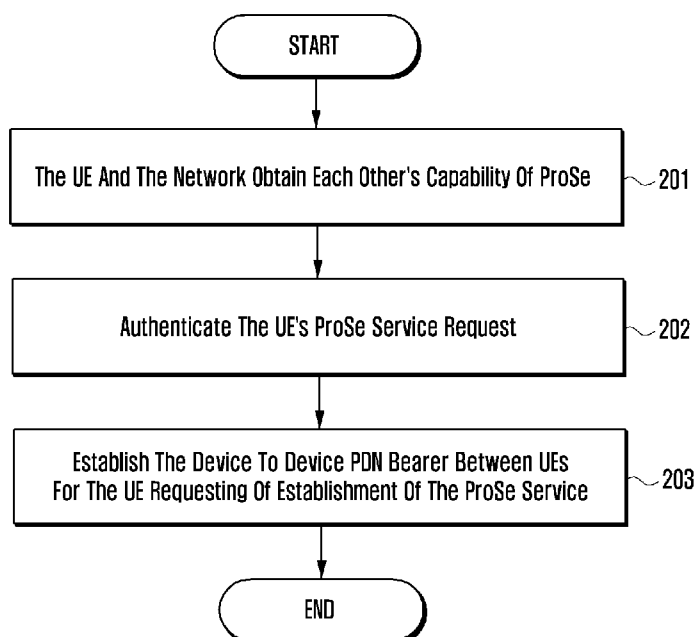




- (51) **International Patent Classification:**
H04W 8/02 (2009.01) H04W 12/06 (2009.01)
H04W 76/02 (2009.01)
- (21) **International Application Number:**
PCT/KR2014/002393
- (22) **International Filing Date:**
21 March 2014 (21.03.2014)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
201310092289.X 21 March 2013 (21.03.2013) CN
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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, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, 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, 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).

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(54) **Title:** METHOD AND USER EQUIPMENT FOR IMPLEMENTING DEVICE TO DEVICE COMMUNICATIONS BETWEEN UES



(57) **Abstract:** The present application provides a method for implementing a device to device (D2D) communication between UEs, wherein a UE and a network obtain each other's capability of Proximity Service (ProSe); the UE may activate the capability of ProSe that both the UE and the network support and initiates a request for a ProSe service with another UE to the network; the network authenticates the request for the ProSe service according to subscription information for the UE's device to device communication; and the network establishes a device to device PDN bearer between the two UEs for the request for the ProSe service passing the authentication. The present application further provides a user equipment. The present application is the basis for implementing the ProSe, the application thereof can satisfy service demands of public safety communication and realize network resource optimization configuration.



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))

Description

Title of Invention: METHOD AND USER EQUIPMENT FOR IMPLEMENTING DEVICE TO DEVICE COMMUNICATIONS BETWEEN UES

Technical Field

- [1] This application relates to wireless communication technology, and more particularly to a method and user equipment for implementing device to device (D2D) communications between UEs.

Background Art

- [2] The modern mobile communication increasingly tends to provide diversified services to users, and as shown in Figure 1, it is a system architecture diagram of the existing evolved packet system (EPS). In Figure 1, the user equipment (UE) 101 is a terminal device for receiving data. The evolved universal terrestrial radio access network (E-UTRAN) 102 is a radio access network, which comprises a macro base station (eNodeB) providing an interface for accessing a wireless network for the UE. The mobility management entity (MME) 103 is responsible for managing mobile context, session context and security information of the UE. The serving gateway (SGW) 104 provides mainly user plane functions, and the MME 103 and SGW 104 may reside in the same physical entity. The packet data network gateway (PGW) 105 may be responsible for functions such as charging, lawful interception and the like, and it may reside in the same physical entity as the SGW 104. The policy and charging rules function (PCRF) 106 provides quality of service (QoS) policies and charging criteria. The general packet radio service support node (SGSN) 108 is a network node device for providing routing for data transmission in the universal mobile telecommunication system (UMTS). The home subscriber server (HSS) 109 is a home subsystem which the UE belongs to, and is responsible for protecting subscriber information including the current location of the user equipment, the address of the serving node, subscriber security information, the packet data context of the user equipment and the like.

Disclosure of Invention

Technical Problem

- [3] Currently, Public Safety Department of the United States has employed the LTE network as an infrastructure communication network of the public safety communication service thereof. In the current public safety communication demands, there is a particular need for supporting a Proximity Service (ProSe) between the UEs,

including a ProSe discovery and a ProSe communication for discovering a ProSe user or being discovered by the ProSe user, and supporting direct path communications between the UEs of the ProSe users or supporting the UE of the ProSe user to implement a locally routed communication over the network. In the current network release of the 3GPP, there is a lack of the definition on the support and capability of the ProSe. Thus, related problems, such as the interaction between the UE and the network capability, the authentication of the subscription information, the one-to-one communication service request and bearer establishment based on locally-routed and the like, are not resolved in the ProSe.

Solution to Problem

- [4] The present application is directed to a method and user equipment for implementing device to device communications between UEs so as to provide a basis for the implementation of the ProSe, thus satisfying service requirements of the public safety communication and accomplishing optimization configurations of network resources.
- [5] The present application provides a method for implementing device to device communications between UEs, including:
 - [6] a user equipment (UE) and a network obtaining each other's capability of ProSe;
 - [7] a second UE initiating to the network a ProSe service request, the ProSe service request carrying a discovered UE identification that is used by a first UE, wherein the UE identification used to be discovered of the first UE is capable of uniquely identifying the first UE or a user to which the first UE corresponds; and
 - [8] the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively.
 - [9] Preferably, a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively includes:
 - [10] an MME of the first UE establishing a PDN bearer of the first UE, and updating an address of the serving packet data network gateway (PGW) and the UE identification used to be discovered to a centralization node; wherein the centralization node is a DNS, an HSS, a designated MME or a separate centralization node of a ProSe; and
 - [11] after receiving the ProSe service request initiated by the second UE, according to the UE identification used to be discovered of the first UE carried in the ProSe service request, an MME of the second UE issuing an query for the address of the serving PGW of the first UE to the centralization node, and selecting the same PGW for the second UE to establish a PDN bearer.
 - [12] Preferably, a process of the first UE and the second UE establishing a device to

device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively includes:

- [13] an MME of the first UE updating IMSI information of the first UE and the UE identification used to be discovered to a centralization node;
- [14] after receiving the ProSe service request initiated by the second UE, an MME of the second UE issuing an query for the IMSI information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE carried in the ProSe service request, and issuing a query for MME information of the first UE to an HSS according to the IMSI information of the first UE; and
- [15] the MME of the second UE requesting an address of the serving PGW of a ProSe service from the MME of the first UE, and selecting the same PGW for the second UE to establish a PDN bear.
- [16] Preferably, a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively includes:
 - [17] an MME of the first UE updating IMSI information of the first UE, MME information of the first UE and the UE identification used to be discovered to a centralization node;
 - [18] when an MME of the second UE receives the ProSe service request initiated by the second UE, based on the UE identification used to be discovered of the first UE carried in the ProSe service request, the MME of the second UE issuing a query for MME information of the first UE to the centralization node; and
 - [19] the MME of the second UE requesting an address of the serving PGW of a ProSe service from the MME of the first UE, and selecting the same PGW for the second UE to establish a PDN bear.
- [20] Preferably, a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively includes:
 - [21] an MME of the first UE updating IMSI information of the first UE and the UE identification used to be discovered to a centralization node; an MME of the second UE being a PGW selected by the second UE to access communication services;
 - [22] when receiving the ProSe service request initiated by the second UE, the MME of the second UE issuing an query for the IMSI information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE carried in the ProSe service request, and issuing a query for MME information of the first UE to an HSS according to the IMSI information of the first UE; and
 - [23] the serving MME of the second UE instructing the MME of the first UE to select the same PGW as the PGW of the ProSe service for first UE and second UE.

- [24] Preferably, a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively includes:
- [25] an MME of the first UE updating IMSI information of the first UE, MME information of the first UE and the UE identification used to be discovered to a centralization node; an MME of the second UE being a PGW selected by the second UE to access communication services;
- [26] when receiving the ProSe service request initiated by the second UE, the MME of the second UE issuing an query for the MME information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE carried in the ProSe service request; and
- [27] the serving MME of the second UE instructing the MME of the first UE to select the same PGW as the PGW of the ProSe service for first UE and second UE.
- [28] Preferably, the method further includes: after the first UE completes handover between MMEs, the target MME updating the MME information to the centralization node.
- [29] Preferably, the UE's capability of ProSe includes UE radio capability of ProSe and UE network capability of ProSe;
- [30] the network's capability of ProSe includes EPS capability of ProSe and E-UTRAN capability of ProSe.
- [31] Preferably, the UE radio capability of ProSe includes, but is not limited to, UE radio capability of ProSe discovery and UE radio capability of ProSe communication; or the UE radio capability of ProSe includes, but is not limited to, UE radio capability of ProSe discovery intra-frequency, UE radio capability of ProSe discovery inter-frequency, UE radio capability of ProSe communication intra-frequency and UE radio capability of ProSe communication inter-frequency; the UE radio capability of ProSe is sent to the network during the UE's attachment or the UE's TAU; and
- [32] the UE network capability of ProSe includes UE capability of ProSe discovery and UE network capability of ProSe communication; wherein, the UE capability of ProSe discovery includes, but is not limited to, UE network capability of ProSe discovery, UE network capability of ProSe being discovered; the UE network capability of ProSe communication includes, but is not limited to, UE network capability of ProSe communication based on locally-routed, UE network capability of ProSe communication based on direct mode, UE network capability of ProSe communication based on relay; the UE network capability of ProSe is sent to the network during the UE's attachment or the UE's TAU.
- [33] Preferably, the EPS capability of ProSe includes, but is not limited to, whether or not EPS capability of ProSe discovery is supported, and whether or not EPS capability of

