for specific requirements pertaining to

various users. These partitions have the right construct of isolation, resources, and topology. The process of network slicing creates end-to-end logical networks that have specific characteristics and are operated independently. Thus, for example, where a new service or a new application is needed to be served by the network, a cloud-native core, for example, may be able to create an instance, or slice, of an entire network virtually. This network slice may be fully customized with network resources for the allocated use case. In fact, these resources may even be dedicated for the purpose if required.

[0007] Further, mobility management is essential to keep track of the location of mobile devices as they move through different cells. Tracking areas in these cellular networks play a critical role in optimizing mobility management and handover processes by logically grouping cells into larger geographical areas. This helps in reducing signaling overheads and ensuring efficient tracking of mobile devices as they move through the network. Each tracking area is identified by a Tracking Area Identity (TAI). The TAI is a unique identifier assigned to each tracking area. The TAI consists of two components:

- PLMN-ID (Public Land Mobile Network Identity), that identifies the Public Land Mobile Network; and
- TAC (Tracking Area Code), that identifies the specific tracking area within the PLMN.

[0008] Furthermore, it may be noted that the NSSF storage unit of the NSSF is provisioned with the slice data. “Provisioning” refers to addition/entry of the slice information into the NSSF storage unit of the NSSF. Particularly, the NSSF comprises of the NSSF storage unit, and a provisioning application. Conventionally, the slice data, provisioned on the NSSF storage unit of the NSSF, includes slice record for each TAC present in range. It may result in a very data intensive set of slice data provisioned on the NSSF storage unit of the NSSF. This may require unnecessary usage of heavy storage on the NSSF storage unit of the NSSF, which may be expensive and may also utilize more resources in the network.

[0009] Thus, there exists an imperative need in the art to provide a system and method for provisioning of slice information to network slice selection functions (NSSF) in an optimized manner, which the present disclosure aims to address.

SUMMARY OF THE DISCLOSURE

[0010] This section is provided to introduce certain aspects of the present disclosure in a simplified form that are further described below in the detailed description. This summary is not intended to identify the key features or the scope of the claimed subject matter.

5 [0011] An aspect of the present disclosure may relate to a method for provisioning slice information in a communication network. The method includes receiving, at a network slice selection function (NSSF) unit, a slice information request from an access and mobility management function (AMF) unit, wherein the slice information request comprises one or more tracking area identifiers. Further, the method encompasses querying, by the network slice selection
10 function (NSSF) unit, a slice database with the one or more tracking area identifiers. The method further includes identifying, by the network slice selection function (NSSF) unit, a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database. The method further includes transmitting, by the network slice selection function (NSSF) unit, the slice
15 information to the access and mobility management function (AMF) unit in response to the slice information request and based on the identification of the slice information.

[0012] In an exemplary aspect of the present disclosure, the method further comprises transmitting, by the network slice selection function (NSSF) unit, an error message to the access
20 and mobility management function (AMF) unit in an event the one or more tracking area identifiers fail to match with at least one from the list of tracking area identifiers provisioned in the slice database.

[0013] In an exemplary aspect of the present disclosure, each TAI in the list of TAIs is
25 associated with a corresponding slice information.

[0014] In an exemplary aspect of the present disclosure, the list of TAIs and the corresponding slice information is provisioned based on receiving, at the network slice selection function (NSSF) unit, a slice provisioning request from a provisioning client, wherein the slice provisioning request
30 comprises the list of tracking area identifiers and the corresponding slice information. Furthermore, the method encompasses provisioning, by the network slice selection function (NSSF) unit, the list of tracking area identifiers and the corresponding slice information to the slice database. The method further includes transmitting, by the network slice selection function (NSSF) unit, a slice provisioning acknowledgement to the provisioning client in response to the slice
35 provisioning request.

[0015] In an exemplary aspect of the present disclosure, the slice information corresponding to the list of tracking area identifiers is further partitioned based on at least one from among a public land mobile network identifier, a tracking area code and a range of tracking area identifiers in the slice database.

[0016] Another aspect of the present disclosure may relate to a system for provisioning slice information in a communication network. The system comprising a network slice selection function (NSSF) unit. The NSSF unit is configured to receive a slice information request from an access and mobility management function (AMF) unit, wherein the slice information request comprises one or more tracking area identifiers. The NSSF unit is further configured to query a slice database with the one or more tracking area identifiers. The NSSF unit is further configured to identify a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database. Further, the NSSF unit is configured to transmit the slice information to the access and mobility management function (AMF) unit in response to the slice information request, and based on the identification of the slice information.

[0017] Yet another aspect of the present disclosure may relate to a user equipment (UE) for availing a service from a communication network. The UE comprises a transceiver unit configured to: transmit to a communication network, a request to avail a service; and receive a response to the request from the communication network. The response is generated by a system configured in the communication network based on: (a) receiving, at a network slice selection function (NSSF) unit, a slice information request from an access and mobility management function (AMF) unit, wherein the slice information request comprises one or more tracking area identifiers; (b) querying, by the network slice selection function (NSSF) unit, a slice database with the one or more tracking area identifiers; (c) identifying, by the network slice selection function (NSSF) unit, a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database; and (d) transmitting, by the network slice selection function (NSSF) unit, the slice information to the access and mobility management function (AMF) unit in response to the slice information request and based on the identification of the slice information.

[0018] Yet another aspect of the present disclosure may relate to a non-transitory computer readable storage medium storing instructions for provisioning slice information in a

communication network, the instructions include executable code which, when executed by a one or more units of a system, causes: a network slice selection function (NSSF) unit to receive a slice information request from an access and mobility management function (AMF) unit, wherein the slice information request comprises one or more tracking area identifiers. Further, the instructions
5 include executable code, which when executed causes the NSSF unit to query a slice database with the one or more tracking area identifiers. Further, the instructions include executable code, which when executed causes the NSSF unit to identify a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database. Further, the instructions include executable code, which when
10 executed causes the NSSF unit to transmit the slice information to the access and mobility management function (AMF) unit in response to the slice information request and based on the identification of the slice information.

