3GPP TSG-RAN WG2 #116e Tdoc R2-16xxxx

Electronic meeting, November 1st – 12th 2021

Agenda Item: x.x.x.x

Source: OPPO

Title: Summary of [POST115-e][714][V2X/SL] (OPPO)

Document for: Discussion, Decision

# Introduction

This document is to kick off the following email discussion:

* [POST115-e][714][V2X/SL] (OPPO)

Scope: For UC and GC, discuss the need of any mechanism to avoid SL DRX inactivity timer (possibly also including HARQ RTT/retransmission timer) mismatch between network and the TX UE for mode1 operation. If companies consider solution is needed, discuss the possible options to solve the issue.

Intended outcome: Discussion summary

Deadline: Long email discussion. 1st phase: check companies’ views for the simple/general question, collect candidate options from the companies for the question including multiple options before checking all companies’ views for each option. 2nd phase: check companies’ views for all questions (no restriction) Checking the rapporteur summary is done from the end of 2nd phase to tdoc submission.

# Phase-1 Discussion

The related issue(s) is discussed in the following contributions

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| --- | --- | --- |
| Tdoc Number | P-number | Justification |
| R2-2107156 | P10 | …it is possible that a SL grant is not in SL active time of any destination that has data to be sent.. |
| R2-2107191 | P1-P4 | …when network receives a BSR (which shows intention by a Tx-UE to send out data) for multiple destinations, how for network to know which destinations are during DRX-active-time, and which are during DRX-inactive-time…  …E.g., in a resource pool configured with PSFCH, if Tx-UE decides to disable the FB, it is a question whether the RTT timer should start since the end of PSSCH. If it is adopted (considering it helps to save unnecessary RTT in case of FB-disabled case), it would be a problem for mode-1 scheduling since the network has no information on FB-enable/disable,… |
| R2-2108016 | P4-P5 | …if Tx UE reports a certain amount of data available for transmission for a specific destination, the gNB needs to know when the peer receiving UE(s) associated with this destination is in ActiveTime in order to allocate SL resources correspondingly….  …Nevertheless, the Tx UE behaviour would need to be specified for cases when it receives a SL allocation which doesn’t fall within its DRX ActiveTime.… |
| R-2108469 | P1-P4 | …gNB cannot derive accurately the active time of SL Rx UE’s DRX in either SL unicast or groupcast even in case of mode 1 resource allocation scheduled from gNB and SL DRX configuration parameters are available in gNB… |
| R2-2106988 | P1-P2 | …Both Tx UE and Rx UE shall keep in SL active time during the period from sending the SL SR/BSR on Uu to SL PSCCH/PSSCH communication. Tx UE needs to indicate Rx UE to keep in SL active time when SL SR/BSR is sent… |

## Inactivity timer

For inactivity timer, the problem can be summarized as:

* On the one hand, when SL DRX is configured, network has to estimate the DRX active time for each Rx-UE in order to provide SL grant to Tx UE during the active time (which is per-Rx-UE) to avoid resource waste.
* On the other hand, however, when Tx-UE is configured as mode-1, the decision of destination selection, are all up to Tx-UE and thus network has no information on them.

Since the destination selection above as input for DRX timer behaviour is unknown to network, from the contributions above perspective, it would lead to troubles for network to decide when to provide SL grant.

The phase-1 discussion is to collect view from companies on the validity of the issue, and to check solution candidates on the table.

Firstly, the problem is at gNB side, I.e., if mode-1 Tx UE reports SL-BSR for specific destinations, the gNB needs to know when the peer receiving UEs associated with these reported destinations (with data in the Tx buffer) are in active-time in order to allocate SL resources correspondingly. However, considering the destination selection is done at UE side, it is hard for gNB to derive the active time for each destination accurately.