- ProSe communication is supported; the EPS capability of ProSe is sent to the UE when the UE's attachment or the UE's TAU is accepted; and
- [34] the E-UTRAN capability of ProSe includes, but is not limited to, whether or not E-UTRAN capability of ProSe discovery is supported, and whether or not E-UTRAN capability of ProSe communication is supported; the E-UTRAN indicates the E-UTRAN capability of ProSe to the UE in a system information of a cell supporting the ProSe.
- [35] Preferably, the method further includes:
- [36] upon receiving the ProSe service request from the second UE, an MME of the second UE authenticating this request from the second UE according to ProSe subscription information of the second UE;
- [37] the ProSe subscription information of a UE includes, but is not limited to, the subscription information associated with ProSe discovery, the subscription information associated with ProSe being discovered, the subscription information associated with the ProSe service, wherein:
- [38] the subscription information associated with ProSe discovery includes: allowing being invoked with or without network coverage, allowing listing invoked APPs and a discovery range; the discovery range including a signal quality range or a range of geographical distances, a list of users, user groups, UEs or UE groups that is allowed to perform discovery, and a list of users, user groups, UEs or UE groups that is forbidden to perform discovery;
- [39] the subscription information associated with ProSe being discovered includes: allowing being invoked with or without network coverage, allowing listing invoked APPs, a list of users, user groups, UEs or UE groups that is allowed to be discovered, and a list of users, user groups, UEs or UE groups that is forbidden to be discovered; and
- [40] the subscription information associated with the ProSe service includes: allowing being invoked with or without network coverage, and an one-to-one communication or group communication based on locally-routed, UE direct path or Relay, communication services including phone calls, data flows and short messages.
- [41] The present application provides a user equipment, wherein the user equipment includes a communication capability interaction module, a ProSe discovery module and a ProSe communication module, wherein:
- [42] the communication capability interaction module is used for acquiring a capability of ProSe of a network, and sending its capability of ProSe to the network;
- [43] the ProSe discovery module is used for discovering another user equipment according to a discovered UE identifications that is used by said another user equipment; and
- [44] the ProSe communication module is used for initiating an ProSe service request to

the network, the ProSe service request carrying the discovered UE identification that is used by said another user equipment, and when the authentication of the said request are passed based on subscription information, establishing a device to device inter-UE PDN bearer based on locally-routed between the user equipment and said another user equipment.

Advantageous Effects of Invention

- [45] As seen from the above, in the technique scheme provided by this application, through the authorization of the communication capabilities and the authentication of the subscription information, the one-to-one locally routed path is established for the UE, thereby achieving routing optimization and saving resource occupations, which is the foundation of deploying and developing the ProSe service, offers various communication ways for the user and enriches the user's service experience.

Brief Description of Drawings

- [46] Figure 1 is a schematic diagram of system architecture of the existing EPS;
- [47] Figure 2 is a schematic flow diagram of a method for implementing device to device communications between UEs in this application;
- [48] Figure 3 is a schematic flow diagram of Method 1 for establishing a device to device PDN bearer between the UEs in this application;
- [49] Figure 4 is a schematic flow diagram of Method 2 for establishing a device to device PDN bearer between the UEs in this application;
- [50] Figure 5 is a schematic flow diagram of Method 3 for establishing a device to device PDN bearer between the UEs in this application;
- [51] Figure 6 is a schematic diagram of an embodiment of a method of the UE and the network obtaining each other's capability of ProSe service in this application;
- [52] Figure 7 is a schematic diagram of an embodiment of Method 1 for establishing a device to device PDN bearer between the UEs in this application;
- [53] Figures 8a and 8b are schematic diagrams of Embodiment 1 of Method 2 for establishing a device to device PDN bearer between the UEs in this application;
- [54] Figures 9a and 9b are schematic diagrams of Embodiment 2 of Method 2 for establishing a device to device PDN bearer between the UEs in this application;
- [55] Figures 10a and 10b are schematic diagrams of an embodiment of Method 3 for establishing a device to device PDN bearer between the UEs in this application; and
- [56] Figure 11 is a schematic diagram of a composition structure of preferred user equipment in this application.

Mode for the Invention

- [57] In order that the objects, technical schemes and advantages of this application become more apparent, the application will be described in further detail below with

reference to the drawing and by way of the embodiment.

- [58] Figure 2 is schematic flow diagram of a method for implementing device to device communications between UEs in this application, the method including the following steps:
- [59] Step 201: a UE and a network obtain each other's capability of Proximity Service (ProSe).
- [60] The UE and the network need to obtain mutually each other's capability of ProSe.
- [61] The UE's capability of ProSe includes UE radio capability of ProSe and UE network capability of ProSe.
- [62] The network's capability of ProSe includes EPS capability of ProSe and E-UTRAN capability of ProSe.
- [63] The UE network capability of ProSe includes UE capability of ProSe discovery and UE network capability of ProSe communication; wherein, the UE capability of ProSe discovery includes, but is not limited to, UE network capability of ProSe discovery, UE network capability of ProSe being discovered; the UE network capability of ProSe communication includes, but is not limited to, UE network capability of ProSe communication based on locally-routed, UE network capability of ProSe communication based on direct mode, UE network capability of ProSe communication based on relay; the UE network capability of ProSe is sent to the network during the UE's attachment or the UE's TAU.
- [64] The UE radio capability of ProSe includes, but is not limited to, UE radio capability of ProSe discovery and UE radio capability of ProSe communication; or the UE radio capability of ProSe further includes, but is not limited to, UE radio capability of ProSe discovery intra-frequency, UE radio capability of ProSe discovery inter-frequency, UE radio capability of ProSe communication intra-frequency and UE radio capability of ProSe communication inter-frequency; the UE radio capability of ProSe is sent to the network during the UE's attachment or the UE's TAU.
- [65] The EPS capability of ProSe includes, but is not limited to, whether or not EPS capability of ProSe discovery is supported, and whether or not EPS capability of ProSe is supported; the EPS capability of ProSe is sent to the UE when the UE's attachment or the UE's TAU is accepted.
- [66] The E-UTRAN capability of ProSe includes, but is not limited to, whether or not E-UTRAN capability of ProSe discovery is supported, and whether or not E-UTRAN capability of ProSe communication is supported; the E-UTRAN indicates the E-UTRAN capability of ProSe to the UE in a system information of a cell supporting the ProSe.
- [67] If both the network and the UE support the ProSe capability, the UE may activate the capability and initiate a request to the network, to discover UE in the proximity, or be discovered by UE in the proximity, or initiate a communication with UE in the

proximity.

[68] Step 202: the ProSe service request initiated by the UE is authenticated.

[69] Specifically, within the ProSe service system, the first UE employs the discovered UE identification that is used by certain UE in order to be discovered, the UE identification may uniquely identify the UE or the user, the second UE may discover the first UE based on the discovered UE identification that is used by certain UE through measurement, or also may discover the first UE based on the discovered UE identification that is used by certain UE which is configured by a network manager or a network, and may initiate to the network a ProSe service request. An MME needs to authenticate the communication request of the second UE according to the subscription information of the user.

[70] The ProSe subscription information of the UE includes but is not limited to the followings:

[71] ProSe discovering: allowing being invoked with or without network coverage, allowing listing invoked APPs and a discovery range; the discovery range including a signal quality range or a range of geographical distances, a list of users, user groups, UEs or UE groups that is allowed to perform discovery, and a list of users, user groups, UEs or UE groups that is forbidden to perform discovery;

[72] ProSe being discovered: allowing being invoked with or without network coverage, allowing listing invoked APPs, a list of users, user groups, UEs or UE groups that is allowed to be discovered, and a list of users, user groups, UEs or UE groups that is forbidden to be discovered; and

[73] ProSe service: allowing being invoked with or without network coverage, and an one-to-one communication or group communication based on locally-routed, UE direct path or Relay, communication services including phone calls, data flows and short messages and the like.

[74] Step 203: a device to device PDN bearer between the UEs based on locally-routed is established, that is: the PDN bearers with the same PGW are established respectively for the two UEs requesting the ProSe service.

[75] With respect to the ProSe service request of which the authentication is passed, the MME establishes two device to device PDN bearers respectively for the two UEs, and the two PDN bearers are established on the same PGW. The establishment procedure of the device to device PDN bearers between the UEs will be described in detail below with reference to the accompanying drawings.

[76] Figure 3 is a schematic flow diagram of Method 1 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:

[77] Step 301: an MME establishes a PDN bearer of the first UE, and updates an address

of the serving PGW and the UE identification used to be discovered to a centralization node.

- [78] When the first UE activates the capability of ProSe or the capability of ProSe of the first UE is authorized, the MME selects for the first UE a PGW nearby as the serving PGW of its ProSe, and stores the address of the serving PGW and the UE identification used by the first UE for being discovered in a centralization node in the network. The address of this centralization node is preconfigured on the MME supporting the ProSe.
- [79] The centralization node may be a DNS, HSS, a certain MME or a separate centralization node of the ProSe.
- [80] Step 302: the MME issues a query for the serving PGW of the first UE to the centralization node, and selects the same PGW for the second UE to establish the PDN bearer.
- [81] When the second UE initiates a request for the ProSe service with the first UE to the network, the request carries the UE identification used to be discovered of the first UE. Based on the UE identification used to be discovered of the first UE, the MME issues a query for the address of the serving PGW which serves the first UE in the ProSe service to the centralization node, and selects the same PGW for the second UE to establish the PDN bearer.
- [82] Figure 4 is a schematic flow diagram of Method 2 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:
- [83] Step 401: the MME of the first UE updates the IMSI information and the UE identification used to be discovered of the first UE, or updates the IMSI information, MME information and the UE identification used to be discovered of the first UE to the centralization node.
- [84] When the first UE activates the capability of ProSe or the capability of ProSe of the first UE is authorized, its MME stores the IMSI information of the first UE and the UE identify used to be used of the first UE in a centralization node in the network, or stores the first UE's IMSI information, MME information and the UE identification used to be discovered in a centralization node in the network. The MME information is the identification (GUMMEI) and the address of the MME.
- [85] The centralization node may be a DNS, HSS, a certain MME or a separate centralization node of the ProSe.
- [86] With respect to the manner that MME information is updated to the centralization node, when the first UE completes handover between MMEs, the target MME updates new MME information to the centralization node.
- [87] Step 402: the MME of the second UE issues a query for the MME of the first UE to the centralization node.

