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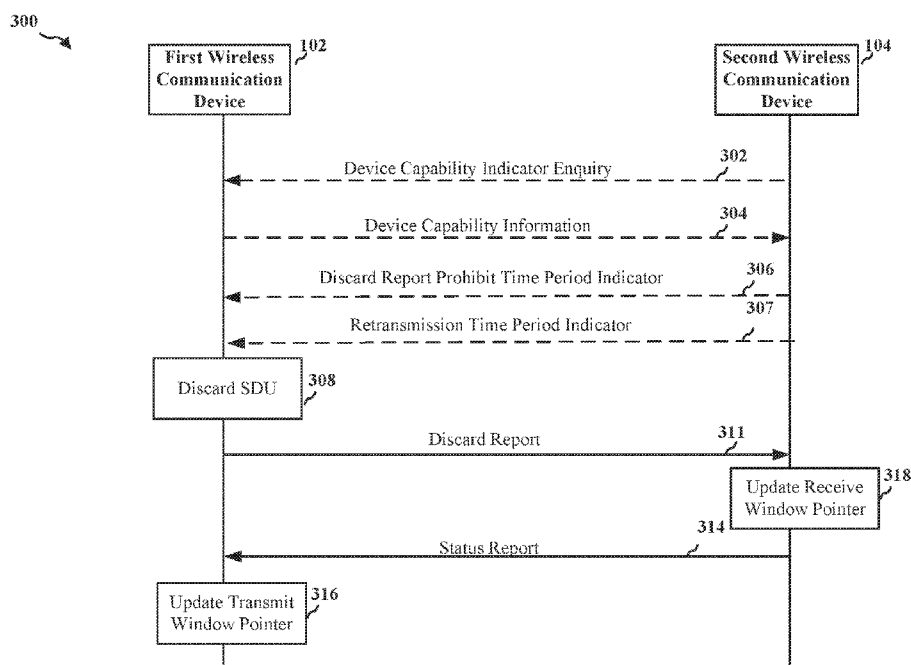


FIG. 3

(57) Abstract: A first wireless communication device (102) transmits (311), to a second wireless communication device (104), a first status protocol data unit (PDU) indicating a discarded service data unit (SDU). The first wireless communication device (102) receives (314), from the second wireless communication device (104), a second status PDU indicating a positive acknowledgement (ACK) for the discarded SDU.

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METHODS AND APPARATUSES FOR PROCESSING DATA UNIT DISCARD REPORTS

CROSS REFERENCE TO RELATED APPLICATION(S)

- [0001] This application claims the benefit of and priority to U.S. Provisional Application Serial No. 63/523,327, entitled “Method and Apparatuses for Processing Data Unit Discard Reports” and filed on June 26, 2023, which is expressly incorporated by reference herein in its entirety.

TECHNICAL FIELD

- [0002] The present disclosure relates generally to wireless communication, and more particularly, to generating and processing data unit discard reports.

BACKGROUND

- [0003] The Third Generation Partnership Project (3GPP) specifies a radio interface referred to as fifth generation (5G) new radio (NR) (5G NR). An architecture for a 5G NR wireless communication system includes a 5G core (5GC) network, a 5G radio access network (5G-RAN), a user equipment (UE), etc. The 5G NR architecture seeks to provide increased data rates, decreased latency, and/or increased capacity compared to prior generation cellular communication systems.
- [0004] Wireless communication systems, in general, may be configured to provide various telecommunication services (e.g., telephony, video, data, messaging, broadcasts, etc.) based on multiple-access technologies, such as orthogonal frequency division multiple access (OFDMA) technologies, that support communication with multiple UEs. Improvements in mobile broadband continue the progression of such wireless communication technologies.

BRIEF SUMMARY

- [0005] The following presents a simplified summary of one or more aspects in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated aspects. This summary neither identifies key or critical elements of all aspects nor delineates the scope of any or all aspects. Its sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

- [0006] Mobile media services with high bandwidth, low latency and mass connection requirements such as augmented reality (AR), virtual reality (VR), or extended reality (XR) pose fundamental challenges to wireless communication systems. AR/VR/XR applications might benefit from discarding SDUs associated with the AR/VR/XR applications. As described below, the PDCP layer of a transmitting entity transmits an SDU discard report in order to decrease a PDCP reordering delay in the receiving entity. The RLC layer of a transmitting entity transmits an SDU discard report in order to prevent a transmitting window stall.
- [0007] A packet data convergence protocol (PDCP) layer or a radio link control (RLC) layer of a transmitting entity (e.g., a wireless communication device such as a network entity or UE) discards one or more data units (e.g., service data units (SDUs)). A PDCP SDU discard at a PDCP transmitting entity might create a gap in consecutive PDCP sequence numbers (SNs), which will lead to a reordering delay at a receiving PDCP entity while the receiving PDCP entity waits to receive an SDU with the missing PDCP SN. At the RLC layer, no reordering delay occurs but an RLC SDU discard at the RLC transmitting entity might cause a gap in consecutive RLC SNs. An RLC SN gap causes a Rx window stall at the receiving RLC entity and subsequently a Tx window stall at the transmitting RLC entity due to the RLC transmitting entity not receiving an acknowledgement (ACK) from the receiving entity for a transmitted RLC SDU.
- [0008] Aspects of the present disclosure addresses these and other deficiencies by the transmitting entity transmitting a discard report to the receiving entity. The discard report indicates (e.g., via SN(s)) which SDUs have been discarded by the transmitting entity. In response to transmitting the discard report, the transmitting entity receives a status report (e.g., a PDCP status report and/or an RLC status report) indicating the SN(s) of the discarded SDU(s) as acknowledged. In this regard, the receiving entity interprets the discard report as a request for the status report.
- [0009] According to some aspects, wireless communication device(s) perform method(s) to transmit/receive a first status protocol data unit (PDU) indicating a discarded SDU. The wireless communication device(s) receive/transmit a second status PDU indicating a positive ACK for the discarded SDU.
- [0010] According to some aspects, wireless communication device(s) perform method(s) to transmit/receive a discard report indicating a discarded data unit. The wireless

communication device(s) communicate a status report indicating a positive ACK for a sequence number of the discarded data unit.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0011] FIG. 1 illustrates a diagram of a wireless communications system that includes a plurality of user equipments (UEs) and network entities in communication over one or more cells.
- [0012] FIG. 2A is a diagram illustrating ordering of service data units (SDUs) at a transmitting entity.
- [0013] FIG. 2B is a diagram illustrating ordering of SDUs at a receiving entity.
- [0014] FIG. 3 is a signaling diagram illustrating SDU discard processing.
- [0015] FIG. 4 is a flowchart of a method of SDU discard processing at an SDU transmitting entity.
- [0016] FIG. 5 is a flowchart of a method of SDU discard processing at an SDU receiving entity.
- [0017] FIG. 6 is a diagram illustrating an example of an SDU status report.
- [0018] FIG. 7 is a flowchart of a method of wireless communication by a first wireless communication device such as a UE.
- [0019] FIG. 8 is a flowchart of a method of wireless communication by a second wireless communication device such as a network entity.
- [0020] FIG. 9 is a diagram illustrating a hardware implementation for an example UE apparatus.
- [0021] FIG. 10 is a diagram illustrating a hardware implementation for one or more example network entities.

DETAILED DESCRIPTION

- [0022] FIG. 1 illustrates a diagram 100 of a wireless communications system associated with a plurality of cells 190. The wireless communications system includes user equipments (UEs) 102 and base stations/network entities 104. Some base stations may include an aggregated base station architecture and other base stations may include a disaggregated base station architecture. The aggregated base station architecture utilizes a radio protocol stack that is physically or logically integrated within a single radio access network (RAN) node. A disaggregated base station architecture utilizes a protocol stack that is physically or logically distributed among two or more units

(e.g., radio unit (RU) 106, distributed unit (DU) 108, central unit (CU) 110). For example, a CU 110 is implemented within a RAN node, and one or more DUs 108 may be co-located with the CU 110, or alternatively, may be geographically or virtually distributed throughout one or multiple other RAN nodes. The DUs 108 may be implemented to communicate with one or more RUs 106. Any of the RU 106, the DU 108 and the CU 110 can be implemented as virtual units, such as a virtual radio unit (VRU), a virtual distributed unit (VDU), or a virtual central unit (VCU). The base station/network entity 104 (e.g., an aggregated base station or disaggregated units of the base station, such as the RU 106 or the DU 108), may be referred to as a transmission reception point (TRP).

[0023] Operations of the base station 104 and/or network designs may be based on aggregation characteristics of base station functionality. For example, disaggregated base station architectures are utilized in an integrated access backhaul (IAB) network, an open-radio access network (O-RAN) network, or a virtualized radio access network (vRAN), which may also be referred to a cloud radio access network (C-RAN). For example, the base stations 104d/104e and/or the RUs 106a-106d may communicate with the UEs 102a-102d and 102s via one or more radio frequency (RF) access links based on a Uu interface. In examples, multiple RUs 106 and/or base stations 104 may simultaneously serve the UEs 102, such as by intra-cell and/or inter-cell access links between the UEs 102 and the RUs 106/base stations 104.

[0024] The RU 106, the DU 108, and the CU 110 may include (or may be coupled to) one or more interfaces configured to transmit or receive information/signals via a wired or wireless transmission medium. The CU 110 executes the aspects of the PDCP layer. The DU 108 executes the aspects of the RLC layer. For example, a wired interface can be configured to transmit or receive the information/signals over a wired transmission medium, such as via the fronthaul link 160 between the RU 106d and the baseband unit (BBU) 112 of the base station 104d associated with the cell 190d. The BBU 112 includes a DU 108 and a CU 110, which may also have a wired interface (e.g., midhaul link) configured between the DU 108 and the CU 110 to transmit or receive the information/signals between the DU 108 and the CU 110. In further examples, a wireless interface, which may include a receiver, a transmitter, or a transceiver, such as an RF transceiver, configured to transmit and/or receive the information/signals via the wireless transmission medium, such as for information communicated between the RU 106a of the cell 190a and the base station 104e of the

cell 190e via cross-cell communication beams 136-138 of the RU 106a and the base station 104e.

[0025] The RUs 106 may be configured to implement lower layer functionality. For example, the RU 106 is controlled by the DU 108 and may correspond to a logical node that hosts RF processing functions, or lower layer PHY functionality, such as execution of fast Fourier transform (FFT), inverse FFT (iFFT), digital beamforming, physical random access channel (PRACH) extraction and filtering, etc. The functionality of the RU 106 may be based on the functional split, such as a functional split of lower layers.

[0026] The RUs 106 may transmit or receive over-the-air (OTA) communication with one or more UEs 102. For example, the RU 106b of the cell 190b communicates with the UE 102b of the cell 190b via a first set of communication beams 132 of the RU 106b and a second set of communication beams 134b of the UE 102b, which may correspond to inter-cell communication beams or, in some examples, cross-cell communication beams. For instance, the UE 102b of the cell 190b may communicate with the RU 106a of the cell 190a via a third set of communication beams 134a of the UE 102b and a fourth set of communication beams 136 of the RU 106a. DUs 108 can control both real-time and non-real-time features of control plane and user plane communications of the RUs 106.

[0027] Any combination of the RU 106, the DU 108, and the CU 110, or reference thereto individually, may correspond to a base station 104. Thus, the base station 104 may include at least one of the RU 106, the DU 108, or the CU 110. The base stations 104 provide the UEs 102 with access to a core network. The base stations 104 may relay communications between the UEs 102 and the core network (not shown). The base stations 104 may be associated with macrocells for higher-power cellular base stations and/or small cells for lower-power cellular base stations. For example, the cell 190e may correspond to a macrocell, whereas the cells 190a-190d may correspond to small cells. Small cells include femtocells, picocells, microcells, etc. A network that includes at least one macrocell and at least one small cell may be referred to as a “heterogeneous network.”

[0028] Transmissions from a UE 102 to a base station 104/RU 106 are referred to as uplink (UL) transmissions, whereas transmissions from the base station 104/RU 106 to the UE 102 are referred to as downlink (DL) transmissions. Uplink transmissions may also be referred to as reverse link transmissions and downlink transmissions may

also be referred to as forward link transmissions. For example, the RU 106d utilizes antennas of the base station 104d of cell 190d to transmit a downlink/forward link communication to the UE 102d or receive an uplink/reverse link communication from the UE 102d based on the Uu interface associated with the access link between the UE 102d and the base station 104d/RU 106d.

[0029] Communication links between the UEs 102 and the base stations 104/RUs 106 may be based on multiple-input and multiple-output (MIMO) antenna technology, including spatial multiplexing, beamforming, and/or transmit diversity. The communication links may be associated with one or more carriers. The UEs 102 and the base stations 104/RUs 106 may utilize a spectrum bandwidth of Y MHz (e.g., 5, 10, 15, 20, 100, 400, 800, 1600, 2000, etc. MHz) per carrier allocated in a carrier aggregation of up to a total of Yx MHz, where x component carriers (CCs) are used for communication in each of the uplink and downlink directions. The carriers may or may not be adjacent to each other along a frequency spectrum. In examples, uplink and downlink carriers may be allocated in an asymmetric manner, with more or fewer carriers allocated to either the uplink or the downlink. A primary component carrier and one or more secondary component carriers may be included in the component carriers. The primary component carrier may be associated with a primary cell (PCell) and a secondary component carrier may be associated with a secondary cell (SCell).

[0030] Some UEs 102, such as the UEs 102a and 102s, may perform device-to-device (D2D) communications over sidelink. For example, a sidelink communication/D2D link utilizes a spectrum for a wireless wide area network (WWAN) associated with uplink and downlink communications. Such sidelink/D2D communication may be performed through various wireless communications systems, such as wireless fidelity (Wi-Fi) systems, Bluetooth systems, Long Term Evolution (LTE) systems, New Radio (NR) systems, etc.

[0031] The base station 104 may include and/or be referred to as a network entity. That is, “network entity” may refer to the base station 104 or at least one unit of the base station 104, such as the RU 106, the DU 108, and/or the CU 110. The base station 104 may also include and/or be referred to as a next generation evolved Node B (ng-eNB), a next generation NB (gNB), an evolved NB (eNB), an access point, a base transceiver station, a radio base station, a radio transceiver, a transceiver function, a basic service set (BSS), an extended service set (ESS), a TRP, a network node, network equipment, or other related terminology. The base station 104 or an entity at the base station 104

can be implemented as an IAB node, a relay node, a sidelink node, an aggregated (monolithic) base station, or a disaggregated base station including one or more RUs 106, DUs 108, and/or CUs 110. A set of aggregated or disaggregated base stations may be referred to as a next generation-radio access network (NG-RAN). In some examples, the UE 102a operates in dual connectivity (DC) with the base station 104e and the base station/RU 106a. In such cases, the base station 104e can be a master node and the base station/RU 160a can be a secondary node.

