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(54) **Title:** COEXISTENCE OF D2D COMMUNICATIONS USING DIFFERENT RATS

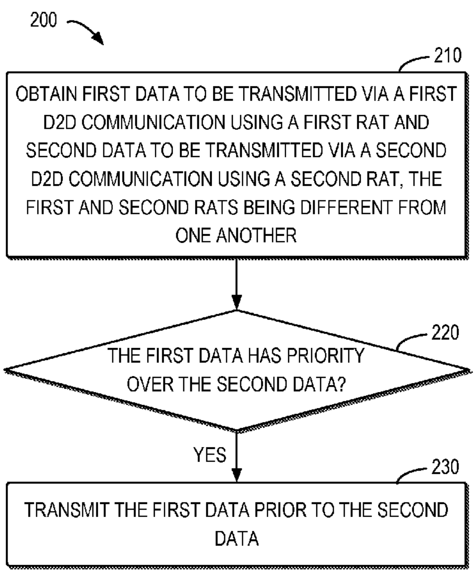

FIG. 2

(57) **Abstract:** Embodiments of the present disclosure provide methods, devices and computer readable media for coexistence of Device-to-Device (D2D) communications using different Radio Access Technologies (RATs). According to a method for communication, a terminal device obtains first data to be transmitted via a first D2D communication using a first RAT and second data to be transmitted via a second D2D communication using a second RAT, the first and second RATs being different from one another. The terminal device determines whether the first data has priority over the second data. In response to determining that the first data has priority over the second data, the terminal device transmits the first data prior to the second data. The embodiments of the present disclosure provide a feasible solution for coexistence of D2D communications using different RATs.

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COEXISTENCE OF D2D COMMUNICATIONS USING DIFFERENT RATS

FIELD

[0001] Embodiments of the present disclosure generally relate to wireless communication, and in particular, to coexistence of Device-to-Device (D2D) communications using different Radio Access Technologies (RATs).

BACKGROUND

[0002] The latest developments of the 3GPP standards are referred to as Long Term Evolution (LTE) of Evolved Packet Core (EPC) network and Evolved UMTS Terrestrial Radio Access Network (E-UTRAN), also commonly termed as '4G'. In addition, the term '5G New Radio (NR)' refers to an evolving communication technology that is expected to support a variety of applications and services. 5G NR is part of a continuous mobile broadband evolution promulgated by Third Generation Partnership Project (3GPP) to meet new requirements associated with latency, reliability, security, scalability (e.g., with Internet of Things (IoTz)), and other requirements. Some aspects of 5G NR may be based on the 4G Long Term Evolution (LTE) standard.

[0003] In a communication system supporting both the 5G NR and the LTE, terminal devices may have D2D communications via the 5G NR technology. In the meanwhile, these terminal devices may also be enabled to perform D2D communications via the LTE technology. In other words, the NR D2D communications coexist with the LTE D2D communications. However, the communication scenarios where D2D communications using different RATs coexist are still not clear and need to be studied.

SUMMARY

[0004] In general, example embodiments of the present disclosure provide a solution for coexistence of D2D communications using different RATs.

[0005] In a first aspect, there is provided a method for communication. The method comprises determining, obtaining first data to be transmitted via a first D2D communication using a first RAT and second data to be transmitted via a second D2D communication using a second RAT, the first and second RATs being different from one another. The method also comprises determining whether the first data has priority over the second data. The method further comprises in response to determining that the first data has priority over the second data, transmitting the first data prior to the second data.

[0006] In a second aspect, there is provided a method for communication. The method comprises obtaining allocation information at a network device, the network device configured to allocate a first resource for a terminal device to perform a first D2D communication using a first RAT. The method also comprises determining, based on the allocation information, a second resource for the terminal device to perform a second D2D communication using a second RAT, the first and second RATs being different from one another. The method further comprises selecting the first resource such that the first and second resources are non-overlapped with one another.

[0007] In a third aspect, there is provided a terminal device. The terminal device comprises a processor and a memory storing instructions. The memory and the instructions are configured, with the processor, to cause the terminal device to obtain first data to be transmitted via a first D2D communication using a first RAT and second data to be transmitted via a second D2D communication using a second RAT, the first and second RATs being different from one another. The memory and the instructions are also configured, with the processor, to cause the terminal device to determine whether the first data has priority over the second data. The memory and the instructions are further configured, with the processor, to cause the terminal device in response to determining that the first data has priority over the second data, to transmit the first data prior to the second data.

[0008] In a fourth aspect, there is provided a network device. The network device comprises a processor and a memory storing instructions. The memory and the instructions are configured, with the processor, to cause the network device to obtain allocation information at the network device, the network device configured to allocate a first resource for a terminal device to perform a first D2D communication using a first RAT. The memory and the instructions are also configured, with the processor, to cause the network device to determine, based on the allocation information, a second resource for the terminal device to perform a second D2D communication using a second RAT, the first and second RATs being different from one another. The memory and the instructions are further configured, with the processor, to cause the network device to select the first resource such that the first and second resources are non-overlapped with one another.

[0009] In a fifth aspect, there is provided a computer readable medium having instructions stored thereon. The instructions, when executed on at least one processor of a device, cause the device to carry out the method according to the first aspect.

[0010] In a sixth aspect, there is provided a computer readable medium having instructions stored thereon. The instructions, when executed on at least one processor of a device, cause the device to carry out the method according to the second aspect.

[0011] It is to be understood that the summary section is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Through the more detailed description of some embodiments of the present disclosure in the accompanying drawings, the above and other objects, features and advantages of the present disclosure will become more apparent, wherein:

[0013] Fig. 1 is a schematic diagram of a communication environment in which some embodiments of the present disclosure can be implemented;

[0014] Fig. 2 shows a flowchart of an example method in accordance with some embodiments of the present disclosure;

[0015] Fig. 3 is a schematic diagram showing an alignment example of allocating D2D communication resources for different RATs in accordance with some embodiments of the present disclosure;

[0016] Fig. 4 shows a flowchart of another example method in accordance with some embodiments of the present disclosure; and

[0017] Fig. 5 is a simplified block diagram of a device that is suitable for implementing some embodiments of the present disclosure.

[0018] Throughout the drawings, the same or similar reference numerals represent the same or similar elements.

DETAILED DESCRIPTION OF EMBODIMENTS

[0019] Principles of the present disclosure will now be described with reference to some example embodiments. It is to be understood that these embodiments are described only for the purpose of illustration and help those skilled in the art to understand and implement the present disclosure, without suggesting any limitations as to the scope of the disclosure. The disclosure described herein can be implemented in various manners other than the ones described below.

[0020] In the following description and claims, unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skills in the art to which this disclosure belongs.

[0021] As used herein, the term "network device" or "base station" (BS) refers to a device which is capable of providing or hosting a cell or coverage where terminal devices can communicate. Examples of a network device include, but not limited to, a Node B (NodeB or NB), an Evolved NodeB (eNodeB or eNB), a next generation NodeB (gNB), a Transmission/Reception Point (TRP), a Remote Radio Unit (RRU), a radio head (RH), a remote radio head (RRH), a low power node such as a femto node, a pico node, and the like.

[0022] As used herein, the term "terminal device" refers to any device having wireless or wired communication capabilities. Examples of the terminal device include, but not limited to, user equipment (UE), vehicle-mounted terminal devices, personal computers, desktops, mobile phones, cellular phones, smart phones, personal digital assistants (PDAs), portable computers, image capture devices such as digital cameras, gaming devices, music storage and playback appliances, or Internet appliances enabling wireless or wired Internet access and browsing and the like. For the purpose of discussion, in the following, some embodiments will be described with reference to UEs as examples of terminal devices and the terms "terminal device" and "user equipment" (UE) may be used interchangeably in the context of the present disclosure.

