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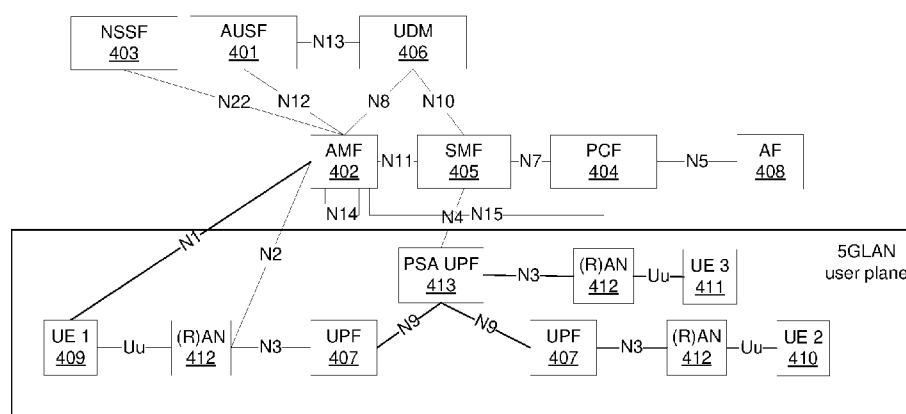


FIG. 4

(57) **Abstract:** An apparatus and a method for performing a group communication are provided. A method for performing the group communication of a user equipment includes transmitting, to a network node, a connection establishment request in the group communication system and establishing, each connection for each group in the group communication system according to the connection establishment request.

APPARATUS AND METHOD OF PERFORMING A GROUP COMMUNICATION
BACKGROUND OF DISCLOSURE

1. Field of Disclosure

[0001] The present disclosure relates to the field of communication systems, and more particularly, to an apparatus and a method of performing a group communication.

2. Description of Related Art

[0002] In long term evolution (LTE) and new radio (NR) systems, a public network system, such as, a public land network based on public land mobile network (PLMN), is usually deployed. However, in some scenarios, such as offices, homes, and factories, in order to be more effective and securely managed, local users or administrators usually lay out a local network. Members in a local network group can communicate in a point-to-point manner or point-to-multipoint communication.

[0003] Therefore, there is a need for an apparatus and a method of performing a group communication.

SUMMARY

[0004] An object of the present disclosure is to propose an apparatus and a method of performing a group communication capable of providing a good group communication performance and high reliability and providing a solution that how a user data is transmitted within 5G system and corresponding control information and/or procedure.

[0005] In a first aspect of the present disclosure, a user equipment in a group communication includes a memory, a transceiver, and a processor coupled to the memory and the transceiver. The processor is configured to control the transceiver to transmit, to a network node, a connection establishment request in the group communication system, and the processor is configured to establish, each connection for each group in the group communication system according to the connection establishment request.

[0006] In a second aspect of the present disclosure, a method for performing a group communication of a user equipment includes transmitting, to a network node, a connection establishment request in the group communication system and establishing, each connection for each group in the group communication system according to the connection establishment request.

[0007] In a third aspect of the present disclosure, a network node in a group communication includes a memory, a transceiver, and a processor coupled to the memory and the transceiver. The processor is configured to control the transceiver to receive a connection establishment request from a user equipment (UE) in the group communication system, and the processor is configured to hand of a connection for the UE in the group communication system.

[0008] In a fourth aspect of the present disclosure, a method for performing a group communication of a network node includes receiving a connection establishment request from a user equipment (UE) in the group communication system and handing of a connection for the UE in the group communication system.

[0009] In a fifth aspect of the present disclosure, a non-transitory machine-readable storage medium has stored thereon instructions that, when executed by a computer, cause the computer to perform the above method.

[0010] In a sixth aspect of the present disclosure, a terminal device includes a processor and a memory configured to store a computer program. The processor is configured to execute the computer program stored in the memory to perform the above method.

[0011] In a seventh aspect of the present disclosure, a network node includes a processor and a memory configured to store a computer program. The processor is configured to execute the computer program stored in the memory to perform the above method.

BRIEF DESCRIPTION OF DRAWINGS

[0012] In order to more clearly illustrate the embodiments of the present disclosure or related art, the following figures will be described in the embodiments are briefly introduced. It is obvious that the drawings are merely some embodiments of the present disclosure, a person having ordinary skill in this field can obtain other figures according to these figures without paying the premise.

[0013] FIG. 1 is a block diagram of a user equipment and a network performing a group communication according to an embodiment of the present disclosure.

[0014] FIG. 2 is a flowchart illustrating a method for performing a group communication of a user equipment according to an embodiment of the present disclosure.

[0015] FIG. 3 is a flowchart illustrating a method for performing a group communication of a network node according to an embodiment of the present disclosure.

[0016] FIG. 4 is a schematic diagram illustrating a 5G system architecture in a centralized user plane architecture case, using reference point representation illustrating how various network functions interact with each other according to an embodiment of the present disclosure.

[0017] FIG. 5 is a schematic diagram illustrating a 5G system architecture in a distributed user plane architecture case, using reference point representation illustrating how various network functions interact with each other according to an embodiment of the present disclosure.

[0018] FIG. 6 is a schematic diagram of exemplary illustration of point-to-multipoint communication user plane topologies according to an embodiment of the present disclosure.

[0019] FIG. 7 is a schematic diagram of exemplary illustration of point-to-multipoint communication group PDU session according to an embodiment of the present disclosure.

[0020] FIG. 8 is a block diagram of a system for wireless communication according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0021] Embodiments of the present disclosure are described in detail with the technical matters, structural features, achieved objects, and effects with reference to the accompanying drawings as follows. Specifically, the terminologies in the embodiments of the present disclosure are merely for describing the purpose of the certain embodiment, but not to limit the disclosure.

[0022] FIG. 1 illustrates that, in some embodiments, a user equipment (UE) 10 and a network node 20 performing a group communication according to an embodiment of the present disclosure are provided. The UE 10 may include a processor 11, a memory 12, and a transceiver 13. The network node 20 may include a processor 21, a memory 22 and a transceiver 23. The processor 11 or 21 may be configured to implement proposed functions, procedures and/or methods described in this description. Layers of radio interface protocol may be implemented in the processor 11 or 21. The memory 12 or 22 is operatively coupled with the processor 11 or 21 and stores a variety of information to operate the processor 11 or 21. The transceiver 13 or 23 is operatively coupled with the processor 11 or 21, and the transceiver 13 or 23 transmits and/or receives a radio signal.

[0023] The processor 11 or 21 may include an application-specific integrated circuit (ASIC), other chipsets, logic circuit and/or data processing devices. The memory 12 or 22 may include a read-only memory (ROM), a random access memory (RAM), a flash memory, a memory card, a storage medium and/or other storage devices. The transceiver 13 or 23 may include baseband circuitry to process radio frequency signals. When the embodiments are implemented in software, the techniques described herein can be implemented with modules (e.g., procedures, functions, and so on) that perform the functions described herein. The modules can be stored in the memory 12 or 22 and executed by the processor 11 or 21. The memory 12 or 22 can be implemented within the processor 11 or 21 or

external to the processor 11 or 21, in which those can be communicatively coupled to the processor 11 or 21 via various means are known in the art.

[0024] The communication between UEs relates to vehicle-to-everything (V2X) communication including vehicle-to-vehicle (V2V), vehicle-to-pedestrian (V2P), and vehicle-to-infrastructure/network (V2I/N) according to a sidelink technology developed under 3rd generation partnership project (3GPP) release 14, 15, and beyond. UEs communicate with each other directly via a sidelink interface such as a PC5 interface.

[0025] In some embodiments, the processor 11 is configured to control the transceiver 13 to receive transmit, to the network node 20, a connection establishment request in the group communication system, and the processor 11 is configured to establish, each connection for each group in the group communication system according to the connection establishment request.

[0026] In some embodiments, the processor 11 is configured to establish multiple connections for multiple groups in the group communication system the UE 10 belongs to according to the connection establishment request. In some embodiments, each connection for each group in the group communication system is terminated at the network node 20 or the network node 20 and the processor 11 of the UE 10. In some embodiments, the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request includes a PDU session identity (ID) and/or group related information, and the connection includes a PDU session.

[0027] In some embodiments, the group related information includes a group index and a UE index within the group. In some embodiments, the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode. In some embodiments, when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6, the processor 11 is configured to receive an IP address and/or prefix of the connection from the network node 20.

[0028] In some embodiments, a connection type is an ethernet type PDU session. In some embodiments, if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system. In some embodiments, the processor 21 is configured to receive a connection establishment request from the user equipment (UE) 10 in the group communication system, and the processor 21 is configured to hand of a connection for the UE 10 in the group communication system.

[0029] In some embodiments, the network node 20 further includes a session management function (SMF) configured to check whether the connection establishment request is compliant with a group the UE 10 belongs to. In some embodiments, the network node 20 further includes a protocol data unit session anchor (PSA) user plane function (UPF) configured to terminate each connection for the UE 10 in the group communication system. In some embodiments, the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request includes a PDU session identity (ID) and/or group related information, and the connection includes a PDU session. In some embodiments, the group related information includes a group index and a UE index within the group.

[0030] In some embodiments, the SMF is configured to retrieve and request to receive an update notification on the group related information from a unified data management (UDM). In some embodiments, the SMF is configured to reject the connection establishment request if the group related information is not a part of explicitly groups the UE 10 belongs to according to a group data in the SMF requested from the UDM. In some embodiments, the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode. In some embodiments, the network node 20 further includes an access and mobility management function (AMF) configured to consider group local configuration information if an appropriate SMF is selected for the group the UE 10 belongs to.