- [88] When the second UE initiates a request for the ProSe service with the first UE to the network, the request carries the UE identification used to be discovered of the first UE. On the condition that in Step 401, the MME only stores the IMSI information and the UE identification used to be discovered of the first UE in the centralization node, then, in this step, at first, the MME issues a query for the IMSI of the first UE to the centralization node according to the UE identification used to be discovered of the first UE, and then issues a query for the MME information of the first UE to the HSS according to the IMSI of the UE. On the condition that in Step 401, the MME stored the IMSI information, MME information and the UE identification used to be discovered of the first UE in the centralization node, then, the target MME needs to update the MME information to the centralization node when the UE performs handover between the MMEs, and in this step, the MME may directly issues a query for the MME information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE.
- [89] Step 403: the MME of the second UE issues a request for the address of the serving PGW of the ProSe of the first UE to the MME of the first UE, and selects the same PGW for the second UE to establish the PDN bearer.
- [90] After receiving communication service request transmitted by the MME of the second UE, the MME of the first UE pages the first UE, selects for the first UE a PGW nearby for establishing a PDN connection of the ProSe service, and returns the PGW's address to the MME of the second UE, and the MME of the second UE selects the same PGW for the second UE to establish the PDN bearer.
- [91] Figure 5 is a schematic flow diagram of Method 3 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:
- [92] Step 501: the MME of the first UE updates the IMSI information and the UE identification used to be discovered of the first UE, or updates the IMSI information, MME information and the UE identification used to be discovered of the first UE to the centralization node.
- [93] When the first UE activates the capability of ProSe or the capability of ProSe of the first UE is authorized, its MME stores the IMSI information of the first UE and the UE identification used to be discovered of the first UE in a centralization node in the network, or stores the first UE's IMSI information, MME information and the UE identification used to be discovered in a centralization node in the network. The MME information is the identification (GUMMEI) and the address of the MME.
- [94] With respect to the manner in which the MME information is updated to the centralization node, the target MME updates the MME information to the centralization node when the first UE completes the handover between MMEs.

- [95] The centralization node may be a DNS, HSS, a certain MME or a separate centralization node of the ProSe.
- [96] Step 502: the MME of the second UE selects for the second UE the PGW through which the second UE is to access a communication service.
- [97] When the second UE initiates a request for the ProSe service with the first UE to the network, the MME selects the PGW through which the second UE is to access the communication service.
- [98] Step 503: the MME of the second UE issues a query for the MME information of the first UE to the centralized node.
- [99] The second UE initiates a request for the ProSe service with the first UE to the network, and the request carries the UE identification used to be discovered of the first UE. On the condition that in Step 501, the MME only stores the IMSI information and the UE identification used to be discovered of the first UE in the centralization node, then, in this step, at first, the MME issues a query for the IMSI of the first UE to the centralization node according to the UE identification used to be discovered of the first UE, and then issues a query for the MME information of the first UE to the HSS according to the IMSI of the UE. On the condition that in Step 501, the MME stored the IMSI information, MME information and the UE identification used to be discovered of the first UE in the centralization node, the target MME needs to update the MME information to the centralization node when the UE performs handover between the MMEs, and in this step, the MME may directly issue a query for the MME information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE.
- [100] Step 504: the MME of the second UE instructs the MME of the first UE to select the same PGW as the PGW of the ProSe service for the first UE and the second UE.
- [101] The MME of the second UE initiates a request for the ProSe service to the MME of the first UE, and the request carries the PGW's address or indicates the storage location of the PGW's address. The MME of the first UE establishes for the first UE a PDN connection to the PGW designated in the request. After receiving a ProSe service response that the MME of the first UE returns, the MME of the second UE establishes a PDN bearer to the same PGW for the second UE.
- [102] Figure 6 is a schematic diagram of an embodiment of a method of the UE and the network obtaining each other's capability of ProSe service in this application, the method including the following steps:
- [103] Step 601: a UE performs the establishment procedure of a RRC connection between the UE and the network.
- [104] Step 602: The UE sends an attach request or a TAU request to the MME, the request carrying the UE network capability of ProSe. The UE network capability of ProSe

includes but is not limited to, UE capability of ProSe discovery and UE network capability of ProSe being discovered. The UE network capability of ProSe communication includes, but is not limited to, UE network capability of ProSe communication based on locally-routed, UE network capability of ProSe communication based on direct mode, UE network capability of ProSe communication based on relay.

- [105] Steps 603: the UE completes procedures of authentication and encryption between the UE and the network.
- [106] Step 604: an MME sends to an eNB an Initial UE Context Setup Request, and the request carries an Attach Accept or TAU Accept, where the Attach Accept or TAU Accept carries the EPS capability of ProSe, and the UE's radio capability parameter carried in the request is null.
- [107] Step 605: after the eNB receives Initial UE Context Setup Request, it finds that the UE's radio capability parameter is null, then triggers Step 607 to issue a query for the UE's radio capability, at the same time, transmits the Attach Accept or TAU Accept to the UE through an RRC message, where the Attach Accept or TAU Accept carries the EPS capability of ProSe which includes but is not limited to, whether or not EPS capability of ProSe discovery is supported, and whether or not EPS capability of ProSe communication is supported.
- [108] Step 606: the UE returns to the network an Accept Complete or TAU Complete.
- [109] Step 607: the eNB sends a UE Capability Enquiry to the UE for querying the radio capability that the UE supports.
- [110] Step 608: the UE returns its UE Capability Information to the eNB, including the UE radio capability of ProSe that the UE supports. The UE radio capability of ProSe includes, but is not limited to, UE radio capability of ProSe discovery and UE radio capability of ProSe communication, or includes, but not limited to, UE radio capability of ProSe discovery intra-frequency, UE radio capability of ProSe discovery inter-frequency, UE radio capability of ProSe communication intra-frequency and UE radio capability of ProSe communication inter-frequency.
- [111] Step 609: the eNB sends the obtained UE radio capability to the MME by a UE Capability Info Indication which includes the UE radio capability of ProSe that the UE supports.
- [112] Furthermore, the UE may obtain the E-UTRAN capability of ProSe of a cell by a system information broadcasted by the cell. The E-UTRAN capability of ProSe includes, but is not limited to, whether or not E-UTRAN capability of ProSe discovery is supported, and whether or not E-UTRAN capability of ProSe communication is supported. The E-UTRAN indicates the E-UTRAN capability of ProSe to the UE in a system information of a cell supporting the ProSe.
- [113] With respect to the ProSe capability that both the network and the UE support, the

UE may activate the capability and initiate a request to the network so as to discover a UE in the proximity, or be discovered by a UE in the proximity, or initiate a communication with a UE in the proximity.

- [114] Figure 7 is a schematic diagram of an embodiment of Method 1 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:
- [115] Step 701: a first UE establishes a RRC connection with a network.
- [116] Step 702: the first UE sends a request for activating a ProSe service to the MME of the first UE, and the request carries the UE identification used to be discovered of the first UE, and the UE identification used to be discovered may uniquely identify the first UE.
- [117] Step 703: the MME of the first UE authenticates the request for activating the ProSe service of the first UE according to the first UE's subscription information for the ProSe.
- [118] Step 704: with respect to the request for activating the ProSe service the authentication of which is passed, the MME of the first UE selects a PGW nearby to establish a PDN connection for the first UE, and the PGW is an IP address which the first UE allocates for the ProSe service.
- [119] Step 705: the MME of the first UE registers in a DNS the first UE's serving PGW of ProSe service, IP address, UE identification used to be discovered.
- [120] Step 706: the DNS returns to the MME of the first UE a registration response.
- [121] Step 707: the MME of the first UE returns to the first UE a ProSe service activation response.
- [122] Step 708: a second UE discovers the UE identification used to be discovered of the first UE.
- [123] Step 709: the second UE establishes a RRC connection with the network.
- [124] Step 710: the second UE sends a request for activating the ProSe service to the MME of the second UE, requesting the establishment of a one-to-one ProSe communication with the first UE, and the request carries the UE identification used to be discovered of the first UE which may uniquely identify the first UE and include the PLMN supporting the ProSe service.
- [125] Step 711: the MME of the second UE authenticates the request for activating the ProSe service of the second UE according to the second UE's subscription information for the ProSe.
- [126] Step 712: with respect to the request for activating the ProSe service whose authentication is passed, the MME of the second UE issues a query for the address of the first UE's serving PGW in the ProSe service to the DNS request according to the UE identification used to be discovered of the first UE.

- [127] Step 713: the DNS returns to the MME of the second UE the address of the first UE's serving PGW in the ProSe service.
- [128] Step 714: the MME of the second UE selects the first UE's serving PGW in the ProSe service for the second UE to establish a PDN connection.
- [129] Figures 8a and 8b are schematic diagrams of Embodiment 1 of Method 2 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:
- [130] Step 801: a first UE establishes a RRC connection with a network.
- [131] Step 802: The first UE sends a request for activating a ProSe service to the MME of the first UE, and the request carries the UE identification used to be discovered of the first UE which may uniquely identify the first UE.
- [132] Step 803: the MME of the first UE authenticates the request for activating the ProSe service of the first UE according to the first UE's subscription information for the ProSe. With respect to the request for activating the ProSe service whose authentication is passed, the MME of the first UE may immediately or upon receiving the ProSe service request sent by the MME of another UE, select a PGW nearby for the first UE to establish a PDN connection, and the PGW is an IP address which the first UE allocates for the ProSe service, which corresponds to Steps 804 and 815 respectively.
- [133] Step 804: the MME of the first UE selects a PGW nearby for the first UE to establish a PDN connection, and the PGW is the IP address which the first UE allocates for the ProSe service.
- [134] Step 805: the MME of the first UE sends a request for updating the ProSe's information of the UE to a centralization node, and stores in the centralization node the IMSI information, MME information and the UE identification to be discovered of the first UE. The MME information is the identification (GUMMEI) and the address of the MME.
- [135] The centralization node may be an HSS, a certain MME or a separate centralization node of the ProSe.
- [136] The target MME updates the new MME information to the centralization node when the first UE completes the handover between the MMEs.
- [137] Step 806: the centralization node returns to the MME of the first UE a update response of the UE's ProSe information.
- [138] Steps 807-811 are identical to Steps 707-711, and so a description thereof will not be repeated.
- [139] Step 812: with respect to the request for activating the ProSe service whose authentication is passed, the MME of the second UE issues to the centralization node a query for the MME information of the first UE according to the UE identification used to be

discovered of the first UE.

