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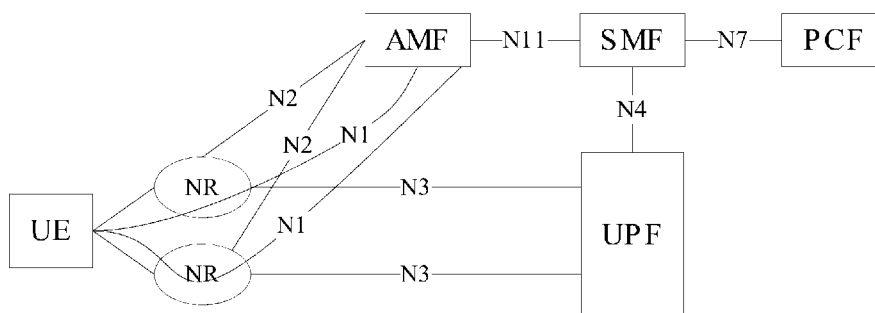


FIG. 1

(57) Abstract: A wireless communication method for use in an access and mobility management function (AMF) is disclosed. The method comprises transmitting, to a session management function (SMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.



METHODS FOR SIMULTANEOUS CONNECTIVITY AND DEVICE AND SYSTEM THEREOF

TECHNICAL FIELD

This document is directed generally to wireless communications, and in particular to 5G communications.

BACKGROUND

In the existing art, a UE (user equipment) may connect a core network via multiple accesses. Note that, in the existing art, the multiple accesses can comprise only one 3GPP (3rd Generation Partnership Project) access. That is the UE may connect the core network via one 3GPP access and (at least) one non-3GPP access. In certain use cases, the non-3GPP access(es) is not ideal to improve network performance, e.g., capacity, coverage, reliability and QoE (quality of experience) of the network.

SUMMARY

This document relates to methods, systems, and devices for simultaneous connectivity, and in particular to methods, systems, and devices simultaneous connectivity via two or more 3GPP accesses.

The present disclosure relates to a wireless communication method for use in an access and mobility management function (AMF). The method comprises:

transmitting, to a session management function (SMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.

Various embodiments may preferably implement the following features:

Preferably, the first identity of the first access node is configured to identify the first access node in the AMF.

Preferably, the wireless communication method further comprises receiving, from the SMF, a first message for the PDU session via the first access node, wherein the first message comprises the first identity.

Preferably, the wireless communication method further comprises transmitting, to the SMF, a second message for the PDU session via the first access node, wherein the second message comprises the first identity.

Preferably, the PDU session supports simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.

Preferably, the wireless communication method further comprises receiving, from a user equipment (UE) of the PDU session via the first access node, a first registration request message indicating a capability of supporting simultaneous connectivity via a plurality of 3GPP access networks.

Preferably, the wireless communication method further comprises transmitting, to the UE via the first access node, a registration accept message indicating that the simultaneous connectivity via the plurality of 3GPP access networks is supported.

Preferably, the first registration request comprises a request type configured to indicate the simultaneous connectivity via the plurality of 3GPP access networks.

Preferably, the plurality of 3GPP access networks has the same radio technology type.

Preferably, the wireless communication method further comprises transmitting, to the SMF, a second PDU session management context create request for the PDU session via a second access node.

Preferably, the first access node and the second access node provide 3GPP accesses.

Preferably, the first access node and the second access node have the same radio technology type.

Preferably, the wireless communication method further comprises receiving, from a UE of the PDU session via the second access node, a second PDU session establishment request for the PDU session via the second access node.

Preferably, the wireless communication method further comprises receiving, from the UE of the PDU session via the second access node, a second registration request indicating a capability of supporting simultaneous connectivity via a plurality of 3GPP access networks.

Preferably, the wireless communication method further comprises transmitting, to the SMF, a context update request for the PDU session via the first access node, wherein the context update request comprises a second identity of a third access node.

The present disclosure relates to wireless communication method for use in a session management function (SMF). The method comprises:

receiving, from an access and management function (AMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request, and

generating session management context of the PDU session via the first access node, wherein the session management context of the PDU session via the first access node comprises the first identity of the first access node.

Various embodiments may preferably implement the following features:

Preferably, the first identity of the first access node is configured to identify the first access node in the AMF.

Preferably, the wireless communication method further comprises transmitting, to the AMF, a first message for the PDU session via the first access node, wherein the first message comprises the first identity.

Preferably, the wireless communication method further comprises receiving, from the AMF, a second message for the PDU session via the first access node, wherein the second message comprises the first identity.

Preferably, the PDU session supports simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.

Preferably, the plurality of 3GPP access networks has the same radio technology type.

Preferably, the wireless communication method further comprises receiving, from the AMF, a second PDU session management context create request for the PDU session via a second access node before receiving the first PDU session management context create request.

Preferably, the first access node and the second access node provide 3GPP accesses.

Preferably, the first access node and the second access node have the same radio technology type.

Preferably, the wireless communication method further comprises:

receiving, from the AMF, a context update request for the PDU session via the first access node, wherein the context update request comprises a second identity of a third access node, and

changing the first identity of the first access node comprised in the session management context of the PDU session via the first access node to the second identity of the third access node.

Preferably, the wireless communication method further comprises transmitting, to a user plane function, a session modification request for the PDU session, wherein the session modification request comprises the second identity of a third access node.

The present disclosure relates to a wireless communication method for use in a user equipment (UE). The method comprises:

transmitting, to an access and mobility management function (AMF) via a first access node, a first registration request, wherein the registration request indicates a simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.

Various embodiments may preferably implement the following features:

Preferably, the wireless communication method further comprises: receiving, from the AMF, a registration accept message indicating that the simultaneous connectivity via the plurality of 3GPP access networks is supported.

Preferably, the first registration request comprises a request type configured to indicate the simultaneous connectivity via the plurality of 3GPP access networks.

Preferably, the plurality of 3GPP access networks has the same radio technology type.

Preferably, the wireless communication method further comprises: transmitting, to the AMF via the first access node, a first protocol data unit (PDU) session establishment request for a PDU session via the first access node.

Preferably, the wireless communication method further comprises transmitting, to the AMF via a second access node, a second PDU session establishment request for the PDU session via the second access node.

Preferably, the wireless communication method further comprises transmitting, to the AMF via the second access node, a second registration request for the PDU session via the second access node indicating the simultaneous connectivity via the plurality of 3GPP access networks.

Preferably, the first access node and the second access node provide 3GPP accesses.

Preferably, the first access node and the second access node have the same radio technology type.

The present disclosure relates to a wireless device. The wireless device comprises:

a communication unit, configured to transmit, to a session management function (SMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.

Various embodiments may preferably implement the following features:

Preferably, the wireless device comprises an AMF.

Preferably, the wireless device further comprises a processor configured to perform any of the aforementioned wireless communication methods.

The present disclosure relates to wireless device. The wireless device comprises:

a communication unit, configured to receive, from an access and management function (AMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request, and

a processor, configured to generate session management context of the PDU session via the first access node, wherein the session management context of the PDU session via the first access node comprises the first identity of the first access node.

Various embodiments may preferably implement the following features:

Preferably, the wireless device comprises an SMF.

Preferably, the processor is further configured to perform any of the aforementioned wireless communication methods.

The present disclosure relates to a user equipment (UE). The UE comprises:

a communication unit, configured to transmitting, to an access and mobility management function (AMF) via a first access node, a first registration request, wherein the registration request indicating a simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.

Various embodiments may preferably implement the following feature:

Preferably, the UE further comprises a processor configured to perform any of the aforementioned wireless communication methods.

The present disclosure relates to a computer program product comprising a computer-readable program medium code stored thereupon, the code, when executed by a processor, causing the processor to implement a wireless communication method recited in any one of foregoing methods.

The exemplary embodiments disclosed herein are directed to providing features that will become readily apparent by reference to the following description when taken in conjunction with the accompany drawings. In accordance with various embodiments, exemplary systems, methods, devices and computer program products are disclosed herein. It is understood, however, that these embodiments are presented by way of example and not limitation, and it will be apparent to those of ordinary skill in the art who read the present disclosure that various modifications to the disclosed embodiments can be made while remaining within the scope of the present disclosure.

Thus, the present disclosure is not limited to the exemplary embodiments and applications described and illustrated herein. Additionally, the specific order and/or hierarchy of steps in the methods disclosed herein are merely exemplary approaches. Based upon design preferences, the specific order or hierarchy of steps of the disclosed methods or processes can be re-arranged while remaining within the scope of the present disclosure. Thus, those of ordinary skill in the art will understand that the methods and techniques disclosed herein present various steps or acts in a sample order, and the present disclosure is not limited to the specific order or hierarchy presented unless expressly stated otherwise.

The invention is specified by the independent claims. Preferred embodiments are defined in the dependent claims. In the following description, although numerous features may be designated as optional, it is nevertheless acknowledged that all features comprised in the independent claims are not to be read as optional.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects and their implementations are described in greater detail in the drawings, the descriptions, and the claims.