[0032] When the discard report is an RLC discard report, the RLC receiving entity updates an Rx window pointer based on the discard report. The RLC receiving entity updates a Rx window pointer to an SN of an SDU that has not been completely received by the RLC receiving entity. The RLC transmitting entity updates a transmit window pointer based on the status report thereby maintaining synchronization between the receive window pointer in the RLC receiving entity and the transmit window pointer in the RLC transmitting entity.

[0033] In one embodiment, a unique field indicates (e.g., via a predefined value) that the discard report is reporting a PDCP SDU discard. In another embodiment, a unique field indicates (e.g., via a predefined value) that the discard report is reporting an RLC SDU discard. Further, the discard report indicates the discarded SDU(s) using any predefined format. For example, the indicator indicating the SN(s) of the discarded SDU(s) may include a starting SN and an ending SN of the discarded SDU(s), the starting SN and a number of consecutive SNs following the starting SN, or a bitmap indicating the SN(s) of the discarded SDU(s).

[0034] In some aspects, the transmitting entity starts a discard report prohibit timer based on a discard prohibit time period. When the transmitting entity is a UE, the discard report prohibit time period may be indicated by the receiving entity (e.g., the network entity). Additionally or alternatively, the discard report prohibit time period is a predefined time period based on a communication standard, stored in a memory of the transmitting entity, and/or determined by the transmitting entity. The transmitting entity refrains from transmitting the discard report for the duration of the discard report prohibit timer and transmits the discard report after the discard report prohibit timer expires. The transmitting entity stores the SNs of SDUs discarded during the discard report prohibit time period and transmit indicators of the stored SNs as a batch after expiration of the discard report prohibit timer thereby reducing signaling overhead and increasing bandwidth efficiency. The discard report prohibit time period

may be the same for all discarded SDU(s) or may be based on a radio bearer or quality of service (QoS) associated with the discarded SDU(s).

[0035] In some aspects, the receiving entity starts a status report prohibit timer. The receiving entity refrains from transmitting the status report for the duration of the status prohibit time period and transmit the status report after the prohibit timer expires. However, in some aspects, if the receiving entity receives a discard report when the status prohibit timer is running, the receiving entity transmits the status report by overriding the remaining status prohibit time and restart the status prohibit timer after transmitting the status report.

[0036] In some aspects, the transmitting entity starts a discard report retransmission timer based on a retransmission time period. When the transmitting entity is a UE, the retransmission time period may be indicated by the receiving entity (e.g., the network unit). Additionally or alternatively, the retransmission time period may be a predefined time period based on a communication standard, stored in a memory of the transmitting entity, and/or determined by the transmitting entity. The transmitting entity retransmits the discard report after expiration of the retransmission timer if the transmitting entity did not receive the status report from the receiving entity after transmitting the discard report.

[0037] Still referring to FIG. 1, in certain aspects, a first wireless communication device includes a discard reporting component 140 and/or 150 configured to transmit, to a second wireless communication device, a first status protocol data unit (PDU) indicating a discarded service data unit (SDU); and receive, from the second wireless communication device, a second status PDU indicating a positive acknowledgement (ACK) for the discarded SDU. In further examples, the discard reporting component is configured to transmit, to a second wireless communication device, a discard report indicating a discarded data unit. The first wireless communication device receives, from the second wireless communication device, a status report indicating a positive ACK for a sequence number of the discarded data unit.

[0038] In certain aspects, a second wireless communication device includes a discard reporting component 140 and/or 150 configured to receive, from a first wireless communication device, a first status PDU indicating a discarded SDU; and transmit, to the first wireless communication device, a second status PDU indicating a positive ACK for the discarded SDU. In further examples, the discard reporting component is configured to receive, from a first wireless communication device, a discard report

indicating a discarded data unit. The second wireless communication device transmits, to the first wireless communication device, a status report indicating a positive ACK for a sequence number of the discarded data unit.

[0039] Accordingly, FIG. 1 describes a wireless communication system that may be implemented in connection with aspects of one or more other figures described herein, such as aspects illustrated in FIGs. 2-10. Further, although the following description may be focused on 5G NR, the concepts described herein may be applicable to other similar areas, such as 5G-Advanced and future versions, and other wireless technologies, such as 6G.

[0040] FIG. 2A is a diagram 200a illustrating ordering of SDUs at a transmitting entity. FIG. 2B is a diagram 200b illustrating ordering of SDUs at a receiving entity. The transmitting entity is one of a UE or a network entity while the receiving entity is the other of a UE or a network entity. For example, a UE may be a transmitting entity that transmits SDUs (e.g., RLC SDUs and/or PDCP SDUs) to a network entity (the receiving entity). Additionally or alternatively, a network entity may be a transmitting entity that transmits SDUs to a UE (the receiving entity). The transmitting entity transmits SDUs to the receiving entity using an acknowledge (AM) mode in which the receiving entity transmits a positive acknowledge (ACK) indicator to the transmitting entity in a status report to indicate correct reception (e.g. decoding) of the SDU or a negative acknowledge (NACK) indicator in the status report to indicate incorrect reception (e.g. decoding) of the SDU.

[0041] In some aspects, a PDCP layer (e.g., a PDCP layer of CU 110) or an RLC layer (e.g., RLC layer of DU 108) of the transmitting entity discards one or more data units (e.g., SDUs). The PDCP layer of the transmitting entity transmits an SDU discard report in order to decrease a PDCP reordering delay in the receiving entity. The RLC layer of the transmitting entity transmits an SDU discard report in order to prevent a transmitting window stall in, for example, XR/AR/VR gaming applications. The transmitting entity discards the SDUs when a discard timer expires, in some embodiments. The transmitting entity discards the SDUs in order to avoid a transmit buffer overflow and/or to support real-time traffic (e.g., XR/AR/VR traffic). A PDCP SDU discard at a PDCP transmitting entity creates a gap in consecutive PDCP SNs 206, which will lead to a reordering delay at a receiving PDCP entity while the receiving PDCP entity waits to receive an SDU with the missing SN 206. At the RLC layer, no reordering delay occurs but an RLC SDU discard at the RLC transmitting

entity causes a gap in consecutive RLC SNs 206, which causes a Rx window stall at the receiving RLC entity and a Tx window stall at the transmitting RLC entity due to the RLC transmitting entity not receiving an ACK indicator from the RLC receiving entity for a transmitted RLC SDU.

[0042] In order to maintain synchronization of SDUs transmitted by the RLC transmitting entity and received by the RLC receiving entity, the RLC transmitting entity maintains a transmit window 202 and the RLC receiving entity maintains a receive window 203. The RLC receiving entity and the RLC transmitting entity keep track of the status of each SDU based on a SN assigned to the SDU. As indicated in FIGs. 2A and 2B by the pattern associated with SNs 206, the transmit window 202 and receive window 203 keep track of SNs of SDUs in which all bytes have been received, no bytes have been received, or a subset of the bytes have been received. For example, within the transmit window 202 and receive window 203, SN 206a indicates all bytes have been received, SN 206b, SN 206e, SN 206f, SN 206g, and SN 206h indicate no bytes have been received, and SN 206c and SN 206d indicates a subset of bytes have been received. In fact, SN 206c and SN 206d in the transmit window 202 indicates that all bytes have been transmitted but SN 206c and SN 206d in the receive window 203 indicates that not all bytes have been received thereby causing a mismatch between the transmit window 202 and the receive window 203.

[0043] In some aspects, the transmitting entity divides an SDU into segments prior to transmitting. When the transmitting entity discards SDU(s) which have had SDU segments submitted to lower layers for transmission, the transmitting entity transmits a discard report to the receiving entity. For example, the transmitting PDCP entity divides an SDU into two segments. If the first segment has been submitted to a lower layer for transmission but the second segment is still in a transmit buffer, the transmitting entity discards the entire SDU and transmit a discard report to the receiving entity. When the SDU is an RLC SDU, the RLC layer of the transmitting entity notifies the PDCP layer that an RLC discard report has been transmitted. In response, the PDCP layer triggers the transmitting entity to transmit a PDCP discard report. In some aspects, if the transmitting entity receives a status report that indicates a NACK for a SN whose data has been discarded, the transmitting entity transmits a discard report to the receiving entity to indicate that the data with the negatively-acknowledged SN has been discarded.

[0044] The discard report indicates via SN(s) 206 which of the SDUs have been discarded by the transmitting entity. In an embodiment, in response to transmitting the discard report, the transmitting entity receives a status report (e.g., a PDCP status report and/or an RLC status report) indicating the SN(s) of the discarded SDU(s). In this regard, the receiving entity can interpret the discard report as a request for the status report. In an embodiment, the status report indicates an ACK associated with the SN(s) of the discarded SDU(s). Further details regarding the content of the status report are described with reference to FIG. 6. The receiving entity updates the receive window pointer 225 based on the discard report. The receiving entity updates the receive window pointer 225 to an SDU with a next-higher SN 206 that has not been completely received by the receiving entity, which might be an SN 206 for which no bytes have been received. The status report indicates an ACK for the SDU that has not been completely received, which might include an SDU where no bytes have been received, by the receiving entity and is indicated as discarded by the transmitting entity. The receive window pointer 225 is updated from SN 206b before synchronization to SN 206c after synchronization. The transmitting entity updates transmit window pointer 223 based on the status report thereby maintaining synchronization between the receive window pointer 225 in the receiving entity and the transmit window pointer 223 in the transmitting entity.

[0045] In some aspects, as shown in FIG. 2B, the receiving entity maintains receive window 203 according to the state variable RX_Next. RX_Next indicates the lowest SN in receive window 203 that has not yet been received. A SN 206 falls within receive window 203 if $RX_Next \leq SN < RX_Next + AM_Window_Size$. In the non-limiting example of FIG. 2B, the AM_window_size is 7. In order for the receive window 203 to advance forward, the receiving entity either receives all bytes of the SDU corresponding to RX_Next indicated as SN 206b or receives a discard report indicating that SN 206b has been discarded. When the receiving entity receives a discard report indicating SN 206b has been discarded, the receiving entity will indicate the discarded SN 206b in the status report as an ACK even though SN 206b has not been received. After receiving the discard report indicating SN 206b has been discarded, the receiving entity will move the RX-Next pointer to the next SN 206 that is not indicated as discarded and for which not all bytes have been received. In the example of FIG. 2B, the receiving entity moves the RX-Next pointer to SN 206c and advances the receive window 203a forward to the receive window 203b thereby

preventing a receive window stall due to an SDU discard at the transmitter. The receiving entity transmits the status report to the transmitting entity after receiving the discard report. In the example of FIGs. 2A and 2B, the status report will indicate an ACK for SN 206b. The transmitting entity processes the status report and based on SN 206b being indicated as an ACK, the transmitting entity moves the TX-Next pointer to SN 206c thereby synchronizing the transmit window 202 pointer and the receive window 203 pointer. The transmitting entity advances the transmit window 202a forward to the transmit window 202b thereby preventing a transmit window stall.

[0046] FIGs. 2A and 2B describe a method of synchronizing a transmit window 202 pointer and a receive window 203 pointer based on an RLC layer discard report. FIG. 3 describes a discard report signal flow between a first wireless communication device (e.g., an SDU transmitting entity) and a second wireless communication device (e.g., an SDU receiving entity). This signal flow applies to both an RLC implementation and a PDCP implementation.

[0047] FIG. 3 is a signal flow diagram of a communication method 300 according to some aspects of the present disclosure. Aspects of the method 300 can be executed by a computing device (e.g., a processor, processing circuit, and/or other suitable component) of a wireless communication device or other suitable means for performing the actions. For example, a wireless communication device, such as the UE 102 or the UE 902 utilizes one or more components, such as the application processor 906, the memory 906', the discard reporting component 140a and/or 140b, the transceiver 930, the wireless baseband processor 926, the memory 926', and the one or more antennas 940, to execute aspects of method 300. In some aspects, a wireless communication device, such as the network entity 104 utilizes one or more components, such as the DU processor 1006, the memory 1026', the CU processor 1046, the memory 1046', the RU processor 1006, the memory 1006', the discard reporting component 150a and/or 150b, the transceiver 1030, and the one or more antennas 1040, to execute aspects of method 300. The method 300 employs similar mechanisms as in the network 100 and the aspects and actions described with respect to FIGs. 2 and 4-8. As illustrated, the method 300 includes a number of enumerated actions, but the method 300 can include additional actions before, after, and in between the enumerated actions. In some aspects, one or more of the enumerated actions can be omitted or performed in a different order.

[0048] The first wireless communication device 102 (e.g., a transmitting entity such as the UE 102, the UE 902, and/or the network entity 104) may receive 302 a device capability indicator enquiry from the second wireless communication device 104 (e.g., a receiving entity such as the UE 102, the UE 902, and/or the network entity 104). In this regard, the first wireless communication device 102 may receive 302 the device capability indicator enquiry from the second wireless communication device 104 using radio resource control (RRC) signaling or other suitable communication. The device capability indicator enquiry is a request for the first wireless communication device 102 to report its capability associated with data unit discard reporting to the second wireless communication device 104.

[0049] The first wireless communication device 102 optionally transmits 304 device capability information to the second wireless communication device 104. In this regard, the first wireless communication device 102 may transmit 304 the device capability information to the second wireless communication device 104 using RRC signaling or other suitable communication. The first wireless communication device 102 might transmit 304 the device capability information to the second wireless communication device 104 autonomously or in response to receiving 302 the device capability indicator enquiry. The device capability information indicates the first wireless communication device's 102 capability associated with data unit discard reporting to the second wireless communication device 104. Additionally or alternatively, the first wireless communication device's 102 capability may be prestored in the first wireless communication device 102 and the second wireless communication device 104.

[0050] The first wireless communication device 102 optionally receives 306 a discard report prohibit time period indicator from the second wireless communication device 104. In this regard, the first wireless communication device 102 may receive 306 the discard report prohibit time period indicator from the second wireless communication device 104 using RRC signaling, a MAC CE communication, a PDCCH communication, or other suitable communication. When the first wireless communication device 102 is a UE, the discard report prohibit timer may be indicated by the second wireless communication device 104 (e.g., the network entity). Additionally or alternatively, the discard report prohibit time period is a predefined time period based on a communication standard, stored in a memory of the first wireless communication device 102, and/or determined by the first wireless

communication device 102. The first wireless communication device 102 refrains from transmitting the discard report for the duration of the discard report prohibit time period and transmits the discard report after the discard report prohibit timer expires as will be described in FIG. 4.

[0051] The first wireless communication device 102 optionally receives 307 a retransmission time period indicator from the second wireless communication device 104. In this regard, the first wireless communication device 102 may receive 307 the retransmission time period indicator from the second wireless communication device 104 using RRC signaling, a MAC CE communication, a PDCCH communication, or other suitable communication. When the first wireless communication device 102 is a UE, the retransmission time period may be indicated by the second wireless communication device 104 (e.g., the network entity). Additionally or alternatively, the retransmission time period is a predefined time period based on a communication standard, stored in a memory of the first wireless communication device 102, and/or determined by the first wireless communication device 102. The first wireless communication device 102 retransmits the discard report after expiration of the retransmission timer if the first wireless communication device 102 does not receive the status report from the second wireless communication device 104.

