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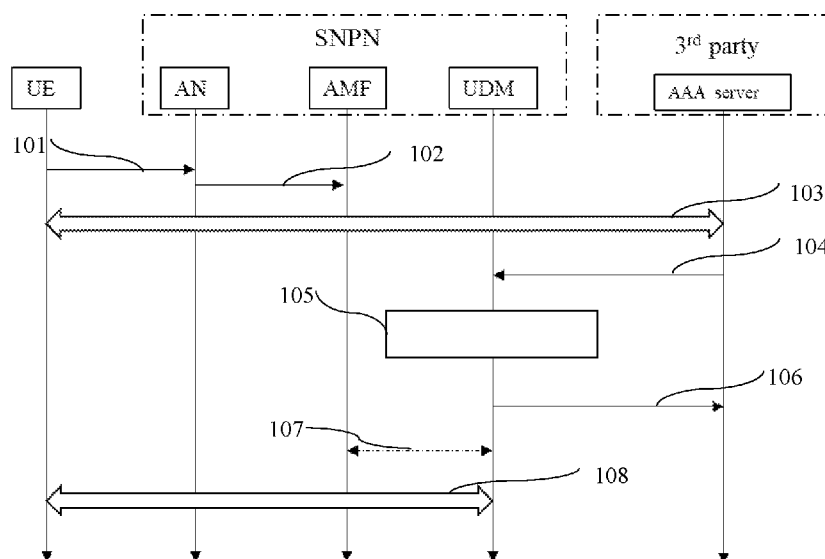


FIG. 1

(57) Abstract: A method and apparatus for managing external subscription data. A method performed by a data management entity is provided. The method may include: receiving external subscription data for a UE from a home network of the UE; registering the UE with the received external subscription data; and generating and transmitting the external subscription registration result to the home network of the UE.

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METHOD AND APPARATUS FOR MANAGING EXTERNAL SUBSCRIPTION DATA

TECHNICAL FIELD

[0001] Embodiments of the present application generally relate to a wireless communication technology, and especially to a method and apparatus for managing external subscription data of a user equipment (UE) owned by a third party.

BACKGROUND

[0002] A private 5G network is also termed a non-public network (NPN). In contrast to a network that offers mobile network services to the general public, the 5G private network provides 5G network services to a clearly defined user organization or group of user organizations. The 5G private network is deployed on the organization's defined premises, such as a campus or a factory. According to 3rd generation partnership project (3GPP) TS 23. 501, there are two types of 5G private network: a standalone non-public network (SNPN), which does not rely on a public land mobile network (PLMN) and is operated by a SNPN operator; and a public network integrated NPN, which is a nonpublic network deployed with the support of a PLMN network.

[0003] Currently, the SNPN is supposed to support a UE with external subscription data owned by a third party (3rd party) entity (e.g., an authentication authorization accounting (AAA) server), it is feasible to communicate between the SNPN and the 3rd party entity for authentication and authorization for the UE.

[0004] However, there is no mechanism to exchange the UE's subscription data between the SNPN and the 3rd party entity so that the SNPN cannot retrieve UE's subscription data from the 3rd party entity to finish the necessary procedures, for example, a registration procedure, or a protocol packet unit (PDU) session establishment procedure and so on.

[0005] Therefore, a method for the SNPN to manage the external subscription data of the UE owned by a 3rd party entity is needed.

SUMMARY OF THE APPLICATION

[0006] Embodiments of the present application provide a method and apparatus for managing the external subscription data.

[0007] An embodiment of the present application provides a method performed by a data management entity. The method may include: receiving external subscription data for a user equipment (UE) from a home network of the UE; registering the UE with the received external subscription data; and generating and transmitting the external subscription registration result to the home network of the UE.

[0008] In an embodiment of the present application, receiving the external subscription data for the UE comprises: receiving an external subscription registration request including an identity of the UE and the external subscription data for the UE from the home network of the UE, and transmitting the external subscription registration result to the home network of the UE comprises: transmitting an external subscription registration response including the identity of the UE and the external subscription registration result to the home network of the UE.

[0009] In an embodiment of the present application, registering the UE with the received external subscription data further comprises: determining to register the UE with the received external subscription data based on a local policy of a non-public network after receiving the external subscription registration request.

[0010] In another embodiment of the present application, receiving the external subscription data for the UE comprises: receiving an external subscription retrieve response including an identity of the UE and the external subscription data for the UE from the home network of the UE, and transmitting the external subscription registration result to the home network of the UE comprises: transmitting an external subscription registration notification including the identity of the UE and the external subscription registration result to the home network of the UE. The method further

comprises: before receiving the external subscription retrieve response, determining to retrieve the external subscription data for the UE from the home network of the UE based on a local policy of a non-public network; and transmitting an external subscription retrieve request including an identity of the UE and an identity of the non-public network to the home network of the UE.

[0011] In another embodiment of the present application, receiving the external subscription data for the UE comprises: receiving an external subscription registration request including an identity of the UE and the external subscription data for the UE from an access and mobility management function entity, and transmitting the external subscription registration result to the home network of the UE comprises: transmitting an external subscription registration response including the identity of the UE and the external subscription registration result to the access and mobility management function entity.

[0012] In an embodiment of the present application, the external subscription data comprises: access and mobility related subscription data; and session management related subscription data. The external subscription data further comprises at least one of: policy related subscription data; and slice related subscription data.

[0013] Another embodiment of the present application provides a method performed by an access and mobility management function entity. The method may include: receiving external subscription data for a user equipment (UE) from a home network of the UE; determining whether to register the external subscription data for the UE to a data management entity; and transmitting an external subscription registration request to the data management entity in response to determining to register the external subscription data for the UE to the data management entity.