- [140] Step 813: the centralization node returns to the MME of the second UE the MME information and IMSI information of the first UE.
- [141] Step 814: the MME of the second UE sends a ProSe service request to the MME of the first UE and designates the IMSI of the first UE.
- [142] Step 815: the MME of the first UE selects a PGW nearby for the first UE to establish a PDN connection, and the PGW is the IP address which the first UE allocates for the ProSe service.
- [143] Step 816: the MME of first UE returns to the MME of the second UE a ProSe service response, and carries the address of the first UE's serving PGW of the ProSe service.
- [144] Step 817: the MME of the second UE selects the first UE's serving PGW of the ProSe service for the second UE to establish a PDN connection.
- [145] Figures 9a and 9b are schematic diagrams of Embodiment 2 of Method 2 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:
- [146] Steps 901-904 are identical to Steps 801-804, and so a description thereof will not be repeated.
- [147] Step 905: the MME of the first UE sends a request for updating the ProSe information of the UE to the centralization node, and stores the IMSI information and the UE identification used to be discovered of the first UE in the centralization node.
- [148] The centralization node may be an HSS, a certain MME or a separate centralization node of the ProSe.
- [149] Step 906: the centralization node returns to the MME of the first UE an update response of the UE's ProSe information.
- [150] Steps 907-911 are identical to Steps 807-811, and so a description thereof will not be repeated.
- [151] Step 912: with respect to the request for activating the communication service whose authentication is passed, the MME of the second UE issues a query for the IMSI information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE.
- [152] Step 913: the centralization node returns the IMSI information of the first UE to the MME of the second UE.
- [153] Step 914: the MME of the second UE issues a query for the MME information of the first UE to an HSS based on the IMSI information of the first UE.
- [154] Step 915: the HSS returns the MME information of the first UE to the MME of the second UE.
- [155] Steps 916-919 are identical to Steps 814-817, and so a description thereof will not be repeated.

- [156] Figures 10a and 10b are schematic diagrams of an embodiment of Method 3 for establishing a device to device PDN bearer between the UEs in this application, the method including the following steps:
- [157] Steps 1001-1003 are identical to Steps 801-803, and so a description thereof will not be repeated.
- [158] Steps 1004-1012 are identical to Steps 805-813, and so a description thereof will not be repeated.
- [159] Step 1013: the MME of the second UE selects a PGW nearby for the second UE.
- [160] Step 1014: the MME of the second UE sends a ProSe service request to the MME of the first UE and designates the IMSI of the first UE and the address of the PGW of the ProSe service which is namely the nearby PGW that the MME of the second UE selects for the second UE in Step 1013.
- [161] Step 1015: the MME of the first UE selects for the first UE the PGW of the ProSe service that is selected for the second UE to establish a PDN connection, and the PGW is the IP address which the first UE allocates for the ProSe service.
- [162] Step 1016: the MME of the first UE returns to the MME of the second UE a ProSe service response.
- [163] Step 1017: the MME of the second UE establishes a PDN connection to the PGW's address of the designated ProSe service for the second UE, and the PGW is the IP address which the second UE allocates for the ProSe service.
- [164] Corresponding to the above described method, the present application also discloses a user equipment as shown in Fig. 11, the user equipment including a communication capability interaction module 1110, a ProSe discovery module 1120 and a ProSe communication module 1130, wherein:
- [165] The communication capability interaction 1110 module is used for acquiring a ProSe capability of a network, and sends its capability of ProSe to the network.
- [166] The ProSe discovery module 1120 is used for discovering another user equipment according to a UE identification used to be discovered of said another user equipment.
- [167] The ProSe communication module 1130 is used for initiating an ProSe service request to the network, the request carrying the UE identification used to be discovered of said another user device, when authentication of the request is passed based on subscription information, this user equipment and said another user equipment establish their device to device PDN bearer between UEs based on locally-routed.
- [168] The method provided by the present application is applicable for solving related problems about capability interactions between the UE and the network in the ProSe, the authentication of the subscription information and the one-to-one communication service request and bearer establishment based on locally-routed. The present application is the basis of achieving the ProSe, thus meeting service demands of public

safety communication and implementing network resource optimization configuration.

- [169] The above-described is only a preferred embodiment of the present application, and is not intended to limit the present application, and any modification, equivalent substitution, improvement and the like that are made within the spirit and principle of this application should be included within the protection scope of the present application.

Claims

- [Claim 1] A method for implementing a device to device (D2D) communication between UEs, wherein the method comprises:
a user equipment (UE) and a network obtaining each other's capability of Proximity Service (ProSe);
a second UE initiating to the network a ProSe service request, the ProSe service request carrying a UE identification used to be discovered of the first UE, wherein the UE identification used to be discovered of the first UE is capable of uniquely identifying the first UE or a user to which the first UE corresponds; and
the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively.
- [Claim 2] The method according to claim 1, wherein a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively comprises:
an MME of the first UE establishing a PDN bearer of the first UE, and updating an address of the serving packet data network gateway (PGW) and the UE identification used to be discovered to a centralization node; wherein the centralization node is a DNS, an HSS, a designated MME or a separate centralization node of a ProSe; and
after receiving the ProSe service request initiated by the second UE, according to the UE identification used to be discovered of the first UE carried in the ProSe service request, an MME of the second UE issuing an query for the address of the serving PGW of the first UE to the centralization node, and selecting the same PGW for the second UE to establish a PDN bearer.
- [Claim 3] The method according to claim 1, wherein a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively comprises:
an MME of the first UE updating IMSI information of the first UE and the UE identification used to be discovered to a centralization node; and
after receiving the ProSe service request initiated by the second UE, an MME of the second UE issuing a query for the IMSI information of the first UE to the centralization node according to the UE identification

used to be discovered of the first UE carried in the ProSe service request, and issuing a query for MME information of the first UE to an HSS according to the IMSI information of the first UE; and the MME of the second UE requesting an address of the serving PGW of a ProSe service from the MME of the first UE, and selecting the same PGW for the second UE to establish a PDN bear.

[Claim 4]

The method according to claim 1, wherein a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively comprises:

an MME of the first UE updating IMSI information of the first UE, MME information of the first UE and the UE identification used to be discovered to a centralization node;

when an MME of the second UE receives the ProSe service request initiated by the second UE, based on the UE identification used to be discovered of the first UE carried in the ProSe service request, the MME of the second UE issuing a query for MME information of the first UE to the centralization node; and

the MME of the second UE requesting an address of the serving PGW of a ProSe service from the MME of the first UE, and selecting the same PGW for the second UE to establish a PDN bear.

[Claim 5]

The method according to claim 1, wherein a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively comprises:

an MME of the first UE updating IMSI information of the first UE and the UE identification used to be discovered to a centralization node; an MME of the second UE being a PGW selected by the second UE to access communication services;

when receiving the ProSe service request initiated by the second UE, the MME of the second UE issuing a query for the IMSI information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE carried in the ProSe service request, and issuing a query for MME information of the first UE to an HSS according to the IMSI information of the first UE; and the serving MME of the second UE instructing the MME of the first UE to select the same PGW as the PGW of the ProSe service for first UE and second UE.

- [Claim 6] The method according to claim 1, wherein a process of the first UE and the second UE establishing a device to device packet data network (PDN) bearer between the UEs with the same packet data network gateway (PGW) respectively comprises:
an MME of the first UE updating IMSI information of the first UE, MME information of the first UE and the UE identification used to be discovered to a centralization node; an MME of the second UE being a PGW selected by the second UE to access communication services; when receiving the ProSe service request initiated by the second UE, the MME of the second UE issuing an query for the MME information of the first UE to the centralization node according to the UE identification used to be discovered of the first UE carried in the ProSe service request; and
the serving MME of the second UE instructing the MME of the first UE to select the same PGW as the PGW of the ProSe service for first UE and second UE.
- [Claim 7] The method according to claim 4 or 6, wherein the method further comprises:
after the first UE completes handover between MMEs, the target MME updating the MME information to the centralization node.
- [Claim 8] The method according to any one of claims 1 to 7, wherein the UE's capability of ProSe comprises UE radio capability of ProSe and UE network capability of ProSe;
the network's capability of ProSe comprises EPS capability of ProSe and E-UTRAN capability of ProSe.
- [Claim 9] The method according to claim 8, wherein
the UE radio capability of ProSe comprises, but is not limited to, UE radio capability of ProSe discovery and UE radio capability of ProSe communication; or the UE radio capability of ProSe comprises, but is not limited to, UE radio capability of ProSe discovery intra-frequency, UE radio capability of ProSe discovery inter-frequency, UE radio capability of ProSe communication intra-frequency and UE radio capability of ProSe communication inter-frequency; the UE radio capability of ProSe is sent to the network during the UE's attachment or the UE's TAU; and
the UE network capability of ProSe comprises UE capability of ProSe discovery and UE network capability of ProSe communication;
wherein, the UE capability of ProSe discovery comprises, but is not

limited to, UE network capability of ProSe discovery, UE network capability of ProSe being discovered; the UE network capability of ProSe communication comprises, but is not limited to, UE network capability of ProSe communication based on locally-routed, UE network capability of ProSe communication based on direct mode, UE network capability of ProSe communication based on relay; the UE network capability of ProSe is sent to the network during the UE's attachment or the UE's TAU.

[Claim 10]

The method according to claim 8, wherein:

the EPS capability of ProSe comprises, but is not limited to, whether or not EPS capability of ProSe discovery is supported, and whether or not EPS capability of ProSe communication is supported; the EPS capability of ProSe is sent to the UE when the UE's attachment or the UE's TAU is accepted; and

the E-UTRAN capability of ProSe comprises, but is not limited to, whether or not E-UTRAN capability of ProSe discovery is supported, and whether or not E-UTRAN capability of ProSe communication is supported; the E-UTRAN indicates the E-UTRAN capability of ProSe to the UE in a system information of a cell supporting the ProSe.