[0052] Regardless of whether the optional signaling occurs, the first wireless communication device 102 discards 308 a data unit (e.g., an SDU). In some aspects, a PDCP layer or an RLC layer of the transmitting first wireless communication device 102 discards 308 one or more SDUs. The first wireless communication device 102 discards 308 the SDUs when a discard timer expires in some embodiments. The first wireless communication device 102 discards 308 the SDUs in order to avoid a transmit buffer overflow and/or to support real-time traffic. This discard 308 can be implemented as multi-step procedure as shown in FIG. 4 element 408.

[0053] The first wireless communication device 102 transmits 311 a discard report to the second wireless communication device 104. In this regard, the first wireless communication device 102 transmits 311 the discard report to the second wireless communication device 104 using RRC signaling, a MAC CE communication, a PDCCH communication, a PUCCH communication, or other suitable communication. The discard report indicates via SN(s) which of the SDUs have been discarded 308 by the first wireless communication device 102. In some aspects, the first wireless communication device 102 refrains from transmitting 311 the discard

report for the duration of the discard report prohibit timer and transmits 311 the discard report after the discard report prohibit timer expires. The first wireless communication device 102 stores the SNs of SDUs discarded during the discard report prohibit time period and transmits the stored SNs as a batch after expiration of the discard report prohibit timer thereby reducing signaling overhead and increasing bandwidth efficiency. The discard report prohibit time period may be the same for all discarded SDU(s) or may be based on a radio bearer or QoS associated with the discarded SDU(s).

[0054] In some aspects, when the discard report is a PDCP discard report, the discard report includes at least a data/control field which is set to '0' to indicate that the discard report is a PDCP control PDU and a PDU type field which is set to a pre-defined value (e.g. a value of 100) to indicate that the PDCP control PDU is a discard report. In some aspects, when the discard report is an RLC discard report, the discard report includes at least a data/control field which is set to '0' to indicate that the discard report is an RLC control PDU and a PDU type field which is set to a pre-defined value (e.g. a value of 001) to indicate that the RLC control PDU is a discard report.

[0055] The discard report indicates the discarded SDU(s) using any predefined format. The indicator indicating the SN(s) of the discarded SDU(s) includes a starting SN and an ending SN of the discarded SDU(s), the starting SN and a number of consecutive SNs following the starting SN, or a bitmap indicating the SN(s) of the discarded SDU(s). For example, a pair of SNs (M, N) indicates consecutive SNs that are discarded. The SNs between M and N (e.g., M+1, M+2, ..., N-1) can be indicated as discarded. In some aspects, the SNs M and N are also discarded. In another embodiment, a starting SN A and a number (e.g., a count) B indicates the number of consecutive SNs following SN A that are discarded. For example, SNs A+1, A+2, ..., A+B are discarded. In some aspects, the SN A is also discarded. In another embodiment, a SN Z and a bitmap indicates which SNs are discarded. The first bit of the bitmap is associated with the SN Z+1, and the X-th bit is associated with SN Z+X. If the Y-th bit is set to a first value, (e.g., "1"), that indicates SN Z+Y is discarded. Otherwise, if the Y-th bit is set to a different value, (e.g., "0"), SN Z+Y is not discarded. In some aspects, SN Z is also discarded.

[0056] After receiving 311 the discard report, the second wireless communication device 104 transmits 314 the status report to the first wireless communication device 102. In

this regard, the second wireless communication device 104 transmits 314 the discard report to the first wireless communication device 102 using RRC signaling, a MAC CE communication, a PDCCH communication, a PUCCH communication, or other suitable communication. The second wireless communication device 104 transmits 314 the status report (e.g., a PDCP status report and/or a RLC status report) indicating the SN(s) of the discarded SDU(s). In this regard, the second wireless communication device 104 interprets the discard report as a request (e.g., a polling request) for the status report. A proposed format and content of the status report is described with reference to FIG. 6

[0057] In some aspects, the second wireless communication device 104 starts a status report prohibit timer as will be described in FIG. 5.

[0058] The first wireless communication device 102 updates 316 a transmit window pointer based on the status report. As described above with reference to FIG. 2A, the first wireless communication device 102 maintains a transmit window according to the state variable TX_Next_Ack. TX_Next_Ack indicates the lowest SN in the transmit window that has not yet been indicated as an ACK in the status report. In order for the transmit window to advance forward, the first wireless communication device 102 receives an ACK for the SDU with SN indicated as TX_Next_Ack. The status report indicates an ACK for the SDU if the second wireless communication device 104 correctly receives the SDU or indicates the SDU as ACK based on the discard report. When the second wireless communication device 104 receives 311 the discard report indicating the SDU has been discarded, the second wireless communication device 104 indicates the SN of the discarded SDU in the status report as an ACK even though the SDU has not been received. After receiving 314 the status report acknowledging the SDU, the first wireless communication device 102 moves the transmit window pointer to the next non-discarded SN that has not been indicated as an ACK. The first wireless communication device 102 moves the transmit window pointer and advances the transmit window forward thereby preventing a transmit window stall. The first wireless communication device 102 updates 316 the transmit window pointer based on the status report thereby maintaining synchronization between the transmit window pointer in the first wireless communication device 102 and the receive window pointer in the second wireless communication device 104.

[0059] The second wireless communication device 104 updates 318 a receive window pointer based on receipt of a discard report 311. The specific order or hierarchy of

blocks in signal flow diagram 300 disclosed herein is an illustration of example approaches. Hence, the specific order or hierarchy of blocks in signal flow diagram 300 may be rearranged. Some blocks may also be combined or deleted. For example, the second wireless communication device 104 may update 318 the receive window pointer before or after transmitting 314 the status report. As described above with reference to FIG. 2B, the second wireless communication device 104 maintains a receive window according to the state variable RX_Next. RX_Next indicates the lowest SN in the receiving window that has not yet been received. In order for the receive window to advance forward, the second wireless communication device 104 either receives the SDU with SN indicated as RX_Next or receives 311 a discard report indicating that the SDU has been discarded. When the second wireless communication device 104 receives 311 the discard report indicating the SDU has been discarded, the second wireless communication device 104 will indicate the SN of the discarded SDU in the status report as an ACK even though the SDU has not been received. After receiving 311 the discard report indicating the SDU has been discarded, the second wireless communication device 104 moves the RLC receive window pointer to the next SN for which not all bytes have been received. The second wireless communication device 104 moves the RLC receive window pointer and advances the receive window forward thereby preventing a receive window stall.

[0060] FIG. 4 illustrates a flowchart of a method 400 of wireless communication at a first wireless communication device (e.g., an SDU transmitting entity). With reference to FIGs. 1-3 and 6-8, the method can be performed by the UE 102, the UE apparatus 902, etc., which includes discard reporting components 140a/140b, memory 926', 906', 916, and which may correspond to the entire UE 102 or the entire UE apparatus 902, or a component of the UE 102 or the UE apparatus 902, such as the wireless baseband processor 926 and/or the application processor 906. Additionally or alternatively, with reference to FIGs. 1-3 and 6-8, the method can be performed by the network entity 104, the DU 108, the CU 110, etc., which includes the discard reporting components 150a/150b, memory 1006', 1026', 1046', and which may correspond to the entire network 104, or a component of the network 104, such as the RU processor 1006, the DU processor 1026 and/or the CU processor 1046.

[0061] The first wireless communication device discards 408 a data unit (e.g., an SDU) in a process that encompasses more than simply discarding an SDU 405. In some aspects, a PDCP layer or an RLC layer of the first wireless communication device

discards one or more SDUs. The first wireless communication device discards the SDUs when a discard timer expires. Discard procedure 408 includes the elements 405, 409, 410, and 417 as described below.

[0062] The first wireless communication device discards 405 the SDUs when a discard timer expires in order to avoid a transmit buffer overflow and/or to support real-time traffic. The first wireless communication device determines 409 whether any segments of the SDU have been submitted to a lower layer for transmission to the second wireless communication device. For example, the first wireless communication device determines 409 whether any segments of the PDCP SDU have been submitted to a RLC layer or whether any segment of the RLC SDU have been submitted to a MAC layer for transmission.

[0063] If no segments of the SDU have been submitted to a lower layer for transmission, the first wireless communication device reassigns 417 the SN of the discarded SDU to a new SDU that is in the transmission buffer.

[0064] If any segments have been submitted to a lower layer for transmission, the first wireless communication device determines 410 whether a prohibit timer has expired. In some aspects, the first wireless communication device starts a discard prohibit timer based on a discard prohibit time period. The first wireless communication device refrains from transmitting the discard report for the duration of the discard prohibit timer and transmits 411 the discard report after the prohibit timer expires. The first wireless communication device stores the SNs of discarded SDUs during the discard prohibit time period and transmits 411 the stored SNs in the discard report as a batch after expiration of the discard prohibit timer thereby reducing signaling overhead and increasing bandwidth efficiency. The discard prohibit time period may be the same for all discarded SDU(s) or may be based on a radio bearer or QoS associated with the discarded SDU(s).

[0065] The first wireless communication device transmits 411 the discard report to the second wireless communication device (e.g., the receiving entity). In this regard, the first wireless communication device transmits 411 the discard report to the second wireless communication device using RRC signaling, a MAC CE communication, a PDCCH communication, a PDSCH communication, a PUCCH communication, a PUSCH communication or other suitable communication. The discard report indicates via SN(s) which of the SDU(s) have been discarded by the first wireless

communication device. In some aspects, the second wireless communication device interprets the discard report as a request for the status report.

[0066] After transmitting 411 the discard report, the first wireless communication device monitors for a status report from the second wireless communication device. When the second wireless communication device receives 411 the discard report indicating the SDU has been discarded, the second wireless communication device indicates the SN of the discarded SDU in the status report as an ACK even though the SDU has not been received. If the first wireless communication receives the status report, the first wireless communication updates 416 the transmit window pointer. The first wireless communication device updates 416 the transmit window pointer based on the content of the status report. The content of the status report is described with reference to FIG. 6. The first wireless communication device updates the transmit window pointer as described with reference to FIG. 2, thereby maintaining synchronization between the transmit window pointer in the first wireless communication device and the receive window pointer in the second wireless communication device.

[0067] If the first wireless communication device does not receive 414 the status report, the first wireless communication device determines 413 whether a discard report retransmission timer has expired. If the discard report retransmission timer has not expired, the first wireless communication device waits for the discard report retransmission timer to expire. The first wireless communication device continues to monitor for the status report while the discard report retransmission timer is running. If the discard report retransmission timer expires and the first wireless communication device has not received the status report, the first wireless communication device retransmits 411 the discard report to the second wireless communication device.

[0068] FIG. 5 illustrates a flowchart 500 of a method of wireless communication at a second wireless communication device (e.g., an SDU receiving entity). With reference to FIGs. 1-3 and 6-8, the method can be performed by the UE 102, the UE apparatus 902, etc., which includes discard reporting components 140a/140b, memory 926', 906', 916, and which may correspond to the entire UE 102 or the entire UE apparatus 902, or a component of the UE 102 or the UE apparatus 902, such as the wireless baseband processor 926 and/or the application processor 906. Additionally or alternatively, with reference to FIGs. 1-3 and 6-8, the method can be performed by the network entity 104, the DU 108, the CU 110, etc., which includes the discard reporting components 150a/150b, memory 1006', 1026', 1046', and which may

correspond to the entire network 104, or a component of the network 104, such as the RU processor 1006, the DU processor 1026 and/or the CU processor 1046.

[0069] The second wireless communication device starts 507 a status report prohibit timer. While the status report prohibit timer is running, the second wireless communication device refrains from transmitting 514 a status report if the second wireless communication device does not receive a discard report. The second wireless communication device transmits 514 a status report when the status report prohibit timer expires.

[0070] The second wireless communication device receives 511 the discard report from the first wireless communication device (e.g., the transmitting entity). The discard report indicates SN(s) of the SDUs discarded by the first wireless communication device.

[0071] The status report prohibit timer controls when the second wireless communication device transmits the status report. When the second wireless communication device does not receive a discard report while the status report prohibit timer is running the second wireless communication device refrains from transmitting the status report. When the second wireless communication device receives a discard report while the status report prohibit timer is running, in this embodiment the second wireless communication device updates 518 the receive window pointer, overrides 512 the status report prohibit timer and transmits 514 the status report. The second wireless communication device updates 518 the receive window pointer as described with reference to FIG. 2B. The second wireless communication device overrides 512 the status report prohibit timer in order to reduce the latency in transmitting the status report and updating 518 the receive window pointer. In another embodiment, receiving a discard report while the status report prohibit timer is running does not override 512 the status report prohibit timer.

[0072] The second wireless communication device transmits 514 the status report to the first wireless communication device. The second wireless communication device indicates the SN of the discarded SDU in the status report as an ACK even though the SDU has not been received. The status report, in some implementations, also acknowledges with an ACK any SDUs that the second wireless communication device has successfully received. The content of the status report is described with reference to FIG. 6.

[0073] Based on at least the content of the discard report, the second wireless communication device updates 518 the receive window pointer as described with reference to FIG. 2B. After transmitting the status report, the second wireless communication device restarts 515 the status report prohibit timer that was overridden 512 in order to transmit 514 the status report. The second wireless communication device updates 518 the receive window pointer as described with reference to FIG. 2, thereby maintaining synchronization between the transmit window pointer in the first wireless communication device and the receive window pointer in the second wireless communication device. The specific order or hierarchy of blocks in flowchart 500 disclosed herein is an illustration of example approaches. Hence, the specific order or hierarchy of blocks in flowchart 500 may be rearranged. Some blocks may also be combined or deleted. For example, the second wireless communication device may update 518 the receive window pointer before or after transmitting 514 the status report.

[0074] FIG. 6 is a diagram illustrating an example of an SDU status report 600. Status report 600 includes a D/C (data/control) field 650 set to “0” to indicate that status report 600 is a control PDU. The CPT field 652 indicates the type of control PDU. A CPT field of “000” indicates a status report PDU. The field ACK_SN 654 indicates 12 bit SNs of acknowledged RLC SDUs and RLC SDU segments. All SNs before ACK_SN 654 are deemed acknowledged. The receiving entity will indicate the SN of the discarded SDU in the status report as an ACK even though the SDU has not been received. If a continuous sequence of bytes has not been received for a partially received RLC SDU, the status report 600 includes 12 bit SNs of NACK_SN 656, SOstart 658 and SOend 660 indicating the part of the RLC SDU that needs to be retransmitted. SOstart 658 and SOend 660 identify the byte offsets of the missing bytes. If a continuous sequence of RLC SDUs have not been received, the range of RLC SDUs can be negatively acknowledged with the NACK range field. R indicates reserved bits. E1, E2, and E3 indicate extension bits.

