

RADIO LINK CONTROL RETRANSMISSION OF A DATA PACKET

TECHNICAL FIELD

[0001] The present disclosure relates to wireless communications, and more specifically to network nodes and methods performed by the network nodes for supporting radio link control (RLC) retransmission of a data packet.

BACKGROUND

[0002] A wireless communications system may include one or multiple network communication devices, such as base stations, which may be otherwise known as an eNodeB (eNB), a next-generation NodeB (gNB), or other suitable terminology. Each network communication devices, such as a base station may support wireless communications for one or multiple user communication devices, which may be otherwise known as UE, or other suitable terminology. The wireless communications system may support wireless communications with one or multiple user communication devices by utilizing resources of the wireless communication system (e.g., time resources (e.g., symbols, slots, subframes, frames, or the like) or frequency resources (e.g., subcarriers, carriers). Additionally, the wireless communications system may support wireless communications across various radio access technologies including third generation (3G) radio access technology, fourth generation (4G) radio access technology, fifth generation (5G) radio access technology, among other suitable radio access technologies beyond 5G (e.g., sixth generation (6G)).

[0003] RLC acknowledged mode (AM) is useful to limit data loss. An RLC transmitter may add an RLC header and then creates two identical copies of a data packet. Then, the RLC transmitter may transmit one of the two copies of the data packet to a lower layer and another copy to a retransmission buffer. Subsequently, the RLC transmitter may trigger a poll to request a status report for the data from an RLC receiver every several numbers of acknowledged mode data (AMD) protocol data unit (PDU) sent, or data bytes sent. If the RLC transmitter receives a status report comprising a negative acknowledgement (NACK) or does not receive any response from the RLC receiver for a certain period of time, the data packet in the retransmission buffer gets retransmitted. If the RLC receives a status report comprising a positive acknowledgement (ACK), the copy of the data packet in the retransmission buffer would be discarded.

[0004] However, the data volume of a PDU set is variable. That is, the number of PDUs or the size of the PDUs of a PDU set or burst data is variable. RLC-AM feedback or retransmission triggering mechanisms are not well adapted for short packet delay budgets applicable to extended reality (XR) traffic. The RLC retransmission may not be timely triggered, which causes the data packet to arrive at the RLC receiver too late, and thus impacts the user experience.

SUMMARY

[0005] The present disclosure relates to devices and methods that support RLC retransmission of a data packet. With the devices and methods, fast RLC retransmission of a data packet may be achieved.

[0006] Some implementations of a first device for wireless communication described herein may include a processor and a transceiver coupled to the processor, wherein the processor is configured to: transmit a first data packet via the transceiver to a second device for wireless communication; trigger a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet; and transmit the first poll via the transceiver to the second device.

[0007] In some implementations, the processor is configured to trigger the first poll based on the delay status by: obtaining a first delay-critical indication indicating the first data packet becomes a first delay-critical data packet; and triggering the first poll based on the first delay-critical indication.

[0008] In some implementations, the processor is configured to trigger the first poll based on the first delay-critical indication by: based on determining that a first number of continuous polls which were triggered based on delay-critical indications is equal to or less than a first threshold, triggering the first poll based on the first delay-critical indication. The delay-critical indications indicate data packets become delay-critical data packets.

[0009] In some implementations, the processor is configured to obtain the first delay-critical indication after transmitting a second poll to request a second status report for a second data packet from the second device. In such implementations, the processor is

configured to trigger the first poll based on the first delay-critical indication by: based on determining that a second number of delay-critical data packets is equal to or greater than a second threshold, triggering the first poll based on the first delay-critical indication. The second number of delay-critical indications for the second number of delay-critical data packets have been obtained since the second poll was transmitted, and the delay-critical data packets comprise the first delay-critical data packet.

[0010] In some implementations, the processor is configured to obtain the first delay-critical indication after transmitting a second poll to trigger a second status report for a second data packet at the second device. In such implementations, the processor is configured to trigger the first poll based on the first delay-critical indication by: based on determining that a third number of data bytes is equal to or greater than a third threshold, triggering the first poll based on the first delay-critical indication. In some implementations, delay-critical indications for delay-critical data packets comprising the third number of data bytes have been obtained since the second poll was transmitted, and the delay-critical data packets comprise the first delay-critical data packet.

[0011] In some implementations, the processor is configured to trigger the first poll based on the first delay-critical indication by: based on determining that the first device does not receive a response to transmission of the first data packet for a period of time, triggering the first poll based on the first delay-critical indication.

[0012] In some implementations, the processor is configured to trigger the first poll based on the first delay-critical indication by: based on determining that the first data packet comprises high importance data, triggering the first poll based on the first delay-critical indication.

[0013] In some implementations, the processor is configured to transmit the first poll by: including the first poll in an RLC control PDU.

[0014] In some implementations, the RLC control PDU comprises an indicator indicating that a type of the RLC control PDU is a polling PDU.

[0015] In some implementations, the processor is configured to transmit the first poll by: including the first poll in an acknowledged mode data (AMD) PDU.

[0016] In some implementations, the AMD PDU comprises an indicator indicating that the first status report is requested based on the delay status of the first data packet.

[0017] In some implementations, the processor is configured to trigger the first poll based on the first end indication of the PDU set by: based on determining that both a transmission buffer and a retransmission buffer associated with the PDU set becomes empty excluding transmitted RLC service data units (SDUs) or RLC SDU segments awaiting acknowledgements after transmission of a third data packet, triggering the first poll.

[0018] In some implementations, the processor is configured to trigger the first poll based on the first end indication of the PDU set based on determining one of the following: PDU set based discard is configured for a data radio bearer (DRB) of an RLC entity of the first device, or PDU set integrated handling information (PSIHI) is configured for a quality of service (QoS) flow associated with the DRB.

[0019] Some implementations of a first device for wireless communication described herein may include a processor and a transceiver coupled to the processor, wherein the processor is configured to: transmit a first data packet via the transceiver to a second device for wireless communication; and retransmit the first data packet via the transceiver to the second device based on a delay status of the first data packet.

[0020] In some implementations, the processor is configured to retransmit the first data packet based on the delay status of the first data packet by: obtaining a first delay-critical indication indicating the first data packet becomes a first delay-critical data packet; and triggering retransmission of the first data packet based on the first delay-critical indication.

[0021] In some implementations, the processor is configured to retransmit the first data packet based on the delay status of the first data packet by: obtaining a discard indication indicating that the first data packet is to be discarded; and triggering retransmission of the first data packet based on the discard indication.

[0022] Some implementations of a second device for wireless communication described herein may include a processor and a transceiver coupled to the processor, wherein the processor is configured to: receive a first data packet via the transceiver from a first device for wireless communication; receive a first poll via the transceiver from the first device, wherein the first poll indicates to request a first status report for the first data

packet from the second device; and transmit the first status report via the transceiver to the first device.

[0023] In some implementations, the processor is configured to transmit the first status report by: ignoring a running status of a timer which is used to prohibit transmission of the first status report.

[0024] In some implementations, the processor is configured to ignore the running status of the timer by: stopping the timer based on determining that the timer is running; or resetting the timer based on determining that the timer is running.

[0025] In some implementations, the processor is further configured to: triggering transmission of the first status report by ignoring a range of a sequence number of the first status report.

[0026] Some implementations of a method described herein may include: transmitting a first data packet to a second device for wireless communication; triggering a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet; and transmitting the first poll to the second device.

[0027] Some implementations of a method described herein may include: transmitting a first data packet to a second device for wireless communication; and retransmitting the first data packet to the second device based on a delay status of the first data packet.

[0028] Some implementations of a method described herein may include: receiving a first data packet from a first device for wireless communication; receiving a first poll from the first device, wherein the first poll indicates to request a first status report for the first data packet from the second device; and transmitting the first status report to the first device.

[0029] Some implementations of a processor described herein may include at least one memory and a controller coupled with the at least one memory and configured to cause the controller to: transmit a first data packet to a second device for wireless communication; trigger a first poll to request a first status report for the first data packet

from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet; and transmit the first poll to the second device.

[0030] Some implementations of a processor described herein may include at least one memory and a controller coupled with the at least one memory and configured to cause the controller to: transmit a first data packet to a second device for wireless communication; and retransmit the first data packet to the second device based on a delay status of the first data packet.

[0031] Some implementations of a processor described herein may include at least one memory and a controller coupled with the at least one memory and configured to cause the controller to: receive a first data packet from a first device for wireless communication; receive a first poll from the first device, wherein the first poll indicates to request a first status report for the first data packet from the second device; and transmit the first status report to the first device.

[0032] 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

[0033] Fig. 1 illustrates an example of a wireless communications system that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure;

[0034] Fig. 2 illustrates another example of a wireless communications system that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure;

[0035] Fig. 3 illustrates a signaling diagram illustrating an example process that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure;

[0036] Fig. 4 illustrates an example of a delay-critical indication in accordance with aspects of the present disclosure;

[0037] Fig. 5 illustrates a flowchart of a method that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure;

[0038] Fig. 6 illustrates an example of triggering a poll based on a delay critical indication and the parameter “*maxPollThreshold*” in accordance with aspects of the present disclosure;

[0039] Figs. 7, 8A, 8B, 8C and 8D illustrate an example of an RLC PDU in accordance with aspects of the present disclosure, respectively;

[0040] Figs. 9 to 12 illustrate a flowchart of a method that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure, respectively;

[0041] Fig. 13 illustrates a signaling diagram illustrating an example process that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure;

[0042] Figs. 14 to 16 illustrate a flowchart of a method that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure, respectively;

[0043] Fig. 17 illustrates an example of a device that supports RLC retransmission of a data packet in accordance with some aspects of the present disclosure;

[0044] Fig. 18 illustrates an example of a processor that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure; and

[0045] Figs. 19 to 21 illustrate a flowchart of a method that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure, respectively.

DETAILED DESCRIPTION

[0046] Principles of the present disclosure will now be described with reference to some 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 limitation as to the scope of the disclosure. The disclosure described herein may be implemented in various manners other than the ones described below.

[0047] 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.

[0048] References in the present disclosure to “one embodiment,” “an example embodiment,” “an embodiment,” “some embodiments,” and the like indicate that the embodiment(s) described may include a particular feature, structure, or characteristic, but it is not necessary that every embodiment includes the particular feature, structure, or characteristic. Moreover, such phrases do not necessarily refer to the same embodiment(s). Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0049] It shall be understood that although the terms “first” and “second” or the like may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another element. For example, a first element could also be termed as a second element, and similarly, a second element could also be termed as a first element, without departing from the scope of embodiments. As used herein, the term “and/or” includes any and all combinations of one or more of the listed terms.

[0050] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. 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. It will be further understood that the terms “comprises”, “comprising”, “has”, “having”, “includes” and/or “including”, when used herein, specify the presence of stated features, elements, and/or components etc., but do not preclude the presence or addition of one or more other features, elements, components and/ or combinations thereof.

