**3GPP TSG-RAN WG2 Meeting #124 R2-23xxxxx**

**Chicago, USA, 13th – 17th Nov 2023**

Agenda Item: x.x.x

Source: vivo (Rapporteur)

Title: RRC Open issues for U2U relay

Document for: Discussion and Decision

# Introduction

This document summarizes the potential RRC open issues for U2U relay. The RRC open issues are further categorized in the following aspects.

* Rapporteur input on issues that involve or may involve ASN.1 impact (see in Table 1)
* Rapporteur input on issues that completes the U2U Relay functionality, and w/o ASN.1 impact (see in Table 2)
* Company input on open issues that haven’t been covered by Rapporteur input (see in Table 3). Currently Table 3 is empty and waits for company’s comments or suggestion if needed.

# RRC Open issues

## Table 1. ASN.1 impact related issues

**Table 1. ASN.1 impact related issues**

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| Number  | Open issue list (i.e., Editor Note) | Rapporteur’s comment |
| Issue 1.1 | 6.6.2 Message definitions*Editor NOTE: WA: AS signalling is used to indicate the end-to-end QoS and QoS split for L2 U2U relay..* | Issue 1.1 was captured in accordance with the RAN2#123bis agreement as following:* WA: AS signalling is used to indicate the end-to-end QoS and QoS split for L2 U2U relay.
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| Issue 1.2 | 5.8.3.1 General*Editor Note:* *FFS stage 3 impact to message formats (e.g., additional fields) for an RRC\_CONNECTED U2U relay/remote UE.* | Issue 1.2 was captured in accordance with the RAN2#123bis agreement as following.* There are no additional procedures at the gNB beyond Rel-16 operation in the ID reporting/resource allocation procedures for an RRC\_CONNECTED U2U relay/remote UE. Some Rel-16 functionality may not be applicable to U2U (to be determined on a case-by-case basis). FFS stage 3 impact to message formats (e.g., additional fields).
 |
| Issue 1.3 | 5.8.9.1.1 General*Editor NOTE: It is FFS that the two conclusions on TX remote UE derivation for e2e SL-DRB do not exclude the involving information from gNB/preconfiguration/specified configuration.* | Issue 1.3 was captured in accordance with the RAN2#123 agreement as following:* The TX Remote UE derives the PDCP and SDAP configuration for e2e SL-DRB and provides the portion of the configuration related to RX to the RX Remote UE using E2E PC5-RRC message (similar to legacy PC5 configuration).
* The TX Remote UE derives the first hop configuration (e.g. PC5 relay RLC Channel configuration) for SL-DRB and provides to the relay UE the portion of the configuration related to RX on the first hop (i.e., Rx by the relay UE), using per-hop PC5-RRC message (similar to legacy PC5 configuration).
	+ The two conclusions above do not exclude the derivation involving information from gNB/preconfiguration/specified configuration.
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| Issue 1.4 | 5.8.9.1.1 General*Editor NOTE: It is FFS how the Relay UE derives second hop configuration for SL-DRB.* | **Issue 1.4** was captured in accordance with the RAN2#123 agreement as following:* It is FFS how the Relay UE derives second hop configuration for SL-DRB.
 |
| Issue 1.5 | 5.8.13.3 NR sidelink discovery transmission*Editor NOTE: FFS whether reuse the U2N relay (re)selection parameters to U2U relay (re)selection.* | Issue 1.5 was proposed in the offline email discussion [Post123][411][Relay] RRC CR on U2U relay (vivo).A question was raised on whether the current U2N relay (re)selection parameters should be reused to the U2U relay (re)selection. Rapporteur suggested to discuss it based on company contribution, and thus an EN was added for further consideration in the coming RAN2 meeting. |
| Issue 1.6 | 9.1.1.4 SCCH configuration*Editor NOTE: FFS how they will be implemented in specs (e.g., if the configurations are identical the tables might be merged for different SL-SRBs).* | Issue 1.6 was captured in accordance with the RAN2#123 agreement as following:* New specified per-hop configurations are used for E2E SL-SRB 0/1/2/3 respectively. FFS how they will be implemented in specs (e.g., if the configurations are identical the tables might be merged for different SL-SRBs).
 |
| Issue 1.7 | 6.3.1 System information blocks*Editor NOTE: FFS whether the old indication for R17 U2N Relay can be used for R18 U2U Relay or a new U2U Relay-specific indication is needed for gNB capability of supporting U2U Relay.* | Issue 1.7 was proposed by the Rapporteur during the RRC running CR drafting.This issue is about how the U2U Remote UE and U2U Relay UE can determine from *SIB12* whether the gNB supports R18 U2U Relay, and whether the old indication for R17 U2N Relay can be used for R18 U2U Relay or a new U2U Relay-specific indication is needed. |
| Issue 1.8 | 5.8.9.1.2 Actions related to transmission of *RRCReconfigurationSidelink* message*Editor NOTE: WA: Carry L2 ID and Local ID in RRCReconfigurationSidelink message with the assumption that the association between User Info and L2 ID is done at ProSe layer.* | Issue 1.8 with the following RAN2#123bis agreement and this issue needs to wait for SA2 LS reply before further discussion and discussion. |