[Claim 11]

The method according to any one of claims 1 to 7, wherein the method further comprises:

upon receiving the ProSe service request from the second UE, an MME of the second UE authenticating this request from the second UE according to ProSe subscription information of the second UE; the ProSe subscription information of a UE comprises, but is not limited to, the subscription information associated with ProSe discovery, the subscription information associated with ProSe being discovered, the subscription information associated with the ProSe service, wherein:

the subscription information associated with ProSe discovery comprises: allowing being invoked with or without network coverage, allowing listing invoked APPs and a discovery range; the discovery range comprising a signal quality range or a range of geographical distances, a list of users, user groups, UEs or UE groups that is allowed to perform discovery, and a list of users, user groups, UEs or UE groups that is forbidden to perform discovery;

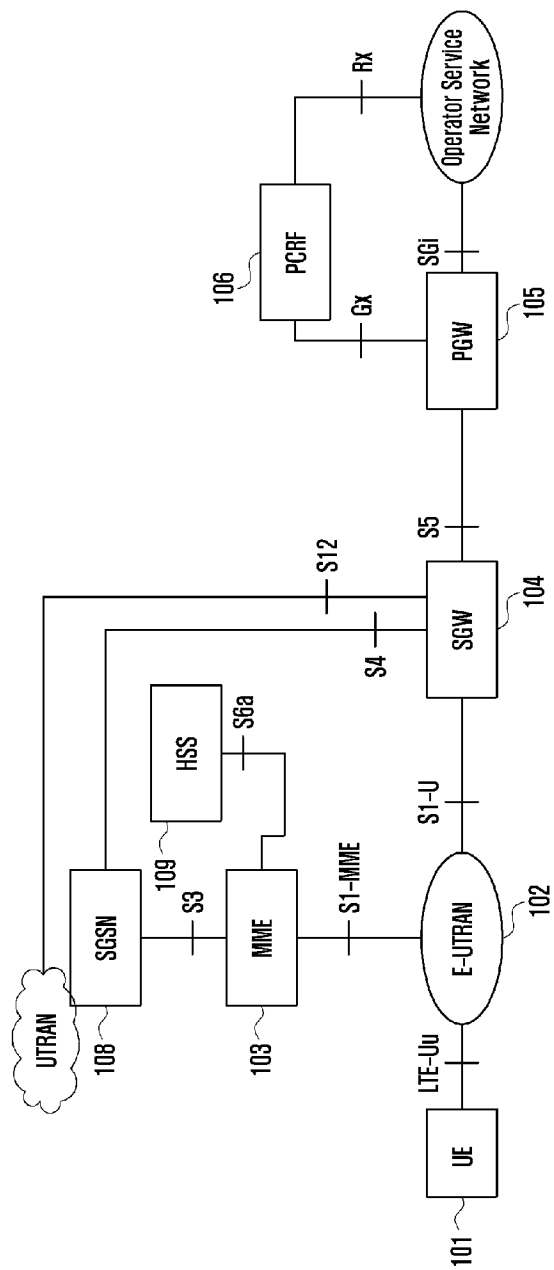
the subscription information associated with ProSe being discovered comprises: allowing being invoked with or without network coverage,

allowing listing invoked APPs, a list of users, user groups, UEs or UE groups that is allowed to be discovered, and a list of users, user groups, UEs or UE groups that is forbidden to be discovered; and the subscription information associated with the ProSe service comprises: allowing being invoked with or without network coverage, and an one-to-one communication or group communication based on locally-routed, UE direct path or Relay, communication services comprising phone calls, data flows and short messages.

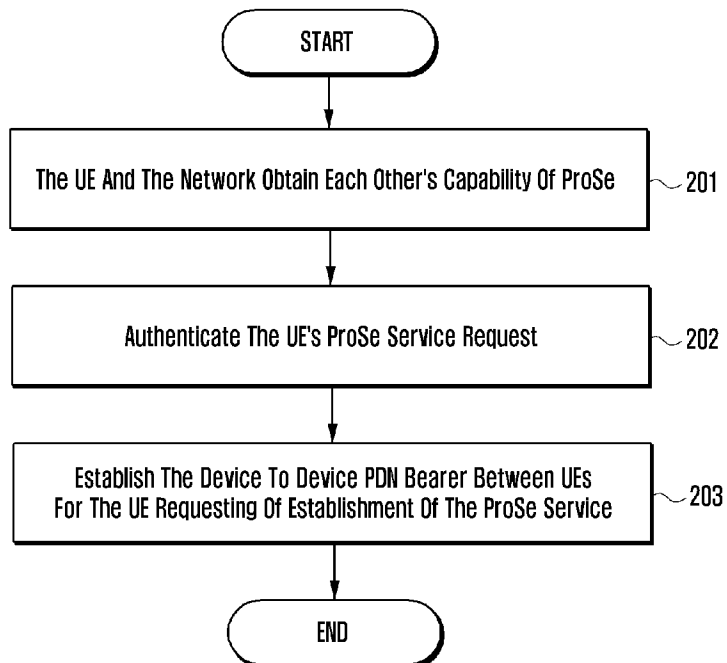
[Claim 12]

A user equipment, wherein the user equipment comprises a communication capability interaction module, a Proximity Service (ProSe) discovery module and a ProSe communication module, wherein: the communication capability interaction module is used for acquiring a capability of ProSe of a network, and sending its capability of ProSe to the network; the ProSe discovery module is used for discovering another user equipment according to a discovered UE identifications that is used by said another user equipment; and the ProSe communication module is used for initiating an ProSe service request to the network, the ProSe service request carrying the discovered UE identification that is used by said another user equipment, and when the authentication of the said request are passed based on subscription information, establishing a device to device inter-UE PDN bearer based on locally-routed between the user equipment and said another user equipment.

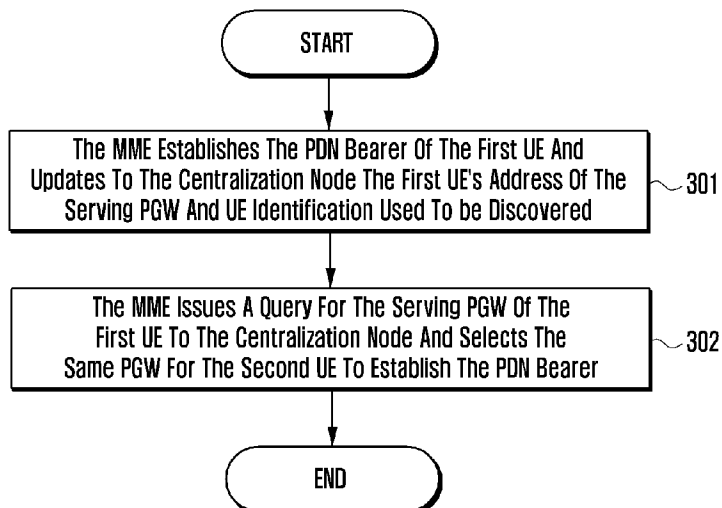
[Fig. 1]



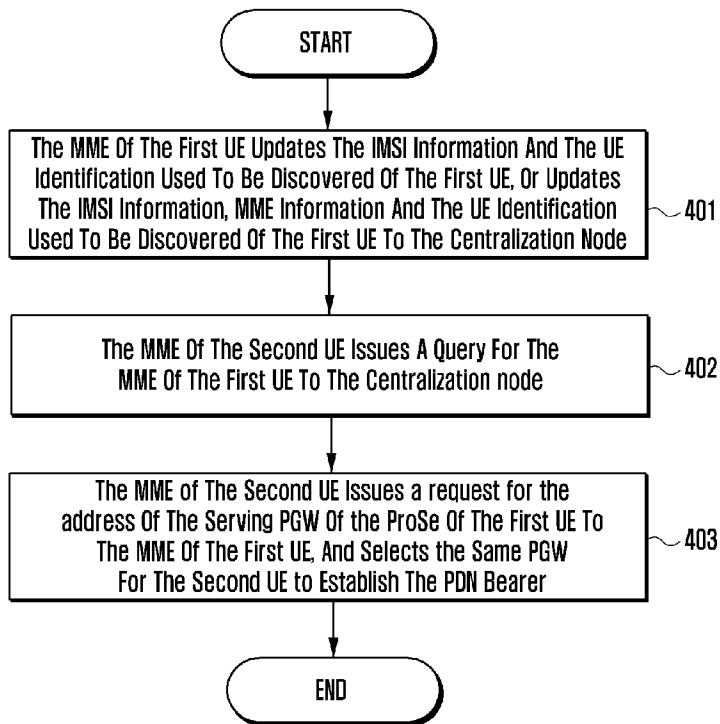
[Fig. 2]



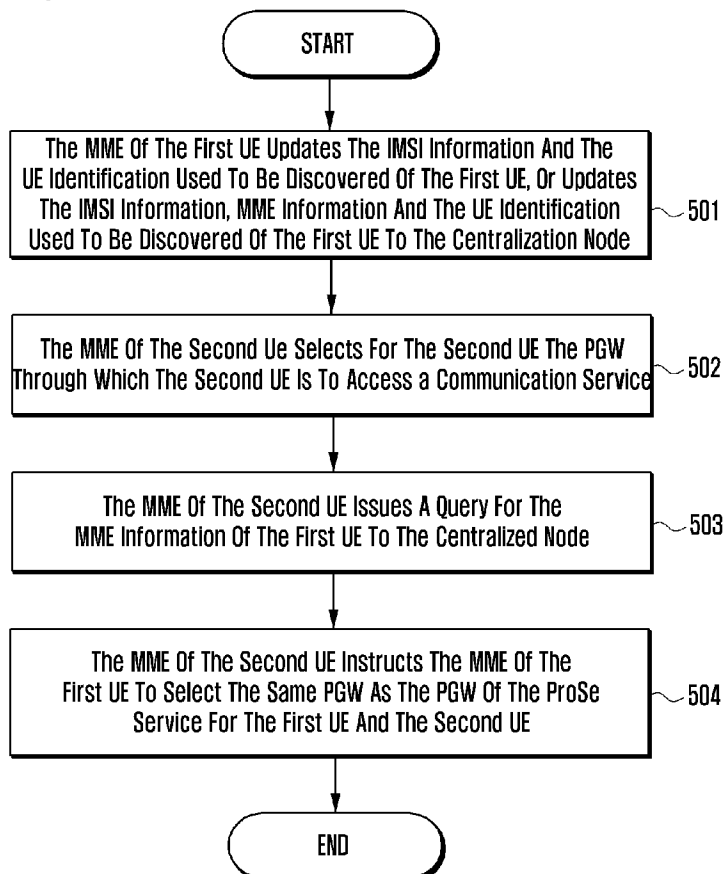
[Fig. 3]