OBJECTS OF THE DISCLOSURE

15 [0019] Some of the objects of the present disclosure, which at least one embodiment disclosed herein satisfies are listed herein below.

[0020] It is an object of the present disclosure to provide a system and a method for provisioning
20 of slice information to network slice selection function (NSSF), which utilizes less storage on the NSSF storage unit of the NSSF.

[0021] It is an object of the present disclosure to provide a system and a method for efficient and optimized availability checking of the slices by the NSSF.

DESCRIPTION OF THE DRAWINGS

25 [0022] The accompanying drawings, which are incorporated herein, and constitute a part of this disclosure, illustrate exemplary embodiments of the disclosed methods and systems in which like
30 reference numerals refer to the same parts throughout the different drawings. Components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Also, the embodiments shown in the figures are not to be construed as limiting the disclosure, but the possible variants of the method and system according to the disclosure are illustrated herein to highlight the advantages of the disclosure. It will be

appreciated by those skilled in the art that disclosure of such drawings includes disclosure of electrical components or circuitry commonly used to implement such components.

5 [0023] FIG. 1 illustrates an exemplary block diagram representation of 5th generation core (5GC) network architecture.

[0024] FIG. 2 illustrates an exemplary block diagram of a computing device upon which the features of the present disclosure may be implemented in accordance with exemplary implementation of the present disclosure.

10 [0025] FIG. 3 illustrates an exemplary block diagram of a system for provisioning slice information in a communication network, in accordance with exemplary implementations of the present disclosure.

15 [0026] FIG. 4 illustrates a method flow diagram for provisioning slice information in a communication network in accordance with exemplary implementations of the present disclosure.

[0027] The foregoing shall be more apparent from the following more detailed description of the disclosure.

20 DETAILED DESCRIPTION

[0028] In the following description, for the purposes of explanation, various specific details are set forth in order to provide a thorough understanding of embodiments of the present disclosure.

25 It will be apparent, however, that embodiments of the present disclosure may be practiced without these specific details. Several features described hereafter may each be used independently of one another or with any combination of other features. An individual feature may not address any of the problems discussed above or might address only some of the problems discussed above.

30 [0029] The ensuing description provides exemplary embodiments only, and is not intended to limit the scope, applicability, or configuration of the disclosure. Rather, the ensuing description of the exemplary embodiments will provide those skilled in the art with an enabling description for implementing an exemplary embodiment. It should be understood that various changes may be made in the function and arrangement of elements without departing from the spirit and scope of
35 the disclosure as set forth.

[0030] Specific details are given in the following description to provide a thorough understanding of the embodiments. However, it will be understood by one of ordinary skill in the art that the embodiments may be practiced without these specific details. For example, circuits, systems, processes, and other components may be shown as components in block diagram form in order not to obscure the embodiments in unnecessary detail.

[0031] Also, it is noted that individual embodiments may be described as a process which is depicted as a flowchart, a flow diagram, a data flow diagram, a structure diagram, or a block diagram. Although a flowchart may describe the operations as a sequential process, many of the operations may be performed in parallel or concurrently. In addition, the order of the operations may be re-arranged. A process is terminated when its operations are completed but could have additional steps not included in a figure.

[0032] The word “exemplary” and/or “demonstrative” is used herein to mean serving as an example, instance, or illustration. For the avoidance of doubt, the subject matter disclosed herein is not limited by such examples. In addition, any aspect or design described herein as “exemplary” and/or “demonstrative” is not necessarily to be construed as preferred or advantageous over other aspects or designs, nor is it meant to preclude equivalent exemplary structures and techniques known to those of ordinary skill in the art. Furthermore, to the extent that the terms “includes,” “has,” “contains,” and other similar words are used in either the detailed description or the claims, such terms are intended to be inclusive in a manner similar to the term “comprising” as an open transition word without precluding any additional or other elements.

[0033] As used herein, a “processing unit” or “processor” or “operating processor” includes one or more processors, wherein processor refers to any logic circuitry for processing instructions. A processor may be a general-purpose processor, a special purpose processor, a conventional processor, a digital signal processor, a plurality of microprocessors, one or more microprocessors in association with a (Digital Signal Processing) DSP core, a controller, a microcontroller, Application Specific Integrated Circuits, Field Programmable Gate Array circuits, any other type of integrated circuits, etc. The processor may perform signal coding data processing, input/output processing, and/or any other functionality that enables the working of the system according to the present disclosure. More specifically, the processor or processing unit is a hardware processor.

[0034] As used herein, “a user equipment”, “a user device”, “a smart-user-device”, “a smart-device”, “an electronic device”, “a mobile device”, “a handheld device”, “a wireless communication device”, “a mobile communication device”, “a communication device” may be any electrical, electronic and/or computing device or equipment, capable of implementing the features of the present disclosure. The user equipment/device may include, but is not limited to, a mobile phone, smart phone, laptop, a general-purpose computer, desktop, personal digital assistant, tablet computer, wearable device or any other computing device which is capable of implementing the features of the present disclosure. Also, the user device may contain at least one input means configured to receive an input from unit(s) which are required to implement the features of the present disclosure.

[0035] As used herein, “storage unit” or “memory unit” refers to a machine or computer-readable medium including any mechanism for storing information in a form readable by a computer or similar machine. For example, a computer-readable medium includes read-only memory (“ROM”), random access memory (“RAM”), magnetic disk storage media, optical storage media, flash memory devices or other types of machine-accessible storage media. The storage unit stores at least the data that may be required by one or more units of the system to perform their respective functions.

[0036] As used herein “interface” or “user interface” refers to a shared boundary across which two or more separate components of a system exchange information or data. The interface may also be referred to a set of rules or protocols that define communication or interaction of one or more modules or one or more units with each other, which also includes the methods, functions, or procedures that may be called.