[0023] As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. The term "includes" and its variants are to be read as open terms that mean "includes, but is not limited to." The term "based on" is to be read as "based at least in part on." The term "one embodiment" and "an embodiment" are to be read as "at least one embodiment." The term "another embodiment" is to be read as "at least one other embodiment." The terms "first," "second," and the like may refer to different or same objects. Other definitions, explicit and implicit, may be included below.

[0024] In some examples, values, procedures, or apparatus are referred to as "best," "lowest," "highest," "minimum," "maximum," or the like. It will be appreciated that such descriptions are intended to indicate that a selection among many used functional alternatives can be made, and such selections need not be better, smaller, higher, or otherwise preferable to other selections.

[0025] Fig. 1 is a schematic diagram of a communication environment 100 in which some embodiments of the present disclosure can be implemented. As shown in Fig. 1, the communication environment 100 may include a first network device 110 and a second network device 120, which provide wireless connections for a plurality of terminal devices 130, 140, and 150 within their coverage. Although a common coverage for the first network device 110 and the second network device 120 is depicted in Fig. 1, it is understood that the first network device 110 and the second network device 120 may have their respective serving cells, which is not shown in Fig. 1.

[0026] In some embodiments, the first network device 110 may be a gNB which is operated with the 5G NR technology, and the second network device 120 may be an eNB which is operated with the LTE technology. In some other embodiments, the first network device 110 and the second network device 120 may be any network devices using two different RATs. As shown in Fig. 1, the terminal devices 130, 140, and 150 are associated with vehicles 132, 142, and 152, respectively. For example, the terminal devices 130, 140, and 150 may be vehicle-mounted terminal devices. Although the terminal devices 130, 140, and 150 are depicted as located in the vehicles 132, 142, and 152, it is understood that embodiments of the present disclosure are equally applicable to any other terminal devices which enable D2D communications.

[0027] The terminal device 130 may communicate with the network devices 110 and 120 via channels such as wireless transmission channels 115 and 125, respectively. For transmissions from the network devices 110 and 120 to the terminal devices 130, the channels 115 and 125 may be referred to as downlink channels, whereas for transmissions from the terminal device 130 to the network devices 110 and 120, the channels 115 and 125 may alternatively be referred to as uplink channels. In a similar manner, the terminal device 140 may have wireless links (not shown) with the network devices 110 and 120. In contrast, since the terminal device 150 is outside of the coverage of the network devices 110 and 120, it may be served by other network devices not shown.

[0028] In addition to the communications via the network devices 110 and 120, the terminal device 130 may communicate with the terminal devices 140 and 150 via device-to-device (D2D) communication links 135 and 145. Although not shown in Fig. 1, there may be D2D communications between the terminal devices 140 and 150 as well as other terminal devices. As used herein, D2D communication links for D2D communications among the terminal devices 130, 140, and 150 as well as other terminal devices not shown may be referred to as sidelinks. In some embodiments, the sidelinks may be half-duplex. However, embodiments of the present disclosure are equally applicable to full-duplex sidelinks. Further, in case that the terminal devices 130, 140, and 150 are vehicle-mounted terminal devices, the communications relate to the terminal devices 130, 140, and 150 may be referred to as V2X (Vehicle to everything) communications.

[0029] It is to be understood that the number of network devices and the number of terminal devices as shown in Fig. 1 are only for the purpose of illustration without suggesting any limitations. The communication environment 100 may include any suitable number of network devices and any suitable number of terminal devices adapted for implementing embodiments of the present disclosure. In addition, it would be appreciated that there may be various wireless communications as well as wireline communications (if needed) among these additional network devices and additional terminal devices.

[0030] The communications in the communication environment 100 may conform to any suitable standards including, but not limited to, Global System for Mobile Communications (GSM), Extended Coverage Global System for Mobile Internet of Things (EC-GSM-IoT), Long Term Evolution (LTE), LTE-Evolution, LTE-Advanced (LTE-A), Wideband Code Division Multiple Access (WCDMA), Code Division Multiple Access (CDMA), GSM EDGE Radio Access Network (GERAN), and the like. Furthermore, the communications may be performed according to any generation communication protocols either currently known or to be developed in the future. Examples of the communication protocols include, but not limited to, the first generation (1G), the second generation (2G), 2.5G, 2.75G, the third generation (3G), the fourth generation (4G), 4.5G, the fifth generation (5G) communication protocols.

[0031] Recently, with respect to in-device coexistence of D2D communications using different RATs, the feasibility of the coexistence mechanisms when the NR sidelink and LTE sidelink technologies are equipped in a same vehicle for the 'not co-channel' scenario is studied. In this scenario, advanced V2X services provided by NR sidelinks coexist with V2X services provided by LTE sidelinks in different channels (i.e., not co-channel). "Not co-channel" could include both adjacent channels and channels that are sufficiently far apart.

[0032] For the study of LTE-V2X and NR-V2X sidelink co-existence, at least the following scenarios are considered from the perspective of a terminal device. In a first scenario, the LTE sidelink and the NR sidelink do not have any coordinated procedures. In a second scenario, the LTE sidelink and the NR sidelink have coordinated procedures and half-duplex constraints are assumed. The 3GPP RAN1 will focus on the second scenario in the study item. In particular, the 3GPP RAN1 focus on at least the following potential solutions for coexistence. The solutions are Time Divisional Multiplexing (TDM) of the LTE V2X and NR V2X sidelink transmissions, and Frequency Divisional Multiplexing (FDM) of the LTE V2X and NR V2X sidelink transmissions.

[0033] In the context of in-device coexistence between NR and LTE V2X sidelinks (not co-channel), the TDM solutions are those that prevent overlapping or simultaneous NR and LTE V2X sidelink transmissions. The FDM solutions are those that involve simultaneous transmissions of NR and LTE V2X sidelink transmissions and defining mechanisms for sharing the total power of the terminal device between the two. For the TDM solutions, the following aspects are studied.

[0034] The first aspect is long term time-scale coordination, where potential transmissions in time of LTE and NR V2X are statically/quasi-statically determined, but the behaviors of the terminal device when LTE and NR V2X sidelink transmissions overlap in time is unclear. The second aspect is short time-scale coordination, where transmissions in time of LTE and NR V2X are known to each RAT, but the behaviors of the terminal device when LTE and NR V2X sidelink transmissions overlap in time is unclear and the coordination details are also unclear. Further, the assistance of the terminal device for coordination is also undetermined.

[0035] Moreover, the 3GPP RAN1 also studies further how to use priority, latency, reliability, and minimum required communication range (as defined by higher layers) if agreed to use in the physical layer aspects of at least the resource allocation, the congestion control, the resolution of in-device coexistence issues and the power control.

[0036] In view of the foregoing, the inventors find that there are some technical problems in the communication scenarios where D2D communications using different RATs coexist. In particular, if a terminal device receives sudden transmission (such as an NR sidelink packet) to be transmitted to other terminal devices, the way how the terminal device transmits the sudden transmission is unclear. In addition, if the terminal device receives NR and LTE sidelink packets simultaneously, the way in which the terminal device handles such overlapped transmissions is also unclear.

