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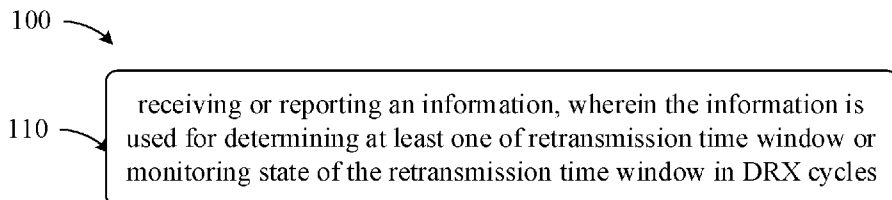


FIG. 2

(57) Abstract: A wireless communication method and related devices are provided. The method, performed by a user equipment (UE), including receiving or reporting an information, wherein the information is used for determining at least one of retransmission time window or monitoring state of the retransmission time window in Discontinuous Reception (DRX) cycles. With this method, UE capacity and power saving performance can be achieved.

WIRELESS COMMUNICATION METHOD AND RELATED DEVICES

TECHNICAL FIELD

[0001] The present application relates to wireless communication technologies, and more particularly, to wireless communication method, and related devices such as a user equipment (UE) and a base station (BS) (e.g., a gNB).

BACKGROUND ART

[0002] Wireless communication systems, such as the third-generation (3G) of mobile telephone standards and technology are well known. Such 3G standards and technology have been developed by the Third Generation Partnership Project (3GPP). The 3rd generation of wireless communications has generally been developed to support macro-cell mobile phone communications. Communication systems and networks have developed towards being a broadband and mobile system. In cellular wireless communication systems, user equipment (UE) is connected by a wireless link to a radio access network (RAN). The RAN includes a set of base stations (BSs) which provide wireless links to the UEs located in cells covered by the base stations, and an interface to a core network (CN) which provides overall network control. The RAN and CN each conducts respective functions in relation to the overall network.

[0003] The 3GPP has developed the so-called Long-Term Evolution (LTE) system, namely, an Evolved Universal Mobile Telecommunication System Territorial Radio Access Network (E-UTRAN), for a mobile access network where one or more macro-cells are supported by base station knowns as an eNodeB or eNB (evolved NodeB). More recently, LTE is evolving further towards the so-called 5G or NR (new radio) systems where one or more cells are supported by base stations known as a next generation Node B called gNodeB (gNB).

[0004] The 5G New Radio (NR) standard will support a multitude of different services each with very different requirements. These services include Enhanced Mobile Broadband (eMBB) for high data rate transmission, Ultra-Reliable Low Latency Communication (URLLC) for devices requiring low latency and high link reliability and Massive Machine-Type Communication (mMTC) to support a large number of low-power devices for a long life-time requiring highly energy efficient communication.

[0005] EXTended Reality (XR) and Cloud Gaming are some of the most important 5G media applications under consideration in the industry. XR is an umbrella term for different types of realities and refers to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearable devices. It includes representative forms such as Augmented Reality (AR), Mixed Reality (MR) and Virtual Reality (VR) and the areas interpolated among them. A new Study Item Description (SID) on XR evaluation has been approved, the characteristics of XR traffic and challenges are summarized below:

[0006] ▪ High data rate with limited latency

[0007] For 3D VR videos with high resolution based on different frame rates, color codecs, bit-depths, compression rates and etc., the transmission data rate could be up to 60Mbps and above with limited latency, around 10~30ms.

[0008] ▪ Non-integer period with jitter

[0009] It has been agreed that 60 frames per second (fps) is baseline for both Downlink (DL) and Uplink (UL) video stream and 30 fps, 90 fps as well as 120 fps can be also optionally evaluated. Based on the formula of arrival time of packet, the corresponding periodicities are {33.33ms, 16.67ms, 11.11ms, 8.33ms}. In addition, there exists

jitter characteristic for XR traffic arrival. According to RAN1 agreements, the jitter can be modeled as truncated Gaussian distribution with varying range of [-4,4] ms (baseline) or [-5,5] ms (optional).

[0010] ▪ Varying frame size

[0011] In the field of video compression, three major frame types are defined through three different video algorithms with the following characteristics:

[0012] - I-frames are the least compressible which can decode independently

[0013] - P-frames can use previous frames to decompress and are more compressible than I-frames.

[0014] - B-frames can use both previous and forward frames to get the highest amount of data compression.

[0015] There is a need to solve the problems raised when merging the XR services into cellular wireless communication, especially for XR service transmission in New Radio (NR).

SUMMARY

[0016] The objective of the present application is to provide a wireless communication method and related devices for solving issues in the prior arts, achieving UE capacity and power saving performance, solving the jitter issue of XR services, improving XR service experience, or providing good communication performance.

[0017] In a first aspect, an embodiment of the present application provides a wireless communication method, performed by a user equipment (UE) in a network, the method including: receiving or reporting an information, wherein the information is used for determining at least one of retransmission time window or monitoring state of the retransmission time window in Discontinuous Reception (DRX) cycles.

[0018] In a second aspect, an embodiment of the present application provides a wireless communication method, performed by a user equipment (UE) in a network, the method including: being configured multiple monitoring patterns for Discontinuous Reception (DRX).

[0019] In a third aspect, an embodiment of the present application provides a wireless communication method, performed by a base station (BS) in a network, the method including: transmitting or receiving an information, wherein the information is used for determining at least one of retransmission time window or monitoring state of the retransmission time window in Discontinuous Reception (DRX) cycles.

[0020] In a fourth aspect, an embodiment of the present application provides a wireless communication method, performed by a base station (BS) in a network, the method including: configuring a user equipment (UE) multiple monitoring patterns for Discontinuous Reception (DRX).

[0021] In a fifth aspect, an embodiment of the present application provides a UE, including a processor configured to call and run program instructions stored in a memory, to execute the method of any of the first or the second aspect.

[0022] In a sixth aspect, an embodiment of the present application provides a BS, including a processor configured to call and run program instructions stored in a memory, to execute the method of any of the third or the fourth aspect.

[0023] In a seventh aspect, an embodiment of the present application provides a computer readable storage medium provided for storing a computer program, which enables a computer to execute the method of any of the first to the fourth aspects.

[0024] In an eighth aspect, an embodiment of the present application provides a computer program product, which includes computer program instructions enabling a computer to execute the method of any of the first to the fourth aspects.

[0025] In a ninth aspect, an embodiment of the present application provides a computer program, when running on a computer, enabling the computer to execute the method of any of the first to the fourth aspects.

DESCRIPTION OF DRAWINGS

[0026] In order to more clearly illustrate the embodiments of the present application or related art, the following figures that will be described in the embodiments are briefly introduced. It is obvious that the drawings are merely some embodiments of the present application, a person having ordinary skill in this field can obtain other figures according to these figures without paying the premise.

[0027] FIG. 1 is a schematic block diagram illustrating a communication network system according to an embodiment of the present application.

[0028] FIG. 2 is a flowchart of a wireless communication method according to a first embodiment of the present application.

[0029] FIG. 3 is a schematic diagram illustrating an exemplary process that UE skips or monitors PDCCH of CG re-transmission according to an embodiment of the present application.

[0030] FIG. 4 is a schematic diagram illustrating an exemplary process that UE skips or monitors PDCCH of PUSCH re-transmission according to an embodiment of the present application.

[0031] FIG. 5 is a flowchart of a wireless communication method according to a second embodiment of the present application.

[0032] FIG. 6 is a schematic diagram illustrating multiple drx-onDurationTimer configuration according to an embodiment of the present application.

[0033] FIG. 7 is a schematic diagram illustrating a combination of WUS pattern and drx-onDurationTimer according to an embodiment of the present application.

DETAILED DESCRIPTION OF EMBODIMENTS

[0034] Embodiments of the 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 application are merely for describing the purpose of the certain embodiment, but not to limit the disclosure.