[0037] All modules, units, components used herein, unless explicitly excluded herein, may be software modules or hardware processors, the processors being a general-purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASIC), Field Programmable Gate Array circuits (FPGA), any other type of integrated circuits, etc.

[0038] As used herein the transceiver unit include at least one receiver and at least one transmitter configured respectively for receiving and transmitting data, signals, information or a combination thereof between units/components within the system and/or connected with the system.

[0039] As discussed in the background section, the current known solutions have several shortcomings. The present disclosure aims to overcome the above-mentioned and other existing problems in this field of technology by providing method and system of provisioning slice information in a communication network. Hereinafter, the embodiments of the present disclosure will be explained in reference to the drawings.

[0040] FIG. 1 illustrates an exemplary block diagram representation of 5th generation core (5GC) network architecture, in accordance with exemplary implementation of the present disclosure. As shown in FIG. 1, the 5GC network architecture [100] includes a user equipment (UE) [102], a radio access network (RAN) [104], an access and mobility management function (AMF) [106], a Session Management Function (SMF) [108], a Service Communication Proxy (SCP) [110], an Authentication Server Function (AUSF) [112], a Network Slice Specific Authentication and Authorization Function (NSSAAF) [114], a Network Slice Selection Function (NSSF) [116], a Network Exposure Function (NEF) [118], a Network Repository Function (NRF) [120], a Policy Control Function (PCF) [122], a Unified Data Management (UDM) [124], an application function (AF) [126], a User Plane Function (UPF) [128], a data network (DN) [130], wherein all the components are assumed to be connected to each other in a manner as obvious to the person skilled in the art for implementing features of the present disclosure.

[0041] Radio Access Network (RAN) [104] is the part of a mobile telecommunications system that connects user equipment (UE) [102] to the core network (CN) and provides access to different types of networks (e.g., 5G network). It consists of radio base stations and the radio access technologies that enable wireless communication.

[0042] Access and Mobility Management Function (AMF) [106] is a 5G core network function responsible for managing access and mobility aspects, such as UE registration, connection, and reachability. It also handles mobility management procedures like handovers and paging.

[0043] Session Management Function (SMF) [108] is a 5G core network function responsible for managing session-related aspects, such as establishing, modifying, and releasing sessions. It coordinates with the User Plane Function (UPF) for data forwarding and handles IP address allocation and QoS enforcement.

[0044] Service Communication Proxy (SCP) [110] is a network function in the 5G core network that facilitates communication between other network functions by providing a secure and efficient messaging service. It acts as a mediator for service-based interfaces.

5 **[0045]** Authentication Server Function (AUSF) [112] is a network function in the 5G core responsible for authenticating UEs during registration and providing security services. It generates and verifies authentication vectors and tokens.

10 **[0046]** Network Slice Specific Authentication and Authorization Function (NSSAAF) [114] is a network function that provides authentication and authorization services specific to network slices. It ensures that UEs can access only the slices for which they are authorized.

15 **[0047]** Network Slice Selection Function (NSSF) [116] is a network function responsible for selecting the appropriate network slice for a UE based on factors such as subscription, requested services, and network policies.

20 **[0048]** Network Exposure Function (NEF) [118] is a network function that exposes capabilities and services of the 5G network to external applications, enabling integration with third-party services and applications.

25 **[0049]** Network Repository Function (NRF) [120] is a network function that acts as a central repository for information about available network functions and services. It facilitates the discovery and dynamic registration of network functions.

30 **[0050]** Policy Control Function (PCF) [122] is a network function responsible for policy control decisions, such as QoS, charging, and access control, based on subscriber information and network policies.

35 **[0051]** Unified Data Management (UDM) [124] is a network function that centralizes the management of subscriber data, including authentication, authorization, and subscription information.

[0052] Application Function (AF) [126] is a network function that represents external applications interfacing with the 5G core network to access network capabilities and services.

[0053] User Plane Function (UPF) [128] is a network function responsible for handling user data traffic, including packet routing, forwarding, and QoS enforcement.

[0054] Data Network (DN) [130] refers to a network that provides data services to user equipment (UE) in a telecommunications system. The data services may include but are not limited to Internet services, private data network related services.

[0055] FIG. 2 illustrates an exemplary block diagram of a computing device [200] upon which the features of the present disclosure may be implemented in accordance with exemplary implementation of the present disclosure. In an implementation, the computing device [200] may also implement a method for provisioning slice information in a communication network utilising the system. In another implementation, the computing device [200] itself implements the method for provisioning slice information in a communication network using one or more units configured within the computing device [200], wherein said one or more units are capable of implementing the features as disclosed in the present disclosure.

[0056] The computing device [200] may include a bus [202] or other communication mechanism for communicating information, and a hardware processor [204] coupled with bus [202] for processing information. The hardware processor [204] may be, for example, a general-purpose microprocessor. The computing device [200] may also include a main memory [206], such as a random-access memory (RAM), or other dynamic storage device, coupled to the bus [202] for storing information and instructions to be executed by the processor [204]. The main memory [206] also may be used for storing temporary variables or other intermediate information during execution of the instructions to be executed by the processor [204]. Such instructions, when stored in non-transitory storage media accessible to the processor [204], render the computing device [200] into a special-purpose machine that is customized to perform the operations specified in the instructions. The computing device [200] further includes a read only memory (ROM) [208] or other static storage device coupled to the bus [202] for storing static information and instructions for the processor [204].

[0057] A storage device [210], such as a magnetic disk, optical disk, or solid-state drive is provided and coupled to the bus [202] for storing information and instructions. The computing device [200] may be coupled via the bus [202] to a display [212], such as a cathode ray tube (CRT), Liquid crystal Display (LCD), Light Emitting Diode (LED) display, Organic LED (OLED) display, etc. for displaying information to a computer user. An input device [214], including

alphanumeric and other keys, touch screen input means, etc. may be coupled to the bus [202] for communicating information and command selections to the processor [204]. Another type of user input device may be a cursor controller [216], such as a mouse, a trackball, or cursor direction keys, for communicating direction information and command selections to the processor [204], and for controlling cursor movement on the display [212]. This input device typically has two degrees of freedom in two axes, a first axis (e.g., x) and a second axis (e.g., y), that allow the device to specify positions in a plane.

