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

17th – 26th Apr. 2023

Source: Lenovo (Rapporteur)

Title: [AT121bis-e][431][Relay] SRAP proposals on U2U relay

Agenda Item: 7.9.2

Document for: Discussion and Decision

# Introduction

This is the trigger of the following email discussion:

* [AT121bis-e][431][Relay] SRAP proposals on U2U relay (Lenovo)

Scope: Discuss the SRAP proposals (P18a to P23) for discussion from [R2-2304194](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2304194.zip) and converge where possible.

Intended outcome: Report to CB session

Deadline: Monday 2023-04-24 2359 UTC

Your inputs before coming Sunday for early draft summary and proposals are appreciated.

# Discussion

## 2.1 Bearer Multiplexing

|  |  |
| --- | --- |
| Tdoc Number | Proposals |
| **[R2-2302643](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302643.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302701.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302791.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302836.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302922.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302997.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303005.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303012.zip)**  Fujitsu | Proposal 1: Multiplexing of different destinations in the same RLC channel is supported in Source Remote UE. |
| **[R2-2303222](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303222.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303340.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303388.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303486.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303545.zip)**  CMCC | Proposal 4: Multiplexing of different destinations in the same RLC channel is not supported in this release. |
| **[R2-2303572](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303572.zip)**  Spreadtrum | Proposal 12: RAN2 supports multiplexing of different sources/destinations in the same RLC channel. |
| **[R2-2303608](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303608.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303934.zip)**  ASUSTeK | Proposal 2 Multiplexing of different destinations in the same egress PC5 RLC channel is supported for L2 UE-to-UE Relay. |
| **[R2-2304123](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2304123.zip)**  MediaTek Inc. | Proposal 2: Support multiplexing of different destinations into the same RLC channel as long as there is overlapping on the whole path. |

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

We discussed if multiplexing of different destinations in the same RLC channel can be supported in last meeting. Unfortunately, there was no consensus in last meeting. Based on the contributions, most of contributions support to multiplex the different destinations in the same RLC channel in the first hop.

Two contributions object multiplexing of different destinations in the same RLC channel. One thinks it may have security problems which are not explained in the contribution. The other contribution proposes multiplexing of data at the MAC-layer.

**Q1-1: Do companies agree that multiplexing of different destinations in the same RLC channel in the first hop is supported?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| NEC | Yes | This is aligned with SA2 agreement |
| OPPO | Yes |  |
| Xiaomi | Yes |  |
| Apple | Yes | We think this is a more flexible design. Otherwise, how many number of different U2U remote UE destinations can be supported will be constrained by the LCID space. |
| InterDigital | Yes |  |
| ASUSTeK | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes | Multiple E2E connections using the same per-hop PC5 unicast link is already supported in SA2 spec. |
| CATT | Yes |  |
| LG | Yes |  |
| vivo | Yes | There is no need to have separate RLC channel for every target remote UE. This kind of multiplexing is also support in Rel-17 U2N relay, which could be inherited. |
| Fujitsu | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| CMCC | Yes | We okay to the proposal 18a since RLC channel and LCID resources can be saved. |

**Summary:**

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**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.**

ZTE and vivo point out that the same (shared) PC5 unicast link should be used between source remote UE and relay UE to ensure multiplexing of different destinations in the same RLC channel. Rapporteur tends to agree with it.

According to TS23.304 (6.7.1.1), the *shared PC5 link* will be used for the case that one L3 source remote UE communicates with multiple target L3 target UEs. According to TS23.304 (6.7.2), the L2 source remote UE can decide whether to use *an existing PC5 link* with the same U2U Relay towards the different target remote UEs. vivo thinks in current TS 23.304, the support of shared PC5 unicast link is described for L3 U2U relay in subclause 6.7.1.1 while it does not seem clear for L2 U2U relay in subclause 6.7.2. Therefore, Vivo proposes RAN2 to send LS to SA2 for confirmation on the support of shared link for L2 U2U relay. Rapporteur (not SA2 delegate) is not sure if it is sufficient for SA2 specification since ‘existing PC5 link’ is allowed by the source remote UE.