[0037] Regarding the LTE-V2X and NR-V2X sidelink co-existence, there have been proposed some possible schemes. In one scheme, with long-term time-scale coordination, the resources between LTE-V2X and NR-V2X are partitioned on a long-term basis by a TDM manner, and individual packet transmissions follow the (quasi-) static resource allocation. However, in this scheme, there is no solution about the sudden traffic and the overlapped transmissions as indicated above. In another scheme, TDM transmission resources in each sidelink can be statically/quasi-statically configured or pre-configured for each terminal device. However, in this scheme, UE-specific resource patterns cannot work properly, and thus there would be adverse impact on the latency and reliability.

[0038] In order to solve the above technical problems and potentially other technical problems in conventional solutions, embodiments of the present disclosure provide methods, devices and computer readable media for coexistence of D2D communications using different RATs. In the proposed solution, a terminal device may handle sudden traffic or overlapped transmissions according to a priority rule in the shared resources, for example, in case that there are not dedicated resources for the D2D communications using different RATs. In some embodiments, a network device of a first RAT can avoid the sudden traffic or overlapped transmissions based on resource allocation information of a second RAT.

[0039] In some embodiments, sharing recourses may be configured for different sidelink communications in a TDM method, and a terminal device may monitor on all the time resources at the first RAT (such as NR) sidelink channel for resource indication of another terminal device. In some other embodiments, dedicated resources may be allocated to a first sidelink of the first RAT (such as the NR sidelink) and a second sidelink of the second RAT (such as the LTE sidelink) for the first sidelink transport and the second sidelink transport, respectively.

[0040] In some further embodiments, if a terminal device is out of the coverage of both a first network device (such as a gNB) of the first RAT (such as the 5G NR) and a second network device (such as an eNB) of the second RAT (such as the LTE), that is, the terminal device is out of control of the first and second network devices, then time resources for transmitting a first D2D communication using the first RAT may be determined from a predefined resource pattern, and time resources other than that determined from the predefined resource pattern may be allocated for transmitting a second D2D communication using the second RAT.

[0041] Alternatively, if the terminal device is out of the coverage of the first network device but still in the coverage of the second network device, that is, the terminal device is out of control of the first network device and under control of the second network device, then time resources for transmitting a first D2D communication using the first RAT may be determined from the predefined resource pattern, and time resources for transmitting a second D2D communication using the second RAT may be configured by the second network device.

[0042] Embodiments of the present disclosure provide feasible solution for coexistence of D2D communications using different RATs, particularly in a TDM manner. Principles and implementations of the present disclosure will be described in detail below with reference to the figures.

[0043] Fig. 2 shows a flowchart of an example method 200 in accordance with some embodiments of the present disclosure. The method 200 can be implemented at a terminal device, such as the terminal device 130 as shown in Fig. 1. Additionally or alternatively, the method 200 can also be implemented at the terminal devices 140 and 150, as well as other the terminal devices not shown in Fig. 1. For the purpose of discussion, the method 200 will be described with reference to Fig. 1 as performed by the terminal device 130 without loss of generality.

[0044] As described above, the terminal device 130 may support multiple types of D2D communications with the terminal devices 140 and 150 as well as other terminal devices in proximity to the terminal device 130 via different RATs, such as the 5G NR, the LTE, or the like. In an example scenario, at block 210 of Fig. 2, the terminal device 130 obtains first data to be transmitted via a first D2D communication using a first RAT. In some embodiments, the first RAT may be the 5G NR technology, and the first D2D communication may be referred to as an NR sidelink communication accordingly. In some other embodiments, the first RAT can be any suitable radio access technology which enables D2D communications.

[0045] As used herein, the first data may be any data that can be transmitted via a D2D communication, including user plane data, control plane data, or the like. Accordingly, the terminal device 130 may obtain the first data from various sources. As an example, the terminal device 130 may generate the first data by itself so as to transmit to other terminal devices. As another example, the terminal device 130 may receive the first data from another terminal device and then transmit it to a further terminal device. As a further example, the terminal device 130 may receive the first data from a network device, such as the network device 110.

[0046] Also at block 210, the terminal device 130 obtains second data to be transmitted via a second D2D communication using a second RAT, which is different from the first RAT. In some embodiments, the second RAT may be the LTE technology and the second D2D communication may accordingly be referred to as an LTE sidelink communication. In some other embodiments, the second RAT can be any suitable radio access technology which enables D2D communications and other than the first RAT.

[0047] Similar to the first data, the second data may be any data that can be transmitted via a D2D communication, including user plane data, control plane data, or the like. Accordingly, the terminal device 130 may obtain the second data from various sources. As an example, the terminal device 130 may generate the second data by itself so as to transmit to other terminal devices. As another example, the terminal device 130 may receive the second data from another terminal device and then transmit it to a further terminal device. As a further example, the terminal device 130 may receive the second data from a network device, such as the network device 120.

[0048] Upon obtaining the first and second data, the terminal device 130 needs to perform two D2D communications using two different RATs. As mentioned above, the terminal device 130 may employ various multiplexing technologies to transmit the first and second data. For example, the terminal device 130 may transmit the first and second data in a TDM manner, which means that the first and second D2D communications are not overlapped or simultaneous. To this end, at block 220 of Fig. 2, the terminal device 130 determines whether the first data has priority over the second data.

[0049] There may be various criteria for the terminal device 130 to determine whether the first data has a higher priority than the second data. In some embodiments, the terminal device 130 may use a criterion of latency. According to this criterion, if the first data has a specified latency less than a threshold latency, which may mean that the first data is urgent, then the terminal device 130 may consider the first data takes priority over the second data. In some embodiments, a latency for a terminal device transmitting data may generally refer to a time length between the time when the terminal device receiving the data and the time when the terminal device transmitting the data. In some other embodiments, the latency may have other reasonable definitions which can reflect a degree of urgency of data.

[0050] In applying the criterion of latency, the terminal device 130 may obtain a first latency specified for transmitting the first data and also obtain the threshold latency. Then, the terminal device 130 may compare the first latency with the threshold latency. If the first latency is less than the threshold latency, which means that the first data has a higher degree of urgency than the predetermined degree, then the terminal device 130 can determine that the first data has priority over the second data. In this way, urgency data to be transmitted via the first D2D communication can be transmitted preferentially.

[0051] In some embodiments, the threshold latency may be configured by a higher layer, that is, a layer higher than a physical layer, such as a medium access control (MAC) layer, a radio link control (RLC) layer, a packet data convergence control (PDCP) layer, a radio resource control (RRC) layer, a non-access stratum (NAS), an internet protocol (IP) layer, or the like. In this event, the terminal device 130 may receive the threshold latency from the higher layer so as to compare it with the specified latency of the first data. Therefore, the higher layer can configure whether the first data is urgent, regardless of the second data.

[0052] In some other embodiments, since the terminal device 130 is to determine which of the first and second data has a higher priority, the terminal device 130 may compare respective specified latencies of the first and second data. In other words, terminal device 130 may determine a second latency specified for transmitting the second data as the threshold latency, so as to compare it with the specified latency of the first data. For example, in case that the second RAT includes the LTE technology, the second latency may be mapped from a ProSe Per-Packet Priority (PPPP) as defined in 3GPP specifications, such as TS 23.303. In this way, the degrees of urgency of the first and second data may be compared, and more urgent data can be transmitted preferentially.

[0053] Another criterion for determining whether the first data has a higher priority than the second data may be a criterion of priority value. According to this criterion, if the first data has a priority value indicating a higher priority than a threshold priority value, the terminal device 130 may consider the first data takes priority over the second data. In applying the criterion of priority value, the terminal device 130 may obtain a first priority value of the first data and also obtain the threshold priority value. Then, the terminal device 130 can compare the first priority value with the threshold priority value. If the first priority value indicates a higher priority than the threshold priority value, the terminal device 130 may determine that the first data has priority over the second data. In this way, the priority of the first data can be represented by a value and more convenient to be compared with other priority values.

