3GPP TSG-RAN WG2 Meeting #121-bis electronic R2-23xxxxx

17th – 26th Apr. 2023

Source: Lenovo (Rapporteur)

Title: Summary of AI 7.9.2 on UE-to-UE relay

Agenda Item: 7.9.2

Document for: Discussion and Decision

# Introduction

This contribution is to summarize all contributions from agenda item 7.9.2 on UE-to-UE relay.

# Discussion

Note 1: ‘source remote UE’ and ‘target remote UE’ would be used in following proposals only for discussion purpose.

Note 2: Proposals are discussed by only one or two companies are not included in the following proposals.

## 2.1 Discovery

### 2.1.1 Discovery configuration for Connected UE

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| Tdoc Number | Proposal |
| **R2-2302902**Ericsson | Proposal 10 In UE-to-UE relaying, the gNB does not provide a dedicated discovery configuration for an in-coverage UE in RRC\_CONNECTED and can rely on cell-specific configuration/preconfiguration. |
| **R2-2302921**InterDigital | Proposal 1: RRC\_CONNECTED remote/relay UEs can obtain discovery configuration via dedicated RRC signalling.  |
| **R2-2303005**ZTE, Sanechips | Proposal 8: In U2U relay, gNB controls RRC\_CONNECTED UEs via dedicated signalling at least in the following procedures: mode1 and mode2 RA, discovery resource configuration, SLRB/PC5 RLC channel configuration. |
| R2-2303339vivo | Proposal 1: RAN2 to agree that in U2U relay, RRC\_CONNECTED remote/relay UEs can obtain discovery configuration via dedicated signalling. |
| **R2-2303486**Huawei | Proposal 19: Following Rel-16/Rel-17 mechanism, if SIB12 does not provide discovery Tx resource pool, the end UEs or relay UEs in RRC\_IDLE/RRC\_INACTIVE should enter RRC\_CONNECTED state and obtain discovery resource configuration from dedicated signalling. |
| **R2-2303572**Spreadtrum | Proposal 1: RRC\_CONNECTED UE in UE-to-UE relay should acquire discovery configuration via dedicated signalling. |
| **R2-2303608**China Telecom | Proposal 6 For the U2U relay, RRC\_CONNECTED UEs may obtain discovery configuration from dedicated signalling. |

**Summary**:

RAN2 has agreed that the remote/relay UE in RRC\_IDLE/RRC\_INACTIVE or OOC can acquire discovery configuration as in Rel17 (i.e., cell-specific configuration/preconfiguration).’ It is FFS if any restriction specific to UE-to-UE relay are introduced for in-coverage UE in RRC\_CONNECTED. Based on the contributions, 6 companies support dedicated signalling to acquire discovery configuration. One company thinks cell-specific configuration/preconfiguration is sufficient since RAN2 has agreed that the gNB involvement will be simplified for U2U relay specific operations as compared to the U2N case.

**[ToDis]Proposal 1: In U2U relay, the remote/relay UE in RRC\_CONNECTED can acquire discovery configuration via dedicated signalling.**

### 2.1.2 UE list included in Model A message

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| Tdoc Number | Proposals |
| **R2-2302643**OPPO | Proposal 4: For model-A discovery, R2 relies on S2 to decide whether an AS-layer criterion is needed for a relay UE to decide whether a remote UE should be included in the announced neighbour list. If Yes, R2 can further work on it. |
| **R2-2302921**InterDigital | Proposal 3: In model A discovery, a relay UE includes, in its discovery message, the identity of remote UE’s it has discovered that have RSRP above a threshold. RAN2 informs SA2.  |
| **R2-2303004**ZTE, Sanechips | Proposal 2: When configured by upper layer to transmit discovery message, the relay UE should* in Model A, only announce the neighbour UEs that the PC5 link quality between the relay UE and the neighbour UE is above a threshold in the discovery announcement message.
* in Model B, transmit discovery solicitation/response message if the PC5 link quality between the relay UE and the remote UE from which the discovery solicitation/response message is received is above a threshold.
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| **R2-2303486**Huawei | Proposal 15: In Model A, only when PC5 signal strength between the relay UE and an end UE is better than a threshold, the relay UE can include User Info ID of this end UE in the discovery announcement. |
| **R2-2303572**Spreadtrum | Proposal 2: In Model A, Relay UE decides the list of "End User Info" by comparing the signal quality between itself and the neighboring UE with one configured lower threshold and/or one configured upper threshold.Proposal 3: In Model A, Relay UE is allowed to transmit the Announcement message if there is at least one End UE included in the End UE list. |
| **R2-2303648**Kyocera | Proposal 1 The conditions for U2U relay UE to transmit Model A discovery should include a list of reachable target remote UEs (i.e., neighbour list) along with the channel conditions between the relay UE and each of the target remote UEs. |
| **R2-2304074**Sharp | Proposal 12. For discovery Model B, RAN2 does not specify the behaviour related to neighbour list unless SA2 asks it. |
| **R2-2303545**CMCC | Proposal 3： For model A, neighbourlist can be used for relay (re)selection procedure by having following two functions:1) To let the remote UE know all attachable ProSe UEs around the candidate relay UE2) To let the remote UE know the second hop channel quality between candidate relay UE and the peer remote UE |

**Summary:**

For Model A, whether the relay UE should announce the neighbour UEs that the PC5 link quality between the relay UE and the neighbour UE is above a threshold is discussed in some papers. InterDigital, ZTE, Huawei, Spreadtrum, Kyocera, CMCC support it. OPPO thinks it is up to SA2 discussion. Since no companies object it based on the contribution, the following proposal is made.

**[Deprioritized] Proposal 2: In Model A, the relay UE should announce the UE list in a discovery announcement message containing UEs for which the quality of PC5 link between the relay UE and the said UE is above a certain threshold. If agreed, LS is sent to SA2.**

### 2.1.3 Condition for discovery transmission/response

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 2: Remote UE can trigger U2U relay discovery message transmission when SL-RSRP/SD-RSRP of the current direct PC5 link between a pair of directly connected remote UEs is below a threshold.Proposal 3: UE-to-UE relay discovery can be triggered when the PC5 RSRP (FFS SL-RSRP or SD-RSRP) between a remote UE and the current serving relay UE is below a threshold.Proposal 5: Only when the RSRP of the PC5 link between the source remote UE and the candidate relay UE is above an threshold, the relay UE can forward the U2U relay discovery message to the target remote UE or send response to the source remote UE. |
| **R2-2302643**OPPO | Proposal 1 As in R17 U2N, no need to differentiate the AS-layer criterion for discovery Tx/Rx and relay (re)selection, and the AS/NAS interaction for relay (re)selection triggering is left to UE implementation.Proposal 5 For model-B discovery, target remote UE, upon discovery solicitation message reception, select suitable relay candidates only if the PC5 RSRP (FFS SL-RSRP or SD-RSRP) towards the relay UEs is above a configured threshold.Proposal 6 For model-B discovery, source remote UE, upon discovery response message reception, select suitable relay candidates only if the PC5 RSRP (FFS SL-RSRP or SD-RSRP) towards the relay UEs is above a configured threshold.Proposal 7 For integrated discovery, target remote UE, upon DCR message reception, select suitable relay candidates only if the PC5 SL-RSRP towards the relay UEs is above a configured threshold. |
| **R2-2302902**Ericsson | Proposal 2 The destination remote UE triggers the relay selection and discovery procedure when the direct link falls below a threshold.Proposal 3 During relay selection, it is left to source remote UE’s implementation to choose a U2U relay UE to perform PC5 connection establishment when more than one suitable candidate U2U relay UEs meet the AS-layer and higher layer criterion.Proposal 4 The destination remote UE can trigger relay reselection and discovery when the link between the U2U relay and destination remote UE is below a threshold.Proposal 5 U2U relay can indicate to the destination remote UE when the link between the source remote UE and U2U relay is below a threshold. The destination remote UE can then trigger relay reselection and discovery procedure. |
| **R2-2302921**InterDigital | Proposal 4: In model B discovery, a relay UE forwards only discovery messages received having RSRP above a threshold. RAN2 informs SA2.  |
| **R2-2303004**ZTE, Sanechips | Proposal 1: When configured by upper layer to transmit discovery message, the remote UE should further check AS conditions before transmitting discovery message. Specifically,* the discoverer UE transmits discovery solicitation message if the PC5 signal strength (SL-RSRP or SD-RSRP) of the discoveree UE is below a threshold;
* the discoveree UE transmits discovery response message if the SL-RSRP towards the relay UE from which the discovery solicitation message is received is above a threshold.

Proposal 2: When configured by upper layer to transmit discovery message, the relay UE should* in Model A, only announce the neighbour UEs that the PC5 link quality between the relay UE and the neighbour UE is above a threshold in the discovery announcement message.
* in Model B, transmit discovery solicitation/response message if the PC5 link quality between the relay UE and the remote UE from which the discovery solicitation/response message is received is above a threshold.
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| **R2-2303339**vivo | Proposal 6: For mode-A discovery, the discovery message can be transmitted by U2U remote UE when the PC5 RSRP (FFS SL-RSRP or SD-RSRP) of the direct link falling below a threshold.Proposal 7: For mode-B discovery, the discovery message can be responded by a remote UE when the PC5 RSRP (FFS SL-RSRP or SD-RSRP) between the remote UE and the relay UE is above a configured threshold.Proposal 8: RAN2 to further discuss the condition for discovery message forwarding/responding at relay UE, e.g. the relay UE should only forward/respond the discovery message when the PC5 RSRP (FFS SL-RSRP or SD-RSRP) between the relay UE and the remote UE from which the discovery message is received, is above a configured threshold. |
| **R2-2303486**Huawei | Proposal 16: In Model B, only when PC5 signal strength between the target end UE and a relay UE is better than a threshold, the destination UE can respond discovery response message to this relay UE. |
| **R2-2303572**Spreadtrum | Proposal 4: In Model B, the discoverer End UE is allowed to transmit Solicitation message with relay indication enabled if the link quality between itself and the discoveree End UE is below one configured threshold (including the case where the discoverer End UE cannot discover the discoveree End UE) when the link quality results are available.Proposal 5: In Model B, candidate Relay UE decides whether it is allowed to send Solicitation message to by comparing the link quality between itself and the discoverer End UE with one configured lower threshold and/or one configured upper threshold.Proposal 6: In Model B, the discoverer End UE decides whether it is allowed to respond to the candidate Relay UE by comparing the link quality between itself and the candidate Relay UE with one configured lower threshold and/or one configured upper threshold.Proposal 7: In discovery integrated into PC5 unicast link establishment procedure, candidate Relay UE decides whether it is allowed to forward Direct Communication Request by comparing the link quality between itself and UE-1 with one configured lower threshold and/or one configured upper threshold. |
| **R2-2303782**Xiaomi | Proposal 1: The Remote UE indicates the AS Relay UE selection trigger to its upper layer in order to trigger a U2U Relay UE discovery, dependant on the Remote UE having no candidate Relay UE. (Whether discovery is triggered if the Remote UE has one or more Relay UE candidates at the AS trigger of selection is a matter for UE implementation.)Proposal 5: Detection of RLF of the PC5 direct link between two Remote UEs can also trigger discovery message transmission.Proposal 10: For Model A, source Remote UE selects a Relay UE for which the SL-RSRP/SD-RSRP is above the minimum threshold.Proposal 11: For Model B, target remote UE can select the relay UE for which the SL-RSRP/SD-RSRP is above the minimum threshold and forwards the discovery response message to the selected relay UE. Proposal 12: For Model B, source remote UE can select the relay UE for which the SL-RSRP/SD-RSRP is above the minimum threshold if multiple discovery response messages from the same target remote UE are received from multiple Relay UEs.Proposal 13: A target Remote UE receiving multiple discovery solicitation messages via Relay UEs from the same source Remote UE should respond to all discovery solicitation messages that are from viable candidate Relay UEs, as determined following successful AS and higher layer checks, in order to assist the source Remote UE in the final Relay UE selection.Proposal 14: A source Remote UE receiving multiple discovery response messages from multiple Relay UEs with a PC5 link quality measurement above the PC5 link quality threshold, may rank these Relay UEs. The Relay UE ranking may be according to their respective PC5 link quality measurement, and forwarded to the source Remote UE higher layer for Relay UE selection.Proposal 18: Load information of U2U relay UE can be included in or with the discovery message for example in the AS information transmitted with the U2U relay discovery message, FFS on how to determine the load information. |
| **R2-2303989**Samsung | Proposal 3. RAN2 is kindly asked to discuss whether the condition on the decision of participating in discovery integrated PC5 unicast link establishment procedure at Relay UE includes AS layer criteria.Proposal 4. RAN2 is kindly asked to discuss whether SL-RSRP or SD-RSRP for relay selection/reselection criteria can be reused as AS layer criteria for participating discovery integrated PC5 unicast link establishment procedure at Relay UE. |
| **R2-2303991**Intel | Proposal 1. With integrated discovery and PC5 link establishment, U2U relay UE decides to forward DCR messages (with relay\_indication) based on first hop PC5 link quality. Proposal 1.1. Relay selection is performed by the target remote UE based on second hop PC5 link quality between itself and the relay UE as well as upper layer criteria. Proposal 2. With model B discovery, relay selection is performed by the source remote UE based on first hop link quality between itself and the relay UE as well as upper layer criteria.  |