[0058] The computing device [200] may implement the techniques described herein using customized hard-wired logic, one or more ASICs or FPGAs, firmware and/or program logic which in combination with the computing device [200] causes or programs the computing device [200] to be a special-purpose machine. According to one implementation, the techniques herein are performed by the computing device [200] in response to the processor [204] executing one or more sequences of one or more instructions contained in the main memory [206]. Such instructions may be read into the main memory [206] from another storage medium, such as the storage device [210]. Execution of the sequences of instructions contained in the main memory [206] causes the processor [204] to perform the process steps described herein. In alternative implementations of the present disclosure, hard-wired circuitry may be used in place of or in combination with software instructions.

[0059] The computing device [200] also may include a communication interface [218] coupled to the bus [202]. The communication interface [218] provides a two-way data communication coupling to a network link [220] that is connected to a local network [222]. For example, the communication interface [218] may be an integrated services digital network (ISDN) card, cable modem, satellite modem, or a modem to provide a data communication connection to a corresponding type of telephone line. As another example, the communication interface [218] may be a local area network (LAN) card to provide a data communication connection to a compatible LAN. Wireless links may also be implemented. In any such implementation, the communication interface [218] sends and receives electrical, electromagnetic or optical signals that carry digital data streams representing various types of information.

[0060] The computing device [200] can send messages and receive data, including program code, through the network(s), the network link [220] and the communication interface [218]. In the Internet example, a server [230] might transmit a requested code for an application program through the Internet [228], the ISP [226], the local network [222], the host [224], and the

communication interface [218]. The received code may be executed by the processor [204] as it is received, and/or stored in the storage device [210], or other non-volatile storage for later execution.

[0061] Referring to FIG. 3, an exemplary block diagram of a system for provisioning slice information in a communication network is shown, in accordance with the exemplary implementations of the present disclosure. The system [300] comprises at least one network slice selection function (NSSF) unit [302], at least one network slice selection function (NSSF) storage unit [304] (or as used herein, the slice database [304]), at least one Access and Mobility Management Function unit [306], and at least one provisioning client unit [308]. Also, all of the components/ units of the system [300] are assumed to be connected to each other unless otherwise indicated below. As shown in the FIG. 3 all units shown within the system should also be assumed to be connected to each other. Also, in FIG. 3 only a few units are shown, however, the system [300] may comprise multiple such units or the system [300] may comprise any such numbers of said units, as required to implement the features of the present disclosure. Further, in an implementation, the system [300] may be present in a network entity.

[0062] The system [300] is configured for provisioning slice information in a communication network, with the help of the interconnection between the components/units of the system [300].

[0063] More specifically, to implement the features of the present disclosure, the NSSF unit [302] comprises the NSSF storage unit [304] (interchangeably referred to herein as the slice database [304]) that is provisioned with the slice data. The NSSF storage unit [304] is suitably programmed to receive and store therein a list or range of Tracking Area Identifiers (TAI)s, and slice information corresponding to the list or range of TAIs. Therefore, the slice data encompasses the list of TAIs along with the corresponding slice information. Pertinently, the slice information comprises Network Slice Selection Assistance Information (NSSAI). The single-NSSAI is made up of two fields, namely, Slice/Service Type (SST) and Service Differentiator (SD). The SST field may have standardized and non-standardized values. Values 0 to 127 belong to the standardized SST, and SD is an optional field. SST has 8-bit field length implying that it can indicate a total of 255 different slice types. SD indicates a kind of slice ID within the SST. SST is a mandatory item in the slice information, whereas SD is an optional item. SD is used to indicate a specific slice when a plurality of slices is supported in the same SST.

[0064] Furthermore, the Network Slice Selection Function (NSSF) unit [302] implements NSSF which is a network function responsible for selecting the appropriate network slice for a User Equipment based on factors such as subscription, requested services, and network policies.

5 **[0065]** The NSSF unit [302] is configured to receive a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers. As used herein, a tracking area identifier is an identifier used to identify tracking areas. In an implementation of the present disclosure, the one or more tracking area identifiers (TAIs) associated with the slice information request includes
10 MCC (Mobile Country Code), MNC (Mobile Network Code) and TAC (Tracking Area Code).

[0066] The NSSF unit [302] is further configured to query a slice database [304] with the one or more tracking area identifiers (TAI), which forms a part of standard query format.

15 **[0067]** The NSSF unit [302] is further configured to identify the slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]. The list of tracking area identifiers is an exhaustive list of tracking area identifiers provisioned in the slice database [304].

20 **[0068]** Furthermore, the NSSF unit [302] is configured to transmit the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request and based on the identification of the slice information.

[0069] The NSSF unit [302] is further configured to transmit an error message to the access and
25 mobility management function (AMF) unit [306] in an event the one or more tracking area identifiers fail to match with at least one from the list of tracking area identifiers provisioned in the slice database [304]. The error message indicates an unavailability of an information requested in the slice information request.

30 **[0070]** In an implementation, each TAI in the list of TAIs is associated with a corresponding slice information. Also, the list of TAIs and the corresponding slice information is provisioned in the slice database [304] based on: (a) receiving, at the network slice selection function (NSSF) unit [302], a slice provisioning request from a provisioning client [308], wherein the slice provisioning request comprises the list of tracking area identifiers and the corresponding slice information; (b)
35 provisioning, by the network slice selection function (NSSF) unit [302], the list of tracking area

identifiers and the corresponding slice information to the slice database; and (c) transmitting, by the network slice selection function (NSSF) unit [302], a slice provisioning approval acknowledgement to the provisioning client [308] in response to the slice provisioning request.