[0051] As described above, the RLC retransmission may not be timely triggered, which causes the data packet to arrive at the RLC receiver too late, and thus impacts the user experience.

[0052] In view of the above, the present disclosure provides a solution that supports RLC retransmission of a data packet. In this solution, a first device for wireless communication transmits a first data packet to a second device for wireless communication. Then, the first device triggers a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet. In turn, the first device transmits the first poll to the second device. This solution supports polling for short packet delay budget. Thus, fast RLC retransmission of a data packet may be achieved.

[0053] Aspects of the present disclosure are described in the context of a wireless communications system.

[0054] Fig. 1 illustrates an example of a wireless communications system 100 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The wireless communications system 100 may include one at least one of network entities 102 (also referred to as network equipment (NE)), one or more terminal devices or UEs 104, a core network 106, and a packet data network 108. The wireless communications system 100 may support various radio access technologies. In some implementations, the wireless communications system 100 may be a 4G network, such as an LTE network or an LTE-advanced (LTE-A) network. In some other implementations, the wireless communications system 100 may be a 5G network, such as an NR network. In other implementations, the wireless communications system 100 may be a combination of a 4G network and a 5G network, or other suitable radio access technology including institute of electrical and electronics engineers (IEEE) 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20. The wireless communications system 100 may support radio access technologies beyond 5G. Additionally, the wireless communications system 100 may support technologies, such as time division multiple access (TDMA), frequency division multiple access (FDMA), or code division multiple access (CDMA), etc.

[0055] The network entities 102 may be dispersed throughout a geographic region to

form the wireless communications system 100. One or more of the network entities 102 described herein may be or include or may be referred to as a network node, a base station (BS), a network element, a radio access network (RAN) node, a base transceiver station, an access point, a NodeB, an eNodeB (eNB), a next-generation NodeB (gNB), or other suitable terminology. A network entity 102 and a UE 104 may communicate via a communication link 110, which may be a wireless or wired connection. For example, a network entity 102 and a UE 104 may perform wireless communication (e.g., receive signaling, transmit signaling) over a Uu interface. The network entities 102 may be collectively referred to as network entities 102 or individually referred to as a network entity 102.

[0056] A network entity 102 may provide a geographic coverage area 112 for which the network entity 102 may support services (e.g., voice, video, packet data, messaging, broadcast, etc.) for one or more UEs 104 within the geographic coverage area 112. For example, a network entity 102 and a UE 104 may support wireless communication of signals related to services (e.g., voice, video, packet data, messaging, broadcast, etc.) according to one or multiple radio access technologies. In some implementations, a network entity 102 may be moveable, for example, a satellite associated with a non-terrestrial network. In some implementations, different geographic coverage areas 112 associated with the same or different radio access technologies may overlap, but the different geographic coverage areas 112 may be associated with different network entities 102. Information and signals described herein may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0057] The one or more UEs 104 may be dispersed throughout a geographic region of the wireless communications system 100. A UE 104 may include or may be referred to as a mobile device, a wireless device, a remote device, a remote unit, a handheld device, or a subscriber device, or some other suitable terminology. In some implementations, the UE 104 may be referred to as a unit, a station, a terminal, or a client, among other examples. Additionally, or alternatively, the UE 104 may be referred to as an internet-of-things (IoT) device, an internet-of-everything (IoE) device, or machine-type communication (MTC) device, among other examples. In some implementations, a UE

104 may be stationary in the wireless communications system 100. In some other implementations, a UE 104 may be mobile in the wireless communications system 100.

[0058] The one or more UEs 104 may be devices in different forms or having different capabilities. Some examples of UEs 104 are illustrated in Fig. 1. A UE 104 may be capable of communicating with various types of devices, such as the network entities 102, other UEs 104, or network equipment (e.g., the core network 106, the packet data network 108, a relay device, an integrated access and backhaul (IAB) node, or another network equipment), as shown in Fig. 1. Additionally, or alternatively, a UE 104 may support communication with other network entities 102 or UEs 104, which may act as relays in the wireless communications system 100.

[0059] A UE 104 may also be able to support wireless communication directly with other UEs 104 over a communication link 114. For example, a UE 104 may support wireless communication directly with another UE 104 over a device-to-device (D2D) communication link. In some implementations, such as vehicle-to-vehicle (V2V) deployments, vehicle-to-everything (V2X) deployments, or cellular-V2X deployments, the communication link 114 may be referred to as a sidelink. For example, a UE 104 may support wireless communication directly with another UE 104 over a PC5 interface.

[0060] A network entity 102 may support communications with the core network 106, or with another network entity 102, or both. For example, a network entity 102 may interface with the core network 106 through one or more backhaul links 116 (e.g., via an S1, N2, N2, or another network interface). The network entities 102 may communicate with each other over the backhaul links 116 (e.g., via an X2, Xn, or another network interface). In some implementations, the network entities 102 may communicate with each other directly (e.g., between the network entities 102). In some other implementations, the network entities 102 may communicate with each other or indirectly (e.g., via the core network 106). In some implementations, one or more network entities 102 may include subcomponents, such as an access network entity, which may be an example of an access node controller (ANC). An ANC may communicate with the one or more UEs 104 through one or more other access network transmission entities, which may be referred to as a radio heads, smart radio heads, or transmission-reception points (TRPs).

[0061] In some implementations, a network entity 102 may be configured in a disaggregated architecture, which may be configured to utilize a protocol stack physically or logically distributed among two or more network entities 102, such as an integrated access backhaul (IAB) network, an open radio access network (O-RAN) (e.g., a network configuration sponsored by the O-RAN Alliance), or a virtualized RAN (vRAN) (e.g., a cloud RAN (C-RAN)). For example, a network entity 102 may include one or more of a central unit (CU), a distributed unit (DU), a radio unit (RU), a RAN intelligent controller (RIC) (e.g., a near-real time RIC (Near-RT RIC), a non-real time RIC (Non-RT RIC)), a service management and orchestration (SMO) system, or any combination thereof.

[0062] An RU may also be referred to as a radio head, a smart radio head, a remote radio head (RRH), a remote radio unit (RRU), or a transmission reception point (TRP). One or more components of the network entities 102 in a disaggregated RAN architecture may be co-located, or one or more components of the network entities 102 may be located in distributed locations (e.g., separate physical locations). In some implementations, one or more network entities 102 of a disaggregated RAN architecture may be implemented as virtual units (e.g., a virtual CU (VCU), a virtual DU (VDU), a virtual RU (VRU)).

[0063] Split of functionality between a CU, a DU, and an RU may be flexible and may support different functionalities depending upon which functions (e.g., network layer functions, protocol layer functions, baseband functions, radio frequency functions, and any combinations thereof) are performed at a CU, a DU, or an RU. For example, a functional split of a protocol stack may be employed between a CU and a DU such that the CU may support one or more layers of the protocol stack and the DU may support one or more different layers of the protocol stack. In some implementations, the CU may host upper protocol layer (e.g., a layer 3 (L3), a layer 2 (L2)) functionality and signaling (e.g., radio resource control (RRC), service data adaptation protocol (SDAP), packet data convergence protocol (PDCP)). The CU may be connected to one or more DUs or RUs, and the one or more DUs or RUs may host lower protocol layers, such as a layer 1 (L1) (e.g., physical (PHY) layer) or an L2 (e.g., radio link control (RLC) layer, medium access control (MAC) layer) functionality and signaling, and may each be at least partially controlled by the CU.

[0064] Additionally, or alternatively, a functional split of the protocol stack may be employed between a DU and an RU such that the DU may support one or more layers of

the protocol stack and the RU may support one or more different layers of the protocol stack. The DU may support one or multiple different cells (e.g., via one or more RUs). In some implementations, a functional split between a CU and a DU, or between a DU and an RU may be within a protocol layer (e.g., some functions for a protocol layer may be performed by one of a CU, a DU, or an RU, while other functions of the protocol layer are performed by a different one of the CU, the DU, or the RU).

[0065] A CU may be functionally split further into CU control plane (CU-CP) and CU user plane (CU-UP) functions. A CU may be connected to one or more DUs via a midhaul communication link (e.g., F1, F1-c, F1-u), and a DU may be connected to one or more RUs via a fronthaul communication link (e.g., open fronthaul (FH) interface). In some implementations, a midhaul communication link or a fronthaul communication link may be implemented in accordance with an interface (e.g., a channel) between layers of a protocol stack supported by respective network entities 102 that are in communication via such communication links.

[0066] The core network 106 may support user authentication, access authorization, tracking, connectivity, and other access, routing, or mobility functions. The core network 106 may be an evolved packet core (EPC), or a 5G core (5GC), which may include a control plane entity that manages access and mobility (e.g., a mobility management entity (MME), an access and mobility management functions (AMF)) and a user plane entity that routes packets or interconnects to external networks (e.g., a serving gateway (S-GW), a packet data network (PDN) gateway (P-GW), or a user plane function (UPF)). In some implementations, the control plane entity may manage non-access stratum (NAS) functions, such as mobility, authentication, and bearer management (e.g., data bearers, signal bearers, etc.) for the one or more UEs 104 served by the one or more network entities 102 associated with the core network 106.

[0067] The core network 106 may communicate with the packet data network 108 over one or more backhaul links 116 (e.g., via an S1, N2, N2, or another network interface). The packet data network 108 may include an application server 118. In some implementations, one or more UEs 104 may communicate with the application server 118. A UE 104 may establish a session (e.g., a protocol data unit (PDU) session, or the like) with the core network 106 via a network entity 102. The core network 106 may route traffic (e.g., control information, data, and the like) between the UE 104 and the

application server 118 using the established session (e.g., the established PDU session). The PDU session may be an example of a logical connection between the UE 104 and the core network 106 (e.g., one or more network functions of the core network 106).

[0068] In the wireless communications system 100, the network entities 102 and the UEs 104 may use resources of the wireless communications system 100 (e.g., time resources (e.g., symbols, slots, subframes, frames, or the like) or frequency resources (e.g., subcarriers, carriers)) to perform various operations (e.g., wireless communications). In some implementations, the network entities 102 and the UEs 104 may support different resource structures. For example, the network entities 102 and the UEs 104 may support different frame structures. In some implementations, such as in 4G, the network entities 102 and the UEs 104 may support a single frame structure. In some other implementations, such as in 5G and among other suitable radio access technologies, the network entities 102 and the UEs 104 may support various frame structures (i.e., multiple frame structures). The network entities 102 and the UEs 104 may support various frame structures based on one or more numerologies.

[0069] One or more numerologies may be supported in the wireless communications system 100, and a numerology may include a subcarrier spacing and a cyclic prefix. A first numerology (e.g., $\mu=0$) may be associated with a first subcarrier spacing (e.g., 15 kHz) and a normal cyclic prefix. In some implementations, the first numerology (e.g., $\mu=0$) associated with the first subcarrier spacing (e.g., 15 kHz) may utilize one slot per subframe. A second numerology (e.g., $\mu=1$) may be associated with a second subcarrier spacing (e.g., 30 kHz) and a normal cyclic prefix. A third numerology (e.g., $\mu=2$) may be associated with a third subcarrier spacing (e.g., 60 kHz) and a normal cyclic prefix or an extended cyclic prefix. A fourth numerology (e.g., $\mu=3$) may be associated with a fourth subcarrier spacing (e.g., 120 kHz) and a normal cyclic prefix. A fifth numerology (e.g., $\mu=4$) may be associated with a fifth subcarrier spacing (e.g., 240 kHz) and a normal cyclic prefix.