[0014] In an embodiment of the present application, receiving the external subscription data for the UE comprises: receiving an external subscription registration request including an identity of the UE and the external subscription data for the UE from the home network of the UE.

[0015] In an embodiment of the present application, the method may further include: receiving an external subscription registration response including an identity of the

UE and an external subscription registration result from the data management entity; and transmitting the external subscription registration response including the identity of the UE and the external subscription registration result to the home network of the UE.

[0016] Another embodiment of the present application provides an apparatus. The apparatus may include at least one non-transitory computer-readable medium having computer executable instructions stored therein; at least one receiver; at least one transmitter; and at least one processor coupled to the at least one non-transitory computer-readable medium, the at least one receiver and the at least one transmitter. The computer executable instructions are programmed to implement the above method with the at least one receiver, the at least one transmitter and the at least one processor.

[0017] Embodiments of the present application can manage the external subscription data of the UE in the UE's home network by the SNPN.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In order to describe the manner in which advantages and features of the application can be obtained, a description of the application is rendered by reference to specific embodiments thereof, which are illustrated in the appended drawings. These drawings depict only example embodiments of the application and are not therefore to be considered limiting of its scope.

[0019] FIG. 1 is a flow chart illustrating a method for a SNPN to manage the external subscription data owned by a 3rd party entity according to an embodiment of the present application;

[0020] FIG. 2 is a flow chart illustrating a method for a SNPN to manage the external subscription data of a UE owned by a 3rd party entity according to another embodiment of the present application;

[0021] FIG. 3 is a flow chart illustrating a method for a SNPN to manage the

external subscription data owned by a 3rd party entity according to yet another embodiment of the present application;

[0022] FIG. 4 illustrates an apparatus according to some embodiments of the present application; and

[0023] FIG. 5 illustrates an apparatus according to some other embodiments of the present application.

DETAILED DESCRIPTION

[0024] The detailed description of the appended drawings is intended as a description of preferred embodiments of the present application and is not intended to represent the only form in which the present application may be practiced. It should be understood that the same or equivalent functions may be accomplished by different embodiments that are intended to be encompassed within the spirit and scope of the present application.

[0025] Reference will now be made in detail to some embodiments of the present application, examples of which are illustrated in the accompanying drawings. To facilitate understanding, embodiments are provided under specific network architecture and new service scenarios, such as 3GPP 5G. It is contemplated that along with developments of network architectures and new service scenarios, all embodiments in the present application are also applicable to similar technical problems; and moreover, the terminologies recited in the present application may change, which should not affect the principle of the present application.

[0026] As discussed above, currently, it is feasible to communicate between the SNPN and the 3rd party entity for authentication and authorization for the UE.

[0027] For example, in a solution, the 3rd party entity is deployed as 5G system, e.g., PLMN or SNPN. When the UE is in a visited-SNPN (V-SNPN), the V-SNPN can retrieve the subscription data of the UE from a unified data management (UDM) in the 3rd party entity via some direct interfaces. However, this solution is only for the

3rd party entity deployed as 5G system with a UDM and having the interface(s) to the SNPN. However, in the embodiments of the present application, it assumes that the 3rd party entity is an entity not deployed as 5G system or not deployed the UDM but only an AAA server. Currently, there is no interface for exchanging the subscription data between the SNPN and the AAA server.

[0028] In another solution, there are two identities (IDs) for a UE. One is subscription ID (SI) created by the SNPN which is used for internal network operations towards UDM or a unified data repository (UDR). The other is an identity of the UE (also called UE ID) allocated by the 3rd party entity which is used for primary authentication and authorization between UE and the 3rd party entity. In this solution, an access and mobility management function (AMF) has to maintain the mapping relationship between the two IDs. And during all the procedures, e.g., registration, PDU session establishment, the AMF in the SNPN has to firstly find the SI by mapping the UE ID, and then to finish the rest of the procedures. It is complicated and almost all of the procedures are impacted.

[0029] In the embodiments of the present application, some methods for a SNPN to manage external subscription data of a UE owned by a 3rd party entity are described. In the embodiments of the present application, the 3rd party entity is a home network of the UE, and the AAA server in the 3rd party entity is an example of an entity storing the subscription data of the UE in the home network of the UE. It should be understood that another entity storing the subscription data of the UE may replace the AAA server to perform its operations in the following embodiments of the present application.

[0030] FIG. 1 is a flow chart illustrating a method for a SNPN to manage the external subscription data owned by a 3rd party entity according to an embodiment of the present application.

[0031] In this embodiment, an AAA server in the 3rd party entity triggers an external subscription registration of a UE by using a new interface between a UDM in the SNPN and the AAA server, when the UE accesses the SNPN (or called the serving SNPN). The AAA server in the 3rd party entity stores the subscription data of the UE.

[0032] As shown in FIG. 1, the SNPN includes an access network (AN), an AMF, and a UDM. The SNPN in FIG. 1 may also include a UDR for storing and retrieving the subscription data for the UDM. Although the AN, the AMF, and the UDM being included in the SNPN are illustrated in FIG. 1 for concise, it should be understood that the SNPN may include other function entities.

[0033] The AN may be configured to provide a network access service for the UE. AN entity may also be referred to as radio access network (RAN) entity, an access point, an access terminal, a base, a macro cell, a Node-B, an enhanced Node B (eNB), a gNB, a home Node-B, a relay node, or any device described using other terminology used in the art.