FIG. 1 shows a schematic diagram of a network according to an embodiment of the present disclosure.

FIG. 2 shows a schematic diagram of a procedure according to an embodiment of the present disclosure.

FIG. 3 shows a schematic diagram of a procedure according to an embodiment of the present disclosure.

FIG. 4 shows a schematic diagram of a procedure according to an embodiment of the present disclosure.

FIG. 5 shows a schematic diagram of a procedure according to an embodiment of the present disclosure.

FIG. 6 shows an example of a schematic diagram of a wireless terminal according to an embodiment of the present disclosure.

FIG. 7 shows an example of a schematic diagram of a wireless network node according to an embodiment of the present disclosure.

FIG. 8 shows a flowchart of a method according to an embodiment of the present disclosure.

FIG. 9 shows a flowchart of a method according to an embodiment of the present disclosure.

FIG. 10 shows a flowchart of a method according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

In an embodiment, the UE may connect the core network via one 3GPP access and another additional 3GPP access or the UE may support connecting the core network via more than two 3GPP accesses simultaneously. The two or more 3GPP accesses can be the same RAT (radio access technology) type or different RAT (radio access technology) types.

FIG. 1 shows a schematic diagram of a network (architecture) according to an embodiment of the present disclosure. In FIG. 1, the UE connects/communicates with network functions (i.e., AMF (access and mobility management function), SMF (session management function), PCF (policy control function) and UPF (user plane function)) via two access nodes (e.g., base stations, gNBs or RAN (radio access network) nodes). In this embodiment, the access nodes have the same RAT type (i.e., NR (new radio)). Under such conditions, the network (functions) may not be able to distinguish related requests from the UE via different access nodes.

In an embodiment, RAT types supported by the network (belonging to the 3GPP access and the non-3GPP access) comprise at least one of those shown in the following table1:

Enumeration value	Description
"NR"	New Radio
"EUTRA"	(WB) Evolved Universal Terrestrial Radio Access
"WLAN"	Untrusted Wireless LAN (IEEE 802.11) access
"VIRTUAL"	Virtual (see NOTE 1)
"NB-IOT"	NB IoT
"WIRELINE"	Wireline access
"WIRELINE_CABLE"	Wireline Cable access
"WIRELINE_BBF"	Wireline BBF access
"LTE-M"	LTE-M (see NOTE 2)
"NR_U"	New Radio in unlicensed bands
"EUTRA_U"	(WB) Evolved Universal Terrestrial Radio Access in unlicensed bands
"TRUSTED_N3GA"	Trusted Non-3GPP access
"TRUSTED_WLAN"	Trusted Wireless LAN (IEEE 802.11) access
"UTRA"	UMTS Terrestrial Radio Access
"GERA"	GSM EDGE Radio Access Network
"NR_LEO"	NR (LEO) satellite access type
"NR_MEO"	NR (MEO) satellite access type
"NR_GEO"	NR (GEO) satellite access type
"NR_OTHER_SAT"	NR (OTHERSAT) satellite access type
"NR_REDCAP"	NR RedCap access type
NOTE 1: Virtual shall be used if the N3IWF does not know the access technology used for an untrusted non-3GPP access.	
NOTE 2: This RAT type value is used only in the Core Network; it shall be used when a Category M UE using E-UTRA has provided a Category M indication to the NG-RAN.	

FIG. 2 shows a schematic diagram of a procedure according to an embodiment of the present disclosure. The procedure shown in FIG. 2 may be used for UE-requested PDU Session

Establishment for non-roaming and roaming with local breakout. The detailed steps of the procedure can be referred to clause 4.3.2.2.1 of 3GPP TS 23.502, e.g., V.

Particularly, in an embodiment, the UE may initiate the procedure shown in FIG. 2 via a 3GPP access using the NR. In this embodiment, the UE in step 3 transmits the Nsmf_PDUSession_CreateSMContext Request as a new PDU session request. The Nsmf_PDUSession_CreateSMContext Request includes: SUPI, selected DNN, UE requested DNN, S-NSSAI(s), PDU Session ID, AMF ID, Request Type, [PCF ID, Same PCF Selection Indication], Priority Access, [Small Data Rate Control Status], N1 SM container (PDU Session Establishment Request), User location information, Access Type, RAT Type, PEI, GPSI, UE presence in LADN service area, Subscription For PDU Session Status Notification, DNN Selection Mode, Trace Requirements, Control Plane CIoT 5GS Optimisation indication, Control Plane Only indicator, Satellite backhaul category, GEO Satellite ID, [PVS FQDN(s) and/or PVS IP address(es), Onboarding Indication], Disaster Roaming service indication.

In addition, in step 4 of FIG. 2, the N2 PDU Session Response transmitted from RAN to AMF comprises PDU Session ID, Cause, N2 SM information (PDU Session ID, AN Tunnel Info, List of accepted/rejected QFI(s), User Plane Enforcement Policy Notification, TL-Container)). In step 15, N2 SM information is conveyed to SMF in Nsmf_PDUSession_UpdateSMContext Request message. The AN tunnel Info is the user plane tunnel end point information on RAN side. In other words, the SMF is not aware of the AN tunnel info until step 15 of FIG. 2 is done.

If the UE initiates another registration procedure via another 3GPP access using the same RAT type (i.e., NR in this embodiment) to 5GS and requests a PDU session establishment with the same PDU session parameters (PDU session ID, DNN, S-NSSAI), the SMF in step 3 of the another registration procedure may consider that this PDU session establishment request intends to create the PDU session context which overlaps with an existing PDU session (established via another 3GPP access). As a result, the SMF may overwrite the existing PDU session or reject this PDU session request, e.g., because the AN tunnel info has not been provided to the SMF in step 3.

In the present disclosure, the term “access” may refer to access node or access network and vice versa.

In the present disclosure, the term “RAN (radio access network)” may refer to “AN” (access network).

In the present disclosure, the term “info” refers to “information”.

FIG. 3 shows a schematic diagram of a procedure according to an embodiment of the present disclosure. In FIG. 3, the AMF indicates the SMF a PDU session establishment request from a UE via one 3GPP access node (e.g., RAN B) which uses the same RAT type with another access node (e.g., RAN A). In the present disclosure, the term “RAN” refers to the access network with RAT types which are supported in 3GPP. That is, the RAN in FIG. 3 provides the 3GPP access to the UE. Specifically, the procedure of FIG. 3 comprises the following steps:

Step 301: The UE initiates a registration procedure (e.g., the procedure shown in FIG. 2) to the network via the RAN A. In the registration request message (e.g., PDU Session Establishment Request), the UE indicates its capability to support simultaneous connectivity via two or more access networks (e.g., two or more 3GPP access networks). In an embodiment, the indicator/indication of the capability can include at least one of:

- dual 3GPP access;
- multiple 3GPP access;
- dual non-3GPP access; or
- multiple non-3GPP access.

In the registration accept message (e.g., PDU Session Establishment Accept), the AMF indicates to the UE that the simultaneous connectivity via two or more (3GPP) access networks is supported/allowed. The UE establishes a PDU session via the RAN A. The AMF selects an SMF supporting the simultaneous connectivity via two or more (3GPP) access networks.

Step 302: The UE initiates a registration procedure to the network via the RAN B. In an embodiment, the RAN B has the same access type (e.g., 3GPP access) and/or the same RAT type (e.g., NR) with the RAN A. In the registration request message, the UE indicates to the network/AMF that this is a registration request for dual/simultaneous steering/connectivity. In an embodiment, a new/dedicated registration request type may be used to represent this indication/indicator.

Step 303: The UE initiates a PDU session establishment procedure via the RAN B. The AMF verifies that the corresponding PDU session establishment request is a PDU session establishment request via the RAN B and that the RAN B has the same access type and/or the same RAT type with the RAN A.

Step 304: The AMF selects the same SMF as in step 301.

Step 305: The AMF indicates to the SMF that the PDU session establishment request is via an addition/second (3GPP) access. In an embodiment, the term "addition" or "second" is considered as an example of an identity for the RAN B. Each access node (e.g., the RAN A or the RAN B) with the same access type and/or the same RAT type is identified with this local unique identity by the AMF.

Steps 306 to 308: The SMF creates related SM context based on the PDU session request. The created SM context includes the identity of the RAN B as mentioned in step 305.

Step 309: The identity of the RAN B is included in Namf_Communication_N1N2MessageTransfer message transmitted from the SMF to the AMF. In this embodiment, the AMF is able to determine which access towards the UE is used based on the PDU session ID, access type and the identity of the access node (with the same access type and/or the same RAT type).