[0031] In some embodiments, the network node 20 further includes a UPF, the SMF is configured to consider group local configuration information if an appropriate UPF is selected for the group the UE belongs to. In some

embodiments, the PSA UPF is configured to enforce a quality of experience (QoS) handling procedure for a group user data transmission in the group communication system, and a SMF based on local configuration or policy control function (PCF) information provides different QoS configurations for unicast and multicast communication. In some embodiments, a QoS enforcement is different for an uplink and downlink traffic, and the SMF provides the different QoS configurations for the uplink and downlink traffic. In some embodiments, in case of multicast, the SMF provides a uniform QoS configuration for a downlink traffic target to different UEs in a group of the group communication system to the PSA UPF, and the PSA UPF enforces a uniform QoS policy for the downlink traffic to the different UEs in the group.

[0032] In some embodiments, the SMF is configured to provide a packet detection rule (PDR) and a forwarding action rule (FAR) to the PSA UPF. In some embodiments, the PDR includes group information and related FAR information, and the FAR includes a destination interface information for the group. In some embodiments, the destination interface information includes a Nx interface or N6 interface associated with the group.

[0033] In some embodiments, in case of unicast communication, the PSA UPF detects a user data from one PDU session belonging to the group and detects that a destination address is an allocated address for other UE in the group, and the PSA UPF forwards the user data to the PDU session of an associated UE in the group. In some embodiments, the network node 20 further includes a serving UPF and other UPF, the connection for each group member UE is terminated at the serving UPF and the related UE.

[0034] In some embodiments, the network node 20 further includes a SMF configured to configure the serving UPF as a PSA UPF for an associated UE, and the PSA UPF is an anchor point for the UE to connect with other UPF serving for other UEs within a group of the group communication system. In some embodiments, when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6 PDU session, the processor 21 is configured to transmit, to the UE 10, an IP address and/or prefix of the connection. In some embodiments, for the IPv4, IPv6, or IPv4v6 type PDU session, the PSA UPF is an IP anchor point of the IP address and/or prefix allocated to the UE 10. In some embodiments, a connection type is an ethernet type PDU session.

[0035] In some embodiments, for the ethernet type PDU session, the SMF instructs the UPF to route a downlink traffic based on a media access control (MAC) address used by the UE 10 for an uplink traffic. In some embodiments, if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.

[0036] FIG. 2 illustrates a method 200 for performing a group communication of a user equipment according to an embodiment of the present disclosure. The method 200 includes: at block 202, transmitting, to a network node, a connection establishment request in the group communication system, and at block 204, establishing, each connection for each group in the group communication system according to the connection establishment request.

[0037] In some embodiments, the method further includes establishing multiple connections for multiple groups in the group communication system the UE belongs to according to the connection establishment request. In some embodiments, the method further includes using the network node or the network node and the UE to terminate each connection for each group in the group communication system. In some embodiments, the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request includes a PDU session identity (ID) and/or group related information, and the connection includes a PDU session.

[0038] In some embodiments, the group related information includes a group index and a UE index within the group. In some embodiments, the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode. In some embodiments, when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6, the method includes receiving an IP address and/or prefix of the connection from the network node. In some embodiments, a connection type is an ethernet type PDU session.

[0039] In some embodiments, if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.

[0040] FIG. 3 illustrates a method 300 for performing a group communication of a network node according to an embodiment of the present disclosure. The method 300 includes: at block 302, receiving a connection establishment request from a user equipment (UE) in the group communication system, and at block 304, handing of a connection for the UE in the group communication system.

[0041] In some embodiments, the method further includes using a session management function (SMF) to check whether the connection establishment request is compliant with a group the UE belongs to. In some embodiments, the method further includes using a protocol data unit session anchor (PSA) user plane function (UPF) to terminate each connection for the UE in the group communication system.

[0042] In some embodiments, the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request includes a PDU session identity (ID) and/or group related information, and the connection includes a PDU session. In some embodiments, the group related information includes a group index and a UE index within the group.

[0043] In some embodiments, the method further includes using the SMF to retrieve and request to receive an update notification on the group related information from a unified data management (UDM). In some embodiments, the method further includes using the SMF to reject the connection establishment request if the group related information is not a part of explicitly groups the UE belongs to according to a group data in the SMF requested from the UDM. In some embodiments, the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode.

[0044] In some embodiments, the method further includes using an access and mobility management function (AMF) to consider group local configuration information if an appropriate SMF is selected for the group the UE belongs to. In some embodiments, the method further includes using the SMF to consider group local configuration information if an appropriate UPF is selected for the group the UE belongs to. In some embodiments, the method further includes using the PSA UPF to enforce a quality of experience (QoS) handling procedure for a group user data transmission in the group communication system, and a SMF based on local configuration or policy control function (PCF) information provides different QoS configurations for unicast and multicast communication.

[0045] In some embodiments, a QoS enforcement is different for an uplink and downlink traffic, and the SMF provides the different QoS configurations for the uplink and downlink traffic. In some embodiments, in case of multicast, the method includes using the SMF to provide a uniform QoS configuration for a downlink traffic target to different UEs in a group of the group communication system to the PSA UPF, and the method further includes using the PSA UPF to enforce a uniform QoS policy for the downlink traffic to the different UEs in the group. In some embodiments, the method further includes using the SMF to provide a packet detection rule (PDR) and a forwarding action rule (FAR) to the PSA UPF.

[0046] In some embodiments, the method further includes the PDR includes group information and related FAR information, and the FAR includes a destination interface information for the group. In some embodiments, the destination interface information includes a Nx interface or N6 interface associated with the group. In some embodiments, in case of unicast communication, the method includes using the PSA UPF to detect a user data from one PDU session belonging to the group and detect that a destination address is an allocated address for other UE in the group, and the method further includes using the PSA UPF to forward the user data to the PDU session of an associated UE in the group.

[0047] In some embodiments, the method further includes using a serving UPF and the related UE to terminate the connection for each group member UE. In some embodiments, the method further includes using a SMF to configure

the serving UPF as a PSA UPF for an associated UE, and the PSA UPF is an anchor point for the UE to connect with other UPF serving for other UEs within a group of the group communication system. In some embodiments, when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6 PDU session, the method includes transmitting, to the UE, an IP address and/or prefix of the connection. In some embodiments, for the IPv4, IPv6, or IPv4v6 type PDU session, the PSA UPF is an IP anchor point of the IP address and/or prefix allocated to the UE.

[0048] In some embodiments, the method further includes a connection type is an ethernet type PDU session. In some embodiments, the method further includes for the ethernet type PDU session, the method includes using the SMF to instruct the UPF to route a downlink traffic based on a media access control (MAC) address used by the UE for an uplink traffic. In some embodiments, if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.

[0049] FIG. 4 illustrates that, in some embodiments, a 5G system architecture in a centralized user plane architecture case, uses reference point representation to illustrate how various network functions interact with each other according to an embodiment of the present disclosure.

[0050] The 5G system architecture is defined to support data connectivity and services enabling deployments to use techniques such as e.g. network function virtualization and software defined networking. The 5G system architecture can leverage service-based interactions between control plane (CP) network functions where identified. In some embodiments, some technical solutions are to separate user plane (UP) functions from the control plane (CP) functions, allowing independent scalability, evolution, and flexible deployments e.g. centralized location or distributed (remote) location. In some embodiments, some technical solutions are to modularize a function design, e.g. to enable flexible and efficient network slicing. In some embodiments, some technical solutions are to wherever applicable, define procedures (i.e. a set of interactions between network functions) as services, so that their re-use is possible. In some embodiments, some technical solutions are to enable each network function to interact with other NF directly if required. The architecture does not preclude the use of an intermediate function to help route control plane messages (e.g. like a DRA).

[0051] In some embodiments, some technical solutions are to minimize dependencies between an access network (AN) and a Core Network (CN). The architecture is defined with a converged core network with a common AN - CN interface which integrates different access Types e.g. 3GPP access and non-3GPP access. In some embodiments, some technical solutions are to support a unified authentication framework. In some embodiments, some technical solutions are to support "stateless" NFs, where the "compute" resource is decoupled from the "storage" resource. In some embodiments, some technical solutions are to support capability exposure. In some embodiments, some technical solutions are to support concurrent access to local and centralized services. To support low latency services and access to local data networks, UP functions can be deployed close to the access network. In some embodiments, some technical solutions are to support roaming with both home routed traffic as well as local breakout traffic in the visited public land mobile network (PLMN).

[0052] This specification describes an architecture for the 5G system. The 5G architecture is defined as service-based and the interaction between network functions is represented as follows. A service-based representation, where network functions (e.g. AMF) within the control plane enables other authorized network functions to access their services. This representation also includes point-to-point reference points where necessary. A reference point representation, illustrates the interaction exist between the NF services in the network functions described by point-to-point reference point (e.g. N11) between any two network functions (e.g. AMF and SMF). Service-based interfaces and reference points are illustrated in FIG. 4. Network functions within the 5G core network control plane only uses service-based interfaces for their interactions.

[0053] In some embodiments, the 5G system architecture includes following network functions (NF), such as an authentication server function (AUSF) 401, an access and mobility management function (AMF) 402, a network slice selection function (NSSF) 403, a policy control function (PCF) 404, a session management function (SMF) 405, a unified data management (UDM) 406, a user plane function (UPF) 407, an application function (AF) 408, a user equipment (UE), such as UE 1 409, UE 2 410, UE 3 411, a (radio) access network ((R)AN) 412, a PSA UPF 413, and interfaces Uu, N1 to N15, and N22.