[0035] Discontinuous Reception (DRX) is one of the efficient approaches for User Equipment (UE) power saving. UE needs to monitor Physical Downlink Control Channel (PDCCH) on active time of DRX and can go asleep on time duration of DRX-OFF. Legacy DRX mechanism is suitable for non-sensitive latency traffic or no-jitter traffic. More details are shown below:

[0036] According to current 3GPP specification, the MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, CI-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, TPC-SRS-RNTI, AI-RNTI, SL-RNTI, SLCS-RNTI and SL Semi-Persistent Scheduling V-RNTI. When using DRX operation, the MAC entity shall

also monitor PDCCH. When in RRC_CONNECTED, if DRX is configured, for all the activated Serving Cells, the MAC entity may monitor the PDCCH discontinuously using the DRX operation; otherwise, the MAC entity shall monitor the PDCCH as specified in TS 38.213. RRC controls DRX operation by configuring the following parameters:

- [0037] - *drx-onDurationTimer*: the duration at the beginning of a DRX cycle;
- [0038] - *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;
- [0039] - *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;
- [0040] - *drx-RetransmissionTimerDL* (per DL HARQ process except for the broadcast process): the maximum duration until a DL retransmission is received;
- [0041] - *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;
- [0042] - *drx-LongCycleStartOffset*: the Long DRX cycle and *drx-StartOffset* which defines the subframe where the Long and Short DRX cycle starts;
- [0043] - *drx-ShortCycle* (optional): the Short DRX cycle;
- [0044] - *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;
- [0045] - *drx-HARQ-RTT-TimerDL* (per DL HARQ process except for the broadcast process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;
- [0046] - *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity;
- [0047] - *drx-RetransmissionTimerSL* (per SL HARQ process): the maximum duration until a grant for SL retransmission is received;
- [0048] - *drx-HARQ-RTT-TimerSL* (per SL HARQ process): the minimum duration before an SL retransmission grant is expected by the MAC entity;
- [0049] - *ps-Wakeup* (optional): the configuration to start associated *drx-onDurationTimer* in case DCP is monitored but not detected;
- [0050] - *ps-TransmitOtherPeriodicCSI* (optional): the configuration to report periodic CSI that is not L1-RSRP on PUCCH during the time duration indicated by *drx-onDurationTimer* in case DCP is configured but associated *drx-onDurationTimer* is not started;
- [0051] - *ps-TransmitPeriodicL1-RSRP* (optional): the configuration to transmit periodic CSI that is L1-RSRP on PUCCH during the time duration indicated by *drx-onDurationTimer* in case DCP is configured but associated *drx-onDurationTimer* is not started;
- [0052] - *uplinkHARQ-Mode* (optional): the configuration to set the HARQ mode per UL HARQ process.
- [0053] In current 3GPP specification, a UE can be provided a set of durations by *PDCCHSkippingDurationList* for PDCCH monitoring on an active DL BWP of a serving cell, and if the UE is not provided *searchSpaceGroupIdList-r17* on the active DL BWP of the serving cell, a DCI format 0_1 and a DCI format 0_2 that schedule PUSCH transmission, and a DCI format 1_1 and a DCI format 1_2 that schedule PDSCH receptions can include a PDCCH

monitoring adaptation field of 1 bit or of 2 bits. When DRX is configured and a time window within a duration of PDCCH skipping, then UE needn't wake up for monitoring a PDCCH on the time window.

[0054] Following issues are identified for service traffic such as EXtended Reality (XR) service transmission.

[0055] Discontinuous Reception (DRX) is one of the efficient approaches for User Equipment (UE) power saving since DRX-OFF state is configured. When both DRX and CG/SPS are transmitted/received or DRX is configured, if the parameters of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* are configured, the UE needs to wake up and monitor the grant of Re-transmission. In general, the re-transmission probability of a XR TB is very low (0.01 or 0.001) when one shot transmission mechanism is used. The target Block Error Rate (BLER) for initial transmission is 0.1 if one shot transmission is not enabled; however, the probability is also low. In other word, UE needn't wake up for monitoring PDCCH occasion at most of the time window of re-transmission. Therefore, whether a UE needs to monitor Re-transmission DCI or not needs to be studied. In addition, in current 3GPP specification, if PDCCH skipping signalling is indicated, then UE would not monitor PDCCH occasion during re-transmission time window. When a NACK for a PDSCH/SPS is to be fed back by UE, there is no PDCCH monitoring occasion for UE until next DRX on duration time. As a result, large latency will be caused. So, some enhanced approaches for this problem should also be studied.

[0056] Issue 1: Whether to monitor re-transmission grant or not during the re-transmission time window for UE should be studied.

[0057] DRX is one of the efficient approaches for UE power saving since UE can step into DRX-OFF state and at this state UE will suspend PDCCH monitoring and can go to sleeping for UE power saving. As discussed in Rel-17 RAN1 meeting, a truncated Gaussian distribution is used to model the jitter of DL and UL video stream for XR services. The range of jitter is agreed to be [-4, 4] ms (baseline) and [-5, 5] ms (optional). This means the XR packets may arrive at gNB or UE within a time window of 8ms or 10ms length, and the exact arrival time is not known in advance for a packet. When the XR traffic is arrived before DRX-ON, then a scheduling grant will be monitored in DRX on duration time. However, when the XR traffic is arrived after DRX-ON, UE needs to wait for a scheduling grant in a next DRX cycle. As a result, large latency will be caused.

[0058] Issue 2: Some enhancement approaches to handle the jitter of XR for DRX should be considered.

[0059] The invention of this disclosure can be summarized as below:

[0060] For UE power saving, this disclosure propose approaches to support UE to determine whether to skip a time window of re-transmission or not. In addition, some approaches to support UE to monitor re-transmission grant at an expected location are also given. These approaches are described briefly as follows:

[0061] Scheme 1: a set of the *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* values can be configured for a DRX, and a signalling to indicate one of the values within the set to UE.

[0062] Scheme 2: a set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* values can be configured for a DRX, and a signalling to indicate one of the values within the set to UE, where the values within the set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* is different.

[0063] Scheme 3: both a set of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* values and a set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* values can be configured for a DRX. A value within the set

of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* values and a value within the set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* values are indicated to a UE.

[0064] Scheme 4: a priority rule is introduced to determine whether the UE needs to skip or monitor the PDCCH or not during the time window of re-transmission for the case the time window of re-transmission of a transmission is indicated as skipped by a data scheduling DCI.

[0065] Scheme 5: a signalling is used to indicate the length of *drx-ReTransmissionTimer* for PDCCH monitoring. The signalling can be a DCI or a DCI piggybacked PDSCH or a new RNTI scrambled DCI or MAC CE.

[0066] This disclosure proposes potential approaches to support XR services with jitter (including predictable or unpredictable jitter between video frames), as follows:

[0067] Scheme 1: multiple values of *drx-onDurationtimer* can be configured. The *drx-onDurationtimer* time duration can be same or different for adjacent DRX cycles.

[0068] Scheme 2: combination of wake up signal (WUS) monitoring pattern and *drx-onDurationtimer* can be considered. Multiple WUS can be configured before *drx-onDurationtimer* or/and after *drx-onDurationtimer* within a DRX cycle.

[0069] Scheme 3: multiple PDCCH monitoring pattern can be configured for DRX. The pattern can be adjusted based on jitter arrived implicitly. Some PDCCH monitoring pattern can be skipped based on the jitter case in front of the DRX cycle.

[0070] The proposed approaches to support to skip or monitor PDCCH during the re-transmission time window, and the capacity and power saving performance can be achieved. In addition, potential approaches to solve the jitter issue of XR service is also given and can improve the XR service experience.