[0034] The AMF, the UDM and the UDR are network function entities of a 5G core network. In particular, the AMF is a network function entity used for receiving all the connection and session information from a UE or the AN and handling connection and mobility management tasks. The UDM is a network function entity used for managing network user data in a single, centralized element. The UDR is a converged repository of subscriber information and can be used to service a number of network functions. For example, in the embodiments of the present application, the UDM can use the UDR to store and retrieve subscription data of a UE.

[0035] The UE may include a computing device, such as a desktop computer, a laptop computer, a personal digital assistant (PDA), a tablet computer, a smart television (e.g., television connected to the Internet), a set-top box, a game console, a security system (including a security camera), a vehicle on-board computer, a network device (e.g., a router, a switch, and a modem), or the like. According to an embodiment of the present disclosure, the UE may include a portable wireless communication device, a smart phone, a cellular telephone, a flip phone, a device having a subscriber identity module, a personal computer, a selective call receiver, or any other device that is capable of sending and receiving communication signals on a wireless network. In some embodiments, the UE may include a wearable device, such as a smart watch, a fitness band, an optical head-mounted display, or the like. Moreover, the UE may be referred to as a subscriber unit, a mobile phone, a mobile station, a user, a terminal, a mobile terminal, a wireless terminal, a fixed terminal, a

subscriber station, a user terminal, or any device described using other terminology used in the art.

[0036] As shown in FIG. 1, in step 101, the UE initiates a registration request including an identity of the UE (UE ID) in the 3rd party to the serving SNPN, that is, the AN of the SNPN. After receiving the registration request, in step 102, the AN transmits the registration request including the UE ID to the AMF.

[0037] In step 103, an external authentication and authorization is successfully performed between the UE and the AAA server in the 3rd party entity.

[0038] Once the authentication and authorization is successful, in step 104, the AAA server determines to send an external subscription registration request for the UE to the UDM in the serving SNPN based on a 3rd party policy or a service agreement with the serving SNPN via for example, the new interface between the UDM and the AAA server. The external subscription registration request may include the UE ID and the external subscription data for the UE. The external subscription data may include access and mobility related subscription data and session management related subscription data. Furthermore, the external subscription data may further include policy related subscription data and/or slice related subscription data.

[0039] In this embodiment, since the 3rd party entity has a service agreement with other networks (e.g., the serving SNPN), the 3rd party entity will create and maintain a set of subscription data of UE that is suitable for the serving network.

[0040] After receiving the external subscription registration request, in step 105, the UDM determines whether the external subscription registration request with the received external subscription data from the 3rd party entity is allowed based on a local policy of the SNPN and/or the agreement with the 3rd party entity.

[0041] Upon determining the registration request is allowed and completing the registration successfully, in step 106, the UDM transmits an external subscription registration response to the AAA server. The external subscription registration response may include the UE ID and an external subscription registration result. Since the UDM determines the registration request is allowed and completes the

registration successfully, the UDM may generate the external subscription registration result as accepting; otherwise, the external subscription registration result is rejecting.

[0042] Upon receiving the external subscription registration response, the AAA server may update the state of the subscription data of the UE related to the serving SNPN.

[0043] In step 107, the UDM will wait to feedback the request from the AMF until the external subscription registration is completed when the UDM is performing the external subscription registration. More details regarding the step 107 are the same as the steps 14a-14c in Figure 4.2.2.2.2-1 (Registration procedure) in section 4.2.2.2.2 in 3GPP 23.502, which will not be described in detail here.

[0044] In step 108, the serving SNPN transmits a registration accept message including necessary parameters to the UE, and the UE transmits a registration complete message to the serving SNPN if needed, more details are the same as the steps 15-24 in Figure 4.2.2.2.2-1 (Registration procedure) in section 4.2.2.2.2 in 3GPP 23.502, which will not be described in detail here.

[0045] FIG. 2 is a flow chart illustrating a method for a SNPN to manage the external subscription data of a UE owned by a 3rd party entity according to another embodiment of the present application.

[0046] In this embodiment, the UDM in the serving SNPN triggers an external subscription registration of a UE by using a new interface between the UDM in the SNPN and an AAA server in the 3rd party entity, when the UE accesses the SNPN (the serving SNPN). The AAA server in the 3rd party entity stores the subscription data of the UE.

[0047] As shown in FIG. 2, the SNPN includes an AN, an AMF, and a UDM. The SNPN in FIG. 2 may also include a UDR for storing and retrieving the subscription data for the UDM. Although the AN, the AMF, and the UDM being included in the SNPN are illustrated in FIG. 2 for concise, it should be understood that the SNPN may include other function entities.

[0048] As shown in FIG. 2, in step 201, the UE initiates a registration request including an identity of the UE (UE ID) in the 3rd party to the serving SNPN, that is, the AN of the SNPN. After receiving the registration request, in step 202, the AN transmits the registration request including the UE ID to the AMF.

[0049] In step 203, an external authentication and authorization is successfully performed between the UE and the AAA server in the 3rd party entity.

[0050] In step 204, the AMF transmits a Nudm_SDM_Get request including the UE ID to the UDM selected by the AMF so as to retrieve the subscription data of the UE from the UDM.

[0051] After receiving the Nudm_SDM_Get request including the UE ID, the UDM determines whether there is the subscription data of the UE corresponding to the UE ID included in the Nudm_SDM_Get request. In step 205, if there is no subscription data of the UE, the UDM determines to retrieve external subscription data of the UE from the AAA server in the 3rd party entity based on a local policy of the SNPN and/or the agreement with the 3rd party entity.

[0052] In step 206, the UDM transmits an external subscription retrieve request to the AAA server in the 3rd party entity via for example, the new interface between the UDM and the AAA server. The external subscription retrieve request may include the UE ID and an identity of the SNPN (SNPN ID).