[0054] In some embodiments, in a centralized user plane architecture, a single SMF405 and a single PSA UPF 413 are responsible for all PDU sessions for 5GLAN group communication. The PDU session for each group member UE is terminated at the PSA UPF 413. The PSA UPF 413 is a user plane anchor point for a user plane path within the 5GLAN group. All traffic of participating 5GLAN group UE traverses the PSA UPF 413. The PSA UPF 413 can be an anchor point for multiple 5GLAN groups.

[0055] In some embodiments, in a handling of PDU session for 5GLAN communication, the SMF 405 is responsible for managing the PDU sessions belonging to the 5GLAN group, including establish, modify, and release the PDU sessions, the PDU sessions are established (upon UE request), modified (upon UE and 5GC request) and released (upon UE and 5GC request) as specified in clause 5.6. In a PDU session establishment request message sent to the network, the UE can provide a PDU session ID and the group related information. This PDU session is specific for the group. The group related information can be combination of S-NSSAI and DNN, or internal Group index. The SMF is responsible of checking whether the UE requests are compliant with the groups the UE belongs to. For this purpose, it retrieves and requests to receive update notifications on SMF level group data from the UDM 406. Such group data may be group index and the UE index (e.g. GPSI) within the group. The SMF 405 can reject a PDU session establishment if the group related information is not part of explicitly groups the UE belongs to according to the group data in the SMF 405 requested from the UDM 406. A UE only establishes one PDU session for one group, and a UE may establish multiple PDU sessions for multiple groups the UE belongs to. SSC Mode 1 may apply to PDU sessions for the centralized user plane architecture.

[0056] In some embodiments, in an address allocation for 5GLAN communication, for IPv4 or IPv6 or IPv4v6 type PDU sessions, the PSA UPF 413 is IP anchor point of the IP address/prefix allocated to the UE. For ethernet type PDU sessions, the SMF 405 may instruct the PSA UPF 413 to route the DL traffic based on the MAC address(es) used by the UE for the UL traffic. For IP type PDU sessions, the SMF 405 performs IP address management and allocation procedure as specified in 5.8.2.2. Additionally, for IP type PDU session, the SMF 405 allocates one IP address/prefix to the UE during the 5GLAN group PDU session establishment procedure. In order to support multicast within 5GLAN, the SMF 405 can allocate the destination multicast address for the group and provide the multicast address to the UEs and the PSA UPF 413 in the group. If the SMF 405 does not allocate the destination multicast address, UE can use a wildcard address as the destination address for multicast in this group. In order to support unicast within 5GLAN, UE needs to know the destination address of the peer UE within 5GLAN group, this can be implemented by the application layer.

[0057] In some embodiments, in a SMF and UPF selection function, when the SMF 405 is selected for 5GLAN group communication, the SMF selection function described in clause 6.3.2 for normal services. The AMF 402 can also consider group local configuration information if any to select an appropriate SMF 405 for the group. When the UPF 407 is selected for 5GLAN group communication, the UPF selection function described in clause 6.3.3 for normal services is applied. The SMF 405 can also consider group local configuration information if any to select an appropriate UPF 407.

[0058] In some embodiments, in a QoS for 5GLAN communication, a QoS model defined in clause 5.7 is applied for 5GLAN communication. The PSA UPF 413 enforces the QoS handling procedure for the group user data transmission. The SMF based on local configuration or PCF information may provide different QoS configurations for

unicast and multicast communication. The QoS enforcement can be different for uplink and downlink traffic and the SMF 405 provides the different QoS configurations for uplink and downlink traffic. In case of multicast, the SMF 405 provides the uniform QoS configuration for the downlink traffic target to different UEs in the group to the PSA UPF 413 and the PSA UPF 413 enforces the uniform QoS policy for the downlink traffic to the different UEs in the group.

[0059] In some embodiments, in a group forwarding path management, the PDU sessions targeting to the 5GLAN group compose the group user data forwarding path. The SMF 405 provides the PDR and FAR to the PSA UPF 413. The PDR contains the group information (e.g. group PDU Session ID or CN Tunnel info) and the related FAR information. The FAR contains the destination interface (i.e. local forwarding) for the group and the destination interface information contains all the Nx interface or N6 interface associated with the group. In case of multicast communication, the PSA UPF 413 detects the user data from one PDU session belonging to the group and detects the destination address is for multicast, the PSA UPF 413 forwards the user data to the other PDU sessions of the group. In case of unicast communication, the PSA UPF 413 detects the user data from one PDU session belonging to the group and detects the destination address is the allocated address for other UE in the group, the PSA UPF 413 forwards the user data to the PDU Session of the associated UE in the group. One CN tunnel is allocated for the PDU session between the other UPF(s) and the PSA UPF 413 if there are other UPF(s) between the UE and the PSA UPF 413, and this CN tunnel is specific for the group that the PDU session is associated. The CN tunnel is released with the PDU session release. The CN tunnel management for 5GLAN group is performed as specified in clause 5.8.2.10.

[0060] FIG. 5 illustrates that, in some embodiments, a 5G system architecture in a distributed user plane architecture case, uses reference point representation to illustrate how various network functions interact with each other according to an embodiment of the present disclosure.

[0061] In some embodiments, the 5G system architecture includes following network functions (NF), such as an authentication server function (AUSF) 501, an access and mobility management function (AMF) 502, a network slice selection function (NSSF) 503, a policy control function (PCF) 504, a session management function (SMF) 505, a unified data management (UDM) 506, a user plane function (UPF) 507, an application function (AF) 508, a user equipment (UE), such as UE 1 509, a (radio) access network ((R)AN) 512, a data network (DN) 514, and interfaces Uu, N1 to N15, N22, and Nx.

[0062] In some embodiments, in an architecture for 5GLAN for distributed user plane architecture, a single SMF 505 and multiple UPF(s) 507 are responsible for all the PDU sessions for 5GLAN group communication. The PDU session for each group member UE is terminated at serving UPF and the related UE. The SMF 505 can configure the serving UPF as the PSA UPF for the associated UE, and the PSA UPF is the anchor point for the UE to connect with other (PSA) UPF serving for other UEs within the group.

[0063] In some embodiments, in a handling of PDU session for 5GLAN communication, the SMF is responsible for managing the PDU sessions belonging to the 5GLAN group, including establish, modify and release the PDU sessions, the PDU sessions are established (upon UE request), modified (upon UE and 5GC request) and released (upon UE and 5GC request). The SMF 505 is responsible of checking whether the UE requests are compliant with the groups the UE belongs to. For this purpose, it retrieves and requests to receive update notifications on SMF level group data from the UDM 506. In a PDU session establishment request message sent to the network, the UE provides a PDU session ID and the group related information. This PDU session is specific for the group. The group related information can be combination of S-NSSAI and DNN, or internal Group index. The SMF 505 can reject a PDU session establishment if the group related information is not part of explicitly groups the UE belongs to according to the group data in SMF requested from the UDM 506. A UE only establishes one PDU session for one group, and a UE may establish multiple PDU sessions for multiple groups the UE belongs to.

[0064] In some embodiments, in an address allocation for 5GLAN communication, for IPv4 or IPv6 or IPv4v6 type PDU sessions, the PSA UPF is IP anchor point of the IP address/prefix allocated to the UE. For Ethernet type PDU

Sessions, the SMF 505 may instruct the UPF 507 to route the DL traffic based on the MAC address(es) used by the UE for the UL traffic. For IP type PDU sessions, the SMF 505 performs IP address management and allocation procedure as specified in 5.8.2.2. Additionally, the SMF 505 allocates one IP address/prefix to the UE during the 5GLAN group PDU session establishment procedure. In order to support multicast within 5GLAN, the SMF 505 can allocate the destination multicast address for the group and provide the multicast address to the UEs in the group. If the SMF 505 does not allocate the destination multicast address, then a wildcard address can be used for the destination address for multicast in this group. In order to support unicast within 5GLAN, UE needs to know the destination address of the peer UE within 5GLAN group, this can be implemented by the application layer.

[0065] In some embodiments, in a SMF and UPF selection function, when the SMF 505 is selected for 5GLAN group communication, the SMF selection function described in clause 6.3.2 for normal services. The AMF 502 can also consider group local configuration information if any to select an appropriate SMF 505 for the group. When the UPF 507 is selected for 5GLAN group communication, the UPF selection function described in clause 6.3.3 for normal services is applied. The SMF 505 can also consider group local configuration information if any to select an appropriate UPF 507.

[0066] In some embodiments, in a QoS for 5GLAN communication, a QoS model defined in clause 5.7 is applied for 5GLAN communication. The PSA UPF enforces the QoS handling procedure for the group user data transmission. The SMF based on local configuration or PCF information may provide different QoS configurations for unicast and multicast communication. The QoS enforcement can be different for uplink and downlink traffic and the SMF 505 provides the different QoS configurations for uplink and downlink traffic. In case of multicast, the SMF 505 provides the uniform QoS configuration for the downlink traffic target to different UEs in the group to the PSA UPF and the PSA UPF enforces the uniform QoS policy for the downlink traffic to the different UEs in the group.