[0071] FIG. 1 illustrates that, in some embodiments, one or more user equipments (UEs) 10 and a base station (e.g., gNB or eNB) 20 for wireless communication in a communication network system 30 according to an embodiment of the present application are provided. The communication network system 30 includes the one or more UEs 10 and the base station 20. The one or more UEs 10 may include a memory 12, a transceiver 13, and a processor 11 coupled to the memory 12 and the transceiver 13. The base station 20 may include a memory 22, a transceiver 23, and a processor 21 coupled to the memory 22 and the transceiver 23. The processor 11 or 21 may be configured to implement proposed functions, procedures and/or methods described in this description. Layers of radio interface protocol may be implemented in the processor 11 or 21. The memory 12 or 22 is operatively coupled with the processor 11 or 21 and stores a variety of information to operate the processor 11 or 21. The transceiver 13 or 23 is operatively coupled with the processor 11 or 21, and the transceiver 13 or 23 transmits and/or receives a radio signal.

[0072] The processor 11 or 21 may include application-specific integrated circuit (ASIC), other chipset, logic circuit and/or data processing device. The memory 12 or 22 may include read-only memory (ROM), random access memory (RAM), flash memory, memory card, storage medium and/or other storage device. The transceiver 13 or 23 may include baseband circuitry to process radio frequency signals. When the embodiments are implemented in software, the techniques described herein can be implemented with modules (e.g., procedures, functions, and so on) that perform the functions described herein. The modules can be stored in the memory 12 or 22 and executed by the processor 11 or 21. The memory 12 or 22 can be implemented within the processor 11 or 21 or external to the processor

11 or 21 in which case those can be communicatively coupled to the processor 11 or 21 via various means as is known in the art.

[0073] For UE power saving, this disclosure proposes approaches to support whether UE to skip a time window of re-transmission or not. In addition, some approaches to support UE to monitor re-transmission grant at an expected location are also given. When both DRX and CG/Semi-Persistent Scheduling (SPS) are transmitted/received or DRX is configured, if the parameters of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* are configured, the UE needs to wake up and monitor the grant of re-transmission. However, the configured semi-static time window of re-transmission (means *drx-ReTransmissionTimer*) is not friendly for UE power saving since UE needn't wake up to monitor PDCCH at most of the time window of re-transmission, some unnecessary time window of re-transmission can be skipped or dynamically adjusted. In addition, in current 3GPP specification, if PDCCH skipping signalling is indicated, then UE would not monitor PDCCH occasion during re-transmission time window. When a NACK for a PDSCH/SPS is fed back by UE, there is no PDCCH monitoring occasion for UE until next DRX on duration time. As a result, large latency will be caused. The additional PDCCH monitoring occasion during the PDCCH skipping duration time for Re-transmission can be indicated to UE. The following approaches can be considered.

[0074] FIG. 2 is a flowchart of a wireless communication method according to a first embodiment of the present application. Referring to FIG. 2 in conjunction with FIG. 1, the method 100 includes the following. In Step 110, the UE receives from the BS or reports to the BS an information, wherein the information is used for determining at least one of retransmission time window or monitoring state of the retransmission time window in Discontinuous Reception (DRX) cycles. That is, the information can be indicated by the BS, or the information can be reported by the UE. The retransmission time window may include at least one of a duration of the retransmission time window, or a start of retransmission time window, or the start and the duration of the retransmission time window. The monitoring state of the retransmission time window may be an on state that UE monitors at retransmission time window in DRX cycles or an off state that UE skips the retransmission time window in DRX cycles. With this method, UE capacity and power saving performance can be achieved.

[0075] In an embodiment of the present application, the retransmission time window is determined by a drx-retransmission timer. Specifically, the receiving or reporting step of the information includes: being configured a set of drx-retransmission timer values for DRX, wherein the drx-retransmission timer values in the set are different or same; and receiving a signaling used to indicate one of the values within the set. In an embodiment, the retransmission time window is determined by a drx-Hybrid Automatic Repeat reQuest (HARQ) RTT timer. Specifically, the receiving or reporting step of the information includes: being configured a set of drx-HARQ RTT timer values for DRX, wherein drx-HARQ RTT timer values in the set are different or same; and receiving a signaling used to indicate one of the values within the set. In an embodiment, the retransmission time window is determined by a drx-retransmission timer and a drx-HARQ-RTT timer. In an example, values of the drx-retransmission timer and the drx-HARQ-RTT timer are indicated jointly. In addition, indication of values of the drx-retransmission timer or the drx-HARQ RTT timer is carried out by Downlink Control Information (DCI) or Uplink Control Information (UCI) or Media Access Control (MAC) Control Element (CE) or piggyback DCI in Physical Downlink Shared Channel (PDSCH) or piggyback UCI in Physical Uplink Shared Channel (PUSCH) or a new RNTI scrambled DCI or any combination of these signals.

[0076] In an embodiment of the present application, the method further includes: receiving a skipping or monitoring indication for skipping or monitoring Physical Downlink Control Channel (PDCCH) monitor occasions of the retransmission time window in the DRX cycles. Further, the method includes: determining whether to wake up at the PDCCH monitor occasions on the retransmission time window based on priority, wherein if the priority of skipping the PDCCH monitor occasions is higher than the priority of monitoring at the PDCCH monitor occasions, the UE wakes up to monitor at the PDCCH monitor occasions on the retransmission time window, wherein if the priority of skipping the PDCCH monitor occasions is lower than the priority of monitoring at the PDCCH monitor occasions, the UE skips the PDCCH monitor occasions on the retransmission time window. In an embodiment, the priority is configured or pre-defined or is determined in an implicit way. In an embodiment, the priority is determined based on the priority of a configured grant and the priority of a DCI with the skipping indication. In an embodiment, the priority is determined based on the priority of a DCI scheduling data transmission and the priority of a DCI with the skipping indication. In an embodiment, the priority is determined based on a relation between a location of a DCI scheduling data transmission and a location of a DCI with the skipping indication.

[0077] In a first possible implementation, a set of the *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* values can be configured for a DRX, and a signaling used to indicate one of the values within the set is transmitted to UE. The values within the set of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* are different. For instance, a set of values of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* are configured and the set of values of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* is {sl 0, sl 1, sl 2, sl 4, sl 8, sl 16, sl 24, sl 32}, where sl 0 is equal to a time window of re-transmission that is 0 slot, sl 1 is equal to a time window of re-transmission that is 1 slot, and so on. Then, one of the values within the set is indicated to UE. 3 bits can be used to indicate the value to the UE. In total, 2^3 states can be used. Each state of the 2^3 can indicate one of the values within the set, as shown in table 1. When the state is “000”, it means the time window of re-transmission is equal to 0 slot; when the state is indicated as “100”, it means the time window of re-transmission is equal to 8 slots, and so on. When UE needs to skip the PDCCH monitoring during the time window of re-transmission, then the sl 0 can be indicated.

Table 1 value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL*

State	The values of <i>drx-RetransmissionTimerUL</i> or <i>drx-RetransmissionTimerDL</i>
000	Sl 0
001	Sl 1
010	Sl 2
011	Sl 4
100	Sl 8
101	Sl 16
110	Sl 24
111	Sl 32

[0078] In some embodiments, the bits used to indicate the information is equal to $\lceil \log_2(\text{the number of values within the set}) \rceil$. In some embodiments, the signaling of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL*

indication can be DCI or UCI or MAC CE or piggyback DCI in PDSCH or piggyback UCI in PUSCH or a new RNTI scrambled DCI or any combination of these signals. For the indication signaling using UCI, whether the UE needs to monitor PDCCH during the time window of re-transmission is based on UE reporting. In some embodiments, a default value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* is configured. When no value is indicated, then default value is used.