[0053] After receiving the external subscription retrieve request, the AAA server in the 3rd party entity determines whether the request is allowed based on a local policy of the 3rd party entity or a service agreement with the serving SNPN. If the request is allowed, in step 207, the AAA server transmits an external subscription retrieve response including the UE ID and the external subscription data of the UE to the UDM. The external subscription data may include access and mobility related subscription data and session management related subscription data. Furthermore, the external subscription data may further include policy related subscription data and/or slice related subscription data.

[0054] Otherwise, if the request is not allowed, the AAA server may transmit an

external subscription retrieve response including the UE ID and a result indicating rejecting.

[0055] In step 208, the UDM registers the UE with the received external subscription data of the UE.

[0056] And then in step 209, the UDM transmits a Undm_SDM_Get response including the UE ID and the required subscription data of the UE to the AMF.

[0057] Meanwhile, in step 210, the UDM may transmit an external subscription registration notification including the UE ID and the registration result to the AAA server. In this embodiment, the UDM registers the UE with the external subscription data of the UE, thus the registration result is accepting; otherwise, the registration result is rejecting.

[0058] In step 211, the serving SNPN transmits a registration accept message including necessary parameters to the UE, and the UE transmits a registration complete message to the serving SNPN if needed, more details are the same as the steps 15-24 in Figure 4.2.2.2.2-1 (Registration procedure) in section 4.2.2.2.2 in 3GPP 23.502, which will not be described in detail here.

[0059] FIG. 3 is a flow chart illustrating a method for a SNPN to manage the external subscription data owned by a 3rd party entity according to yet another embodiment of the present application.

[0060] In this embodiment, an AAA server in the 3rd party entity triggers an external subscription registration of a UE by using an AMF in the SNPN as a proxy, when the UE accesses the SNPN (the serving SNPN). The AAA server in the 3rd party entity stores the subscription data of the UE. In this embodiment, there is a new interface between the AMF and the AAA server. The message between the AMF and the AAA server (for example, the messages communicated in steps 304 and 309 in FIG. 3) can be directly transferred via the new interface. In another embodiment, the message between the AMF and the AAA server can be indirectly transferred via other network function entities (such as, a network exposure function (NEF) entity, authentication server function (AUSF) entity, a proxy of AAA server).

[0061] As shown in FIG. 3, the SNPN includes an AN, an AMF, and a UDM. The SNPN in FIG. 3 may also include a UDR for storing and retrieving the subscription data for the UDM. Although the AN, the AMF, and the UDM being included in the SNPN are illustrated in FIG. 3 for concise, it should be understood that the SNPN may include other function entities, for example, the NEF, the AUSF, and so on.

[0062] As shown in FIG. 3, in step 301, the UE initiates a registration request including an identity of the UE (UE ID) in the 3rd party to the serving SNPN, that is, the AN of the SNPN. After receiving the registration request, in step 302, the AN transmits the registration request including the UE ID to the AMF.

[0063] In step 303, an external authentication and authorization is successfully performed between the UE and the AAA server in the 3rd party entity via the AMF.

[0064] Once the authentication and authorization is successful, in step 304, the AAA server determines to send an external subscription registration request for the UE to the AMF in the serving SNPN based on a 3rd party policy or a service agreement with the serving SNPN via for example, the new interface between the AMF and the AAA server. The external subscription registration request includes the UE ID and the external subscription data for the UE. The external subscription data may include access and mobility related subscription data and session management related subscription data. Furthermore, the external subscription data may further include policy related subscription data and/or slice related subscription data.

[0065] In this embodiment, since the 3rd party entity has a service agreement with other networks (e.g., the serving SNPN), the 3rd party entity will create and maintain a set of subscription data of UE that is suitable for the serving network.

[0066] After receiving the external subscription registration request, in step 305, the AMF determines the external subscription registration request is allowed based on a local policy of the SNPN and/or the agreement with the 3rd party entity. In another embodiment, if the AMF determines the external subscription registration request is not allowed, for example, based on the local policy or there is no agreement with the 3rd party entity, the AMF may transmit a rejecting message as a response to the request to the AAA server.

[0067] Upon determining the external subscription registration request is allowed, in step 306, the AMF transmits the external subscription registration request including the UE ID and the external subscription data for the UE to the UDM.

[0068] In step 307, the UDM registers the UE with the UE ID and the received subscription data. For example, the UDM may store the received subscription data of the UE in the UDR.

[0069] After completing the registration successfully, in step 308, the UDM transmits an external subscription registration response to the AMF. The external subscription registration response may include the UE ID and the external subscription registration result. Since the UDM completes the registration successfully, the external subscription registration result indicates accepting; otherwise, the external subscription registration result indicates rejecting.

[0070] After receiving the external subscription registration response, in step 309, the AMF transmits the external subscription registration response including the UE ID and the external subscription registration result to the AAA server, for example, via the new interface. The AAA server may update the state of the subscription data of the UE related to the serving SNPN.

[0071] And then in step 310, the AMF may transmit a registration accept message to the UE. In particular, the serving SNPN transmits the registration accept message including necessary parameters to the UE, and the UE transmits a registration complete message to the serving SNPN if needed, more details are the same as the steps 15-24 in Figure 4.2.2.2.2-1 (Registration procedure) in section 4.2.2.2.2 in 3GPP 23.502, which will not be described in detail here.

[0072] Therefore, through the above described embodiments of the present application, it is possible for the SNPN to support the UE with external subscription data owned by a 3rd party entity by registering the external subscription data from the 3rd party entity to the UDM in the SNPN, so that the SNPN can manage the external UE as a native UE.