[0067] In some embodiments, in a group forwarding path management, the PDU sessions for the UEs in the group, the CN tunnel on Nx interface for this group compose the group user data forwarding path. The SMF 505 is responsible for establishing and managing the CN tunnels on Nx interface between the different PSA UPF for the different UEs within 5GLAN group. The SMF 505 provides the all the CN tunnel information to each PSA UPF within the group and update the CN tunnel information if the CN tunnel is changed due to e.g. PDU session(s) established or released for the group. The SMF 505 configures each PSA UPF the PDR and FAR. The PDR contains the group information (e.g. group PDU session ID or CN tunnel info) and the related FAR information. The FAR contains the destination interface for the group and the destination interface information contains all the Nx interface or N6 interface associated with the group. The PDU sessions and the CN tunnel is specific for the group. In case of multicast communication, the PSA UPF of the transmitting UE detects the user data from one PDU Session associated to the group and detects the destination address is for multicast, the PSA UPF forwards the user data to all the other PSA UPF(s) according to the configured CN tunnel information for the group. The other PSA UPF(s) forwards the use data to the PDU sessions associated to the group. PDR table and FAR table are illustrated as follows.

PDR table:			
Attribute		Description	Comment
N4 Session ID		Identifies the N4 session associated to this PDR	
Rule ID		Unique identifier to identify this rule	
Precedence		Determines the order, in which the detection information of all rules is applied	
Packet detection information	Source interface	Contains the values "access side", "core side", "SMF", "N6-LAN"	Combination of UE IP address (together with Network instance, if necessary), CN tunnel info, packet filter set, application ID, Ethernet PDU Session Information and QFI are used for traffic detection or group detection or unicast/multicast detection.
	UE IP address	One IPv4 address and/or one IPv6 prefix with prefix length	
	Network instance (NOTE 1)	Identifies the Network instance associated with the incoming packet	
	CN tunnel info	CN tunnel info on N3, N9 interfaces, i.e. F-TEID	
	Packet Filter Set	Details see clause 5.7.6, TS 23.501.	Details like all the combination possibilities on N3, N9 interfaces are left for stage 3 decision.
	Application ID		
	QoS Flow ID	Contains the value of 5QI or non-standardized QFI	
	Ethernet PDU Session Information	Refers to all the (DL) Ethernet packets matching an Ethernet PDU session, as further described in clause 5.6.10.2 and in TS 29.244 [65].	
group information (e.g. group index, or group related S-NSSAI and/or DNN)			
Outer header removal		Instructs the UP function to remove one or	Any extension header shall be

	more outer header(s) (e.g. IP+UDP+GTP, IP + possibly UDP, VLAN tag), from the incoming packet.	stored for this packet.
Forwarding Action Rule ID	The Forwarding Action Rule ID identifies a forwarding action that has to be applied.	
List of Usage Reporting Rule ID(s)	Every Usage Reporting Rule ID identifies a measurement action that has to be applied.	
List of QoS Enforcement Rule ID(s)	Every QoS Enforcement Rule ID identifies a QoS enforcement action that has to be applied.	
NOTE 1: Needed e.g. in case: - UPF supports multiple DNN with overlapping IP addresses; - UPF is connected to other UPF or AN node in different IP domains.		

FAR table		
Attribute	Description	Comment
N4 Session ID	Identifies the N4 session associated to this FAR.	
Rule ID	Unique identifier to identify this information.	
Action	Identifies the action to apply to the packet	Indicates whether the packet is to be forwarded, duplicated, dropped or buffered. When action indicates forwarding or duplicating, a number of additional attributes are included in the FAR. For buffering action, a Buffer Action Rule is also included.
Network instance (NOTE 2)	Identifies the Network instance associated with the outgoing packet (NOTE 1).	
Destination interface (NOTE 3)	Contains the values "access side", "core side", "SMF" or "N6-LAN" or "Local" or "Nx (the CN Tunnel info of each Nx interface associated with the group)".	Identifies the interface for outgoing packets towards the access side (i.e. down-link), the core side (i.e. up-link), the SMF or, the N6-LAN (i.e. the DN or the local DN), or the UPF on N9 interface (i.e. down-link), or the UPF on Nx interface (i.e. down-link)
Outer header creation (NOTE 3)	Instructs the UP function to add an outer header (e.g. IP+UDP+GTP+QFI, VLAN tag), IP + possibly UDP to the outgoing packet.	Contains the CN tunnel info, N6 tunnel info or AN tunnel info of peer entity (e.g. NG-RAN, another UPF, SMF, DNAI). Any extension header stored for this packet shall be added.
Send end marker packet(s) (NOTE 2)	Instructs the UPF to construct end marker packet(s) and send them out as described in clause 5.8.1.	This parameter should be sent together with the "outer header creation" parameter of the new CN tunnel info.
Transport level marking (NOTE 3)	Transport level packet marking in the uplink and downlink, e.g. setting the DiffServ Code Point.	

Forwarding policy (NOTE 3)	Reference to a preconfigured traffic steering policy or http redirection (NOTE 4).	Contains one of the following policies identified by a TSP ID: - an N6-LAN steering policy to steer the subscriber's traffic to the appropriate N6 service functions deployed by the operator, or - a local N6 steering policy to enable traffic steering in the local access to the DN according to the routing information provided by an AF as described in clause 5.6.7. or a Redirect Destination and values for the forwarding behaviour (always, after measurement report (for termination action "redirect")).
Request for Proxying in UPF	Indicates that the UPF shall perform ARP proxying and / or IPv6 Neighbour Solicitation Proxying as specified in clause 5.6.10.2.	Applies to the Ethernet PDU Session type.
Container for header enrichment (NOTE 2)	Contains information to be used by the UPF for header enrichment.	Only relevant for the uplink direction.
Buffering Action Rule (NOTE 5)	Reference to a Buffering Action Rule ID defining the buffering instructions to be applied by the UPF (NOTE 6)	

NOTE 1: Needed e.g. in case:

- UPF supports multiple DNN with overlapping IP addresses;
- UPF is connected to other UPF or NG-RAN node in different IP domains.

NOTE 2: These attributes are required for FAR action set to forwarding.

NOTE 3: These attributes are required for FAR action set to forwarding or duplicating.

NOTE 4: The TSP ID is preconfigured in the SMF, and included in the FAR according to the description in clauses 5.6.7 and 6.1.3.14 of 23.503 [45] for local N6 steering and 6.1.3.14 of 23.503 [45] for N6-LAN steering.
The TSP ID action is enforced before the Outer header creation actions.

NOTE 5: This attribute is present for FAR action set to buffering.

NOTE 6: The buffering action rule is created by the SMF and associated with the FAR in order to apply a specific buffering behaviour for DL packets requested to be buffered, as described in clause 5.8.3 and clause 5.2.4 in TS 29.244 [65].

[0068] In some embodiments, in case of unicast communication, a PSA UPF of a transmitting UE detects a user data from one PDU session associated to a group and detects that a destination address is an address for other UE in the other (PSA) UPF in the group, the PSA UPF forwards the user data to the (PSA) UPF via Nx interface. With this alternative, a SMF provides all the UE addresses in the group to each PSA UPF in the group, and PSA UPF information (e.g. CN tunnel info) of each address is associated (the PDU session with the address is terminated). For ethernet type PDU, when the PDU session is established, the UE reports the MAC address to the SMF and the SMF notifies to the related PSA UPF.

[0069] In some embodiments, the PSA UPF of the transmitting UE detects the user data from one PDU session associated to the group and detects that the destination address is the address for other UE in this (PSA) UPF in the group, the PSA UPF forwards the user data to PDU Session to the destination UE.

[0070] In some embodiments, the PSA UPF of the transmitting UE detects the user data from one PDU session associated to the group, the PSA UPF forwards the user data to all the other PSA UPF(s) according to the configured CN tunnel information for the group. The other PSA UPF(s) detect the destination address of the user data and if the destination address is the address for the PDU session terminated to itself, the PSA UPF(s) forward the user data to the PDU session; otherwise, the PSA UPF(s) discard the user data.

[0071] FIGS. 6 to 7 illustrate that, in some embodiments, point-to-multipoint group communication is provided. in some embodiments, in order to support one to many communications in one group, group specific packet data network (PDU) session is introduced. Fifth generation system (5GS) can support a group specific PDU session establishment, release, modify along with the group/group member addition or removal. It is understood that session management function (SMF) node 108 is responsible for group specific PDU session management. Different members in the group can be served by same user plane function (UPF) node such as a UPF1 node 106 or different UPF nodes such as the UPF1 node 106 and a UPF2 node 112. In one group, scenario can be illustrated in FIGS. 6 to 8. UE-T 102 is a transmitter UE while UE-R1 104 and UE-R2 110 are the receiver UEs, in which UE-T 102 and UE-R1 104 are served by same UPF1 node 106, UE-R2 110 are served by UPF2 node 112. Data from UE-T 102 is transmitted within fifth generation system (5GS) and routed by UPF nodes such as UPF1 node 106 and UPF2 node 112.

[0072] The group specific PDU session is terminated at the member and the serving UPF. When a group is established by one application function (AF) or one UE, a group specific PDU session is established for each group member who is added into the group with the group creation. The SMF node 108 is enhanced to support the group-based PDU session management function, including group-based PDU session establishment. After the group creation, when a group member is added into the group, the group specific PDU session is established for a new joined member. The SMF node 108 is responsible for establishing a routing tunnel between the UPF node serving the new joined member and the UPF nodes serving the authorized transmitting members.

[0073] In some embodiments, this procedure describes the one to many communications PDU session establishment procedure. It is understood that one group is managed by a same SMF. The group creation and group member joining procedure is based on other solution and not mentioned in this solution. This embodiment is an example, and the present disclosure is not limited thereto.