[0070] A time interval of a resource (e.g., a communication resource) may be organized according to frames (also referred to as radio frames). Each frame may have a duration, for example, a 10 millisecond (ms) duration. In some implementations, each frame may include multiple subframes. For example, each frame may include 10 subframes, and each subframe may have a duration, for example, a 1 ms duration. In some

implementations, each frame may have the same duration. In some implementations, each subframe of a frame may have the same duration.

[0071] Additionally or alternatively, a time interval of a resource (e.g., a communication resource) may be organized according to slots. For example, a subframe may include a number (e.g., quantity) of slots. The number of slots in each subframe may also depend on the one or more numerologies supported in the wireless communications system 100. For instance, the first, second, third, fourth, and fifth numerologies (i.e., $\mu=0$, $\mu=1$, $\mu=2$, $\mu=3$, $\mu=4$) associated with respective subcarrier spacings of 15 kHz, 30 kHz, 60 kHz, 120 kHz, and 240 kHz may utilize a single slot per subframe, two slots per subframe, four slots per subframe, eight slots per subframe, and 16 slots per subframe, respectively. Each slot may include a number (e.g., quantity) of symbols (e.g., OFDM symbols). In some implementations, the number (e.g., quantity) of slots for a subframe may depend on a numerology. For a normal cyclic prefix, a slot may include 14 symbols. For an extended cyclic prefix (e.g., applicable for 60 kHz subcarrier spacing), a slot may include 12 symbols. The relationship between the number of symbols per slot, the number of slots per subframe, and the number of slots per frame for a normal cyclic prefix and an extended cyclic prefix may depend on a numerology. It should be understood that reference to a first numerology (e.g., $\mu=0$) associated with a first subcarrier spacing (e.g., 15 kHz) may be used interchangeably between subframes and slots.

[0072] In the wireless communications system 100, an electromagnetic (EM) spectrum may be split, based on frequency or wavelength, into various classes, frequency bands, frequency channels, etc. By way of example, the wireless communications system 100 may support one or multiple operating frequency bands, such as frequency range designations FR1 (410 MHz – 7.125 GHz), FR2 (24.25 GHz – 52.6 GHz), FR3 (7.125 GHz – 24.25 GHz), FR4 (52.6 GHz – 114.25 GHz), FR4a or FR4-1 (52.6 GHz – 71 GHz), and FR5 (114.25 GHz – 300 GHz). In some implementations, the network entities 102 and the UEs 104 may perform wireless communications over one or more of the operating frequency bands. In some implementations, FR1 may be used by the network entities 102 and the UEs 104, among other equipment or devices for cellular communications traffic (e.g., control information, data). In some implementations, FR2 may be used by the network entities 102 and the UEs 104, among other equipment or devices for short-range, high data rate capabilities.

[0073] FR1 may be associated with one or multiple numerologies (e.g., at least three numerologies). For example, FR1 may be associated with a first numerology (e.g., $\mu=0$), which includes 15 kHz subcarrier spacing; a second numerology (e.g., $\mu=1$), which includes 30 kHz subcarrier spacing; and a third numerology (e.g., $\mu=2$), which includes 60 kHz subcarrier spacing. FR2 may be associated with one or multiple numerologies (e.g., at least 2 numerologies). For example, FR2 may be associated with a third numerology (e.g., $\mu=2$), which includes 60 kHz subcarrier spacing; and a fourth numerology (e.g., $\mu=3$), which includes 120 kHz subcarrier spacing.

[0074] Fig. 2 illustrates another example of a wireless communications system 200 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. As shown in Fig. 2, the wireless communications system 200 may comprise a first device 210 for wireless communication and a second device 220 for wireless communication.

[0075] In some implementations, the first device 210 may be implemented as a transmitter of a data packet and the second device 220 may be implemented as a receiver of the data packet. For example, the first device 210 may be implemented as an RLC transmitter of the data packet and the second device 220 may be implemented as an RLC receiver of the data packet.

[0076] In some implementations, the first device 210 may be implemented as the network entity 102 in Fig. 1 and the second device 220 may be implemented as the UE 104 in Fig. 1. Alternatively, the first device 210 may be implemented as the UE 104 in Fig. 1 and the second device 220 may be implemented as the network entity 102 in Fig. 1.

[0077] Fig. 3 illustrates a signaling diagram illustrating an example process 300 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The process 300 may involve the first device 210 for wireless communication and the second device 220 for wireless communication in Fig. 2. For the purpose of discussion, the process 300 will be described with reference to Fig. 2.

[0078] Generally, in the process 300, the first device 210 may be implemented as a transmitter of a data packet and the second device 220 may be implemented as a receiver of the data packet. For example, the first device 210 may be implemented as an RLC

transmitter of the data packet and the second device 220 may be implemented as an RLC receiver of the data packet.

[0079] As shown in Fig. 3, the first device 210 transmits 310 a first data packet to the second device 220.

[0080] Then, the first device 210 triggers 320 a first poll to request a first status report for the first data packet from the second device 220 based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet.

[0081] In turn, the first device 210 transmits 330 the first poll to the second device 220.

[0082] With the process 300, fast RLC retransmission of a data packet may be achieved.

[0083] Hereinafter, some implementations of triggering the first poll based on the delay status of the first data packet will be described with reference to Figs. 4 to 12.

[0084] In some implementations, the first device 210 may trigger the first poll based on the delay status of the first data packet. In such implementations, the first device 210 may obtain a first delay-critical indication. The first delay-critical indication may indicate the first data packet becomes a first delay-critical data packet. Alternatively, the first delay-critical indication may indicate remaining time of a discard timer for the first data packet is below a threshold. In turn, the first device 210 may trigger the first poll based on the first delay-critical indication. This will be described with reference to Figs. 4 and 5.

[0085] Fig. 4 illustrates an example 400 of a delay-critical indication in accordance with aspects of the present disclosure. For the purpose of discussion, the example 400 will be described with reference to Fig. 2.

[0086] As shown in Fig. 4, the first device 210 may comprise at least a PDCP entity 210-1 and an RLC entity 210-2. If the first device 210 is implemented as a transmitter of a data packet, the PDCP entity 210-1 may be referred to as a transmitting PDCP entity 210-1, and the RLC entity 210-2 may be referred to as a transmitting RLC entity 210-1 corresponding to the transmitting PDCP entity 210-1.

[0087] In the example 400, a PDU set may comprise PDUs #1, #2, #3, #4, #5 and #6.

[0088] Fig. 5 illustrates a flowchart of a method 500 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 500 may be considered as an example implementation of the action 320 in Fig. 3. For the purpose of discussion, the method 500 will be described from the perspective of the first device 210 with reference to Fig. 2.

[0089] As shown in Fig. 5, at reception of a PDCP service data unit (SDU) from upper layers, the transmitting PDCP entity 210-1 starts, at 510, a discard timer for the PDCP SDU. For example, at reception of each of PDCP SDUs #1, #2, #3, #4, #5 and #6 corresponding to the PDUs #1, #2, #3, #4, #5 and #6 in Fig. 4 from upper layers, the transmitting PDCP entity 210-1 starts a discard timer for a respective one of PDCP SDUs #1, #2, #3, #4, #5 and #6.

[0090] If a PDCP SDU becomes a delay-critical PDCP SDU, and if the corresponding PDCP Data PDU has already been submitted to lower layers, the transmitting PDCP entity 210-1 provides, at 520, a delay-critical indication for the PDCP Data PDU to the transmitting RLC entity 210-2 corresponding to the transmitting PDCP entity 210-1. In this regard, the delay-critical indication for the PDCP Data PDU may indicate the PDCP SDU corresponding to the PDCP Data PDU becomes a delay-critical PDCP SDU.

[0091] In some implementations, if *pdu-SetDiscard* is not configured, a delay-critical PDCP SDU may refer to a PDCP SDU for which the remaining time till discard timer expiry is less than the *remainingTimeThreshold*. If *pdu-SetDiscard* is configured, a delay-critical PDCP SDU may refer to a PDCP SDU belonging to a PDU Set of which at least one PDCP SDU has the remaining time till discard timer expiry less than the *remainingTimeThreshold*. In this regard, the delay-critical indication for the PDCP Data PDU may indicate remaining time of the discard timer for the PDCP SDU corresponding to the PDCP Data PDU is below the *remainingTimeThreshold*.

[0092] For example, in the example 400, the PDCP SDU #1, 2 and 3 become delay-critical PDCP SDUs, and the PDCP Data PDUs corresponding to the PDCP SDU #1, 2 and 3 have already been submitted to lower layers. Thus, the transmitting PDCP entity 210-1 may provide, to the transmitting RLC entity 210-2, a delay-critical indication for each of the PDCP Data PDUs corresponding to the PDCP SDU #1, 2 and 3.

[0093] Upon notification of a transmission opportunity by lower layer, the transmitting RLC entity 210-2 may determine to submit a second AMD PDU to lower layer for transmission at 530.

[0094] If the transmitting RLC entity 210-2 receives the delay-critical indication for the PDCP Data PDU which is corresponding to the first data packet (such as a first RLC PDU), the transmitting RLC entity 210-2 may trigger, at 540, the first poll to request the first status report for the first data packet from the second device 220. For example, the transmitting RLC entity 210-2 may trigger the first poll by including a poll in the second AMD PDU submitted for transmission at 540.

[0095] In some implementations, the first RLC PDU may be awaiting acknowledgements from the second device 220 (such as an RLC receiver).

[0096] In some implementations, the second AMD PDU submitted for transmission may contain either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment.

[0097] In some implementations, the first RLC PDU may be the same as or different from the second AMD PDU.

[0098] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on a delay status of a data packet by performing a procedure in shown in Table 1.

Table 1

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall: - if receiving delay-critical indication for an RLC SDU from upper layer: - include a poll in the AMD PDU as described below. To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall: - set the P field of the AMD PDU to "1"; - set PDU_WITHOUT_POLL to 0; - set BYTE_WITHOUT_POLL to 0.
--

[0099] In some implementations, the first device 210 may continuously receive delay-critical indications for subsequent packets which may be in a PDU set or in a data burst. To avoid frequent triggering polls to the second device 220, the first device 210 may trigger the first poll based on the first delay-critical indication and at least one other parameter.

[0100] In some implementations, if a first number of continuous polls which were triggered based on delay-critical indications is equal to or less than a first threshold, the first device 210 may trigger the first poll based on the first delay-critical indication. The delay-critical indications indicating data packets become delay-critical data packets. Hereinafter, the first number is represented by DELAY_POLL, and the first threshold is represented by *maxPollThreshold*.