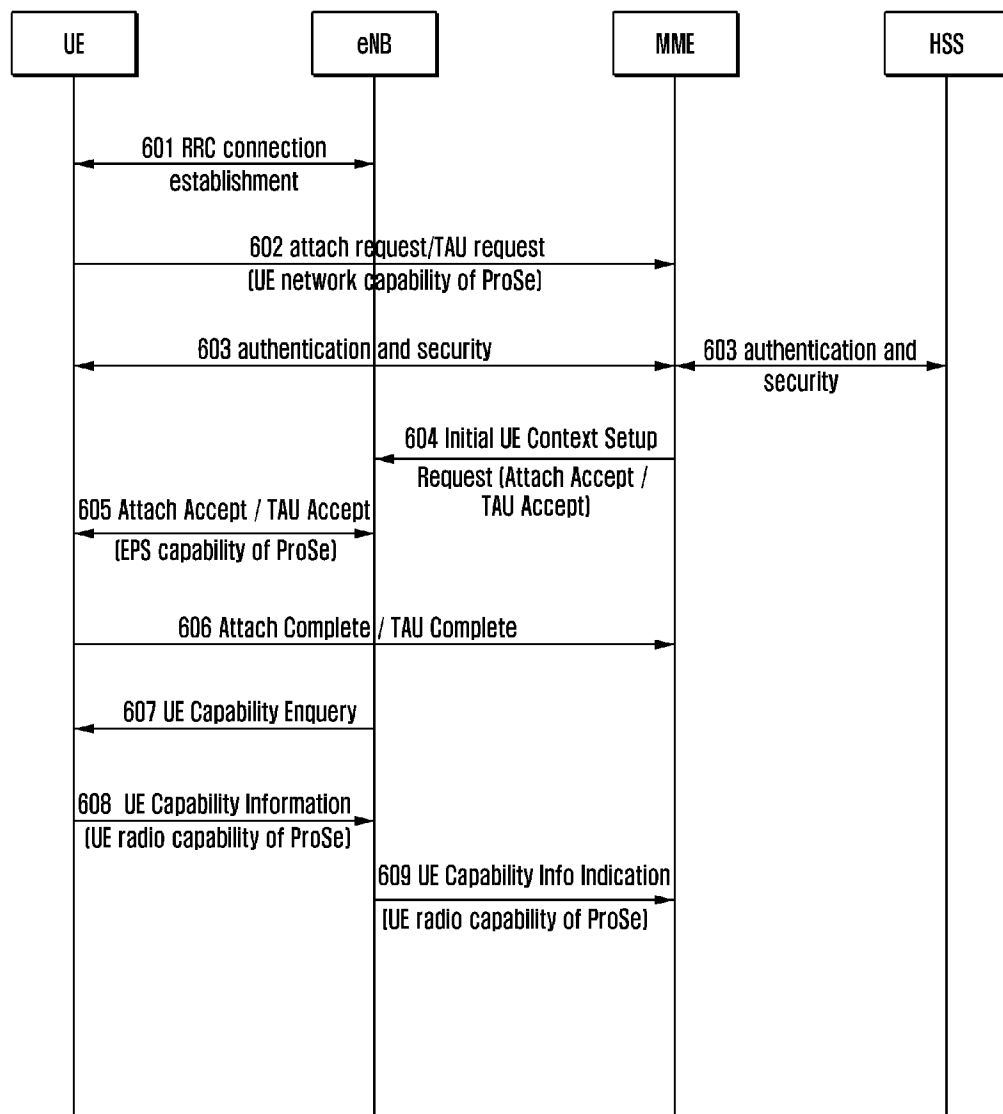
[Fig. 4]



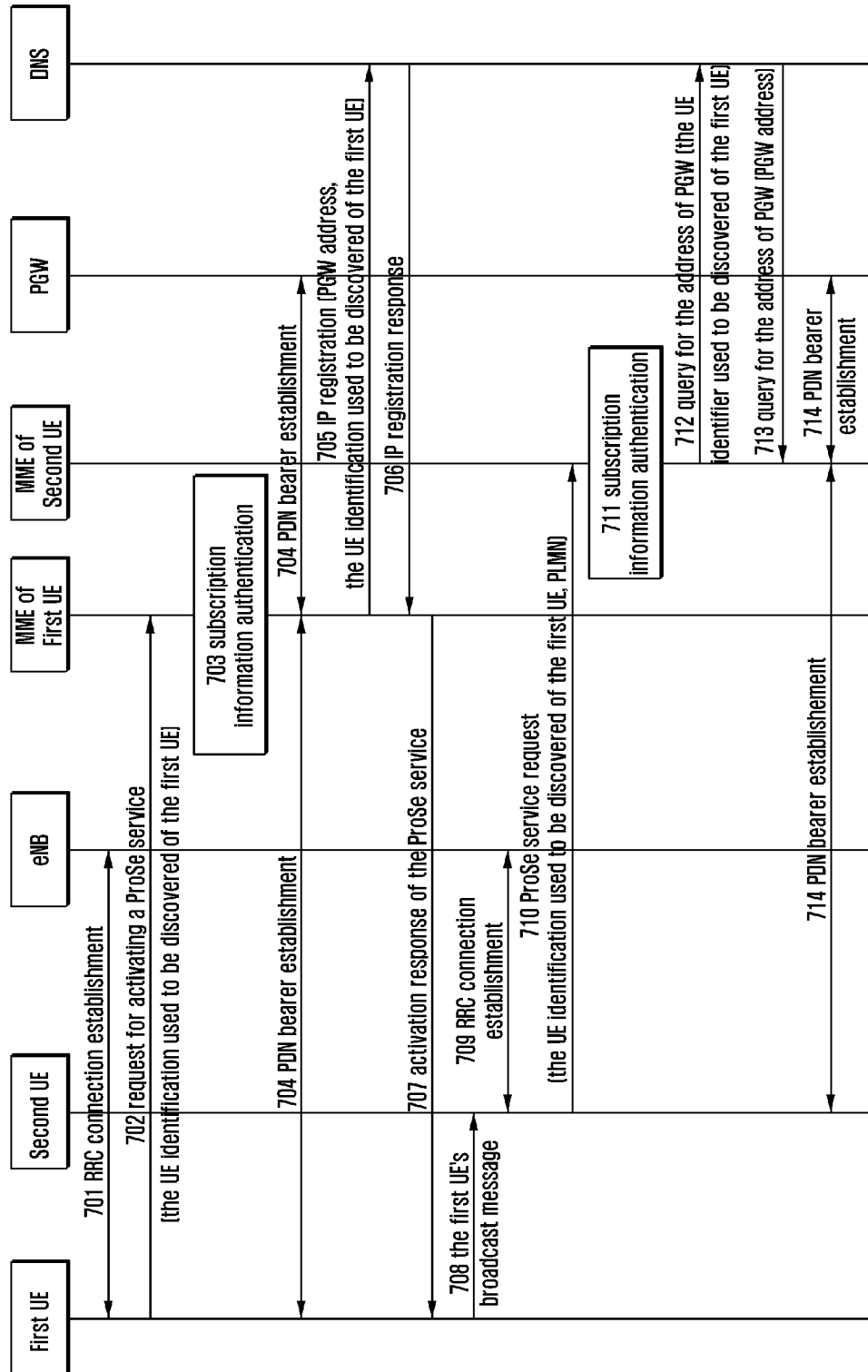
[Fig. 5]



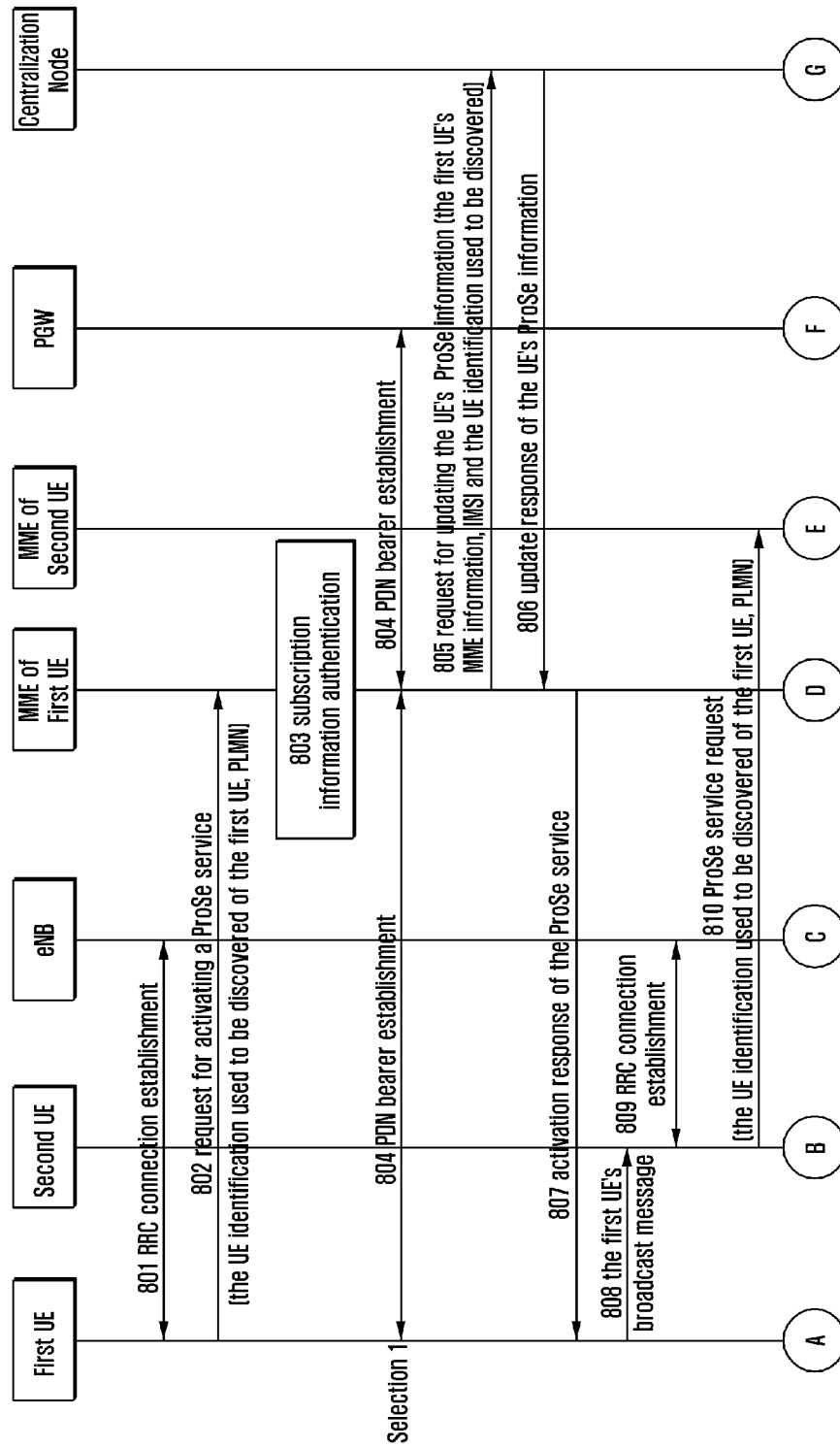
[Fig. 6]



