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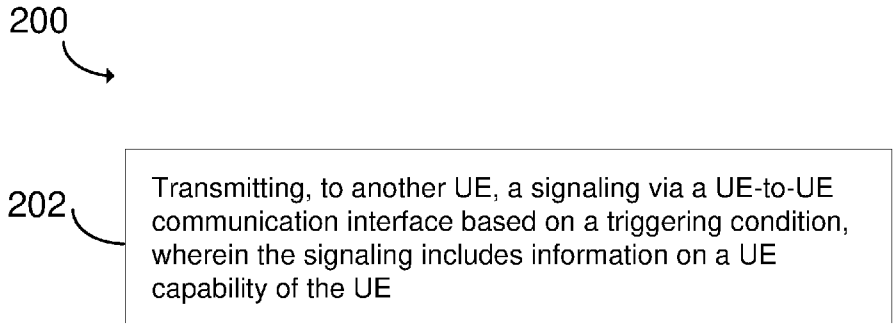

FIG. 2

(57) Abstract: A user equipment (UE) and a method for controlling transmission of the same in a wireless communication system are provided. The method includes transmitting, to another user equipment, a signaling via a UE-to-UE communication interface based on a triggering condition, and the signaling includes information on a UE capability of the user equipment.

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USER EQUIPMENT AND METHOD FOR CONTROLLING TRANSMISSION OF SAME IN A WIRELESS COMMUNICATION SYSTEM

BACKGROUND OF DISCLOSURE

1. Field of Disclosure

[0001] The present disclosure relates to a field of communication systems, and more particularly, to a user equipment and a method for controlling transmission of the same in a wireless communication system.

2. Description of Related Art

[0002] Development of wireless technologies for direct vehicle-to-vehicle (V2V) or vehicle-to-everything (V2X) communication as part of intelligent transportation system (ITS) is gradually evolving from broadcasting basic safety transmission like a periodic vehicle status and warning messages to supporting more advanced use cases and services like extended sensor data sharing, autonomous driving, and vehicle platooning.

[0003] Latency and reliability play important roles when setting requirements in wireless communication systems. A packet data control protocol (PDCP) duplication is configured to increase reliability as well as potentially decrease latency.

[0004] There is a need to provide a new technical solution for a user equipment and a method for controlling transmission of the same in a wireless communication system to reach low latency and high reliability.

SUMMARY

[0005] An object of the present disclosure is to propose a user equipment and a method for controlling transmission of same in a wireless communication system to reach low latency and high reliability.

[0006] In a first aspect of the present disclosure, a user equipment for controlling transmission in a wireless communication system 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 another UE, a signaling via a UE-to-UE communication interface based on a triggering condition, and the signaling includes information on a UE capability of the UE.

[0007] In a second aspect of the present disclosure, a method for controlling transmission of a user equipment in a wireless communication system is provided. The method includes transmitting, to another UE, a signaling via a UE-to-UE communication interface based on a triggering condition, wherein the signaling includes information on a UE capability of the UE.

[0008] In a third aspect of the present disclosure, a user equipment for controlling transmission in a wireless communication system 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

signaling via a UE-to-UE communication interface based on a triggering condition from another UE, and the signaling includes information on a UE capability of the another UE.

[0009] In a fourth aspect of the present disclosure, a method for controlling transmission of a user equipment in a wireless communication system is provided. The method includes receiving a signaling via a UE-to-UE communication interface based on a triggering condition from another UE, wherein the signaling includes information on a UE capability of the another UE.

[0010] 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.

[0011] 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.

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 based on these figures without paying the premise.

[0013] FIG. 1 is a block diagram of a user equipment for controlling transmission in a wireless communication system based on an embodiment of the present disclosure.

[0014] FIG. 2 is a flowchart illustrating a method for controlling transmission of a user equipment in a wireless communication system based on an embodiment of the present disclosure.

[0015] FIG. 3 is a flowchart illustrating a method for controlling transmission of a user equipment in a wireless communication system based on an embodiment of the present disclosure.

[0016] FIG. 4 is a block diagram of a system for wireless communication based on an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0017] 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.

[0018] Long term evolution-V2X (LTE-V2X) communication technologies are developed by 3rd generation partnership project (3GPP) in a release 14 and a release 15. In the release 15, some new features are introduced for evolved V2X, which is not release 14 compatible, e.g., but not limited to a revised rate matching scheme, a new MCS table, including a higher order modulation scheme like a 64 quadrature amplitude modulation (64QAM), a new transport block size (TBS) table, a new multiple-input multiple-output (MIMO) scheme, i.e., a transmit diversity scheme, and/or a packet data control protocol (PDCP) duplication, which is to provide diversity at a PDCP layer by duplicating the

PDCP protocol data units (PDUs) into different logical channels mapped to different frequency carriers.

[0019] Considering that a release 15 eV2X may share a radio resource with release 14 V2X UEs, which means that for a specific release 15 eV2X user equipment (UE), there may be both release 14 V2X and release 15 eV2X UEs in proximity. Assuming that:

[0020] For the release 14 V2X UE: it can only support release 14 features, i.e., cannot receive a packet transmitted using release 15 new features which are not release 14 compatible.