**Summary**:

**Condition for discovery message transmission**

6 companies (CATT, Ericsson, ZTE, Vivo, Spreadtrum, Xiaomi) think the condition for discovery message transmission in remote UE is needed. Oppo thinks R17 spec did not differentiate discovery Tx/Rx condition and relay (re)selection condition. And the internal interaction between AS and NAS for relay (re)selection triggering in R17 U2N relay UE was left to UE implementation. Xiaomi thinks it should be UE implementation.

**[ToDis]Proposal 3a: RAN2 to discuss if the condition for triggering discovery message transmission in remote UE should be specified separately from the condition for relay (re)selection.**

**[ToDis]Proposal 3b: If P3a is agreed, RAN2 to discuss if remote UE can trigger a discovery procedure when the direct link falls below a threshold.**

**[ToDis]Proposal 3c: If P3a is agreed, RAN2 to discuss if remote UE can trigger a discovery procedure when the link between the remote UE and the serving relay UE falls below a threshold.**

**Condition for discovery response message transmission**

7 companies including CATT, InterDigital, ZTE, Vivo, Huawei, Spreadtrum, Intel think after a relay UE receives a discovery message from a source remote UE, whether relay UE transmits discovery message e.g solicitation/response message should consider the channel quality between the relay UE and the remote UE transmitting the discover message. The condition can be that the PC5 RSRP between the relay UE and the remote UE is above a configured threshold.

6 companies including ZTE, Vivo, Huawei, Spreadtrum, Oppo, Xiaomi think in Model B, only when PC5 signal strength between the target UE and a relay UE is better than a threshold, the target UE can transmit discovery response message to this relay UE.

**[Easy]Proposal 4a: After a relay UE receives a discovery message from a source remote UE, the relay UE transmits discovery response message or forwards the discovery message for DCR message with integrated Discovery case only if the PC5 RSRP between the relay UE and the source remote UE is above a threshold.**

**[Easy] Proposal 4b: For Model-B discovery, after receiving a discovery message from a relay UE, a target remote UE transmits the discovery response message only if the PC5 RSRP between the target remote UE and the relay UE is above a configured threshold.**

If multiple relay UEs can meet the condition, another issue is whether target remote UE can select one relay UE for response. Xiaomi further points out that a target Remote UE receiving multiple discovery solicitation messages via Relay UEs from the same source Remote UE should respond to all discovery solicitation messages that are from viable candidate Relay UEs, as determined following successful AS and higher layer checks, in order to assist the source Remote UE in the final Relay UE selection. There is no discussion in other contributions. Therefore, no proposal is made for this.

**Relay selection based on discovery**

Some companies e.g Oppo, Xiaomi, Intel, Ericsson further discuss if source remote UE receives multiple responses from multiple relay UE, how to select one relay.

**[ToDis]Proposal 5: For model-B discovery, source remote UE, upon discovery response message reception, selects a relay UE only if the PC5 RSRP towards the relay UE is above a configured threshold.**

## 2.2 Relay (re)selection

### 2.2.1 SL-RSRP and SD-RSRP

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| Tdoc Number | Proposals |
| **R2-2302643**OPPO | Proposal 3 A single threshold is configured for SL-RSRP and SD-RSRP in R18 U2U relay. |
| **R2-2302921**InterDigital | Proposal 8: The same threshold can be used for triggering (re)selection based on either SL-RSRP or SD-RSRP. |
| **R2-2303339**vivo | Proposal 14: If direct comparison between SD-RSRP and SL-RSRP is NOT feasible as confirmed by RAN1/RAN4, different thresholds are configured for SL-RSRP and SD-RSRP in relay UE selection and reselection. |
| **R2-2303388**Apple | Proposal 1 Different thresholds configured for SL-RSRP and SD-RSRP used to trigger U2U relay (re)selection. |
| **R2-2303486**Huawei | Proposal 17: Whether the thresholds configured for SL-RSRP and SD-RSRP should be different is pended to RAN1/RAN4 LS reply. |
| **R2-2303545**CMCC | Proposal 2: Waiting for RAN1 and RAN4 reply on the comparison issue between on SD-RSRP and SL-RSRP firstly, then we can decide whether to configure different thresholds or not. |
| **R2-2303608**China Telecom | Proposal 1 There are no need to be different configured thresholds for SL-RSRP and SD-RSRP. |
| **R2-2304123**MediaTek Inc. | Proposal 1: No need for different configured thresholds for SL-RSRP and SD-RSRP. |
| **R2-2303782**Xiaomi | Proposal 2: In addition to open “FFS if there needs to be different configured thresholds for SL-RSRP and SD-RSRP”, RAN2 are invited to consider whether the threshold(s) for SL-RSRP and SD-RSRP measurements are different for triggering of Relay UE selection compared to the SL-RSRP and SD-RSRP measurements taken to trigger Relay UE reselection. |

**Summary:**

For both relay selection and relay reselection, it is FFS if different configured thresholds for SL-RSRP and SD-RSRP are needed or not. Based on the contributions, the companies are listed as follows. There is no consensus. Considering it is not an urgent case and LS (R2-2302234) related to comparison between SL-RSRP and SD-RSRP has been sent out, Rapp thinks currently we can wait for RAN1/RAN4 LS reply.

* A single threshold: Oppo, InterDigital, CT, MTK
* Different threshold: Apple
* Wait for RAN1/RAN4 LS reply: Vivo, Huawei, CMCC

**[ToDis]Proposal 6: If different configured thresholds for SL-RSRP and SD-RSRP are needed or not can wait for RAN1/RAN4 LS reply.**

### 2.2.2 Co-existence

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 8: U2U relay and U2N relay co-existence can be started only when the U2U relay study is completed. |
| **R2-2302902**Ericsson | Proposal 9 RAN2 does not pursue the co-existence between U2N relays and U2U relays in this release as it is not scope of the work item. |
| **R2-2303608**China Telecom | Proposal 2 In this release, RAN2 does not need to achieve the coexistence between the U2N relay and the U2U relay. |

**Summary:**

The LS reply (R2-2301933) from SA2 on co-existence and L2 ID issue was received. The co-existence between U2N relays and U2U relays can be supported. In last meeting, we have not discussed at details. Based on the contributions, this issue is discussed in only three contributions. Therefore, we can deprioritize the discussion.

**[Deprioritized]Proposal 7: RAN2 does not pursue the co-existence between U2N relay and U2U relay in this release.**

### 2.2.3 Which remote UE can trigger relay selection

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 1: Any remote UE can trigger relay selection when the PC5 RSRP (FFS SL-RSRP or SD-RSRP) of the direct link falling below a threshold. |
| **R2-2302902**Ericsson | Proposal 2: The destination remote UE triggers the relay selection and discovery procedure when the direct link falls below a threshold. |
| **R2-2303004**ZTE, Sanechips | Proposal 5: Each remote UE can trigger relay selection based on the direct link quality. |
| **R2-2303222**Lenovo | Proposal 1: If the remote UE is in coverage, the threshold of triggering relay selection is configured by the serving cell. It is sufficient that only one remote UE is configured with the threshold from power saving point of view.Proposal 2: Considering the case that the remote UE is out of coverage, the threshold of triggering relay selection is preconfigured. That means both remote UEs can trigger relay selection based on the preconfigured threshold. |
| **R2-2303545**CMCC | Proposal 1: Each Remote UE can trigger Relay selection based at least on current hop quality. |
| **R2-2303572**Spreadtrum | Proposal 8: End UE triggers relay selection when: RLF of PC5 link with peer End UE is detected. |

**Summary:**

RAN2 agreed that UE-to-UE relay selection can be triggered based on the PC5 RSRP (FFS SL-RSRP or SD-RSRP) of the direct link falling below a threshold. It is FFS which remote UE (or both) can trigger relay selection. This issue is discussed in 6 contributions. 5 companies support any remote UE can trigger relay selection. Ericsson prefers that the target remote UE can trigger relay selection since the destination remote UE (the one receiving) will be able to measure the PC5 RSRP. Rapporteur thinks the traffic is bi-direction. Therefore, the following proposal is made.