Steps 310 to 313: The identity of the RAN B is included in Nsmf_PDUSession_UpdateSMContext Request transmitted from the AMF to the SMF. Based on the identity of the RAN B, the SMF acknowledges that the AN (RAN) tunnel information in the Nsmf_PDUSession_UpdateSMContext Request is for the RAN B. The SMF sends the AN tunnel information of the RAN B as well as the identity of the RAN B to the UPF.

FIG. 4 shows a schematic diagram of a procedure according to an embodiment of the present disclosure. The embodiment shown in FIG. 4 shows the procedure of a handover when there is simultaneous connectivity via two or more (3GPP) access networks, e.g., when the UE has established two/dual connectivity via RAN A and RAN C respectively and a handover from the RAN A to RAN B takes place. The procedure comprises the following steps:

Step 401: The RAN B sends an N2 Path Switch Request message to an AMF to inform that the UE has moved to a new target cell and provides a List Of PDU Sessions To Be Switched. In addition, AN Tunnel Info for each PDU Session to be switched is included in the N2 SM Information.

Step 402: The PDU sessions to be switched were identified with the identity of the RAN A by the AMF. Since the PDU sessions are to be switched to the RAN B, the AMF changes the RAN identity associated with the PDU sessions from the identity of the RAN A to the identity of the RAN B and includes the identity of the RAN B in the Nsmf_PDUSession_UpdateSMContext Request.

Steps 403 to 406: For the PDU Sessions that are associated with the RAN B, the SMF sends an N4 Session Modification Request message to the UPF. The SMF notifies the UPF that the updated identity of the access node associated with the switched PDU sessions.

FIG. 5 shows a schematic diagram of a procedure according to an embodiment of the present disclosure. In FIG. 5, the AMF indicates the SMF that a PDU session establishment request from a UE is via a specific access node. In this embodiment, "RAN" refers to an access network with RAT types which are supported in the above table (e.g., 3GPP RAT types).

Step 501: The UE initiates a registration procedure to the network via the RAN. The UE indicates to the network/AMF that this is a registration request for dual steering/connectivity. In an embodiment, a new/dedicated registration request type may be used to represent this purpose.

Step 502: The UE initiates a PDU session establishment procedure.

Step 503: The AMF selects the SMF based on the indicator received in step 501.

Step 504: The AMF uses an identity to indicate to the SMF that the PDU session establishment request is via an access node. In an embodiment, the identity is used to represent the RAN node. In an embodiment, the identity is locally unique in the AMF.

Steps 505 to 507: The SMF creates related SM context based on the PDU session request. The created SM context includes the identity of the RAN.

Step 508: The identity of RAN is included in Namf_Communication_N1N2MessageTransfer message transmitted from the SMF to the AMF. The AMF is able to determine which access towards the UE is based on the PDU session ID, access type and the identity of the access node.

Steps 509 to 512: The identity of the RAN is included in Nsmf_PDUSession_UpdateSMContext Request transmitted from the AMF to the SMF.

FIG. 6 relates to a schematic diagram of a wireless terminal 60 according to an embodiment of the present disclosure. The wireless terminal 60 may be a user equipment (UE), a mobile phone, a laptop, a tablet computer, an electronic book or a portable computer system and is not limited herein. The wireless terminal 60 may include a processor 600 such as a microprocessor or Application Specific Integrated Circuit (ASIC), a storage unit 610 and a communication unit 620. The storage unit 610 may be any data storage device that stores a program code 612, which is accessed and executed by the processor 600. Embodiments of the storage unit 610 include but are

not limited to a subscriber identity module (SIM), read-only memory (ROM), flash memory, random-access memory (RAM), hard-disk, and optical data storage device. The communication unit 620 may be a transceiver and is used to transmit and receive signals (e.g., messages or packets) according to processing results of the processor 600. In an embodiment, the communication unit 620 transmits and receives the signals via at least one antenna 622 shown in FIG. 6.

In an embodiment, the storage unit 610 and the program code 612 may be omitted and the processor 600 may include a storage unit with stored program code.

The processor 600 may implement any one of the steps in exemplified embodiments on the wireless terminal 60, e.g., by executing the program code 612.

The communication unit 620 may be a transceiver. The communication unit 620 may as an alternative or in addition be combining a transmitting unit and a receiving unit configured to transmit and to receive, respectively, signals to and from a wireless network node (e.g., a base station).

FIG. 7 relates to a schematic diagram of a wireless network node 70 according to an embodiment of the present disclosure. The wireless network node 70 may be a satellite, a base station (BS), a network entity, a Mobility Management Entity (MME), Serving Gateway (S-GW), Packet Data Network (PDN) Gateway (P-GW), a radio access network (RAN) node, a next generation RAN (NG-RAN) node, a gNB, an eNB, a gNB central unit (gNB-CU), a gNB distributed unit (gNB-DU), a data network, a core network or a Radio Network Controller (RNC), and is not limited herein. In addition, the wireless network node 70 may comprise (perform) at least one network function such as an access and mobility management function (AMF), a session management function (SMF), a user plane function (UPF), a policy control function (PCF), an application function (AF), etc. The wireless network node 70 may include a processor 700 such as a microprocessor or ASIC, a storage unit 710 and a communication unit 720. The storage unit 710 may be any data storage device that stores a program code 712, which is accessed and executed by the processor 700. Examples of the storage unit 710 include but are not limited to a SIM, ROM, flash memory, RAM, hard-disk, and optical data storage device. The communication unit 720 may be a transceiver and is used to transmit and receive signals (e.g., messages or packets) according to processing results of the processor 700. In an example, the communication unit 720 transmits and receives the signals via at least one antenna 722 shown in FIG. 7.

In an embodiment, the storage unit 710 and the program code 712 may be omitted. The processor 700 may include a storage unit with stored program code.

The processor 700 may implement any steps described in exemplified embodiments on the wireless network node 70, e.g., via executing the program code 712.

The communication unit 720 may be a transceiver. The communication unit 720 may as an alternative or in addition be combining a transmitting unit and a receiving unit configured to transmit and to receive, respectively, signals to and from a wireless terminal (e.g., a user equipment or another wireless network node).

In some embodiments, during the registration procedure:

- In the registration request message, the UE indicates its capability to support simultaneous connectivity via two or more access networks (e.g., two or more 3GPP access networks). For example, the indicator of the capability can include at least one of following information:

- 1) dual 3GPP access;
- 2) multiple 3GPP access;
- 3) dual non-3GPP access; or
- 4) multiple non-3GPP access.

- In the registration accept message, the AMF indicates to the UE that the simultaneous/dual connectivity via two or more (3GPP) access networks is supported/allowed.

- In the registration request, the UE indicates to the network/AMF that the registration request is for dual steering/connectivity. In an embodiment, a new registration type can be defined/introduced to achieve this purpose.

In some embodiments, during a connectivity establishment/modification or handover procedure:

- The connectivity is configured with an identity which is associated with an access node, e.g., to indicate that the connectivity is established via this access node.

- The identity of the access node is configured or updated by the AMF and conveyed to SMF.

- The SMF conveys the identity of the access node to the UPF.

- The signaling message from the SMF to the AMF includes the identity of the access node, to assist the AMF to determine the access to which the handling is towards.

In the present disclosure, a wireless device comprising network function(s) (e.g., AMF and/or SMF and/or PCF) refers to the wireless device performing at least part of functionalities of the network function(s).

FIG. 8 shows a flowchart of a method according to an embodiment of the present disclosure. The method shown in FIG. 8 may be used in an AMF (e.g., a wireless device, a wireless device comprising the AMF) and comprises the following step:

Step 801: Transmit, to an SMF, a first PDU session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.

In FIG. 8, the AMF transmits a first PDU session management context create request for a PDU session via a first access node to the SMF. In this embodiment, the AMF also transmits a first identity of the first access node associated with the first PDU session management context create request, to indicate that the first PDU session management context create request is for the PDU session via the first access node. In this way, PDU session context for the PDU session via the first access node can be created/generated.

In an embodiment, the first identity of the first access node is configured to identify the first access node in the AMF.

In an embodiment, the AMF receives a first message for the PDU session via the first access node from the SMF. The first message comprises the first identity, e.g., to indicate that the first message is for the PDU session via the first access node. For example, the first message may be an `Namf_Communication_N1N2MessageTransfer` message.

In an embodiment, the AMF transmits a second message for the PDU session via the first access node to the SMF. The second message comprises the first identity, e.g., to indicate that the first message is for the PDU session via the first access node. For instance, the second message may be a `Nsmf_PDUSession_UpdateSMContext Request`.

In an embodiment, the PDU session supports the simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.

In an embodiment, the AMF receives a first registration request message indicating a capability of supporting simultaneous connectivity via a plurality of 3GPP access networks from a UE (e.g., wireless terminal). For example, the first registration request may comprise a request type configured to indicate the simultaneous connectivity via the plurality of 3GPP access networks.

In an embodiment, the AMF transmits a registration accept message to the UE via the first access node. The registration accept message may indicate that the simultaneous connectivity via the plurality of 3GPP access networks is supported.