5 [0071] The slice information corresponding to the list of tracking area identifiers, in an implementation, is further partitioned based on at least one from among a public land mobile network identifier, a tracking area code (TAC) and a range of tracking area identifiers in the slice database. The partitioning is done to ease the identification process of corresponding slice information. Here, in order to cater large geographical area network, the slice information may be
10 partitioned into different PLMNs to store the corresponding slice data with TAC information to optimize the query from the database.

[0072] Referring to FIG. 4, an exemplary method flow diagram [400] for provisioning slice information in a communication network, in accordance with exemplary implementations of the
15 present disclosure is shown. In an implementation the method [400] is performed by the system [300]. Further, in an implementation, the system [300] may be present in the communication network to implement the features of the present disclosure. Also, as shown in FIG. 4, the method [400] starts at step [402].

20 [0073] At step [404], the NSSF unit [302] receives a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers. The Tracking Area identifier is the identifier used to identify tracking areas. In an implementation of the present disclosure, the Tracking Area Identifier (TAI) comprises of MCC (Mobile Country Code), MNC (Mobile Network Code) and TAC (Tracking
25 Area Code).

[0074] Next, at step [406], the method includes querying, by the network slice selection function (NSSF) unit [302], a slice database [304] with the one or more tracking area identifiers.

30 [0075] Next at step [408], the method encompasses identifying, by the network slice selection function (NSSF) unit [302], the slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]. The list of tracking area identifiers is an exhaustive list of tracking area identifiers provisioned in the slice database [304].

[0076] Further at step [410], the method includes transmitting, by the network slice selection function (NSSF) unit [302], the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request and based on the identification of the slice information.

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[0077] In an implementation, the method comprises transmitting, by the NSSF unit [302], an error message to the access and mobility management function (AMF) unit [306] in an event the one or more tracking area identifiers fail to match with at least one from the list of tracking area identifiers provisioned in the slice database [304]. The error message indicates an unavailability of an information requested in the slice information request.

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[0078] In an implementation, each TAI in the list of TAIs is associated with a corresponding slice information. Also, the list of TAIs and the corresponding slice information is provisioned in the slice database [304] based on: (a) receiving, at the network slice selection function (NSSF) unit [302], a slice provisioning request from a provisioning client [308], wherein the slice provisioning request comprises the list of tracking area identifiers and the corresponding slice information; (b) provisioning, by the network slice selection function (NSSF) unit [302], the list of tracking area identifiers and the corresponding slice information to the slice database [304]; and (c) transmitting, by the network slice selection function (NSSF) unit [302], a slice provisioning approval acknowledgement to the provisioning client [308] in response to the slice provisioning request.

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[0079] The slice information corresponding to the list of tracking area identifiers, in an implementation, is further partitioned based on at least one from among a public land mobile network identifier, a tracking area code and a range of tracking area identifiers in the slice database [304]. The partitioning is done to ease the identification process of corresponding slice information. Here, in order to cater large geographical area network, the slice information may be partitioned into different PLMNs to store the corresponding slice data with TAC information to optimize the query from the database.

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[0080] The method comes to an end at step [412].

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[0081] The present disclosure further encompasses a user equipment (UE) for availing a service from a communication network. The UE comprises a transceiver unit configured to: transmit to a communication network, a request to avail a service; and receive a response to the request from the communication network, wherein the response is generated by a system [300] configured in

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the communication network based on: (a) receiving, at a network slice selection function (NSSF) unit [302], a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers; (b) querying, by the network slice selection function (NSSF) unit [302], a slice database [102A] with the one or more tracking area identifiers; (c) identifying, by the network slice selection function (NSSF) unit [302], a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]; and (d) transmitting, by the network slice selection function (NSSF) unit [302], the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request and based on the identification of the slice information.

[0082] The present disclosure further encompasses a non-transitory computer readable storage medium storing instructions for provisioning slice information in a communication network, the instructions include executable code which, when executed by a one or more units of a system, causes: a network slice selection function (NSSF) unit [302] to receive a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers. Further, the instructions include executable code, which when executed causes the NSSF unit [302] to query a slice database [304] with the one or more tracking area identifiers. Further, the instructions include executable code, which when executed causes the NSSF unit [302] to identify a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]. Further, the instructions include executable code, which when executed causes the NSSF unit [302] to transmit the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request, and based on the identification of the slice information.

[0083] As is evident from the above, the present disclosure provides a technically advanced solution for provisioning slice information in a communication network. The present solution addresses the challenge of slice provisioning of large TAI (Tracking Area Identity) ranges efficiently. By optimizing the slice provisioning process for large TAI ranges, the present disclosure streamlines the overall provisioning workflow and enhances the overall operational efficiency. The aim of the present disclosure is to reduce the time and complexity associated with provisioning extensive TAI ranges.

[0084] The present disclosure is advantageous as instead of maintaining slice record for each TAC present in range, a single entry in slice data store is created based on the implementation of features as disclosed in the present disclosure. The present disclosure is advantageous as it reduces the complexity of maintaining multiple individual entries and uses data store optimally. The present disclosure further aims to reduce the query processing time.

[0085] While considerable emphasis has been placed herein on the disclosed implementations, it will be appreciated that many implementations can be made and that many changes can be made to the implementations without departing from the principles of the present disclosure. These and other changes in the implementations of the present disclosure will be apparent to those skilled in the art, whereby it is to be understood that the foregoing descriptive matter to be implemented is illustrative and non-limiting.

[0086] Further, in accordance with the present disclosure, it is to be acknowledged that the functionality described for the various components/units can be implemented interchangeably. While specific embodiments may disclose a particular functionality of these units for clarity, it is recognized that various configurations and combinations thereof are within the scope of the disclosure. The functionality of specific units as disclosed in the disclosure should not be construed as limiting the scope of the present disclosure. Consequently, alternative arrangements and substitutions of units, provided they achieve the intended functionality described herein, are considered to be encompassed within the scope of the present disclosure.