**[ToDis] Proposal 8: Each remote UE can trigger relay selection based on the direct link quality.**

### 2.2.4 Relay selection specific

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 7: If multiple suitable candidates U2U relay UEs which meet both the AS-layer and higher layer criteria are available, it is up to remote UE implementation to choose which U2U relay UE. |
| **R2-2302643**OPPO | Proposal 8:R2 not pursue U2U relay selection criterion based on relay-load/PLMN/gNB/Cell ID. |
| **R2-2302791**Nokia | Proposal 2: As when triggering the relay selection, each UE may provide a list of U2U Relay UE candidates for the other UE to make the U2U relay selection decision for a direct-to-indirect path switch. |
| **R2-2302902**Ericsson | Proposal 2:The destination remote UE triggers the relay selection and discovery procedure when the direct link falls below a threshold.Proposal 3 During relay selection, it is left to source remote UE’s implementation to choose a U2U relay UE to perform PC5 connection establishment when more than one suitable candidate U2U relay UEs meet the AS-layer and higher layer criterion. |
| **R2-2302997**LG Electronics | Proposal 1: The remote UE, in which relay selection/reselection is triggered, has to select one relay UE which is available to both remote UEs.Proposal 2: When relay selection is triggered, the remote UE can initiate relay selection based on the relay discovery procedure.Proposal 3: If the current direct path is usable (e.g., before RLF), the remote UE can initiate the relay selection by providing the candidate relay UE IDs to the target remote UE via a PC5-S message. The target remote UE receiving the PC5-S message can select one relay UE among the candidate relay UEs if that is an available relay UE on the target remote UE side. FFS for detail about measurement reports.Proposal 4: If there is no selectable relay UE among the candidate relay UE IDs, the target remote UE can send the other candidate relay UE IDs to the remote UE via the direct link. FFS for detail about the measurement report. |
| **R2-2303004**ZTE, Sanechips | Proposal 6: U2U relay selection can be triggered based on the SD-RSRP (if ProSe direct discovery message is monitored from the peer remote UE) is below a threshold when there is no direct link between remote UE and the peer remote UE. Proposal 7: When relay selection is triggered, discovery is also triggered at the same time to search for candidate relay UEs. However, relay selection may be not triggered when discovery is performed. |
| **R2-2303088**Sony | Proposal 1: The source UE will send an ordered candidate relay list, according to the preference from source UE’s point of view to destination UE. Proposal 2: A U2U relay UE is considered suitable if the PC5 link quality between source UE and U2U relay UE as well as PC5 link quality between U2U relay UE and destination UE exceeds a (pre)configured threshold.Proposal 3: PLMN ID and cell ID should be considered as the criteria on the selection of U2U relay. |
| **R2-2303222**Lenovo | Proposal 3: When a remote UE performs the relay selection based on the (pre)configured threshold, a PC5 RRC message including the indication of relay selection is sent to peer remote UE.Proposal 4a: When a remote UE performs the relay selection based on the (pre)configured threshold, the remote UE sends a potential list of candidate Relay UEs to the peer remote UE. Proposal 4b: If P4a is not acceptable, RAN2 at least needs to ensure that the selected relay must be the one which has suitable radio connection to both transmitting remote UE and the receiving (peer) remote UEs.Proposal 5: RLF on the direct PC5 link between two remote UEs can also be used to trigger relay selection. |
| **R2-2303608**China Telecom | Proposal 3 For the U2U relay (re)selection, the remote UE may select a relay UE from multiple suitable UEs based on its implementation. FFS on the detailed process. |
| **R2-2303782**Xiaomi | Proposal 9: Candidate U2U Relay UE is considered to meet the AS criteria for selection if its PC5 link quality measurement is above a configured or pre-configured threshold. FFS regarding how to set the Threshold e.g. signalled or preconfigured.Proposal 10: For Model A, source Remote UE selects a Relay UE for which the SL-RSRP/SD-RSRP is above the minimum threshold.Proposal 11: For Model B, target remote UE can select the relay UE for which the SL-RSRP/SD-RSRP is above the minimum threshold and forwards the discovery response message to the selected relay UE. Proposal 12: For Model B, source remote UE can select the relay UE for which the SL-RSRP/SD-RSRP is above the minimum threshold if multiple discovery response messages from the same target remote UE are received from multiple Relay UEs.Proposal 13: A target Remote UE receiving multiple discovery solicitation messages via Relay UEs from the same source Remote UE should respond to all discovery solicitation messages that are from viable candidate Relay UEs, as determined following successful AS and higher layer checks, in order to assist the source Remote UE in the final Relay UE selection.Proposal 14: A source Remote UE receiving multiple discovery response messages from multiple Relay UEs with a PC5 link quality measurement above the PC5 link quality threshold, may rank these Relay UEs. The Relay UE ranking may be according to their respective PC5 link quality measurement, and forwarded to the source Remote UE higher layer for Relay UE selection.Proposal 15: If multiple U2U Relay UEs fulfil the AS and NAS selection requirement, the Remote UE selects the U2U relay UE with the lowest load. |

Note that some proposals in the above table are not included in the summary proposal because only one or two company propose it.

**Summary:**

It was agreed that remote UE triggers relay selection if the direct PC5 link is less than a configured threshold. That means the relay selection may be triggered before RLF happens. The source remote UE can continue communicating with the target remote UE before selecting a suitable relay. 4 companies propose the source remote UE can transmit the candidate relay UE list to target remote UE. Then, target remote UE can select a relay UE for PC5 establishment based on channel quality between target remote UE and the candidate relay UE.

**[Deprioritized] Proposal 9: It is up to SA2 to discuss whether candidate relay UE list should be transmitted from source remote UE to target remote UE after relay selection is triggered in source remote UE.**

4 contributions discuss the issue how to select one candidate relay UE if multiple U2U relay UEs which meet both the AS-layer and higher layer criteria are available. 3 contributions propose that it is up to source remote UE implementation to choose one U2U relay UE. One company prefers to select a suitable relay based on a criteria e.g RSRP based ranking or load information. Rapporteur thinks it is not an urgent issue and a optimized issue. We can discuss it until the discovery/relay selection procedure is stable.

**[Deprioritized]Proposal 10: During relay selection, it is left to source remote UE’s implementation to choose a U2U relay UE to perform PC5 connection establishment when more than one candidate U2U relay UEs meet the AS-layer and upper layer criterion.**

### 2.2.5 Relay reselection specific

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 7: If multiple suitable candidates U2U relay UEs which meet both the AS-layer and higher layer criteria are available, it is up to remote UE implementation to choose which U2U relay UE. |
| **R2-2302791**Nokia | Proposal 4: One of the UEs (either the source End UE or the target End UE) may provide a list of U2U Relay UE candidates for the other UE to make the U2U relay reselection decision for an indirect-to-indirect path switch. |
| **R2-2302921**InterDigital | Proposal 11: Aside from prioritization of direct link and existing PC5-RRC connection, a UE can select any relay (up to UE implementation) having RSRPs in both hops above a threshold. |
| **R2-2302997**LG Electronics | Proposal 5: If the current indirect path is usable (e.g., before RLF), the remote UE can initiate the relay reselection by providing the candidate relay UE IDs to the target remote UE via a PC5-S message. The target remote UE receiving the PC5-S message can select one relay UE among the candidate relay UEs if that is an available relay UE on the target remote UE side. FFS for detail about the measurement report.Proposal 7: When relay reselection is triggered and the current indirect path is not usable, the remote UE, which triggered relay reselection can initiate either the discovery message transmission procedure or the discovery procedure integrated into PC5 unicast link establishment.Proposal 8: If the remote UE and the target remote UE trigger relay selection/reselection simultaneously and each end remote UE selects each different relay UE for communicating each other, RAN2 expects at SA2/CT1 will handle this case. Proposal 10: If both PC5-RSRPs, one is for the PC5-RSRP between remote UE and relay UE in the 1st-hop and the other is for the PC5-RSRP between relay UE and the target remote UE in the 2nd-hop, are above a pre-defined threshold, the remote UE can trigger path switching from indirect path to the direct path. |
| **R2-2303088**Sony | Proposal 1: The source UE will send an ordered candidate relay list, according to the preference from source UE’s point of view, to destination UE. Proposal 2: A U2U relay UE is considered suitable if the PC5 link quality between source UE and U2U relay UE as well as PC5 link quality between U2U relay UE and destination UE exceeds a (pre)configured threshold.Proposal 3: PLMN ID and cell ID should be considered as the criteria on the selection of U2U relay. |
| **R2-2303222**Lenovo | Proposal 4a: When a remote UE performs the relay selection based on the (pre)configured threshold, the remote UE sends a potential list of candidate Relay UEs to the peer remote UE.  |
| **R2-2303608**China Telecom | Proposal 3 For the U2U relay (re)selection, the remote UE may select a relay UE from multiple suitable UEs based on its implementation. FFS on the detailed process.Proposal 4-b Relay UE with the established unicast link is prioritized over other Relay UEs in the candidate list.Proposal 5 Introduce the relay selection threshold value to determine a suitable relay UE achieving E2E U2U transmission. |

**Summary:**

It was agreed that UE-to-UE relay reselection can be triggered based on the PC5 RSRP between a remote UE and the relay UE falling below a threshold. The relay reselection may be triggered before RLF happens. The source remote UE can continue communicating with the target remote UE before selecting another relay. 4 companies propose the source remote UE can transmit the candidate relay UE list to target remote UE UE. It could be helpful for target remote UE to select a suitable relay UE for PC5 establishment.

**[Deprioritized] Proposal 11: RAN2 confirms that the source remote UE can transmit the candidate relay UE list to the target remote UE via relay UE after relay reselection is triggered in the source remote UE.**

Same as relay selection case, some contributions discuss how to select a relay UE during relay reselection if multiple candidate relay UEs meet the AS and upper layer condition. Similar proposals as relay selection happen in relay reselection. Rapporteur thinks it is not an urgent issue as well. We can discuss it until the discovery/relay reselection procedure is stable. The similar proposal is made as follows.

**[Deprioritized] Proposal 12: During relay reselection, it is left to source remote UE’s implementation to choose a U2U relay UE to perform PC5 connection establishment when more than one candidate U2U relay UEs meet the AS-layer and upper layer criteria.**

### 2.2.6 Source remote UE and second hop

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| Tdoc Number | Proposals |
| **R2-2302643**OPPO | Proposal 2 Relay UE does not forward AS link quality degradation of one hop to the peer remote UE of the other hop. |
| **R2-2302902**Ericsson | Proposal 5 U2U relay can indicate to the destination remote UE when the link between the source remote UE and U2U relay is below a threshold. The destination remote UE can then trigger relay reselection and discovery procedure. |
| **R2-2302997**LG Electronics | Proposal 9: PC5 RSRP between relay UE and target remote UE can be delivered via PC5-RRC message from the relay UE to the source remote UE. |
| **R2-2303339**vivo | Proposal 12: There is no need to consider the second hop quality (between U2U relay and remote UE2) by remote UE1 to trigger relay reselection because the second hop quality is already considered by remote UE2 as its current hop quality.Proposal 13: After relay reselection triggering by remote UE1, the PC5-RSRP between the relay UE and remote UE2 should be considered by remote UE2, e.g. remote UE2 would decide the relay UE to be selected when PC5-RSRP between a relay UE and remote UE2 is above a threshold. |
| **R2-2303222**Lenovo | Proposal 6: Once the second (receiving) remote UE detects the PC5 link between the relay UE and the second(receiving) remote UE is less than the threshold associated with relay reselection, the second(receiving) remote UE indicates to the relay UE. Then, the relay UE transmits the indication to the first (transmitting) remote UE. Proposal 8: If the threshold for triggering relay reselection can be (pre)configured to the relay UE, the relay UE can transmit the indication of relay reselection to the first (transmitting) remote UE once the relay UE detects the PC5 link between the relay UE and the second (receiving) remote UE is less than the threshold.  |
| **R2-2303572**Spreadtrum | Proposal 9: End UE triggers relay reselection when an indication is received from relay which indicates that the PC5 link quality between relay UE and the peer End UE is below a configured threshold. |
| **R2-2303648**Kyocera | Proposal 4 RAN2 should consider which metric should be used by the relay UE to inform the source remote UE/target remote due to drop in quality on the second hop. |
| **R2-2304074**Sharp | Proposal 8. For triggering condition of U2U relay UE reselection, UE should consider channel quality of second hop.Proposal 9. Relay UE can transmit an information related PC5 RSRP between Relay UE and peer UE.Proposal 10. RAN2 to discuss whether to support the negotiated relay reselection procedure.Proposal 11. Even U2U relay UE (re)selection other than negotiated relay reselection, UE should consider channel quality of both hops. |
| **R2-2303004**ZTE, Sanechips | Proposal 8: The PC5 link quality of the second hop between the relay UE and the peer remote UE may be used for triggering relay re-selection by the remote UE, when there is only uni-directional data from the peer remote UE to the remote UE.Proposal 9: Relay UE sends indication to the remote UE upon detecting the PC5 link quality of the second hop is below a configured threshold. When receiving the indication, the remote UE may trigger relay re-selection even the PC5 link quality of the first hop is good. |

**Summary:**

After relay link has been established already, whether the second hop information e.g channel quality should be transmitted to the source remote UE in the first hop is discussed in some contributions. 7 companies propose that the information related to second hop should be transmitted to the source remote UE via relay UE. Oppo and Vivo think it is not needed.