[0075] Additionally, or alternatively, the SDU status report 600 may include only positive ACKs to indicate SNs of SDUs that have been either completely received by the receiving entity or discarded by the transmitting entity as indicated by the discard report. The transmitting entity will consider SNs of SDUs that have not been positively acknowledged in the status report to be negatively acknowledged (NACKed).

- [0076] Additionally or alternatively, the SDU status report 600 may include only negative acknowledgements (NACKs) to indicate SNs of SDUs that have not been completely received by the transmitting entity. The transmitting entity will consider SNs of SDUs that have not been negatively acknowledged in the status report to be completely received by the receiving.
- [0077] FIG. 7 illustrates a flowchart 700 of a method of wireless communication at a first wireless communication device 102 (e.g., an SDU transmitting entity). With reference to FIGs. 1-6, the method can be performed by the UE 102, the UE apparatus 902, etc., which includes discard reporting components 140a/140b, memory 926', 906', 916, and which may correspond to the entire UE 102 or the entire UE apparatus 902, or a component of the UE 102 or the UE apparatus 902, such as the wireless baseband processor 926 and/or the application processor 906. Additionally or alternatively, with reference to FIGs. 1-6, the method can be performed by the network 104 (e.g., network entity), the RU 1006, the DU 108, the CU 110, etc., which includes the discard reporting components 150a/150b, memory 1006', 1026', 1046', and which may correspond to the entire network 104, or a component of the network 104, such as the DU processor 1026 and/or the CU processor 1046.
- [0078] The first wireless communication device 102 optionally receives 702, from a second wireless communication device 104, a device capability information enquiry. For example, referring to FIG. 3, the first wireless communication device receives 302 the device capability information enquiry from the second wireless communication device 104.
- [0079] The first wireless communication device 102 transmits 704, to the second wireless communication device 104 in response to the receiving 702 the device capability information enquiry, a capability information indicating support for data unit discard reporting. For example, referring to FIG. 3, the first wireless communication device 102 transmits 304, to the second wireless communication device 104 in response to the receiving 302 the device capability information enquiry, a capability information indicating support for data unit discard reporting.
- [0080] The first wireless communication device 102 optionally receives 706, from the second wireless communication device 104, an indicator indicating a discard report prohibit time period. For example, referring to FIGs. 3 and 4, the first wireless communication device 102 receives 306 an indicator indicating the discard report

prohibit time period. The first wireless communication device 102 starts a discard report prohibit timer 411 based on the discard report prohibit time period.

[0081] The first wireless communication device 102 optionally receives 707, from the second wireless communication device 104, an indicator indicating a retransmission time period. For example, referring to FIGs. 3 and 4, the first wireless communication device 102 receives 307 an indicator indicating the retransmission time period. The first wireless communication device 102 starts a retransmission timer 413 based on the retransmission time period.

[0082] The first wireless communication device 102 transmits 711, to the second wireless communication device 104, a discard report indicating a discarded data unit. For example, referring to FIGs. 3 and 4, the first wireless communication device 102 transmits 311, 411, to the second wireless communication device 104, a discard report indicating a discarded data unit.

[0083] The first wireless communication device 102 receives 714, from the second wireless communication device 104, a status report indicating a positive ACK for a sequence number of the discarded data unit. For example, referring to FIGs. 3 and 4, the first wireless communication device 102 receives 314, 414, from the second wireless communication device 104, a status report indicating a positive ACK for a sequence number of the discarded data unit. FIG. 7 describes a method from the point of view of an SDU transmitting entity, whereas FIG. 8 describes a method from the point of view of an SDU receiving entity.

[0084] FIG. 8 illustrates a flowchart 800 of a method of wireless communication at a first wireless communication device (e.g., an SDU receiving entity). With reference to FIGs. 1-6, the method can be performed by the UE 102, the UE apparatus 902, etc., which includes the discard reporting components 140a/140b, memory 926', 906', 916, and which may correspond to the entire UE 102 or the entire UE apparatus 902, or a component of the UE 102 or the UE apparatus 902, such as the wireless baseband processor 926 and/or the application processor 906. Additionally or alternatively, with reference to FIGs. 1, 3, 5, and 8, the method can be performed by the network 104 (e.g., network entity), the DU 108, the CU 110, etc., which includes the discard reporting components 150a/150b, memory 1026', 1006', 1016, and which may correspond to the entire network 104, or a component of the network 104, such as the DU processor 1026 and/or the CU processor 1046.

- [0085] The second wireless communication device 104 optionally transmits 802, to a first wireless communication device 102, a device capability information enquiry. For example, referring to FIG. 3, second wireless communication device 104 transmits 302 the device capability information enquiry from to the first wireless communication device 102.
- [0086] The second wireless communication device 104 optionally receives 804, from the first wireless communication device 102 in response to the transmitting 802 the device capability information enquiry, a capability information indicating support for data unit discard reporting. For example, referring to FIG. 3, the second wireless communication device 104 receives 304, from the first wireless communication device 102 in response to the transmitting 302 the device capability information enquiry, a capability information indicating support for data unit discard reporting.
- [0087] The second wireless communication device 104 optionally transmits 806, to the first wireless communication device 102, an indicator indicating a discard report prohibit time period. For example, referring to FIGs. 3 and 5, the second wireless communication device 104 transmits 306 an indicator indicating the discard report prohibit time period. The first wireless communication device 102 starts 507 a discard report prohibit timer based on the discard report prohibit time period.
- [0088] The second wireless communication device 104 optionally transmits 807, to the first wireless communication device 102, an indicator indicating a retransmission time period. For example, referring to FIG. 3, the second wireless communication device 104 transmits 307 an indicator indicating the prohibit time period. The first wireless communication device 102 starts a retransmission timer based on the retransmission time period.
- [0089] The second wireless communication device 104 receives 811, from the first wireless communication device 102, a discard report indicating a discarded data unit. For example, referring to FIGs. 3 and 5, second wireless communication device 104 receives 311, 511, from the first wireless communication device 104, a discard report indicating a discarded SDU.
- [0090] The second wireless communication device 104 transmits 814, to the first wireless communication device 102, a status report indicating a positive ACK for a sequence number of the discarded data unit. For example, referring to FIGs. 3 and 5, the second wireless communication device 104 transmits 314, 514, to the first wireless communication device 102, a status report indicating a positive ACK for a sequence

number of the discarded data unit. FIG. 8 describes a method from the point of view of an SDU receiving entity. A second wireless communication device (e.g., an SDU receiving entity), as described in FIG. 8, performs the methods of flowchart 500. A first wireless communication device (e.g., an SDU transmitting entity), as described in FIG. 7, performs the methods of flowchart 400.

[0091] FIG. 9 is a diagram 900 illustrating an example of a hardware implementation for a UE apparatus 902. The UE apparatus 902 may be the UE 102, a component of the UE 102, or may implement UE functionality. The UE apparatus 902 may include an application processor 906, which may have on-chip memory 906'. In examples, the application processor 906 may be coupled to a secure digital (SD) card 908 and/or a display 910. The application processor 906 may also be coupled to a sensor(s) module 912, a power supply 914, an additional module of memory 916, a camera 918, and/or other related components. For example, the sensor(s) module 912 may control a barometric pressure sensor/altimeter, a motion sensor such as an inertial management unit (IMU), a gyroscope, accelerometer(s), a light detection and ranging (LIDAR) device, a radio-assisted detection and ranging (RADAR) device, a sound navigation and ranging (SONAR) device, a magnetometer, an audio device, and/or other technologies used for positioning.

[0092] The UE apparatus 902 may further include a wireless baseband processor 926, which may be referred to as a modem. The wireless baseband processor 926 may have on-chip memory 926'. Along with, and similar to, the application processor 906, the wireless baseband processor 926 may also be coupled to the sensor(s) module 912, the power supply 914, the additional module of memory 916, the camera 918, and/or other related components. The wireless baseband processor 926 may be additionally coupled to one or more subscriber identity module (SIM) card(s) 920 and/or one or more transceivers 930 (e.g., wireless RF transceivers).

[0093] Within the one or more transceivers 930, the UE apparatus 902 may include a Bluetooth module 932, a WLAN module 934, an SPS module 936 (e.g., GNSS module), and/or a cellular module 938. The Bluetooth module 932, the WLAN module 934, the SPS module 936, and the cellular module 938 may each include an on-chip transceiver (TRX), or in some cases, just a transmitter (TX) or just a receiver (RX). The Bluetooth module 932, the WLAN module 934, the SPS module 936, and the cellular module 938 may each include dedicated antennas and/or utilize antennas 940 for communication with one or more other nodes. For example, the UE apparatus

902 communicates through the transceiver(s) 930 via the antennas 940 with another UE 102 (e.g., sidelink communication) and/or with a network entity 104 (e.g., uplink/downlink communication), where the network entity 104 may correspond to a base station or a unit of the base station, such as the RU 106, the DU 108, or the CU 110.

[0094] The wireless baseband processor 926 and the application processor 906 may each include a computer-readable medium / memory 926', 906', respectively. The additional module of memory 916 may also be considered a computer-readable medium / memory. Each computer-readable medium / memory 926', 906', 916 may be non-transitory. The wireless baseband processor 926 and the application processor 906 may each be responsible for general processing, including execution of software stored on the computer-readable medium / memory 926', 906', 916. The software, when executed by the wireless baseband processor 926 / application processor 906, causes the wireless baseband processor 926 / application processor 906 to perform the various functions described herein. The computer-readable medium / memory may also be used for storing data that is manipulated by the wireless baseband processor 926 / application processor 906 when executing the software. The wireless baseband processor 926 / application processor 906 may be a component of the UE 102. The UE apparatus 902 may be a processor chip (e.g., modem and/or application) and include just the wireless baseband processor 926 and/or the application processor 906. In other examples, the UE apparatus 902 may be the entire UE 102 and include the additional modules of the apparatus 902.

[0095] As discussed, the discard reporting components 140a and/or 140b are configured to transmit, to a second wireless communication device, a first status PDU indicating a discarded SDU; and receive, from the second wireless communication device, a second status PDU indicating a positive ACK for the discarded SDU. In further examples, the discard reporting components 140a and/or 140b are further configured to transmit, to discard reporting component 150a and/or 150b a discard report indicating a discarded data unit. The discard reporting component components 140a and/or 140b are further configured to receive, from the discard reporting component 150a and/or 150b, a status report indicating a positive ACK for a sequence number of the discarded data unit. The discard reporting component 140a is within the application processor 906. The discard reporting component 140b is within the wireless baseband processor 926. The discard reporting components 140a/140b may

be one or more hardware components specifically configured to carry out the stated processes/algorithm, implemented by one or more processors configured to perform the stated processes/algorithm, stored within a computer-readable medium for implementation by the one or more processors, or a combination thereof.

[0096] The UE apparatus 902 may include a variety of components configured for various functions. In examples, the UE apparatus 902, and in particular the wireless baseband processor 926 and/or the application processor 906, includes transceiver 930 for transmitting a discard report indicating a discarded data unit and receiving a status report indicating a positive ACK for a sequence number of the discarded data unit. The UE apparatus 902 further includes transceiver 930 for receiving a device capability information enquiry and transmitting, in response to the receiving the device capability information enquiry, a capability information indicating support for data unit discard reporting.

[0097] The UE apparatus 902 further includes transceiver 930 for transmitting the discard report after a discard report retransmission timer expires.

[0098] The UE apparatus 902 further includes transceiver 930 for transmitting, based on a segment of the discarded data unit being submitted to a medium access control layer of the first wireless communication device, the discard report. The discard report includes at least one of a PDU type field with a pre-defined value or an indicator indicating the sequence number of the discarded data unit. In some aspects, the discard report supports indicating more than one sequence number and includes at least one of a starting sequence number, an ending sequence number, a number of consecutive sequence numbers following the starting sequence number, or a bitmap representing the sequence number.

[0099] The UE apparatus 902 further includes transceiver 930 or receiving an indicator indicating a prohibit time period, starting a prohibit timer based on the prohibit time period, and transmitting the discard report after the prohibit timer expires. In some aspects, the prohibit time period is based on at least one of a radio bearer associated with the discarded data unit or a QoS associated with the discarded data unit.

[00100] The UE apparatus 902 further includes transceiver 930 for optionally receiving an indicator indicating a retransmission time period, starting a retransmission timer based on the retransmission time period, and retransmitting, based on not receiving the status report for the discarded sequence number, the discard report after the retransmission timer expires. In some aspects, the retransmission time period is based

on at least one of a radio bearer associated with the discarded data unit, or a QoS associated with the discarded data unit. In some aspects, the discarded data unit is an RLC SDU and the status report includes an ACK/NACK. In some aspects, the discarded data unit is a PDCP SDU and the status report contains a bitmap field. In some aspects, the status report is at least one of a RLC status report or a PDCP status report. In some aspects, the status report indicates an ACK associated with the sequence number of the discarded data unit.

[00101] The UE apparatus 902 further includes transceiver 930 for updating a receive window pointer to a next lowest sequence number of a data unit that has not been completely received by the SDU receiving entity. The sequence number of the data unit that has not been completely received is greater than the sequence number of the discarded data unit. The means can be the transceiver 930, the discard reporting component 140a and/or 140b of the UE apparatus 902 configured to perform the functions recited by the means.

[00102] FIG. 10 is a diagram 1000 illustrating an example of a hardware implementation for one or more network entities 104. The one or more network entities 104 may be a base station, a component of a base station, or may implement base station functionality. The one or more network entities 104 may include, or may correspond to, at least one of the RU 106, the DU, 108, or the CU 110. The CU 110 may include a CU processor 1046, which may have on-chip memory 1046'. In some aspects, the CU 110 may further include an additional module of memory 1056 and/or a communications interface 1048, both of which may be coupled to the CU processor 1046. The CU 110 can communicate with the DU 108 through a midhaul link 162, such as an F1 interface between the communications interface 1048 of the CU 110 and a communications interface 1028 of the DU 108.

[00103] The DU 108 may include a DU processor 1026, which may have on-chip memory 1026'. In some aspects, the DU 108 may further include an additional module of memory 1036 and/or the communications interface 1028, both of which may be coupled to the DU processor 1026. The DU 108 can communicate with the RU 106 through a fronthaul link 160 between the communications interface 1028 of the DU 108 and a communications interface 1008 of the RU 106.

[00104] The RU 106 may include an RU processor 1006, which may have on-chip memory 1006'. In some aspects, the RU 106 may further include an additional module of memory 1016, the communications interface 1008, and one or more transceivers

1030, all of which may be coupled to the RU processor 1006. The RU 106 may further include antennas 1040, which may be coupled to the one or more transceivers 1030, such that the RU 106 can communicate through the one or more transceivers 1030 via the antennas 1040 with the UE 102.

