

3GPP TSG RAN Rel-18 Workshop RWS-210575

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.2

Title: Email discussion summary for [RAN-R18-WS-non-eMBB-InterDigital]

1 Introduction

This document is the report from the email discussion prior to the Rel-18 Workshop of the contributions submitted by InterDigital to agenda item 4.2 'non-eMBB-driven Functional Evolution'.

InterDigital submitted the following tdocs to the agenda item 4.2:

RWS-201426 V2X Enhancements for R18

RWS-210427 Sidelink Relay Enhancements for R18

RWS-210428 XR Enhancements for R18

2 General questions/comments

In addition to the 3 tdocs submitted to AI 4.2, InterDigital submitted an overview of Red-18 to AI 4 [RWS-210422] which includes some additional non-eMBB-driven functional evolution aspects. General questions/comments to InterDigital related to non-eMBB-driven functional evolution can be raised in this section

2.1 Round 1 Questions

Feedback Form 1: General questions/comments related to non-eMBB-driven functional evolution

1 – Nokia Germany

Some questions on URLLC/IIoT on slide 14:

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URLLC in INACTIVE: Could this be also handled in the Small Data Transmission (SDT) work?

- URLLC with high data rates: Should this be handled as part of the XR work or as part of a potential Rel-18 URLLC/IIoT WI? (as there is a separate slide on XR)
- URLLC unlicensed: would be good to know more details about proposed initial access and wide-band operation enhancements? Type-B rep with multi-TTI is still in R17 discussion, so should wait conclusions.
- Network coding: On which layer the network coding is envisioned? Should this be handled in a separate WI/SI (and not in as part of potential URLLC/IIoT WI)?

2.2 Round 1 Answers

Answers to Nokia:

Thank you for the very good questions. Please find our answers:

- URLLC in INACTIVE could be handled in SDT if work on further SDT enhancements are agreed; considerations for enabling high reliability and low latency should be included.
- If there is a separate XR work, URLLC with high data rates can be handled as part of the XR WI.
- Agree that for URLLC in unlicensed we should wait conclusions of ongoing Rel-17 discussions
- Network coding can be applied to different layers depending on the use case, though it can be easier to define at the MAC layer to be useful for different applications. This could be handled in a separate WI/SI.

2.3 Round 2 Questions

Please let us know if you have any follow-up questions

Feedback Form 2: General questions/comments related to non-eMBB-driven functional evolution (2nd Round)

1 – Nokia Germany

Thanks to InterDigital for the clarifications to our round 1 questions. Maybe one small follow-up question still:

Does network coding in MAC mean that MAC can perform joint coding across different MAC PDUs? Do you think the achievable gain to justify the additional complexity?

2.4 Round 2 Answers

Answers to Nokia:

Yes, coding across different MAC PDUs is a possibility. We believe that in some scenarios, network coding can provide improved reliability at reduced resource use and for acceptable complexity. For example, in factory scenarios with multiple backup UEs, or in personalized networks or collaborative communication (possibly multi-hop) or IAB.

3 Rel-18 V2X Enhancement

Questions related to RWS-201426 'V2X Enhancements for R18' can be raised in this section

3.1 Round 1 Questions

Feedback Form 3: Questions related to RWS-201426 'V2X Enhancements for R18'

1 – Classon Consulting

[for FUTUREWEI]

We also support sidelink FR2 and unlicensed enhancements, see RWS-210039 and <https://nwm-trial.etsi.org/#/documents/>. Do you feel that the sidelink enhancements for FR2 should include work on CSI feedback?

2 – Huawei Tech.(UK) Co.. Ltd

For FR2, is there a particular band you would prioritize, e.g. 60 GHz?

3 – Intel Corporation (UK) Ltd

Q1: Thanks for contribution and proposal. Could you clarify the motivation behind sidelink coverage enhancements on top of potential sidelink relay enhancements being considered by multiple companies?