[0079] In a second possible implementation, a set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* values can be configured for a DRX, and a signaling used to indicate one of the values within the set is transmitted to UE. The values within the set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* are different. For instance, a set of values of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* are configured and the set of values of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* are $\{0, 1, 2, 3, 4, 5, \dots, 56\}$, where 0 is equal to a value in number of symbols of the BWP where the transport block was transmitted or received that is 0 symbol, 1 is equal to a value in number of symbols of the BWP where the transport block was transmitted or received that is 1 symbol, 2 is equal to a value in number of symbols of the BWP where the transport block was transmitted or received is that 2 symbols, and so on. Then, one of the values within the set is indicated to UE. N bits can be used to indicate the value to the UE. In total, 2^N states can be used. Each state of the 2^N can indicate one of the values within the set.

[0080] In some embodiments, the signaling of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* indication can be DCI or UCI or MAC CE or piggyback DCI in PDSCH or piggyback UCI in PUSCH or a new RNTI scrambled DCI or any combination of these signals. For the indication signaling using UCI, it means whether the UE needs to monitor PDCCH during the time window of re-transmission is based on UE reporting.

[0081] In some embodiments, a specific value X of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* can be configured. X is a specific value and it's different from 0~56, where X can be predefined, and the granularity of X can be a slot or a symbol or ms. When the value X of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* is 0, the UE can skip the PDCCH monitoring during the time window of re-transmission before the next DRX on duration time. In some embodiments, a default value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* is configured. When no value is indicated, the default value is used.

[0082] In a third possible implementation, both a set of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* values and a set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* values can be configured for a DRX. A value within the set of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* values and a value within the set of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* values are indicated to a UE. The start and the length of the re-transmission time window is based on the value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* and the value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL*. In some embodiments, the value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* and the value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* can be indicated independently (detailed implementation for the indication is similar as the first and second possible implementations). In some embodiments, the value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* and the value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* can be indicated jointly. In this case, the value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* and the value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* are jointly coded.

Each state of an indication field can be used to indicate both the value of *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerDL* and the value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL*.

[0083] In some embodiments, a default value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* and a default value of *drx-HARQ-RTT-TimerDL* or *drx-HARQ-RTT-TimerUL* are configured. When no value is indicated, the default value is used.

[0084] In a fourth possible implementation, a priority rule is introduced to determine whether the UE needs to skip or monitor the PDCCH or not during the time window of re-transmission for the case the time window of re-transmission is indicated as skipped by a data scheduling DCI. If skipping PDCCH during the time window of re-transmission has a high priority, then UE need not wake up for monitoring PDCCH during the time window of re-transmission. If monitoring PDCCH during the time window of re-transmission has a high priority, then UE needs to wake up for monitoring PDCCH during the time window of re-transmission, wherein the priority of skipping or monitoring PDCCH during the time window of re-transmission is configured or pre-defined. For instance, as shown in FIG. 3, both CG and DRX are configured, we assume a PUSCH is transmitted on the CG1 and gNB decodes the PUSCH incorrectly, so a re-transmission of the CG based on a DCI is needed. During the *drx-on* 1, a data scheduling DCI with PDCCH skipping is indicated to UE and the *drx-Retransmission* timer of CG1 is landed in skipping PDCCH monitor duration. If the priority of skipping PDCCH monitor is higher than the priority of monitoring PDCCH, then the UE need not wake up for monitor PDCCH during the *drx-ReTransmissionTimer*. If the priority of skipping PDCCH monitor is lower than the priority of monitoring PDCCH, then the UE needs to wake up for monitor PDCCH during the *drx-ReTransmissionTimer*.

[0085] In some embodiments, the priority of skipping or monitoring PDCCH is not pre-defined or configured. An implicit way can be used to determine the priority of skipping or monitoring PDCCH during the *drx-ReTransmissionTimer*. The priority of CG1 and the DCI scheduling data with PDCCH skipping indication (if configured) can be used for determining priority of skipping or monitoring PDCCH during the *drx-ReTransmissionTimer*. When the priority of CG1 is higher than the data scheduled by the DCI, then UE needs to monitor PDCCH during *drx-ReTransmissionTimer*. When the priority of CG1 is lower than the data scheduled by the DCI, then UE needs to skip PDCCH during *drx-ReTransmissionTimer*. The CG1 can be located before *drx-on*1 or during *drx-on*1 or after *drx-on*1. Similar way can be reused for SPS transmission.

[0086] Taking a dynamic PUSCH transmission during a *drx-onDurationTimer* as another example, as shown in FIG. 4, multiple dynamic scheduling data transmissions are during *drx-on*1, DCI 1 schedules PUSCH transmission, and DCI 2 with PDCCH adaption (PDCCH skipping or search space set group switching) schedules another data transmission during *drx-on*1. If priority indication in DCI 1 is higher than priority indication in DCI 2 (e.g., the priority index indicated by DCI 1 is 1 and the priority index indicated by DCI 2 is 0), then UE needs to wake up to monitor PDCCH during *drx-ReTransmissionTimer*. If priority indication in DCI 1 is lower than priority indication in DCI 2 (e.g., the priority index indicated by DCI 1 is 0 and the priority index indicated by DCI 2 is 1), then UE need not wake up to monitor PDCCH during *drx-ReTransmissionTimer*.

[0087] In some embodiments, the priority of PDCCH skipping or monitoring is based on the first symbol location of the DCI. The DCI which has a front symbol is determined as having a high or low priority, where PDCCH skipping

means UE need not to wake up to monitor PDCCH during *drx-ReTransmissionTimer*, where PDCCH monitoring means UE needs to wake up to monitor PDCCH during *drx-ReTransmissionTimer*. As shown in FIG. 4, DCI 2 is in front of DCI 1 during drx-on1. If DCI 2 schedules a data transmission with PDCCH skipping indication and DCI 1 schedules a PUSCH transmission (the PUSCH is not received by gNB correctly, so a re-transmission of the PUSCH is needed), since the first symbol of the DCI 2 for PDCCH skipping indication is located in front of DCI 1, then UE need not to wake up for monitoring PDCCH during the *drx-ReTransmissionTimer*. If DCI 1 schedules a data transmission with PDCCH skipping indication and DCI 2 schedules a PUSCH transmission (the PUSCH is not received by gNB correctly, so a re-transmission of the PUSCH is needed), since the first symbol of the DCI 1 for PUSCH scheduling is in front of DCI 2, then UE needs to wake up for monitoring PDCCH during the *drx-ReTransmissionTimer*. Similar way can be reused for PDSCH transmission.

[0088] In a fifth possible implementation, a signalling is used to indicate the length of *drx-ReTransmissionTimer* for PDCCH monitoring. The signalling can be a DCI or a DCI piggybacked PDSCH or a new RNTI scrambled DCI or MAC CE. The relationship between a field in DCI and the *drx-ReTransmissionTimer* length is pre-defined or configured, where the size of the field in DCI is configurable or pre-defined. Taking a field of 2 bits in DCI as an example, as shown in table 2, when the field in DCI or MAC CE is indicated as “00”, which means the duration of *drx-ReTransmissionTimer* is 0 slot or 0 ms. In other words, the UE need not wake up to monitor PDCCH for re-transmission. When the field in DCI or MAC CE is indicated as “01”, it means the duration of *drx-ReTransmissionTimer* is 1 slot or 1ms, and the UE needs to wake up to monitor PDCCH during the *drx-ReTransmissionTimer* for re-transmission.