[0021] For release 15 eV2X UE: it can support both release 14 and release 15 features, i.e., can receive the packet transmitted using release 15 new features which are not release 14 compatibles.

[0022] Considering this, for release 15 eV2X UEs, it needs to decide between the following two approaches when it is about to transmit a packet.

[0023] Either this packet is sent using a release 14 format, i.e., the release 15 new features which are not release 14 compatibles would not be used. A benefit is that the packet can be received by both release 14 and release 15 UEs in the proximity. A constraint is that the transmission cannot benefit from the gains from the release 15 new features like a higher order modulation scheme, and/or diversity gain from transmit-diversity.

[0024] In another embodiment, this packet is sent using a release 15 format, i.e., the release 15 new features which are not release 14 compatibles would be used. A constraint is that the packet can be received by only release 15 UEs in the proximity. A benefit is that the transmission can benefit from gains from the release 15 new features like a higher order modulation scheme, and/or diversity gain from transmit-diversity.

[0025] Therefore, a key is how to judge between two cases. One case is that there is only release 15 UE in the proximity so that a latter scheme above can be used to purse gain from release 15 new features. Another case is that there are both release 14 and release 15 UE in the proximity so that a former scheme above can be used to ensure the packet can be received by all neighboring UEs, in case the packet is important, e.g., the packet is safety-related.

[0026] FIG. 1 illustrates that, in some embodiments, a user equipment (UE) 10 or a user equipment (UE) 20 for controlling transmission in a wireless communication system based on an embodiment of the present disclosure are provided. The UE 10 may include a processor 11, a memory 12, and a transceiver 13. The processor 11 may be configured to implement proposed functions, procedures and/or methods described in this description. Layers of a radio interface protocol may be implemented in the processor 11. The memory 12 is operatively coupled with the processor 11 and stores a variety of information to operate the processor 11. The transceiver 13 is operatively coupled with the processor 11, and the transceiver 13 transmits and/or receives a radio signal. The UE 20 may include a processor 21, a memory 22, and a transceiver 23. The processor 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 21. The memory 22 is operatively coupled with the processor 21 and stores a variety of information to operate the processor

21. The transceiver 23 is operatively coupled with the processor 21, and the transceiver 23 transmits and/or receives a radio signal.

[0027] The processor 11 or 21 may include an application-specific integrated circuit (ASIC), other chipsets, logic circuits and/or data processing devices. The memory 12 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 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.

[0028] 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) based on 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.

[0029] In some embodiments, the processor 11 is configured to control the transceiver 13 to transmit, to another UE 20, a signaling via a UE-to-UE communication interface based on a triggering condition, and the signaling includes information on a UE capability of the UE 10.

[0030] In some embodiments, the information on the UE capability of the UE 10 includes information to indicate whether the UE 10 supports a feature. In details, the feature includes a physical layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability. The PHY capability includes information to indicate whether the UE 10 supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability includes information to indicate whether the UE 10 supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability includes information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability includes information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability includes information to indicate whether the UE 10 supports a PC5-signaling signaling or a message format.

[0031] In some embodiments, the feature is a release 15 feature. The triggering condition includes a timer-based trigger or an event-based trigger. The processor 11 controls the transceiver 13 to transmit, to the another UE 20, the signaling when an event happens based on the event-based trigger. The event is configured by a network, preconfigured at the UE 10 or the another UE 20, or specified in a specification.

[0032] In some embodiments, the event is another signaling from the another UE 20, the event is an action of the UE 10, the event is based on a UE mobility and/or speed level of the UE 10, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

[0033] Further, the event can be based on a UE mobility/speed level of the UE 10, e.g., if the UE mobility/speed level of the UE 10 reaches a specific range/value, or a change of the UE mobility/speed level of the UE 10 reaches a specific threshold. The event can be based on a measured CBR value of a radio resource, e.g., if the measured CBR reaches a specific range/value, or a change of the measured CBR reaches a specific threshold. The event can be based on the PPPP of the packet to be transmitted, e.g., if the PPPP of the packet to be transmitted is of a specific range/value. The event can be based on the PPPR of the packet to be transmitted, e.g., if the PPPR of the packet to be transmitted is of a specific range/value.

[0034] In some embodiments, when the event is the another signaling from the another UE 20, the another signaling is to request the UE 10 to transmit, to the another UE 20, the signaling. The another signaling includes a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message. In some embodiments, when the event is the action of the UE 10, the action is that the UE 10 requests to join a group.

[0035] In some embodiments, the timer-based trigger includes a (pre-)configured timer, when the (pre-)configured timer expires, the processor 11 controls the transceiver 13 to transmit, to the another UE 20, the signaling. In some embodiments, the (pre-)configured timer is restarted when the processor 11 controls the transceiver 13 to transmit, to the another UE 20, the signaling. In details, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE 10 or the another UE 20. The length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

[0036] In some embodiments, for example, the length of the (pre-)configured timer is scaled based on mobility, for mobility/speed level of A, the length of the (pre-)configured timer is set to length A, and for mobility/speed level of B, the length of the (pre-)configured timer is set to length B.