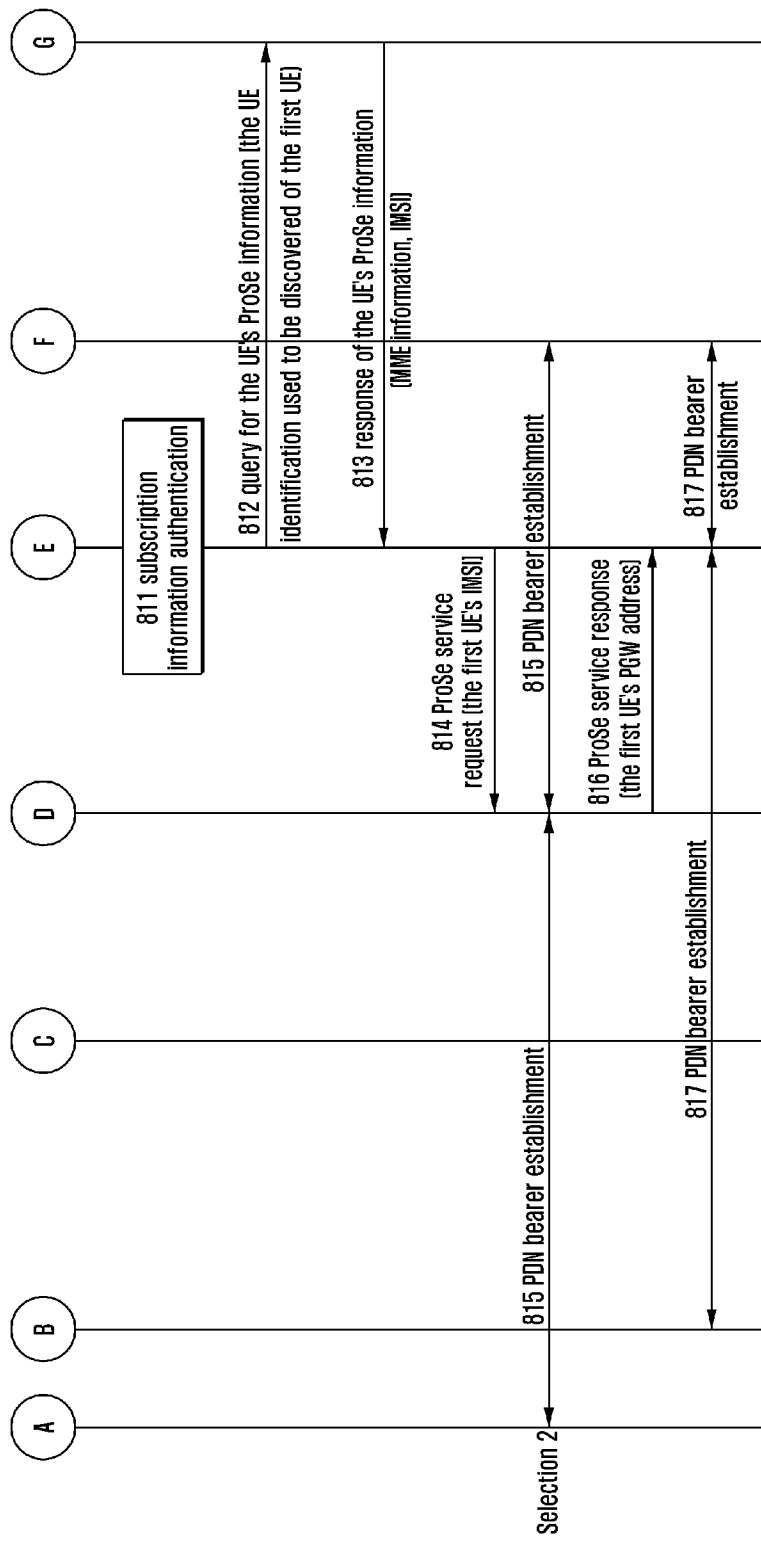
[Fig. 7]



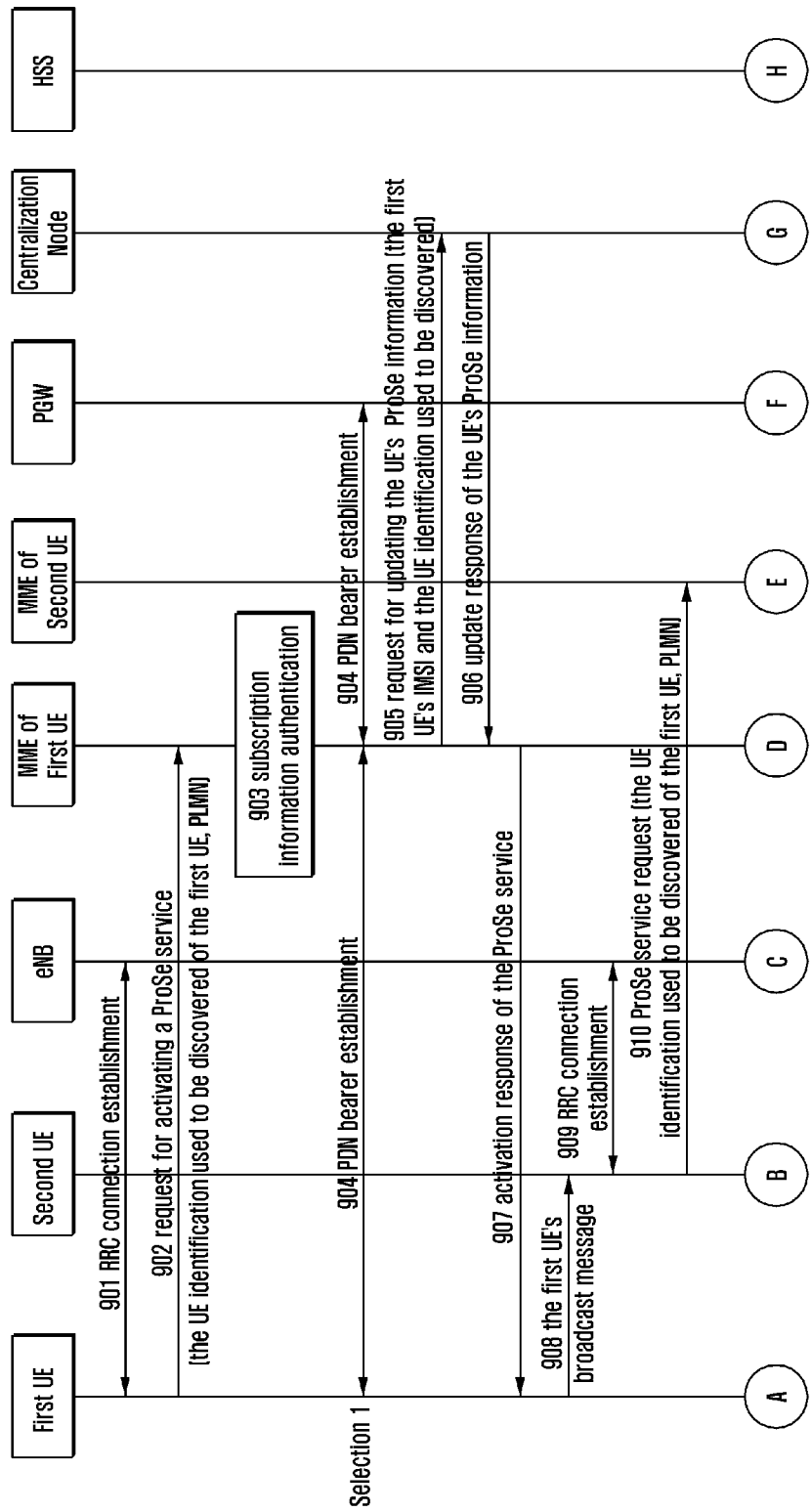
[Fig. 8a]



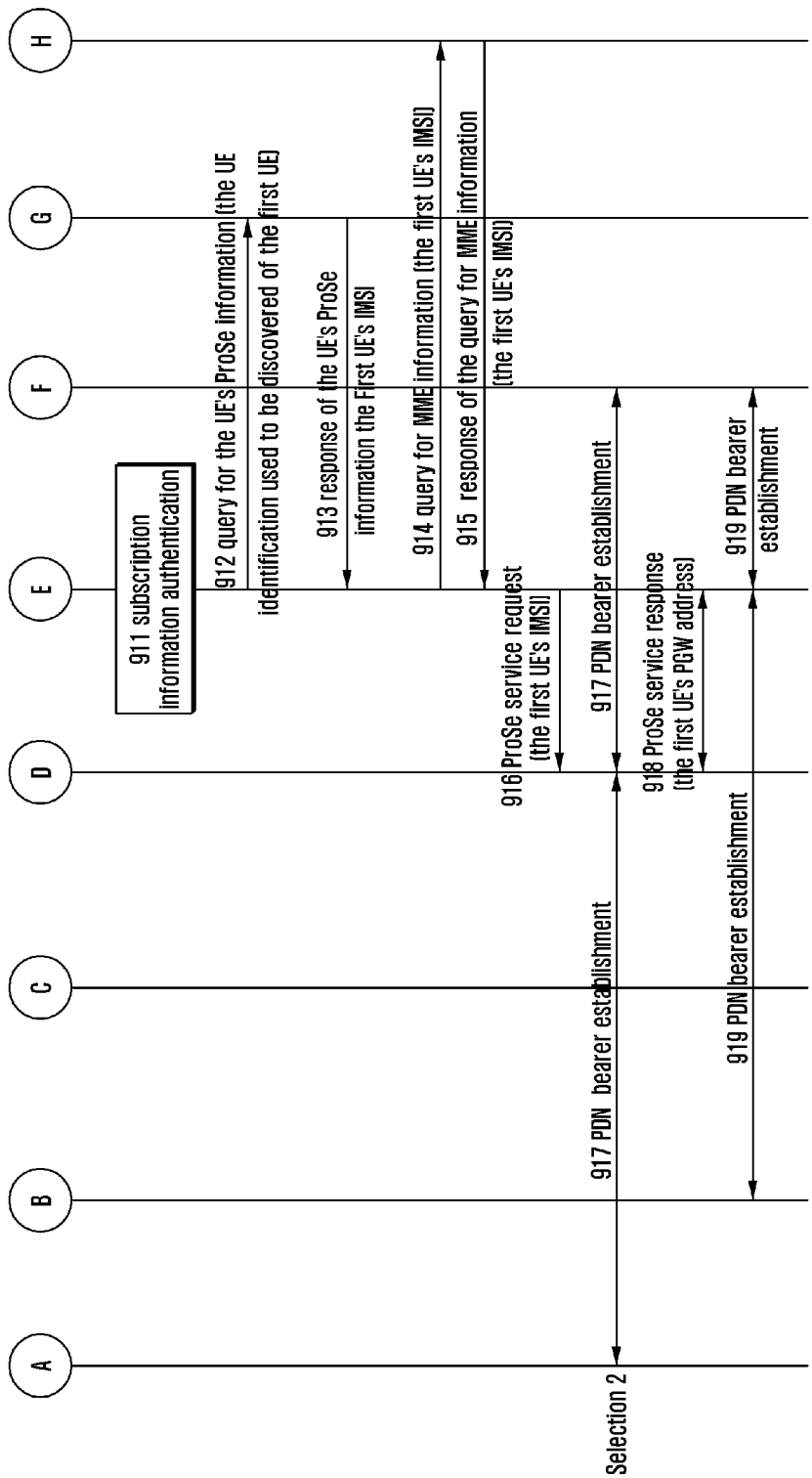
[Fig. 8b]