[0101] In some implementations, the parameter “*maxPollThreshold*” may be used by the first device 210 (such as the transmitting side of an AM RLC entity) to limit the number of polls which are triggered by delay critical indications from the upper layer.

[0102] Fig. 6 illustrates an example 600 of triggering a poll based on a delay critical indication and the parameter “*maxPollThreshold*” in accordance with aspects of the present disclosure. For the purpose of discussion, the example 600 will be described with reference to Fig. 2.

[0103] As shown in Fig. 6, the first device 110 may continuously obtain delay-critical indications for data packets #1, #2 and #3. For brevity, the delay-critical indications for data packets #1, #2 and #3 may be referred to as an indication for data packet #1, an indication for data packet #2 and an indication for data packet #3. The indication for data packet #1 indicates data packet #1 becomes a delay-critical data packet, the indication for data packet #2 indicates data packet #2 becomes a delay-critical data packet, and the indication for data packet #3 indicates data packet #3 becomes a delay-critical data packet.

[0104] In the example 600, initially, the parameter “DELAY_POLL” is set to be zero and the parameter “*maxPollThreshold*” may be configured to be three. The *maxPollThreshold* may be configured by the network entity 102. When the first device 110 obtains the delay-critical indication for data packet #1, the first device 110 may determine whether DELAY_POLL is equal to or less than *maxPollThreshold*. Because

DELAY_POLL is equal to zero, the first device 110 may trigger a poll based on the delay-critical indication for data packet #1 and increment DELAY_POLL by one.

[0105] Similarly, the first device 110 may trigger a poll based on each of the delay-critical indication for data packet #2 and the delay-critical indication for data packet #3. After the first device 110 may trigger the three polls, DELAY_POLL is equal to three.

[0106] Then, when the first device 110 obtains a delay-critical indication for a subsequent data packet #4, the first device 110 may determine that DELAY_POLL is equal to *maxPollThreshold*. In turn, the first device 110 will not trigger a poll based on the delay-critical indication for the subsequent data packet #4.

[0107] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on a delay critical indication by performing a procedure in shown in Table 2.

Table 2

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall: - if receiving delay-critical indication for an RLC SDU from upper layer, and - if $DELAY_POLL \leq maxPollThreshold$: - include a poll in the AMD PDU as described below. - increment DELAY_POLL by one; To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall: - set the P field of the AMD PDU to "1"; - set PDU_WITHOUT_POLL to 0; - set BYTE_WITHOUT_POLL to 0. - set DELAY_POLL to 0.

[0108] In some implementations, the first device 210 may obtain the first delay-critical indication after transmitting a second poll to request a second status report for a second data packet from the second device 220. In such implementations, if a second number of delay-critical data packets is equal to or greater than a second threshold, the

first device 210 may trigger the first poll based on the first delay-critical indication. The second number of delay-critical indications for the second number of delay-critical data packets have been obtained since the second poll was transmitted, and the delay-critical data packets comprise the first delay-critical data packet. Hereinafter, the second number is represented by DELAY_PDU_POLL, and the second threshold is represented by *pollDelayPDU*.

[0109] In some implementations, the parameter “*pollDelayPDU*” may be used by the first device 210 (such as the transmitting side of an AM RLC entity) to trigger a poll for every *pollDelayPDU* PDUs after a poll triggered based on the delay critical indication is transmitted. The the parameter “*pollDelayPDU*” may be configured by the network entity 102.

[0110] In some implementations, the first device 210 (such as the transmitting side of an AM RLC entity) may set DELAY_PDU_WITHOUT_POLL to 0 if the first device 210 determines to include a poll in an AMD PDU. Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, if receiving delay-critical indication for an RLC SDU from upper layer, the first device 210 increments DELAY_PDU_WITHOUT_POLL by one.

[0111] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on a delay critical indication by performing a procedure in shown in Table 3.

Table 3

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall: - if receiving delay-critical indication for an RLC SDU from upper layer: - increment DELAY_PDU_POLL by one; - if DELAY_PDU_POLL >= <i>pollDelayPDU</i>: - include a poll in the AMD PDU as described below.

To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall:

- set the P field of the AMD PDU to "1";
- set PDU_WITHOUT_POLL to 0;
- set BYTE_WITHOUT_POLL to 0.
- set DELAY_PDU_POLL to 0.

[0112] In some implementations, the first device 210 may obtain the first delay-critical indication after transmitting a second poll to trigger a second status report for a second data packet at the second device 220. In such implementations, if a third number of data bytes is equal to or greater than a third threshold, the first device 210 may trigger the first poll based on the first delay-critical indication. Delay-critical indications for delay-critical data packets comprising the third number of data bytes have been obtained since the second poll was transmitted, and the delay-critical data packets comprise the first delay-critical data packet. Hereinafter, the third number is represented by DELAY_BYTE_POLL, and the third threshold is represented by *pollDelayByte*.

[0113] In some implementations, the parameter “*pollDelayByte*” may be used by the first device 210 (such as the transmitting side of an AM RLC entity) to trigger a poll for every *pollDelayByte* bytes after a poll triggered based on the delay critical indication is transmitted. the parameter “*pollDelayByte*” may be configured by the network entity 102.

[0114] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on a delay critical indication by performing a procedure in shown in Table 4.

Table 4

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall:

- if receiving delay-critical indication for an RLC SDU from upper layer:
 - increment DELAY_BYTE_POLL by every new byte of Data field element that it maps to the Data field of the AMD PDU;
- if DELAY_BYTE_POLL $\geq$ *pollDelayByte*:

- include a poll in the AMD PDU as described below.

To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall:

- set the P field of the AMD PDU to "1";
- set PDU_WITHOUT_POLL to 0;
- set BYTE_WITHOUT_POLL to 0.
- set DELAY_BYTE_WITHOUT_POLL to 0.

[0115] In some implementations, the first device 210 may obtain the first delay-critical indication after transmitting a second poll to trigger a second status report for a second data packet at the second device 220. In such implementations, if a fourth number of delay-critical indications is equal to or greater than a third threshold, the first device 210 may trigger the first poll based on the first delay-critical indication. Delay-critical indications for delay-critical data packets have been obtained since the second poll was transmitted, and the delay-critical data packets comprise the first delay-critical data packet. Hereinafter, the fourth number is represented by DELAY_NUMBER_POLL, and the fourth threshold is represented by *pollDelayNumber*.

[0116] In some implementations, the parameter “*pollDelayNumber*” may be used by the first device 210 (such as the transmitting side of an AM RLC entity) to trigger a poll for every *pollDelayNumber* indications after a poll triggered is transmitted.

[0117] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on a delay critical indication by performing a procedure in shown in Table 5.

Table 5

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall:

- if receiving delay-critical indication for an RLC SDU from upper layer:
 - increment DELAY_NUMBER_POLL by every new indication that it maps to the Data field of the AMD PDU;
- if DELAY_NUMBER_POLL $\geq$ *pollDelayNumber*:
 - include a poll in the AMD PDU as described below.

To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall:

- set the P field of the AMD PDU to "1";
- set PDU_WITHOUT_POLL to 0;
- set BYTE_WITHOUT_POLL to 0.
- set DELAY_BYTE_WITHOUT_POLL to 0.

[0118] In some implementations, if there is not the second AMD PDU including an RLC SDU for transmission at 530 in Fig. 5, the first device 210 may generate an RLC PDU without RLC SDU. In such implementations, the action at 530 in Fig. 5 may be changed as below: upon notification of a transmission opportunity by lower layer, the transmitting RLC entity determines to submit an RLC PDU to lower layer for transmission.

[0119] In some implementations, the RLC PDU may be an RLC control PDU. In order to transmit the first poll, the first device 210 may include the first poll in the RLC control PDU.

[0120] Fig. 7 illustrates an example of an RLC PDU 700 in accordance with aspects of the present disclosure. As shown in Fig. 7, the RLC PDU 700 may comprise at least one of the following: a D/C field, a CPT field, a P field, an SN field or a reserved (R) field.

[0121] In some implementations, the D/C field may indicate whether the RLC PDU 700 is an RLC data PDU or RLC control PDU. The interpretation of the D/C field is provided in Table 6.

Table 6

Value	Description
0	Control PDU
1	Data PDU

[0122] In some implementations, the CPT field may indicate a type of the RLC control PDU. The interpretation of the CPT field is provided in Table 7.

Table 7

Value	Description
000	STATUS PDU

xxx (e.g., 001)	Polling PDU
--------------------	-------------

[0123] As shown in Table 7, the CPT field set to 000 may indicate that a type of the RLC control PDU is a STATUS PDU. The CPT field set to other value than 000 may indicate that a type of the RLC control PDU is a polling PDU. For example, the CPT field set to 001 may indicate that a type of the RLC control PDU is a polling PDU.

[0124] In some implementations, the P field may indicate whether or not the transmitting side of an AM RLC entity requests a status report from its peer AM RLC entity. The interpretation of the P field is provided in Table 8.

Table 8

Value	Description
0	Status report not requested
1	Status report is requested

[0125] In some implementations, the SN field may indicate the sequence number (SN) of the corresponding RLC SDU. The transmitting side of an AM RLC entity requests a status report till the SN of the RLC SDU.

[0126] In some implementations, the SN field may indicate a range of sequence number of the corresponding RLC SDU. The transmitting side of an AM RLC entity requests a status report till the SN of the RLC SDU.

[0127] Alternatively, in some implementations, the RLC PDU may be an AMD PDU. In order to transmit the first poll, the first device 210 may include the first poll in the AMD PDU.

[0128] In some implementations, the AMD PDU may comprise an indicator indicating that the first status report is requested based on the delay status of the first data packet.

[0129] In some implementations, the AMD PDU may comprise a Data field and an AMD PDU header. The AMD PDU header may comprise the indicator indicating that the first status report is requested based on the delay status of the first data packet.

[0130] Fig. 8A illustrates an example of an AMD PDU with 12-bit SN field and without segment offset (SO) field in accordance with aspects of the present disclosure.

Fig. 8B illustrates an example of an AMD PDU with 18-bit SN field and without SO field in accordance with aspects of the present disclosure. Fig. 8C illustrates an example of an AMD PDU with 12-bit SN field and with SO field in accordance with aspects of the present disclosure. Fig. 8D illustrates an example of an AMD PDU with 18-bit SN field and with SO field in accordance with aspects of the present disclosure.

[0131] In the examples of Figs. 8A, 8B, 8C and 8D, an AMD PDU header may comprise at least one of the following: a D/C field, a P field, a segmentation info (SI) field, an SN field, an additional indicator (AD) field or a reserved (R) field.

[0132] For example, the AD field set to 1 may indicate a status report is requested based on a delay status of a data packet. That is, the AD field set to 1 may indicate the polling request is triggered by a delay-critical indication or by a delay status. For example, the AD field set to 0 may indicate the status report is requested not based on the delay status. That is, the AD field set to 0 may indicate the polling request is not triggered by the delay-critical indication.