[0073] FIG. 4 illustrates an apparatus according to some embodiments of the present

application. In some embodiments of the present disclosure, the apparatus 400 may be the UDM illustrated in the above embodiments of the present application.

[0074] As shown in FIG. 4, the apparatus 400 may include a receiver 401, a transmitter 403, a processor 405, and a non-transitory computer-readable medium 407. The non-transitory computer-readable medium 407 has computer executable instructions stored therein. The processor 405 is configured to be coupled to the non-transitory computer readable medium 407, the receiver 401, and the transmitter 403. It is contemplated that the apparatus 400 may include more computer-readable mediums, receiver, transmitter and processors in some other embodiments of the present application according to practical requirements. In some embodiments of the present application, the receiver 401 and the transmitter 403 are integrated into a single device, such as a transceiver. In certain embodiments, the apparatus 400 may further include an input device, a memory, and/or other components.

[0075] In some embodiments of the present application, the non-transitory computer-readable medium 407 may have stored thereon computer-executable instructions to cause a processor to implement the processes performed by the UE in the above methods according to embodiments of the present application.

[0076] FIG. 5 illustrates an apparatus according to some other embodiments of the present application. In some embodiments of the present disclosure, the apparatus 500 may be the AMF illustrated in the above embodiments of the present application.

[0077] As shown in FIG. 5, the apparatus 500 may include a receiver 501, a transmitter 503, a processor 505, and a non-transitory computer-readable medium 507. The non-transitory computer-readable medium 507 has computer executable instructions stored therein. The processor 505 is configured to be coupled to the non-transitory computer readable medium 507, the receiver 501, and the transmitter 503. It is contemplated that the apparatus 500 may include more computer-readable mediums, receiver, transmitter and processors in some other embodiments of the present application according to practical requirements. In some embodiments of the present application, the receiver 501 and the transmitter 503 are integrated into a single device, such as a transceiver. In certain embodiments, the apparatus 500 may further include an input device, a memory, and/or other components.

[0078] In some embodiments of the present application, the non-transitory computer-readable medium 507 may have stored thereon computer-executable instructions to cause a processor to implement the processes performed by the AMF in the above methods according to embodiments of the present application.

[0079] Persons skilled in the art should understand that as the technology develops and advances, the terminologies described in the present application may change, and should not affect or limit the principle and spirit of the present application.

[0080] Those having ordinary skill in the art would understand that the steps of a method described in connection with the aspects disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. Additionally, in some aspects, the steps of a method may reside as one or any combination or set of codes and/or instructions on a non-transitory computer-readable medium, which may be incorporated into a computer program product.

[0081] While this disclosure has been described with specific embodiments thereof, it is evident that many alternatives, modifications, and variations may be apparent to those skilled in the art. For example, various components of the embodiments may be interchanged, added, or substituted in the other embodiments. Also, all of the elements of each figure are not necessary for operation of the disclosed embodiments. For example, one of ordinary skill in the art of the disclosed embodiments would be enabled to make and use the teachings of the disclosure by simply employing the elements of the independent claims. Accordingly, embodiments of the disclosure as set forth herein are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the disclosure.

[0082] In this document, the terms "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "a," "an," or the

like does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element. Also, the term "another" is defined as at least a second or more. The terms "including," "having," and the like, as used herein, are defined as "comprising."

WHAT IS CLAIMED:

1. A method performed by a data management entity, comprising:
 - receiving external subscription data for a user equipment (UE) from a home network of the UE;
 - registering the UE with the received external subscription data; and
 - generating and transmitting the external subscription registration result to the home network of the UE.
2. The method of Claim 1, wherein receiving the external subscription data for the UE comprises: receiving an external subscription registration request including an identity of the UE and the external subscription data for the UE from the home network of the UE, and
 - wherein transmitting the external subscription registration result to the home network of the UE comprises: transmitting an external subscription registration response including the identity of the UE and the external subscription registration result to the home network of the UE.
3. The method of Claim 2, wherein registering the UE with the received external subscription data further comprises: determining to register the UE with the received external subscription data based on a local policy of a non-public network after receiving the external subscription registration request.
4. The method of Claim 1, wherein receiving the external subscription data for the UE comprises: receiving an external subscription retrieve response including an identity of the UE and the external subscription data for the UE from the home network of the UE, and
 - wherein transmitting the external subscription registration result to the home network of the UE comprises: transmitting an external subscription registration

notification including the identity of the UE and the external subscription registration result to the home network of the UE.

5. The method of Claim 4, wherein the method further comprises:

before receiving the external subscription retrieve response, determining to retrieve the external subscription data for the UE from the home network of the UE based on a local policy of a non-public network; and

transmitting an external subscription retrieve request including an identity of the UE and an identity of the non-public network to the home network of the UE.

6. The method of Claim 1, wherein receiving the external subscription data for the UE comprises: receiving an external subscription registration request including an identity of the UE and the external subscription data for the UE from an access and mobility management function entity, and

wherein transmitting the external subscription registration result to the home network of the UE comprises: transmitting an external subscription registration response including the identity of the UE and the external subscription registration result to the access and mobility management function entity.

7. The method of claim 1, wherein the external subscription data comprises:

access and mobility related subscription data; and

session management related subscription data.

8. The method of claim 7, wherein the external subscription data further comprises at least one of:

policy related subscription data; and

slice related subscription data.