In an embodiment, the plurality of 3GPP access networks has the same radio technology type (e.g., NR).

In an embodiment, the AMF receives a first PDU session establishment request for the PDU session via the first access node.

In an embodiment, the AMF transmits a second PDU session management context create request for the PDU session via a second access node to the SMF. Note that the second PDU session management context create request may be transmitted before the first PDU session management context create request (see, e.g., FIG. 3). As an alternative, the second PDU session management context create request may be transmitted after the first PDU session management context create request. In the case that the PDU session is over 2 access networks, because the first PDU session management context create request is transmitted with the first identity of the first access node, the SMF is able to acknowledge that the second PDU session management context create request is for the PDU session via the second access node even if the second PDU session management context create request is not transmitted with an identity of the second access node.

In an embodiment, the second PDU session management context create request is transmitted with the identity of the second access node.

In an embodiment, the first access node and the second access node provide 3GPP accesses. That is the first access node and the second access node have the same access type “3GPP access”.

In an embodiment, the first access node and the second access node have the same RAT (e.g., RAT supported by 3GPP).

In an embodiment, the AMF receives a second PDU session establishment request for the PDU session via the second access node from the UE of the PDU session via the second access node.

In an embodiment, the AMF receives a second registration request indicating a capability of supporting simultaneous connectivity via a plurality of 3GPP access networks from the UE. For example, the second registration request may be a new request type indicating the capability of supporting simultaneous connectivity.

In an embodiment, the AMF transmits a context update request for the PDU session via the first access node to the SMF. The context update request comprises a second identity of a third access node (see, e.g., FIG. 5).

FIG. 9 shows a flowchart of a method according to an embodiment of the present disclosure. The method shown in FIG. 9 may be used in an SMF (e.g., a wireless device or a wireless device comprising the SMF) and comprises:

Step 901: Receive, from an AMF, a first PDU session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.

Step 902: Generate session management context of the PDU session via the first access node, wherein the session management context of the PDU session via the first access node comprises the first identity of the first access node.

In FIG. 9, the SMF receives a first PDU session management context create request for a PDU session via a first access node from the AMF. The first PDU session management context create request is received with a first identity of the first access node. That is the first PDU session management context create request is associated with the first identity of the first access node. Based on the received first identity, the SMF acknowledges that the first PDU session management context create request is for the PDU session via the first access node. The SMF therefore generates session management context of the PDU session via the first access node. The session management context of the PDU session via the first access node may comprise the first identity of the first access node.

In an embodiment, the first identity of the first access node is configured to identify the first access node in the AMF.

In an embodiment, the SMF transmits a first message for the PDU session via the first access node to the AMF. The first message comprises the first identity, to allow the AMF to know that the first message is for the PDU session via the first access node.

In an embodiment, the SMF receives a second message for the PDU session via the first access node. The second message comprises the first identity, to indicate that the second message is for the PDU session via the first access node.

In an embodiment, the PDU session supports simultaneous connectivity via a plurality of (3GPP) access networks.

In an embodiment, the plurality of (3GPP) access networks has the same radio technology type (e.g., RAT supported by 3GPP).

In an embodiment, the SMF receives a context update request for the PDU session via the first access node from the AMF. The context update request comprises a second identity of a third access node. Based on the context update request, the SMF changes the first identity of the first access node comprised in the session management context of the PDU session via the first access node to the second identity of the third access node.

In an embodiment, the SMF transmits a session modification request for the PDU session (via the first access node) to a UPF. The session modification request comprises the second identity of a third access node.

FIG. 10 shows a flowchart of a method according to an embodiment of the present disclosure. The method shown in FIG. 10 may be used in a UE (e.g., wireless terminal) and comprises:

Step 1001: Transmit, to an AMF via a first access node, a first registration request, wherein the registration request indicating a simultaneous connectivity via a plurality of 3GPP access networks.

In this embodiment, the UE transmits a first registration request to an AMF via a first access node. The registration request indicates a simultaneous connectivity via a plurality of 3GPP access networks. For example, the first registration request comprises or is a request type configured to indicate the simultaneous connectivity via the plurality of 3GPP access networks.

In an embodiment, the UE receives a registration accept message from the AMF. The registration accept message indicates that the simultaneous connectivity via the plurality of 3GPP access networks is supported. The UE therefore can connect to the network via two or more 3GPP access networks.

In an embodiment, the plurality of 3GPP access networks has the same RAT (e.g., the RAT supported by 3GPP).

In an embodiment, the UE transmits a first PDU session establishment request to the SMF via the first access node, for (establishing) a PDU session via the first access node.

In an embodiment, the UE further transmits a second PDU session establishment request, to the AMF via a second access node, for the PDU session via the second access node.

In an embodiment, the UE transmits a second registration request for the PDU session via the second access node to the AMF via the second access node. The second registration request for the PDU session may also indicate the simultaneous connectivity via the plurality of 3GPP access networks.

In an embodiment, the first access node and the second access node provide 3GPP access networks.

In an embodiment, the first access node and the second access node have the same RAT (e.g., the RAT supported by 3GPP).

While various embodiments of the present disclosure have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. Likewise, the various diagrams may depict an example architectural or configuration, which are provided to enable persons of ordinary skill in the art to understand exemplary features and functions of the present disclosure. Such persons would understand, however, that the present disclosure is not restricted to the illustrated example architectures or configurations, but can be implemented using a variety of alternative architectures and configurations. Additionally, as would be understood by persons of ordinary skill in the art, one or more features of one embodiment can be combined with one or more features of another embodiment described herein. Thus, the breadth and scope of the present disclosure should not be limited by any one of the above-described exemplary embodiments.

It is also understood that any reference to an element herein using a designation such as "first," "second," and so forth does not generally limit the quantity or order of those elements. Rather, these designations can be used herein as a convenient means of distinguishing between two or more elements or instances of an element. Thus, a reference to first and second elements does not mean that only two elements can be employed, or that the first element must precede the second element in some manner.

Additionally, a person having ordinary skill in the art would understand that information and signals can be represented using any one of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits and symbols, for example, which may be referenced in the above description can be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

A skilled person would further appreciate that any one of the various illustrative logical blocks, units, processors, means, circuits, methods and functions described in connection with the aspects disclosed herein can be implemented by electronic hardware (e.g., a digital implementation, an analog implementation, or a combination of the two), firmware, various forms of program or design code incorporating instructions (which can be referred to herein, for convenience, as "software" or a "software unit"), or any combination of these techniques.

To clearly illustrate this interchangeability of hardware, firmware and software, various illustrative components, blocks, units, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware, firmware or software, or a combination of these techniques, depends upon the particular application and design constraints imposed on the overall system. Skilled artisans can implement the described functionality in various ways for each particular application, but such implementation decisions do not cause a departure from the scope of the present disclosure. In accordance with various embodiments, a processor, device, component, circuit, structure, machine, unit, etc. can be configured to perform one or more of the functions described herein. The term "configured to" or "configured for" as used herein with respect to a specified operation or function refers to a processor, device, component, circuit, structure, machine, unit, etc. that is physically constructed, programmed and/or arranged to perform the specified operation or function.

Furthermore, a skilled person would understand that various illustrative logical blocks, units, devices, components and circuits described herein can be implemented within or performed by an integrated circuit (IC) that can include a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, or any combination thereof. The logical blocks, units, and circuits can further include antennas and/or transceivers to communicate with various components within the network or within the device. A general purpose processor can be a microprocessor, but in the

alternative, the processor can be any conventional processor, controller, or state machine. A processor can also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other suitable configuration to perform the functions described herein. If implemented in software, the functions can be stored as one or more instructions or code on a computer-readable medium. Thus, the steps of a method or algorithm disclosed herein can be implemented as software stored on a computer-readable medium.

Computer-readable media includes both computer storage media and communication media including any medium that can be enabled to transfer a computer program or code from one place to another. A storage media can be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can include RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store desired program code in the form of instructions or data structures and that can be accessed by a computer.

In this document, the term "unit" as used herein, refers to software, firmware, hardware, and any combination of these elements for performing the associated functions described herein. Additionally, for purpose of discussion, the various units are described as discrete units; however, as would be apparent to one of ordinary skill in the art, two or more units may be combined to form a single unit that performs the associated functions according to embodiments of the present disclosure.

Additionally, memory or other storage, as well as communication components, may be employed in embodiments of the present disclosure. It will be appreciated that, for clarity purposes, the above description has described embodiments of the present disclosure with reference to different functional units and processors. However, it will be apparent that any suitable distribution of functionality between different functional units, processing logic elements or domains may be used without detracting from the present disclosure. For example, functionality illustrated to be performed by separate processing logic elements, or controllers, may be performed by the same processing logic element, or controller. Hence, references to specific functional units are only references to a suitable means for providing the described functionality, rather than indicative of a strict logical or physical structure or organization.