[0133] As described above, in some implementations, the first device 210 may be implemented as the UE 104 and the second device 220 may be implemented as the network entity 102. In such implementations, an AMD PDU header may comprise the AD field only if the network entity 102 configures the UE 104 to use the field.

[0134] In some implementations, the SI field may indicate whether an RLC PDU comprises a complete RLC SDU or the first, middle, last segment of an RLC SDU. The interpretation of the SI field is provided in Table 9.

Table 9

Value	Description
00	Data field contains all bytes of an RLC SDU
01	Data field contains the first segment of an RLC SDU
10	Data field contains the last segment of an RLC SDU
11	Data field contains neither the first nor last segment of an RLC SDU

[0135] In some implementations, the SO field may indicate the position of the RLC SDU segment in bytes within the original RLC SDU. Specifically, the SO field may indicate the position within the original RLC SDU to which the first byte of the RLC SDU

segment in the Data field corresponds. The first byte of the original RLC SDU is referred by the SO field value "0000000000000000", i.e., numbering starts at zero.

[0136] The interpretations of the D/C field, the P field and the SN field in Figs. 8A, 8B, 8C and 8D are the same as those in Tables 5-7. Details of these fields are omitted for brevity.

[0137] In some implementations, if the first device 210 does not receive a response to transmission of the first data packet for a period of time, the first device 210 may trigger the first poll based on the first delay-critical indication.

[0138] In some implementations, the response to transmission of the first data packet may comprise the first status report for the first data packet from the second device 220. In such implementations, after the first device 210 transmits the first poll to request the first status report for the first data packet, if the first device 210 does not receive the first status report for a period of time, the first device 210 may trigger the first poll based on the first delay-critical indication.

[0139] For example, if there is delay critical data awaiting acknowledge at the RLC transmitter, and if the RLC transmitter does not get any response from the RLC receiver for a certain period of time, the RLC transmitter triggers the poll based on the delay-critical indication for the delay critical data.

[0140] In some implementations, the first device 210 may trigger the first poll based on the first delay-critical indication for high importance data. In such implementations, if the first device 210 determines that the first data packet comprises high importance data, the first device 210 may trigger the first poll based on the delay status (e.g., first delay-critical indication) for the first data packet.

[0141] For example, the first device 210 (such as the RLC transmitter) may only trigger the poll based on a delay status for high importance data. If the RLC transmitter receives a delay critical indication for low importance data, the RLC transmitter does not trigger a poll based on the delay status for the low importance data. If the RLC transmitter receives a delay critical indication for high importance data, the RLC transmitter triggers a poll based on a delay status for the high importance data.

[0142] In some implementations, the first device 210 may trigger the first poll based on the first end indication of the PDU set. The first end indication indicates an end of the

PDU set. In such implementations, if both a transmission buffer and a retransmission buffer associated with the PDU set becomes empty excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements after transmission of a third data packet, the first device 210 may trigger the first poll. This will be described with reference to Fig. 9 and Table 10.

[0143] Fig. 9 illustrates a flowchart of a method 900 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 900 may be considered as an example implementation of the action 320 in Fig. 3. For the purpose of discussion, the method 900 will be described from the perspective of the first device 210 with reference to Fig. 2.

[0144] As shown in Fig. 9, at 910, the first device 210 may identify PDU sets dynamically. For example, the first device 210 may identify an end of a PDU set based on implementation of the first device 210.

[0145] Upon notification of a transmission opportunity by lower layer, the first device 210 (such as the transmitting RLC entity of the first device 210) may determine, at 920, to submit a third AMD PDU to lower layer for transmission.

[0146] If an end of a PDU set is identified, the transmitting RLC entity may trigger a poll at 930. For example, the transmitting RLC entity may include a poll in the third AMD PDU submitted for transmission at 930.

[0147] In other words, if both a transmission buffer and a retransmission buffer associated with a PDU set becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the third AMD PDU associated with the PDU set, the transmitting RLC entity may include a poll in the third AMD PDU submitted for transmission.

[0148] In some implementations, the third AMD PDU submitted for transmission may contain either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment.

[0149] In some implementations, the third AMD PDU is the last PDU of the PDU set.

[0150] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on an end of a PDU set by performing a procedure in shown in Table 10.

Table 10

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission, the transmitting side of an AM RLC entity shall: - if both the transmission buffer and the retransmission buffer associated with a PDU set becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU associated with the PDU set; - include a poll in the AMD PDU as described below. NOTE: Empty RLC buffer (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) should not lead to unnecessary polling when data associated with the PDU set awaits in the upper layer. Details are left up to UE implementation.

[0151] In some implementations, if PDU set based discard is configured for a data radio bearer (DRB) of an RLC entity of the first device 210, the first device 210 may trigger the first poll based on the first end indication of the PDU set.

[0152] In some implementations, if PDU set integrated handling information (PSIHI) is configured for a quality of service (QoS) flow associated with the DRB, the first device 210 may trigger the first poll based on the first end indication of the PDU set. The PSIHI indicates whether all PDUs of a PDU set are needed for the usage of the PDU set by application layer.

[0153] In some implementations, the first device 210 may trigger the first poll based on the second end indication of the data burst comprising the first data packet. The second end indication indicates an end of the data burst. This will be described with reference to Fig. 10 and Table 11.

[0154] Fig. 10 illustrates a flowchart of a method 1000 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 1000 may be considered as an example implementation of the action 320 in Fig. 3. For the purpose of discussion, the method 1000 will be described from the perspective of the first device 210 with reference to Fig. 2.

- [0155] As shown in Fig. 10, at 1010, the first device 210 may identify data bursts dynamically. For example, the first device 210 identifies an end of a data burst based on implementation of the first device 210.
- [0156] Upon notification of a transmission opportunity by lower layer, the first device 210 (such as the transmitting RLC entity of the first device 210) may determine, at 1020, to submit a third AMD PDU to lower layer for transmission.
- [0157] If the transmitting RLC entity identifies the end of the data burst, the transmitting RLC entity may trigger a poll poll at 1030. For example, the transmitting RLC entity may include a poll in the third AMD PDU submitted for transmission at 1030.
- [0158] In other words, if both a transmission buffer and a retransmission buffer associated with a data burst becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU associated with the data burst, the transmitting RLC entity may include a poll in a third AMD PDU submitted for transmission at 1030.
- [0159] In some implementations, the third AMD PDU submitted for transmission contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment.
- [0160] In some implementations, the third AMD PDU is the last PDU of the data burst.
- [0161] For example, the first device 210 (such as the transmitting side of an AM RLC entity) may trigger a poll based on an end of a data burst by performing a procedure in shown in Table 11.

Table 11

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission, the transmitting side of an AM RLC entity shall: - if both the transmission buffer and the retransmission buffer associated with a data burst becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU associated with the data burst; - include a poll in the AMD PDU as described below.

NOTE: Empty RLC buffer (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) should not lead to unnecessary polling when data associated with the data burst awaits in the upper layer. Details are left up to UE implementation.

[0162] In some implementations, the first device 210 may trigger the first poll based on the delay status of the first data packet and the first end indication of the PDU set. The first end indication indicates an end of the PDU set. In such implementations, if both a transmission buffer and a retransmission buffer associated with the PDU set becomes empty excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements after transmission of a third data packet, the first device 210 may trigger the first poll. This will be described with reference to Fig. 11.

[0163] Fig. 11 illustrates a flowchart of a method 1100 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 1100 may be considered as an example implementation of the action 320 in Fig. 3. For the purpose of discussion, the method 1100 will be described from the perspective of the first device 210 with reference to Fig. 2.

[0164] As shown in Fig. 11, at 1110, the first device 210 may identify PDU sets dynamically. For example, the first device 210 may identify an end of a PDU set based on implementation of the first device 210.

[0165] At reception of a PDCP SDU from upper layers, the first device 210 (such as the transmitting PDCP entity of the first device 210) may start, at 1120, a discard timer for the PDCP SDU.

[0166] If a PDCP SDU becomes a delay-critical PDCP SDU, and if the corresponding PDCP Data PDU has already been submitted to lower layers, the first device 210 (such as the transmitting PDCP entity of the first device 210) may provide, at 1130, the delay-critical indication for the PDCP Data PDU to the transmitting RLC entity corresponding to the transmitting PDCP entity.

[0167] Upon notification of a transmission opportunity by lower layer, the first device 210 (such as the transmitting RLC entity of the first device 210) may determine, at 1140, to submit an AMD PDU to lower layer for transmission.

[0168] If the transmitting RLC entity receives the delay-critical indication for the PDCP Data PDU, and if both a transmission buffer and a retransmission buffer associated with the PDU set becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU associated with the PDU set, the transmitting RLC entity may trigger a poll at 1150. For example, the transmitting RLC entity may include a poll in the AMD PDU submitted for transmission at 1150.

[0169] In some implementations, the first device 210 may trigger the first poll based on the delay status of the first data packet and the second end indication of the data burst. The second end indication indicates an end of the data burst. This will be described with reference to Fig. 12.

[0170] Fig. 12 illustrates a flowchart of a method 1200 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 1200 may be considered as an example implementation of the action 320 in Fig. 3. For the purpose of discussion, the method 1200 will be described from the perspective of the first device 210 with reference to Fig. 2.

[0171] As shown in Fig. 12, at reception of a PDCP SDU from upper layers, the first device 210 (such as the transmitting PDCP entity of the first device 210) starts, at 1210, a discard timer for the PDCP SDU.

[0172] If a PDCP SDU becomes a delay-critical PDCP SDU, and if the corresponding PDCP Data PDU has already been submitted to lower layers, the transmitting PDCP entity may provide, at 1220, a delay-critical indication for the PDCP Data PDU to the transmitting RLC entity corresponding to the transmitting PDCP entity.

[0173] If the transmitting RLC entity receives the delay-critical indication for the PDCP Data PDU, and if both a transmission buffer and a retransmission buffer associated with a data burst becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU associated with the data burst, the transmitting RLC entity may trigger a poll at 1230. For example, the transmitting RLC entity may include a poll in the AMD PDU submitted for transmission at 1230.

[0174] Fig. 13 illustrates a signaling diagram illustrating an example process 1300 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The process 1300 may involve the first device 210 for wireless communication and the second device 220 for wireless communication in Fig. 2. For the purpose of discussion, the process 1300 will be described with reference to Fig. 2.

[0175] Generally, in the process 1300, the first device 210 may be implemented as a transmitter of a data packet and the second device 220 may be implemented as a receiver of the data packet. For example, the first device 210 may be implemented as an RLC transmitter of the data packet and the second device 220 may be implemented as an RLC receiver of the data packet.

[0176] As shown in Fig. 13, the first device 210 transmits 1310 a first data packet to the second device 220.

[0177] Then, the first device 210 retransmits 1320 the first data packet to the second device 220 based on a delay status of the first data packet.

[0178] The transmission for the first packet in the retransmission buffer is pending on reception of a status report comprising NACK or ACK from the peer entity. If the status report is not timely received, it delays the RLC retransmission of the first packet. With the process 1300, fast RLC retransmission of the first packet with short packet delay budget may be achieved.