**[ToDis]Proposal 13: RAN2 to discuss if U2U relay can indicate one of the following information related to the second hop to the source remote UE after relay link between source remote UE and target remote UE has been established.**

* **An indication to indicate that the link between the target remote UE and U2U relay is below a threshold.**
* **PC5 RSRP of second hop between relay UE and target remote UE.**

### 2.2.7 Fallback to direct path

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| Tdoc Number | Proposals |
| **R2-2302791**Nokia | Proposal 6: RAN2 considers specifying triggers at least for indirect-to-direct path switch related to U2U relay. |
| **R2-2302902**Ericsson | Proposal 6 During relay reselection, it is left to source remote UE’s implementation to choose either the direct link or an indirect link. |
| **R2-2302921**InterDigital | Proposal 9: (Re)selection should prioritize a direct link over a relayed link. FFS on details. |
| **R2-2302997**LG Electronics | Proposal 11. Even though not considering the lossless path switching, the remote UE performing U2U relay can switch from the indirect path to the direct path by releasing and adding SLRB via the RRCReconfigurationSidelink message. |
| **R2-2303222**Lenovo | Proposal 9: Remote UE can switch back from the U2U relay operation to direct PC5 link if PC5 signal strength condition of direct PC5 link between two remote UEs is better than a threshold. |
| **R2-2303339**vivo | Proposal 15: RAN2 to discuss which interpretation is the correct understanding and send a LS to SA2 to confirm.- Interpretation 1: UE can compare or select from direct link and indirect link based on two PC5-RSRPs even the two links are using different L2 ID pair;- Interpretation 2: UE cannot compare or select from direct link and indirect link based on two PC5-RSRPs because the two links are using different L2 ID pair. |
| **R2-2303608**China Telecom | Proposal 4-a The direct link between the two remote UEs is prioritized over any indirect link. |
| **R2-2303648**Kyocera | Proposal 9 RAN2 should consider if U2U path switch between direct path and indirect path can be supported. |

**Summary:**

The reselection from relay link to direct link is discussed in 8 contributions. 7 companies support the switching from relay link to direct link. However, Vivo points out that the Layer2 IDs of the remote UE is different for U2U Relay service and Non-relay service. Therefore, source remote UE cannot determine two different L2 IDs for U2U Relay service and Non-relay service are belonging to the same UE. Therefore, RAN2 needs to consult with SA2. Rapporteur thinks the same situation Vivo mentioned may happen in the switching case from direct link to relay link. Informing SA2 may be necessary.

**[ToDis]Proposal 14a: During relay reselection, reselection towards direct link is supported.**

**[ToDis]Proposal 14b: If P14a can be agreed, RAN2 to discuss whether AS criterion is needed for switching back from indirect to direct link .**

### 2.2.8 Different relay UEs are selected by two remote UEs.

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| Tdoc Number | Proposals |
| **R2-2303004**ZTE, Sanechips | Proposal 10: RAN2 send LS to SA2 to ask for the issue that two relay UEs are selected and initiated for relay link establishment simultaneously. |
| **R2-2302997**LG Electronics | Proposal 8: If the remote UE and the target remote UE trigger relay selection/reselection simultaneously and each end remote UE selects each different relay UE for communicating each other, RAN2 expects at SA2/CT1 will handle this case.  |
| **R2-2303339**vivo | Proposal 11: Leave the decision to SA2 of whether/how to handle the case that relay reselection is triggered simultaneously at both remote UE1 and remote UE2. Send a LS to SA2 to inform this if agreed. |

**Summary:**

RAN2 agreed each remote UE can trigger relay (re)selection based on the current hop/direct link quality. 3 companies think since each remote UE can trigger relay (re)selection, two different relay UEs may be selected by the two remote UEs individually. If the two remote UE initiate hop-by-hop/E2E PC5 unicast link simultaneously, they may connect to each other with two relay UEs, which is not aligned with the WID that a remote UE is connected to only a single relay UE at a given time for a given destination UE. Rapporteur thinks some issues related to discovery procedure are still under RAN2 discussion. RAN2 can decide whether the case may happen when the discovery procedure is stable. Therefore, this proposal can be deprioritized for this meeting.

**[ToDis]Proposal 15: RAN2 to discuss if two remote UE may select two different relay UEs for communicating each other. If yes, send LS to inform SA2.**

## 2.3 Resource allocation

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 6: The resource allocation mechanism for U2U relay discovery scenario should follow the Rel-16 principle. |
| **R2-2303004**ZTE, Sanechips | Proposal 3: Both mode 1 and mode 2 resource allocation are supported for RRC\_CONNECTED U2U UEs. RRC\_CONNECTED U2U UEs acquire discovery resource configuration from dedicated signalling as legacy.  |
| **R2-2303339**vivo | Proposal 9: RAN2 to agree that the same dedicated discovery resource pool (defined in Rel-17), if configured, can be used for non-relay discovery, U2N relay discovery and/or U2U relay discovery as baseline. Can be revisited if any impact on co-existence between U2N/U2U. |
| **R2-2303486**Huawei | Proposal 19: Following Rel-16/Rel-17 mechanism, if SIB12 does not provide discovery Tx resource pool, the end UEs or relay UEs in RRC\_IDLE/RRC\_INACTIVE should enter RRC\_CONNECTED state and obtain discovery resource configuration from dedicated signalling. |
| **R2-2303989**Samsung | Proposal 6. RAN2 is kindly asked to confirm that both shared and dedicated resource pool can be used to transmit the discovery integrated into PC5 unicast link establishment procedure. |
| **R2-2302921**InterDigital | Proposal 2: Discovery transmission can be performed using either mode1 or mode 2, as in legacy.  |

**Summary**:

3 companies including CATT, ZTE and InterDigital propose that both mode1 and mode2 can be used for discovery transmission. Rapporteur notices that resource allocation is discussed in more contributions which is not limited to discovery. Therefore, the proposal will be made below.

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| Tdoc Number | Proposals |
| **R2-2303005**ZTE, Sanechips | Proposal 7: RAN2 discuss how RRC\_CONNECTED U2U UE performs relay (re)selection, operates the same as RRC\_IDLE/INACTIVE/OoC UE or is controlled by gNB.Proposal 8: In U2U relay, gNB controls RRC\_CONNECTED UEs via dedicated signalling at least in the following procedures: mode1 and mode2 RA, discovery resource configuration, SLRB/PC5 RLC channel configuration. |
| **R2-2302643**OPPO | Proposal 22 Introduce indication(s) in SIB message for the network capability on U2U service.Proposal 23 RAN2 to discuss support Mode-1 resource allocation for L2 and L3 U2U remote/relay UE.Proposal 24 For RRC CONNECTED UE, RAN2 to discuss whether to support dedicated configuration or rely on the configurations in SIB for L2 U2U relay SLRB configuration.Proposal 25 RAN2 to discuss L2 U2U relay and remote UE reports the UE role to network.Proposal 26 Besides the AS layer criterion for U2U relay reselection, R2 not pursue further AS-layer spec impact for relay reselection, but just rely on the higher layer procedure defined by SA2. |
| **R2-2302902**Ericsson | Proposal 7 For in-coverage scenarios, the U2U relay relay (re-)selection procedure are purely UE-based procedures with no gNB assistance/involvement required.Proposal 8 For in-coverage UEs in RRC\_CONNECTED state, the gNB does not provide a dedicated configuration for relay (re-)selection. Such configurations can be acquired from the cell-specific configuration or preconfiguration. |
| **R2-2303339**vivo | Proposal 3: Resource allocation mode-1 and mode-2 are supported in U2U relay for both remote UEs and relay UE. |
| **R2-2303486**Huawei | Proposal 19: Following Rel-16/Rel-17 mechanism, if SIB12 does not provide discovery Tx resource pool, the end UEs or relay UEs in RRC\_IDLE/RRC\_INACTIVE should enter RRC\_CONNECTED state and obtain discovery resource configuration from dedicated signalling. |
| **R2-2303608**China Telecom | Proposal 7 Mode-1 and/or mode-2 can be supported in different U2U relay coverage scenarios for remote UEs and relay UE. |

**Summary:**

For RRC CONNECTED UE, some configuration e.g mode1, discovery resource configuration, SLRB/PC5 RLC channel configuration can be controlled by gNB. Regarding discovery resource configuration, we already have a proposal for it. 4 companies support to have mode 1 and mode 2 RA for both remote UE and relay UE. How to configure SLRB/PC5 RLC channel configuration can be discussed in end-to-end PC5 RRC section. In addition, the proposal for discovery case will also be considered here.

**[Easy]Proposal 16: Both mode-1 and mode-2 resource allocation can be supported on both remote UE and relay UE in U2U relay case.**

## 2.4 Authorization (SA2 LS)

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| Tdoc Number | Proposals |
| **R2-2303005**ZTE, Sanechips | Proposal 9: From RAN2’s perspective, authorization for L2 U2U relay/remote UE is needed. While authorization for L3 U2U relay/remote UE is not needed. |
| **R2-2303339**vivo | Proposal 4: From RAN2’s point of view, the authorization information regarding whether the UE is authorized to act as a 5G ProSe Layer-3 UE-to-UE Relay or Layer-3 U2U UE, is not needed. FFS for Layer-2 UE-to-UE relay and Layer-2 U2U UE.Proposal 5: If Proposal 4 is agreed, send a reply LS to SA2 on authorization. |
| **R2-2303388**Apple | Proposal 4 RAN2 reply to SA2 that ProSe authorization for U2U relay is still needed between AMF and NG-RAN.Proposal 5 No need to differentiation Layer 2 and Layer 3 in U2U relay authorization. |
| **R2-2303486**Huawei | Proposal 20: Reply to SA2/RAN3 that the authorization info is needed for U2U relay operation. |

**Summary:**

The reply to SA2 LS has been postponed by three meetings. In RAN2#119bis meeting, we have an email discussion for it. If any special control for RRC\_CONNECTED remote or relay UE in UE-to-UE relay is needed, the authorization is needed. Some companies think authorization information is useful for gNB to decide which resource allocation mode is selected if both mode-1 and mode-2 are supported. Regarding discovery configuration, there is no U2U specific configuration even the discovery configuration is provided by dedicated signaling. Therefore, we can discuss whether the authorization for U2U is needed or not after we discuss whether mode1 can be supported.