Table 2. Length of *drx-ReTransmissionTimer* indication

State	<i>drx-ReTransmissionTimer</i> length (slot or ms)
00	0
01	1
10	2
11	4

[0089] In some embodiments, both the start and the length of *drx-ReTransmissionTimer* for PDCCH monitoring can be indicated by a DCI or a DCI piggybacked PDSCH or a new RNTI scrambled DCI or MAC CE or a new RNTI scrambled DCI or any combination of these signals. In some embodiments, for PDSCH or SPS transmission, when an ACK is fed back, UE need not wake up for monitoring PDCCH for the PDSCH or SPS re-transmission; when a NACK is fed back, UE needs to wake up for monitoring PDCCH for the PDSCH or SPS re-transmission. In some embodiments, whether a UE needs to monitor a PDCCH during the *drx-ReTransmissionTimer* is indicated by a DCI or/and MAC CE or a wake up signaling (WUS) signaling. In some embodiments, the length of *drx-ReTransmissionTimer* for PDCCH monitoring can be reported by UE, and UCI or/and MAC CE can be used. The relationship between the field in DCI and the *drx-ReTransmissionTimer* length is pre-defined or configured, where the size of the field in DCI is configurable or pre-defined. In some embodiments, both the start and the length of *drx-ReTransmissionTimer* for PDCCH monitoring can be reported by UE with UCI or/and MAC CE.

[0090] This disclosure proposes potential approaches to support XR services with jitter (including predictable or unpredictable jitter between video frames). Discontinuous Reception (DRX) is one of the efficient approaches for User Equipment (UE) power saving. When UE steps into a DRX-OFF state, the UE will suspend Physical Downlink Control Channel (PDCCH) monitoring and then go to sleeping for UE power saving. When a DRX is configured, if the XR traffic arrives out of *drx-onDurationtimer*, large delay will be caused in the current mechanism and the Packet Delay Budget (PDB) of a packet will be over budget. To reduce the latency caused by jitter, the following approaches can be considered.

[0091] FIG. 5 is a flowchart of a wireless communication method according to a second embodiment of the present application. Referring to FIG. 5 in conjunction with FIG. 1, the method 100 includes the following. In Step 110, the UE is configured by the BS multiple monitoring patterns for Discontinuous Reception (DRX). The monitoring pattern may correspond to a *drx-onDurationTimer* value, or a wake up signal (WUS) monitoring pattern, or a Physical Downlink Control Channel (PDCCH) monitoring pattern, or a combination of the WUS monitoring pattern and the PDCCH monitoring pattern. Each monitoring pattern may have different monitoring duration or monitoring occasions are different for each pattern. With this method, the jitter issue of XR services is solved, thereby improving XR service experience.

[0092] In an embodiment of the present application, the *drx-onDurationTimer* value is different or same for adjacent DRX cycles. In an embodiment, the WUS monitoring pattern is before a time duration determined by the *drx-onDurationTimer* value or/and after the time duration for one DRX cycle. The WUS may be used to indicate a start of the time duration determined by the *drx-onDurationTimer* value. Alternatively, the WUS is used to skip some WUS monitoring occasions. In an embodiment, if one WUS within a WUS monitoring pattern is located before the time duration determined by the *drx-onDurationTimer* value in one DRX cycle, the time duration is enabled right after the one WUS. In an embodiment, if no Downlink Control Information (DCI) is detected during the time duration determined by the *drx-onDurationTimer* value, the WUS monitoring pattern located after the time duration is enabled. In an embodiment, the PDCCH monitoring pattern is adjusted based on jitters. In an example, some of the PDCCH monitoring patterns are skipped based on a jitter state in previous DRX cycles.

[0093] In a first possible implementation, multiple values of *drx-onDurationtimer* can be configured. The *drx-onDurationtimer* time duration can be same or different for adjacent DRX cycles. As shown in FIG. 6, the *Drx-on* (it's equal to *drx-onDurationtimer*) time duration for two adjacent DRX cycles is different. The value of *Drx-on1* is different from the value of *Drx-on2*, and the value of *Drx-on2* is different from the value of *Drx-on3*.

[0094] In some embodiments, the pattern of *Drx-on* timer duration within multiple DRX cycles is pre-defined or configured. In some embodiments, the pattern of *Drx-on* time duration within multiple DRX cycle is not pre-defined or configured, and a default value is configured, and if there is no signaling to indicate a value, then the default value is used for all DRX cycles. In some cases, there is a signaling to indicate a *Drx-on* value, then the indicated value can be used for a next DRX cycle or next multiple DRX cycles.

[0095] In a second possible implementation, a combination of wake up signal (WUS) monitoring pattern and *drx-onDurationtimer* can be considered. Multiple WUS can be configured before *drx-onDurationtimer* or/and after *drx-onDurationtimer* within a DRX cycle. The WUS can be used to indicate UE the start of *drx-onDurationtimer* or skip

some WUS monitoring pattern. For instance (based on DRX cycle1, similar ways can be reused for other DRX cycles.), as shown in FIG. 7, a combination of WUS pattern and *drx-onDurationtimer* is configured to UE. In DRX cycle1, WUS part 1-1 is located before Drx-on1 in DRX cycle 1 and WUS part 1-3 is located behind Drx-on1 in DRX cycle 1, where the total duration of WUS part1-1 and WUS pattern 1-3 is larger than jitter range. UE needs to wake up at each WUS monitoring occasions within WUS part. If UE monitors a WUS within the WUS pattern 1-1, then the DRX-on1 starts right after the WUS. When there is no WUS during the WUS pattern 1-1, the DRX-on1 starts based on the configured parameters. If there is no DCI which schedules a PDSCH or PUSCH transmission is detected during the DRX-on1, then the WUS Part 1-3 is started. UE needs to wake up at each WUS monitor occasion during the part 1-3.

[0096] In some embodiments, the WUS or a signaling (e.g., DCI, UCI, piggyback DCI, piggyback UCI, MAC CE or a new RNTI scrambled DCI or any combination of these signals.) within a *drx-onDurationtimer* can be used to skip the WUS monitoring pattern within next or next multiple DRX cycles.

[0097] In a third possible implementation, multiple PDCCH monitoring patterns can be configured for DRX. The patterns can be adjusted based on jitter arrival implicitly. Some PDCCH monitoring patterns can be skipped based on the jitter state in previous DRX cycles. In some embodiments, a jitter monitoring time window is introduced, and the jitter arrived between an adjacent packet in a jitter monitoring time window is predicted, and then the PDCCH monitoring patterns within next DRX cycle are based on the jitter arrival state within the current DRX cycle.

[0098] Commercial interests for some embodiments are as follows. 1. Solving issues in the prior art. 2. Achieving UE capacity and power saving performance. 3. solving the jitter issue of XR services. 4. improving XR service experience. 5. providing good communication performance. Some embodiments of the present application are used by 5G-NR chipset vendors, V2X communication system development vendors, automakers including cars, trains, trucks, buses, bicycles, moto-bikes, helmets, and etc., drones (unmanned aerial vehicles), smartphone makers, communication devices for public safety use, AR/VR device maker for example gaming, conference/seminar, education purposes. Some embodiments of the present application are a combination of “techniques/processes” that can be adopted in 3GPP specification to create an end product. Some embodiments of the present application could be adopted in the 5G NR unlicensed band communications. Some embodiments of the present application propose technical mechanisms.

[0099] The embodiment of the present application further provides a computer readable storage medium for storing a computer program. The computer readable storage medium enables a computer to execute corresponding processes implemented by the UE/BS in each of the methods of the embodiment of the present application. For brevity, details will not be described herein again.

[0100] The embodiment of the present application further provides a computer program product including computer program instructions. The computer program product enables a computer to execute corresponding processes implemented by the UE/BS in each of the methods of the embodiment of the present application. For brevity, details will not be described herein again.

[0101] The embodiment of the present application further provides a computer program. The computer program enables a computer to execute corresponding processes implemented by the UE/BS in each of the methods of the embodiment of the present application. For brevity, details will not be described herein again.

[0102] A person of ordinary skill in the art may be aware that, in combination with the examples described in the embodiments disclosed in this specification, units and algorithm steps may be implemented by electronic hardware or a combination of computer software and electronic hardware. Whether the functions are performed by hardware or software depends on particular applications and design constraint conditions of the technical solutions. A person skilled in the art may use different approaches to implement the described functions for each particular application, but it should not be considered that the implementation goes beyond the scope of the present application.