[0074] When the group is created, and group member UE-T 102 and UE-R1 104 are added into the group, and UE-T 102 is authorized to send one to many data to the member in the group. UE-T 102 initiates group specific PDU session establishment request, including the request S-NSSAI, group information, etc. In details, the group information could be e.g. group index, group specific data network name (DNN) information, or group specific application server information.

[0075] After receiving the request from UE-T 102, SMF node 108 selects the UPF1 node 106 as the serving UPF for the specific group based on the S-NSSAI information and group information. SMF node 108 sends session establishment request to UPF1 node 106, including the allocated core network (CN) tunnel information on N3 interface. UPF1 node 106 acknowledges by sending session establishment response message. SMF node 108 sends PDU session accept to the UE-T 102. In case of PDU session type IPv4 or IPv6 or IPv4v6, the SMF node 108 allocates an IP address/prefix for the PDU Session, and the address/prefix is for the group specific. Alternatively, if the group shares the PDU session with other groups, a group specific address is also allocated to at least one UE of other groups.

[0076] When UE-R2 110 is added into the group, UE-R2 110 initiates PDU session establishment request to the SMF node 108, including S-NSSAI information and group information. SMF node 108 selects UPF2 node 112 as the serving UPF for UE-R2 110, and determines to establish a routing tunnel between UPF1 node 106 serving UE-T 102 and the UPF2 node 112. SMF node 108 sends session establishment request to UPF2 node 112, including the allocated CN tunnel information, the CN tunnel information includes the UPF2 address of the tunnel between UPF1 node 106 and UPF2 node 112 and the UPF2 address of N3 tunnel. UPF2 node 112 acknowledges by sending session establishment response message. SMF node 108 establishes routing tunnel between UPF1 node 106 and UPF2 node 112, and provides the UPF2 address of the tunnel between UPF1 node 106 and UPF2 node 112 to UPF1 node 106. Also, SMF node 108 provides the association information of this routing tunnel and PDU session for UE-T 102. SMF node 108 sends PDU session accept to UE-R2 110. In case of PDU session type IPv4 or IPv6 or IPv4v6, the SMF node 108 allocates an IP address/prefix for the PDU session, and the address/prefix is the group specific for UE-R2 110. If there is existing PDU session for another group for UE-R2 110, the existing PDU Session can be re-used for a newly joined group, i.e. multiple groups can share one PDU session for the receiving member in the group.

[0077] Further, UE-T 102 sends the group data to the UPF1 node 106, UPF1 node determines the receiving UE-R1 104, UE-R2 110 according to the routing association information provided at block 8 and routes the data to the tunnel corresponding to UE-R1 104 and UE-R2 110 respectively. If PDU session is shared by multiple groups, UPF 1 node 106 determines the receiving UE-R1 104, UE-R2 110 according to the group specific address information to obtain the group information.

[0078] FIG. 8 is a block diagram of an example system 700 for wireless communication according to an embodiment of the present disclosure. Embodiments described herein may be implemented into the system using any suitably configured hardware and/or software. FIG. 8 illustrates the system 700 including a radio frequency (RF) circuitry 710, a baseband circuitry 720, an application circuitry 730, a memory/storage 740, a display 750, a camera 760, a sensor 770, and an input/output (I/O) interface 780, coupled with each other at least as illustrated.

[0079] The application circuitry 730 may include a circuitry, such as, but not limited to, one or more single-core or multi-core processors. The processors may include any combinations of general-purpose processors and dedicated processors, such as graphics processors and application processors. The processors may be coupled with the memory/storage and configured to execute instructions stored in the memory/storage to enable various applications and/or operating systems running on the system.

[0080] The baseband circuitry 720 may include a circuitry, such as, but not limited to, one or more single-core or multi-core processors. The processors may include a baseband processor. The baseband circuitry may handle various radio control functions that enable communication with one or more radio networks via the RF circuitry. The

radio control functions may include, but are not limited to, signal modulation, encoding, decoding, radio frequency shifting, etc. In some embodiments, the baseband circuitry may provide for communication compatible with one or more radio technologies. For example, in some embodiments, the baseband circuitry may support communication with an evolved universal terrestrial radio access network (EUTRAN) and/or other wireless metropolitan area networks (WMAN), a wireless local area network (WLAN), a wireless personal area network (WPAN). Embodiments in which the baseband circuitry is configured to support radio communications of more than one wireless protocol may be referred to as multi-mode baseband circuitry.

[0081] In various embodiments, the baseband circuitry 720 may include circuitry to operate with signals that are not strictly considered as being in a baseband frequency. For example, in some embodiments, baseband circuitry may include circuitry to operate with signals having an intermediate frequency, which is between a baseband frequency and a radio frequency.

[0082] The RF circuitry 710 may enable communication with wireless networks using modulated electromagnetic radiation through a non-solid medium. In various embodiments, the RF circuitry may include switches, filters, amplifiers, etc. to facilitate the communication with the wireless network.

[0083] In various embodiments, the RF circuitry 710 may include circuitry to operate with signals that are not strictly considered as being in a radio frequency. For example, in some embodiments, RF circuitry may include circuitry to operate with signals having an intermediate frequency, which is between a baseband frequency and a radio frequency.

[0084] In various embodiments, the transmitter circuitry, control circuitry, or receiver circuitry discussed above with respect to the user equipment, eNB, or gNB may be embodied in whole or in part in one or more of the RF circuitry, the baseband circuitry, and/or the application circuitry. As used herein, "circuitry" may refer to, be part of, or include an Application Specific Integrated Circuit (ASIC), an electronic circuit, a processor (shared, dedicated, or group), and/or a memory (shared, dedicated, or group) that execute one or more software or firmware programs, a combinational logic circuit, and/or other suitable hardware components that provide the described functionality. In some embodiments, the electronic device circuitry may be implemented in, or functions associated with the circuitry may be implemented by, one or more software or firmware modules.

[0085] In some embodiments, some or all of the constituent components of the baseband circuitry, the application circuitry, and/or the memory/storage may be implemented together on a system on a chip (SOC).

[0086] The memory/storage 740 may be used to load and store data and/or instructions, for example, for system. The memory/storage for one embodiment may include any combination of suitable volatile memory, such as dynamic random access memory (DRAM)), and/or non-volatile memory, such as flash memory.

[0087] In various embodiments, the I/O interface 780 may include one or more user interfaces designed to enable user interaction with the system and/or peripheral component interfaces designed to enable peripheral component interaction with the system. User interfaces may include, but are not limited to a physical keyboard or keypad, a touchpad, a speaker, a microphone, etc. Peripheral component interfaces may include, but are not limited to, a non-volatile memory port, a universal serial bus (USB) port, an audio jack, and a power supply interface.

[0088] In various embodiments, the sensor 770 may include one or more sensing devices to determine environmental conditions and/or location information related to the system. In some embodiments, the sensors may include, but are not limited to, a gyro sensor, an accelerometer, a proximity sensor, an ambient light sensor, and a positioning unit. The positioning unit may also be part of, or interact with, the baseband circuitry and/or RF circuitry to communicate with components of a positioning network, e.g., a global positioning system (GPS) satellite.

[0089] In various embodiments, the display 750 may include a display, such as a liquid crystal display and a touch screen display. In various embodiments, the system 700 may be a mobile computing device such as, but not limited to, a laptop computing device, a tablet computing device, a netbook, an ultrabook, a smartphone, etc. In various

embodiments, system may have more or less components, and/or different architectures. Where appropriate, methods described herein may be implemented as a computer program. The computer program may be stored on a storage medium, such as a non-transitory storage medium.

[0090] In the embodiment of the present disclosure, an apparatus and a method of performing a group communication capable of providing a good group communication performance and high reliability and providing a solution that how a user data is transmitted within 5G system and corresponding control information and/or procedure are provided. The embodiment of the present disclosure is a combination of techniques/processes that can be adopted in 3GPP specification to create an end product.

[0091] A person having ordinary skill in the art understands that each of the units, algorithm, and steps described and disclosed in the embodiments of the present disclosure are realized using electronic hardware or combinations of software for computers and electronic hardware. Whether the functions run in hardware or software depends on the condition of application and design requirement for a technical plan.

[0092] A person having ordinary skill in the art can use different ways to realize the function for each specific application while such realizations should not go beyond the scope of the present disclosure. It is understood by a person having ordinary skill in the art that he/she can refer to the working processes of the system, device, and unit in the above-mentioned embodiment since the working processes of the above-mentioned system, device, and unit are basically the same. For easy description and simplicity, these working processes will not be detailed.

[0093] It is understood that the disclosed system, device, and method in the embodiments of the present disclosure can be realized with other ways. The above-mentioned embodiments are exemplary only. The division of the units is merely based on logical functions while other divisions exist in realization. It is possible that a plurality of units or components are combined or integrated in another system. It is also possible that some characteristics are omitted or skipped. On the other hand, the displayed or discussed mutual coupling, direct coupling, or communicative coupling operate through some ports, devices, or units whether indirectly or communicatively by ways of electrical, mechanical, or other kinds of forms.

[0094] The units as separating components for explanation are or are not physically separated. The units for display are or are not physical units, that is, located in one place or distributed on a plurality of network units. Some or all of the units are used according to the purposes of the embodiments. Moreover, each of the functional units in each of the embodiments can be integrated in one processing unit, physically independent, or integrated in one processing unit with two or more than two units.