[0054] The first priority value of the first data may be any suitable value which can reflect a priority of the first data. In some embodiments, the first priority value may be configured by a higher layer, and thus the terminal device 130 may receive the first priority value from the higher layer so as to compare it with the threshold priority value. Therefore, the higher layer may control the priority level of the first data. In some other embodiments, the terminal device 130 may determine the first priority value from control information for the first D2D communication, which control information may be sent by a transmitting entity transmitted the first data. Therefore, the priority level of the first data can be flexibly set through the control information, for example, by the transmitting entity.

[0055] In some embodiments, the threshold priority value may also be configured by a higher layer, and thus the terminal device 130 may receive the first priority value from the higher layer so as to compare it with the priority value of the first data. In some other embodiments, since the terminal device 130 is to determine which of the first and second data has a higher priority, the terminal device 130 may compare a first priority value of the first data and a second priority value of the second data. Therefore, the higher layer can configure whether the first data has a high priority, regardless of the second data.

[0056] If the first priority value indicates a higher priority than the second priority value (for example, the first priority value is less than the second priority value in case that a less value indicates a higher priority), which may mean that the first data takes priority over the second data, then the terminal device 130 may determine that the first data has a higher priority than the second data. In other words, the terminal device 130 may determine the second priority value of the second data as the threshold priority value. In particular, if the second RAT includes the LTE technology, the second priority value may be the PPPP as defined in 3GPP specifications, such as TS 23.303. In this way, the priority levels of the first and second data may be compared, and the data with a higher priority level can be transmitted preferentially.

[0057] A further criterion for determining whether the first data has a higher priority than the second data may be a criterion of difference priority value. According to this criterion, if a difference value between the first priority value and the second priority value is greater than the threshold offset, the terminal device 130 may consider the first data takes priority over the second data. In this way, if the second data (for example, a packet to be transmitted via LTE D2D technology) is very urgent or important such as related to public security, the first data with a normal priority value would not preempt the resources for transmitting the second data.

[0058] In applying the criterion of difference priority value, the terminal device 130 may obtain a threshold offset for comparing the first priority value and the second priority value. If the difference value between the first priority value and the second priority value is greater than the threshold offset, the terminal device 130 may determine that the first priority value indicates a higher priority than the second priority value. In some embodiments, the threshold offset may be configured by a higher layer. In some other embodiments, the terminal device 130 may obtain the threshold offset in any other suitable manners. In this way, the second data with very high priority level, such as data related to the public safety, would not be delayed by the terminal device 130.

[0059] As a non-limiting example, the first priority value of the first data may be represented by a numerical value p, the second priority value of the second data may be represented by a numerical value P, which may be the LTE PPPP value if the second RAT includes the LTE technology, and the threshold offset may be represented by a numerical value m. In case that a lower priority value indicates a higher priority, upon calculating that $p + m < P$, the terminal device 130 can determine that the first data takes priority over the second data. It is understood that the numerical representation of a priority value is only for example, any other suitable representations can be employed in other embodiments, such as an alphabet. It is also understood that a lower priority value indicating a higher priority is only for example, a lower priority value may indicate a lower priority in other embodiments.

[0060] Further, it is appreciated that the terminal device 130 may use the criterion of latency, the criterion of priority value, and the criterion of difference priority value, as described above, either alone or in any combination. For example, the terminal device 130 may use the criterion of latency alone. In this event, if the terminal device 130 determines that the first data has a specified latency less than the threshold latency, then the terminal device 130 can directly consider that the first data has priority over the second data.

[0061] As another example, the terminal device 130 may use the criterion of difference priority value alone. In this event, if the terminal device 130 determines that the difference value between the priority values of the first and second data is greater than the threshold offset, then the terminal device 130 can directly consider that the first data has priority over the second data. In a similar way, the terminal device 130 can also utilize the criterion of priority value alone.

[0062] Alternatively, the terminal device 130 may use a combination of these criteria. For example, terminal device 130 can employ a combination of the criterion of latency and the criterion of priority value. In this event, if the terminal device 130 determines that the first data has a specified latency less than the threshold latency and has a priority value indicating a higher priority than the threshold priority value, the terminal device 130 may consider that the first data has priority over the second data.

[0063] As another example, terminal device 130 can employ a combination of the criterion of latency and the criterion of difference priority value. In this event, if the terminal device 130 determines that the first data has a specified latency less than the threshold latency and that the difference value between the priority values of the first and second data is greater than the threshold offset, the terminal device 130 may consider that the first data has priority over the second data.

[0064] Furthermore, in addition to the criteria as discussed above, the terminal device 130 may also use various other suitable criteria for determining whether the first data has priority over the second data, such as a source of data, content of data, or the like. Embodiments of the present disclosure are not limited to the criteria as described in detail herein.

[0065] At block 230, in response to determining that the first data has priority over the second data, the terminal device 130 transmits the first data prior to the second data. In other words, the terminal device 130 transmits preferentially the first data over the second data. In some embodiments, the terminal device 130 may transmit the first data using time resources pre-allocated to the second D2D communication. This may be the case that the first and second D2D communications have their respective predetermined resources, and the subsequent available resource is for the second D2D communication.

[0066] In some other embodiments, the terminal device 130 may transmit the first data using subsequent time resources common to the first and second D2D communications. This may be the case that the first and second D2D communications have common resources in addition to or instead of their respective predetermined resources. That is, in order to transmit the first data prior to the second data, the terminal device 130 preempts the resources for the second D2D communication or preempts the resources shared by the first and second D2D communications to perform the first D2D communication.

[0067] In some embodiments, the first and second D2D communications may have different minimum unit of time resources. For example, if the first and second RATs include the 5G NR and LTE technologies, respectively, the subcarrier spacing (SCS) for the first D2D communication may be 15 kHz, 30 kHz, 60 kHz, 120 kHz, 240kHz or the like, and the minimum unit (the SCS) for the second D2D communication can only be 15 kHz. The minimum units of time resources for the RATs correspond to the SCSs of the RATs. If the terminal device 130 uses time resources pre-allocated to the second D2D communication to transmit the first data, an alignment between the time resources for the first and second D2D communications may need to be performed, which will be detailed with reference to Fig. 3.

[0068] Fig. 3 is a schematic diagram showing an alignment example 300 of allocating D2D communication resources for different RATs in accordance with some embodiments of the present disclosure. As shown in Fig.3, a first set 310 of time resources for the first D2D communication includes time resources 312, 314, 316, and 318, which have a first minimum unit. A second set 320 of time resources for the second D2D communication includes time resources 322 and 324, which have a second minimum unit. In the example of Fig.3, the first minimum unit is half of the second minimum unit, for example, the first minimum unit may correspond to a SCS of 30 kHz and the second minimum unit may correspond to a SCS of 15 kHz.

[0069] Before using time resources pre-allocated to the second D2D communication to transmit the first data, the terminal device 130 may transmit an indication for indicating the time resources to be used for transmitting the first data. For the alignment between the time resources for the first and second D2D communications, the indication may indicate the time resources based on a minimum unit of time resources for the second D2D communication. For the example shown in Fig.3, the terminal device 130 may indicate the time resources which correspond to an integral multiple of a time unit associated with the SCS of 15 kHz, that is, indicate how many time slots (OFDM symbols), each of which corresponding to the SCS of 15 kHz.