**Q2.1-1a: For inactivity timer, for gNB, do you agree that if mode-1 Tx UE reports SL-BSR for specific destinations, considering the destination selection is done at UE side, it is hard for gNB to derive the active time for each destination accurately and to provide SL grant accordingly?**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| OPPO | Yes | W/o information on destination selection, gNB implementation cannot figure out the inactivity timer status for each specific destination. |
| Xiaomi | Yes, with further clarification. | We understand the problem is caused by priority based destination selection in LCP. If there is no new data arrival at destination with higher LCH priority after SL-BSR report and before SL grant, UE would select the destination whose BS is included in previously transmitted BSR. gNB is able to know the destination selected by UE, since gNB is aware of the essential LCP parameters, such as LCH priority, PBR. However, if there is new data arrival at a destination with higher LCH priority after SL-BSR and before SL grant, UE may select this destination. But this destination was not included in transmitted SL-BSR. In this case, gNB may not be aware of the destination selected by UE and not be able to derive inactivity timer running. |
| CATT | Yes, but with comment | Firstly, we are puzzled that why we discuss this issue based on each DRX timer, since the active time is decided by the combinations of inactivity timer, retransmission timer and etc. **It is a common problem, and there is no need to discuss this issue timer by timer.**  **The common problem should be that: for gNB, do you agree that if mode-1 Tx UE reports SL-BSR for specific destinations, considering the destination selection is done at UE side, it is hard for gNB to derive the active time for each destination accurately and to provide SL grant accordingly?**  Since the LCP procedure is based on the highest priority of the logical channel with data available or sidelink MAC CE, hence, the gNB cannot know which destination will use the sidelink grant actually. Based on this, the gNB cannot derive the active time for each destination accurately. |
| Ericsson | No | In typical cases, the UE selects the destination with MAC CE or LCH with highest LCH priority. At least for the destination with LCH with highest LCH priority, the gNB is aware of it, since the BSR contains BS for each LCG of each destination. In most cases, each LCG contains only one LCH. The gNB is able to know BS of each LCH of each destination. In this case, the gNB will know which destination that the TX UE is mostly likely to select. In addition, for Mode 1 scheduling, the gNB is also aware when the selected destination will be in ON-duration, such the gNB can assign the grant to TX UE for the assumed Destination when the Destination is in ON-duration. Therefore, we don’t think the issue is valid. |
| InterDigital | Yes – with comments. | We would like to clarify that this problem is not due to the fact that the gNB does not know the DRX configuration of the RX UE(s) but rather that it does not know the active time because the inactivity timer (or retransmission timer) may be running at an RX UE without knowledge of the gNB being aware of this. This is because the TX UE does destination selection and knows whether the corresponding timers at the RX UE are running (e.g. inactivity timer and retransmission timer).  We also note that this is not an issue for groupcast transmission since inactivity timer and retransmission timer are not supported. So it is only an issue for mode 1 transmissions associated with unicast/groupcast. |
| vivo | Yes | Since the LCP procedure including destination selection is done by TX UE itself, the gNB cannot know which destination uses the sidelink grant finally. Hence, the gNB cannot deduce the inactivity timer status for each specific destination.  Furthermore, agree with CATT that there is a similar issue for the retransmission timer. |
| Nokia | Yes | We admit the existence of the problem for two reasons: gNB is not aware about the prolonged active time (caused by running inactivity timer or retransmission timer) at the RX-UE since the gNB does not know whether Inactivitiy timer (or Retransmission timer) at a specific destination (i.e. at a particular RX-UE) is running. Secondly the gNB is not aware about the final destination selection at the TX-UE (caused by LCH priority based destination selection) after gNB has provided SL grant. |
| Qualcomm | Comment | No, gNB knows all the LCGs associated different Destinations included in SL-BSRs, as well as the corresponding SL DRX configurations.  Yes, one rare corner case, if Tx UE uses a resource, allocated for a first SL data associated with a first destination, for a second SL data associated with a second destination which hasn’t been included in any SL-BSR yet, gNB won’t know the sidelink status for the second destination. However, the SL DRX active state for the second destination should be same as the first destination otherwise the Tx UE cannot use the resource, scheduled for the first destination, for the second destination. In this case, gNB may not know the destination accurately but may know that Tx UE and Rx UE are active (e.g., Inactivity timer) with the sidelink grant. |

In phase-1 discussion, the guidance is to start from solution candidate collection.