[0037] In some embodiments, for example, the length of the (pre-)configured timer is scaled based on different types of synchronization references, i.e., synchronization based on GNSS, synchronization based on a cellular network, synchronization based on UE-to-UE signal, for synchronization reference type of A, the length of the timer is set to length A, and synchronization reference type of B, the length of the (pre-)configured timer is set to length B.

[0038] In some embodiments, for example, the length of the (pre-)configured timer is scaled based on CBR levels of the radio resource, i.e., for CBR level/range of A, the length of the timer is set to length A, and for CBR level/range of B, the length of the (pre-)configured timer is set to length B.

[0039] In some embodiments, for example, the length of the (pre-)configured timer is scaled based on PPPP value of the packet to be transmitted, i.e., for PPPP value of A, the length of the timer is set to length A, and for PPPP value of B, the length of the (pre-)configured timer is set to length B.

[0040] In some embodiments, for example, the length of the (pre-)configured timer is scaled based on PPPR value of the packet to be transmitted, i.e., for PPPR value of A, the length of the timer is set to length A, and for PPPR value of B, the length of the (pre-)configured timer is set to length B.

[0041] In some embodiments, the processor 21 is configured to control the transceiver 23 to receive a signaling via a UE-to-UE communication interface based on a triggering condition from another UE 10, and the signaling includes information on a UE capability of the another UE 10.

[0042] In some embodiments, the processor 21 knows whether the another UE 10 supports a feature based on the signaling (or further assisted by other information, e.g., an input from an upper layer on a quality of service (QoS) requirement for a specific packet, e.g., PPPP, PPPR information and etc.). The processor 21 decides whether to use the feature for packet transmission based on the signaling. The processor 21 obtains the UE capability of the another UE 10 via an identity (ID) of the another UE 10, a relationship of the UE capability of the another UE 10 and the ID of the another UE 10 is preconfigured in the UE 20 or configured by a network.

[0043] In some embodiments, the processor 21 regards a group capability as the UE capability of the another UE 10. In some embodiments, the processor 21 obtains the UE capability of the another UE 10 via a network. In some embodiments, the information on the UE capability of the another UE 10 includes information to indicate whether the another UE 10 supports a feature.

[0044] In some embodiments, the UE 20 obtains the UE capability of the UE 10 via the ID of the UE 10, e.g. Layer-2 ID. The relationship of the capability and the ID of the UE 10 is preconfigured in the UE 20, or configured by the network. The UE 20 regards the group capability as the UE capability of the UE 10. The UE 20 transmits message to group UEs, and the UE 10 is in the group. The UE 20 knows the UE capability of the UE 10with the group. The UE 20 obtains the UE capability of the UE 10 via the network. The UE 20 requests the UE capability of the UE 10 from the network, optionally, including the requested capability information, the network feedbacks the related capability to the UE 20.

[0045] In details, the feature includes a physical layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability. The PHY capability includes information to indicate whether the UE 10 supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability includes information to indicate whether the UE 10 supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability includes information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability includes information to indicate whether the PDCP layer capability supports

the PDCP duplication, and/or the PC5-signaling layer capability includes information to indicate whether the UE 10 supports a PC5-signaling signaling or a message format.

[0046] In some embodiments, the feature is a release 15 feature. The triggering condition includes a timer-based trigger or an event-based trigger. The processor 21 controls the transceiver 23 to receive the signaling from the another UE 10 when an event happens based on the event-based trigger. The event is configured by a network, preconfigured at the UE 20 or the another UE 10, or specified in a specification. The event is another signaling from the UE 20, the event is an action of the another UE 10, the event is based on a UE mobility and/or speed level of the another UE 10, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

[0047] In some embodiments, when the event is the another signaling from the UE 20, the another signaling is to request the another UE 10 to transmit, to the UE 20, the signaling. The another signaling includes a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message. In some embodiments, when the event is the action of the another UE 10, the action is that the another UE 10 requests to join a group.

[0048] In some embodiments, the timer-based trigger includes a (pre-)configured timer, when the (pre-)configured timer expires, the processor 21 controls the transceiver 23 to receive the signaling from the another UE 10. The (pre-)configured timer is restarted when the processor 21 controls the transceiver 23 to receive the signaling from the another UE 10. In details, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE 20 or the another UE 10. The length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

[0049] FIG. 2 illustrates a method 200 for controlling transmission of a user equipment (UE) in a wireless communication system based on an embodiment of the present disclosure. In some embodiments, the method 200 includes: a block 202 transmitting to another UE, a signaling via a UE-to-UE communication interface based on a triggering condition, wherein the signaling includes information on a UE capability of the UE.

[0050] In some embodiments, the information on the UE capability of the UE includes information to indicate whether the UE supports a feature. The feature includes a physical layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability. In details, the PHY capability includes information to indicate whether the UE supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability includes information to indicate whether the UE supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability includes information to indicate whether the RLC layer capability supports a PDCP

duplication, the PDCP layer capability includes information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability includes information to indicate whether the UE supports a PC5-signaling signaling or a message format.

