higher reliability (up to $10^{-6}$ level), higher availability, packet sizes of up to 256 bytes, time synchronization down to the order of a few μs where the value can be one or a few μs depending on frequency range and short latency in the order of 0.5 to 1 ms in particular a target user plane latency of 0.5 ms, depending on the use cases.

**[0063]** Moreover, for NR URLLC, several technology enhancements from the physical layer perspective have been identified. Among these are PDCCH (Physical Downlink Control Channel) enhancements related to compact DCI, PDCCH repetition, increased PDCCH monitoring. Moreover, UCI (Uplink Control Information) enhancements are related to enhanced HARQ (Hybrid Automatic Repeat Request) and CSI feedback enhancements. Also PUSCH enhancements related to mini-slot level hopping and retransmission/repetition enhancements have been identified. The term "mini-slot" refers to a Transmission Time Interval (TTI) including a smaller number of symbols than a slot (a slot comprising fourteen symbols).

**[0064]** The 5G QoS (Quality of Service) model is based on QoS flows and supports both QoS flows that require guaranteed flow bit rate (GBR QoS flows) and QoS flows that do not require guaranteed flow bit rate (non-GBR QoS Flows). At NAS level, the QoS flow is thus the finest granularity of QoS differentiation in a PDU session. A QoS flow is identified within a PDU session by a QoS flow ID (QFI) carried in an encapsulation header over NG-U interface.

**[0065]** For each UE, 5GC establishes one or more PDU Sessions. For each UE, the NG-RAN establishes at least one Data Radio Bearers (DRB) together with the PDU Session, and additional DRB(s) for QoS flow(s) of that PDU session can be subsequently configured (it is up to NG-RAN when to do so), e.g. as shown above with reference to Fig. 3. The NG-RAN

4. As baseline, for Sidelink DRX for SL unicast, it is proposed to inherit and use timers similar to what are used in Uu DRX. FFS for SL broadcast/groupcast. FFS on detailed timers.
5. Support of long DRX cycle for SL unicast should be assumed as a baseline. FFS on the need of short DRX cycle.
6. Deprioritize SL WUS (Wake-Up Signal) from RAN2 point of view in Rel-17.
7. RAN2 will prioritize normal use case without consideration of relay UE use case in Rel-17.
8. RAN2 is not going to introduce SL paging and SL PO for SL DRX.

**[0071]** It is noted that from RAN2 perspective, the partial coverage case has not been precluded by the first agreement. RAN2 kindly asks RAN1 to provide feedback if there is any concern on the working assumption and take the above information into their future works.

**[0072]** In various embodiments below, a communication apparatus may refer to a sidelink UE. The sidelink UE may transmit and/or receive sidelink signals such as Physical Sidelink Control Channels (PSCCHs), Physical Sidelink Shared Channels (PSSCHs), Sidelink Synchronization Blocks (S-SSBs), Physical Sidelink Feedback Channels (PSFCHs), first-stage and second-stage Sidelink Control Information (SCI), Downlink Control Indication signal, Radio Resource Control signal, Media Access Control (MAC) Control Element (CE), Radio Resource Control (RRC) signal, Physical Downlink Control Channels (PDCCHs), Sidelink Synchronization Signals (SLSSs), Physical Sidelink Broadcast Channel (PSBCHs), and Physical Sidelink Feedback Channels (PSFCHs).

**[0080]** The communication apparatus 700, when in operation, provides functions required for allocating one or more additional operating window between a first operating window and a second operating window for a reception or a transmission of a sidelink signal. For example, the communication apparatus 700 may be a UE and the circuitry 714 may be configured to, in operation, allocate one or more additional operating windows between a first operating window and a second operating window for a reception or a transmission of a sidelink signal. The at least one radio receiver 704 may, in operation, receive a sidelink signal within the one or more additional operating windows. Alternatively or additionally, the at least one radio transmitter 702 may, in operation, transmit a sidelink signal within the one or more additional operating windows.

**[0081]** Figure 8 shows a flow chart 800 illustrating a communication method for allocating one or more additional operating window between a first operating window and a second operating window for a reception or a transmission of a sidelink signal according to various embodiments of the present disclosure. In step 802, a step of allocating one or more additional operating windows between a first operating window and a second operating window for a reception or a transmission of a sidelink signal is carried out. In step 804, a step of transmitting or receiving a sidelink signal within the one or more additional operating window is carried out.

**[0082]** In the following paragraphs, a first embodiment of the present disclosure is explained with reference to an allocation of a contiguous operating window between a first operating window and a second operating window which is backwardly extended from a start of the second operating window.

duration. The UE is switched on for the slot(s) determined by the new timer parameter and is able to perform SL reception/monitoring (sensing) operation within the slot(s). It could also be independent timer parameters (e.g., ForwardTimerTx, ForwardTimerRx) for transmission and reception respectively.

**[0092]** Figure 11 shows a block diagram illustrating a contiguous operating window 1106 allocated between a first operating window 1102 and a second operating window 1104 of a UE and extended from the first operating window 1102 according to an embodiment of the present disclosure. In this embodiment, the length of the contiguous operating window 1106 extended forwardly and located right after the last slot ($t = m$) 1108 of the first operating window 1102 (i.e. within semi-static inactive duration between the first operating window 1102 and the second operating window 1104) is calculated based on a value of the new timer parameter (e.g. $ForwardTimer$) with respect to the last slot ($t = m$) 1108 of the on-duration, and the contiguous operating window 1106 is started from $t = m + 1$ to $t = m + ForwardTimer$.