Q2: Multi-slot transmission is considered together with extended PSFCH format. Is the intention behind multi-slot transmission is to improve coverage of sidelink control channel (SCIs)? Do you expect large impact on sidelink resource allocation framework from such optimizations?

<p>4 – Qualcomm Technologies Int</p> <p>1. Does multi-carrier operation include aggregation?</p> <p>2. For Sidelink positioning operation, how do you see the different bands being used? Will coordination signaling and PRS be sent in different bands?</p>
<p>5 – Guangdong OPPO Mobile Telecom.</p> <p>For SL coverage enh., changing the existing PHY structure of SL is not expected by considering the compatibility issue. Or how would you solve this backward compatibility issue?</p>
<p>6 – ROBERT BOSCH GmbH</p> <p>Q1: for Flexible/dynamic BWP operation for SL, do you see a need to use this enhancement to have adaptive BWP for power saving? If yes, does this require introduce search space in SL ?</p> <p>Q2: for SL multi-carrier: do you support multiplexing as well as duplication? If yes, do you support multiple TBs on different carriers or you support intra-UE prioritization ?</p>
<p>7 – Lenovo (Beijing) Ltd</p> <p>Q1: For FR2 SL operation only unicast is shown in the figure, whether groupcast,e.g., connection based groupcast can also work with FR2 band?</p>
<p>8 – CATT</p> <p>Can you explain more about the benefit of SL WUS? Generally WUS saves the UE power but at the cost of gNB power consumption (gNB needs to transmit WUS signal in additional to legacy control signalling). If WUS is used in SL, will the UE which transmit WUS signal consumes more power ?</p>

3.2 Round 1 Answers

Answers to FutureWei:

Yes, CSI feedback enhancement is necessary from our perspective to enable beam management. L1-based sidelink CSI feedback mechanism has to be introduced for faster beam reporting which is essential especially for the high mobility UE. In addition, resource allocation of CSI reporting and/or multiplexing of CSI and data need to be also studied.

Answers to Huawei:

We prefer to start with FR in licensed band as it requires less standards impacts and consider 60GHz (unlicensed band) in a future release. However, if enough TU is allocated for sidelink enhancement in Rel-18, we are ok to include unlicensed operation for sidelink in Rel-18 as well.

Answers to Intel:

One of main motivations for SL coverage enhancement is to enable SL operation for handheld and wearable devices with a limited/small form factor and/or cost limitation (with a less sophisticated receiver and/or high antenna gain loss). SL relay is mainly for extended coverage of the network while SL coverage enhancement is to enhance coverage of SL itself.

Multi-slot transmission is thus one of the features, which can be used to improve both control and data channel coverage, e.g., by repeating the SCI and/or spread a TB over multiple slots. We expect certain impact of such scheme, for example, the sensing/RA granularity will change from a single-slot resource to a multi-slot-resource and as a result, current Mode 2 sensing procedure may need to be modified. In addition, we deem multi-slot transmission a viable technique to enable beamforming on SL (also helping coverage) while maintaining the current SL PHY structure.

Answers to Qualcomm:

Yes. We think carrier aggregation is one of preferred features of multi-carrier operation. The starting point can be enabling intra- and inter-band FR1 carrier aggregation based on PDCP duplication (the technique applied in R15 LTE V2X) and carrier (re)selection. Regarding more advance features that may involving said coordination signaling and PRS transmission in different bands, we see the potential applicability but would consider them as future enhancement/optimization that may depend on progress of other technologies such as FR2 operation.

Answers to Oppo:

Yes, SL coverage enhancement shall maintain backward compatibility if resource pools are shared between legacy V2X UEs and Rel-18 V2X UEs operating with coverage enhancement features. In this case, we should only consider the features that is possible to be designed in a compatible manner with existing PHY structure, e.g., multi-slot-based scheduling/transmission. However, it will be also part of discussion whether a separate resource pool will be used to enable coverage enhancement feature so that RAN1 doesn't need to worry about backward compatibility issue or not.