[00105] The on-chip memory 1006', 1026', 1046' and the additional modules of memory 1016, 1036, 1056 may each be considered a computer-readable medium / memory. Each computer-readable medium / memory may be non-transitory. Each of the processors 1006, 1026, 1046 is responsible for general processing, including execution of software stored on the computer-readable medium / memory. The software, when executed by the corresponding processor(s) 1006, 1026, 1046 causes the processor(s) 1006, 1026, 1046 to perform the various functions described herein. The computer-readable medium / memory may also be used for storing data that is manipulated by the processor(s) 1006, 1026, 1046 when executing the software. In examples, the discard reporting component 150a can be a component of the DU 108. The discard reporting component 150b can be a component of the CU 110.

[00106] As discussed, the discard reporting components 150a and/or 150b are configured to transmit, to a discard reporting component 140a and/or 140b, a discard report indicating a discarded data unit. The discard reporting component 150a and/or 150b are further configured to receive, from a first wireless communication device, a first status PDU indicating a discarded SDU; and transmit, to the first wireless communication device, a second status PDU indicating a positive ACK for the discarded SDU. The discard reporting component 150a and/or 150b are further configured to receive, from the discard reporting component 140a and/or 140b, a status report indicating a positive ACK for a sequence number of the discarded data unit. The discard reporting component 150a can be within the DU processor 1026. The discard reporting component 150b can be within the CU processor 1046. The discard reporting components 150a and/or 150b can be one or more hardware components specifically configured to carry out the stated processes/algorithm, implemented by one or more processors configured to perform the stated processes/algorithm, stored within a computer-readable medium for implementation by the one or more processors, or a combination thereof.

[00107] The network entity 104 can include a variety of components configured for various functions. In examples, the network entity 104, and in particular the DU processor 1026, the CU processor 1046, and/or RU 106 includes transceiver 1030 for

transmitting a discard report indicating a discarded data unit and receiving a status report indicating a positive ACK for a sequence number of the discarded data unit. The network entity 104 further includes transceiver 1030 for receiving a device capability information enquiry and transmitting, in response to the receiving the device capability information enquiry, a capability information indicating support for data unit discard reporting. The network entity 104 further includes transceiver 1030 for transmitting the discard report after a discard report retransmission timer expires.

[00108] The network entity 104 further includes transceiver 1030 for transmitting, based on a segment of the discarded data unit being submitted to a medium access control layer of the first wireless communication device, the discard report. The discard report transmitted by the network entity 104 may use the same structure as the discard report transmitted by the UE apparatus 902 and described in FIG. 9.

[00109] The network entity 104 further includes transceiver 1030 for receiving an indicator indicating a prohibit time period, starting a prohibit timer based on the prohibit time period, and transmitting the discard report after the prohibit timer expires. In some aspects, the prohibit time period is based on at least one of a standardized prohibit time period, a radio bearer associated with the discarded data unit, or a QoS associated with the discarded data unit.

[00110] The network entity 104 further includes transceiver 1030 optionally receiving an indicator indicating a retransmission time period, starting a retransmission timer based on the retransmission time period, and retransmitting, based on not receiving the status report for the discarded sequence number, the discard report after the retransmission timer expires. In some aspects, the retransmission time period is based on at least one of a radio bearer associated with the discarded data unit, or a QoS associated with the discarded data unit. In some aspects, the discarded data unit is an RLC SDU and the status report includes an ACK/NACK. In some aspects, the discarded data unit is a PDCP SDU and the status report includes a bitmap field. In some aspects, the status report is at least one of a RLC status report or a PDCP status report. In some aspects, the status report indicates an ACK associated with the sequence number of the discarded data unit.

[00111] The network entity 104 further includes transceiver 1030 for updating a receive window pointer to a next lowest sequence number of a data unit that has not been completely received by the SDU receiving entity. The sequence number of the data unit that has not been completely received is greater than the sequence number of the

discarded data unit. The means may be the discard reporting component 150a and/or 150b of the network entity 104 configured to perform the functions recited by the means.

[00112] The specific order or hierarchy of blocks in the processes and flowcharts disclosed herein is an illustration of example approaches. Hence, the specific order or hierarchy of blocks in the processes and flowcharts may be rearranged. Some blocks may also be combined or deleted. Dashed lines may indicate optional elements of the diagrams. The accompanying method claims present elements of the various blocks in an example order and are not limited to the specific order or hierarchy presented in the claims, processes, and flowcharts.

[00113] The detailed description set forth herein describes various configurations in connection with the drawings and does not represent the only configurations in which the concepts described herein may be practiced. The detailed description includes specific details for the purpose of providing a thorough explanation of various concepts. However, these concepts may be practiced without these specific details. In some instances, well known structures and components are shown in block diagram form in order to avoid obscuring such concepts.

[00114] Aspects of wireless communication systems, such as telecommunication systems, are presented with reference to various apparatuses and methods. These apparatuses and methods are described in the following detailed description and are illustrated in the accompanying drawings by various blocks, components, circuits, processes, call flows, systems, algorithms, etc. (collectively referred to as “elements”). These elements may be implemented using electronic hardware, computer software, or combinations thereof. Whether such elements are implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system.

[00115] An element, or any portion of an element, or any combination of elements may be implemented as a “processing system” that includes one or more processors. Examples of processors include microprocessors, microcontrollers, graphics processing units (GPUs), central processing units (CPUs), application processors, digital signal processors (DSPs), reduced instruction set computing (RISC) processors, systems-on-chip (SoC), baseband processors, field programmable gate arrays (FPGAs), programmable logic devices (PLDs), state machines, gated logic, discrete hardware circuits, and other similar hardware configured to perform the

various functionality described throughout this disclosure. One or more processors in the processing system may execute software, which may be referred to as software, firmware, middleware, microcode, hardware description language, or otherwise. Software shall be construed broadly to mean instructions, instruction sets, code, code segments, program code, programs, subprograms, software components, applications, software applications, software packages, routines, subroutines, objects, executables, threads of execution, procedures, functions, or any combination thereof.

[00116] If the functionality described herein is implemented in software, the functions may be stored on, or encoded as, one or more instructions or code on a computer-readable medium, such as a non-transitory computer-readable storage medium. Computer-readable media includes computer storage media and can include a random-access memory (RAM), a read-only memory (ROM), an electrically erasable programmable ROM (EEPROM), optical disk storage, magnetic disk storage, other magnetic storage devices, combinations of these types of computer-readable media, or any other medium that can be used to store computer executable code in the form of instructions or data structures that can be accessed by a computer. Storage media may be any available media that can be accessed by a computer.

[00117] Aspects, implementations, and/or use cases described herein may be implemented across many differing platform types, devices, systems, shapes, sizes, and packaging arrangements. For example, the aspects, implementations, and/or use cases may come about via integrated chip implementations and other non-module-component based devices, such as end-user devices, vehicles, communication devices, computing devices, industrial equipment, retail/purchasing devices, medical devices, artificial intelligence (AI)-enabled devices, machine learning (ML)-enabled devices, etc. The aspects, implementations, and/or use cases may range from chip-level or modular components to non-modular or non-chip-level implementations, and further to aggregate, distributed, or original equipment manufacturer (OEM) devices or systems incorporating one or more techniques described herein.

[00118] Devices incorporating the aspects and features described herein may also include additional components and features for the implementation and practice of the claimed and described aspects and features. For example, transmission and reception of wireless signals necessarily includes a number of components for analog and digital purposes, such as hardware components, antennas, RF-chains, power amplifiers, modulators, buffers, processor(s), interleavers, adders/summers, etc. Techniques

described herein may be practiced in a wide variety of devices, chip-level components, systems, distributed arrangements, aggregated or disaggregated components, end-user devices, etc., of varying configurations.

[00119] The description herein is provided to enable a person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects. Thus, the claims are not limited to the aspects described herein, but are to be interpreted in view of the full scope of the present disclosure consistent with the language of the claims.

[00120] Reference to an element in the singular does not mean “one and only one” unless specifically stated, but rather “one or more.” Terms such as “if,” “when,” and “while” do not imply an immediate temporal relationship or reaction. That is, these phrases, e.g., “when,” do not imply an immediate action in response to or during the occurrence of an action, but simply imply that if a condition is met then an action will occur, but without requiring a specific or immediate time constraint for the action to occur. The terms “may”, “might”, and “can”, as used in this disclosure, often carry certain connotations. For example, “may” refers to a permissible feature that may or may not occur, “might” refers to a feature that probably occurs, and “can” refers to a capability (e.g., capable of). The phrase “For example” often carries a similar connotation to “may” and, therefore, “may” is sometimes excluded from sentences that include “for example” or other similar phrases.

[00121] Unless specifically stated otherwise, the term “some” refers to one or more. Combinations such as “at least one of A, B, or C” or “one or more of A, B, or C” include any combination of A, B, and/or C, such as A and B, A and C, B and C, or A and B and C, and may include multiples of A, multiples of B, and/or multiples of C, or may include A only, B only, or C only. Sets should be interpreted as a set of elements where the elements number one or more.

[00122] Unless otherwise specifically indicated, ordinal terms such as “first” and “second” do not necessarily imply an order in time, sequence, numerical value, etc., but are used to distinguish between different instances of a term or phrase that follows each ordinal term. Reference numbers, as used in the specification and figures, are sometimes cross-referenced among drawings to denote same or similar features. A feature that is exactly the same in multiple drawings may be labeled with the same reference number in the multiple drawings. A feature that is similar among the

multiple drawings, but not exactly the same, may be labeled with reference numbers that have different leading numbers, but have one or more of the same trailing numbers (e.g., 206, 306, 406, etc., may refer to similar features in the drawings).

[00123] Structural and functional equivalents to elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are encompassed by the claims. The words “module,” “mechanism,” “element,” “device,” and the like may not be a substitute for the word “means.” As such, no claim element is to be construed as a means plus function unless the element is expressly recited using the phrase “means for.” As used herein, the phrase “based on” shall not be construed as a reference to a closed set of information, one or more conditions, one or more factors, or the like. In other words, the phrase “based on A”, where “A” may be information, a condition, a factor, or the like, shall be construed as “based at least on A” unless specifically recited differently.

[00124] The following examples are illustrative only and may be combined with other examples or teachings described herein, without limitation.

[00125] Example 1 is a method of wireless communication performed by a first wireless communication device, the method including: transmitting, to a second wireless communication device, a first status PDU indicating a discarded SDU; and receiving, from the second wireless communication device, a second status PDU indicating a positive ACK for the discarded SDU.

[00126] Example 2 may be combined with Example 1 and includes that the transmitting the first status PDU further includes: transmitting, based on a segment of the discarded SDU being submitted to a lower layer of the first wireless communication device, the first status PDU after a discard timer expires.

[00127] Example 3 may be combined with any of Examples 1 to 2 and includes that the transmitting the first status PDU further includes: reaching a maximum number of transmissions of a PDU containing data associated with the discarded SDU.

[00128] Example 4 may be combined with Example 3 and includes that the first status PDU indicates more than one sequence number and includes at least one of: a starting sequence number; an ending sequence number; a length indicator indicating a number of consecutive sequence numbers following the starting sequence number; or a bitmap representing the sequence number.

- [00129] Example 5 may be combined with any of Examples 1 to 4 and further includes receiving an indicator indicating a first status PDU retransmission time period; starting a first status PDU retransmission timer based on the first status PDU retransmission time period; and retransmitting, based on not receiving the second status PDU, the first status PDU after the first status PDU retransmission timer expires.
- [00130] Example 6 may be combined with any of Examples 1 to 5 and includes that the second status PDU indicates an ACK associated with the sequence number of the discarded SDU.
- [00131] Example 7 may be combined with Example 6 and further includes moving a receive window pointer to a next lowest sequence number of an SDU that has not been completely received by the second wireless communication device, and includes that the sequence number of the SDU that has not been completely received by the first wireless communication device is greater than the sequence number (206) of the discarded SDU.
- [00132] Example 8 is a method of wireless communication performed by a second wireless communication device, the method including: receiving, from a first wireless communication device, a first status PDU indicating a discarded SDU; and transmitting, to the first wireless communication device, a second status PDU indicating a positive ACK for the discarded SDU.
- [00133] Example 9 may be combined with Example 8 and includes that the transmitting the second status PDU includes transmitting the second status PDU in response to receiving the first status PDU.
- [00134] Example 10 may be combined with any of Examples 8 to 9 and includes that the second status PDU comprises an RLC status report.
- [00135] Example 11 may be combined with any of Examples 8 to 10 and includes that the first status PDU indicates more than one sequence number and includes that at least one of: a starting sequence number; an ending sequence number; a length indicator indicating a number of consecutive sequence numbers following the starting sequence number; or a bitmap indicating the sequence number.
- [00136] Example 12 may be combined with any of Examples 8 to 11 and further includes starting a second status PDU prohibit timer based on a second status PDU prohibit time period, and includes that: the receiving the first status PDU comprises receiving (311) the first status PDU while the second status PDU prohibit timer is running; and

the transmitting the second status PDU includes transmitting (314) the second status PDU before the second status PDU prohibit timer expires.

[00137] Example 13 may be combined with any of Examples 8 to 12 and includes that the second status PDU indicates an ACK associated with the sequence number of the discarded SDU.

[00138] Example 14 may be combined with Example 13 and further includes moving a receive window pointer to a next lowest sequence number of an SDU that has not been completely received by the second wireless communication device, and includes that the sequence number of the SDU that has not been completely received by the second wireless communication device is greater than the sequence number of the discarded SDU.

[00139] Example 15 is a method of wireless communication at a first wireless communication device, the method including transmitting, to a second wireless communication device, a discard report indicating a discarded data unit and receiving, from the second wireless communication device, a status report indicating a positive ACK for a sequence number of the discarded data unit.

[00140] Example 16 may be combined with Example 15 and includes receiving, from the second wireless communication device, a device capability information enquiry and transmitting, to the second wireless communication device in response to the receiving the device capability information enquiry, a capability information indicating support for data unit discard reporting.

[00141] Example 17 may be combined with any of Examples 15-16 and further includes transmitting the discard report after a discard report retransmission timer expires.

[00142] Example 18 may be combined with any of Examples 15-17 and further includes transmitting, based a segment of the discarded data unit being submitted to MAC layer of the first wireless communication device, the discard report.

[00143] Example 19 may be combined with any of Examples 15-18 and further includes the discard report includes at least one of a PDU type field comprising a pre-defined value or an indicator indicating the sequence number of the discarded data unit.

[00144] Example 20 may be combined with Example 19 and further includes the indicator supports indicating more than one sequence number and includes at least one of a starting sequence number, an ending sequence number, a number of consecutive sequence numbers following the starting sequence number, or a bitmap representing the sequence number.