We Claim:

1. A method [400] for provisioning slice information in a communication network, the method comprising:
 - 5 - receiving, at a network slice selection function (NSSF) unit [302], a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers (TAIs);
 - querying, by the network slice selection function (NSSF) unit [302], a slice database [304] with the one or more tracking area identifiers;
 - 10 - identifying, by the network slice selection function (NSSF) unit [302], a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]; and
 - transmitting, by the network slice selection function (NSSF) unit [302], the slice
15 information to the access and mobility management function (AMF) unit [306] in response to the slice information request and based on the identification of the slice information.
2. The method [400] as claimed in claim 1, the method further comprising transmitting, by
20 the network slice selection function (NSSF) unit [302], an error message to the access and mobility management function (AMF) unit [306] in an event the one or more tracking area identifiers fail to match with at least one from the list of tracking area identifiers provisioned in the slice database [304].
- 25 3. The method [400] as claimed in claim 1, wherein each TAI in the list of TAIs is associated with a corresponding slice information.
4. The method [400] as claimed in claim 3, wherein the list of TAIs and the corresponding slice information is provisioned based on:
 - 30 - receiving, at the network slice selection function (NSSF) unit [302], a slice provisioning request from a provisioning client [308], wherein the slice provisioning request comprises the list of tracking area identifiers and the corresponding slice information;
 - provisioning, by the network slice selection function (NSSF) unit [302], the list of tracking area identifiers and the corresponding slice information to the slice database [304]; and

- transmitting, by the network slice selection function (NSSF) unit [302], a slice provisioning acknowledgement to the provisioning client [308] in response to the slice provisioning request.
- 5 5. The method [400] as claimed in claim 4, wherein the slice information corresponding to the list of tracking area identifiers is further partitioned based on at least one from among a public land mobile network identifier, a tracking area code and a range of tracking area identifiers in the slice database [304].
- 10 6. A system [300] for provisioning slice information in a communication network, the system comprising:
- a network slice selection function (NSSF) unit [302] configured to:
 - o receive a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one
 - 15 or more tracking area identifiers (TAIs);
 - o query a slice database [304] with the one or more tracking area identifiers;
 - o identify a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]; and
 - 20 o transmit the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request, and based on the identification of the slice information.
- 25 7. The system [300] as claimed in claim 6, wherein the network slice selection function (NSSF) unit [302] is further configured to transmit an error message to the access and mobility management function (AMF) unit [306] in an event the one or more tracking area identifiers fail to match with at least one from the list of tracking area identifiers provisioned in the slice database [304].
- 30 8. The system [300] as claimed in claim 6, wherein each TAI in the list of TAIs is associated with a corresponding slice information.
9. The system [300] as claimed in claim 8, wherein the list of TAIs and the corresponding slice information is provisioned based on:
- 35 - receiving, at the network slice selection function (NSSF) unit [302], a slice provisioning request from a provisioning client [308], wherein the slice provisioning request comprises the list of tracking area identifiers and the corresponding slice information;

- provisioning, by the network slice selection function (NSSF) unit [302], the list of tracking area identifiers and the corresponding slice information to the slice database [304]; and
- transmitting, by the network slice selection function (NSSF) unit [302], a slice provisioning acknowledgement to the provisioning client [308] in response to the slice provisioning request.

10. The system [300] as claimed in claim 9, wherein the slice information corresponding to the list of tracking area identifiers is further partitioned based on at least one from among a public land mobile network identifier, a tracking area code and a range of tracking area identifiers in the slice database [304].

11. A user equipment (UE) for availing a service from a communication network, the UE comprising:

- a transceiver unit configured to:

- o transmit to a communication network, a request to avail a service; and
- o receive a response to the request from the communication network, wherein the response is generated by a system [300] configured in the communication network based on:

- receiving, at a network slice selection function (NSSF) unit [302], a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers (TAIs);
- querying, by the network slice selection function (NSSF) unit [302], a slice database [304] with the one or more tracking area identifiers;
- identifying, by the network slice selection function (NSSF) unit [302], a slice information based on a successful matching of the one or more tracking area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]; and
- transmitting, by the network slice selection function (NSSF) unit [302], the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request and based on the identification of the slice information.

12. A non-transitory computer readable storage medium storing instruction for provisioning slice information in a communication network, the instructions include executable code which, when executed by a one or more units of a system [300], causes:

- a network slice selection function (NSSF) unit [302] to:

- 5 ○ receive a slice information request from an access and mobility management function (AMF) unit [306], wherein the slice information request comprises one or more tracking area identifiers (TAIs);
- query a slice database [304] with the one or more tracking area identifiers;
- identify a slice information based on a successful matching of the one or more tracking
10 area identifiers with at least one from a list of tracking area identifiers provisioned in the slice database [304]; and
- transmit the slice information to the access and mobility management function (AMF) unit [306] in response to the slice information request, and based on the identification
15 of the slice information.