**[ToDis]Proposal 17: RAN2 to discuss if the authorization information is needed for L2/L3 U2U relay operation.**

## 2.5 SRAP design and E2E PC5 link

### 2.5.1 Bearer Multiplexing

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| Tdoc Number | Proposals |
| **R2-2302643**OPPO | Proposal 9 The SRAP for L2 U2U relay supports multiplexing of the different bearers from the same and/or different remote UEs into the same RLC channel. |
| **R2-2302701**Intel | Proposal 1. Agree to support multiplexing of different destinations in the same RLC channel. Revisit the agreement if SA2 does not update TS23.304 for Layer-2 U2U relaying (consistent with L3 U2U relaying update). |
| **R2-2302791**Nokia | Proposal 7: L2 U2U relay supports multiplexing of data in the same RLC channel from/to a source End UE to/from different target End UEs between the source End UE and a serving U2U relay UE or data to/from a target End UE from/to different source End UEs between a serving U2U relay UE and the target End UE. |
| **R2-2302836**Ericsson | Proposal 8 RAN2 to discuss the issue of multiplexing of data at the MAC-layer when the LCHs are associated with different (final) destination remote UEs. |
| **R2-2302922**InterDigital | Proposal 13: Traffic for multiple destination UEs can be multiplexed by a remote UE on the same SL-RLC channel on the first hop.  |
| **R2-2302997**LG Electronics | Proposal 15. The rel-17 SRAP header structure can be reused for supporting the multiplexing of different destinations in the same RLC channel in the 1st-hop.Proposal 16. The rel-17 SRAP header structure be reused for supporting the multiplexing of different sources in the same RLC channel in the 2nd-hop. |
| **R2-2303005**ZTE, Sanechips | Proposal 1a: If the same PC5 unicast link is used between source remote UE and relay UE when the source remote UE communicates with different destination UEs through the same relay UE, multiplexing of different destinations in the same RLC channel is supported.Proposal 1b: If the same PC5 unicast link is used between relay UE and destination UE when different source remote UEs communicate with the same destination UE through the same relay UE, multiplexing of different sources in the same RLC channel is supported. |
| **R2-2303012**Fujitsu | Proposal 1: Multiplexing of different destinations in the same RLC channel is supported in Source Remote UE. |
| **R2-2303222**Lenovo | Proposal 10: In U2U relaying, multiplexing of sidelink data by the transmitter remote UE towards more than one Rx remote UE served by the same relay node into a TB is supported.Proposal 11: In U2U relaying, the multiplexing data from the different transmitting remote UEs towards the same destination UE at the relay UE is supported. |
| **R2-2303340**Vivo | Proposal 1 RAN2 to send LS to SA2 for confirmation on the support of shared link for L2 U2U relay.Proposal 2 RAN2 to support multiplexing of different destinations in the same RLC channel for both of the following two cases, if shared link for L2 U2U relay is supported by SA2.- Case 1: the same RLC channel over 1st hop (between Source Remote UE and Relay UE) used for multiplexing data terminated to different Target Remote UEs - Case 2: the same RLC channel over 2nd hop (between Relay UE and Target Remote UE) used for multiplexing data originated from different Source Remote UEs |
| **R2-2303388**Apple | Proposal 6 Allow multiplexing traffic to different remote SL destinations in the same PC5 Relay RLC channel.Proposal 7 SRAP header with different IDs (source and destination UE ID) as baseline. FFS on the need of support of pair-based local ID.Proposal 8 Include both source and remote UE addresses in the SRAP header of both hops, because SA2 assumption on L2 ID separation prevents relay UE from regenerating SRAP header from L2 IDs used in the lower layer headers. |
| **R2-2303486**Huawei | Proposal 1: Multiplexing of different destination end UEs in the same RLC channel should be supported for L2 U2U relay operation, and the end UE ID in adaptation header is used to differentiate different E2E unicast link (i.e. the link between one source end UE and one destination UE). |
| **R2-2303545**CMCC | Proposal 4: Multiplexing of different destinations in the same RLC channel is not supported in this release. |
| **R2-2303572**Spreadtrum | Proposal 12: RAN2 supports multiplexing of different sources/destinations in the same RLC channel. |
| **R2-2303608**China Telecom | Proposal 10 For the scenario of U2U relay, one or more Source UEs can connect to one target UE with one relay UE or one Source UE can connect to more than one target UE with one relay UE may be supported in RAN2. |
| **R2-2303934**ASUSTeK | Proposal 2 Multiplexing of different destinations in the same egress PC5 RLC channel is supported for L2 UE-to-UE Relay. |
| **R2-2304123**MediaTek Inc. | Proposal 2: Support multiplexing of different destinations into the same RLC channel as long as there is overlapping on the whole path. |

**Summary:**

We discussed if multiplexing of different destinations in the same RLC channel can be supported in last meeting. Unfortunately, there is no consensus. Based on the contribution, Intel, Nokia, InterDigital, LG, ZTE, Fujitsu, Lenovo, Vivo, Apple, Huawei, Spreadtrum, China Telecom, ASUSTeK and MediaTek support to multiplex the different destination in the same RLC channel of first hop.

ZTE and Vivo further point out that the same PC5 unicast link should be used between source remote UE and relay UE to ensure multiplexing. Rapporteur agrees with it since PC5 RRC connection and PC5 unicast link is one-to-one operation. However, Rapporteur thinks it is up to upper layer of UE. Therefore, the corresponding description will not be included in the proposal. But fine to discuss if a LS for SA2 is needed or not.

CMCC does not support to multiplex based on the consideration that ‘Compared with multiplexing different RLC channels into the same TB, we don’t see any strong motivation or benefit from the FFS proposal.’. Rapporteur thinks the packet from multiplexing of different destinations in the same RLC channel is also included in a same TB.

Ericsson proposes multiplexing of different destinations should be realized in MAC layer based on the following concern for multiplexing at SRAP layer.

* As the different logical channels are associated with different (final) destination remote UEs, it is possible that low priority transmissions get a treatment above its indicated priority. Thereby degrading the performance of the other UEs in the system. In addition, as the source remote UE can communicate with multiple final destinations further exacerbating the problem.
* For mode-2, the selection window (sl-SelectionWindow-r16) is configured independently for each priority value (sl-Priority-r16). In which case, it is possible that the sl-SelectionWindow-r16 are different for different (final) destination remote UEs i.e., T1 for destination remote UE1, T2 for destination remote UE2 and T1 < T2. The source remote UE can select resources for transmission using T2 in which case multiplexing would of data could result in the PDB not being satisfied for one of the (final) destination remote UEs. The same is also applicable for the case when a high priority data arrives for a different (final) destination UEs.

**[ToDis]Proposal 18a: RAN2 to agree multiplexing of different destinations in the same RLC channel is supported.[14:2]**

**[ToDis]Proposal 18b: If P18a is agreed, RAN2 to discuss if LS to SA2 is needed to ensure that the same PC5 unicast link is used between source remote UE and relay UE when the source remote UE communicates with different destination UEs through the same relay UE.**

Some contributions also discuss if L2 U2U relay supports multiplexing of the different bearers from the same and/or different remote UEs into the same RLC channel. Based on the contributions, Oppo, Nokia, LG, ZTE, Lenovo, Vivo, Spreadtrum, China Telecom think multiplexing of the different bearers from the same and/or different remote UEs into the same RLC channel can be supported.

**[ToDis]Proposal 18c: RAN2 to discuss if multiplexing of the different bearers from the different source remote UEs into the same RLC channel in the second hop is supported.**