[0179] In some implementations, the first device 210 may obtain a first delay-critical indication. The first delay-critical indication may indicate the first data packet becomes a first delay-critical data packet. Alternatively, the first delay-critical indication may indicate remaining time of a discard timer for the first data packet is below a threshold. In turn, the first device 210 may trigger retransmission of the first data packet based on the first delay-critical indication. This will be described with reference to Fig. 14.

[0180] Fig. 14 illustrates a flowchart of a method 1400 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 1400 may be considered as an example implementation of the action 1320 in Fig. 13. For the purpose of discussion, the method 1400 will be described from the perspective of the first device 210 with reference to Fig. 2.

[0181] As shown in Fig. 14, at reception of a PDCP SDU from upper layers, the first device 210 (such as the transmitting PDCP entity of the first device 210) may start, at 1410, a discard timer for the PDCP SDU.

[0182] If a PDCP SDU becomes a delay-critical PDCP SDU, and if the corresponding PDCP Data PDU has already been submitted to lower layers, the transmitting PDCP entity may provide, at 1420, the delay-critical indication for the PDCP Data PDU to the transmitting RLC entity corresponding to the transmitting PDCP entity.

[0183] Upon notification of a transmission opportunity by lower layer, the transmitting RLC entity may determine, at 1430, to submit an RLC PDU to lower layer for transmission.

[0184] At 1440, the transmitting RLC entity may trigger an RLC retransmission of the RLC PDU which is corresponding the delay-critical indication.

[0185] In some implementations, if the transmitting RLC entity does not receive a response to transmission of the RLC PDU for a period of time, the transmitting RLC entity may trigger retransmission of the RLC PDU based on the delay-critical indication for the RLC PDU. In one implementation, the transmitting RLC entity E may ignore the parameter of maximum number of RLC retransmissions. In one implementation, the transmitting RLC entity may not trigger if the number of RLC retransmissions of the RLC PDU has reached the maximum number of RLC retransmissions. For example, the response to transmission of the RLC PDU may comprise the status report for the RLC PDU from the RLC receiver.

[0186] In some implementations, the first device 210 may obtain a discard indication indicating that the first data packet is to be discarded. In turn, the first device 210 may trigger retransmission of the first data packet based on the discard indication. In such implementations, the first data packet is a data packet awaiting acknowledge in a retransmission buffer of the first device 210. In this case, the first device 210 may ignore the parameter of maximum number of RLC retransmissions.

[0187] Fig. 15 illustrates a flowchart of a method 1500 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The method 1500 may be considered as an example implementation of the action 1320 in Fig.

13. For the purpose of discussion, the method 1500 will be described from the perspective of the first device 210 with reference to Fig. 2.

[0188] As shown in Fig. 15, at reception of a PDCP SDU from upper layers, the first device 210 (such as the transmitting PDCP entity of the first device 210) may start, at 1510, a discard timer for the PDCP SDU.

[0189] If the discard timer for the PDCP SDU expires, the transmitting PDCP entity may provide, at 1520, a discard indication for the PDCP Data PDU to the transmitting RLC entity corresponding to the transmitting PDCP entity.

[0190] Upon notification of a transmission opportunity by lower layer, the transmitting RLC entity may determine, at 1530, to submit an RLC PDU to lower layer for transmission.

[0191] At 1540, the transmitting RLC entity may trigger an RLC retransmission of the RLC PDU which is corresponding the discard indication.

[0192] In some implementations, if the transmitting RLC entity does not receive a response to transmission of the RLC PDU for a period of time, the transmitting RLC entity may trigger retransmission of the RLC PDU based on the discard indication for the RLC PDU. For example, the response to transmission of the RLC PDU may comprise the status report for the RLC PDU from the RLC receiver.

[0193] Fig. 16 illustrates a signaling diagram illustrating an example process 1600 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The process 1600 may involve the first device 210 for wireless communication and the second device 220 for wireless communication in Fig. 2. For the purpose of discussion, the process 1600 will be described with reference to Fig. 2.

[0194] Generally, in the process 1600, the first device 210 may be implemented as a transmitter of a data packet and the second device 220 may be implemented as a receiver of the data packet. For example, the first device 210 may be implemented as an RLC transmitter of the data packet and the second device 220 may be implemented as an RLC receiver of the data packet.

[0195] As shown in Fig. 16, the second device 220 receives 1610 a first data packet from the first device 210 for wireless communication.

[0196] The second device 220 receives 1620 a first poll from the first device 210. The first poll indicates to request a first status report for the first data packet from the second device 220.

[0197] In turn, the second device 220 transmits 1630 the first status report to the first device 210.

[0198] In some implementations, in order to transmit the first status report, the second device 220 may ignore a running status of a timer which is used to prohibit transmission of the first status report. Hereinafter, the timer is also referred to as a *t-StatusProhibit* timer or the timer is represented by *t-StatusProhibit*.

[0199] In such implementations, transmission of the first status report is not limited by the timer. In other words, triggering condition and transmission condition for the first status report are relaxed. Thus, the first status report may be timely received by the first device. Therefore, fast RLC retransmission of the first data packet may be achieved.

[0200] In some implementations, the second device 220 may ignore the running status of the timer by stopping the timer if the timer is running or resetting the timer if the timer is running.

[0201] In some implementations, if the second device 220 (such as a receiving side of an AM RLC entity) is configured with at least one enhanced RLC configuration, the second device 220 may stop or reset the timer if the timer is running and the second device 220 received the first poll from the first device 210. For example, an RLC entity of the second device 220 may be configured with the at least one enhanced RLC configuration.

[0202] For example, the second device 220 (such as the receiving side of an AM RLC entity) may reset the *t-StatusProhibit* timer by performing a procedure in shown in Table 12.

Table 12

When STATUS reporting has been triggered and the RLC entity is configured with at least one enhanced RLC configuration, the receiving side of an AM RLC entity shall: - if <i>t-StatusProhibit</i> is running: - reset <i>t-StatusProhibit</i>, and the at the first transmission opportunity indicated by lower layer, construct a STATUS PDU and submit it to lower layer.
--

[0203] In some implementations, the second device 220 may stop or reset the timer if the timer is running, the second device 220 received the first poll from the first device 210 and the second device 220 determines that the first poll is triggered based on the delay status. For example, the second device 220 receives one of the RLC PDUs as shown in Figs. 7A, 8A, 8B, 8C and 8D which comprises the first poll, the second device 220 may determine that the first poll is triggered based on the delay status.

[0204] For example, the second device 220 (such as the receiving side of an AM RLC entity) may reset the *t-StatusProhibit* timer by performing a procedure in shown in Table 13.

Table 13

When STATUS reporting has been triggered by an enhanced RLC PDU including P bit, the receiving side of an AM RLC entity shall: - if <i>t-StatusProhibit</i> is running: - reset <i>t-StatusProhibit</i>, and the at the first transmission opportunity indicated by lower layer, construct a STATUS PDU and submit it to lower layer.
--

[0205] In some implementations, the second device 220 may not start the timer if the second device 220 is configured with the at least one enhanced RLC configuration. For example, if a value of the timer may be configured as zero, the second device 220 may not start the timer.

[0206] In some implementations, the second device 220 may not start the timer if the second device 220 determines that the first poll is triggered based on the delay status and the second device 220 is configured not to start the timer.

[0207] For example, the second device 220 (such as the receiving side of an AM RLC entity) may reset the *t-StatusProhibit* timer by performing a procedure in shown in Table 14.

Table 14

When a STATUS PDU has been submitted to lower layer, the receiving side of an AM RLC entity shall: - if the AM RLC entity is not configured to not start <i>t-StatusProhibit</i>. - if the RLC without configured with the at least one enhanced RLC configuration:

- start *t-statusProhibit*.

[0208] In some implementations, the at least one enhanced RLC configuration may comprise at least one of the following:

- triggering a poll based on a delay status of a data packet,
- triggering the poll based on an end of a PDU set,
- triggering the poll based on an end of a data burst,
- triggering the RLC retransmission based on the delay status,
- triggering the RLC retransmission based on the discard indication, or
- relaxing triggering condition and transmission condition for status reports.

[0209] In some implementations, the first device 210 may be implemented as the network entity 102 in Fig. 1 and the second device 220 may be implemented as the UE 104 in Fig. 1. Alternatively, the first device 210 may be implemented as the UE 104 in Fig. 1 and the second device 220 may be implemented as the network entity 102 in Fig. 1. The UE 104 may transmit capability to the network entity 102 to indicate that the UE 104 supports at least one enhanced RLC configuration as described above. Then, the network entity 102 may configure the UE 104 to use the at least one enhanced RLC configuration. In turn, the UE 104 may use the at least one enhanced RLC configuration.

[0210] In legacy, an RLC receiver triggers transmission of a status report based on the relationship among an SN value associated with the P field and the following state variables: RX_Highest_Status, TX_Next and AM_Window_Size.

[0211] RX_Highest_Status represents a Maximum STATUS transmit state variable. This state variable holds the highest possible value of the SN which can be indicated by "ACK_SN" when a STATUS PDU needs to be constructed. It is initially set to 0.

[0212] TX_Next represents a UM send state variable. This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

[0213] AM_Window_Size is used by both the transmitting side and the receiving side of each AM RLC entity. AM_Window_Size = 2048 when a 12 bit SN is used, AM_Window_Size = 131072 when an 18 bit SN is used.

[0214] In some implementations, the second device 220 may trigger transmission of the first status report by ignoring a range of an SN of the first status report. For example, the second device 220 may trigger transmission of the first status report without determining the relationship among the SN of the first status report and any of the above state variables. In some implementations, if the second device 220 configured with the at least one enhanced RLC configuration receives the first poll from the first device 210, the second device 220 may trigger transmission of the first status report regardless of the SN value associated with the P field in the RLC PDU.

[0215] In some implementations, the at least one enhanced RLC configuration may comprise at least one of the following:

- triggering transmission of the first status report regardless of the SN value associated with the P field in an RLC PDU.

[0216] For example, the second device 220 (such as the receiving side of an AM RLC entity) may trigger transmission of the first status report by performing a procedure in shown in Table 15.

Table 15

Trigger to initiate STATUS reporting include: - Polling from its peer AM RLC entity: - When an AMD PDU with SN = x and the P field set to "1" is received from lower layer, the receiving side of an AM RLC entity shall: - if the RLC configured with the at least one enhanced RLC configuration: - trigger a STATUS report.

[0217] In some implementations, if the first poll is triggered based on the first delay status, the second device 220 may trigger transmission of the first status report by ignoring a range of an SN of the first status report.

[0218] In such implementations, if the second device 220 received the first poll and determines that the first poll in the RLC PDU is triggered based on the first delay status, the second device 220 may trigger transmission of the first status report regardless of the SN value associated with the P field in the RLC PDU.

[0219] In such implementations, the second device 220 may not determine the relationship among the SN of the first status report and any of the above state variables.