Answers to BOSCH:

We consider flexible/dynamic BWP as an enabler for BWP adaptation for power saving purpose. The number and location of PSCCH candidates in each slot will be different in each BWP, so the set of PSCCH candidates of each resource pool in each BWP are in our view equivalent to search space. Essentially, we'd like to see a power saving benefit by adapting BWP, which is possible due to the reduction of SCI decoding.

We do see multiplexing as potential enhancement feature to support multiple TBs on different carriers and intra-UE prioritization, but we consider carrier aggregation of same TB as the starting point to introduce multi-carrier operation for SL.

Answers to Lenovo:

We provided an illustrative example showing clear benefit of beamforming for unicast transmission, but we also think FR2 will benefit connection based groupcast as suggested. In addition, we see a potential benefit in FR2 for connection-less groupcast and broadcast transmissions with beam sweeping schemes.

Answers to CATT:

We agree that sending a WUS signal will impose addition power consumption to the UE who send the WUS. The scenario we envision is the one in which the UE sending WUS will be a more advanced UE (for whom power consumption may not be critical, e.g. a vehicle or a device plug in to external power supply) and the UE receiving WUS is a VRU or low power device (power consumption is paramount). We think the topic of who can/will become the UE sending WUS will be included in the design if the technology is considered.

3.3 Round 2 Questions

Please let us know if you have any follow-up question

Feedback Form 4: Questions related to RWS-201426 'V2X Enhancements for R18' (2nd Round)

1 – CATT

Thank a lot for the reply. For WUS to work with sidelink, the sending UE is a advanced UE with external power source. This makes sense. A follow up question is what is the use case /work scenario ? Even if power consumption is not a problem for WUS sending UE, there is still resource usage problem – WUS signal will consume time-frequency resources. In legacy WUS mechanism, this is OK since only gNB sends WUS. For sidelink WUS it seems we need to carefully choose the use case.

3.4 Round 2 Answers

Answers to CATT:

Thanks for the follow-up question. We think the applicable use cases can be found in advanced SL use cases including e.g. personalized network of wearable devices with a “leader” device, e.g., a helmet, providing WUS functionalities or in-vehicle network consisting e.g., all personal and wearable devices in the vehicle with the vehicle’s V2X module providing WUS functionalities. We agree that the resource usage of WUS shall be carefully designed to strive for resource utilization efficiency, e.g., regarding whether WUS will share time and/or frequency resource with PSSCH resource and how WUS resources are determined, and in our view reasonable solutions can be found to achieve similar benefit of the power saving provided by WUS as that demonstrated in NR Uu.

4 Rel-18 Sidelink Relay Enhancement

Questions related to RWS-210427 'Sidelink Relay Enhancements for R18' can be raised in this section

4.1 Round 1 Questions

Feedback Form 5: Questions related to RWS-210427 'Sidelink Relay Enhancements for R18'

1 – Intel

Could you clarify what power saving enhancements are needed beyond SL DRX introduced for sidelink in Rel-17?

2 – CATT

Thanks for the contribution. We generally agree that relay work should continue in Rel-18, as stated in our paper RWS-210407.

Then a few question for clarification

1) for multi-connectivity, data rate is mentioned as motivation, but is it also beneficial in terms of latency or reliability improvement?

2) is multi-connectivity only for U2N relay, or it can also be used for the case of U2U relay?

then one comment is on mobility aspects: We tend to think advanced features/enhancements for sidelink mobility, e.g., DAPS is not very urgent. Perhaps we could first discuss on basic mobility functionalities.

3 – LG Electronics Inc.

Q1: Does the proposal "Efficient resource selection for discovery" mean a new resource allocation different from those specified in Rel-16/17? If so, what additional feature would be needed?

4 – HuaWei Technologies Co.