[0103] While the present application has been described in connection with what is considered the most practical and preferred embodiments, it is understood that the present application 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.

CLAIMS

1. A wireless communication method, performed by a user equipment (UE) in a network, the method comprising:
receiving or reporting an information, wherein the information is used for determining at least one of retransmission time window or monitoring state of the retransmission time window in Discontinuous Reception (DRX) cycles.
2. The method of claim 1, wherein the information is indicated.
3. The method of claim 1, wherein the information is reported by the UE.
4. The method of claim 1, wherein the retransmission time window includes at least one of a duration of the retransmission time window, or a start of retransmission time window, or the start and the duration of the retransmission time window.
5. The method of claim 1, wherein the retransmission time window is determined by a drx-retransmission timer.
6. The method of claim 5, wherein the receiving or reporting step of the information comprises:
being configured a set of drx-retransmission timer values for DRX, wherein the drx-retransmission timer values in the set are different or same; and
receiving a signaling used to indicate one of the values within the set.
7. The method of claim 1, wherein the retransmission time window is determined by a drx-Hybrid Automatic Repeat reQuest (HARQ) RTT timer.
8. The method of claim 7, wherein the receiving or reporting step of the information comprises:
being configured a set of drx-HARQ RTT timer values for DRX, wherein drx-HARQ RTT timer values in the set are different or same; and
receiving a signaling used to indicate one of the values within the set.
9. The method of claim 1, wherein the retransmission time window is determined by a drx-retransmission timer and a drx-HARQ-RTT timer.
10. The method of claim 9, wherein values of the drx-retransmission timer and the drx-HARQ-RTT timer are indicated jointly.
11. The method of any of claims 5 to 10, wherein indication of values of the drx-retransmission timer or the drx-HARQ RTT timer is carried out by Downlink Control Information (DCI) or Uplink Control Information (UCI) or Media Access Control (MAC) Control Element (CE) or piggyback DCI in Physical Downlink Shared Channel (PDSCH) or piggyback UCI in Physical Uplink Shared Channel (PUSCH) or a new RNTI scrambled DCI.
12. The method of claim 1, further comprising:
receiving a skipping or monitoring indication for skipping or monitoring Physical Downlink Control Channel (PDCCH) monitor occasions of the retransmission time window in the DRX cycles.
13. The method of claim 12, further comprising:
determining whether to wake up at the PDCCH monitor occasions on the retransmission time window based on priority,
wherein if the priority of skipping the PDCCH monitor occasions is higher than the priority of monitoring at the PDCCH monitor occasions, the UE wakes up to monitor at the PDCCH monitor occasions on the retransmission time window,
wherein if the priority of skipping the PDCCH monitor occasions is lower than the priority of monitoring at the PDCCH monitor occasions, the UE skips the PDCCH monitor occasions on the retransmission time window.
14. The method of claim 13, wherein the priority is configured or pre-defined or is determined in an implicit way.

15. The method of claim 13, wherein the priority is determined based on the priority of a configured grant and the priority of a DCI with the skipping indication.

16. The method of claim 13, wherein the priority is determined based on the priority of a DCI scheduling data transmission and the priority of a DCI with the skipping indication.

17. The method of claim 13, wherein the priority is determined based on a relation between a location of a DCI scheduling data transmission and a location of a DCI with the skipping indication.

18. A wireless communication method, performed by a user equipment (UE) in a network, the method comprising: being configured multiple monitoring patterns for Discontinuous Reception (DRX).

19. The method of claim 18, wherein the monitoring pattern corresponds to a drx-onDurationTimer value, or a wake up signal (WUS) monitoring pattern, or a Physical Downlink Control Channel (PDCCH) monitoring pattern, or a combination of the WUS monitoring pattern and the PDCCH monitoring pattern.

20. The method of claim 19, wherein the drx-onDurationTimer value is different or same for adjacent DRX cycles.

21. The method of claim 19, wherein the WUS monitoring pattern is before a time duration determined by the drx-onDurationTimer value or/and after the time duration for one DRX cycle.

22. The method of claim 21, wherein WUS is used to indicate a start of the time duration determined by the drx-onDurationTimer value.

23. The method of claim 22, wherein if one WUS within a WUS monitoring pattern is located before the time duration determined by the drx-onDurationTimer value in one DRX cycle, the time duration is enabled right after the one WUS.

24. The method of claim 21, wherein if no Downlink Control Information (DCI) is detected during the time duration determined by the drx-onDurationTimer value, the WUS monitoring pattern located after the time duration is enabled.

25. The method of claim 21, wherein WUS is used to skip some WUS monitoring occasions.

26. The method of claim 19, wherein the PDCCH monitoring pattern is adjusted based on jitters.

27. The method of claim 19, wherein some of the PDCCH monitoring patterns are skipped based on a jitter state in previous DRX cycles.

28. A wireless communication method, performed by a base station (BS) in a network, the method comprising: transmitting or receiving an information, wherein the information is used for determining at least one of retransmission time window or monitoring state of the retransmission time window in Discontinuous Reception (DRX) cycles.

29. The method of claim 28, wherein the BS indicates the information to a user equipment (UE).

30. The method of claim 28, wherein the information is received from a UE.

31. The method of claim 28, wherein the retransmission time window includes at least one of a duration of the retransmission time window, or a start of retransmission time window, or the start and the duration of the retransmission time window.

32. The method of claim 28, wherein the retransmission time window is determined by a drx-retransmission timer.

33. The method of claim 32, wherein the transmitting or receiving step of the information comprises: configuring a UE a set of drx-retransmission timer values for DRX, wherein the drx-retransmission timer values in the set are different or same; and

transmitting to the UE a signaling used to indicate one of the values within the set.

34. The method of claim 28, wherein the retransmission time window is determined by a drx-Hybrid Automatic

Repeat reQuest (HARQ) RTT timer.

35. The method of claim 34, wherein the transmitting or receiving step of the information comprises: configuring a UE a set of drx-HARQ RTT timer values for DRX, wherein drx-HARQ RTT timer values in the set are different or same; and

transmitting to the UE a signaling used to indicate one of the values within the set.

36. The method of claim 28, wherein the retransmission time window is determined by a drx-retransmission timer and a drx-HARQ-RTT timer.

37. The method of claim 36, wherein values of the drx-retransmission timer and the drx-HARQ-RTT timer are indicated jointly.

38. The method of any of claims 32 to 37, wherein indication of values of the drx-retransmission timer or the drx-HARQ RTT timer is carried out by Downlink Control Information (DCI) or Uplink Control Information (UCI) or Media Access Control (MAC) Control Element (CE) or piggyback DCI in Physical Downlink Shared Channel (PDSCH) or piggyback UCI in Physical Uplink Shared Channel (PUSCH) or a new RNTI scrambled DCI.

39. The method of claim 28, further comprising:

transmitting a skipping or monitoring indication for UE skipping or monitoring Physical Downlink Control Channel (PDCCH) monitor occasions of the retransmission time window in the DRX cycles.

40. The method of claim 39, further comprising:

expecting the UE to determine whether to wake up at the PDCCH monitor occasions on the retransmission time window based on priority,

wherein if the priority of skipping the PDCCH monitor occasions is higher than the priority of monitoring at the PDCCH monitor occasions, the UE wakes up to monitor at the PDCCH monitor occasions on the retransmission time window,

wherein if the priority of skipping the PDCCH monitor occasions is lower than the priority of monitoring at the PDCCH monitor occasions, the UE skips the PDCCH monitor occasions on the retransmission time window.

41. The method of claim 40, wherein the priority is configured or pre-defined or is determined in an implicit way.

42. The method of claim 40, wherein the priority is determined based on the priority of a configured grant and the priority of a DCI with the skipping indication.