**[0093]** Figure 12 shows a block diagram illustrating a contiguous operating window 1206 allocated between first operating window 1202 and a second operating window 1204 of a UE and extended from the first operating window 1202 according to another embodiment of the present disclosure. In this embodiment, the length of the contiguous operating window 1206 extended forwardly and located right after the last slot ($t = m$) 1207 of the first operating window 1202 is calculated based on a value of the new timer parameter (e.g. $ForwardTimer$) with respect to a transmission trigger slot 1208 at $t = m - q$ within the first operating window 1204, and the contiguous operating window 1206 is started from $t = m + 1$ to $t = m - q + ForwardTimer$.

**[0094]** For transmission, such forward extension switching-on right after the first operating window 1202 can be enabled by at least one of instructions from higher layers (e.g. an one-bit EnableForwardTimerTx as a MAC CE or a RRC message), PSFCH received in a previous reception duration (e.g. an operating window or a SL DRX on-duration prior to the first operating window 1202, a previously allocated additional operating window extended from an operating window prior to the first operating window 1202, pre-emption, reservation, etc.), some new or reused SCI information bits received in a previous reception duration, a new or reused DL signalling, an always-on configuration or up to implementation.

**[0095]** For reception, the forward extension switching-on right after the first operating window 1202 can be enabled by at least one instructions from higher layers (e.g., a one-bit EnabledForwardTimerRx as a MAC or a RRC message), a PSFCH triggered in current reception duration (e.g. the first operating window 1202), some new or reused SCI information bits received in previous or current reception duration, a reception decoding results (e.g., a NACK for failed reception) for a received trigger block, a new or reused DL signalling, an always-on configuration or up to implementation.

**[0096]** The length parameter or the timer parameter (e.g., BackwardTimer, ForwardTimer) can be (pre-)configured by regulators/operators/vendors, application layer, UE internal generation or specified by standards. In an embodiment, the timer parameter (e.g., BackwardTimer, ForwardTimer) could be implemented as RRC information elements in either ENUMERATED, INTETGER, SEQUENCE, CHOICE, etc. format, such as BackwardTimer ENUMERATED {ms10, ms20ms, ms30}.

**[0097]** different lengths of the additional operating window through backward/forward extension can also be configured with different enabling schemes such as different power-saving modes. For example, for the switched-on slots (e.g., for sensing) located in SL DRX semi-static inactive duration, the switching-on timer parameter (e.g., BackwardTimer, ForwardTimer) could have different levels with different numbers of switched-on slots for each level. This is for trade-offs between power saving (low-to-high) and UE performance (high-to-low) as following (more levels if needed). Examples of different new timer parameters configured for different power-saving modes/levels are as follows:

- Level 0: Entire full/partial sensing window allowed in SL DRX-off duration
- Level 1: A longer truncated full/partial sensing window allowed (e.g., specified max/min or extension limit) allowed in SL DRX-off duration
- Level 2: A shorter truncated full/partial sensing window allowed (e.g., specified max/min or extension limit) allowed in SL DRX-off duration
- Level 3: No sensing allowed during SL DRX-off duration

**[0098]** Additionally or alternatively, an additional operating window within the semi-static inactive duration and the new parameter (e.g. BackwardTimer, ForwardTimer) could be triggered by higher layers when at least one of the following conditions is met: (i) when a triggering signalling in a semi-static active duration (e.g. the second operating window) is before a threshold slot or a duration between a transmission trigger slot within the semi-static active duration and the start of the semi-static active duration is less than a threshold duration, i.e. a transmission trigger slot is too close to the start of semi-static active duration, a backward extension may be applied to allocate an additional operating window so to ensure there is enough window for sensing; (ii) when a triggering signaling in a semi-static active duration (e.g. first operating window) is after a threshold slot or a duration between a transmission

durations is carried out. In step 1604, a step of configuring switching-on schemes for SL UEs is carried out. In step 1606, a step of trigger and enabling the switching-on schemes is carried out. In step 1608, a step of switching slots determined for the switching-on scheme from “off” to “on” is carried out.

**[0119]** Figure 17 shows a flow chart 1700 illustrating a process of allocating one or more additional operating windows between a first operating window and a second operating window carried out by a transmitter (Tx) communication apparatus according to various embodiments of the present disclosure. In step 1702, a step of configuring semi-static SL DRX active/inactive durations is carried out. In step 1704, a step of configuring switching-on determination parameters (e.g., timer/bitmap, etc.) and rules is carried out. In step 1706, a step of receiving switching-enabling signalling in previous Rx duration or from higher layers is carried out. In step 1708, a step of enabling switching-on schemes during the semi-static inactive duration is carried out. In step 1710, a step of switching slots indicated by the determination parameters and rules from “off” to “on” is carried out.

**[0120]** Figure 18 shows a flow chart 1800 illustrating a process of allocating one or more additional operating windows between a first operating window and a second operating window carried out by a receiver (Rx) communication apparatus according to various embodiments of the present disclosure. In step 1802, a step of configuring with semi-static SL DRX active/inactive durations is carried out. In step 1804, a step of configuring switching-on determination parameters (timer/bitmap, etc.) and rules is carried out. In step 1806, a step of receiving switching-enabling signalling in previous or current Rx duration or from high layers is carried out. In step 1808, a step of enabling switching-on schemes during the semi-static