## Table 2. U2U Relay functionality related issues

**Table 2. U2U Relay functionality related issues**

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| Number  | Open issue list (i.e., Editor Note) | Rapporteur’s comment |
| Issue 2.1 | 5.8.9.3 Sidelink radio link failure related actions*Editor Note: FFS whether additional procedure for L2 U2U PC5 RLF initiation.* | Issue 2.1 was proposed by Rapporteur during the RRC running CR drafting.An EN was added here to remind companies to check whether/how U2U specific PC5 RLF would impact the Uu procedures e.g., whether the UE would send SUI to gNB. |
| Issue 2.2 | 5.8.9.10.2 Initiation*Editor Note:* *FFS the previous agreement “When the remote UE receives PC5-RLF indication from the U2U relay UE, it would inform upper layers and rely on upper layers to trigger relay reselection (or not).” applies to L3 U2U relay or not, including whether there is a need for the PC5-RLF indication in this case.* | **Issue 2.2** was captured in accordance with the RAN2#123bis agreement as below.* RAN2 confirm the following agreement applies to both source L2 remote UE and L2 target remote UE. FFS for L3 U2U relay, including whether there is a need for the PC5-RLF indication in this case.
	+ When the remote UE receives PC5-RLF indication from the U2U relay UE, it would inform upper layers and rely on upper layers to trigger relay (re)selection (or not).
 |
| Issue 2.3 | 5.8.9.10.4 Actions related to reception of *NotificationMessageSidelink* message*Editor Note: FFS if there would be any constraints on the Remote UE implementation behaviour to keep or release the PC5 link with the relay UE.* | Issue 2.3 was captured in accordance with the RAN2#120 agreement as following:* When the remote UE receives PC5-RLF indication from the U2U relay UE, it would inform upper layers and rely on upper layers to trigger relay reselection (or not). FFS if there would be any constraints on the remote UE implementation behavior to keep or release the PC5 link with the relay UE.
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| Issue 2.4 | 5.8.X2.2 NR Sidelink U2U Remote UE threshold conditions*Editor Note: FFS whether/how to capture if the SL-RSRP/SD-RSRP measurement of the peer NR sidelink U2U Remote UE is not available.* | Issue 2.4 was proposed by the Rapporteur during the RRC running CR drafting.Rapporteur noticed that current RAN2 agreements for triggering relay selection were made only for the case when there is a direct link with the peer U2U Remote UE, in which case either SL-RSRP or SD-RSRP measurement can be used for the PC5 threshold condition checking. But for the case when there is no direct link established yet (which means both the SL-RSRP/SD-RSRP measurements of the peer U2U Remote UE are not available), there is no conclusion whether/how to capture it for triggering relay selection. Therefore, an EN was added for companies to have further consideration in the coming RAN2 meeting. |

## Table 3. Company input on other/more open issues

**Table 3: Collect company input on other/more open issues**

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| Company name | Issue description | Comments or suggestions |
| Xiaomi | RAN2 has agreed the direct link RSRP falling below threshold can trigger relay selection. However, the direct link SL RLF, i.e. feedback DTX reaches maximum, may be declared before the RSRP measurement falling below threshold. In this case, UE should try to perform relay selection to recover the communication with peer UE. | UE can trigger relay selection if SL RLF occurs. This can be specified at AS or NAS.[Rapp’s comment] It’s observed that the Issue described by Xiaomi has been discussed in clause 2.1.4 Trigger for relay selection in offline [AT123bis][421][Relay] U2U discovery and (re)selection (ZTE), but most companies disagree with proposal, see in summary report in R2-2311531. Based on this observation, it seems that there is no motivation to capture this issue for the time being. |
| ZTE | For issue 1.1, there is a remaining issue that whether the split QoS need to be sent to the target remote UE. Suggest to add an editor Note for this. | Suggest to add an editor Note for this.[Rapp’s comment] For issue 1.1, we are ok to add ZTE’s comment and will modify the existing issue description as below (see highlighted in yellow) 6.6.2 Message definitions*Editor NOTE: WA: AS signalling is used to indicate the end-to-end QoS and QoS split for L2 U2U relay. FFS AS singnalling content design, including whether the split QoS needs to be sent to the target remote UE for QoS split.* |
| ZTE | RAN2 is suggested to discuss the issue that whether the local ID is assigned per UE or per pair per UE, which has impacts on signalling/ASN.1 design, i.e. whether a single local ID is assigned to a UE or multiple local IDs are assigned to a UE for different UE pairs. E.g.:Alt 1: Local ID is allocated per UE. **Each remote UE has only one (source) local ID**. Relay UE ensures the uniqueness of (source) local ID of each remote UE.Alt 2: Local ID is allocated per pair per UE. **Each remote UE may have multiple (source) local IDs**, **each local ID is specific for a UE pair/destination**. E.g. src local **IDx1 (UE1)**, dest local IDy (UE2) are allocated for {UE1, UE2} pair while src local **IDx2 (UE1)**, dest local IDz (UE3) are allocated for {UE1, UE3} pair.We understand Alt 2 is adopted in the current running CR.  | RAN2 is suggested to discuss the issue that whether the local ID is assigned per UE or per pair per UE.[Rapp’s comment] According to RAN2#123bis agreement as below, we assume no further discussion and spec change is needed.* The UE ID assignment for U2U remote UEs is up to U2U relay UE implementation, i.e., no specification impact on how to assign the local ID is needed.