9. A method performed by an access and mobility management function entity, comprising:
- receiving external subscription data for a user equipment (UE) from a home network of the UE;
 - determining whether to register the external subscription data for the UE to a data management entity; and
 - transmitting an external subscription registration request to the data management entity in response to determining to register the external subscription data for the UE to the data management entity.
10. The method of claim 9, wherein receiving the external subscription data for the UE comprises: receiving an external subscription registration request including an identity of the UE and the external subscription data for the UE from the home network of the UE.
11. The method of claim 9, further comprising:
- receiving an external subscription registration response including an identity of the UE and an external subscription registration result from the data management entity; and
 - transmitting the external subscription registration response including the identity of the UE and the external subscription registration result to the home network of the UE.
12. The method of claim 9, wherein the external subscription data comprises:
- access and mobility related subscription data; and
 - session management related subscription data.
13. The method of claim 12, wherein the external subscription data further comprises at least one of:

policy related subscription data; and
slice related subscription data.

14. An apparatus, comprising:

at least one non-transitory computer-readable medium having computer executable instructions stored therein;

at least one receiver;

at least one transmitter; and

at least one processor coupled to the at least one non-transitory computer-readable medium, the at least one receiver and the at least one transmitter;

wherein the computer executable instructions are programmed to implement a method according to any one of Claims 1-8 with the at least one receiver, the at least one transmitter and the at least one processor.

15. An apparatus, comprising:

at least one non-transitory computer-readable medium having computer executable instructions stored therein;

at least one receiver;

at least one transmitter; and

at least one processor coupled to the at least one non-transitory computer-readable medium, the at least one receiver and the at least one transmitter;

wherein the computer executable instructions are programmed to implement a method according to any one of Claims 9-13 with the at least one receiver, the at least one transmitter and the at least one processor.