[0095] If the software function unit is realized and used and sold as a product, it can be stored in a readable storage medium in a computer. Based on this understanding, the technical plan proposed by the present disclosure can be essentially or partially realized as the form of a software product. Or, one part of the technical plan beneficial to the conventional technology can be realized as the form of a software product. The software product in the computer is stored in a storage medium, including a plurality of commands for a computational device (such as a personal computer, a server, or a network device) to run all or some of the steps disclosed by the embodiments of the present disclosure. The storage medium includes a USB disk, a mobile hard disk, a read-only memory (ROM), a random access memory (RAM), a floppy disk, or other kinds of media capable of storing program codes.

[0096] While the present disclosure has been described in connection with what is considered the most practical and preferred embodiments, it is understood that the present disclosure is not limited to the disclosed embodiments but is intended to cover various arrangements made without departing from the scope of the broadest interpretation of the appended claims.

What is claimed is:

1. A user equipment (UE) in a group communication system, comprising:
a memory;
a transceiver; and
a processor coupled to the memory and the transceiver,
wherein the processor is configured to:
control the transceiver to transmit, to a network node, a connection establishment request in the group communication system; and
establish, each connection for each group in the group communication system according to the connection establishment request.
2. The UE of claim 1, wherein the processor is configured to establish multiple connections for multiple groups in the group communication system the UE belongs to according to the connection establishment request.
3. The UE of claim 1 or 2, wherein each connection for each group in the group communication system is terminated at the network node or the network node and the processor of the UE.
4. The UE of any one of claims 1 to 3, wherein the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request comprises a PDU session identity (ID) and/or group related information, and the connection comprises a PDU session.
5. The UE of claim 4, wherein the group related information comprises a group index and a UE index within the group.
6. The UE of any one of claims 1 to 5, wherein the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode.
7. The UE of any one of claims 1 to 6, wherein when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6, the processor is configured to receive an IP address and/or prefix of the connection from the network node.
8. The UE of any one of claims 1 to 6, wherein a connection type is an ethernet type PDU Session.
9. The UE of claim 7, wherein if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.
10. A method performing a group communication of a user equipment (UE), comprising:
transmitting, to a network node, a connection establishment request in the group communication system; and
establishing, each connection for each group in the group communication system according to the connection establishment request.
11. The method of claim 10, further comprising establishing multiple connections for multiple groups in the group communication system the UE belongs to according to the connection establishment request.
12. The method of claim 10 or 11, further comprising using the network node or the network node and the UE to terminate each connection for each group in the group communication system.
13. The method of any one of claims 10 to 12, wherein the connection establishment request is a PDU session establishment request, the PDU session establishment request comprises a PDU session identity (ID) and/or group related information, and the connection comprises a PDU session.
14. The method of claim 13, wherein the group related information comprises a group index and a UE index within the group.
15. The method of any one of claims 10 to 14, wherein the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode.
16. The method of any one of claims 10 to 15, wherein when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6, the method comprises receiving an IP address and/or prefix of the connection from the network node.
17. The method of any one of claims 10 to 15, wherein a connection type is an ethernet type PDU Session.

18. The method of claim 16, wherein if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.
19. A network node in a group communication system, comprising:
a memory;
a transceiver; and
a processor coupled to the memory and the transceiver,
wherein the processor is configured to:
control the transceiver to receive a connection establishment request from a user equipment (UE) in the group communication system; and
hand of a connection for the UE in the group communication system.
20. The network node of claim 19, further comprising a session management function (SMF) configured to check whether the connection establishment request is compliant with a group the UE belongs to.
21. The network node of claim 19 or 20, further comprising a protocol data unit session anchor (PSA) user plane function (UPF) configured to terminate each connection for the UE in the group communication system.
22. The network node of any one of claims 19 to 21, wherein the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request comprises a PDU session identity (ID) and/or group related information, and the connection comprises a PDU session.
23. The network node of claim 22, wherein the group related information comprises a group index and a UE index within the group.
24. The network node of claim 22 or 23, wherein the SMF is configured to retrieve and request to receive an update notification on the group related information from a unified data management (UDM).
25. The network node of claim 24, wherein the SMF is configured to reject the connection establishment request if the group related information is not a part of explicitly groups the UE belongs to according to a group data in the SMF requested from the UDM.
26. The network node of any one of claims 19 to 25, wherein the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode.
27. The network node any one of claims 20 to 26, further comprising an access and mobility management function (AMF) configured to consider group local configuration information if an appropriate SMF is selected for the group the UE belongs to.
28. The network node of claims 20 to 27, further comprising a UPF, the SMF is configured to consider group local configuration information if an appropriate UPF is selected for the group the UE belongs to.
29. The network node of any one of claims 21 to 28, wherein the PSA UPF is configured to enforce a quality of experience (QoS) handling procedure for a group user data transmission in the group communication system, and a SMF based on local configuration or policy control function (PCF) information provides different QoS configurations for unicast and multicast communication.
30. The network node of claim 29, wherein a QoS enforcement is different for an uplink and downlink traffic, and the SMF provides the different QoS configurations for the uplink and downlink traffic.
31. The network node of claim 29 or 30, wherein in case of multicast, the SMF provides a uniform QoS configuration for a downlink traffic target to different UEs in a group of the group communication system to the PSA UPF, and the PSA UPF enforces a uniform QoS policy for the downlink traffic to the different UEs in the group.
32. The network node of any one of claims 21 to 31, wherein the SMF is configured to provide a packet detection rule (PDR) and a forwarding action rule (FAR) to the PSA UPF.
33. The network node of claim 32, wherein the PDR comprises group information and related FAR information, and the FAR comprises a destination interface information for the group.

34. The network node of claim 33, wherein the destination interface information comprises a Nx interface or N6 interface associated with the group.
35. The network node of any one of claims 21 to 34, wherein in case of unicast communication, the PSA UPF detects a user data from one PDU session belonging to the group and detects that a destination address is an allocated address for other UE in the group, and the PSA UPF forwards the user data to the PDU session of an associated UE in the group.
36. The network node of claim 19, further comprising a serving UPF and other UPF, the connection for each group member UE is terminated at the serving UPF and the related UE.
37. The network node of claim 36, further comprising a SMF configured to configure the serving UPF as a PSA UPF for an associated UE, and the PSA UPF is an anchor point for the UE to connect with other UPF serving for other UEs within a group of the group communication system.
38. The network node of any one of claims 19 to 37, wherein when a connection type is an internet protocol version four (IPv4), IPv6, or IPv4v6 PDU session, the processor is configured to transmit, to the UE, an IP address and/or prefix of the connection.
39. The network node of claim 38, wherein for the IPv4, IPv6, or IPv4v6 type PDU session, the PSA UPF is an IP anchor point of the IP address and/or prefix allocated to the UE.
40. The network node of any one of claims 19 to 37, wherein a connection type is an ethernet type PDU session.
41. The network node of claim 40, wherein for the ethernet type PDU session, the SMF instructs the UPF to route a downlink traffic based on a media access control (MAC) address used by the UE for an uplink traffic.
42. The network node of claim 40, wherein if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.
43. A method performing a group communication of a network node, comprising:
receiving a connection establishment request from a user equipment (UE) in the group communication system; and
handing of a connection for the UE in the group communication system.
44. The method of claim 43, further comprising using a session management function (SMF) to check whether the connection establishment request is compliant with a group the UE belongs to.
45. The method of claim 43 or 44, further comprising using a protocol data unit session anchor (PSA) user plane function (UPF) to terminate each connection for the UE in the group communication system.
46. The method of any one of claims 43 to 45, wherein the connection establishment request is a protocol data unit (PDU) session establishment request, the PDU session establishment request comprises a PDU session identity (ID) and/or group related information, and the connection comprises a PDU session.
47. The method of claim 46, wherein the group related information comprises a group index and a UE index within the group.
48. The method of claim 46 or 47, further comprising using the SMF to retrieve and request to receive an update notification on the group related information from a unified data management (UDM).
49. The method of claim 48, further comprising using the SMF to reject the connection establishment request if the group related information is not a part of explicitly groups the UE belongs to according to a group data in the SMF requested from the UDM.
50. The method of any one of claims 43 to 49, wherein the connection is configured to a centralized user plane architecture using a session-and-service continuity (SSC) mode.
51. The method any one of claims 44 to 50, further comprising using an access and mobility management function (AMF) to consider group local configuration information if an appropriate SMF is selected for the group the UE belongs to.
52. The method of claims 44 to 50, further comprising using the SMF to consider group local configuration information

if an appropriate UPF is selected for the group the UE belongs to.

53. The method of any one of claims 45 to 52, further comprising using the PSA UPF to enforce a quality of experience (QoS) handling procedure for a group user data transmission in the group communication system, and a SMF based on local configuration or policy control function (PCF) information provides different QoS configurations for unicast and multicast communication.

54. The method of claim 53, wherein a QoS enforcement is different for an uplink and downlink traffic, and the SMF provides the different QoS configurations for the uplink and downlink traffic.

55. The method of claim 53 or 54, wherein in case of multicast, the method comprises using the SMF to provide a uniform QoS configuration for a downlink traffic target to different UEs in a group of the group communication system to the PSA UPF, and the method further comprises using the PSA UPF to enforce a uniform QoS policy for the downlink traffic to the different UEs in the group.

56. The method of any one of claims 45 to 55, further comprising using the SMF to provide a packet detection rule (PDR) and a forwarding action rule (FAR) to the PSA UPF.

57. The method of claim 56, wherein the PDR comprises group information and related FAR information, and the FAR comprises a destination interface information for the group.

58. The method of claim 57, wherein the destination interface information comprises a Nx interface or N6 interface associated with the group.