For another example, the second device 220 may not determine whether the SN value is among the reception window.

[0220] For example, the second device 220 (such as the receiving side of an AM RLC entity) may trigger transmission of the first status report by performing a procedure in shown in Table 16.

Table 16

Triggers to initiate STATUS reporting include: - if an enhanced poll from its peer AM RLC entity is included in an RLC PDU: - When an RLC PDU with SN = x and the P field set to "1" is received from lower layer, the receiving side of an AM RLC entity shall: - trigger a STATUS report.

[0221] It shall be noted that the enhanced poll in Table 16 may refer to a poll triggered based on a delay status of a data packet.

[0222] Fig. 17 illustrates an example of a device 1700 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The device 1700 may be an example of the first device 210 or the second device 220 as described herein. The device 1700 may support wireless communication with one or more network entities 102, UEs 104, or any combination thereof. The device 1700 may include components for bi-directional communications including components for transmitting and receiving communications, such as a processor 1702, a memory 1704, a transceiver 1706, and, optionally, an I/O controller 1708. These components may be in electronic communication or otherwise coupled (e.g., operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g., buses).

[0223] The processor 1702, the memory 1704, the transceiver 1706, or various combinations thereof or various components thereof may be examples of means for performing various aspects of the present disclosure as described herein. For example, the processor 1702, the memory 1704, the transceiver 1706, or various combinations or components thereof may support a method for performing one or more of the operations described herein.

[0224] In some implementations, the processor 1702, the memory 1704, the transceiver 1706, or various combinations or components thereof may be implemented in

hardware (e.g., in communications management circuitry). The hardware may include a processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA) or other programmable logic device, a discrete gate or transistor logic, discrete hardware components, or any combination thereof configured as or otherwise supporting a means for performing the functions described in the present disclosure. In some implementations, the processor 1702 and the memory 1704 coupled with the processor 1702 may be configured to perform one or more of the functions described herein (e.g., executing, by the processor 1702, instructions stored in the memory 1704).

[0225] For example, the processor 1702 may support wireless communication at the device 1700 in accordance with examples as disclosed herein. The processor 1702 may be configured to operable to support a means for performing the following: transmitting a first data packet to a second device for wireless communication; triggering a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet; and transmitting the first poll to the second device.

[0226] Alternatively, in some implementations, the processor 1702 may be configured to operable to support a means for performing the following: transmitting a first data packet to a second device for wireless communication; and retransmitting the first data packet to the second device based on a delay status of the first data packet.

[0227] Alternatively, in some implementations, the processor 1702 may be configured to operable to support a means for performing the following: receiving a first data packet from a first device for wireless communication; receiving a first poll from the first device, wherein the first poll indicates to request a first status report for the first data packet from the second device; and transmitting the first status report to the first device.

[0228] The processor 1702 may include an intelligent hardware device (e.g., a general-purpose processor, a DSP, a CPU, a microcontroller, an ASIC, an FPGA, a programmable logic device, a discrete gate or transistor logic component, a discrete hardware component, or any combination thereof). In some implementations, the processor 1702 may be configured to operate a memory array using a memory controller. In some other implementations, a memory controller may be integrated into the processor

1702. The processor 1702 may be configured to execute computer-readable instructions stored in a memory (e.g., the memory 1704) to cause the device 1700 to perform various functions of the present disclosure.

[0229] The memory 1704 may include random access memory (RAM) and read-only memory (ROM). The memory 1704 may store computer-readable, computer-executable code including instructions that, when executed by the processor 1702 cause the device 1700 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. In some implementations, the code may not be directly executable by the processor 1702 but may cause a computer (e.g., when compiled and executed) to perform functions described herein. In some implementations, the memory 1704 may include, among other things, a basic I/O system (BIOS) which may control basic hardware or software operation such as the interaction with peripheral components or devices.

[0230] The I/O controller 1708 may manage input and output signals for the device 1700. The I/O controller 1708 may also manage peripherals not integrated into the device 1700. In some implementations, the I/O controller 1708 may represent a physical connection or port to an external peripheral. In some implementations, the I/O controller 1708 may utilize an operating system such as iOS®, ANDROID®, MS-WINDOWS®, OS/2®, UNIX®, LINUX®, or another known operating system. In some implementations, the I/O controller 1708 may be implemented as part of a processor, such as the processor 1702. In some implementations, a user may interact with the device 1700 via the I/O controller 1708 or via hardware components controlled by the I/O controller 1708.

[0231] In some implementations, the device 1700 may include a single antenna 1710. However, in some other implementations, the device 1700 may have more than one antenna 1710 (i.e., multiple antennas), including multiple antenna panels or antenna arrays, which may be capable of concurrently transmitting or receiving multiple wireless transmissions. The transceiver 1706 may communicate bi-directionally, via the one or more antennas 1710, wired, or wireless links as described herein. For example, the transceiver 1706 may represent a wireless transceiver and may communicate bi-directionally with another wireless transceiver. The transceiver 1706 may also include a modem to modulate the packets, to provide the modulated packets to one or more

antennas 1710 for transmission, and to demodulate packets received from the one or more antennas 1710. The transceiver 1706 may include one or more transmit chains, one or more receive chains, or a combination thereof.

[0232] A transmit chain may be configured to generate and transmit signals (e.g., control information, data, packets). The transmit chain may include at least one modulator for modulating data onto a carrier signal, preparing the signal for transmission over a wireless medium. The at least one modulator may be configured to support one or more techniques such as amplitude modulation (AM), frequency modulation (FM), or digital modulation schemes like phase-shift keying (PSK) or quadrature amplitude modulation (QAM). The transmit chain may also include at least one power amplifier configured to amplify the modulated signal to an appropriate power level suitable for transmission over the wireless medium. The transmit chain may also include one or more antennas 1710 for transmitting the amplified signal into the air or wireless medium.

[0233] A receive chain may be configured to receive signals (e.g., control information, data, packets) over a wireless medium. For example, the receive chain may include one or more antennas 1710 for receive the signal over the air or wireless medium. The receive chain may include at least one amplifier (e.g., a low-noise amplifier (LNA)) configured to amplify the received signal. The receive chain may include at least one demodulator configured to demodulate the receive signal and obtain the transmitted data by reversing the modulation technique applied during transmission of the signal. The receive chain may include at least one decoder for decoding the processing the demodulated signal to receive the transmitted data.

[0234] Fig. 18 illustrates an example of a processor 1800 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The processor 1800 may be an example of a processor configured to perform various operations in accordance with examples as described herein. The processor 1800 may include a controller 1802 configured to perform various operations in accordance with examples as described herein. The processor 1800 may optionally include at least one memory 1804, such as L1/L2/L3 cache. Additionally, or alternatively, the processor 1800 may optionally include one or more arithmetic-logic units (ALUs) 1806. One or more of these components may be in electronic communication or otherwise coupled (e.g.,

operatively, communicatively, functionally, electronically, electrically) via one or more interfaces (e.g., buses).

[0235] The processor 1800 may be a processor chipset and include a protocol stack (e.g., a software stack) executed by the processor chipset to perform various operations (e.g., receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) in accordance with examples as described herein. The processor chipset may include one or more cores, one or more caches (e.g., memory local to or included in the processor chipset (e.g., the processor 1800) or other memory (e.g., random access memory (RAM), read-only memory (ROM), dynamic RAM (DRAM), synchronous dynamic RAM (SDRAM), static RAM (SRAM), ferroelectric RAM (FeRAM), magnetic RAM (MRAM), resistive RAM (RRAM), flash memory, phase change memory (PCM), and others).

[0236] The controller 1802 may be configured to manage and coordinate various operations (e.g., signaling, receiving, obtaining, retrieving, transmitting, outputting, forwarding, storing, determining, identifying, accessing, writing, reading) of the processor 1800 to cause the processor 1800 to support various operations in accordance with examples as described herein. For example, the controller 1802 may operate as a control unit of the processor 1800, generating control signals that manage the operation of various components of the processor 1800. These control signals include enabling or disabling functional units, selecting data paths, initiating memory access, and coordinating timing of operations.

[0237] The controller 1802 may be configured to fetch (e.g., obtain, retrieve, receive) instructions from the memory 1804 and determine subsequent instruction(s) to be executed to cause the processor 1800 to support various operations in accordance with examples as described herein. The controller 1802 may be configured to track memory address of instructions associated with the memory 1804. The controller 1802 may be configured to decode instructions to determine the operation to be performed and the operands involved. For example, the controller 1802 may be configured to interpret the instruction and determine control signals to be output to other components of the processor 1800 to cause the processor 1800 to support various operations in accordance with examples as described herein. Additionally, or alternatively, the controller 1802 may be configured to manage flow of data within the processor 1800. The controller 1802 may

be configured to control transfer of data between registers, arithmetic logic units (ALUs), and other functional units of the processor 1800.

[0238] The memory 1804 may include one or more caches (e.g., memory local to or included in the processor 1800 or other memory, such RAM, ROM, DRAM, SDRAM, SRAM, MRAM, flash memory, etc. In some implementation, the memory 1804 may reside within or on a processor chipset (e.g., local to the processor 1800). In some other implementations, the memory 1804 may reside external to the processor chipset (e.g., remote to the processor 1800).

[0239] The memory 1804 may store computer-readable, computer-executable code including instructions that, when executed by the processor 1800, cause the processor 1800 to perform various functions described herein. The code may be stored in a non-transitory computer-readable medium such as system memory or another type of memory. The controller 1802 and/or the processor 1800 may be configured to execute computer-readable instructions stored in the memory 1804 to cause the processor 1800 to perform various functions. For example, the processor 1800 and/or the controller 1802 may be coupled with or to the memory 1804, the processor 1800, the controller 1802, and the memory 1804 may be configured to perform various functions described herein. In some examples, the processor 1800 may include multiple processors and the memory 1804 may include multiple memories. One or more of the multiple processors may be coupled with one or more of the multiple memories, which may, individually or collectively, be configured to perform various functions herein.

[0240] The one or more ALUs 1806 may be configured to support various operations in accordance with examples as described herein. In some implementation, the one or more ALUs 1806 may reside within or on a processor chipset (e.g., the processor 1800). In some other implementations, the one or more ALUs 1806 may reside external to the processor chipset (e.g., the processor 1800). One or more ALUs 1806 may perform one or more computations such as addition, subtraction, multiplication, and division on data. For example, one or more ALUs 1806 may receive input operands and an operation code, which determines an operation to be executed. One or more ALUs 1806 be configured with a variety of logical and arithmetic circuits, including adders, subtractors, shifters, and logic gates, to process and manipulate the data according to the operation. Additionally, or alternatively, the one or more ALUs 1806 may support logical operations

such as AND, OR, exclusive-OR (XOR), not-OR (NOR), and not-AND (NAND), enabling the one or more ALUs 1806 to handle conditional operations, comparisons, and bitwise operations.