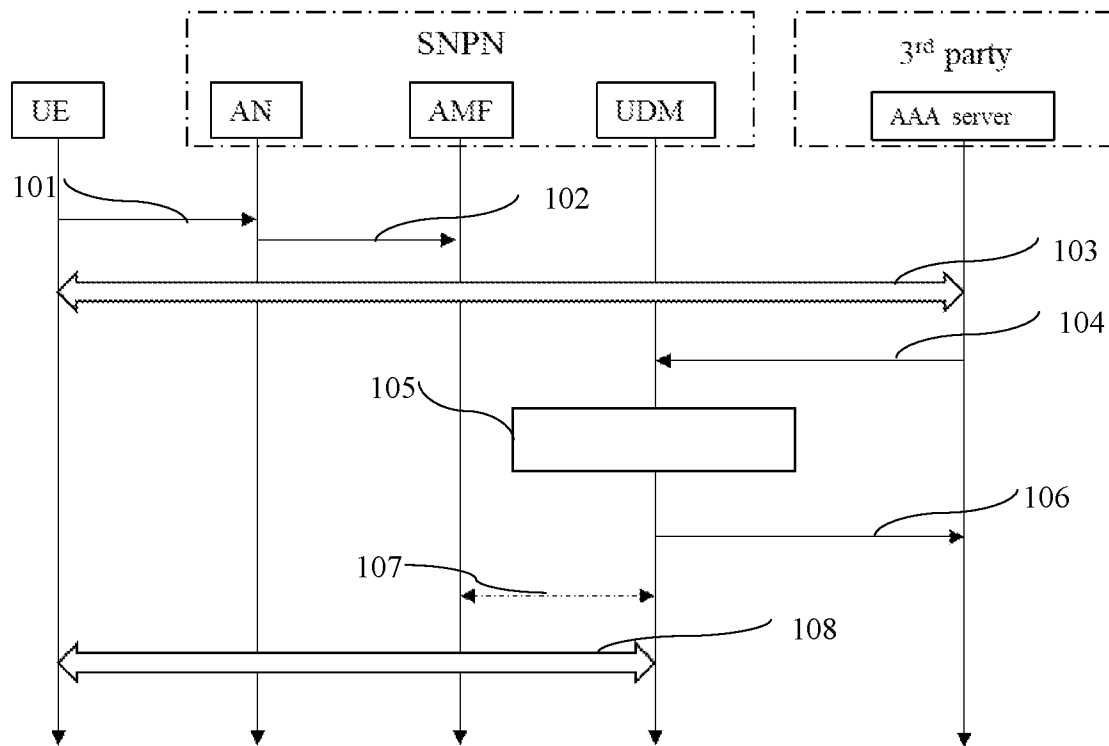


FIG. 1

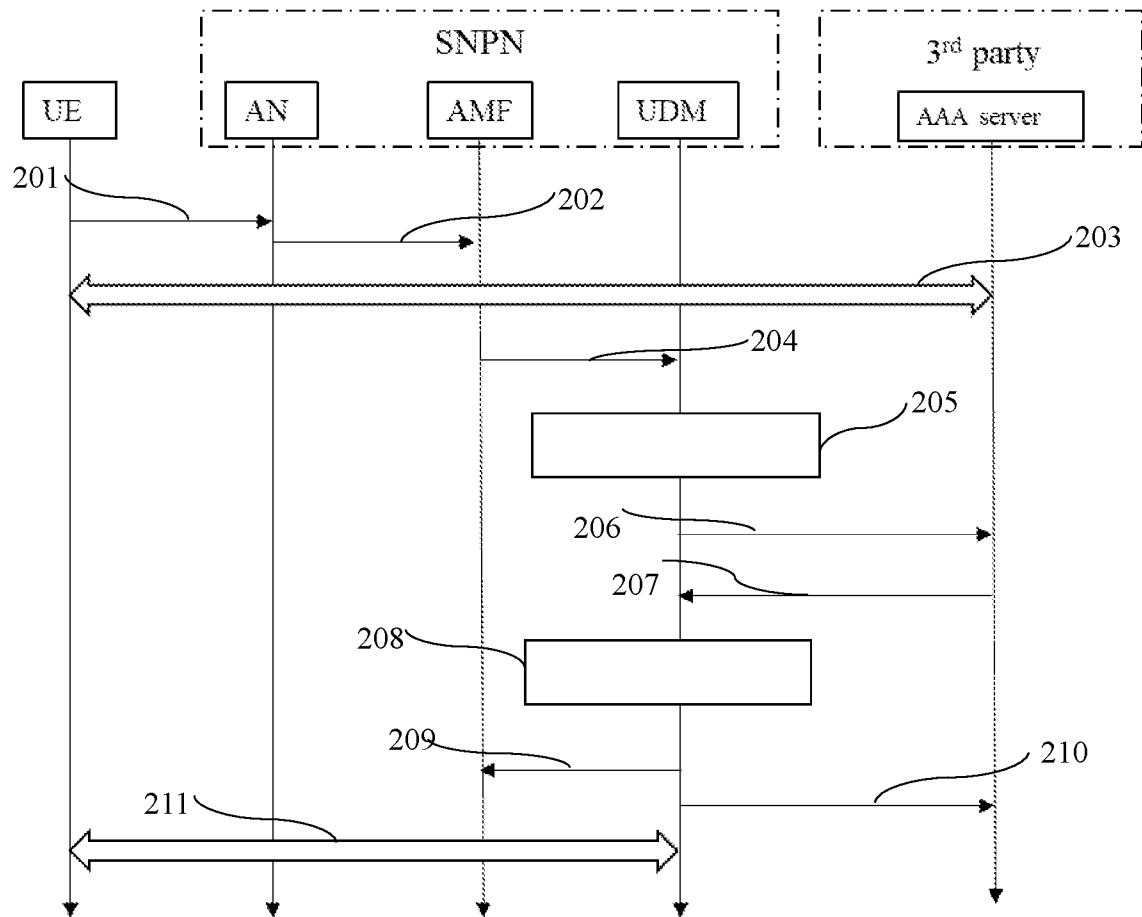


FIG. 2

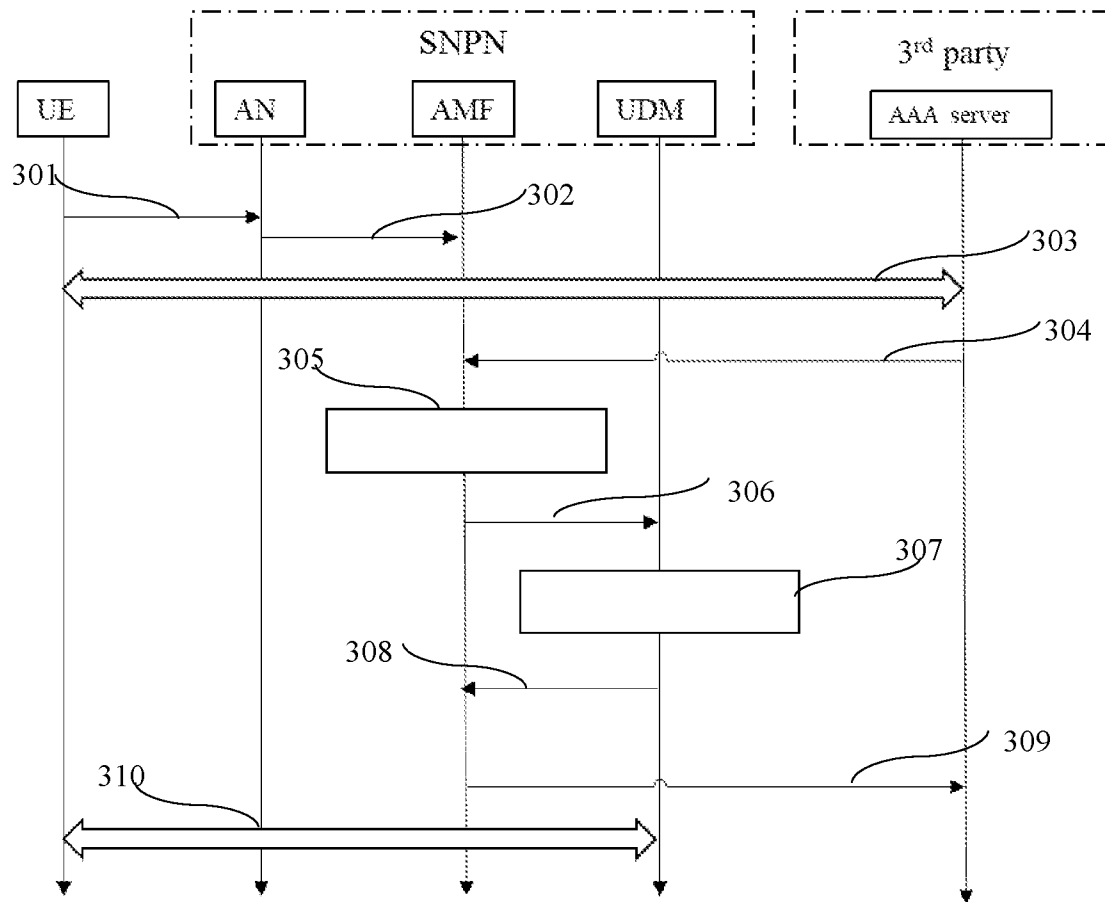


FIG. 3

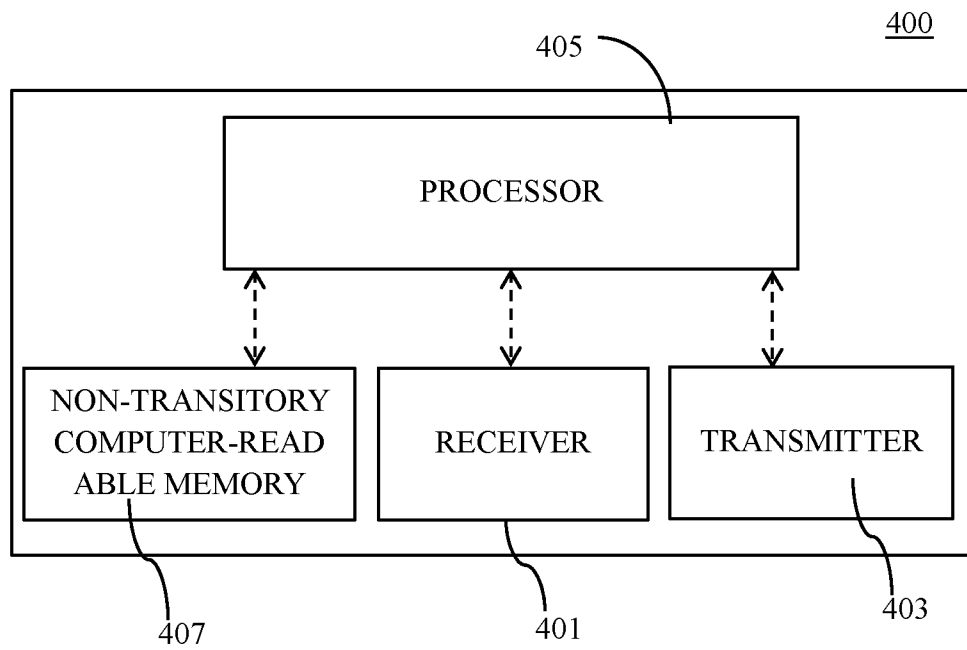


FIG. 4

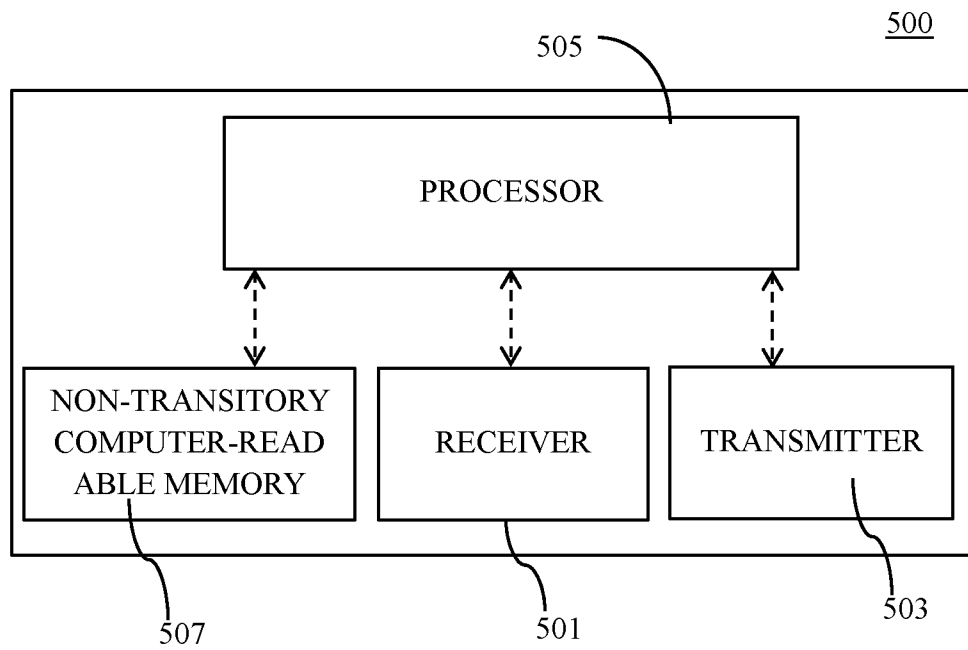


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/104468

A. CLASSIFICATION OF SUBJECT MATTER

H04W 48/02(2009.01)i; H04L 29/06(2006.01)i

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; H04L

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

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

CNPAT, CNKI, WPI, EPODOC, IEEE: UE, user w equipment, private, non-public, network, NPN, AMF, UDM, AAA, register +, subscription, subsrib+, request, data w management

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2020036401 A1 (SAMSUNG ELECTRONICS CO., LTD.) 20 February 2020 (2020-02-20) abstract; paragraphs 35,99-112 in description; figs. 1,7	1-15
A	WO 2020003576 A1 (NEC CORPORATION) 02 January 2020 (2020-01-02) the whole document	1-15
A	CN 109429214 A (HUAWEI TECHNOLOGIES CO., LTD.) 05 March 2019 (2019-03-05) the whole document	1-15
A	WO 2018138656 A1 (TATA COMMUNICATIONSUK LIMITED) 02 August 2018 (2018-08-02) the whole document	1-15
A	US 20200112841 A1 (SAMSUNG ELECTRONICS CO., LTD.) 09 April 2020 (2020-04-09) the whole document	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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“P” document published prior to the international filing date but later than the priority date claimed

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/104468

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
WO	2020036401	A1	20 February 2020	KR	2020019057	A	21 February 2020
WO	2020003576	A1	02 January 2020	CN	111684826	A	18 September 2020
				EP	3732907	A1	04 November 2020
				IN	202017032970	A	18 September 2020
CN	109429214	A	05 March 2019	None			
WO	2018138656	A1	02 August 2018	US	2019387394	A1	19 December 2019
				GB	2573920	A	20 November 2019
				US	20210021987	A1	21 January 2021
US	20200112841	A1	09 April 2020	WO	2020071704	A1	09 April 2020
				KR	2020039410	A1	16 April 2020