**Q2.1-1b: If one answer Yes to Q2.1-1a, please briefly describe the solution candidate(s).**

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| Company | Comments |
| OPPO | We believe   1. The specification effort on this issue has to be restricted carefully, e.g., R2 should not pursue a solution that move destination selection to gNB 2. Some assistance information from UE to gNB is needed to solve this. However, a RRC-based solution is too slow and will cause high signaling overhead considering the information on destination selection (and thus inactivity timer status) is triggered per-grant.   Combining the two, R2 should working on a MAC CE based solution to solve this.  In light of that, OPPO proposal is to enhance the legacy SL-BSR, in a way that   1. We do not need to change the format of SL-BSR at all 2. But restrict the UE behavior in a way that, only report the BS-entries for a destination if the concerned destination is in active-time. |
| Xiaomi | As we clarified in first question, the mismatch between UE and NW could only happen when there is new data arrival at a destination, which was not included in previously BSR, with higher LCH priority after SL-BSR and before SL grant. This is caused by LCH priority based destination selection. If we don’t change the LCH priority based destination selection, which we shouldn’t, the problem would always exist. The solution proposed by OPPO couldn’t resolve this problem. Anyway, we understand this should not happen frequently as the condition is rather harsh. Therefore, we don’t see a feasible solution with acceptable spec impact. |
| CATT | We have the same view as xiaomi, the solution proposed by OPPO cannot resolve this problem, since the destination which is in active time when SL-BSR reporting may be switched to inactive when receiving the sidelink grant.  In our understanding, there is no need to perform any enhancement on gNB, we only need to let both the destination(s) UE and the Tx UE which SL-BSR is reported keep in active time to wait the sidelink grant from network, which is similar as the current Uu behaviour that the UE should be kept in active time once it send SR. |
| Ericsson | First, we don’t believe the issue is relevant as we commented in Q2.1-a. Second, the solution which OPPO has proposed would bring additional design efforts for RAN2. Considering limited left in Rel-17, RAN2 shall focus on other more critical issues. |
| InterDigital | We think destination selection should remain at the UE. However, using the BSR to report only the destinations in the active time will not completely resolve the issue, because the gNB is still not aware of WHEN the inactivity timer will expire or was reset, and will still not know when to schedule the transmission.  In our opinion, the only solution which can resolve this issue is to inform the gNB when a timer gets reset or started (e.g. inactivity timer), so that the gNB can accurately predict how to schedule resources for each UE. |
| Vivo | In our understanding, only if the gNB can actually know the mapping between SL grant and destination, SL grant allocation by gNB can be really efficient and avoid wasting. But the overhead and specification impacts may be not acceptable.  Therefore, there seems no preferred solution (with limited spec impact) on this issue. |
| Nokia | Given the limited time in Rel-17 and the specification impact we do not favour to change destination selection mechanism and/or LCH priority handling. Obviously to resolve the problem, the gNB needs to be informed about the status of the inactivity timer (running or not running) at the RX-UE by an indication or assistance data provided by the TX-UE. |
| Qualcomm | Share the same view with Xiaomi. This is a rare corner case and not worth the impact to spec to get fixed. |

Secondly, the problem is at UE side, i.e., if mode-1 Tx UE obtains a SL grant, which is however not in SL active time of any destination that has data to be sent, so how should the UE to behave.

**Q2.1-2a: For inactivity timer, for UE, do you agree that a mode-1 SL grant may be provided by network to Tx-UE yet it is not in SL active time of any destination that has data to be sent?**

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| Company | Yes/No | Comments |
| OPPO | Yes | As replied to Q2.1-1a, considering gNB anyway cannot derive the active time accurately, this may happen |
| Xiaomi | Yes |  |
| CATT | No | Firstly, as commented in Q2.1-1a, we are puzzled why we discuss this issue timer by timer, in our understanding, since the destination is selected by UE, it is hard for the gNB to know the actual active time for sidelink.    Secondly, we think the case mentioned by rapporteur should be avoided since it will cause sidelink resource waste.  In order to avoid this, the simplest method is to let the destinations which have reported SL-BSR to network to keep in active time until sidelink grant is received. |
| Ericsson | No | As we commented, we don’t believe the issue is valid. |
| InterDigital | Yes – but | While this is a problem now, the solution we indicated in the previous question would result in the gNB being able to derive the active time accurately, and so we would no longer need to handle this case. |
| Vivo | Yes but | Since gNB cannot deduce the active time of each destination accurately, this may not be avoided. But this issue usually occurs when a higher priority data of other destination arrives suddenly or the buffer status situation known by gNB and TX UE about highest priority data has obvious gap, which are not normal cases. Hence, there is no need to make a big effort to solve it. |
| Nokia | Yes |  |
| Qualcomm | Comment | If the grant is not in SL active time of a destination that has data to be sent, the Tx UE cannot use the grant for this destination. |

In phase-1 discussion, the guidance is to start from solution candidate collection.