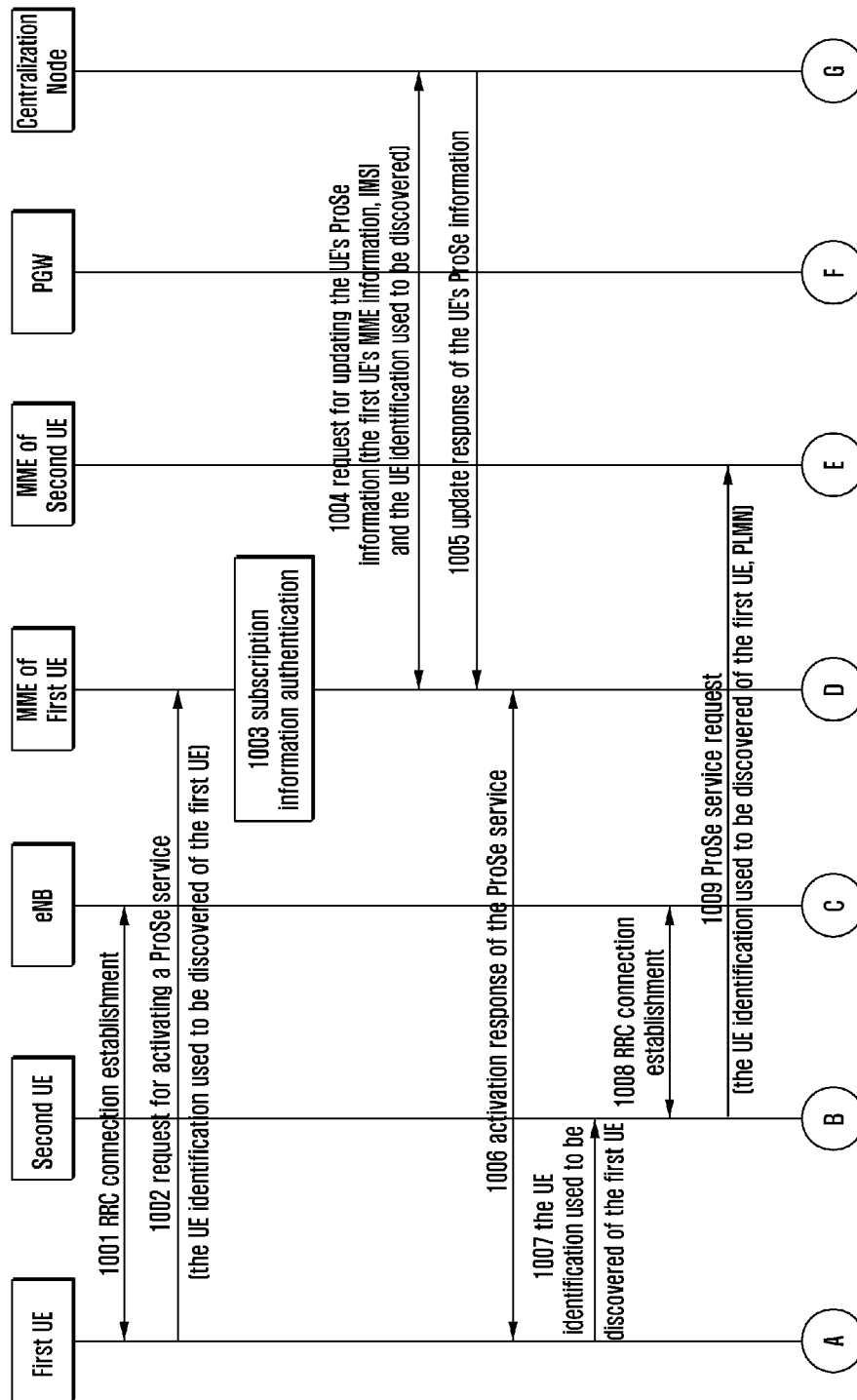
[Fig. 9a]



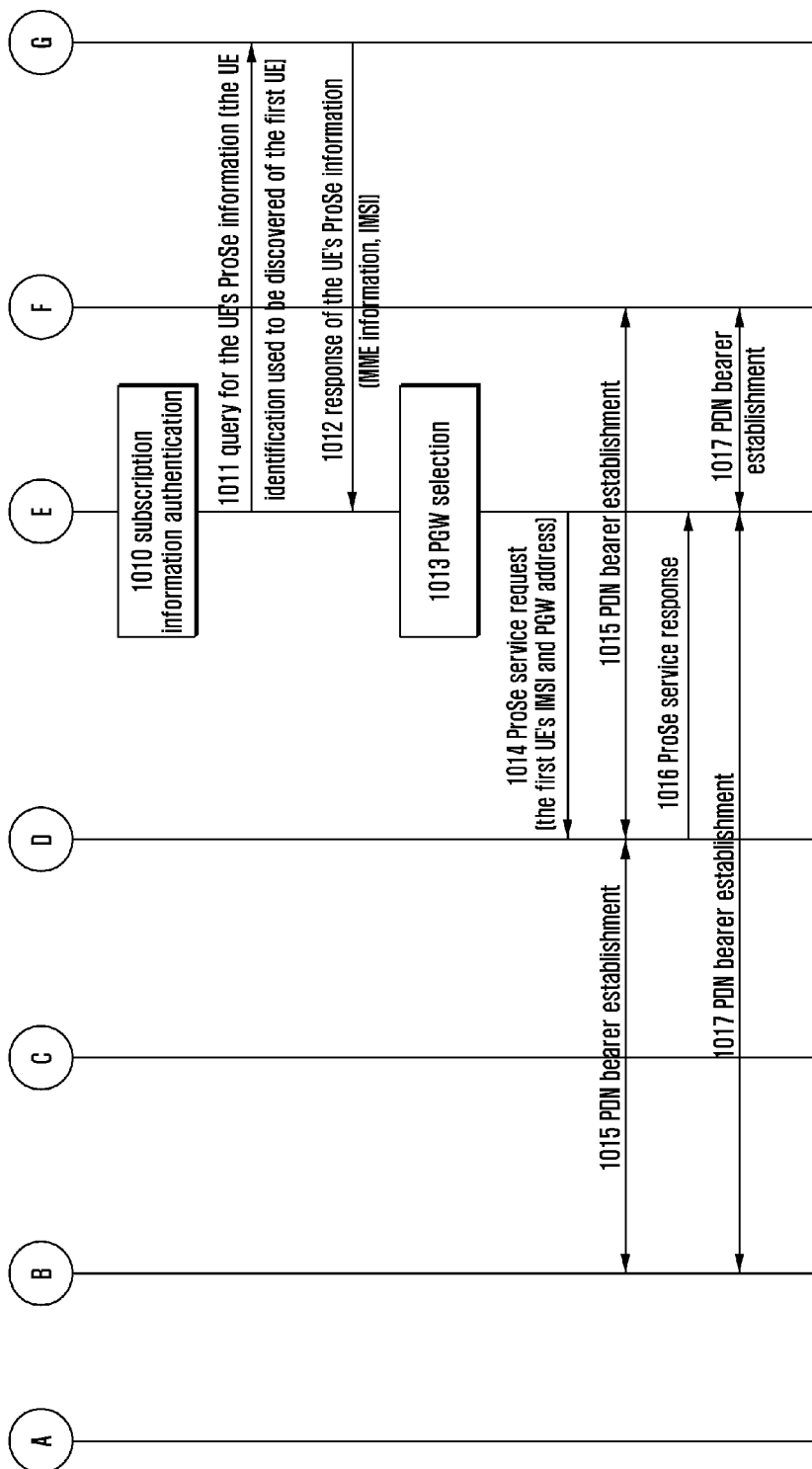
[Fig. 9b]



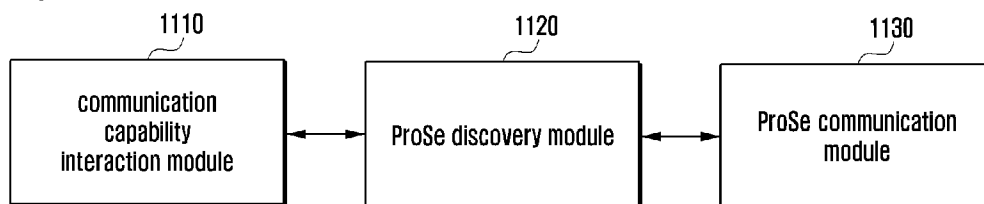
[Fig. 10a]



[Fig. 10b]



[Fig. 11]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2014/002393**A. CLASSIFICATION OF SUBJECT MATTER****H04W 8/02(2009.01)i, H04W 76/02(2009.01)i, H04W 12/06(2009.01)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 8/02; G06F 15/16; G06F 15/173; H04W 24/00; H04Q 7/20; H04W 4/00; H04W 76/02; H04W 12/06

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: mobile, proximity, detection, D2D

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011-0258313 A1 (SIDDHARTHA MALLIK et al.) 20 October 2011 See paragraphs [0029]–[0030], [0035]; and figures 2–3.	1–7, 12
Y	US 2010-0009675 A1 (CARL WIJTING et al.) 14 January 2010 See paragraphs [0057], [0059], [0071]–[0072]; and figures 5, 11.	1–7, 12
A	US 2012-0258703 A1 (SAMI-JUKKA HAKOLA et al.) 11 October 2012 See paragraphs [0039]–[0056]; and figure 1a.	1–7, 12
A	US 2012-0011247 A1 (SIDDHARTHA MALLIK et al.) 12 January 2012 See paragraphs [0041]–[0046]; and figure 3.	1–7, 12
A	US 2012-0082091 A1 (IANA SIOMINA et al.) 05 April 2012 See paragraphs [0049]–[0054]; and figure 6.	1–7, 12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"T" 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

"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

"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

Date of the actual completion of the international search

18 July 2014 (18.07.2014)

Date of mailing of the international search report

21 July 2014 (21.07.2014)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/KR2014/002393**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 9-10
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claims 9-10 do not comply with PCT Article 6 because they are referring to unsearchable claim 8.
3. ☒ Claims Nos.: 8, 11
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

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