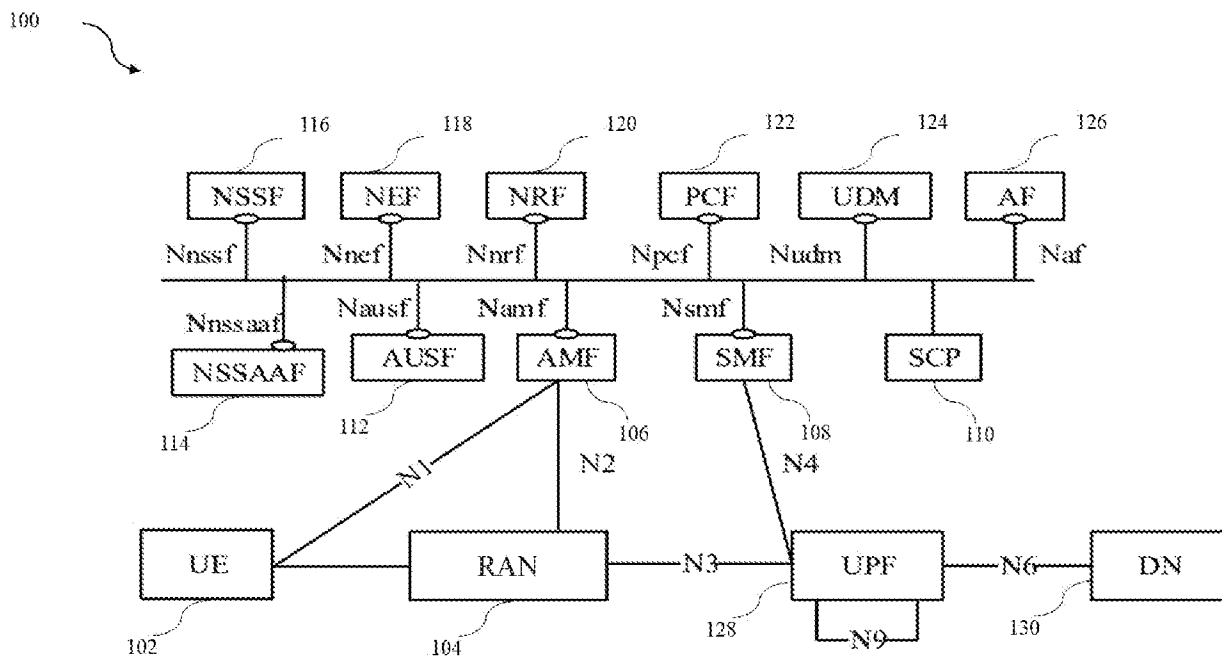


FIG. 1

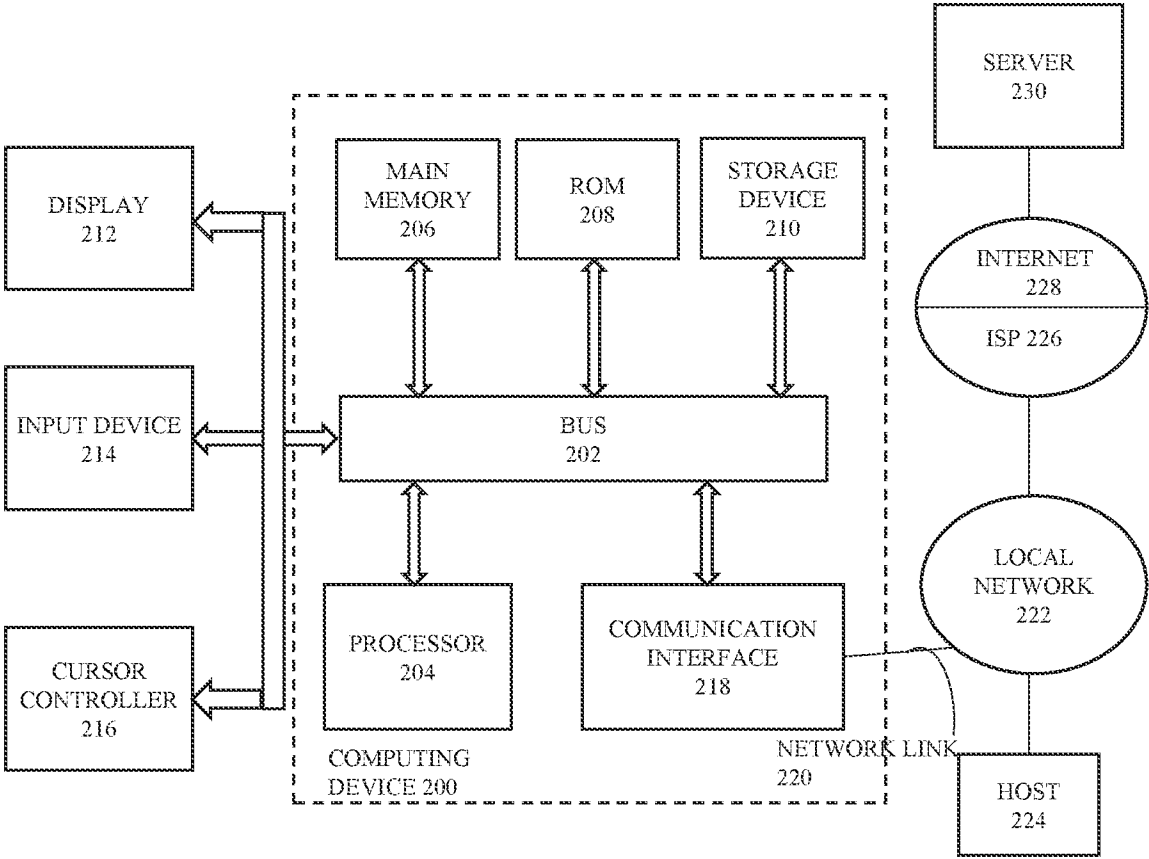


FIG. 2

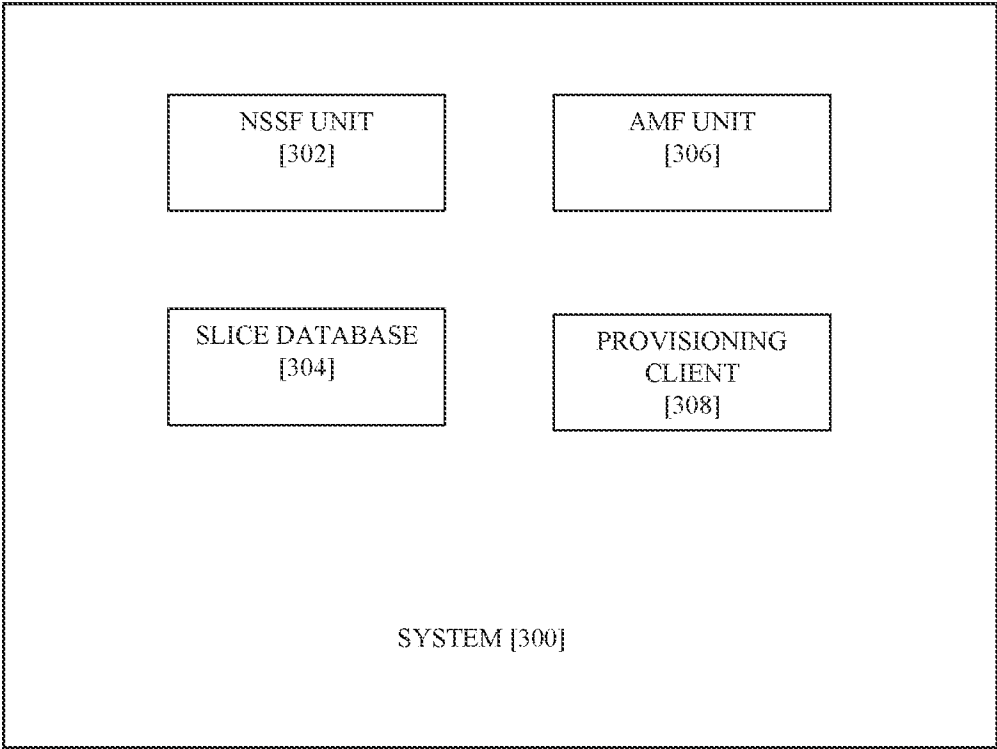


FIG. 3

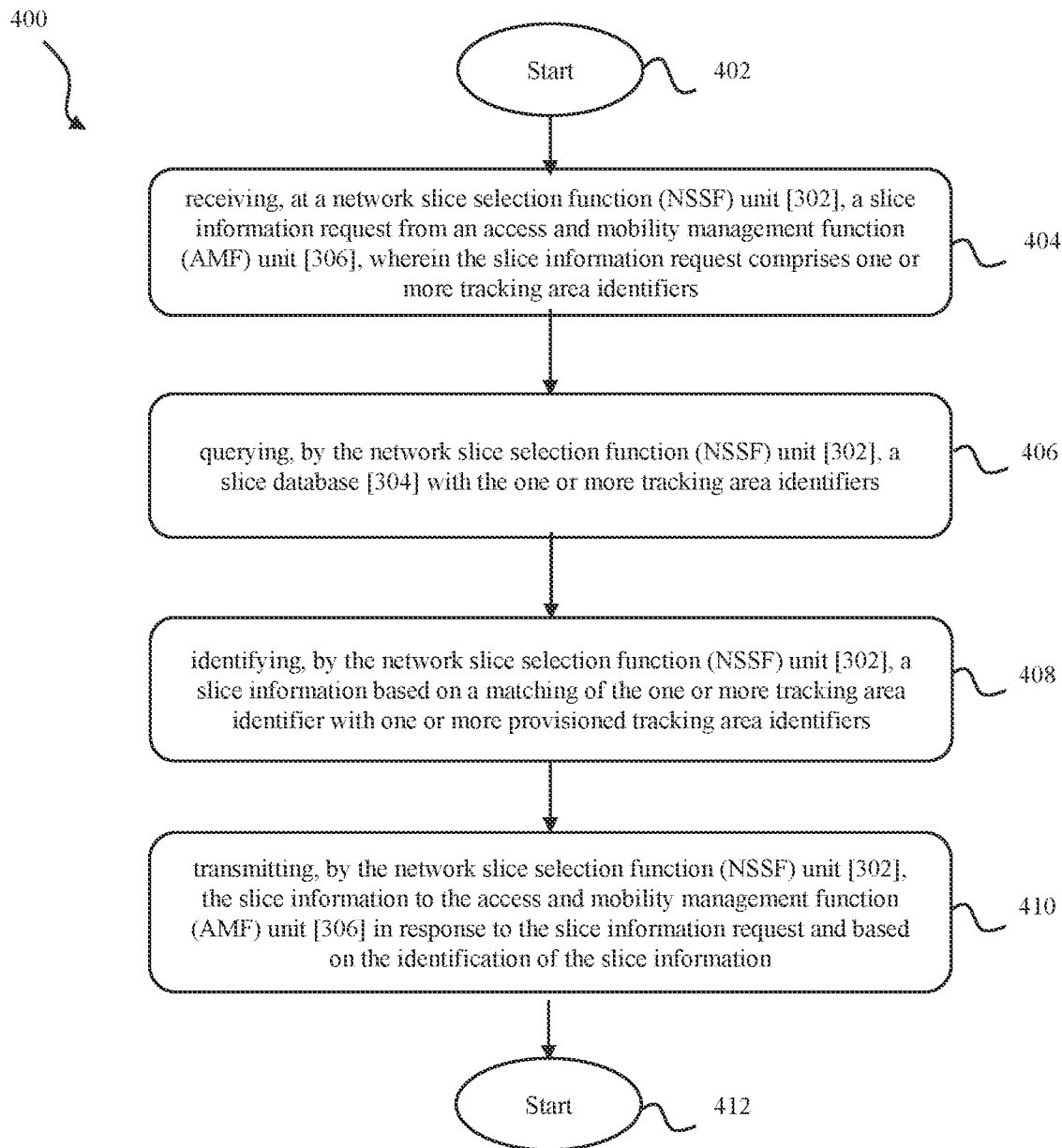


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2024/051253

A. CLASSIFICATION OF SUBJECT MATTER
H04W48/18, H04W60/04, H04W48/16 Version=2024.01

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W

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

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

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US2018368061A1 (HUAWEI TECHNOLOGIES CO LTD) , Publication Date:20/12/2018 (20 December 2018) Abstract, Para [0031],[0115], Claims 1-8 -----	1-12
A	IN201817030878A (HUAWEI TECHNOLOGIES CO LTD), Publication Date:16/11/2018 (16 November 2018) Abstract	1-12

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

* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

22-11-2024

Date of mailing of the international search report

22-11-2024

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2024/051253

Citation	Pub.Date	Family	Pub.Date
US 2018368061 A1	20-12-2018	EP 3425963 B1	23-12-2020
		WO 2018205147 A1	15-11-2018
		CN 110603851 B	01-12-2020
		JP 7035078 B2	14-03-2022
		KR 102284316 B1	30-07-2021