Various modifications to the implementations described in this disclosure will be readily apparent to those skilled in the art, and the general principles defined herein can be applied to other

implementations without departing from the scope of the claims. Thus, the disclosure is not intended to be limited to the implementations shown herein, but is to be accorded the widest scope consistent with the novel features and principles disclosed herein, as recited in the claims below.

1. A wireless communication method for use in an access and mobility management function (AMF), the method comprising:
transmitting, to a session management function (SMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.
2. The wireless communication method of claim 1, wherein the first identity of the first access node is configured to identify the first access node in the AMF.
3. The wireless communication method of claim 1 or 2, further comprising:
receiving, from the SMF, a first message for the PDU session via the first access node, wherein the first message comprises the first identity.
4. The wireless communication method of any of claims 1 to 3, further comprising:
transmitting, to the SMF, a second message for the PDU session via the first access node, wherein the second message comprises the first identity.
5. The wireless communication method of any of claims 1 to 4, wherein the PDU session supports simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.
6. The wireless communication method of any of claims 1 to 5, further comprising:
receiving, from a user equipment (UE) of the PDU session via the first access node, a first registration request message indicating a capability of supporting simultaneous connectivity via a plurality of 3GPP access networks.
7. The wireless communication method of claim 6, further comprising:
transmitting, to the UE via the first access node, a registration accept message indicating that the simultaneous connectivity via the plurality of 3GPP access networks is supported.
8. The wireless communication method of claim 6 or 7, wherein the first registration request comprises a request type configured to indicate the simultaneous connectivity via the plurality of 3GPP access networks.

9. The wireless communication method of any of claims 5 to 8, wherein the plurality of 3GPP access networks has the same radio technology type.
10. The wireless communication method of any of claims 1 to 9, further comprising:
receiving, from a UE of the PDU session via the first access node, a first PDU session establishment request for the PDU session via the first access node.
11. The wireless communication method of any of claims 1 to 10, further comprising:
transmitting, to the SMF, a second PDU session management context create request for the PDU session via a second access node.
12. The wireless communication method of claim 11, wherein the first access node and the second access node provide 3GPP accesses.
13. The wireless communication method of claim 11 or 12, wherein the first access node and the second access node have the same radio technology type.
14. The wireless communication method of any of claims 11 to 13, further comprising:
receiving, from a UE of the PDU session via the second access node, a second PDU session establishment request for the PDU session via the second access node,
and/or
receiving, from the UE of the PDU session via the second access node, a second registration request indicating a capability of supporting simultaneous connectivity via a plurality of 3GPP access networks.
15. The wireless communication method of any of claims 1 to 14, further comprising:
transmitting, to the SMF, a context update request for the PDU session via the first access node, wherein the context update request comprises a second identity of a third access node.
16. A wireless communication method for use in a session management function (SMF), the method comprising:
receiving, from an access and management function (AMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request, and

generating session management context of the PDU session via the first access node,
wherein the session management context of the PDU session via the first access
node comprises the first identity of the first access node.

17. The wireless communication method of claim 16, wherein the first identity of the first access node is configured to identify the first access node in the AMF.
18. The wireless communication method of claim 16 or 17, further comprising:
transmitting, to the AMF, a first message for the PDU session via the first access node,
wherein the first message comprises the first identity.
19. The wireless communication method of any of claims 16 to 18, further comprising:
receiving, from the AMF, a second message for the PDU session via the first access node,
wherein the second message comprises the first identity.
20. The wireless communication method of any of claims 16 to 19, wherein the PDU session supports simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.
21. The wireless communication method of claim 20, wherein the plurality of 3GPP access networks has the same radio technology type.
22. The wireless communication method of any of claims 16 to 21, further comprising:
receiving, from the AMF, a second PDU session management context create request for
the PDU session via a second access node before receiving the first PDU session
management context create request.
23. The wireless communication method of claim 22, wherein the first access node and the second access node provide 3GPP accesses.
24. The wireless communication method of claim 22 or 23, wherein the first access node and the second access node have the same radio technology type.
25. The wireless communication method of any of claims 16 to 25, further comprising:
receiving, from the AMF, a context update request for the PDU session via the first access
node, wherein the context update request comprises a second identity of a third
access node, and

changing the first identity of the first access node comprised in the session management context of the PDU session via the first access node to the second identity of the third access node.

26. The wireless communication method of claim 25, further comprising:
transmitting, to a user plane function, a session modification request for the PDU session, wherein the session modification request comprises the second identity of a third access node.
27. A wireless communication method for use in a user equipment (UE), the method comprising:
transmitting, to an access and mobility management function (AMF) via a first access node, a first registration request, wherein the registration request indicates a simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.
28. The wireless communication method of claim 27, further comprising:
receiving, from the AMF, a registration accept message indicating that the simultaneous connectivity via the plurality of 3GPP access networks is supported.
29. The wireless communication method of claim 27 or 28, wherein the first registration request comprises a request type configured to indicate the simultaneous connectivity via the plurality of 3GPP access networks.
30. The wireless communication method of any of claims 27 to 29, wherein the plurality of 3GPP access networks has the same radio technology type.
31. The wireless communication method of any of claims 27 to 30, further comprising:
transmitting, to the AMF via the first access node, a first protocol data unit (PDU) session establishment request for a PDU session via the first access node.
32. The wireless communication method of claim 31, further comprising:
transmitting, to the AMF via a second access node, a second PDU session establishment request for the PDU session via the second access node, and/or
transmitting, to the AMF via the second access node, a second registration request for the PDU session via the second access node indicating the simultaneous connectivity

via the plurality of 3GPP access networks.

33. The wireless communication method of claim 32, wherein the first access node and the second access node provide 3GPP access networks.
34. The wireless communication method of claim 32 or 33, wherein the first access node and the second access node have the same radio technology type.
35. A wireless device, comprising:
a communication unit, configured to transmit, to a session management function (SMF),
a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request.
36. The wireless device of claim 35, further comprising a processor configured to perform a wireless communication method of any one of claims 2 to 15.
37. A wireless device, comprising:
a communication unit, configured to receive, from an access and management function (AMF), a first protocol data unit (PDU) session management context create request for a PDU session via a first access node and a first identity of the first access node associated with the first PDU session management context create request, and
a processor, configured to generate session management context of the PDU session via the first access node, wherein the session management context of the PDU session via the first access node comprises the first identity of the first access node.
38. The wireless device of claim 37, wherein the processor is further configured to perform a wireless communication method of any one of claims 17 to 26.
39. A user equipment (UE), comprising:
a communication unit, configured to transmitting, to an access and mobility management function (AMF) via a first access node, a first registration request, wherein the registration request indicating a simultaneous connectivity via a plurality of 3rd generation partner project (3GPP) access networks.
40. The UE of claim 39, further comprising a processor configured to perform a wireless

communication method of any one of claims 28 to 34.

41. A computer program product comprising a computer-readable program medium code stored thereupon, the code, when executed by a processor, causing the processor to implement a wireless communication method recited in any one of claims 1 to 34.