### 2.5.2 Bearer mapping and SRAP design

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| Tdoc Number | Proposals |
| **R2-2302492**NEC | Proposal-1: The U2U SRAP sublayer is only for the purpose of bearer mapping.Proposal-2: The identity information of source U2U Remote UE end-to-end Radio Bearer and a local Remote UE ID are included in the SRAP header in order for the target Remote UE to correlate the received packets for the specific PDCP entity associated with the right end-to-end Radio Bearer. Proposal-3: Destination Remote UE ID or a local ID is included at SRAP data header to support bearer mapping for end-to-end UE-to-UE traffic for first hop.Proposal-4: The identity information of source Remote UE is not included in the adaptation layer header of first hop assuming there is mapping at Relay UE.Proposal-5: The U2U Relay UE configures source and target Remote UEs with the local UE identities. |
| **R2-2302601**CATT | Proposal 12：RAN2 confirm relay UE determines the egress RLC channel based on the mapping from the E2E bearer ID to egress RLC channel, for a particular target remote UE.Proposal 13: For U2U relay, PC5 adaptation layer header should include: source remote UE L2 ID, target remote UE L2 ID and BEARER ID. Considering the overhead, a mapping from the combination of source remote UE L2 ID and target remote UE L2 ID to a shorter link identifier is needed in Rel-18 U2U relay. |
| **R2-2302643**OPPO | Proposal 9 The SRAP for L2 U2U relay supports multiplexing of the different bearers from the same and/or different remote UEs into the same RLC channel.Proposal 10 R2 discuss including IDs of both end-UEs in the adaptation layer.Proposal 11 R2 discusses using 24-bit L2 ID as the UE ID to be included in SRAP header. |
| **R2-2302701**Intel | Proposal 1.1. Agree that destination remote UE ID is included within the SRAP header for support of L2 U2U relaying. Proposal 2. Both source UE ID and destination UE ID are included in the SRAP header for U2U relaying.Proposal 2.1. The L2 U2U relay UE does not do any mapping based on the UE IDs in the SRAP header. Proposal 3. U2U relay UE assigns the 8-bit local UE ID for source remote UE and target remote UE involved in UE-to-UE relaying.  |
| **R2-2302791**Nokia | Proposal 8: The Local ID identifies a pair of the source and target End UEs on SRAP level over each hop in the L2 U2U relay connection.Proposal 9: The Local ID is unique per hop and specific to each hop.Proposal 10: RAN2 adopts a single 8-bit Local ID that is included in the SRAP header.Proposal 11: The assignment of the Local ID is hop-by-hop.Proposal 12: The assignment of the local ID is initiated by either the source End UE or the target End UE whichever makes decision on the U2U relay (re)selection. |
| **R2-2302836**Ericsson | Proposal 1 U2U relay determines the egress RLC channel based on mapping from a SRC UE’s E2E bearer ID to egress RLC channel of a particular DST UE.Proposal 2 SRC ID should be included in the adaptation layer in the first and second hop.Proposal 3 Local IDs are used to identify the SRC and DST UEs.Proposal 4 Different local IDs are assigned to the SRC and DST UEs.Proposal 5 The U2U relay assigns the local ID for the SRC and DST UEs. |
| **R2-2302922**InterDigital | Proposal 14: Include both UE IDs (e.g., source and destination L2 UE IDs) in the adaptation layer header on both hops. Proposal 15: Adaptation layer mapping for ingress unicast link/L2 ID pair to egress unicast link/L2 ID pair is configured by upper layers. Proposal 16: Adaptation layer mapping for ingress LCH to egress LCH is (pre)configured based on the QoS profile of the end-to-end bearer. FFS whether obtained by the TX remote UE or the relay UE. |
| **R2-2302997**LG Electronics | Proposal 12: For reducing the overhead of the SRAP header, only one local ID can be included in the SRAP header. In other words, the local ID mapped to the target remote UE includes in the 1st-hop SRAP header. The local ID mapped to the source remote UE includes in the 2nd-hop SRAP header.Proposal 13: A common local ID for a pair between source and target remote UE can reduce the load of the relay UE. Relay UE can deliver a traffic packet including a common local ID as it is from the source remote UE to the target remote UE.Proposal 14: We prefer that relay UE assigns the local ID for the source remote UE and the target remote UE for preventing to be assigned duplicated local IDs. |
| **R2-2303005**ZTE, Sanechips | Proposal 2: It is suggested that both source UE L2 ID and destination UE L2 ID are included in the adaptation header.Proposal 3: Relay UE determines the egress RLC channel based on the mapping from the ingress RLC channel to egress RLC channel, for a particular source-destination remote UE pair. |
| **R2-2303012**Fujitsu | Proposal 2: The egress PC5-RLC channel in Relay UE is differentiated for each Destination remote UE. Proposal 3: The transmission SRAP entity in Relay UE delivers data for different Destination remote UEs to different egress PC5-RLC channels.Proposal 4: Destination Remote UE ID is included in the adaptation layer in the 1st hop and Source Remote UE ID is included in the adaptation layer in the 2nd hop, and Relay UE does a mapping.Proposal 5: The Source Remote UE ID or the Destination Remote UE ID is a local/temporary UE ID. Proposal 6: The Source Remote UE ID and the Destination Remote UE ID are allocated by Relay UE. |
| **R2-2303336**Samsung | Proposal 1. SRAP functions for U2N case also apply to the U2U case, while bearing in mind that determination of UE ID field function in the U2N case may mean determination of a pair identifier in the U2U case or a destination UE identifier.Proposal 2. Source UE inserts the ID of the Destination UE or the pair ID into the SRAP header. RAN2 to decide which option will be supported in Rel-18.Proposal 3. For the case where the Source UE inserts the ID of the Destination UE, RAN2 to discuss whether Source UE also inserts its own ID into the SRAP header.Proposal 4. The SRAP function of ‘Determination of SRAP ID field and BEARER ID field for data packets’ needs to be modified according to Proposals 2 and 3.Proposal 5. For the case where the Source UE inserts the pair ID into the SRAP header, RAN2 to discuss using the PC5 Link Identifier for this purpose.Proposal 6. RAN2 to discuss handling of collision in the {SRC UE ID, DST UE ID} pair ID space.Proposal 7. RAN2 to discuss self-assignment of SRAP IDs by Remote UEs.Proposal 8. RAN2 to discuss assignment of SRAP IDs by Remote UEs or Relay UEs to other Remote UEs.Proposal 9. RAN2 to discuss handling of potential mismatch of per-hop SLRB configurations for the case of QoS handling for bearer multiplexing. |
| **R2-2303340**Vivo | Proposal 3 If signalling overhead is the most import metric in Rel-18 single-hop scenario, adopt Option 1 (i.e., one local UE ID over first and second hop) in the adaptation layer header. Otherwise, adopt Option 3 (i.e., two L2 IDs over first and second hop).Proposal 4 If local UE ID is used in the PC5 adaption layer header, the Relay UE is responsible to allocate the local UE ID for the remote UE. FFS detailed signalling procedure.Proposal 5 If local UE ID is used in the PC5 adaption layer header, the local UE ID to be included over the first and second hop can be different, i.e.:* The Relay UE allocates a local UE ID based on the numbering of Target Remote UE(s) and include it over the first hop
* The Relay UE allocates a local UE ID based on the numbering of Source Remote UE(s) and include it over the second hop
 |
| **R2-2303388**Apple | Proposal 7 SRAP header with different IDs (source and destination UE ID) as baseline. FFS on the need of support of pair-based local ID.Proposal 9 Support SRAP control PDU design to enhance the relay UE’s operation of end-to-end radio bearer. Details of Control PDU(s) can be further discussed. |
| **R2-2303486**Huawei | Proposal 2: For L2 U2U relay, before the E2E PC5 link establishment, the local ID should be assigned on each hop via per-hop PC5-RRC message. Proposal 3: For L2 U2U relay, the Tx end UE allocates local ID for Rx end UE on each direction. Proposal 4: The UE identification carried in adaptation layer on the hop between one end UE#x and the Relay UE is a UE ID which can uniquely identify the peer end UE#y in the scope of the end UE#x.Proposal 5: The E2E bearer identification should be able to identify E2E SL-DRBs and E2E SL-SRBs which carry E2E PC5-S messages and E2E PC5-RRC messages.Proposal 6: For L2 U2U relay, the adaptation layer header includes Local ID and bearer ID in the same format of SRAP as defined for U2N relay in Rel-17. |
| **R2-2303506**Qualcomm | Proposal 1: Relay UE determines the egress RLC Channel based on the mapping of E2E bearer and egress RLC Channel mapping, which is same as U2N relay.Proposal 2: RAN2 should comply with the principle that forward compatibility for supporting multi-hop U2U relay should be taken into account.Proposal 3: RAN2 does not pursue the Layer-2 ID as ID format in adaptation layer.Proposal 4: To use local ID in adaptation layer to present the S-UE/D-UE pair (i.e. presenting the D-UE on the first hop and the S-UE on the second hop).Proposal 5: The local ID is unique within one PC5 link.Proposal 6: The Relay UE maintains the mapping from ingress local ID on the previous hop to egress local ID on the next hop, and replace the ingress local ID with egress local ID.Proposal 7: Relay UE assigns local ID for each hop and notifies the S-Remote-UE or the D-Remote-UE using PC5-S message. |
| **R2-2303545**CMCC | Proposal 5: Both source UE ID and destination UE ID should be contained in the adaptation layer header.Proposal 6: Local UE ID mechanism is needed to reduce signalling overhead in R18 L2 U2U relay and R17 U2N relay mechanism can be reused.Proposal 7: The destination UE takes the role for local UE IDs allocation. FFS when for destination UE to allocate local UE IDs. |
| **R2-2303572**Spreadtrum | Proposal 13: For UE-to-UE relay, adaptation layer header should include local UE ID of the source End UE and local UE ID of the target End UE.Proposal 15: For E2E SL-SRB, dedicated configuration/SIB/pre-configuration is used for the configuration of PC5 RLC channels of both hops. |
| **R2-2303608**China Telecom | Proposal 8 For the U2U relay, the local IDs for each hop are needed to distinguish the S-Remote-UE and D-Remote-UE.Proposal 9 For the U2U relay, the local IDs should be assigned by the relay UE, details are FFS. |
| **R2-2303782**Xiaomi | Proposal 19: Multiplexing of different destinations in the same RLC channel is supported. Proposal 20: The IDs mappable to the source and destination remote UE are different IDs. Proposal 21: Include both source and destination UE IDs in the SRAP header.  |
| **R2-2303934**ASUSTeK | Proposal 1 In L2 UE-to-UE Relay, separate PC5 RLC channels are used for transmitting (1) per-hop PC5-S messages between ProSe end UE and U2U Relay UE and (2) E2E PC5-S messages between ProSe end UEs via U2U Relay UE.Proposal 3 SRAP header contains an 8-bit UE ID field for supporting L2 UE-to-UE Relay.Proposal 4 Different UE IDs are used in the SRAP header, and U2U Relay UE modifies the ID mappable to the destination remote UE in the SRAP header to the ID mappable to the source remote UE before sending the SRAP packet to the destination remote UE.Proposal 5 U2U Relay UE assigns the ID mappable to the destination remote UE and provides it to the source remote UE in a RRCReconfigurationSidelink message.Proposal 6 U2U Relay UE assigns the ID mappable to the source remote UE and provides it to the destination remote UE in a RRCReconfigurationSidelink message. |
| **R2-2304123**MediaTek Inc. | Proposal 3: Include both source and destination UE ID into the adaptation layer.Proposal 4: Using 24-bit L2 ID as the UE ID to be included in SRAP header. |

**Summary:**

In the last meeting, it was agreed that Remote UE determines the egress RLC channel based on the mapping from the E2E bearer ID to egress RLC channel, for a particular target Remote UE. One issue to be discussed is how the Relay UE determines the egress RLC Channel, and there could be two potential options. ZTE supports option1. 3 companies support option 2 because it is same as L2 U2N case.

* Option 1: mapping from E2E bearer ID to egress RLC channel
* Option 2: mapping from ingress RLC channel to egress RLC channel

**[ToDis]Proposal 19: RAN2 to discuss if Relay UE determines the egress RLC Channel based on the mapping of E2E bearer ID and egress RLC Channel mapping as L2 U2N relay.**

Another issue is SRAP header design. RAN2 has already discussed the SRAP header design assuming multiplexing of different destinations in the same RLC channel is supported in last meeting. Unfortunately, it is still FFS. According to the contributions for this meeting, the possible options are listed as follows.

* Option 1: Target remote UE ID in first hop and source remote UE ID in second hop. FFS 24-bit layer-2 ID or local ID.
	+ NEC (local ID), Fujitsu (Local ID) , Huawei (Local ID), QC (Local ID), ASUSTeK(Local ID), Vivo
* Option 2: Both source remote UE ID and target remote UE ID included in each hop. FFS 24-bit layer-2 ID or local ID
	+ CATT (local ID) , Intel (Local ID), Oppo (layer-2 ID), CMCC (Local ID), Spreadtrum(Local ID), Xiaomi (Local ID), ZTE (layer-2 ID), MediaTek (Layer-2 ID), InterDigital, Vivo, Apple, China Telecom,
* Option 3: An ID for a pair between source remote UE and target remote UE included in each hop.
	+ Nokia, LG.
* Option 4: source remote UE ID included in first and second hop. FFS 24-bit layer-2 ID or local ID
	+ Ericsson (local ID)

All above options can work. From signaling overhead point of view, option 1 and option 3 is better. The merit of Option 2 is forward compatibility for multi-hop. Option 1 cannot support multi-hop case. If pair ID based option3 is used for multi-hop, how to ensure unique for each hop should be enhanced.

**[ToDis]Proposal 20a: RAN2 to discuss for L2 U2U relay case, SRAP header should include:**

* Option 1: Target remote UE ID (layer-2 ID) in first hop and source remote UE ID (layer-2 ID) in second hop.
* Option 2: Target remote UE ID (local ID) in first hop and source remote UE ID (local ID) in second hop.
* Option 3: Both source remote UE ID (layer-2 ID) and target remote UE ID (layer-2 ID) included in each hop.
* Option 4: Both source remote UE ID (local ID) and target remote UE ID (local ID) included in each hop.
* Option 5: A common ID for a pair between source UD and target remote UE included in each hop.

**[ToDis]Proposal 20b: If local ID or an ID for the pair between source remote UD and target remote UE is agreed in P20a, RAN2 to discuss which node (relay UE or source remote UE) assign this ID.**

### 2.5.3 E2E PC5 link

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| Tdoc Number | Proposals |
| **R2-2302492**NEC | Proposal-6: The one-to-one relationship between the PC5 unicast link and the PC5-RRC connection is kept to support PC5 RRC connection between the source Remote UE and the target Remote UE.Proposal-7: PC5-RRC connection state management is not needed for UE-to-UE Relay.Proposal-8: End-to-end PC5 RRC connection establishment can be only established after the hop-by-hop PC5 RRC connections are established for UE-to-UE Relay. |
| **R2-2302601**CATT | Proposal 9: RAN2 to discuss that whether a new explicit end-to-end RRC connection procedure between the source remote UE and the target remote UE is needed or not. |
| **R2-2302701**Intel | Proposal 4. The first PC5 unicast link towards the U2U relay UE is initiated by the source remote UE while the second PC5 unicast link can be initiated by the relay UE in general or by the target remote UE while doing integrated discovery and connection establishment scenario. Proposal 5. The end-to-end PC5 unicast link and thereby the PC5 RRC configuration is initiated by the TX UE or the source remote UE initiating the overall U2U relay communication. |
| **R2-2302836**Ericsson | Proposal 9 RAN2 to consider Figure 1. as the baseline for L2 U2U relaying in PC5 end-to-end link establishment for cases (a) and (b). |
| **R2-2303005**ZTE, Sanechips | Proposal 6: PC5 RLC channel(s) for E2E SL-SRBs is configured by per hop PC5 unicast link. |
| **R2-2303340**Vivo | Proposal 6 There should be one-to-one correspondence between the PC5-RRC connection and the PC5 unicast link in L2 U2U relay communication.Proposal 7 There should be three PC5-RRC connections in L2 U2U relay communication:* Per-hop PC5-RRC connection between source remote UE and the U2U relay UE;
* Per-hop PC5-RRC connection between target remote UE and the U2U relay UE;
* End-to-end PC5-RRC connection between source remote UE and target remote UE.