59. The method of any one of claims 45 to 58, wherein in case of unicast communication, the method comprises using the PSA UPF to detect a user data from one PDU session belonging to the group and detect that a destination address is an allocated address for other UE in the group, and the method further comprises using the PSA UPF to forward the user data to the PDU session of an associated UE in the group.

60. The method of claim 43, further comprising using a serving UPF and the related UE to terminate the connection for each group member UE.

61. The method of claim 60, further comprising using a SMF to configure the serving UPF as a PSA UPF for an associated UE, and the PSA UPF is an anchor point for the UE to connect with other UPF serving for other UEs within a group of the group communication system.

62. The method of any one of claims 43 to 61, wherein when a connection type is an IPv4, IPv6, or IPv4v6 PDU session, the method comprises transmitting, to the UE, an IP address and/or prefix of the connection.

63. The method of claim 62, wherein for the IPv4, IPv6, or IPv4v6 type PDU session, the PSA UPF is an IP anchor point of the IP address and/or prefix allocated to the UE.

64. The method of any one of claims 43 to 61, wherein a connection type is an ethernet type PDU session.

65. The method of claim 64, wherein for the ethernet type PDU session, the method comprises using the SMF to instruct the UPF to route a downlink traffic based on a media access control (MAC) address used by the UE for an uplink traffic.

66. The method of claim 65, wherein if the group communication system shares the connection with another group communication system, the IP address and/or prefix of the connection is allocated to another UE of the another group communication system.

67. A non-transitory machine-readable storage medium having stored thereon instructions that, when executed by a computer, cause the computer to perform the method of any one of claims 10 to 18 and 43 to 66.

68. A terminal device, comprising: a processor and a memory configured to store a computer program, the processor configured to execute the computer program stored in the memory to perform the method of any one of claims 10 to 18.

69. A network node, comprising: a processor and a memory configured to store a computer program, the processor configured to execute the computer program stored in the memory to perform the method of any one of claims 43 to 66.