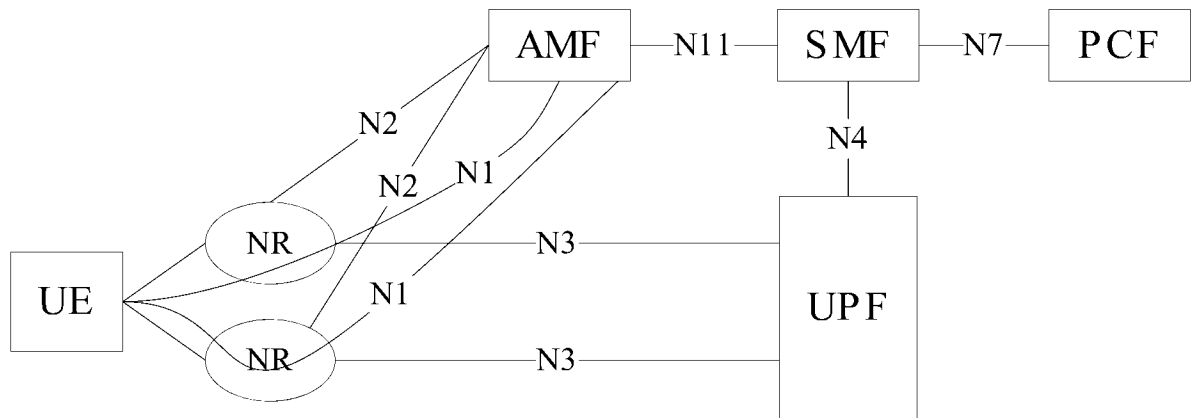


FIG. 1

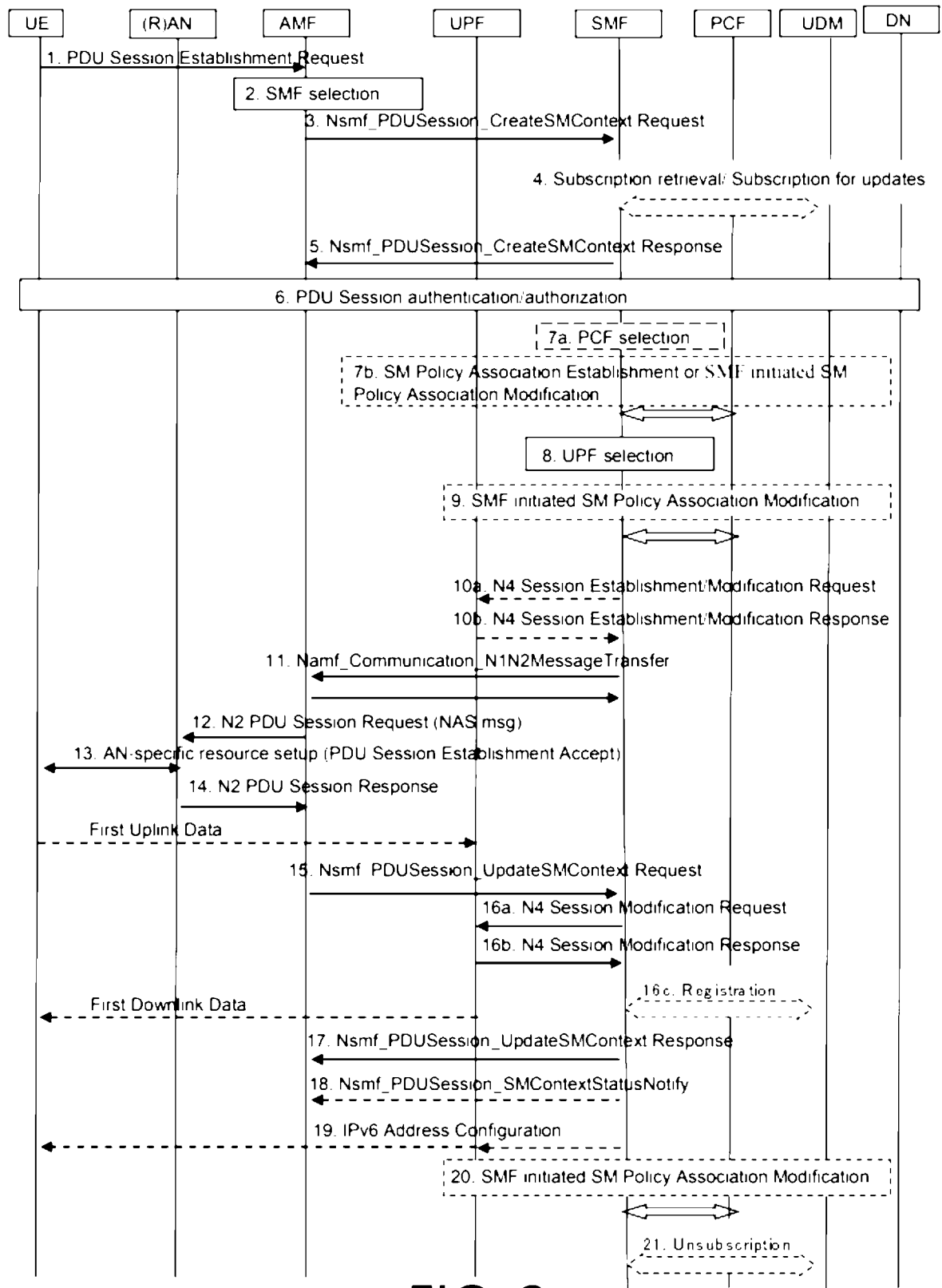


FIG. 2

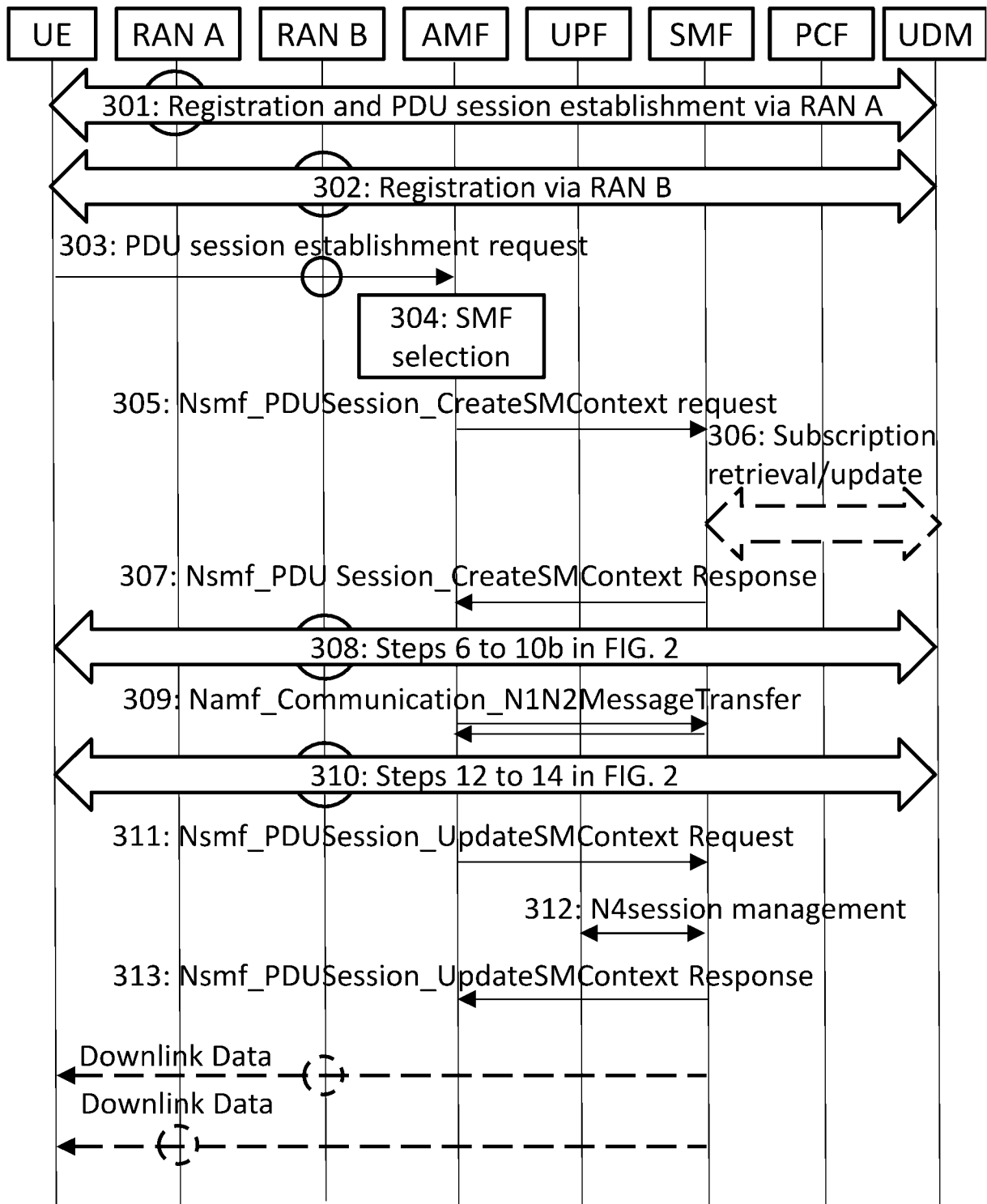


FIG. 3

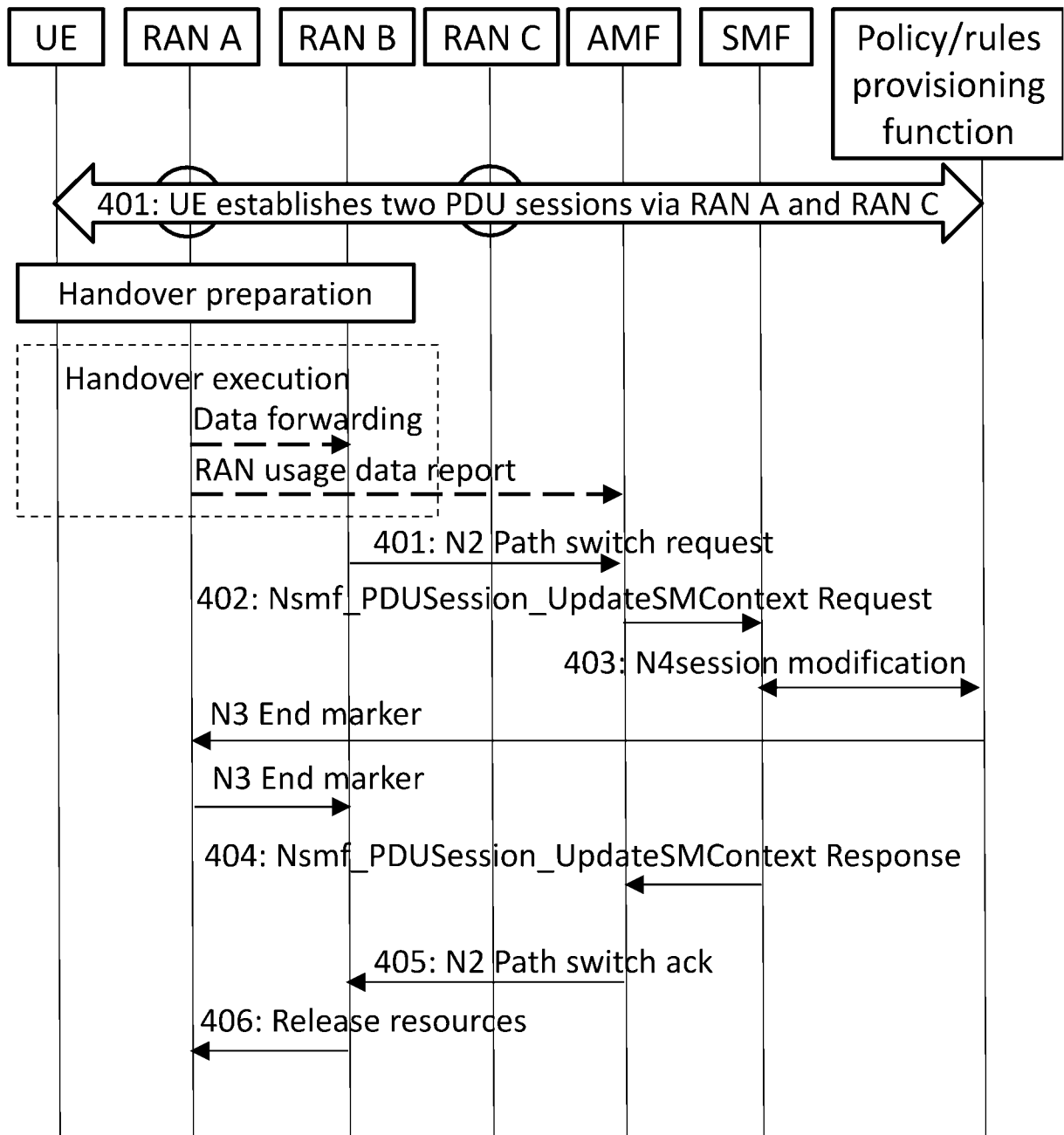


FIG. 4

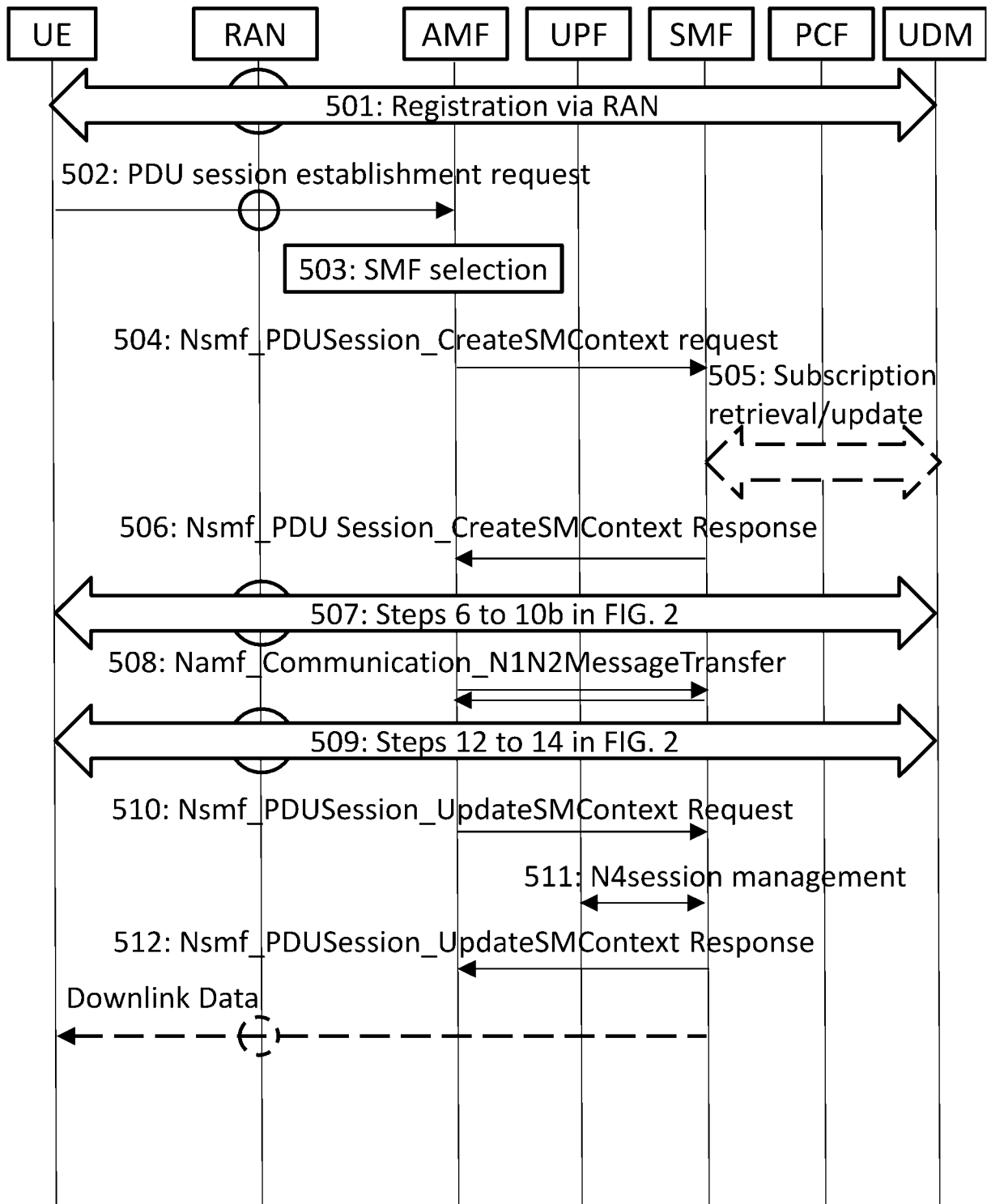


FIG. 5

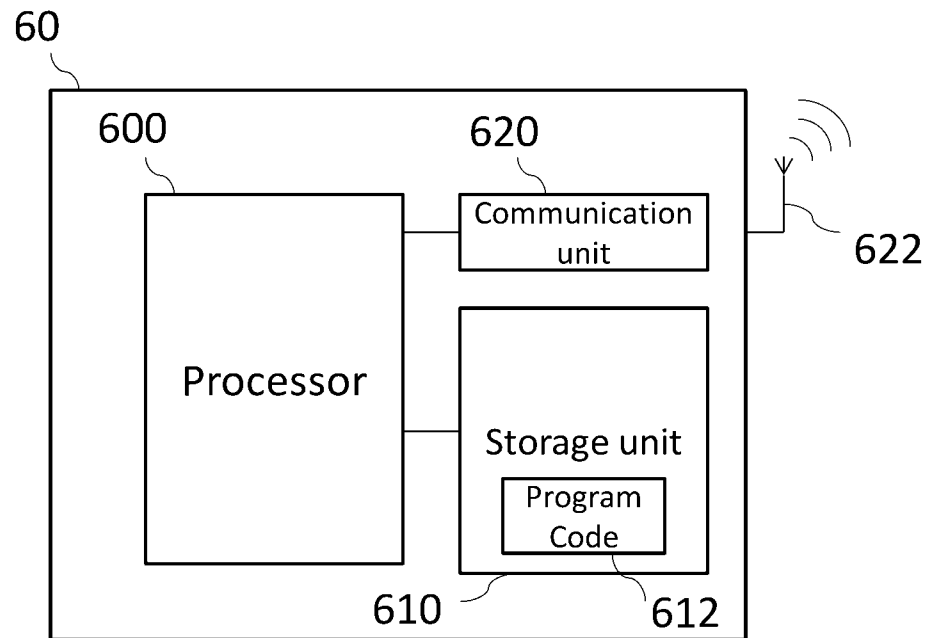


FIG. 6

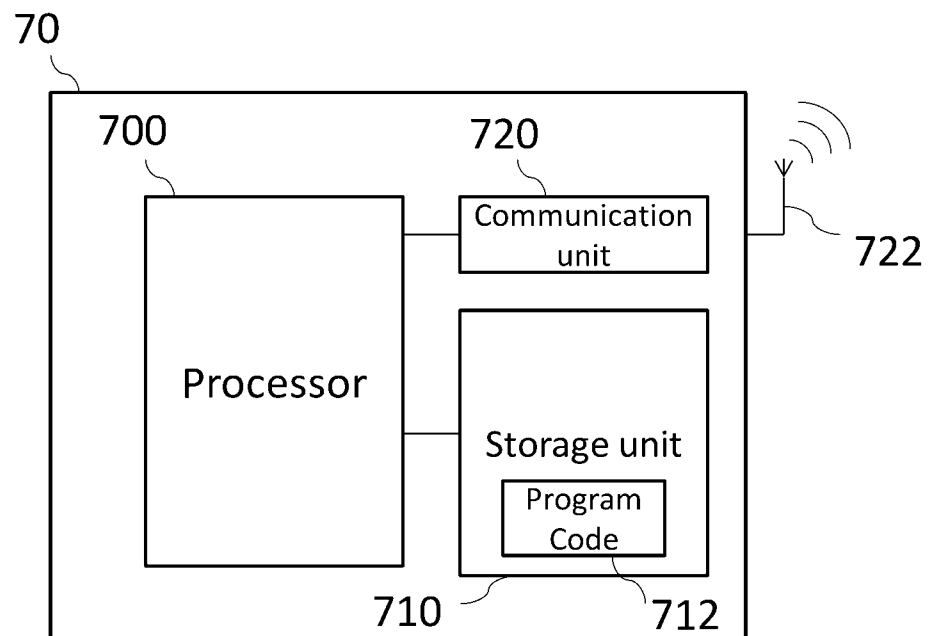


FIG. 7

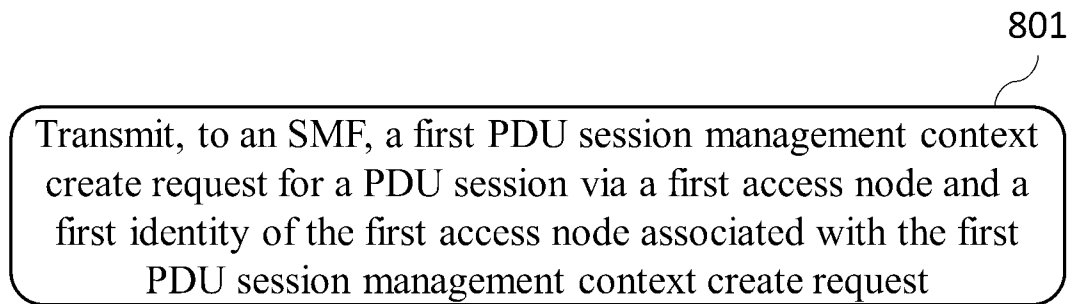


FIG. 8

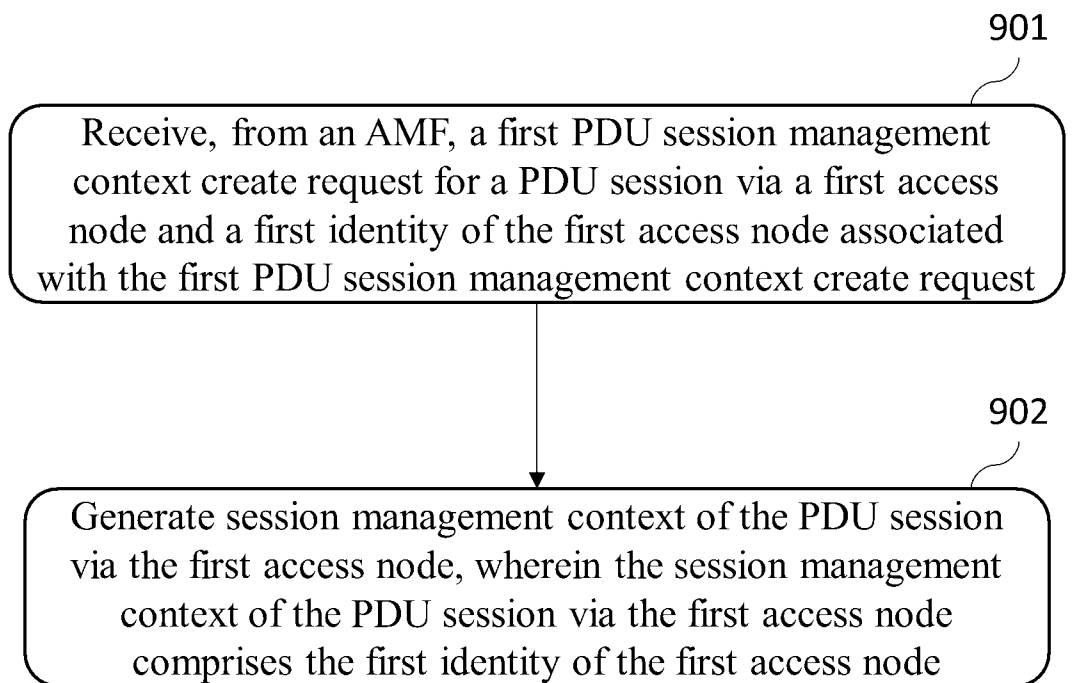


FIG. 9

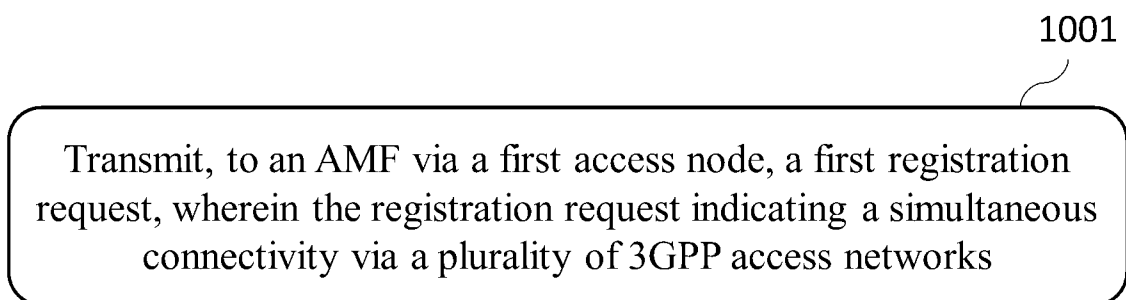


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/108746

A. CLASSIFICATION OF SUBJECT MATTER H04W 12/08(2021.01)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) IPC: H04W 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) 3GPP,CNXT,DWPI,ENTXT:MA-PDU, multiple, access, PDU, dual, multiple, 3GPP, SMF, AMF, two, establishment, create, request,registration																	
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 2023078760 A1 (CABLE TELEVISION LABORATORIES, INC.) 16 March 2023 (2023-03-16) description, paragraphs 31-128</td> <td>27-34,39-41</td> </tr> <tr> <td>A</td> <td>CN 111034336 A (IDAC HOLDINGS INC.) 17 April 2020 (2020-04-17) the whole