43. The method of claim 40, wherein the priority is determined based on the priority of a DCI scheduling data transmission and the priority of a DCI with the skipping indication.

44. The method of claim 40, wherein the priority is determined based on a relation between a location of a DCI scheduling data transmission and a location of a DCI with the skipping indication.

45. A wireless communication method, performed by a base station (BS) in a network, the method comprising: configuring a user equipment (UE) multiple monitoring patterns for Discontinuous Reception (DRX).

46. The method of claim 45, wherein the monitoring pattern corresponds to a drx-onDurationTimer value, or a wake up signal (WUS) monitoring pattern, or a Physical Downlink Control Channel (PDCCH) monitoring pattern, or a combination of the WUS monitoring pattern and the PDCCH monitoring pattern.

47. The method of claim 46, wherein the drx-onDurationTimer value is different or same for adjacent DRX cycles.

48. The method of claim 46, wherein the WUS monitoring pattern is before a time duration determined by the drx-onDurationTimer value or/and after the time duration for one DRX cycle.

49. The method of claim 48, wherein WUS is used to indicate a start of the time duration determined by the drx-onDurationTimer value.

50. The method of claim 49, wherein if one WUS within a WUS monitoring pattern is located before the time duration determined by the drx-onDurationTimer value in one DRX cycle, the time duration is enabled right after the one WUS.

51. The method of claim 48, wherein if no Downlink Control Information (DCI) is detected by the UE during the time duration determined by the drx-onDurationTimer value, the WUS monitoring pattern located after the time duration is enabled.

52. The method of claim 48, wherein WUS is used to skip some WUS monitoring occasions.

53. The method of claim 46, wherein the PDCCH monitoring pattern is adjusted based on jitters.

54. The method of claim 46, wherein some of the PDCCH monitoring patterns are skipped based on a jitter state in previous DRX cycles.

55. A user equipment (UE), comprising a processor and a transmitter, wherein the processor is configured to call and run program instructions stored in a memory, to cooperate with the transmitter to execute the method of any of claims 1 to 17.

56. A user equipment (UE), comprising a processor and a transmitter, wherein the processor is configured to call and run program instructions stored in a memory, to cooperate with the transmitter to execute the method of any of claims 18 to 27.

57. A base station (BS), comprising a processor and a transmitter, wherein the processor is configured to call and run program instructions stored in a memory, to cooperate with the transmitter to execute the method of any of claims 28 to 44.

58. A base station (BS), comprising a processor and a transmitter, wherein the processor is configured to call and run program instructions stored in a memory, to cooperate with the transmitter to execute the method of any of claims 45 to 54.