1. Does the multi-connectivity via U2N mean multi-path relay? If yes, we have similar understanding on having multi-path support, and in our understanding for UL this mainly requires the gNB to aggregate the data from multi-path (either direct or indirect), is it consistent with your proposal?

2. We also share the similar view of using CHO/DAPS for mobility enhancement, do you consider it for reducing path switch interruption time?

3. For power saving, can you elaborate a bit on power saving with efficient paging/system info reception on SL?

5 – Qualcomm Incorporated

Release 17 introduced DRX for sidelink power savings. In the proposal for power saving for relays, is the intention to reuse the R17 techniques in Sidelink Relay architecture, or is there something more that needs to be done?

6 – ROBERT BOSCH GmbH

For Sidelink relaying: do you support other cast types than unicast ?

7 – MediaTek Inc.

Thank you for the contribution. We have generally similar views about the need to progress the relay functionality, and a couple of questions for clarification:

- We would like to understand if there is a specific motivation for supporting CHO and DAPS, and if they are intended for use in the direct<->indirect path-switch mechanism, in handover of the relay UE, or both.

- The last bullet on slide 4 mentions RRC_INACTIVE data transmission by the remote UE "via a relay or combined with direct Uu transmission". We would be interested to unpack this description a little bit; is it intended that a remote UE in coverage could, for example, use SDT towards the gNB directly on Uu while monitoring paging via the relay?

8 – Nokia Denmark

The scope of mobility enhancements should be carefully defined.

Question for power efficient paging/SI reception, what more expected beyond SL DRX specified in SL DRX objective in Rel17 and potential enhancement in Rel18? Should it not be specific only for SL Relay?

4.2 Round 1 Answers

Answers to Intel:

SL DRX in Rel-17 is designed assuming that SL UEs have active data sessions/DRBs (similar to UEs in CONNECTED mode). Rel-17 SL DRX should be used as baseline for RRC Connected relay/remote UEs. However, we think power savings enhancements should also be studied for the case when the relay/remote UE(s) are in RRC_IDLE/RRC_INACTIVE. In such scenarios, the only expected traffic is paging and SI reception, therefore further power saving opportunities are possible.

Answers to CATT:

1. Yes. Data rate is mentioned as a primary motivation, but we agree that multi-connectivity is also beneficial in terms of latency and reliability.
2. We think it can be used for both.

We are open to considered this later, depending on the load of the WI.

Answers to LG Electronics:

We think some enhancements to the Rel-16/Rel-17 resource allocation could be considered to address and leverage the specific nature of discovery transmissions which can be quite different from data transmissions.

Answers to Huawei:

1. Yes, your understanding is consistent with our proposal.
2. As in Uu, CHO should target mobility robustness, while DAPS should target reduction of switch interruption time.
3. SL DRX in Rel-17 is designed assuming that SL UEs have active data sessions/DRBs (similar to UEs in CONNECTED mode). Rel-17 SL DRX should be used as baseline for RRC Connected relay/remote UEs. However, we think power savings enhancements should also be studied for the case when the relay/remote UE(s) are in RRC_IDLE/RRC_INACTIVE.

Answers to Qualcomm:

The intention is to use Rel-17 SL DRX as a baseline for relays/remote that are in RRC CONNECTED. However we think that we think power savings enhancements should also be studied for the case when the relay/remote UEs are in RRC_IDLE/RRC_INACTIVE.

Answers to BOSCH:

Yes. For instance support for MBS over sidelink would benefit from relaying using groupcast/broadcast.

Answers to MediaTek:

We think a remote UE connected via a U2N relay should benefit, eventually, from as many of the features defined for Uu as possible. This would apply to CHO/DAPS (both cases you mention could be beneficial), and data transmissions while it is in INACTIVE state (both via the relay and via Uu).

Answers to Nokia:

For mobility enhancement, we think the aspects excluded from Rel-17 should be addressed (e.g. inter-gNB, group mobility), and if time permits, extending Uu mobility features of CHO/DAPS to SL relay would be beneficial.