Proposal 8 Hop-by-hop PC5-RRC connection is established/reused after corresponding hop-by-hop PC5 unicast link establishment/modification. Specified SCCH configuration is used for hop-by-hop SL-SRBs as in legacy.Proposal 9 End-to-end PC5-RRC connection is considered to be established after corresponding end-to-end PC5 unicast link establishment. Specified SRAP configuration on top of the legacy specified SCCH configuration is used for end-to-end SL-SRBs. |
| **R2-2303486**Huawei | Proposal 7: As same as in Rel-16 V2X, the E2E PC5-RRC connection can be considered as established once E2E PC5 unicast link is established in L2 U2U relay operation.  |
| **R2-2303572**Spreadtrum | Proposal 14: E2E PC5-RRC is supported via E2E upper layer connection establishment procedure. |
| **R2-2303648**Kyocera | Proposal 7 RAN2 should consider whether SL reestablishment of the E2E PC5 link should be supported for U2U relay. Proposal 8 RAN2 should consider introducing PC5-RRC state if SL re-establishment of the E2E PC5 link is supported for U2U relay. |

**Summary:**

The following issues are discussed in the above proposals.

* Whether an end-to-end PC5 RRC connection is supported for L2 U2U relay operation?
* How to establish end-to-end PC5 RRC connection?

In TS38.300, ‘A PC5-RRC connection is a logical connection between two UEs for a pair of Source and Destination Layer-2 IDs which is considered to be established after a corresponding PC5 unicast link is established as specified in TS 23.287 [40]. There is one-to-one correspondence between the PC5-RRC connection and the PC5 unicast link.’ Several contributions point out that the procedure of E2E PC5 link establishment has been captured in TS23.304. Therefore, some companies propose the definition of end-to-end PC5 RRC connection which has a one-to-one correspondence between the end-to-end PC5-RRC connection and the end-to-end PC5 unicast link. Regarding How to establish end-to-end PC5 RRC connection, there are several options proposed by the different companies.

**[Easy]Proposal 21a: End-to-end PC5 RRC connection between source remote UE and target remote UE is supported.**

**[ToDis] Proposal 21b: If P21a can be agreed, a one-to-one correspondence between end-to-end PC5 RRC connection and end-to-end PC5 unicast link is supported as legacy.**

**[ToDis] Proposal 21c: RAN2 to discuss which one of the following options can be considered as ‘a PC5-RRC connection is established’.**

* **Option 1: E2E PC5 unicast link is established**
* **Option 2: Hop-by-hop PC5 RRC connections are established for UE-to-UE Relay.**

### 2.5.4 QoS split

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| Tdoc Number | Proposals |
| **R2-2302601**CATT | Proposal 10: The end-to-end PDB parameter needs to be splitted between two PC5 links.Proposal 11：The source remote UE is in charge of splitting the end-to-end QoS to hop-by-hop QoS for U2U relay. |
| **R2-2302643**OPPO | Proposal 13 As L3 U2U relay, rely on PC5-S procedure for the QoS split decision of L2 U2U relay. |
| **R2-2302701**Intel | Proposal 6. Wait for SA2 progress before discussing end-to-end QoS handling for U2U relaying. |
| **R2-2302836**Ericsson | Proposal 6 The U2U relay configures the QoS split for the end-to-end unicast link.Proposal 7 SRC UE can provide the U2U relay with assistance info to assist in splitting the QoS. |
| **R2-2302922**InterDigital | Proposal 5: The TX remote UE determines the QoS split and sends the second-hop portion to the relay UE.Proposal 6: f the TX remote UE and/or the relay UE are in RRC\_CONNECTED, this UE informs its gNB of the portion of the QoS split over its hop. |
| **R2-2302997**LG Electronics | Proposal 17: The following two options can be considered for the SL connection establishments for the U2U relay.(Option 1) If the source remote UE performs the QoS split, the source remote UE needs to receive the 2nd-hop PC5 RSRP from the relay UE. In this case, the source remote UE can configure for the 1st-hop and the 2nd-hop sidelink.(Option 2) If the relay performs the QoS split, the relay UE needs to receive the QoS-related information from the source remote UE. In this case, the relay UE can configure for the 1st-hop and the 2nd-hop sidelink.Proposal 18: We prefer relay UE configures QoS split for simplicity. Proposal 19: If relay UE performs QoS split and SL configuration for each remote UE, the configuration information has to be included the end-to-end bearer ID, RLC channel ID in a hop, and the mapping information between the end-to-end bearer and RLC channel ID in a hop. |
| **R2-2303005**ZTE, Sanechips | Proposal 5: Each UE involved in U2U relay communication decides the PC5 QoS split of its next hop (i.e. the hop between the UE and the next UE). |
| **R2-2303340**Vivo | Proposal 13 RAN2 to discuss which node is responsible for QoS split in L2 U2U relay:* Option 1: by TX UE per hop (or TX UE’s serving gNB in case of RRC CONNECTED)
* Option 2: by L2 U2U Relay UE (or Relay UE’s serving gNB in case of RRC CONNECTED)

Proposal 14 Using Hop-by-Hop PC5 RRC procedure in L2 U2U relay scenario to perform the E2E QoS splitting over the two hops. |
| **R2-2303486**Huawei | Proposal 8: In L2 U2U relay operation, the E2E QoS requirement is to be divided into per-hop QoS requirement in AS layer via PC5-RRC messages.Proposal 9: Following Rel-16 sidelink communication principle of Tx UE configuring Rx UE, in L2 U2U relay operation: ‐ Tx end UE provides E2E SDAP/PDCP configuration to the Rx end UE, meanwhile provide first hop RLC bearer configuration to the relay UE, ‐ The relay UE provides the second hop RLC bearer configuration to the Rx end UE, ‐ The Rx end UE receives packets from second hop RLC bearer and passes the packets to the E2E PDCP entity associated with the E2E radio bearer.Proposal 10: QoS split is performed per direction from Tx end UE to Rx end UE.Proposal 11: The QoS split is performed by Tx end UE side, and as baseline the Tx end UE obtains the split QoS info in the following way:‐ If the Tx end UE is OoC, the QoS split is based on pre-config, otherwise the QoS split is based on network configuration.‐ If the network provides QoS split information in SIB12, the idle/inactive UE can use the info in SIB12 to perform QoS split, otherwise the idle/inactive UE should enter RRC connected state.‐ If the Tx end UE is in connected state, it reports QoS parameters to the network, and network can provide per-hop QoS parameters via Uu RRC message.Proposal 12: The existing RSRP measurement report and CBR measurement report can be used to assist Tx end UE or its gNB on QoS split, FFS on other assistance information. |
| **R2-2303545**CMCC | Proposal 8: The relay UE takes the role for splitting QoS parameters in R18 L2 U2U relay. The relay UE can get E2E QoS parameters from the Source remote UE.Proposal 9: The relay UE can perform QoS split in OOC and IC RRC idle/inactive/connected state. It’s up to relay UE’s gNB implementation whether to perform QoS split when the relay UE is in RRC Connected state.Proposal 10: QoS split is based on PC5-S messages in R18 U2U relay. |
| **R2-2303572**Spreadtrum | Proposal 11: source End UE or source End UE’s serving gNB perform QoS split. |
| **R2-2303608**China Telecom | Proposal 11 RAN2 to discuss how to design the PC5-RRC or PC5-S procedure for E2E QoS split.Proposal 12 It’s more efficient for the relay UE to split the QoS profiles.Proposal 13 The source remote UE can negotiate with the relay UE to decide the two hops QoS split. |
| **R2-2303782**Xiaomi | Proposal 22: Rely on the UE itself to perform QoS split. FFS source remote UE or relay UE. |
| **R2-2303990**Samsung | Proposal 1. L2 U2U Relay UE can take the role of E2E QoS parameter splitting into two parts: one part is the QoS parameters between Source Remote UE and Relay UE, the other part is the QoS parameters between Relay UE and Target Remote UE. |

**Summary:**

The above proposals are discussing how to perform QoS split in L2 U2U relay operation. In L2 U2N relaying, it is up to gNB how to perform PDB split between two hops. In L3 U2U relaying, the split QoS is handled during the PC5-S L2 link establishment procedure according to TS23.304. For L2 U2U relay operation, the first question is which layer is responsible for QoS split. OPPO, CMCC and Intel(?) prefer to upper layer e.g PC-S layer. More companies think AS layer can handle it. The second question is which node can perform QoS split. Based on the contribution, there is no consensus for second question. Majority propose one of source UE and relay UE. Therefore, the following proposal is made.

**[ToDis]Proposal 22a: RAN2 to discuss which layer (AS layer or upper layer e.g PC5-S) is responsible for QoS split.**

**[ToDis]Proposal 22b: RAN2 to discuss which node is responsible for QoS split.**

* **Option 1: source remote UE**
* **Option 2: relay UE**

### 2.5.5 End-to-end security

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| Tdoc Number | Proposals |
| **R2-2302643**OPPO | Proposal 21 RAN2 to discuss using the bearer ID as input for the L2 U2U relay ciphering and deciphering at PDCP, and check with SA3 on the feasibility using LS. |
| **R2-2303486**Huawei | Proposal 14: For L2 U2U relay, the E2E security between the two end UEs is supported via E2E PDCP in the same manner of Rel-16 V2X, further discuss how to ensure the aligned LCIDs are used by the two end UEs. |
| **R2-2303935**ASUSTeK | Proposal 1 RB ID of each E2E sidelink radio bearer (DRB/SRB) is used as an input parameter to the ciphering/deciphering function for the E2E security between Source UE and Target UE in L2 UE-to-UE Relay. |

**Summary:**

How to perform end-to-end security is discussed in this part. In R16 NR sidelink communication, ciphering is performed based on LSB 5 bits of LCID. Namely, LCID is used as ‘input’ for ciphering and deciphering at PDCP. However, in L2 U2U relaying operation, PDCP entities are located at source remote UE and destination remote UE correspondingly. However, the LCID may be different between first hop and second hop. If E2E LCID is used as an input parameter to SL ciphering/deciphering function in UE-to-UE relaying as legacy sidelink communication, there is a need to restrict 1:1 mapping between Remote UE SL Radio Bearers and PC5 RLC channels for relaying. Therefore, Opp and ASUSTek propose that end-to-end bearer ID can be used as input.

**[ToDis]Proposal 23:** **RAN2 to discuss using the end-to-end bearer ID as input for the L2 U2U relay ciphering and deciphering at PDCP, and LS is sent to SA3 for checking feasibility.**