- [00145] Example 21 may be combined with any of Examples 15-20 and further includes receiving an indicator indicating a prohibit time period, starting a prohibit timer based on the prohibit time period, and transmitting the discard report after the prohibit timer expires.
- [00146] Example 22 may be combined with Example 21 and further includes the prohibit time period is based on at least one of a radio bearer associated with the discarded data unit or a QoS associated with the discarded data unit.
- [00147] Example 23 may be combined with any of Examples 15-22 and further includes receiving an indicator indicating a discard report retransmission time period, starting a retransmission timer based on the discard report retransmission time period, and retransmitting, based on not receiving the status report for the discarded sequence number, the discard report after the retransmission timer expires.
- [00148] Example 24 may be combined with Example 23 and further includes the retransmission time period is based on at least one of a radio bearer associated with the discarded data unit, or a QoS associated with the discarded data unit.
- [00149] Example 25 may be combined with any of Examples 15-24 and further includes the discarded data unit is a RLC SDU and the status report includes an ACK/NACK.
- [00150] Example 26 may be combined with any of Examples 15-25 and further includes the discarded data unit is a PDCP SDU and the status report includes a bitmap field.
- [00151] Example 27 may be combined with any of Examples 15-26 and further includes the status report is at least one of a RLC status report or a PDCP status report.
- [00152] Example 28 may be combined with any of Examples 15-27 and further includes the first wireless communication device is one of a UE or a network entity and the second wireless communication device is the other of the UE or the network entity.
- [00153] Example 29 may be combined with any of Examples 15-28 and further includes the status report indicates an ACK associated with the sequence number of the discarded data unit.
- [00154] Example 30 may be combined with Example 29 and further includes updating a receive window pointer to a next lowest sequence number of a data unit that has not been completely received by the second wireless communication device. The sequence number of the data unit that has not been completely received by the first wireless communication device is greater than the sequence number of the discarded data unit.

- [00155] Example 31 is a method of wireless communication at a second wireless communication device including receiving, from a first wireless communication device, a discard report indicating a discarded data unit and transmitting, to the first wireless communication device, a status report indicating a positive ACK for a sequence number of the discarded data unit.
- [00156] Example 32 may be combined with Example 31 and further includes transmitting, to the first wireless communication device, a device capability indicator information enquiry and receiving, from the first wireless communication device in response to the transmitting the device capability information enquiry, a capability information indicating support for data unit discard reporting.
- [00157] Example 33 may be combined with any of Examples 31-32 and further includes receiving, from the first wireless communication device, the discard report after a discard report retransmission timer expires.
- [00158] Example 34 may be combined with any of Examples 31-33 and further includes receiving, based on a segment of the discarded data unit being submitted to a MAC layer of the first wireless communication device, the discard report.
- [00159] Example 35 may be combined with any of Examples 31-34 and further includes the discard report includes at least one of PDU type field comprising a pre-defined value or an indicator indicating the sequence number of the discarded data unit.
- [00160] Example 36 may be combined with Example 35 and further includes the indicator supports indicating more than one sequence number and includes at least one of a starting sequence number, an ending sequence number, a number of consecutive sequence numbers following the starting sequence number, or a bitmap indicating the sequence number.
- [00161] Example 37 may be combined with any of Examples 31-36 and further includes starting a status report prohibit timer based on a status report prohibit time period, receiving the discard report while the status report prohibit timer is running and transmitting the status report before the status report prohibit timer expires.
- [00162] Example 38 may be combined with Example 37 and further includes restarting the status report prohibit timer after transmitting the status report.
- [00163] Example 39 may be combined with any of Examples 31-38 and further includes the discarded data unit is a RLC SDU and the status report includes ACK/NACK.
- [00164] Example 40 may be combined with any of Examples 31-39 and further includes the discarded data unit is a PDCP SDU and the status report includes a bitmap field.

- [00165] Example 41 may be combined with any of Examples 31-40 and further includes the status report is at least one of a RLC status report or a PDCP status report.
- [00166] Example 42 may be combined with any of Examples 31-41 and further includes the first wireless communication device is one of a UE or a network entity and the second wireless communication device is the other of the UE or the network entity.
- [00167] Example 43 may be combined with any of Examples 31-42 and further includes transmitting the status report in response to receiving the discard report.
- [00168] Example 44 may be combined with any of Examples 31-43 and further includes the status report indicates an ACK associated with the sequence number of the discarded data unit.
- [00169] Example 45 may be combined with Example 44 and further includes updating a receive window pointer to a next lowest sequence number of a data unit that has not been completely received by the second wireless communication device. The sequence number of the data unit that has not been completely received by the second wireless communication device is greater than the sequence number of the discarded data unit.
- [00170] Example 46 is an apparatus for wireless communication for implementing a method as in any of Examples 1-45.
- [00171] Example 47 is an apparatus for wireless communication including means for implementing a method as in any of Examples 1-45.
- [00172] Example 48 is a non-transitory computer-readable medium storing computer executable code, the code when executed by a processor causes the processor to implement a method as in any of Examples 1-45.

CLAIMS**WHAT IS CLAIMED IS:**

1. A method of wireless communication performed by a first wireless communication device (102), the method comprising:
 - transmitting (311), to a second wireless communication device (104), a first status protocol data unit (PDU) indicating a discarded service data unit (SDU); and
 - receiving (314), from the second wireless communication device (104), a second status PDU indicating a positive acknowledgement (ACK) for the discarded SDU.
2. The method of claim 1, wherein the transmitting the first status PDU comprises:
 - transmitting (311), based on a segment of the discarded SDU being submitted to a lower layer of the first wireless communication device, the first status PDU after a discard timer expires.
3. The method of any of claims 1 to 2, wherein the transmitting the first status PDU comprises:
 - reaching a maximum number of transmissions of a PDU containing data associated with the discarded SDU.
4. The method of claim 3, wherein the first status PDU indicates more than one sequence number and comprises at least one of:
 - a starting sequence number (206);
 - an ending sequence number (206);
 - a length indicator indicating a number of consecutive sequence numbers following the starting sequence number (206); or
 - a bitmap representing the sequence number (206).
5. The method of any of claims 1 to 4, further comprising:
 - receiving (307) an indicator indicating a first status PDU retransmission time period;
 - starting a first status PDU retransmission timer based on the first status PDU retransmission time period; and
 - retransmitting (311), based on not receiving the second status PDU, the first status PDU after the first status PDU retransmission timer expires.

6. The method of any of claims 1 to 5, wherein the second status PDU indicates an ACK associated with the sequence number (206) of the discarded SDU.

7. The method of claim 6, further comprising:

moving (316) a receive window pointer to a next lowest sequence number (206) of an SDU that has not been completely received by the second wireless communication device (104), wherein the sequence number (206) of the SDU that has not been completely received by the first wireless communication device (102) is greater than the sequence number (206) of the discarded SDU.

8. A method of wireless communication performed by a second wireless communication device (104), the method comprising:

receiving (311), from a first wireless communication device (102), a first status protocol data unit (PDU) indicating a discarded service data unit (SDU); and

transmitting (314), to the first wireless communication device (102), a second status PDU indicating a positive acknowledgement (ACK) for the discarded SDU.

9. The method of claim 8, wherein the transmitting the second status PDU comprises transmitting (314) the second status PDU in response to receiving the first status PDU.

10. The method of any of claims 8 to 9, wherein the second status PDU comprises a radio link control (RLC) status report.

11. The method of any of claims 8 to 10, wherein the first status PDU indicates more than one sequence number (206) and comprises at least one of:

a starting sequence number (206);

an ending sequence number (206);

a length indicator indicating a number of consecutive sequence numbers following the starting sequence number (206); or

a bitmap indicating the sequence number (206).

12. The method of any of claims 8 to 11, further comprising:

starting a second status PDU prohibit timer based on a second status PDU prohibit time period, wherein:

the receiving the first status PDU comprises receiving (311) the first status PDU while the second status PDU prohibit timer is running; and

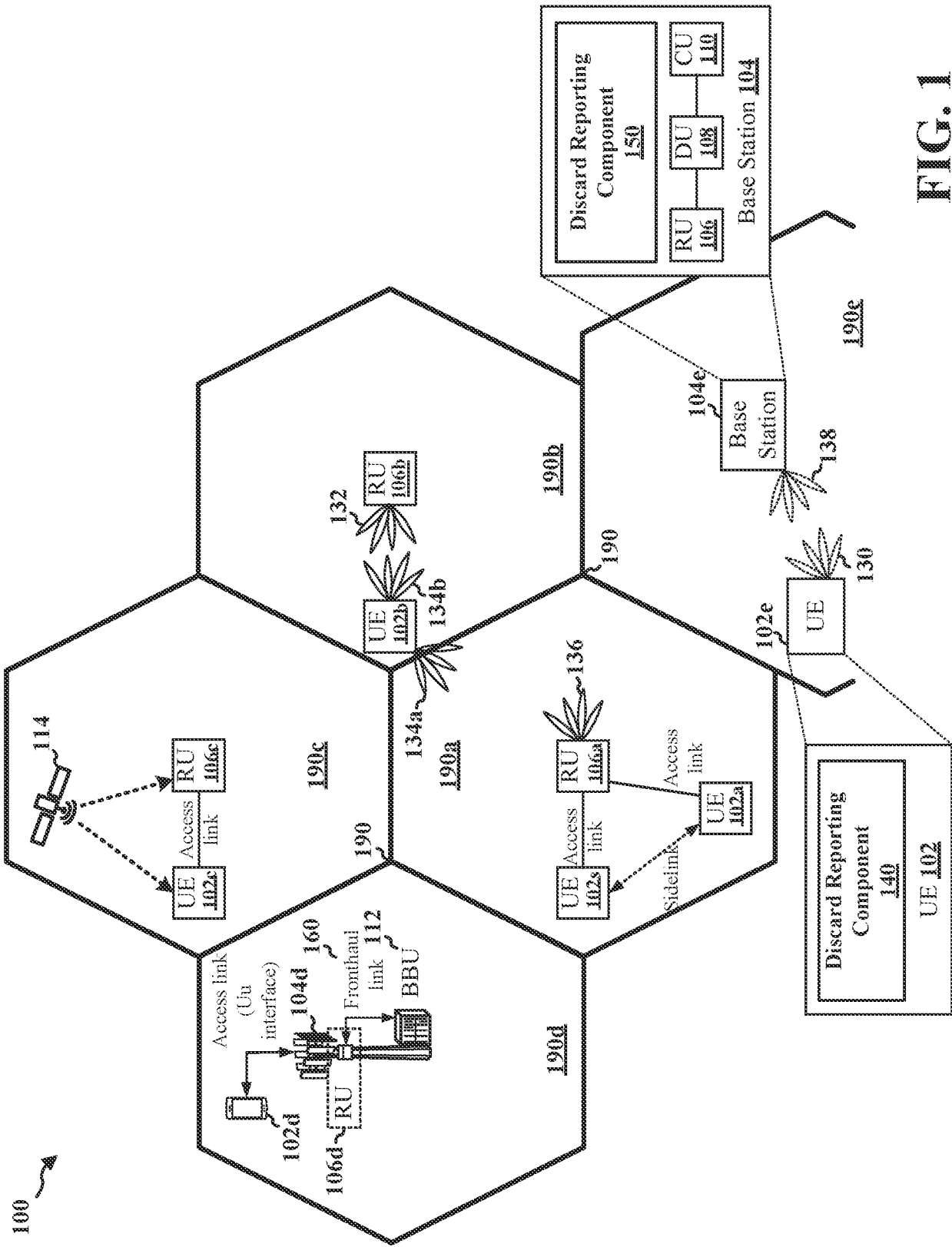
the transmitting the second status PDU comprises transmitting (314) the second status PDU before the second status PDU prohibit timer expires.

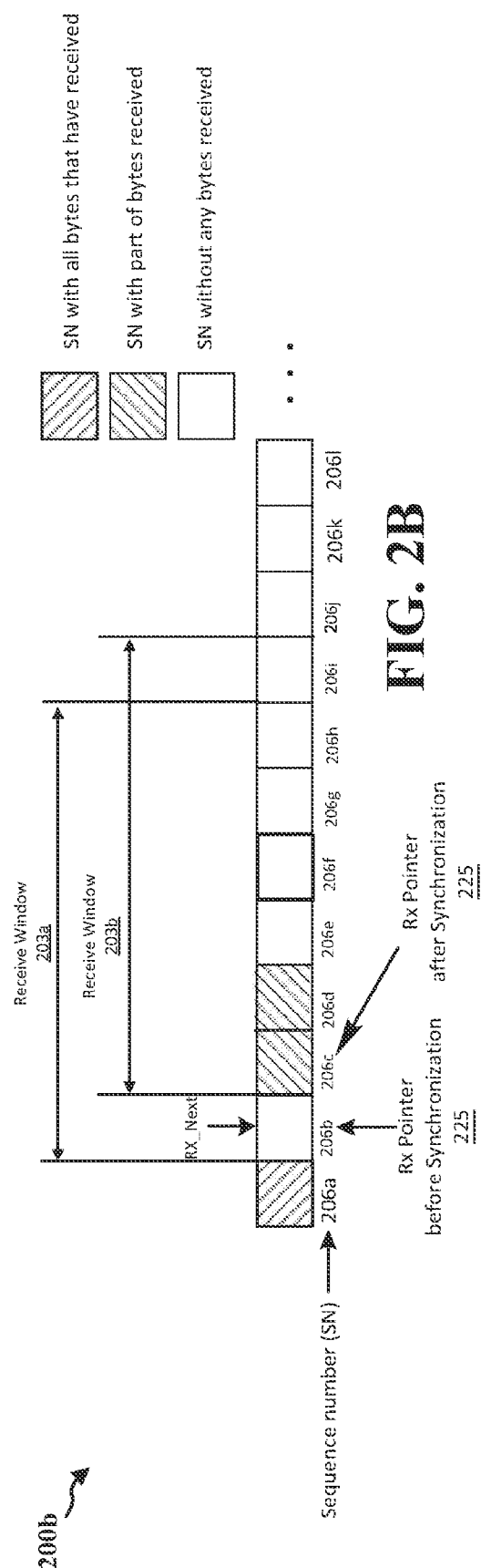
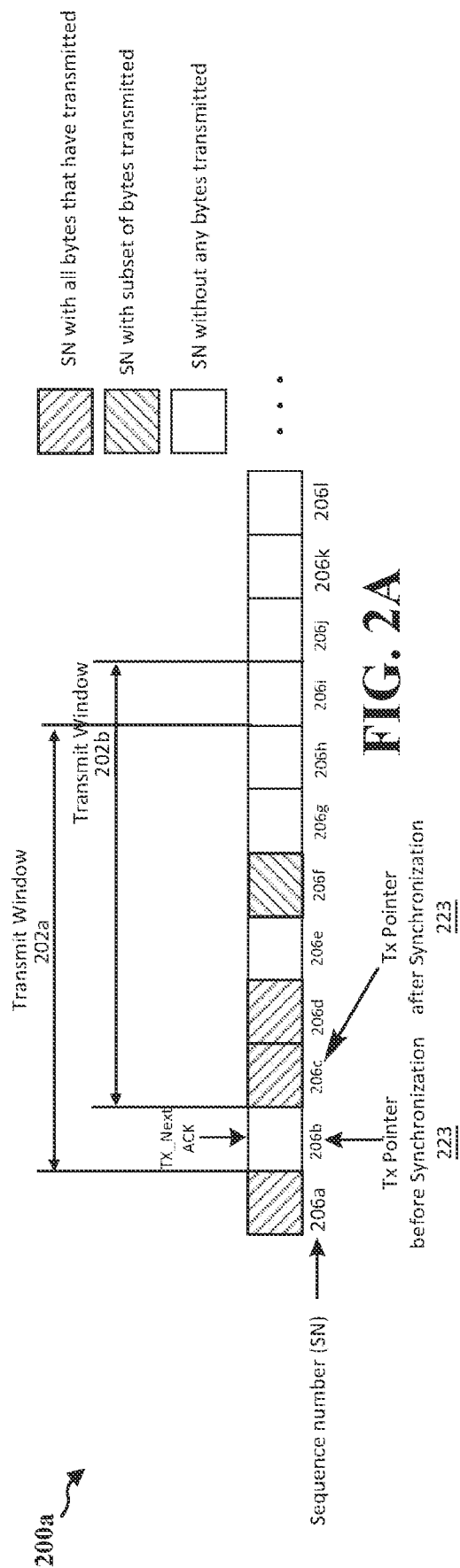
13. The method of any of claims 8 to 12, wherein the second status PDU indicates an ACK associated with the sequence number (206) of the discarded SDU.