[0051] In some embodiments, the feature is a release 15 feature. The triggering condition includes a timer-based trigger or an event-based trigger. The signaling is transmitted to the another UE when an event happens based on the event-based trigger. The event is configured by a network, preconfigured at the UE or the another UE, or specified in a specification.

[0052] In some embodiments, the event is another signaling from the another UE, the event is an action of the UE, the event is based on a UE mobility and/or speed level of the UE, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

[0053] In some embodiments, when the event is the another signaling from the another UE, the another signaling is to request the UE to transmit, to the another UE, the signaling. The another signaling includes a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message. In some embodiments, when the event is the action of the UE, the action is that the UE requests to join a group.

[0054] In some embodiments, the timer-based trigger includes a (pre-)configured timer, when the (pre-)configured timer expires, the signaling is transmitted to the another UE. In some embodiments, the (pre-)configured timer is restarted when the signaling is transmitted to the another UE. In details, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE or the another UE. The length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

[0055] FIG. 3 illustrates a method 300 for controlling transmission of a user equipment (UE) in a wireless communication system based on an embodiment of the present disclosure. In some embodiments, the method 300 includes: at block 302, receiving a signaling via a UE-to-UE communication interface based on a triggering condition from another UE, wherein the signaling includes information on a UE capability of the another UE.

[0056] In some embodiments, the method further includes that the UE knows whether the another UE supports a feature based on the signaling. The method further includes deciding whether to use the feature for packet transmission based on the signaling. The method further includes obtaining the UE capability of the another UE via an identity (ID) of the another UE, a relationship of the UE capability of the another UE and the ID of the another UE is preconfigured in the UE or configured by a network. The method further includes regarding a group capability as the UE capability of the another UE. The method further includes obtaining the UE capability of the another UE via a network.

[0057] In some embodiments, the information on the UE capability of the another UE includes information to indicate whether the another UE supports a feature. The feature includes a physical

layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability. The PHY capability includes information to indicate whether the another UE supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability includes information to indicate whether the another UE supports a MAC protocol data unit (PDU) format, and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability includes information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability includes information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability includes information to indicate whether the another UE supports a PC5-signaling signaling or a message format.

[0058] In some embodiments, the feature is a release 15 feature. The triggering condition includes a timer-based trigger or an event-based trigger. The signaling is received from the another UE when an event happens based on the event-based trigger. The event is configured by a network, preconfigured at the UE or the another UE, or specified in a specification.

[0059] In some embodiments, the event is another signaling from the UE, the event is an action of the another UE, the event is based on a UE mobility and/or speed level of the another UE, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

[0060] In some embodiments, when the event is the another signaling from the UE, the another signaling is to request the another UE to transmit, to the UE, the signaling. The another signaling includes a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message.

[0061] In some embodiments, when the event is the action of the another UE, the action is that the another UE requests to join a group. The timer-based trigger comprises a (pre-)configured timer, when the (pre-)configured timer expires, the signaling is received from the another UE. The (pre-)configured timer is restarted when the signaling is received from the another UE. A length of the (pre-)configured timer is configured by a network or pre-configured at the UE or the another UE. The length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

[0062] FIG. 4 is a block diagram of an example system 700 for wireless communication based on an embodiment of the present disclosure. Embodiments described herein may be implemented into the system using any suitably configured hardware and/or software. FIG. 4 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.

[0063] 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.

[0064] 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.

[0065] 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.

[0066] 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.

[0067] 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.

[0068] 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 circuitries, 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.

[0069] 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).

[0070] 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.

[0071] 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.

[0072] 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.

[0073] 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.

[0074] In the embodiment of the present disclosure, a user equipment and a method for controlling transmission of the same in a wireless communication system to reach low latency and high reliability 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.

[0075] 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.

[0076] 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.

[0077] 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.

[0078] 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 based on 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.

[0079] 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.

[0080] 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) for controlling transmission in a wireless 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 another UE, a signaling via a UE-to-UE communication interface based on a triggering condition, and the signaling comprises information on a UE capability of the UE.

2. The UE of claim 1, wherein the information on the UE capability of the UE comprises information to indicate whether the UE supports a feature.

3. The UE of claim 2, wherein the feature comprises a physical layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability.

4. The UE of claim 3, wherein the PHY capability comprises information to indicate whether the UE supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability comprises information to indicate whether the UE supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability comprises information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability comprises information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability comprises information to indicate whether the UE supports a PC5-signaling signaling or a message format.

5. The UE of any one of claims 2 to 4, wherein the feature is a release 15 feature.

6. The UE of any one of claims 1 to 5, wherein the triggering condition comprises a timer-based trigger or an event-based trigger.

7. The UE of claim 6, wherein the processor controls the transceiver to transmit, to the another UE, the signaling when an event happens based on the event-based trigger.

8. The UE of claim 7, wherein the event is configured by a network, preconfigured at the UE or the another UE, or specified in a specification.

9. The UE of claim 7 or 8, wherein the event is another signaling from the another UE, the event is an action of the UE, the event is based on a UE mobility and/or speed level of the UE, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

10. The UE of claim 9, wherein when the event is the another signaling from the another UE, the another signaling is to request the UE to transmit, to the another UE, the signaling.