[0070] In some embodiments, the indication may include a start point and a time length of the time resources to be used for transmitting the first data. For example, referring to Fig. 3, if the time resources 312, 314, 316, and 318 are to be used, the start point may be the beginning of the time resource 312 and the time length may correspond to four time resources (also referred to as time slots or OFDM symbols) of the first D2D communication, each time resource corresponding to the SCS of 30 kHz. In this way, the time resources can be indicated with a minimum information bits. It is noted that the time length is an integral multiple of (twice) the time unit associated with the SCS of 15 kHz.

[0071] In some other embodiments, the indication may include a bitmap including a bit for indicating whether a unit of time resource is to be used for transmitting the first data. For example, referring to Fig. 3, if the time resources 312, 314, 316, and 318 are to be used, the bitmap may be "00111100," in which a value of 1 indicates that the corresponding resource is to be used. It is appreciated that the specific values used herein are only for example without any limitation, and that a value of 0 may indicate that the corresponding resource is to be used in some other embodiments. In this way, the time resources can be indicated individually, which is advantageous for indicating discontinuous resources.

[0072] As described, the terminal device 130 may transmit the first D2D communication via the first RAT using a resource pre-allocated to the second D2D communication via the second RAT or a resource common to the first and second D2D communications. Therefore, as a receiving device for receiving a third D2D communication using the first RAT transmitted by another terminal device, such as the terminal device 140 or 150 in Fig. 1, the terminal device 130 may monitor on a resource pre-allocated to the second RAT or common to the first and second RATs for control information, which may be used for receiving the third D2D communication using the first RAT.

[0073] In the foregoing, there is provided the method 200 for coexistence of D2D communications using different RATs, which method may be implemented at a terminal device, for example at the terminal device 130. In the following, another method for coexistence of D2D communications using different RATs, which may be performed by a network device, will be described with reference to Fig. 4.

[0074] Fig. 4 shows a flowchart of another example method 400 in accordance with some embodiments of the present disclosure. The method 400 can be implemented at a network device, such as the network device 110 as shown in Fig. 1. Additionally or alternatively, the method 400 can also be implemented at the network device 120 and other network devices not shown in Fig. 1. For the purpose of discussion, the method 400 will be described with reference to Fig. 1 as performed by the network device 110.

[0075] Without loss of generality, it is assumed that the network device 110 is configured to allocate a first resource for the terminal device 130 to perform a first D2D communication using a first RAT. In order to prevent the first resource from overlapping in time with a second resource for the terminal device 130 to perform a second D2D communication using a second RAT, the network device 110 at block 410 of Fig. 4 obtains allocation information which can be used to derive the second resource for the terminal device 130 to perform the second D2D communication using the second RAT.

[0076] For example, the allocation information may include Time Division Duplex (TDD) configuration, SLSS information, a bitmap associated with a resource pool, or the like, and any combination thereof. In some other embodiments, the allocation information may include any appropriate information which can be used to derive the second resource for the terminal device 130 to perform a second D2D communication using a second RAT, such as the information of resources as defined in the 3GPP specifications, for example, TS 36.213.

[0077] In some embodiments, the network device 110 may receive the allocation information from a further network device configured to allocate the second resource. For example, the further network device may be network device 120 as shown in Fig. 1. In some other embodiments, the network device 110 may obtain the allocation information in any other suitable manners, such as receiving it from the terminal device 130. In some embodiments, the first RAT may include the 5G New Radio (NR) technology and the second RAT may include the Long Term Evolution (LTE) technology. In some other embodiments, the first and second RATs may be any two different RATs which support D2D communications.

[0078] At block 420, the network device 110 determines, based on the allocation information, the second resource for the terminal device 130 to perform the second D2D communication using the second RAT. Upon determining the second resource, at block 430, the network device 110 selects the first resource such that the first and second resources are non-overlapped with one another.

[0079] Fig. 5 is a simplified block diagram of a device 500 that is suitable for implementing some embodiments of the present disclosure. The device 500 can be considered as a further example embodiment of the network devices 110 and 120 as well as the terminal devices 130, 140, and 150 as shown in Fig. 1. Accordingly, the device 500 can be implemented at or as at least a part of the network devices 110, 120 and the terminal devices 130, 140, 150.

[0080] As shown, the device 500 includes a processor 510, a memory 520 coupled to the processor 510, a suitable transmitter (TX) and receiver (RX) 540 coupled to the processor 510, and a communication interface coupled to the TX/RX 540. The memory 520 stores at least a part of a program 530. The TX/RX 540 is for bidirectional communications. The TX/RX 540 has at least one antenna to facilitate communication, though in practice an Access Node mentioned in this application may have several ones. The communication interface may represent any interface that is necessary for communication with other network elements, such as X2 interface for bidirectional communications between gNBs or eNBs, S1 interface for communication between a Mobility Management Entity (MME)/Serving Gateway (S-GW) and the gNB or eNB, Un interface for communication between the gNB or eNB and a relay node (RN), or Uu interface for communication between the gNB or eNB and a terminal device.

[0081] The program 530 is assumed to include program instructions that, when executed by the associated processor 510, enable the device 500 to operate in accordance with the embodiments of the present disclosure, as discussed herein with reference to Fig. 2 or 4. The embodiments herein may be implemented by computer software executable by the processor 510 of the device 500, or by hardware, or by a combination of software and hardware. The processor 510 may be configured to implement various embodiments of the present disclosure. Furthermore, a combination of the processor 510 and memory 520 may form processing means 550 adapted to implement various embodiments of the present disclosure.

[0082] The memory 520 may be of any type suitable to the local technical network and may be implemented using any suitable data storage technology, such as a non-transitory computer readable storage medium, semiconductor based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory, as non-limiting examples. While only one memory 520 is shown in the device 500, there may be several physically distinct memory modules in the device 500. The processor 510 may be of any type suitable to the local technical network, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multicore processor architecture, as non-limiting examples. The device 500 may have multiple processors, such as an application specific integrated circuit chip that is slaved in time to a clock which synchronizes the main processor.

[0083] The components included in the apparatuses and/or devices of the present disclosure may be implemented in various manners, including software, hardware, firmware, or any combination thereof. In one embodiment, one or more units may be implemented using software and/or firmware, for example, machine-executable instructions stored on the storage medium. In addition to or instead of machine-executable instructions, parts or all of the units in the apparatuses and/or devices may be implemented, at least in part, by one or more hardware logic components. For example, and without limitation, illustrative types of hardware logic components that can be used include Field-programmable Gate Arrays (FPGAs), Application-specific Integrated Circuits (ASICs), Application-specific Standard Products (ASSPs), System-on-a-chip systems (SOCs), Complex Programmable Logic Devices (CPLDs), and the like.

[0084] Generally, various embodiments of the present disclosure may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. Some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device. While various aspects of embodiments of the present disclosure are illustrated and described as block diagrams, flowcharts, or using some other pictorial representation, it will be appreciated that the blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[0085] The present disclosure also provides at least one computer program product tangibly stored on a non-transitory computer readable storage medium. The computer program product includes computer-executable instructions, such as those included in program modules, being executed in a device on a target real or virtual processor, to carry out the process or method as described above with reference to any of Figs. 5 and 6. Generally, program modules include routines, programs, libraries, objects, classes, components, data structures, or the like that perform particular tasks or implement particular abstract data types.

The functionality of the program modules may be combined or split between program modules as desired in various embodiments. Machine-executable instructions for program modules may be executed within a local or distributed device. In a distributed device, program modules may be located in both local and remote storage media.