14. The method of claim 13, further comprising:

moving (312) a receive window pointer to a next lowest sequence number (206) of an SDU that has not been completely received by the second wireless communication device (104), wherein the sequence number (206) of the SDU that has not been completely received by the second wireless communication device (104) is greater than the sequence number (206) of the discarded SDU.

15. An apparatus for wireless communication comprising a transceiver, a memory, and a processor coupled to the transceiver and the memory and configured to implement a method as in any of claims 1-14.





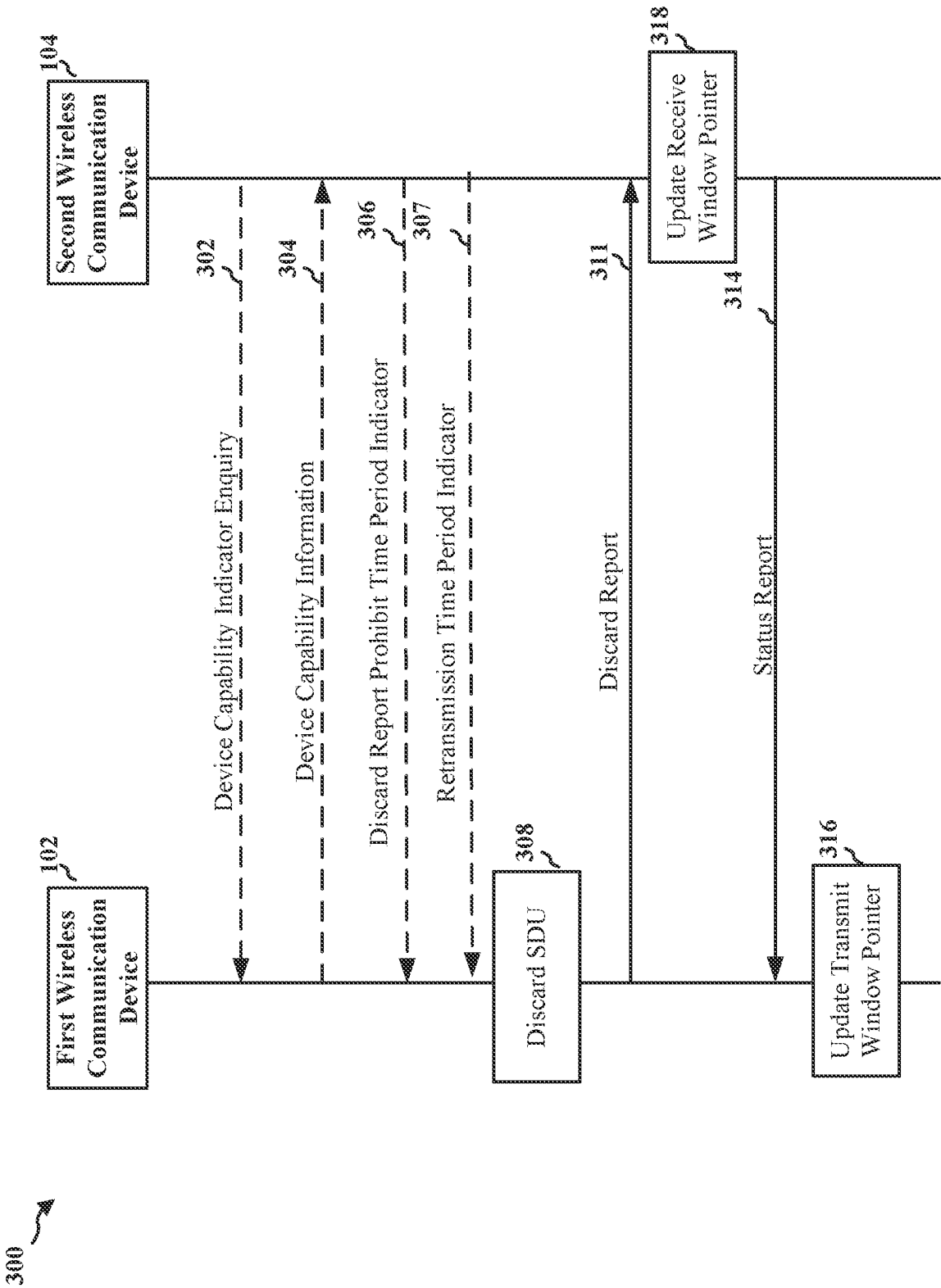


FIG. 3

4/10

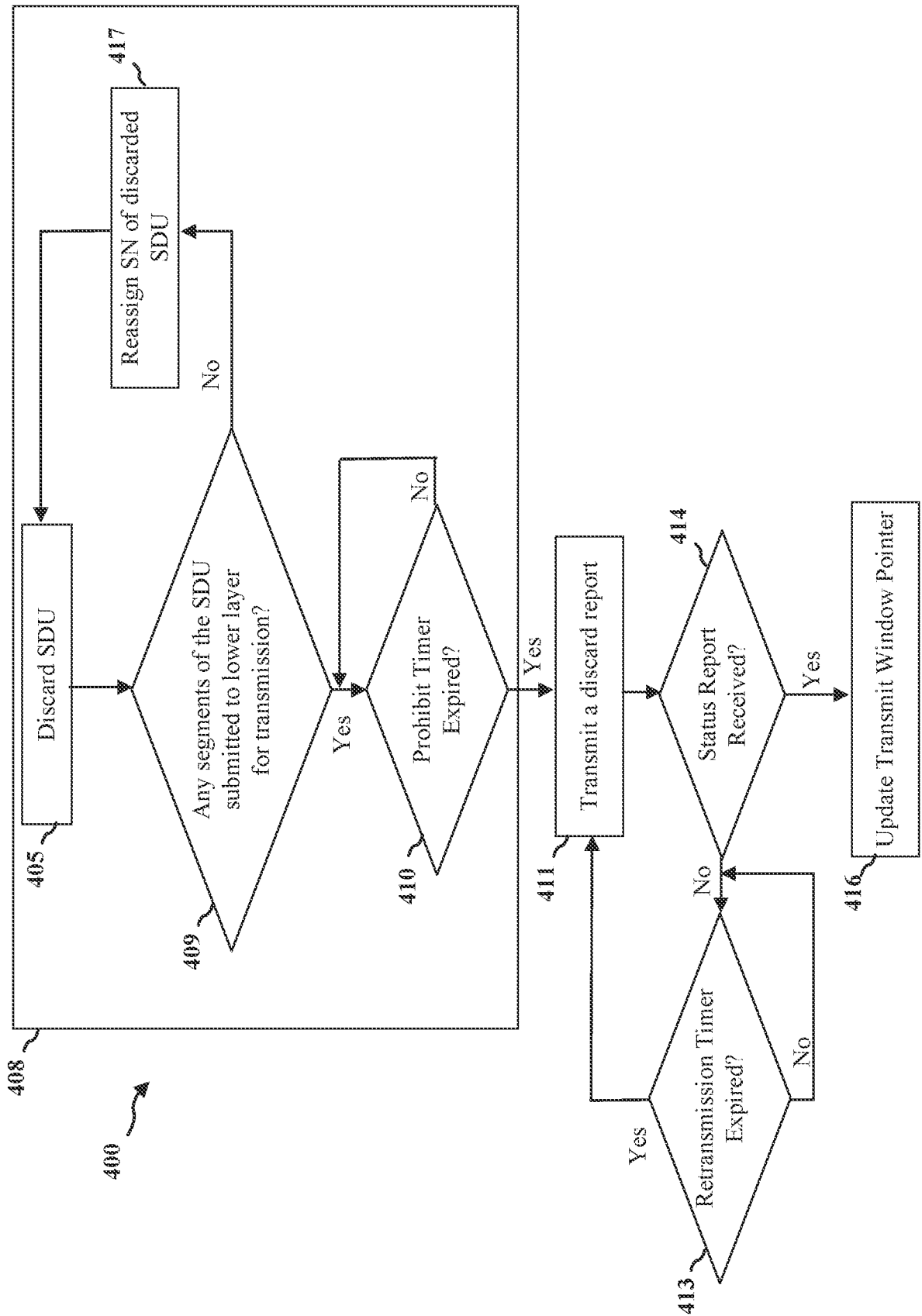


FIG. 4

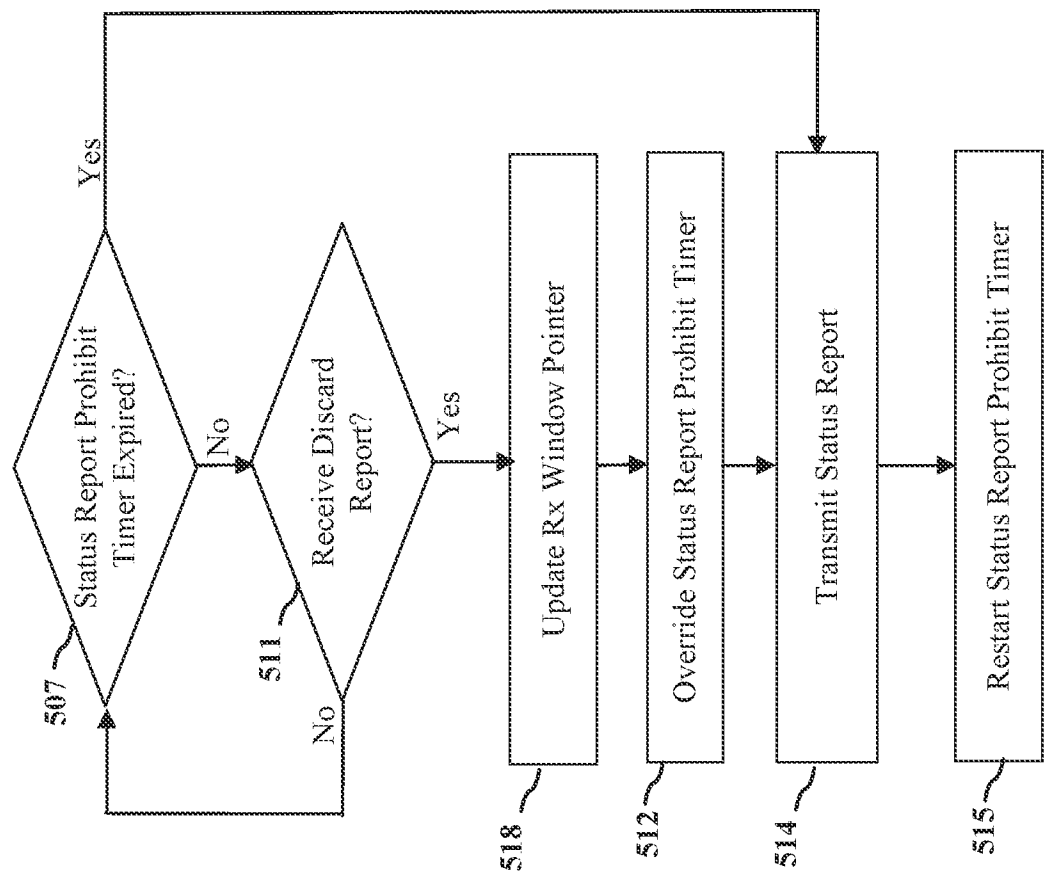


FIG. 5

600 ↗

D/C <u>650</u>	CPT <u>652</u>			ACK_SN <u>654</u>		
ACK_SN <u>654</u>						
E1	R	R	R	R	R	R
ACK_SN <u>654</u>						
ACK_SN <u>654</u>			E1	E2	E3	R
NACK_SN <u>656</u>						
NACK_SN <u>656</u>			E1	E2	E3	R
Sostart <u>658</u>						
Sostart <u>658</u>						
Soend <u>660</u>						
Soend <u>660</u>						
NACK range <u>662</u>						
NACK_SN <u>656</u>						
NACK_SN <u>656</u>			E1	E2	E3	R
...						