11. The UE of claim 9 or 10, the another signaling comprises a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message.

12. The UE of claim 9, wherein when the event is the action of the UE, the action is that the UE requests to join a group.

13. The UE of claim 6, wherein the timer-based trigger comprises a (pre-)configured timer, when the (pre-)configured timer expires, the processor controls the transceiver to transmit, to the another UE, the signaling.

14. The UE of claim 13, wherein the (pre-)configured timer is restarted when the processor controls the transceiver to transmit, to the another UE, the signaling.

15. The UE of claim 13 or 14, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE or the another UE.

16. The UE of claim 15, wherein the length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

17. A method for controlling transmission of a user equipment (UE) in a wireless communication system, comprising:

transmitting, to another UE, a signaling via a UE-to-UE communication interface based on a triggering condition, wherein the signaling comprises information on a UE capability of the UE.

18. The method of claim 17, wherein the information on the UE capability of the UE comprises information to indicate whether the UE supports a feature.

19. The method of claim 18, wherein the feature comprises a physical layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability.

20. The method of claim 19, wherein the PHY capability comprises information to indicate whether the UE supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability comprises information to indicate whether the UE supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability comprises information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability comprises information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability comprises information to indicate whether the UE supports a PC5-signaling signaling or a message format.

21. The method of any one of claims 18 to 20, wherein the feature is a release 15 feature.

22. The method of any one of claims 17 to 21, wherein the triggering condition comprises a timer-based trigger or an event-based trigger.

23. The method of claim 22, wherein the signaling is transmitted to the another UE when an event happens based on the event-based trigger.

24. The method of claim 23, wherein the event is configured by a network, preconfigured at the UE or the another UE, or specified in a specification.

25. The method of claim 23 or 24, wherein the event is another signaling from the another UE, the event is an action of the UE, the event is based on a UE mobility and/or speed level of the UE, the

event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

26. The method of claim 25, wherein when the event is the another signaling from the another UE, the another signaling is to request the UE to transmit, to the another UE, the signaling.

27. The method of claim 25 or 26, the another signaling comprises a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message.

28. The method of claim 25, wherein when the event is the action of the UE, the action is that the UE requests to join a group.

29. The method of claim 22, wherein the timer-based trigger comprises a (pre-)configured timer, when the (pre-)configured timer expires, the signaling is transmitted to the another UE.

30. The method of claim 29, wherein the (pre-)configured timer is restarted when the signaling is transmitted to the another UE.

31. The method of claim 29 or 30, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE or the another UE.

32. The method of claim 31, wherein the length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

33. A user equipment (UE) for controlling transmission in a wireless 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 signaling via a UE-to-UE communication interface based on a triggering condition from another UE, and the signaling comprises information on a UE capability of the another UE.

34. The UE of claim 33, the processor knows whether the another UE supports a feature based on the signaling.

35. The UE of claim 34, the processor decides whether to use the feature for packet transmission based on the signaling.

36. The UE of claim 33, the processor obtains the UE capability of the another UE via an identity (ID) of the another UE, a relationship of the UE capability of the another UE and the ID of the another UE is preconfigured in the UE or configured by a network.

37. The UE of claim 33, the processor regards a group capability as the UE capability of the another UE.

38. The UE of claim 33, the processor obtains the UE capability of the another UE via a network.

39. The UE of any one of claims 33 to 38, wherein the information on the UE capability of the another UE comprises information to indicate whether the another UE supports a feature.

40. The UE of claim 39, wherein the feature comprises a physical layer (PHY) capability, a medium

access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability.

41. The UE of claim 40, wherein the PHY capability comprises information to indicate whether the another UE supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability comprises information to indicate whether the another UE supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability comprises information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability comprises information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability comprises information to indicate whether the another UE supports a PC5-signaling signaling or a message format.

42. The UE of any one of claims 39 to 41, wherein the feature is a release 15 feature.

43. The UE of any one of claims 33 to 42, wherein the triggering condition comprises a timer-based trigger or an event-based trigger.

44. The UE of claim 33, wherein the processor controls the transceiver to receive the signaling from the another UE when an event happens based on the event-based trigger.

45. The UE of claim 44, wherein the event is configured by a network, preconfigured at the UE or the another UE, or specified in a specification.

46. The UE of claim 44 or 45, wherein the event is another signaling from the UE, the event is an action of the another UE, the event is based on a UE mobility and/or speed level of the another UE, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

47. The UE of claim 46, wherein when the event is the another signaling from the UE, the another signaling is to request the another UE to transmit, to the UE, the signaling.

48. The UE of claim 46 or 47, the another signaling comprises a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message.

49. The UE of claim 47, wherein when the event is the action of the another UE, the action is that the another UE requests to join a group.

50. The UE of claim 43, wherein the timer-based trigger comprises a (pre-)configured timer, when the (pre-)configured timer expires, the processor controls the transceiver to receive the signaling from the another UE.

51. The UE of claim 50, wherein the (pre-)configured timer is restarted when the processor controls the transceiver to receive the signaling from the another UE.