document</td> <td>1-41</td> </tr> <tr> <td>A</td> <td>WO 2023076773 A1 (QUALCOMM INC.) 04 May 2023 (2023-05-04) the whole document</td> <td>1-41</td> </tr> <tr> <td>A</td> <td>LENOVO et al. "New SID on Access Traffic Steering, Switching and Splitting support in the 5G system architecture; Phase 3" SA WG2 Meeting #S2-147E S2-2107635, 22 October 2021 (2021-10-22), the whole document</td> <td>1-41</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2023078760 A1 (CABLE TELEVISION LABORATORIES, INC.) 16 March 2023 (2023-03-16) description, paragraphs 31-128	27-34,39-41	A	CN 111034336 A (IDAC HOLDINGS INC.) 17 April 2020 (2020-04-17) the whole document	1-41	A	WO 2023076773 A1 (QUALCOMM INC.) 04 May 2023 (2023-05-04) the whole document	1-41	A	LENOVO et al. "New SID on Access Traffic Steering, Switching and Splitting support in the 5G system architecture; Phase 3" SA WG2 Meeting #S2-147E S2-2107635, 22 October 2021 (2021-10-22), the whole document	1-41
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.															
X	US 2023078760 A1 (CABLE TELEVISION LABORATORIES, INC.) 16 March 2023 (2023-03-16) description, paragraphs 31-128	27-34,39-41															
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A	WO 2023076773 A1 (QUALCOMM INC.) 04 May 2023 (2023-05-04) the whole document	1-41															
A	LENOVO et al. "New SID on Access Traffic Steering, Switching and Splitting support in the 5G system architecture; Phase 3" SA WG2 Meeting #S2-147E S2-2107635, 22 October 2021 (2021-10-22), the whole document	1-41															
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																	
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Date of the actual completion of the international search 21 March 2024		Date of mailing of the international search report 27 March 2024															
Name and mailing address of the ISA/CN CHINA NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China		Authorized officer XU,Quan Telephone No. (+86) 010-53961794															

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2023/108746

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				EP	3666032	A1	17 June 2020
				US	2020178196	A1	04 June 2020
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				JP	2023178979	A	18 December 2023
				KR	20200049760	A	08 May 2020
				KR	20220035977	A	22 March 2022
WO	2023076773	A1	04 May 2023	None			