[ZTE]: Actually, the issue is related to whether a L2 ID is needed when allocate local ID to a source remote UE (when relay UE sends allocated local IDs to source remote UE). We understand the following WA is for source remote UE to identify a local ID for a peer remote UE with L2 ID. However, whether a L2 ID is needed to be associated with a local ID for source remote UE is not clear. There may be three ways:1. Local ID is per UE, even there are multiple L2 IDs of source remote UE for different PC5 links/dest remote UEs, only one local ID is allocated to source UE. L2 ID is not needed when allocate local ID to source UE.
2. Local ID is per L2 ID of source remote UE, local ID is allocated with a L2 ID of source remote UE, as implemented in the current running CR.
3. Local ID is per dest L2 ID/per UE pair, , a (source) local ID is allocated to the source remote UE per dest L2 ID. In this case, even if (dest) local IDs of different destinations UEs are the same, as long as the source local IDs are different for different destinations, there is no collision issue.

As we can see, different ways/understanding have different ASN.1 impacts.* WA: Carry L2 ID and Local ID in *RRCReconfigurationSidelink* message with the assumption that the association between User Info and L2 ID is done at ProSe layer.

[Rapp’s comment]Thanks for ZTE’s further explanation. For the above details, we suggest discussing it based on company contribution together with confirming the WA in the next meeting. It can be part of the discussion related to the WA. |
| Qualcomm | For Issue 2.1 and 2.3 | Would like to add how to handle E2E connection if per-hop RLF is detected[Rapp’s comment] We are ok to add it as new open issue e.g., *Editor NOTE: FFS on how to handle E2E connection if per-hop RLF is detected*. Let’s hear more company views if there is any more suggestion or concern before updating in the running CR.[Lenovo] We have the same suggestion as QC. The handling E2E connection when per-hop RLF is detected should be discussed.[Rapp’s comment] Now, related Editor Notes are reflected in the running CR. See as below:5.8.9.1a.1.2 Sidelink DRB release operations*Editor Note: FFS on how to release SL DRB on E2E and hop configuration for U2U relay.*5.8.9.1a.3 Sidelink SRB release*Editor Note: FFS on how to release SL SRB on E2E and hop configuration for U2U relay.*5.8.9.3 Sidelink radio link failure related actions*Editor Note: FFS on how to handle E2E PC5 connection and hop PC5 connection.* |
| Qualcomm | Other open issues | Currently, SIB12 will provide the DRB and QoS profiles mapping, and the UE will derive the DRB configuration. In U2U relay, there E2E QoS profiles and per-hop QoS profiles, how the Remote UE derives the derives bearer E2E and per-hop configuration from the SIB according to the two QoS profiles should be discussed.[Rapp’s comment] Agree with Qualcomm’s comments. And we think the solution details can be covered by the above Issue 1.3 and Issue 1.4.  |
| ASUSTeK | The *NotificationMessageSidelink* message, sent by the U2U Relay UE to inform the U2U Remote UE of the PC5 RLF with the peer U2U Remote UE, only includes a *sl-IndicationType* to indicate relayUE-PC5-RLF. Since a U2U Remote UE may connect or communicate with multiple peer U2U Remote UEs via one U2U Relay UE (according to clause 6.7.1.1 in TS 23.304 [2]), there is a need for the U2U Relay UE to include information in the *NotificationMessageSidelink* message for identifying the concerned peer U2U Remote UE with which the PC5 RLF is detected so that the U2U Remote UE can initiate relay reselection for the concerned peer U2U Remote UE.  | The *NotificationMessageSidelink* message includes the information for identifying the concerned peer U2U Remote UE with which the PC5 RLF is detected. The information for identifying the concerned peer U2U Remote UE is FFS.[Rapp’s comment] Now we understand the issue. And already added the destination field of U2U Remote UE where the PC5 link RLF between U2U Relay UE and U2U Relay UE is detected, so that the peer U2U Remote UE will not have ambiguity on which E2E link is impacted when shared link case happen on the other hop.The Notification procedure is also updated accordingly.Please check the updated running CR and see if there is still an issue. |