SL DRX in Rel-17 is designed assuming that SL UEs have active data sessions/DRBs (similar to UEs in CONNECTED mode). Rel-17 SL DRX should be used as baseline for RRC Connected relay/remote UEs. However, we think power savings enhancements should also be studied for the case when the relay/remote UE(s) are in RRC_IDLE/RRC_INACTIVE. We agree that this should be specific to the SL Relay scenario, and not for general paging/SI reception.

4.3 Round 2 Questions

Please let us know if you have any follow-up questions

Feedback Form 6: Questions related to RWS-210427 'Sidelink Relay Enhancements for R18' (Round 2)

<p>1 – Apple GmbH</p> <p>Thanks for the paper and 1st round discussion. As follow-up for the questions asked by Intel and Qualcomm, I share the same question about what additional mechanism specific for SL relay needs to be used for power saving. Regarding the 1st-round answer, I believe SI-DRX in Rel-17 is not only used by RRC_CONNECTED UEs. In general, it can be used by both SL unicast when there is PC5-RRC connection between the remote UE and relay UE, and for SL groupcast and broadcast in absence of PC5-RRC connection between the UEs. Even if remote/relay UE is in IDLE/INACTIVE mode for Uu RRC, SL DRX can still be applicable. Could you please clarify more on this aspect?</p>
<p>2 – CATT</p> <p>Many thanks for your discussions in Round 1.</p> <p>Regarding your response in round 1, firstly we tend to agree with what you explained for power saving aspects.</p> <p>Then we tend to feel that the part "We think some enhancements to the Rel-16/Rel-17 resource allocation could be considered to address and leverage the specific nature of discovery transmissions which can be quite different from data transmissions." not 100% clear. Does it mainly require some R1 continuation of R17 resource allocation? Maybe we could further discuss what would be the gap/requirements.</p>
<p>3 – LG Electronics Inc.</p> <p>Q1: As a follow-up question, can you elaborate on the specific nature of discovery transmissions different from data transmissions and what potential enhancements would be needed?</p>

4.4 Round 2 Answers

Answers to Apple:

SL DRX is designed for active traffic (similar to Uu CONNECTED mode). It therefore uses the concept of an

inactivity timer, retransmission timers, etc. For a remote UE in IDLE/INACTIVE, the UE expects to receive only paging. While SL DRX can be used as a baseline for this case, there may be enhancements that can be used to reduce power consumption beyond simply re-using SL DRX. The applicability of paging enhancements for power savings in Uu can also be considered for the relay case.

Answers to CATT:

We think such resource allocation enhancements could be limited to RAN2 work only, but it would need further discussion. In LTE, discovery transmissions were designed to meet specific requirements (e.g. frequency diversity), and we think similar requirements should apply to NR discovery.

Answers to LG:

In LTE, discovery transmissions were designed to meet specific requirements (e.g. frequency diversity), and we think similar requirements should apply to NR discovery. Resource allocation enhancements to ensure this could be studied further.

5 Rel-18 XR Enhancement

Questions related to RWS-210428 'XR Enhancements for R18' can be raised in this section

5.1 Round 1 Questions

Feedback Form 7: Questions related to RWS-210428 'XR Enhancements for R18'

<p>1 – CATT</p> <p>Thanks for sharing the idea of NR enhancement for XR. The proposed schemes of capacity enhancement in SPS and CG for XR are quite interesting. However, we believe the aspects of NR enhancements should be discussed and concluded in the working groups first during the XR study before further discussion of the scope of XR work item.</p>
<p>2 – Classon Consulting</p> <p>[for FUTUREWEI]</p> <p>We also think enhancements are needed in Rel-18 for application-oriented QoS control to support low/bounded latency high throughput transmission of XR data bursts. Please see RWS-210040 page 8 and NWM https://nwm-trial.etsi.org/#/documents/4751 .</p>
<p>3 – Intel</p> <p>In-coverage remote UEs, do you prefer that it performs Uu paging on its own?</p>
<p>4 – HuaWei Technologies Co.</p> <p>Q1. Regarding to the granular QoS differentiation, it may be useful to have some flexibility to schedule data at different granularities and we have similar proposals. Do you think the scheduling needs to consider multiple packets belonging to one application layer frame, and the importance of different packets with</p>

different QoS packets? Do you think such handling requires also CN involvement as in our understanding, QoS management is E2E and it cannot be purely RAN decision.