52. The UE of claim 50 or 51, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE or the another UE.

53. The UE of claim 52, wherein the length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

54. A method for controlling transmission of a user equipment (UE) in a wireless communication system, comprising:

receiving a signaling via a UE-to-UE communication interface based on a triggering condition from another UE, wherein the signaling comprises information on a UE capability of the another UE.

55. The method of claim 54, further comprising that the UE knows whether the another UE supports a feature based on the signaling.

56. The method of claim 55, further comprising deciding whether to use the feature for packet transmission based on the signaling.

57. The method of claim 54, further comprising obtaining the UE capability of the another UE via an identity (ID) of the another UE, a relationship of the UE capability of the another UE and the ID of the another UE is preconfigured in the UE or configured by a network.

58. The method of claim 54, further comprising regarding a group capability as the UE capability of the another UE.

59. The method of claim 54, further comprising obtaining the UE capability of the another UE via a network.

60. The method of any one of claims 33 to 38, wherein the information on the UE capability of the another UE comprises information to indicate whether the another UE supports a feature.

61. The method of claim 60, wherein the feature comprises a physical layer (PHY) capability, a medium access control (MAC) layer capability, a radio link control (RLC) layer capability, a packet data control protocol (PDCP) layer capability, and/or a PC5-signaling layer capability.

62. The method of claim 61, wherein the PHY capability comprises information to indicate whether the another UE supports a modulation and coding scheme (MCS), a rate matching scheme, and/or a multiple-input multiple-output (MIMO) scheme, the MAC layer capability comprises information to indicate whether the another UE supports a MAC protocol data unit (PDU) format and whether a link control identifier (LCID) value is to be recognized, the RLC layer capability comprises information to indicate whether the RLC layer capability supports a PDCP duplication, the PDCP layer capability comprises information to indicate whether the PDCP layer capability supports the PDCP duplication, and/or the PC5-signaling layer capability comprises information to indicate whether the another UE supports a PC5-signaling signaling or a message format.

63. The method of any one of claims 60 to 62, wherein the feature is a release 15 feature.

64. The method of any one of claims 54 to 63, wherein the triggering condition comprises a timer-based trigger or an event-based trigger.

65. The method of claim 54, wherein the signaling is received from the another UE when an event happens based on the event-based trigger.

66. The method of claim 65, wherein the event is configured by a network, preconfigured at the UE or the another UE, or specified in a specification.

67. The method of claim 65 or 66, wherein the event is another signaling from the UE, the event is an action of the another UE, the event is based on a UE mobility and/or speed level of the another UE, the event is based on a channel busy ratio (CBR) value of a radio resource, the event is based on a

proximity-based services (ProSe) per packet reliability priority (PPPP) of a packet to be transmitted, and/or the event is based on a ProSe per packet reliability (PPPR) of the packet to be transmitted.

68. The method of claim 67, wherein when the event is the another signaling from the UE, the another signaling is to request the another UE to transmit, to the UE, the signaling.

69. The method of claim 67 or 68, the another signaling comprises a PHY message, a MAC message, an RLC message, a PDCP message, and/or a PC5-signaling message.

70. The method of claim 68, wherein when the event is the action of the another UE, the action is that the another UE requests to join a group.

71. The method of claim 64, wherein the timer-based trigger comprises a (pre-)configured timer, when the (pre-)configured timer expires, the signaling is received from the another UE.

72. The method of claim 71, wherein the (pre-)configured timer is restarted when the signaling is received from the another UE.

73. The method of claim 71 or 72, a length of the (pre-)configured timer is configured by a network or pre-configured at the UE or the another UE.

74. The method of claim 73, wherein the length of the (pre-)configured timer is scaled based on mobility, different types of synchronization references, a CBR value of a radio resource, a PPPP of a packet to be transmitted, and/or a PPPR of the packet to be transmitted.

75. 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 17 to 32 and 54 to 74.

76. 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 17 to 32 and 54 to 74.