[0241] The processor 1800 may support wireless communication in accordance with examples as disclosed herein. The processor 1800 may be configured to operable to support a means for performing the following: transmitting a first data packet to a second device for wireless communication; triggering a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet; and transmitting the first poll to the second device.

[0242] Alternatively, in some implementations, the processor 1800 may be configured to operable to support a means for performing the following: transmitting a first data packet to a second device for wireless communication; and retransmitting the first data packet to the second device based on a delay status of the first data packet.

[0243] Alternatively, in some implementations, the processor 1800 may be configured to operable to support a means for performing the following: receiving a first data packet from a first device for wireless communication; receiving a first poll from the first device, wherein the first poll indicates to request a first status report for the first data packet from the second device; and transmitting the first status report to the first device.

[0244] Fig. 19 illustrates a flowchart of a method 1900 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The operations of the method 1900 may be implemented by a device or its components as described herein. For example, the operations of the method 1900 may be performed by the first device 210 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0245] At 1910, the method may include transmitting a first data packet to a second device for wireless communication. The operations of 1910 may be performed in accordance with examples as described herein. In some implementations, aspects of the

operations of 1910 may be performed by the first device 210 as described with reference to Fig. 2.

[0246] At 1920, the method may include triggering a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a PDU set comprising the first data packet, or a second end indication of a data burst comprising the first data packet. The operations of 1920 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1920 may be performed by the first device 210 as described with reference to Fig. 2.

[0247] At 1910, the method may include transmitting the first poll to the second device. The operations of 1930 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 1930 may be performed by the first device 210 as described with reference to Fig. 2.

[0248] Fig. 20 illustrates a flowchart of a method 2000 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The operations of the method 2000 may be implemented by a device or its components as described herein. For example, the operations of the method 2000 may be performed by the first device 210 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0249] At 2010, the method may include transmitting a first data packet to a second device for wireless communication. The operations of 2010 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 2010 may be performed by the first device 210 as described with reference to Fig. 2.

[0250] At 2020, the method may include retransmitting the first data packet to the second device based on a delay status of the first data packet. The operations of 2020 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 2020 may be performed by the first device 210 as described with reference to Fig. 2.

[0251] Fig. 21 illustrates a flowchart of a method 2100 that supports RLC retransmission of a data packet in accordance with aspects of the present disclosure. The operations of the method 2100 may be implemented by a device or its components as described herein. For example, the operations of the method 2100 may be performed by the second device 220 as described herein. In some implementations, the device may execute a set of instructions to control the function elements of the device to perform the described functions. Additionally, or alternatively, the device may perform aspects of the described functions using special-purpose hardware.

[0252] At 2110, the method may include receiving a first data packet from a first device for wireless communication. The operations of 2110 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 2110 may be performed by the second device 220 as described with reference to Fig. 2.

[0253] At 2120, the method may include receiving a first poll from the first device, wherein the first poll indicates to request a first status report for the first data packet from the second device. The operations of 2120 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 2120 may be performed by the second device 220 as described with reference to Fig. 2.

[0254] At 2130, the method may include transmitting the first status report to the first device. The operations of 2130 may be performed in accordance with examples as described herein. In some implementations, aspects of the operations of 2130 may be performed by the second device 220 as described with reference to Fig. 2.

[0255] It shall be noted that implementations of the present disclosure which have been described with reference to Figs. 1 to 16 are also applicable to the device 1700, the processor 1800 and the methods 1900, 2000 and 2100.

[0256] It should be noted that the methods described herein describes possible implementations, and that the operations and the steps may be rearranged or otherwise modified and that other implementations are possible. Further, aspects from two or more of the methods may be combined.

[0257] The various illustrative blocks and components described in connection with the disclosure herein may be implemented or performed with a general-purpose processor,

a DSP, an ASIC, a CPU, an FPGA or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but in the alternative, the processor may be any processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices (e.g., a combination of a DSP and a microprocessor, multiple microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration).

[0258] The functions described herein may be implemented in hardware, software executed by a processor, firmware, or any combination thereof. If implemented in software executed by a processor, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Other examples and implementations are within the scope of the disclosure and appended claims. For example, due to the nature of software, functions described herein may be implemented using software executed by a processor, hardware, firmware, hardwiring, or combinations of any of these. Features implementing functions may also be physically located at various positions, including being distributed such that portions of functions are implemented at different physical locations.

[0259] Computer-readable media includes both non-transitory computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A non-transitory storage medium may be any available medium that may be accessed by a general-purpose or special-purpose computer. By way of example, non-transitory computer-readable media may include RAM, ROM, electrically erasable programmable ROM (EEPROM), flash memory, compact disk (CD) ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other non-transitory medium that may be used to carry or store desired program code means in the form of instructions or data structures and that may be accessed by a general-purpose or special-purpose computer, or a general-purpose or special-purpose processor.

[0260] As used herein, including in the claims, an article “a” before an element is unrestricted and understood to refer to “at least one” of those elements or “one or more” of those elements. The terms “a,” “at least one,” “one or more,” and “at least one of one

or more” may be interchangeable. As used herein, including in the claims, “or” as used in a list of items (e.g., a list of items prefaced by a phrase such as “at least one of” or “one or more of” or “one or both of”) indicates an inclusive list such that, for example, a list of at least one of A, B, or C means A or B or C or AB or AC or BC or ABC (i.e., A and B and C). Also, as used herein, the phrase “based on” shall not be construed as a reference to a closed set of conditions. For example, an example step that is described as “based on condition A” may be based on both a condition A and a condition B without departing from the scope of the present disclosure. In other words, as used herein, the phrase “based on” shall be construed in the same manner as the phrase “based at least in part on. Further, as used herein, including in the claims, a “set” may include one or more elements.

[0261] The description herein is provided to enable a person having ordinary skill in the art to make or use the disclosure. Various modifications to the disclosure will be apparent to a person having ordinary skill in the art, and the generic principles defined herein may be applied to other variations without departing from the scope of the disclosure. Thus, the disclosure is not limited to the examples and designs described herein but is to be accorded the broadest scope consistent with the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

1. A first device for wireless communication, comprising:
a processor; and
a transceiver coupled to the processor,
wherein the processor is configured to:
transmit a first data packet via the transceiver to a second device for wireless communication;
trigger a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a protocol data unit (PDU) set comprising the first data packet, or a second end indication of a data burst comprising the first data packet;
and
transmit the first poll via the transceiver to the second device.
2. The first device of claim 1, wherein the processor is configured to trigger the first poll based on the delay status by:
obtaining a first delay-critical indication indicating the first data packet becomes a first delay-critical data packet; and
triggering the first poll based on the first delay-critical indication.
3. The first device of claim 2, wherein the processor is configured to trigger the first poll based on the first delay-critical indication by:
based on determining that a first number of continuous polls which were triggered based on delay-critical indications is equal to or less than a first threshold, triggering the first poll based on the first delay-critical indication, wherein the delay-critical indications indicating data packets become delay-critical data packets.
4. The first device of claim 2, wherein the processor is configured to obtain the first delay-critical indication after transmitting a second poll to request a second status report for a second data packet from the second device; and
wherein the processor is configured to trigger the first poll based on the first delay-critical indication by:

based on determining that a second number of delay-critical data packets is equal to or greater than a second threshold, triggering the first poll based on the first delay-critical indication, wherein the second number of delay-critical indications for the second number of delay-critical data packets have been obtained since the second poll was transmitted, and the delay-critical data packets comprise the first delay-critical data packet.

5. The first device of claim 2, wherein the processor is configured to trigger the first poll based on the first delay-critical indication by:

based on determining that the first device does not receive a response to transmission of the first data packet for a period of time, triggering the first poll based on the first delay-critical indication.

6. The first device of claim 2, wherein the processor is configured to trigger the first poll based on the first delay-critical indication by:

based on determining that the first data packet comprises high importance data, triggering the first poll based on the first delay-critical indication.

7. The first device of claim 1, wherein the processor is configured to transmit the first poll by:

including the first poll in a radio link control (RLC) control PDU.

8. The first device of claim 1, wherein the RLC control PDU comprises an indicator indicating that a type of the RLC control PDU is a polling PDU.

9. The first device of claim 1, wherein the processor is configured to transmit the first poll by:

including the first poll in an acknowledged mode data (AMD) PDU.

10. The first device of claim 9, wherein the AMD PDU comprises an indicator indicating that the first status report is requested based on the delay status of the first data packet.

11. The first device of claim 1, wherein the processor is configured to trigger the first poll based on the first end indication of the PDU set by:

based on determining that both a transmission buffer and a retransmission buffer associated with the PDU set becomes empty excluding transmitted radio link control (RLC) service data units (SDUs) or RLC SDU segments awaiting acknowledgements after transmission of a third data packet, triggering the first poll.

12. The first device of claim 1, wherein the processor is configured to trigger the first poll based on the first end indication of the PDU set based on determining one of the following:

PDU set based discard is configured for a data radio bearer (DRB) of a radio link control (RLC) entity of the first device, or

PDU set integrated handling information (PSIHI) is configured for a quality of service (QoS) flow associated with the DRB.

13. A first device for wireless communication, comprising:

a processor; and

a transceiver coupled to the processor,

wherein the processor is configured to:

transmit a first data packet via the transceiver to a second device for wireless communication; and

retransmit the first data packet via the transceiver to the second device based on a delay status of the first data packet.

14. The first device of claim 13, wherein the processor is configured to retransmit the first data packet based on the delay status of the first data packet by:

obtaining a first delay-critical indication indicating the first data packet becomes a first delay-critical data packet; and

triggering retransmission of the first data packet based on the first delay-critical indication.

15. The first device of claim 13, wherein the processor is configured to retransmit the first data packet based on the delay status of the first data packet by:

obtaining a discard indication indicating that the first data packet is to be discarded;
and
triggering retransmission of the first data packet based on the discard indication.

16. A second device for wireless communication, comprising:
a processor; and
a transceiver coupled to the processor,
wherein the processor is configured to:
receive a first data packet via the transceiver from a first device for
wireless communication;
receive a first poll via the transceiver from the first device, wherein the
first poll indicates to request a first status report for the first data packet from the second
device; and
transmit the first status report via the transceiver to the first device.

17. The second device of claim 16, wherein the processor is configured to transmit
the first status report by:
ignoring a running status of a timer which is used to prohibit transmission of the
first status report.

18. The second device of claim 17, wherein the processor is configured to ignore
the running status of the timer by:
stopping the timer based on determining that the timer is running; or
resetting the timer based on determining that the timer is running.

19. The second device of claim 16, wherein the processor is further configured to:
triggering transmission of the first status report by ignoring a range of a sequence
number of the first status report.

20. A processor for wireless communication, comprising:
at least one memory; and
a controller coupled with the at least one memory and configured to cause the
controller to:

transmit a first data packet v to a second device for wireless communication;

trigger a first poll to request a first status report for the first data packet from the second device based on at least one of the following: a delay status of the first data packet, a first end indication of a protocol data unit (PDU) set comprising the first data packet, or a second end indication of a data burst comprising the first data packet; and

transmit the first poll to the second device.