**Q2.1-2b: If one answer Yes to Q2.1-2a, please briefly describe the solution candidate(s).**

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| Company | Comments |
| OPPO | We believe the legacy spec as follows already allows the UE to skip the grant  The MAC entity shall not generate a MAC PDU for the HARQ entity if the following conditions are satisfied:  - there is no Sidelink CSI Reporting MAC CE generated for this PSSCH transmission as specified in clause 5.22.1.7; and  - the MAC PDU includes zero MAC SDUs. |
| Xiaomi | We already agreed the active time should be consider during LCP. In this case, the grant should be dropped. |
| InterDigital | Same solution as 2.1-1b. |
| vivo | Agree with the Xiaomi that the grant can be dropped. |
|  |  |

## RTT/Re-transmission timer

Compared with inactivity timer, the difference is

* For RTT/Re-transmission, it is mainly for the retransmission of an transmitted TB. I.e., for each provided SL grant, the task of gNB is to decide on whether to provide subsequent SL retransmission grant, based on PUCCH if configured, regardless of destination selection for the provided SL grant
* For inactivity timer, it is mainly for initial transmission of a new TB. I.e., gNB has to associate it with the destination specific BSR info, to decide whether to provide subsequent SL initial-transmission grant, where destination selection of the provided SL grant matters.

So there seems no problem for network to unknow destination selection by Tx-UE.

However, based on the agreement from R2#115

9: HARQ RTT is supported for both HARQ enabled and HARQ disabled cases by allowing HARQ RTT timer to be set to different values. FFS on the specific values that can be used for HARQ disabled case.

I.e., UE may be configured with **different** RTT timer value setting for FB enable/disabled case.

And based on the discussion in R2#113bis

Proposal 23 [12/13] If SL HARQ RTT timer is supported for HARQ disabled transmissions, the RX UE starts the SL HARQ RTT timer in the symbol/slot following SCI (SCI1+SCI2) reception. FFS whether this applies to all SCI transmissions.

* Skipped because it has dependency with the previous FFS.

Proposal 24 [19/21] For transmissions with HARQ feedback, the RX UE starts the SL HARQ RTT timer in the symbol/slot following the end of PSFCH transmission.

* Agreed.

Proposal 25 [21/21] If the RX UE does not transmit PSFCH for a HARQ enabled transmission (e.g. due to UL/SL prioritization) the RX UE still starts the HARQ RTT timer in the symbol/slot following the end of PSFCH resource.

* Agreed.

So, if P23 is adopted finally (not concluded yet), UE may adopt **mode-1 Tx UE,** RTT timer restart position for FB enabled/disabled case will be different.

Combining the two together, the problem can be summarized as uncertainty due to different RTT timer length/starting-position (and thus different re-tx timer starting position) for FB-enable/disabled case, which is essentially because network has no information on LCH selection decision by Tx-UE, and thus does not know the FB-enable/disable decision, in a resource pool configured with PSFCH.

**Q2.2-1a: For RTT/Re-tx timer, for gNB, do you agree that for a mode-1 resource pool configured with PSFCH, considering the LCH selection and thus FB enable/disable decision is done at UE side, it is hard for gNB to derive the RTT/Re-tx timer accurately and to provide SL grant accordingly?**

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| Company | Yes/No | Comments |
| OPPO | See comment | For the two issues on timer length difference and timer starting position difference   * For the former, it is not an issue since network configuration can configure a same value for both case * Yet the latter one cannot be solved yet.   So the problem mainly comes from the ambiguity of RTT timer starting position in case P23 is adopted as stated above. |
| Xiaomi | Yes | Similar as Q1. If there is new data arrival at a LCH with higher priority after SL-BSR and before SL grant, gNB may not be able to derive th RTT/RTX timer. |
| CATT | Yes, but with comment | As commented in Q2.1-1a, we are puzzled why we discuss this issue timer by timer, in our understanding, since the destination is selected by UE, it is hard for the gNB to know the actual active time for sidelink. |
| Ericsson | No | From the BSR, the gNB knows which destination the UE is likely to select, and what LCHs are likely to select, since the gNB knows LCH mapping restrictions for each LCH. Based on which, the gNB also knows whether SL HARQ feedback is enabled or disabled (based on info associated with the LCH with highest priority). Therefore, at least for SL FB enabled case, we don’t see the issue. For FB disabled, it is likely that the RTT timer will be set to zero. Therefore, there is no issue either. |
| InterDigital | No | We agree with Ericsson that the gNB should know which logical channel the UE will select for a specific grant. Otherwise, the whole scheduling framework would breakdown to begin with, and there would be no use for BSR (regardless if this is Uu or SL). |
| Vivo | Yes | The reason is also that the gNB cannot know which destination and what type of data, e.g. HARQ feedback disabled/enabled, use the SL grant. |
| Nokia | Yes | According to our understanding the problem arises due to the fact that the gNB does not know whether TX-UE has FB enabled/disabled and different RTT timer lengths can be configured dependent on the HARQ feedback enabled/disabled (as agreed by #9 in RAN2#115) |
| Qualcomm | No | If gNB grants SL resources with PSFCH and corresponding PUCCH, then Tx UE may respond ACK for no more retransmissions or respond NACK for retransmissions regardless if HARQ enabled or not and gNB may operate the RTT/Re-tx timer referenced from the PUCCH. |

In phase-1 discussion, the guidance is to start from solution candidate collection.