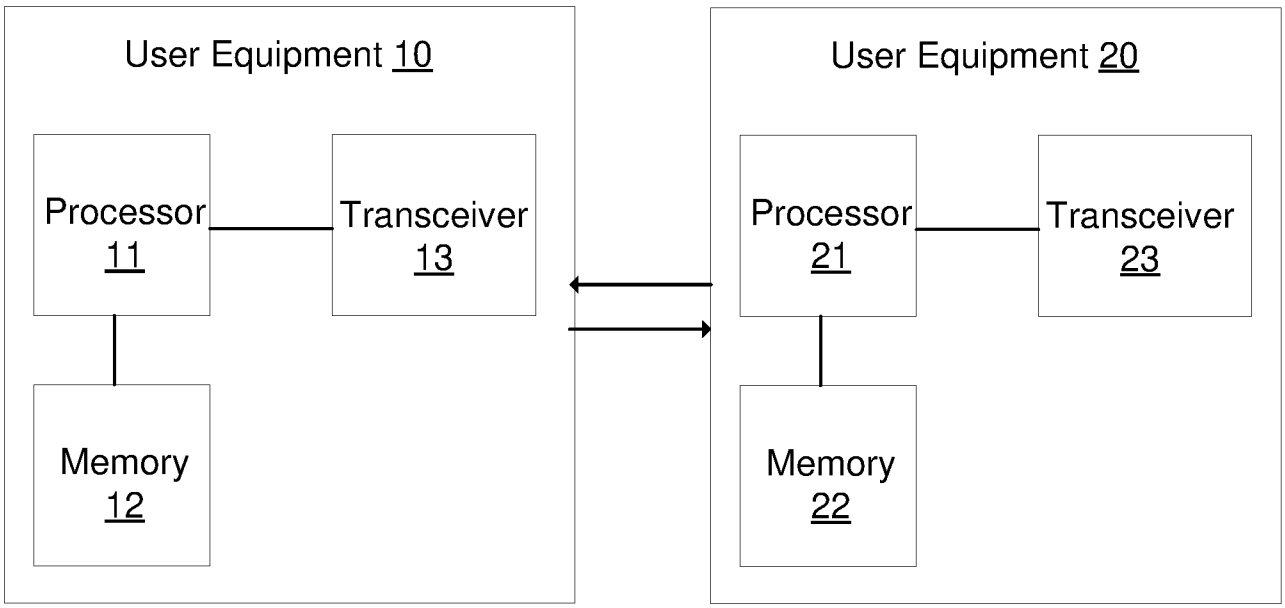
User Equipment 10
Processor 11
Transceiver 13
Memory 12
User Equipment 20
Processor 21
Transceiver 23
Memory 22

FIG. 1

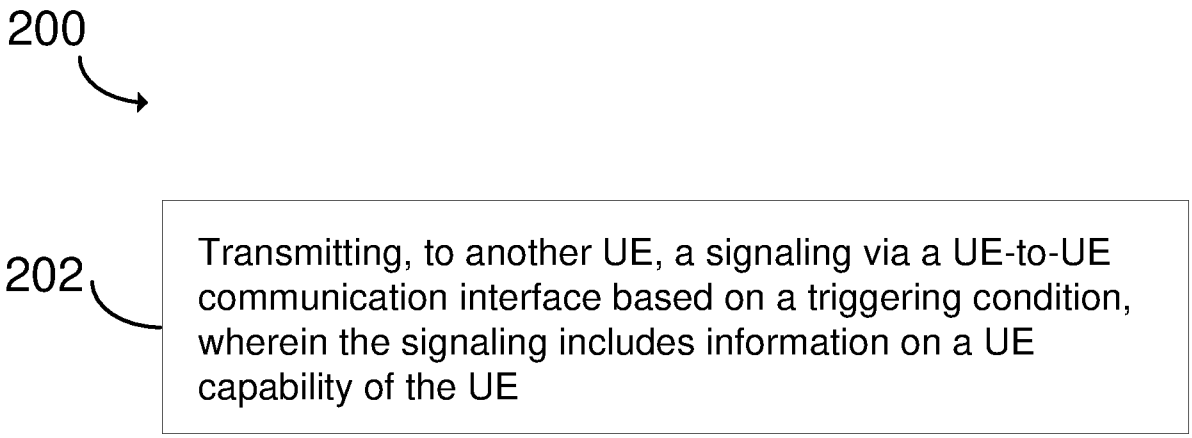
200
202
Transmitting, to another UE, a signaling via a UE-to-UE communication interface based on a triggering condition, wherein the signaling includes information on a UE capability of the UE

FIG. 2

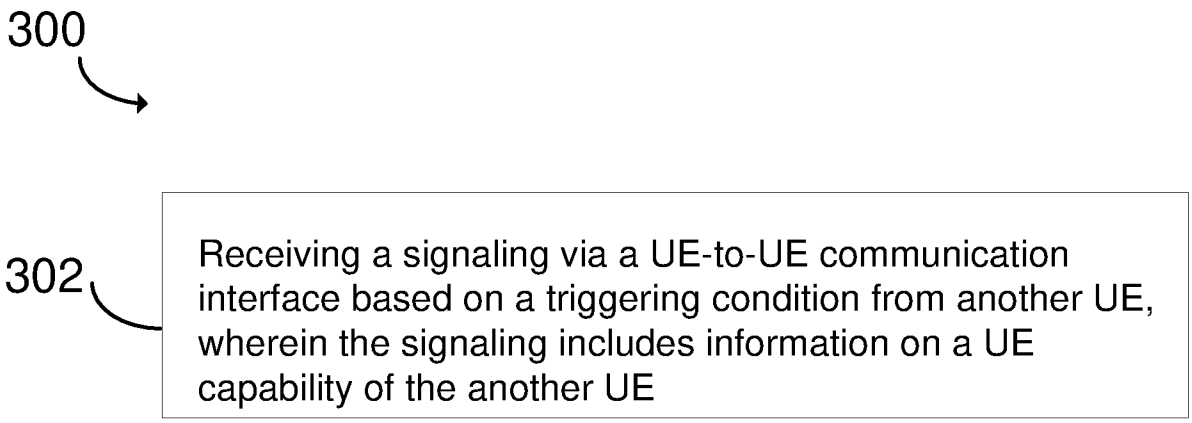
300
302
Receiving a signaling via a UE-to-UE communication interface based on a triggering condition from another UE, wherein the signaling includes information on a UE capability of the another UE