[0086] Program code for carrying out methods of the present disclosure may be written in any combination of one or more programming languages. These program codes may be provided to a processor or controller of a general purpose computer, special purpose computer, or other programmable data processing apparatus, such that the program codes, when executed by the processor or controller, cause the functions/operations specified in the flowcharts and/or block diagrams to be implemented. The program code may execute entirely on a machine, partly on the machine, as a stand-alone software package, partly on the machine and partly on a remote machine or entirely on the remote machine or server.

[0087] The above program code may be embodied on a machine readable medium, which may be any tangible medium that may contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device. The machine readable medium may be a machine readable signal medium or a machine readable storage medium. A machine readable medium may include but not limited to an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples of the machine readable storage medium would include an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[0088] Further, while operations are depicted in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific embodiment details are contained in the above discussions, these should not be construed as limitations on the scope of the present disclosure, but rather as descriptions of features that may be specific to particular embodiments. Certain features that are described in the context of separate embodiments may also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment may also be implemented in multiple embodiments separately or in any suitable sub-combination.

[0089] Although the present disclosure has been described in language specific to structural features and/or methodological acts, it is to be understood that the present disclosure defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

WHAT IS CLAIMED IS:

1. A method for communication, comprising:

obtaining first data to be transmitted via a first Device-to-Device (D2D) communication using a first radio access technology (RAT) and second data to be transmitted via a second D2D communication using a second RAT, the first and second RATs being different from one another;

determining whether the first data has priority over the second data; and

in response to determining that the first data has priority over the second data, transmitting the first data prior to the second data.

2. The method of claim 1, wherein determining whether the first data has priority over the second data comprises:

obtaining a first latency specified for transmitting the first data;

obtaining a threshold latency;

comparing the first latency with the threshold latency; and

in response to the first latency being less than the threshold latency, determining that the first data has priority over the second data.

3. The method of claim 2, wherein obtaining the threshold latency comprises at least one of:

receiving the threshold latency from a layer higher than a physical layer; and

determining a second latency specified for transmitting the second data as the threshold latency.

4. The method of claim 1, wherein determining whether the first data has priority over the second data comprises:

obtaining a first priority value of the first data;

obtaining a threshold priority value;

comparing the first priority value with the threshold priority value; and

in response to the first priority value indicating a higher priority than the threshold priority value, determining that the first data has priority over the second data.

5. The method of claim 4, wherein obtaining the first priority value comprises at least one of:

receiving the first priority value from a layer higher than a physical layer; and

determining the first priority value from control information for the first D2D communication.

6. The method of claim 4, wherein obtaining the threshold priority value comprises at least one of:

receiving the threshold priority value from a layer higher than a physical layer; and

determining a second priority value of the second data as the threshold priority value.

7. The method of claim 6, wherein comparing the first priority value with the threshold priority value comprises:

obtaining a threshold offset for comparing the first priority value and the second priority value; and

in response to determining that a difference value between the first priority value and the second priority value is greater than the threshold offset, determining that the first priority value indicates a higher priority than the second priority value.

8. The method of claim 1, wherein transmitting the first data prior to the second data comprises at least one of:

transmitting the first data using time resources pre-allocated to the second D2D communication; and

transmitting the first data using subsequent time resources common to the first and second D2D communications.

9. The method of claim 1, further comprising:

transmitting an indication for indicating time resources to be used for transmitting the first data, the indication indicating the time resources based on a minimum unit of time resources for the second D2D communication.

10. The method of claim 9, wherein the indication comprises at least one of:

a start point and a time length of the time resources to be used for transmitting the first data; and

a bitmap including a bit for indicating whether a unit of time resource is to be used for transmitting the first data.

11. The method of claim 1, further comprising:

monitoring on a resource pre-allocated to the second RAT or common to the first and second RATs for control information for receiving a third D2D communication using the first RAT.

12. The method of claim 1, wherein the first RAT comprises the 5G New Radio (NR) technology, and the second RAT comprises the Long Term Evolution (LTE) technology.

13. A method for communication, comprising:

obtaining allocation information at a network device, the network device configured to allocate a first resource for a terminal device to perform a first Device-to-Device (D2D) communication using a first radio access technology (RAT);

determining, based on the allocation information, a second resource for the terminal device to perform a second D2D communication using a second RAT, the first and second RATs being different from one another; and

selecting the first resource such that the first and second resources are non-overlapped with one another.

14. The method of claim 13, wherein obtaining the allocation information comprises:

receiving the allocation information from a further network device configured to allocate the second resource.

15. The method of claim 13, wherein the allocation information comprises at least one of Time Division Duplex (TDD) configuration, SLSS information, and a bitmap associated with a resource pool.

16. The method of claim 13, wherein the first RAT comprises the 5G New Radio (NR) technology and the second RAT comprises the Long Term Evolution (LTE) technology.

17. A terminal device, comprising:

a processor; and

a memory storing instructions,

the memory and the instructions being configured, with the processor, to cause the terminal device to:

obtain first data to be transmitted via a first Device-to-Device (D2D) communication using a first radio access technology (RAT) and second data to be transmitted via a second D2D communication using a second RAT, the first and second RATs being different from one another;

determine whether the first data has priority over the second data; and

in response to determining that the first data has priority over the second data, transmit the first data prior to the second data.

18. The terminal device of claim 17, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to:

obtain a first latency specified for transmitting the first data;

obtain a threshold latency;

compare the first latency with the threshold latency; and

in response to the first latency being less than the threshold latency, determine that the first data has priority over the second data.

19. The terminal device of claim 18, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to at least one of:

receive the threshold latency from a layer higher than a physical layer; and

determine a second latency specified for transmitting the second data as the threshold latency.

20. The terminal device of claim 17, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to:

obtain a first priority value of the first data;

obtain a threshold priority value;

compare the first priority value with the threshold priority value; and in response to the first priority value indicating a higher priority than the threshold priority value, determine that the first data has priority over the second data.

21. The terminal device of claim 20, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to at least one of:

receive the first priority value from a layer higher than a physical layer; and

determine the first priority value from control information for the first D2D communication.

22. The terminal device of claim 20, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to at least one of:

receive the threshold priority value from a layer higher than a physical layer; and

determine a second priority value of the second data as the threshold priority value.

23. The terminal device of claim 22, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to:

obtain a threshold offset for comparing the first priority value and the second priority value; and

in response to determining that a difference value between the first priority value and the second priority value is greater than the threshold offset, determine that the first priority value indicates a higher priority than the second priority value.

24. The terminal device of claim 17, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to at least one of:

transmit the first data using time resources pre-allocated to the second D2D communication; and

transmit the first data using subsequent time resources common to the first and second D2D communications.

25. The terminal device of claim 17, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to:

transmit an indication for indicating time resources to be used for transmitting the first data, the indication indicating the time resources based on a minimum unit of time resources for the second D2D communication.

26. The terminal device of claim 25, wherein the indication comprises at least one of:

a start point and a time length of the time resources to be used for transmitting the first data; and

a bitmap including a bit for indicating whether a unit of time resource is to be used for transmitting the first data.

27. The terminal device of claim 17, wherein the memory and the instructions are further configured, with the processor, to cause the terminal device to:

monitor on a resource pre-allocated to the second RAT or common to the first and second RATs for control information for receiving a third D2D communication using the first RAT.

28. The terminal device of claim 17, wherein the first RAT comprises the 5G New Radio (NR) technology, and the second RAT comprises the Long Term Evolution (LTE) technology.