FIG. 6

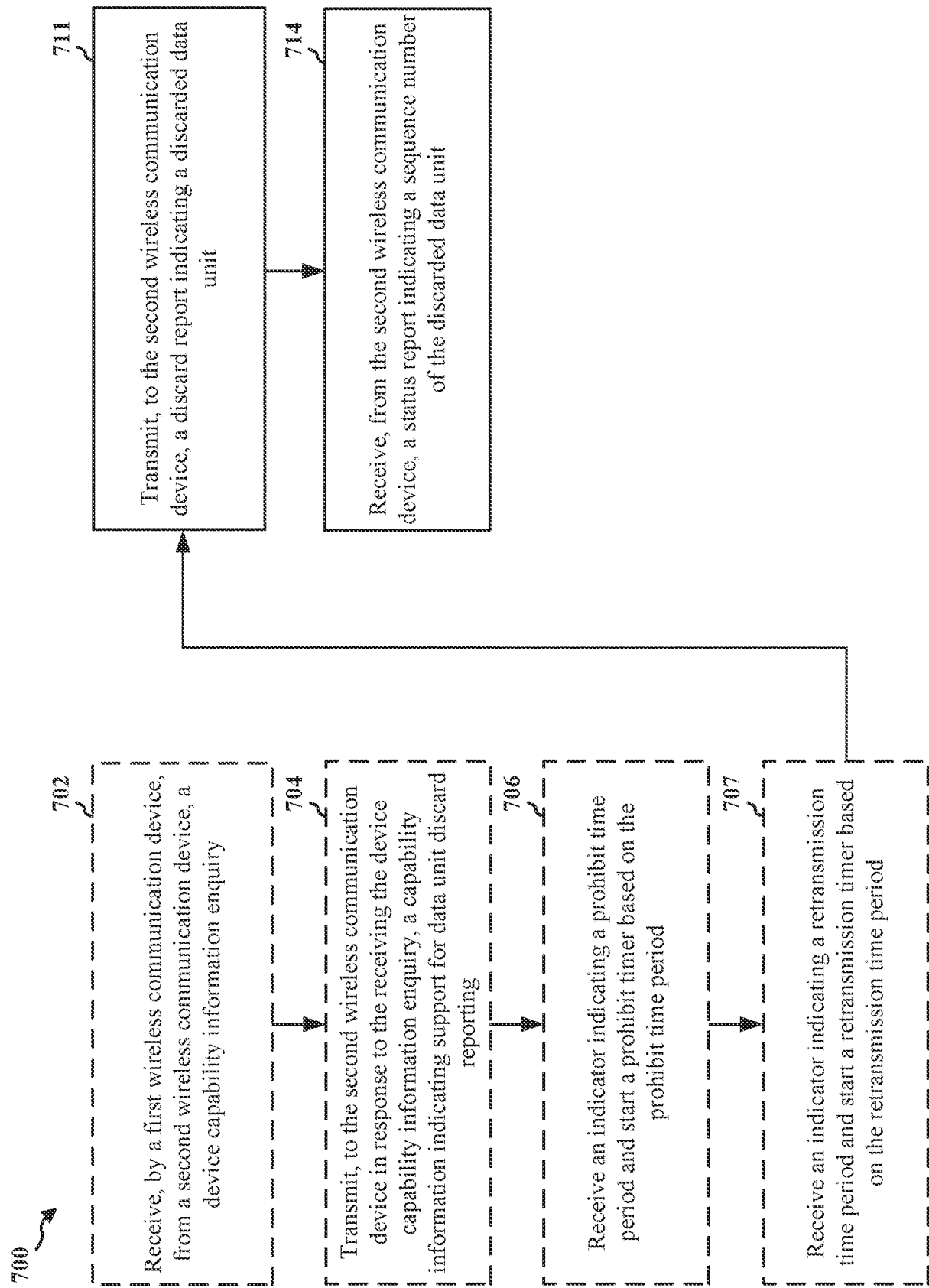


FIG. 7

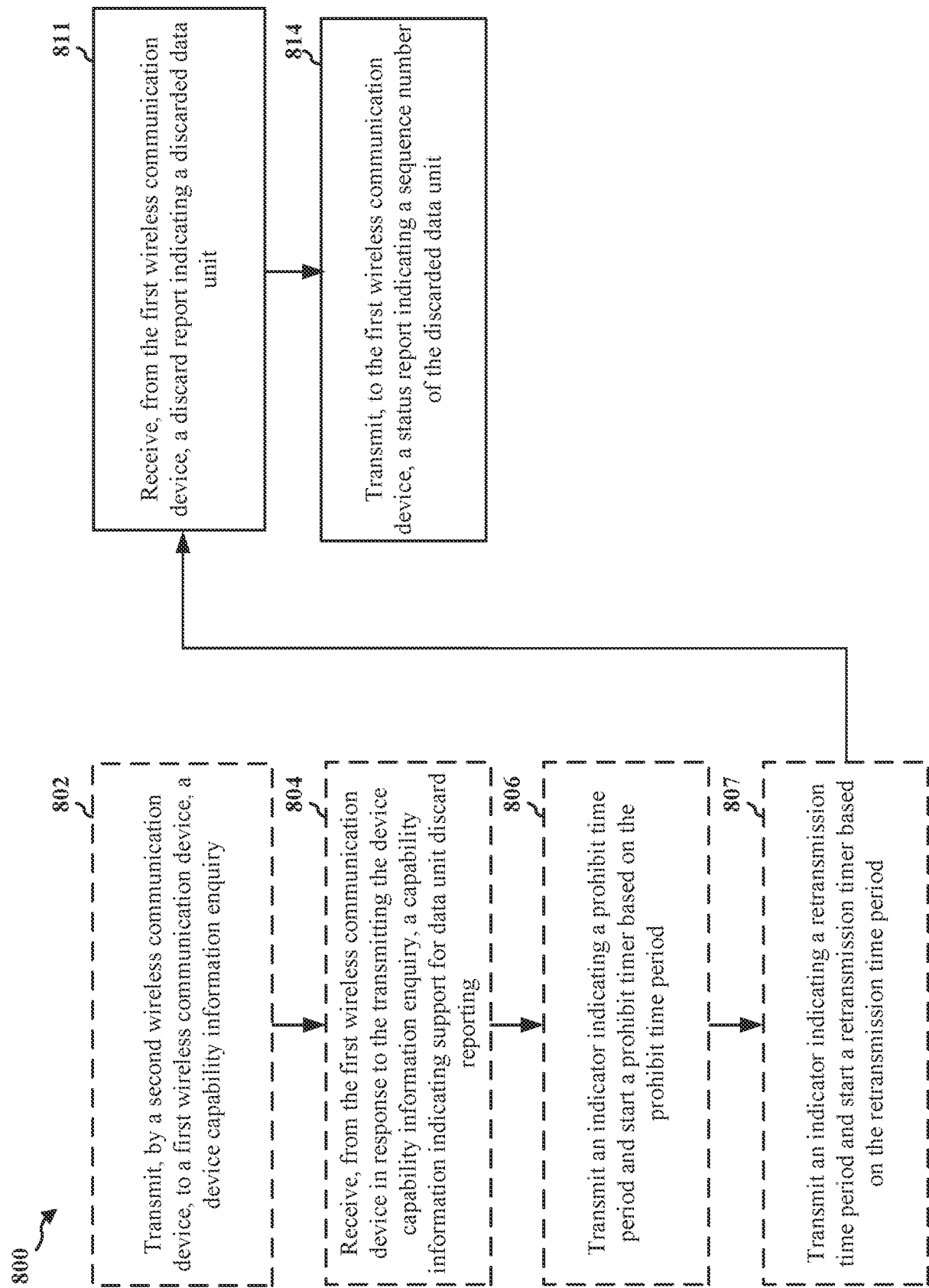


FIG. 8

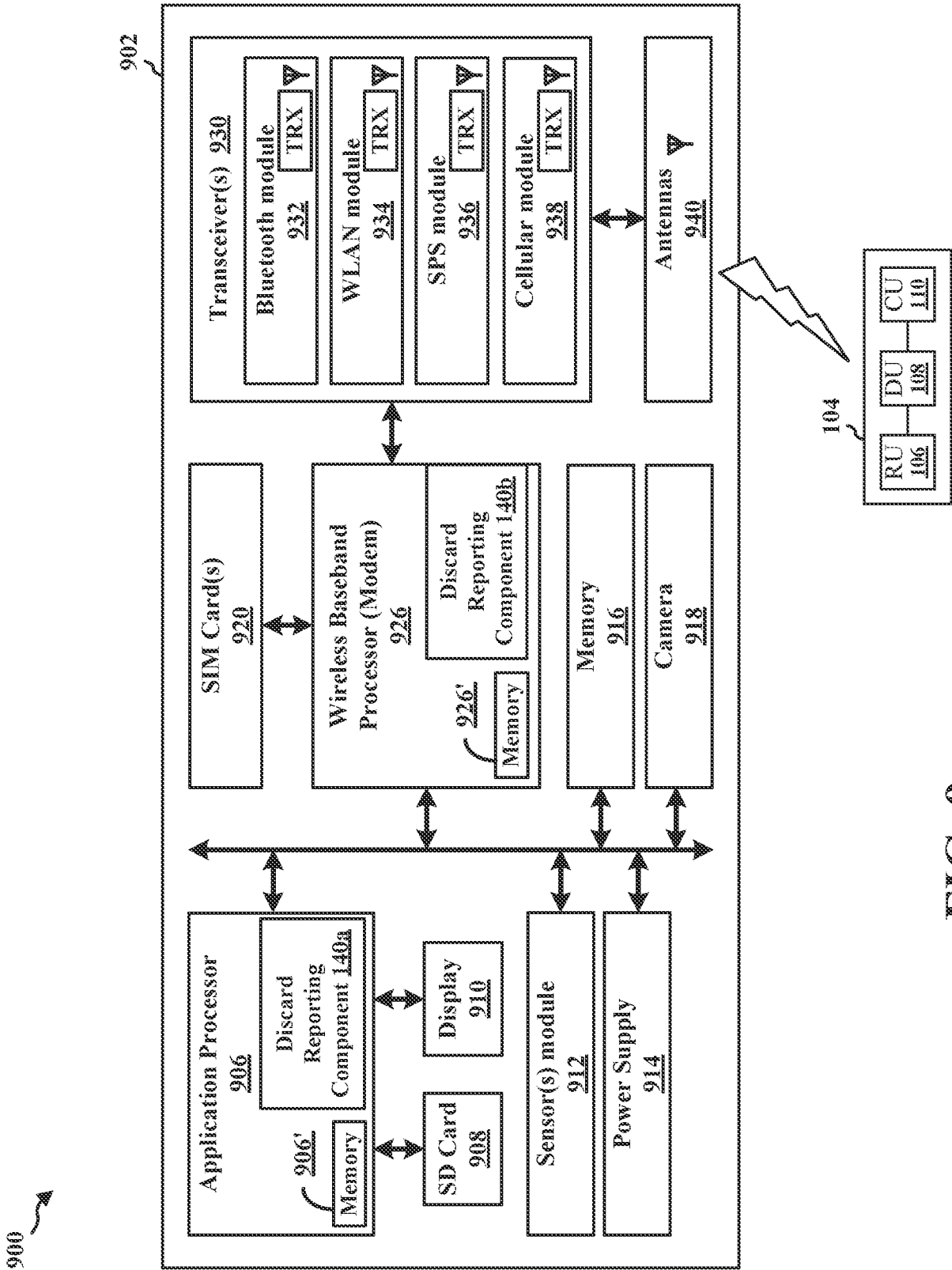


FIG. 9

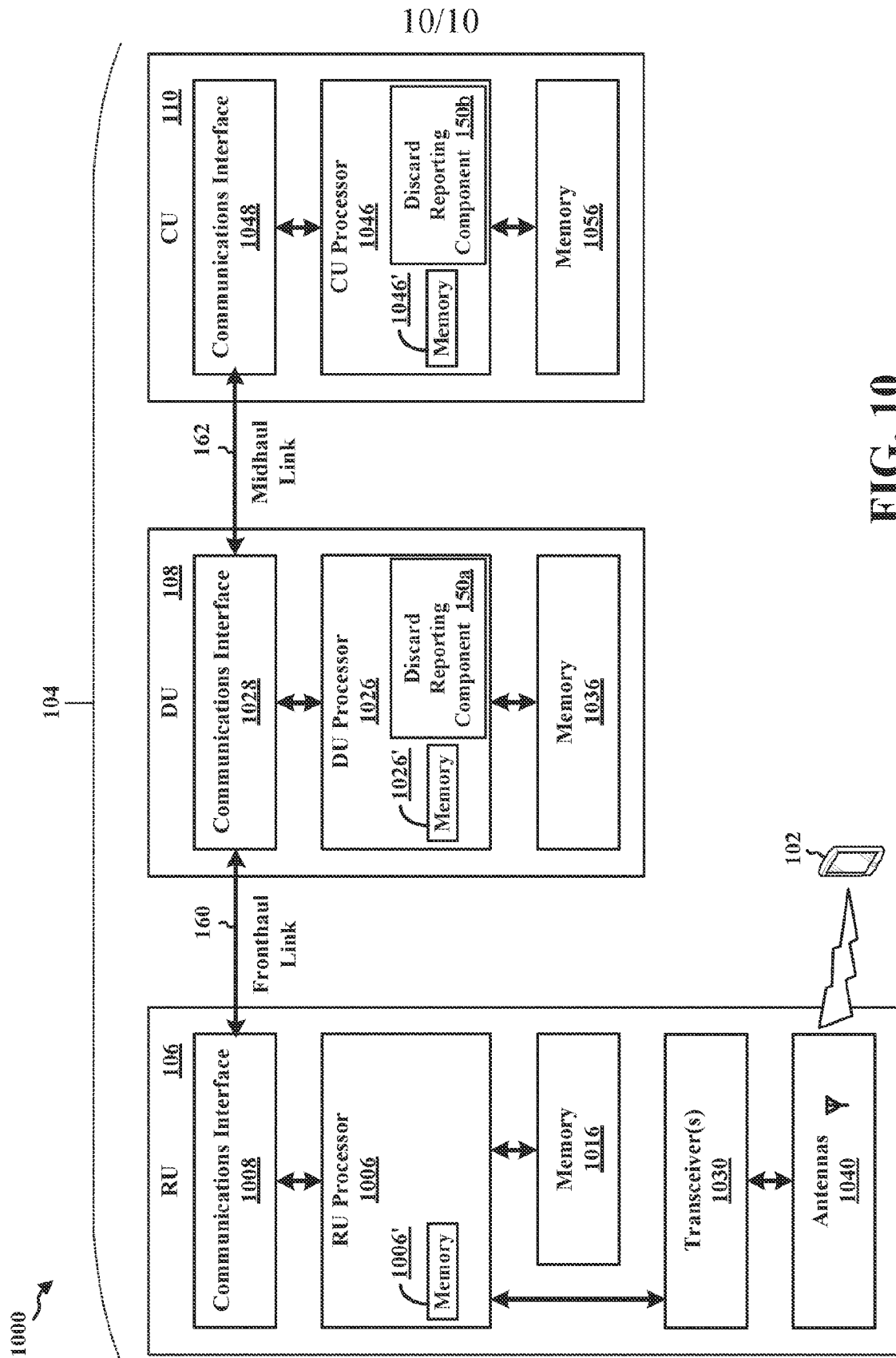


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2024/034609

A. CLASSIFICATION OF SUBJECT MATTERINV. H04L1/1607 H04L1/1829 H04L1/1867
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L

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

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

EPO- Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NOKIA CORPORATION ET AL: "RLC SDU discard procedures", 3GPP DRAFT; R2-073897 RLC SDU DISCARD PROCEDURES, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Shanghai, China; 20071001, 1 October 2007 (2007-10-01), XP050136553, [retrieved on 2007-10-01] * Section 5.3.2 - RLC PDU discard procedure * * Proposal 3 *; pages 2, 4 -----	1 - 15
X	US 2003/147396 A1 (JIANG SAM SHIAW-SHIANG [TW]) 7 August 2003 (2003-08-07) paragraph [0005]; figure 1 -----	1, 8, 15



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

19 September 2024

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2024/034609

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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