### 2.5.6 Configuration for L2 U2U relay case

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| **Tdoc** | **Proposal** |
| **R2-2302643**OPPO | Proposal 12: Rely on specified configuration for E2E SRB in L2 U2U Relay, including PDCP/SRAP/RLC/MAC configuration of end-UE, and SRAP/RLC/MAC configuration of relay-UE.Proposal 14: For PDCP/SDAP configuration for E2E DRB in L2 U2U Relay, as in legacy, Tx end-UE (or its serving gNB) decides on the Tx side related parameters, and Tx end-UE forward the parameters that are related to both Tx side and Rx side to Rx end-UE via E2E PC5-RRC signaling. Rx end-UE decides on the parameters only related to Rx side by implementation.Proposal 15: For SRAP/RLC/MAC/PHY configuration for E2E DRB in L2 U2U Relay, for end-UEs, as in legacy, Tx side related parameters are decided by Tx-UE its (or its serving gNB), and the parameters that related to both Tx side and Rx side are to be forwarded to Rx-UE, and parameters only related to Rx side is decided by Rx UE by implementation.Proposal 16: For OOC/IDLE/INACTIVE L2 U2U Remote UE, PDCP/SDAP setting is obtained via Pre-configuration/SIB by referring to end-to-end QoS as in legacy. FFS whether the legacy SLRB configuration IE is reused or a new SLRB configuration IE is necessary.Proposal 17: For OOC/IDLE/INACTIVE L2 U2U Remote UE, SRAP/RLC/MAC setting is obtained via Pre-configuration/SIB by referring to end-to-end QoS as input at least. RAN2 further discusses whether per-hop QoS needs to be taken into account.Proposal 18: For relay UE as Rx-UE of first hop, for SRAP/RLC/MAC/PHY configuration for E2E DRB in L2 U2U Relay, it follows the legacy design to derive the Rx side related parameters.Proposal 19: For relay UE as Tx-UE of the second hop, R2 discusses whether rely on relay UE itself (or the serving gNB) or the Tx end-UE (or the serving gNB) to decide on the Tx side related parameters. |
| **R2-2302922**InterDigital | Proposal 1: The TX remote UE receives end-to-end SDAP and PDCP configuration parameters associated with the QoS profile from (pre)configuration. Proposal 2: The TX remote UE sends the RX-related configuration parameters to the RX UE via end-to-end PC5-RRC signalling. Proposal 3: The TX remote UE receives RLC, MAC, and PHY configuration parameters associated to the QoS profile from (pre)configuration. FFS how to distinguish parameters associated with relaying compared to parameters associated with a direct link. |
| **R2-2303005**ZTE, Sanechips | Proposal 4a: In U2U relay, the remote/relay UEs in RRC\_IDLE/RRC\_INACTIVE acquire SLRB/RLC channel configuration in the SIB. The UEs in OOC acquire SLRB/RLC channel configuration in pre-configuration.Proposal 4b: In U2U relay, the remote/relay UEs in RRC\_CONNECTED acquire SLRB/RLC channel configuration via dedicated signalling. |
| **R2-2303340**Vivo | Proposal 10: RAN2 to discuss the following options for configuring SL radio bearer and RLC channel for L2 U2U relay:* Option 1: Centralized control

Option 1a: Source remote UE (or its serving gNB if RRC CONNECTED) decides E2E configurations (ie.PC5-SDAP, PC5-PDCP) and HbH configurations (i.e., PC5-SRAP, PC5-MAC, PC5-PHY)Option 1b: L2 U2U Relay UE (or its serving gNB if RRC CONNECTED) decides E2E configurations (ie.PC5-SDAP, PC5-PDCP) and HbH configurations (i.e., PC5-SRAP, PC5-MAC, PC5-PHY)* Option 2: Distributed control

i.e., Source remote UE (or its serving gNB if RRC CONNECTED) decides E2E configurations and HbH configurations for first hop, and L2 U2U Relay UE (or its serving gNB if RRC CONNECTED) decides HbH configurations for second hop |
| **R2-2303506**Qualcomm | Proposal 8: Taking the default configuration as baseline for E2E SL-SRB, i.e. use default E2E PC5 PDCP configuration, use default per-hop RLC Channel configuration and SRAP configuration (if needed) .Proposal 10: The Remote UE sends E2E PC5 QoS profiles to the Relay UE using per-hop PC5-S message, and the Relay UE splits the E2E QoS profiles into per-hop QoS profiles and sends to the two Remote UEs using per-hop PC5-S message. Proposal 11: Per-hop RLC Channel is configured based on the per-hop QoS profiles using per-hop RRC message, E2E SL SDAP and PDCP is configured based on the E2E QoS profiles using E2E RRC message/QoS splitProposal 12: It leaves to Remote UE and Relay UE implementation based on e.g. per-hop QoS profile to configure the mapping between E2E bearer and egress RLC channel configuration in SRAP layer. |
| **R2-2303934**ASUSTeK | Proposal 8 Source remote UE transmits an E2E RRCReconfigurationSidelink message to Target remote UE to provide the SDAP configuration and the PDCP configuration for establishing the new E2E SL DRB for a new PC5 QoS flow. Proposal 9 Source remote UE includes an ID of Target remote UE in a RRCReconfigurationSidelink message sent to U2U Relay UE to provide the 1st hop PC5 RLC channel configuration for establishing 1st hop PC5 RLC channel(s) in L2 U2U Relay for a new PC5 QoS flow. The Target remote UE ID is FFS.Proposal 10: U2U Relay UE in RRC\_CONNECTED includes an ID of Source remote UE in a SidelinkUEInformation message so that gNB can provide the 2nd hop PC5 RLC channel configuration for a new PC5 QoS flow. The Source remote UE ID is FFS.Proposal 11: Source remote UE assigns a RB ID for each E2E SL DRB and provides the RB ID in the E2E RRCReconfigurationSidelink message to Target remote UE for identifying the new E2E SL DRB. Proposal 12: Source remote UE includes RB ID of each E2E SL DRB for the mapped PC5 QoS flow(s) in a RRCReconfigurationSidelink message sent to U2U Relay UE. Proposal 13: U2U Relay UE in RRC\_CONNECTED includes RB ID of an E2E SL DRB associated with a PC5 QoS flow in a SidelinkUEInformation message sent to gNB so that gNB can provide the 2nd hop PC5 RLC channel configuration and E2E RB ID-to-2nd hop PC5 RLC channel mapping in L2 U2U Relay.  |
| **R2-2303990**Samsung | Proposal 2. RAN2 is kindly asked to discuss the options to configure Layer-2 bearer configuration for E2E PC5-S messages: option 1) using specified configuration or option 2) using dedicated configuration.Proposal 3. If option 1 is agreed, RAN2 is kindly asked to further discuss whether to define multiple or one specified Layer-2 configuration for relayed E2E PC5-S messages.Proposal 4. If option 2 is agreed, RAN2 is kindly asked to further discuss who e.g., Relay UE or Source Remote UE will configure the dedicated Layer-2 configuration for relayed E2E PC5-S messages. |

**Summary:** We can discuss it until other aspects have more progress. Therefore, there is no proposal.

# Conclusion

**[Easy proposal]**

**Discovery**

**Proposal 4a: After a relay UE receives a discovery message from a source remote UE, the relay UE transmits discovery response message or forwards the discovery message for DCR message with integrated Discovery case only if the PC5 RSRP between the relay UE and the source remote UE is above a threshold.**

**Proposal 4b: For Model-B discovery, after receiving a discovery message from a relay UE, a target remote UE transmits the discovery response message only if the PC5 RSRP between the target remote UE and the relay UE is above a configured threshold.**

**Resource allocation**

**Proposal 16: Both mode-1 and mode-2 resource allocation can be supported on both remote UE and relay UE in U2U relay case.**

**SRAP design and E2E PC5 link**

**Proposal 21a: End-to-end PC5 RRC connection between source remote UE and target remote UE is supported.**

**[To Discuss]**

**Discovery**

**Proposal 1: In U2U relay, the remote/relay UE in RRC\_CONNECTED can acquire discovery configuration via dedicated signalling.**

**Proposal 3a: RAN2 to discuss if the condition for triggering discovery message transmission in remote UE should be specified separately from the condition for relay (re)selection.**

**Proposal 3b: If P3a is agreed, RAN2 to discuss if remote UE can trigger a discovery procedure when the direct link falls below a threshold.**

**Proposal 3c: If P3a is agreed, RAN2 to discuss if remote UE can trigger a discovery procedure when the link between the remote UE and the serving relay UE falls below a threshold.**

**Proposal 4c: After receiving discovery solicitation message from source remote UE, relay UE is triggered to transmit discovery solicitation message to target remote UE only if the PC5 RSRP between the relay UE and the source remote UE is above a threshold.**

**Proposal 5: For model-B discovery, source remote UE, upon discovery response message reception, selects a relay UE only if the PC5 RSRP towards the relay UE is above a configured threshold.**

**Relay (re)selection**

**Proposal 6: If different configured thresholds for SL-RSRP and SD-RSRP are needed or not can wait for RAN1/RAN4 LS reply.**

**Proposal 8: Each remote UE can trigger relay selection based on the direct link quality.**

**Proposal 13: RAN2 to discuss if U2U relay can indicate one of the following information related to the second hop to the source remote UE after relay link between source remote UE and target remote UE has been established.**

* **An indication to indicate that the link between the target remote UE and U2U relay is below a threshold;**
* **PC5 RSRP of second hop between relay UE and target remote UE.**

**Proposal 14a: During relay reselection, reselection towards direct link is supported.**

**Proposal 14b: If P14a can be agreed, RAN2 to discuss whether AS criterion is needed for switching back from indirect to direct link.**

**Authorization (SA2 LS)**

**Proposal 17: RAN2 to discuss if the authorization information is needed for L2/L3 U2U relay operation.**

**SRAP design and E2E PC5 link**

**Proposal 18a: RAN2 to agree multiplexing of different destinations in the same RLC channel is supported. [14:2]**

**Proposal 18b: If P18a is agreed, RAN2 to discuss if LS to SA2 is needed to ensure that the same PC5 unicast link is used between source remote UE and relay UE when the source remote UE communicates with different destination UEs through the same relay UE.**

**Proposal 18c: RAN2 to discuss if multiplexing of the different bearers from the different source remote UEs into the same RLC channel in the second hop is supported.**

**Proposal 19: RAN2 to discuss if Relay UE determines the egress RLC Channel based on the mapping of E2E bearer ID and egress RLC Channel mapping as L2 U2N relay.**

**Proposal 20a: RAN2 to discuss for L2 U2U relay case, SRAP header should include:**

* Option 1: Target remote UE ID (layer-2 ID) in first hop and source remote UE ID (layer-2 ID) in second hop.
* Option 2: Target remote UE ID (local ID) in first hop and source remote UE ID (local ID) in second hop.
* Option 3: Both source remote UE ID (layer-2 ID) and target remote UE ID (layer-2 ID) included in each hop.
* Option 4: Both source remote UE ID (local ID) and target remote UE ID (local ID) included in each hop.
* Option 5: A common ID for a pair between source UD and target remote UE included in each hop.

**Proposal 20b: If local ID or an ID for the pair between source remote UD and target remote UE is agreed in P20a, RAN2 to discuss which node (relay UE or source remote UE) assign this ID.**

**Proposal 21b: If P21a can be agreed, a one-to-one correspondence between end-to-end PC5 RRC connection and end-to-end PC5 unicast link is supported as legacy.**

**Proposal 21c: RAN2 to discuss which one of the following options can be considered as ‘a PC5-RRC connection is established’.**

* **Option 1: E2E PC5 unicast link is established**
* **Option 2: Hop-by-hop PC5 RRC connections are established for UE-to-UE Relay.**

**Proposal 22a: RAN2 to discuss which layer (AS layer or upper layer e.g PC5-S) is responsible for QoS split.**

**Proposal 22b: RAN2 to discuss which node is responsible for QoS split.**

* **Option 1: source remote UE**
* **Option 2: relay UE**

**Proposal 23: RAN2 to discuss using the end-to-end bearer ID as input for the L2 U2U relay ciphering and deciphering at PDCP, and LS is sent to SA3 for checking feasibility.**

**[Deprioritized]**

**Relay (re)selection**

**Proposal 7: RAN2 does not pursue the co-existence between U2N relay and U2U relay in this release.**

**Proposal 9: It is up to SA2 to discuss whether candidate relay UE list should be transmitted from source remote UE to target remote UE after relay selection is triggered in source remote UE.**

**Proposal 10: During relay selection, it is left to source remote UE’s implementation to choose a U2U relay UE to perform PC5 connection establishment when more than one candidate U2U relay UEs meet the AS-layer and upper layer criterion.**

**Proposal 11: RAN2 confirms that the source remote UE can transmit the candidate relay UE list to the target remote UE via relay UE after relay reselection is triggered in the source remote UE.**

**Proposal 12: During relay reselection, it is left to source remote UE’s implementation to choose a U2U relay UE to perform PC5 connection establishment when more than one candidate U2U relay UEs meet the AS-layer and upper layer criteria.**

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