29. A network device, comprising:

a processor; and

a memory storing instructions,

the memory and the instructions being configured, with the processor, to cause the network device to:

obtain allocation information at the network device, the network device configured to allocate a first resource for a terminal device to perform a first Device-to-Device (D2D) communication using a first radio access technology (RAT);

determine, based on the allocation information, a second resource for the terminal device to perform a second D2D communication using a second RAT, the first and second RATs being different from one another; and

select the first resource such that the first and second resources are non-overlapped with one another.

30. The network device of claim 29, the memory and the instructions are further configured, with the processor, to cause the network device to:

receive the allocation information from a further network device configured to allocate the second resource.

31. The network device of claim 29, wherein the allocation information comprises at least one of Time Division Duplex (TDD) configuration, SLSS information, and a bitmap associated with a resource pool.

32. The network device of claim 29, wherein the first RAT comprises the 5G New Radio (NR) technology and the second RAT comprises the Long Term Evolution (LTE) technology.

33. A computer readable medium having instructions stored thereon, the instructions, when executed on at least one processor of a device, causing the device to carry out the method according to any of claims 1 to 12.

34. A computer readable medium having instructions stored thereon, the instructions, when executed on at least one processor of a device, causing the device to carry out the method according to any of claims 13 to 16.

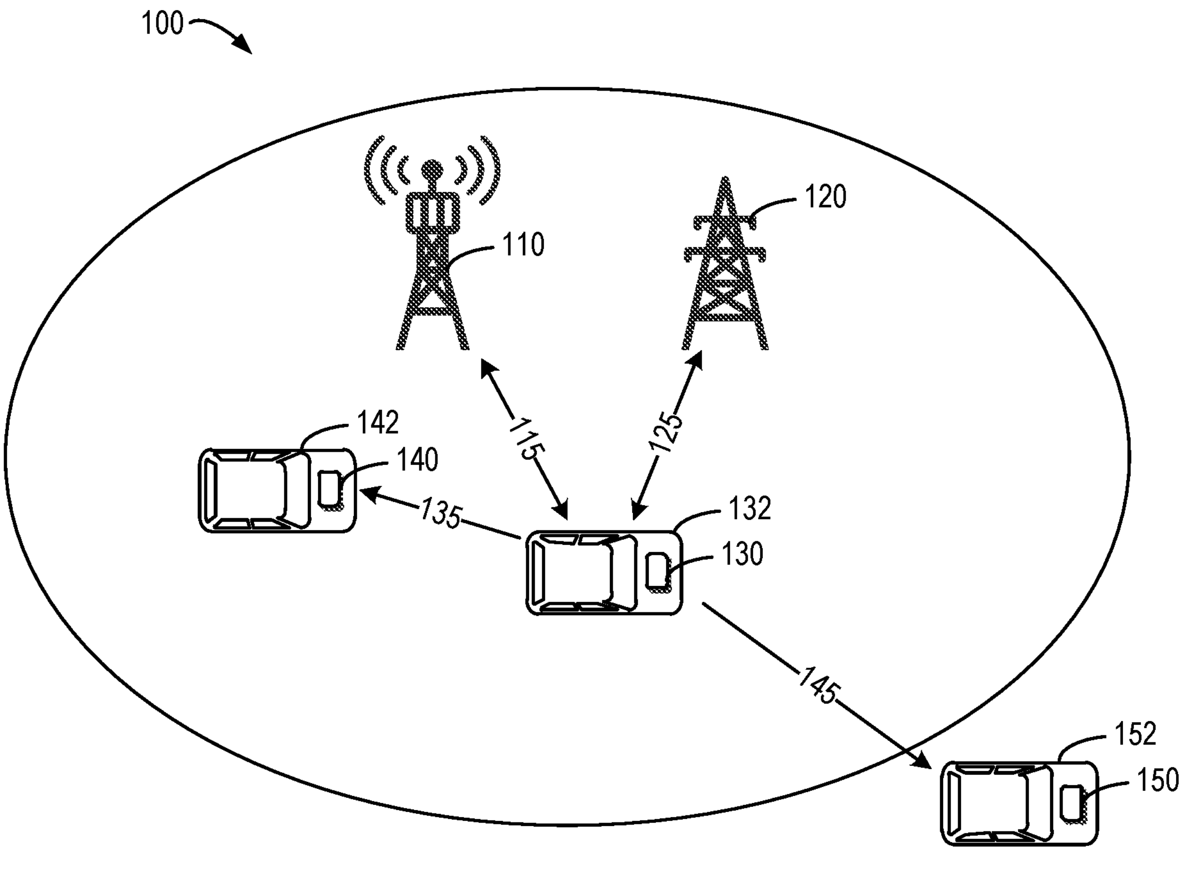

FIG. 1

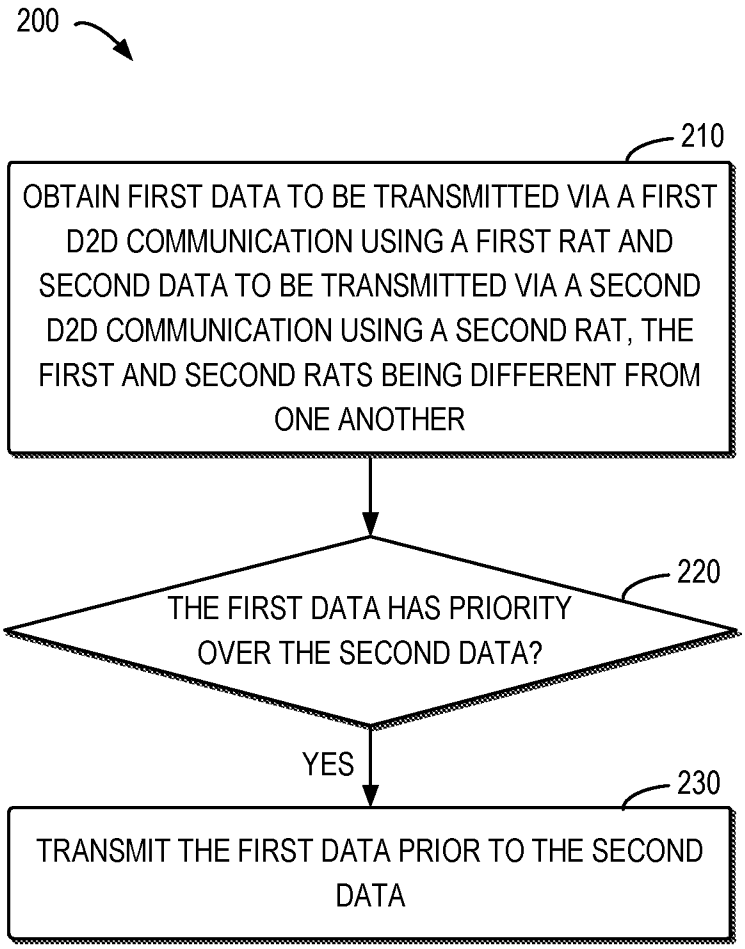
200
210
OBTAIN FIRST DATA TO BE TRANSMITTED VIA A FIRST D2D COMMUNICATION USING A FIRST RAT AND SECOND DATA TO BE TRANSMITTED VIA A SECOND D2D COMMUNICATION USING A SECOND RAT, THE FIRST AND SECOND RATS BEING DIFFERENT FROM ONE ANOTHER
220
THE FIRST DATA HAS PRIORITY OVER THE SECOND DATA?
YES
230
TRANSMIT THE FIRST DATA PRIOR TO THE SECOND DATA