| ASUSTeK | In RAN2#123bis, it was agreed that the TX Remote UE derives the PDCP and SDAP configuration for e2e SL-DRB and provides the portion of the configuration related to RX to the RX Remote UE using E2E PC5-RRC message (similar to legacy PC5 configuration). To determine the proper PC5-PDCP configuration, we think the Source UE (Tx UE) needs to know the *pdcp-ParametersSidelink* of the Target UE (Rx UE) as in legacy sidelink communication. Thus, an E2E sidelink UE capability transfer procedure is needed to support PC5-PDCP configuration between Source UE and Target UE. | In addition to the E2E sidelink RRC reconfiguration procedure, the E2E sidelink UE capability transfer procedure is also needed to support sidelink DRB configuration between Source UE and Target UE for L2 U2U Relay.[Rapp’s comment] Agree that there is potential UE capability issue, but we think it’s better to leave it to the UE capability CR rapporteur to handle the capability issues. |
| ZTE | As commented for sl-QoS-InfoListPC5, and the reply from ASUSTek,When source remote UE sends E2E QoS info list to relay UE, it needs to indicate the E2E QoS info list is towards for which target remote UE, considering the src remote UE has two dest remote UEs via the same relay UE, and the PC5 link of the first hop is shared by the two dest remote UEs (i.e. different RBs towards different dest remote UEs can be multiplexed to the same PC5 relay RLC channel at the first hop). | When source remote UE sends E2E QoS info to relay UE, the sl-QoS-InfoListPC5 should be per target remote UE.[Rapp’s comment] Now we understand the issue. And already added the destination field which is associated to Target U2U Remote UE in the procedure. Please check the updated running CR and see if there is still an issue. |
| Lenovo | When a remote UE communicates another remote UE via a U2U relay UE, the direct PC5 link may become better. In this case, the remote UE may fall back to the direct PC5 link between two remote UEs. Once the quality of the PC5 direct link is better than the configured threshold, the remote UE can fall back to the direct PC5 link. Namely, the remote UE establishes the PC5 link to the peer remote UE and release the link between the remote UE and the relay UE. | Suggest discussing the condition for switching back from the U2U relay operation to direct PC5 link.[Rapp’s comment] Rapp understands that switching back from the U2U relay operation to direct PC5 link also needs to involve with SA2, e.g., whether/how for the same pair of Remote UEs to maintain both the direct PC5 link and U2U Relay link via Relay UE. Therefore, the issue is very difficult to be addressed and thus we suggest not to capture this issue for the time being, especially considering that we still have still have many basic issues left for the next meeting. |
| Lenovo | We have the following agreement including a FFS in RAN2#120. UE-to-UE relay reselection can be triggered based on the PC5 RSRP (FFS SL-RSRP or SD-RSRP) between a remote UE and the relay UE falling below a threshold. FFS which remote UE (or both) can trigger relay reselection. FFS if/how the second hop between the relay UE and the peer UE is considered. | Suggest discussing this FFS.[Rapp’s comment] It’s observed that the Issue described by Lenovo has been discussed in clause 2.1.5 Relay re-selection in offline [AT123bis][421][Relay] U2U discovery and (re)selection (ZTE), but not much support with proposal, see in summary report in R2-2311531. Based on this observation, it seems that there is no motivation to capture this issue for the time being. |
| Fujitsu | On issue 2.1 and 2.3 | We also need to discuss how to handle per-hop connection if E2E RLF is detected. In addition, if a remote UE is communicating with more than one peer remote UEs via the same relay UE, when RLF is detected in one of the second hops, we should discuss whether the relay UE should indicate the identifier of the failed peer remote UE or not.[Rapp’s comment] Now, related Editor Notes are reflected in the running CR. See as below:5.8.9.1a.1.2 Sidelink DRB release operations*Editor Note: FFS on how to release SL DRB on E2E and hop configuration for U2U relay.*5.8.9.1a.3 Sidelink SRB release*Editor Note: FFS on how to release SL SRB on E2E and hop configuration for U2U relay.*5.8.9.3 Sidelink radio link failure related actions*Editor Note: FFS on how to handle E2E PC5 connection and hop PC5 connection.*  |

# Summary

TBD

# References

1. R2-2309755, remaining open issues for SL relay, LG.