Q2. We also see some value on RAN awareness of XR application. To achieve this, do you also think interaction between 3GPP network and application may be needed, and thus CN and SA2/SA4 needs to be involved to ensure an E2E mechanism is workable to support XR services?

5 – Qualcomm Incorporated

Can Interdigital provide more information on why synchronization of XR streams would provide significant benefit over current implementation?

5.2 Round 1 Answers

Answers to CATT:

We think the enhancements for capacity can be identified and studied during the SI phase and the exact scope of the WI will eventually be based on the conclusions of the study. However, we think that discussions on the identification of potential enhancements and scope for Rel-18 WI can take place in parallel during the Rel-18 package discussions.

Answers to FutureWei:

We share similar views regarding enhancements for supporting bounded latency for XR traffic.

Answers to Intel:

This question seems to be related to relay work. Can you please elaborate for which aspects/slide on the relay presentation the question is referring to? In general, we already agreed that paging for in-coverage remote UEs will be done via the relay UE in the Rel-17 SI.

Answers to Huawei:

Q1: Yes, having the knowledge at RAN on the association of packets at frame level and importance of packets is useful for QoS enforcement. We think certain CN involvement in assisting with E2E QoS management may be needed to some extent.

Q2: We have similar understanding in terms of having some RAN awareness of XR application. The extent to which the interaction between 3GPP network and application would be needed should be further studied.

Answers to Qualcomm:

We think the current implementation where the different data streams are handled without synchronization and bounded latency considerations can result in degradation of application performance. This issue may be pronounced when considering the XR data streams (e.g. video and pose) which may differ significantly in terms of traffic characteristics (e.g. packet size distribution, arrival rate). In this regard, it is beneficial to ensure the XR streams are transmitted at AS layer with synchronization considerations.

5.3 Round 2 Questions

Feedback Form 8: Questions related to RWS-210428 'XR Enhancements for R18' (Round 2)

1 – Fujitsu Limited

We have interest in this contribution.

On the synchronized transmission of multiple data streams per-application, we have the similar view that this function is needed as we also have contribution in RWS-210288.

(1) Do you have any specific method/procedure/mechanism and so on in mind?

(2) In addition, which do you assume that such a synchronized transmission is intra UE (App. and UE has one to one), or inter UE (App. and UEs have one to many)?

5.4 Round 2 Answers

Answers to Fujitsu:

Q1: From our understanding, the traffic generated by an XR application can typically consist of multiple data streams (e.g. pose, video, control). The data streams may have different traffic characteristics (e.g. aperiodic, periodic, semi-persistent) and subject to different per-stream QoS requirements (e.g. PDB, PER). As such, the different streams may be mapped to different radio bearers at the AS layer for enforcing the respective QoS requirements. For ensuring that the streams are delivered in synchronized manner (e.g. within a synchronization window as per application requirement), we think certain mechanisms such as timing/flow control across different radio bearers may be considered at the AS layer.

Q2: We think synchronized transmission may apply in scenarios where there could be multiple function/modules (e.g. sensors, cameras) generating different data streams which are intended for the same XR application. The different functions/modules may be either co-located in the same UE (i.e. intra-UE) or in different UEs (i.e. inter-UE), associated with the same application. The mechanisms/procedures that can be applied for ensuring synchronized transmission may vary depending on the distribution of the functions.