FIG. 2

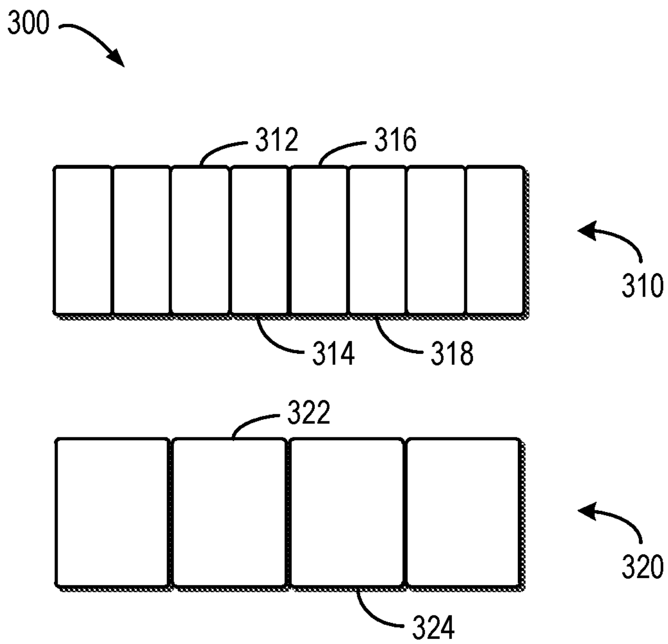

FIG.3

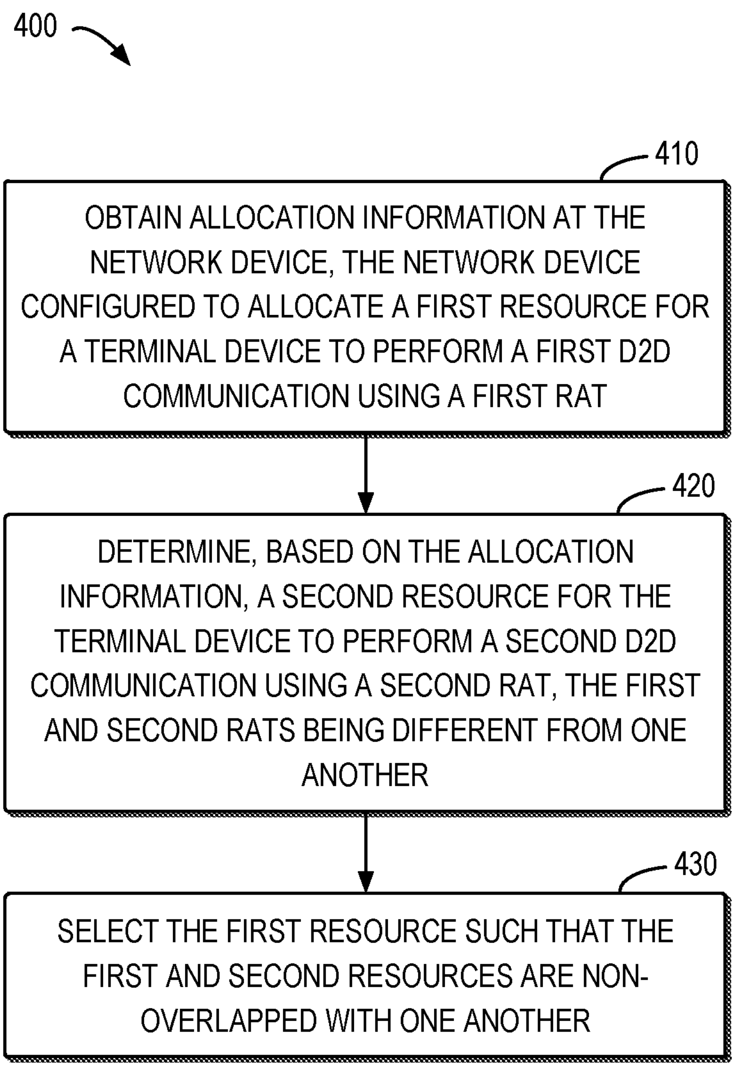
400
410
OBTAIN ALLOCATION INFORMATION AT THE NETWORK DEVICE, THE NETWORK DEVICE CONFIGURED TO ALLOCATE A FIRST RESOURCE FOR A TERMINAL DEVICE TO PERFORM A FIRST D2D COMMUNICATION USING A FIRST RAT
420
DETERMINE, BASED ON THE ALLOCATION INFORMATION, A SECOND RESOURCE FOR THE TERMINAL DEVICE TO PERFORM A SECOND D2D COMMUNICATION USING A SECOND RAT, THE FIRST AND SECOND RATS BEING DIFFERENT FROM ONE ANOTHER
430
SELECT THE FIRST RESOURCE SUCH THAT THE FIRST AND SECOND RESOURCES ARE NON-OVERLAPPED WITH ONE ANOTHER

FIG.4

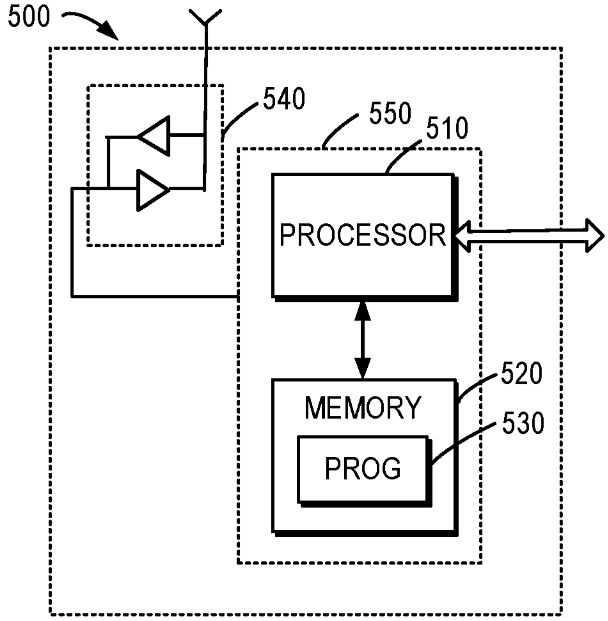

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/121327

A. CLASSIFICATION OF SUBJECT MATTER

H04W 72/04(2009.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W H04L H04B

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

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

CNPAT,CNKI,WPI,EPODOC,3GPP:NR, LTE, D2D, V2X, V2V,sidelink,prioritization, priority, overlap, no, non

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	INTERDIGITAL INC. "On Coexistence of LTE V2X sidelink and NR V2X Sidelink" *3GPP TSG RAN WG1 Meeting #95 R1-1813232,* 16 November 2018 (2018-11-16), sections 1-3	1-34
X	ZTE et al. "In-device coexistence between NR V2X and LTE V2X" *3GPP TSG RAN WG2 Meeting #104 R2-1816996,* 16 November 2018 (2018-11-16), sections 1-3	1-12, 17-28, 33
X	ZTE et al. "Coexistence between NR V2X and LTE V2X" *3GPP TSG RAN WG1 Meeting #95 R1-1813178,* 16 November 2018 (2018-11-16), sections 1-3	1-12, 17-28, 33
X	QUALCOMM INCORPORATED. "Co-existence aspects for NR-V2X and LTE-V2X" *3GPP TSG RAN WG1 Meeting #95 R1-1813428,* 16 November 2018 (2018-11-16), sections 1-5	13-16, 29-32, 34
A	WO 2018145628 A1 (CHINA ACADEMY OF TELECOMMUNICATIONS TECHNOLOGY) 16 August 2018 (2018-08-16) the whole document	1-34

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

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Date of the actual completion of the international search	Date of mailing of the international search report
26 August 2019	**16 September 2019**

Name and mailing address of the ISA/CN	Authorized officer
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INTERNATIONAL SEARCH REPORT
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International application No.
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