FIG. 3

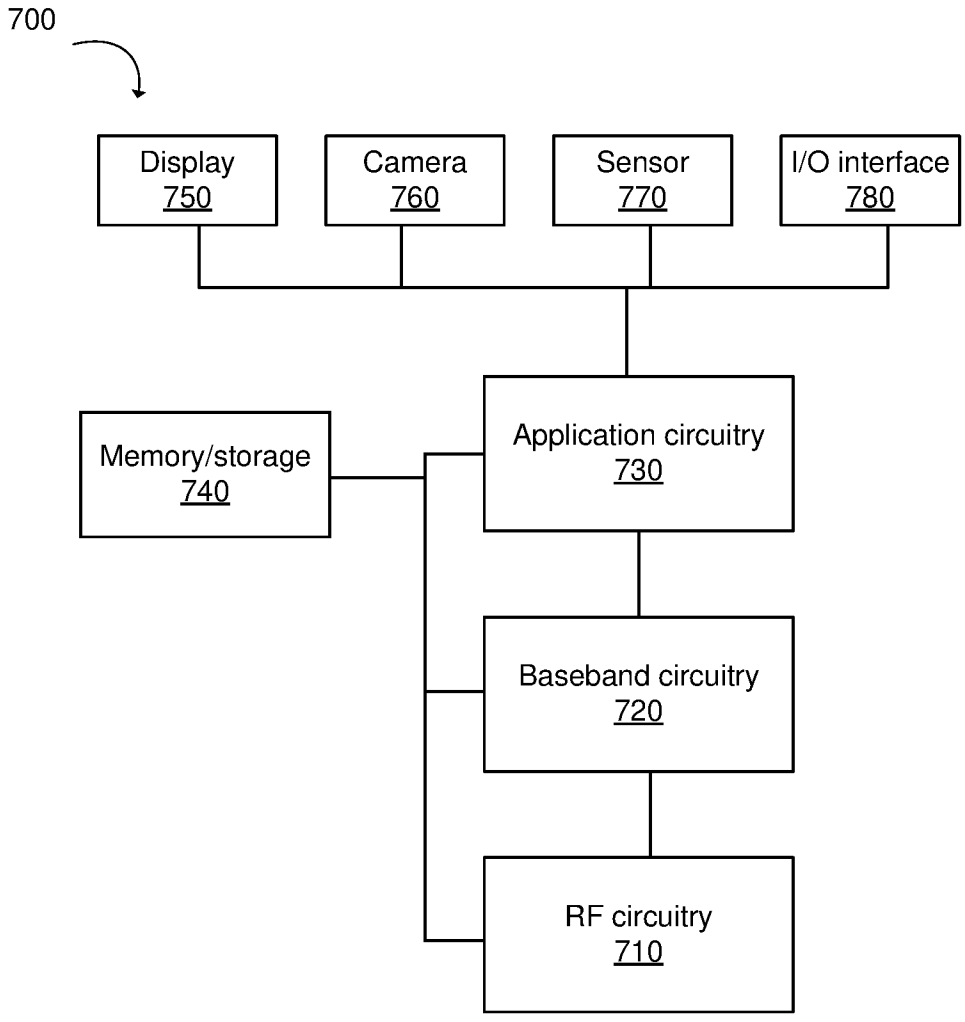
700
Display 750
Camera 760
Sensor 770
I/O interface 780
Memory/storage 740
Application circuitry 730
Baseband circuitry 720
RF circuitry 710

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/081319

A. CLASSIFICATION OF SUBJECT MATTER

H04W 4/40(2018.01)i; H04W 4/70(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; H04L; H04B; 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)

CNPAT, WPI, EPODOC, CNKI, 3GPP: V2X, eV2X, V2V, V2P, V2I, UE-to-UE, V2N, UE, terminal, capabil+, feature, interface, trigger+, initiat+, activ+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 107736038 A (INTEL CORPORATION) 23 February 2018 (2018-02-23) description, paragraphs [0029]-[0086], figures 1-11	1-76
A	CN 107172672 A (CHINA INTERNET NETWORK INFORMATION CENTER) 15 September 2017 (2017-09-15) the whole document	1-76
A	US 2017279858 A1 (OFINNO TECHNOLOGIES, LLC) 28 September 2017 (2017-09-28) the whole document	1-76

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

* Special categories of cited documents:

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

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

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

"O" document referring to an oral disclosure, use, exhibition or other means

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 June 2019	**28 June 2019**
Name and mailing address of the ISA/CN **National Intellectual Property Administration, PRC** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing** **100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer **GUO,Haibo** Telephone No. **86-(10)-53961730**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/081319

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	107736038	A	23 February 2018	US	2018167790	A1	14 June 2018
				JP	2018524861	A	30 August 2018
				HK	1250117	A0	23 November 2018
				EP	3318072	A1	09 May 2018
				WO	2017003405	A1	05 January 2017
CN	107172672	A	15 September 2017		None		
US	2017279858	A1	28 September 2017	US	2017280378	A1	28 September 2017