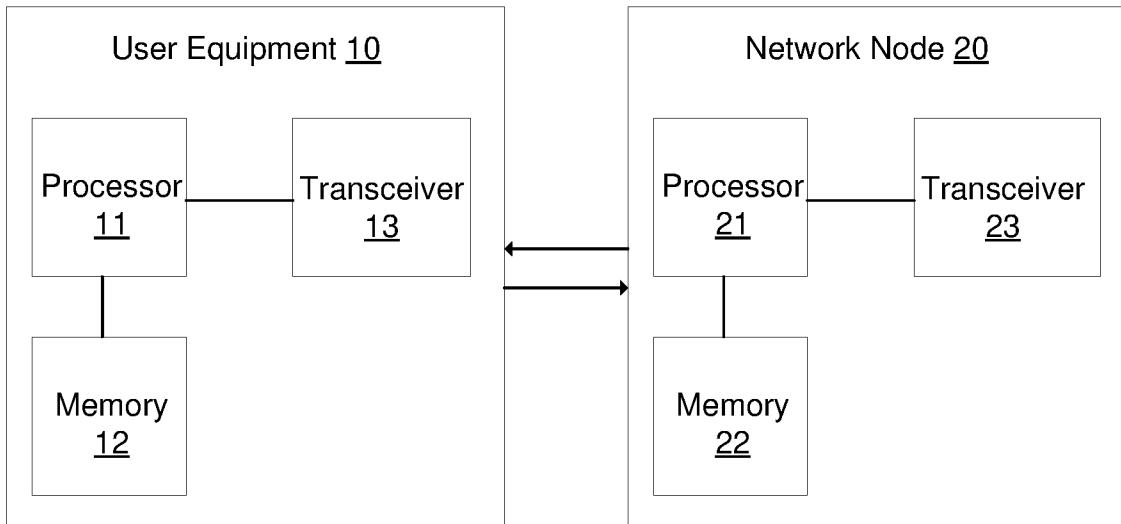


FIG. 1

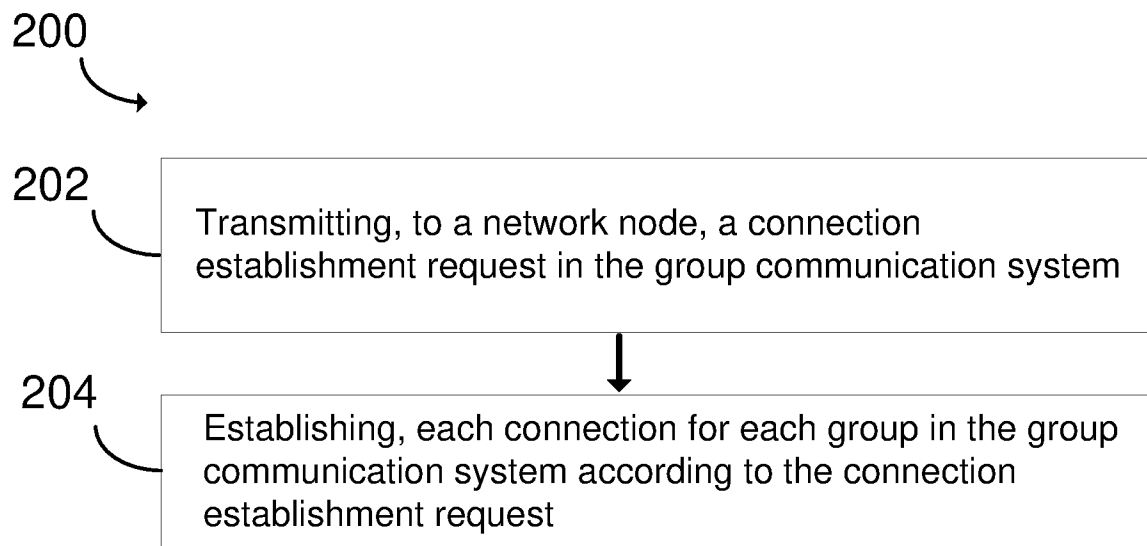


FIG. 2

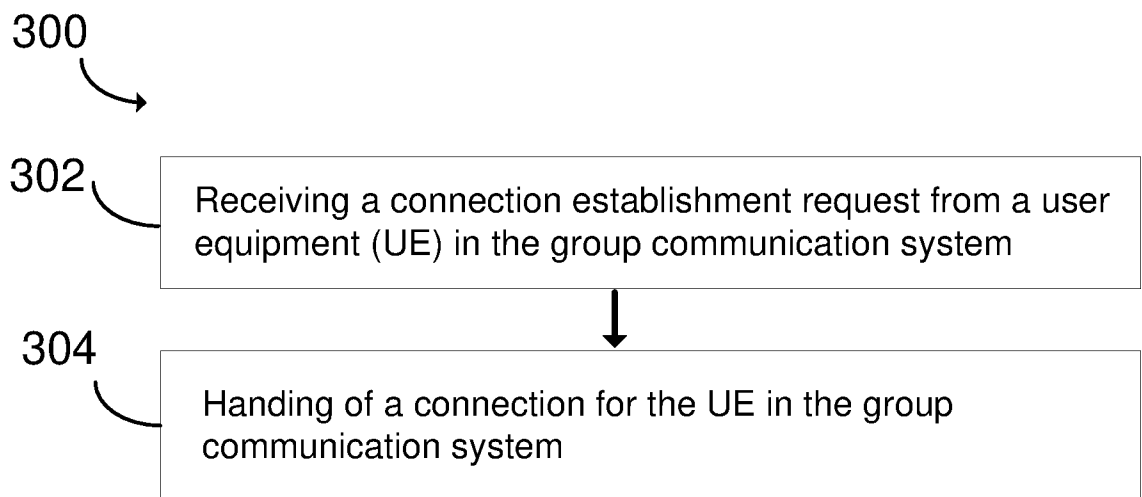


FIG. 3

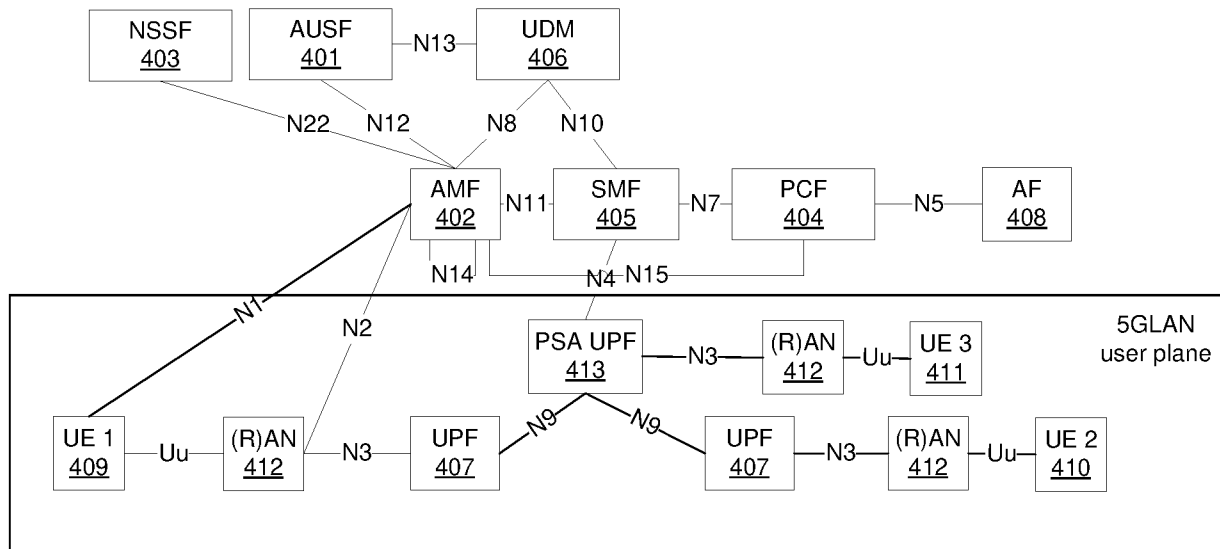


FIG. 4

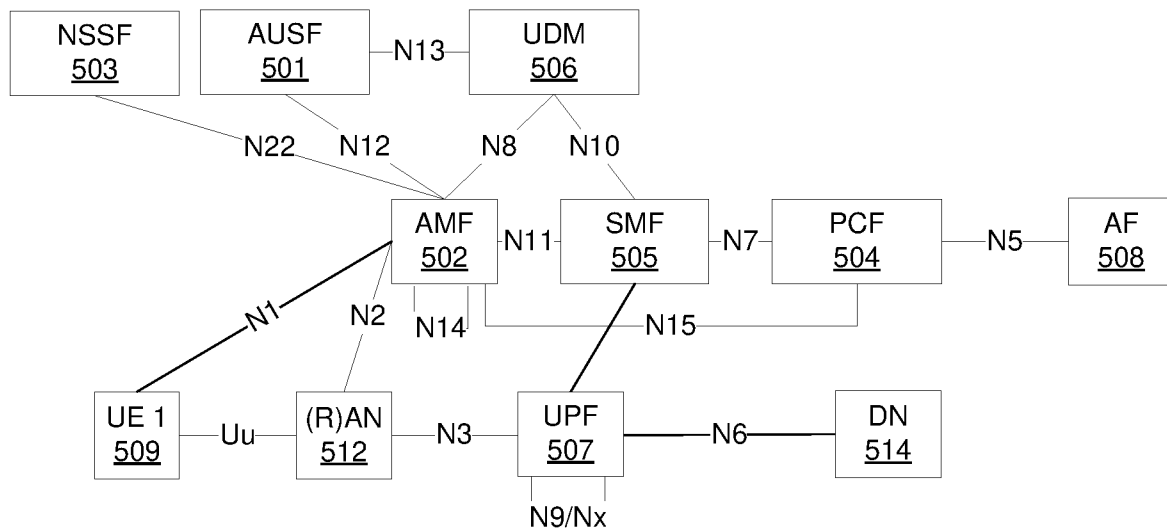


FIG. 5

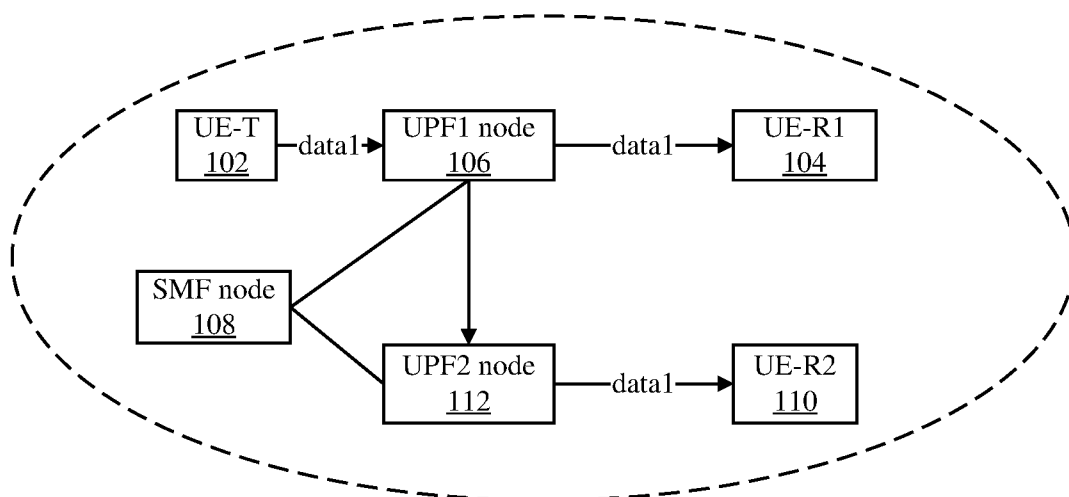


FIG. 6

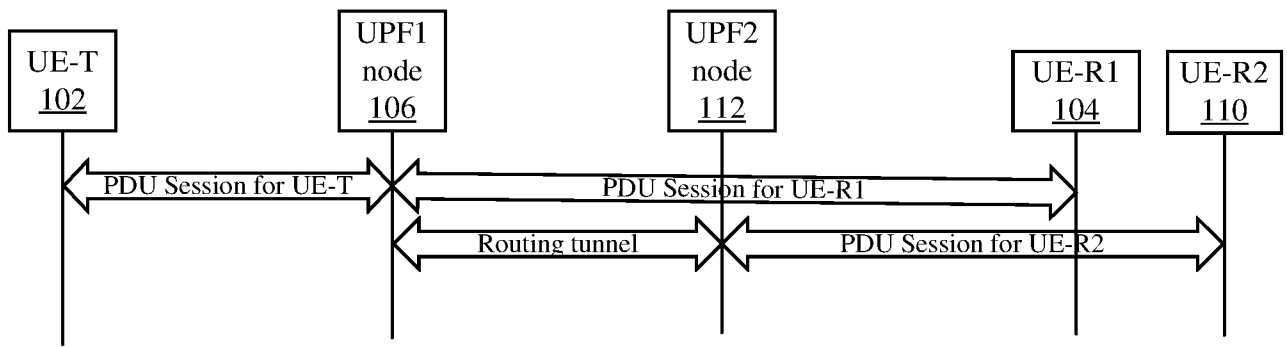


FIG. 7

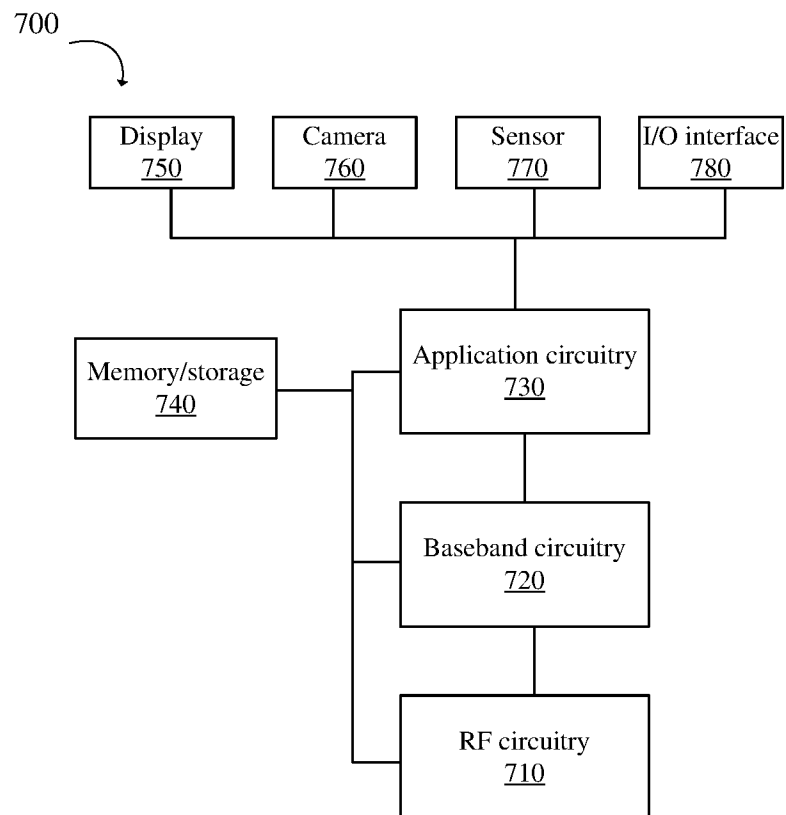


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/071826

A. CLASSIFICATION OF SUBJECT MATTER

H04W 76/10(2018.01)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; H04Q

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)

EPODOC, WPI, CNKI, CNPAT, 3GPP: request, group, network, establish+, PDU, SSC, UE, ID, IP, SMF, PCF, UDM, UPF.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	VIVO. "Solution for how to support 5G LAN group communication" SA WG2 Meeting #128-bis S2-187937, 24 August 2018 (2018-08-24), the section 6.X.4.1, figure 6.X.3-1	1-69
A	ERICSSON. "5G SM - PDU session establishment procedure - message content" 3GPP TSG-CT WG1 Meeting #104 C1-172435, 19 May 2017 (2017-05-19), the whole document	1-69
A	CN 108323245 A (HUAWEI TECHNOLOGIES CO., LTD.) 24 July 2018 (2018-07-24) the whole document	1-69
A	CN 108370600 A (HUAWEI TECHNOLOGIES CO., LTD.) 03 August 2018 (2018-08-03) the whole document	1-69

☐ 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

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"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

16 September 2019

Date of mailing of the international search report

27 September 2019

Name and mailing address of the ISA/CN

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Telephone No. 86-(10)-53961642

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2019/071826

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	108323245	A	24 July 2018	EP	3442202	A1	13 February 2019
				WO	2018232570	A1	27 December 2018
				US	2019208573	A1	04 July 2019
				US	2019174405	A1	06 June 2019
CN	108370600	A	03 August 2018	CA	3047037	A1	15 November 2018
				WO	2018205153	A1	15 November 2018
				KR	2019088536	A	26 July 2019
				IN	201917022531	A	26 July 2019