30 ↪

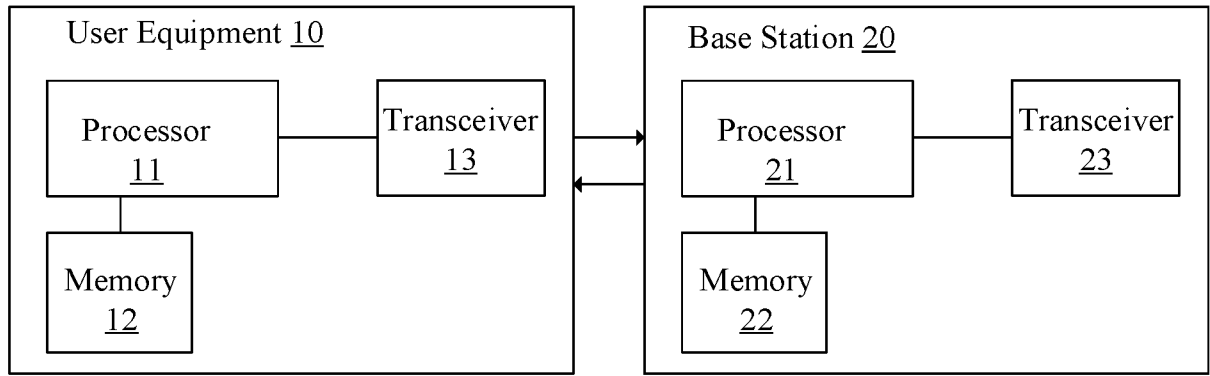


FIG. 1

100 ↪

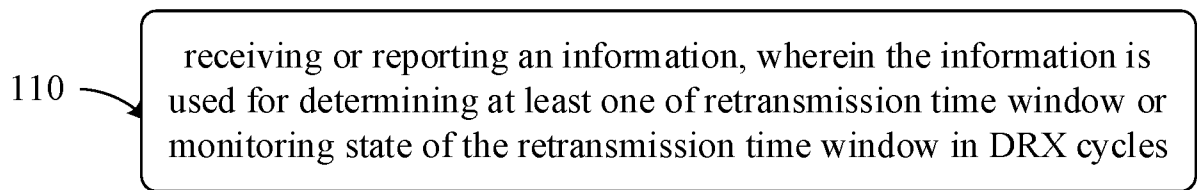


FIG. 2

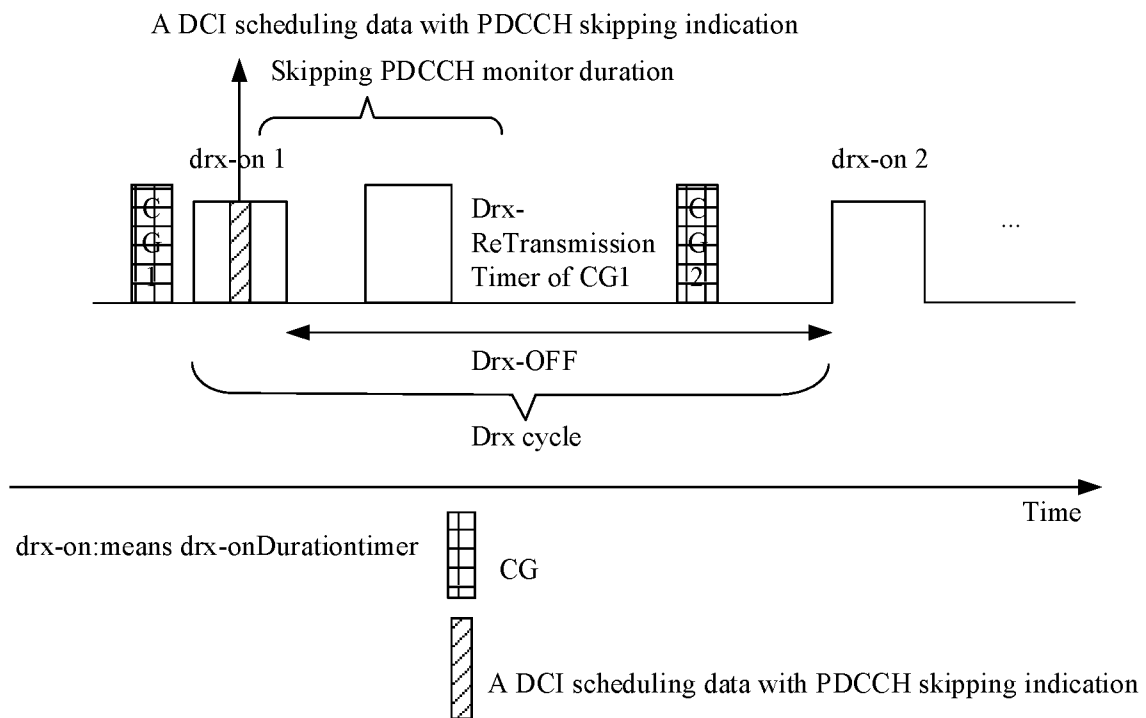


FIG. 3

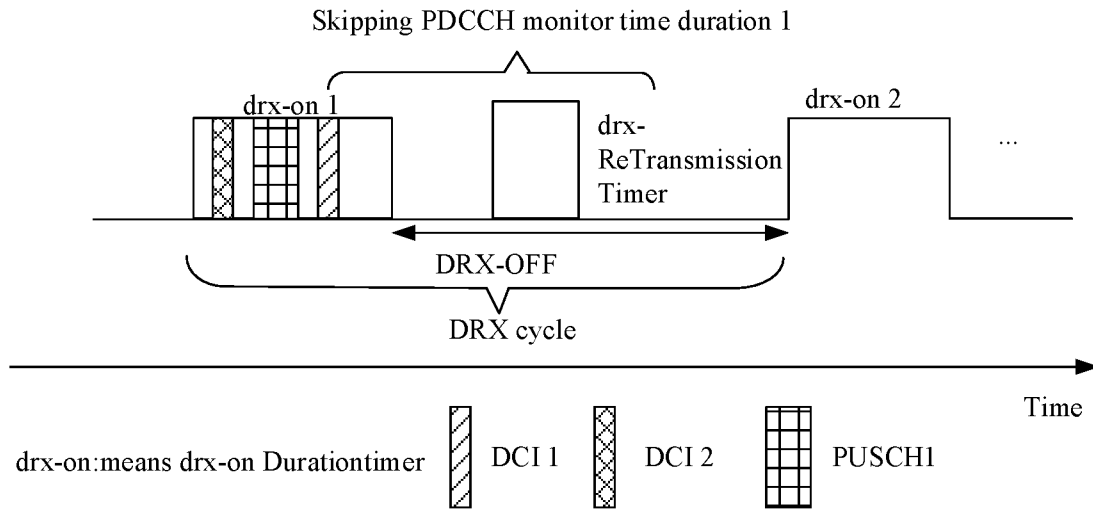


FIG. 4

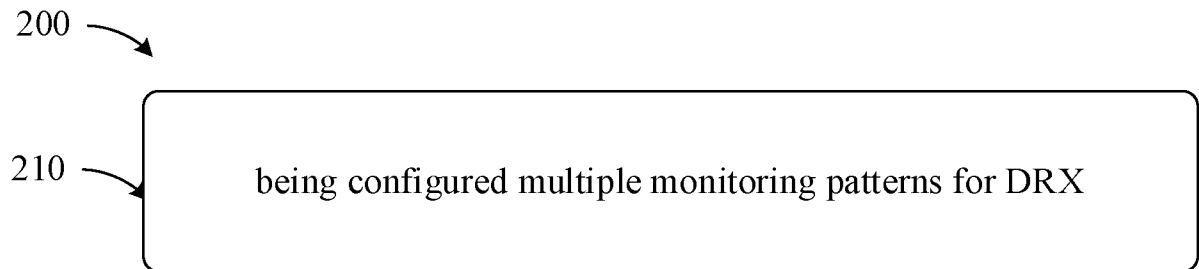


FIG. 5

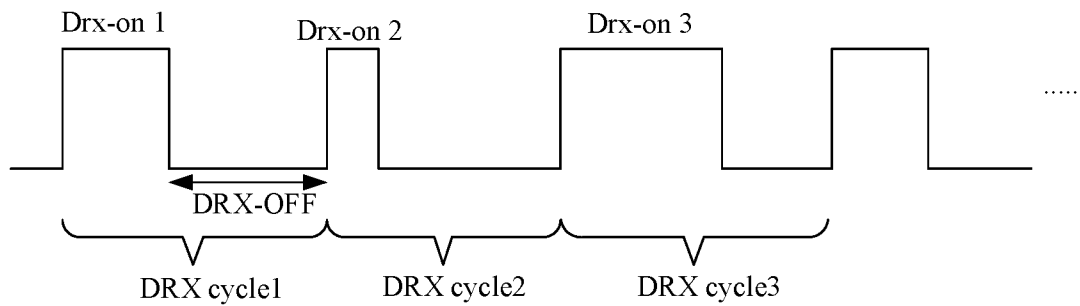


FIG. 6

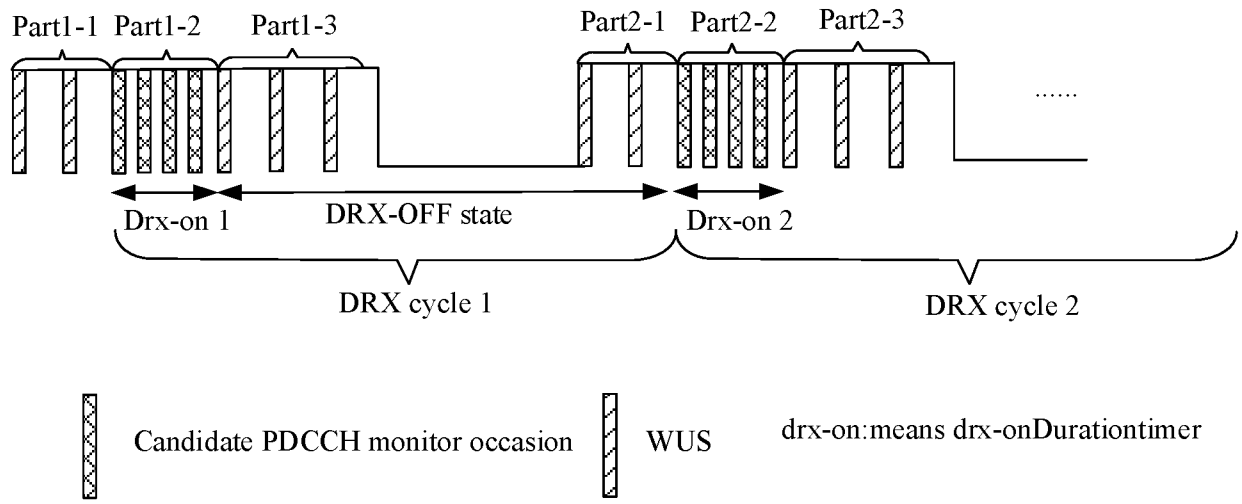


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/123504

A. CLASSIFICATION OF SUBJECT MATTER

H04W 52/02(2009.01)i;H04L 1/18(2023.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:H04W,H04Q,H04L

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

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

3GPP,CNXT,DWPI,ENTXTC:DCI, UCI, MAC CE, DRX, HARQ, indicate, configuration, monitor, occasion, PDCCH, priority, report, RTT, slot, WUS, wake, skip+, DRX-retransmissionTimer, window, subframe, value, number

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 115087082 A (VIVO MOBILE COMMUNICATION CO., LTD.) 20 September 2022 (2022-09-20) description, paragraphs [0031]-[0225]	1-17,28-44,55,57
X	CN 112291860 A (GUANGDONG COMMUNICATIONS & NETWORKS INSTITUTE) 29 January 2021 (2021-01-29) description, paragraphs [0018]-[0036]	18-27,45-54,56,58
X	CN 113785517 A (OFINNO, LLC) 10 December 2021 (2021-12-10) description, paragraphs [0376]-[0417]	1-17,28-44,55,57
X	US 2022264616 A1 (PANASONIC INTELLECTUAL PROOERTY CORPORATION OF AMERICA) 18 August 2022 (2022-08-18) description, paragraphs [0202]-[0399]	1-17,28-44,55,57
X	WO 2021088015 A1 (NOKIA SHANGHAI BELL CO., LTD. et al.) 14 May 2021 (2021-05-14) description, paragraphs [0068]-[0149]	1-17,28-44,55,57



Further documents are listed in the continuation of Box C.



See patent family annex.

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“&” document member of the same patent family

Date of the actual completion of the international search

19 April 2023

Date of mailing of the international search report

23 April 2023

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/123504**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	ZTE CORPORATION et al. "Impact of HARQ on DRX" <i>R2-1906117,3GPP TSG RAN WG2 Meeting #106</i> , 17 May 2019 (2019-05-17), the whole document	1-58

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/123504

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