**Q2.2-1b: If one answer Yes to Q2.2-1a, please briefly describe the solution candidate(s).**

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| Company | Comments |
| OPPO | We need to allow, **for resource pool configured with PSFCH**, that RTT timer starting position is PSFCH, i.e., the same as for the case of FB-enabled.  The solution can be   1. Either to adopt it for both mode-1/2, so P23 above is not adopted; 2. Or use it for mode-1 only, which means the RTT timer starts from either SCI or PSFCH is configurable per pool, and thus P23 is adopted for mode-2 only (implemented by network configuration); |
| Xiaomi | The mismatch between UE and NW could only happen when there is new data arrival at LCH with higher priority after SL-BSR and before SL grant. This is caused by priority based LCH selection. If we don’t change the priority based LCH selection, which we shouldn’t, the problem would always exist. Anyway, we understand this should not happen frequently as the condition is rather harsh. Therefore, we don’t see a feasible solution with acceptable spec impact. |
| CATT | As answered in Q2.1-1b, in our understanding, there is no need to perform any enhancement on gNB, we only need to let both the destination(s) UE and the Tx UE which SL-BSR is reported keep in active time to wait the sidelink grant from network, which is similar as the current Uu behaviour that the UE should be kept in active time once it send SR. |
| vivo | Similar with reply in Q2.1-1b, the overhead and specification impacts may be not acceptable if the gNB is timely informed with the selected destination and RTT/Retx timer triggering. So no solution seems acceptable. |
| Nokia | Given the limited time in Rel-17 and existing overload situation we do not favour to tackle this issue in Rel-17 by introducing new signalling to inform the gNB by the TX-UE about its selected RX-UE feedback mode and RTT setting. |

Secondly, similar to inactivity timer above, for completion, maybe good to check if any problem at UE side, i.e., if mode-1 Tx UE obtains a SL grant, which is however not in SL active time of any destination that has data to be sent, so how should the UE to behave.

**Q2.2-2a: For RTT/Re-tx timer, for UE, do you agree a mode-1 SL grant may be provided by network to Tx-UE yet it is not in SL active time of any destination that has data to be sent?**

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| Company | Yes/No | Comments |
| OPPO | Yes | As replied to Q2.1-2a.  The difference is that here for Q2.2-2a, the problem is for re-transmission grant, yet the former one for Q2.1-2a is more for initial transmission grant. |
| Xiaomi | Yes |  |
| CATT | No | As replied to Q2.1-2a.  We think the case mentioned by rapporteur should be should be avoided since it will cause sidelink resource waste.  In order to avoid this, the simplest method is to let the destinations which have reported SL-BSR to network to keep in active time until sidelink grant is received. |
| Ericsson | No | We don’t believe the issue is relevant see our comments for Q2.2-1a |
| InterDigital | No | Same view as Ericsson |
| vivo | Yes with comments | For retransmission, the SL grant may not be wasted since the RX UE with NACK feedback will be in active time triggered by retx timer.  For SL grant of new data, the situation is similar with Q2.1-2a. |
| Nokia | Yes |  |
| Qualcomm | Comment | If the grant is not in SL active time of a destination that has data to be sent, the Tx UE cannot use the grant for this destination’s HARQ retransmission. |

In phase-1 discussion, the guidance is to start from solution candidate collection.

**Q2.2-2b: If one answer Yes to Q2.1-2a, please briefly describe the solution candidate(s).**

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| Company | Comments |
| OPPO | Different from Q2.1-2b, here for re-transmission, current spec has not considered the case where SL re-transmission grant has to be discarded even if the buffer is not empty, so a solution is needed, to   * Discard the retransmission grant if the concerned Rx UE is not in DRX active-time * And report NACK to network if PUCCH is configured |
| Xiaomi | The same principle should be applied for retransmission, i.e. the grant should be dropped. |
| vivo | Agree with Xiaomi that the grant can be dropped. |
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1. xxx.
2. xxx.

# Conclusion

# References

1. xxx