**Q1-2: If Yes for Q1-1, do companies agree to send LS to SA2 to ensure that the same PC5 unicast link between source remote UE and relay UE is used when the source remote UE communicates with different destination UEs through the same relay UE?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| NEC | No | No need since this is the SA2 understanding. |
| Xiaomi | See comment | Actually we fail to understand the motivation to establish multiple link between the source remote UE and the same relay UE for different DSTs. In our understanding, there should be only one link. |
| Apple | No | Multiplexing is a basic principle for relay function. There is no need to use different PC5 links for different remote UE destinations. Not sure why SA2 will have a different understanding. |
| InterDigital | No | Same view as Apple – multiplexing can be done with a single unicast link between source and relay without the need to ask SA2. |
| ASUSTeK | No |  |
| OPPO | No | Same view as NEC and Apple that SA2 spec as follows already supports this  2. The source 5G ProSe End UE decides whether to use an existing PC5 link with the 5G ProSe UE-to-UE Relay for the required service. If an existing PC5 link is used then the Layer-2 link modification procedure as specified in clause 6.4.3.7 is used towards a 5G ProSe UE-to-UE Relay, otherwise a Layer-2 link establishment procedure is used towards a 5G ProSe UE-to-UE Relay. |
| Qualcomm | No |  |
| Huawei, HiSilicon | No | We do not see what to be confirmed, the SA2 spec quoted by OPPO should be clear already. |
| CATT | No |  |
| LG | See comment | We think RAN2 can support this kind of multiplexing. But, before agreeing to proposal 18a, we need to check whether this is essential or not. We may need to ask SA2 whether this kind of multiplexing should be supported. The current SA2 spec is describing these multiplexing for only the layer-3 case. We wonder whether the upper layer of the source remote UE really uses the same source L2 ID for the different target remote UE.  If the upper layer of the source remote UE assigns different L2 ID for different target remote UE, RAN2 may not need to consider this kind of multiplexing. |
| vivo | Yes | Our observation is that, in current SA2 TS 23.304, the support of shared link is explicitly described for L3 U2U relay in subclause 6.7.1.1 while it does not seem so clear for L2 U2U relay in subclause 6.7.2. Thus, it would be better that we check with SA2 on the shared link case in L2 U2U. |
| Fujitsu | No |  |
| Samsung | No | Same view as NEC, and also share Xiaomi’s concern. |
| ZTE | No | The LS is not needed. SA2 specification [TS 23.304, 6.7.2] has clearly captured this feature. |
| Ericsson | No |  |
| CMCC | No |  |

**Summary:**

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**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.**

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 in the second hop. The corresponding scenario is that multiple remote UEs communicates with the same target remote UE via the same relay UE. Based on the contributions, 8 contributions support multiplexing of the different bearers from the same and/or different remote UEs into the same RLC channel can be supported.

**Q1-3: Do companies agree that multiplexing of the different bearers from the different source remote UEs into the same RLC channel in the second hop is supported?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| NEC | Yes |  |
| OPPO | Yes |  |
| Xiaomi | See comments | In last meeting we already agreed to include bearer ID in both first hop and second hop. Also we agreed to include a ID mappable to source remote UE in the second hop. So we think this proposal is already agreed to be supported. Not sure if anything additional is missing? |
| Apple | Yes | This is already agreed in R17 SI |
| InterDigital | Yes |  |
| ASUSTeK | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes | Agree with Xiaomi and Apple. |
| CATT | Yes |  |
| LG | Yes |  |
| vivo | Yes | The case is similar to the discussion for the case of multiplexing in the first hop. |
| Fujitsu | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| CMCC | Yes |  |

**Summary:**

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Similar to Q1-2, we also need to check the same question for this scenario that the different source remote UEs communicate with a same destination UE through the same relay UE. According to TS23.304 (6.7.2), the L2 U2U Relay is allowed to decide whether to use an existing PC5 link between the relay UE and the L2 target remote UE.

**Q1-4: If Yes for Q1-3, do companies agree to send LS to SA2 to ensure that the same PC5 unicast link in the second hop is used when the different source remote UEs communicate with a same destination UE through the same relay UE?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| NEC | No | No need since this is the SA2 understanding. |
| Xiaomi | See comments | See reply on Q1-2. |
| Apple | No | Same as our reply in Q1-2 |
| InterDigital | No | Same as reply in Q1-2. |
| ASUSTeK | No |  |
| OPPO | No | No need for the LS |
| Qualcomm | No |  |
| Huawei, HiSilicon | No |  |
| CATT | No |  |
| LG | See comments | See reply on Q1-2. |
| vivo | Yes | See reply on Q1-2. |
| Fujitsu | No |  |
| Samsung | No | Same view as NEC |
| ZTE | No |  |
| Ericsson | No |  |
| CMCC | No |  |

**Summary:**

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## 2.2 Bearer mapping and SRAP design

|  |  |
| --- | --- |
| Tdoc Number | Proposals |
| **[R2-2302492](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302492.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302601.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302643.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302701.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302791.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302836.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302922.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302997.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303005.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303012.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303336.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303340.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303388.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303486.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303506.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303545.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303572.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303608.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303782.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303934.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2304123.zip)**  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. |

**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.**

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 as follows. Rapporteur thinks both options can work. And the option 1 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

**Q2: Do companies agree that Relay UE determines the egress RLC Channel based on the mapping of E2E bearer ID and egress RLC Channel mapping as L2 U2N relay?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| NEC | Yes |  |
| OPPO | Yes |  |
| Xiaomi | Yes but | Considering we are supporting multiplexing from different DST in the first hop and multiplexing from different sources in the second hop, the mapping of the E2E bearer ID to the egress RLC channel maintained at the relay UE should be for a particular source and target remote UE pair. So we propose reword the proposal as:  **Relay UE determines the egress RLC Channel based on the mapping of E2E bearer ID and egress RLC Channel, for a particular source and destination remote UE pair. ~~mapping as L2 U2N relay~~** |
| Apple | Yes | We understand E2E bearer ID is always based on a pair of source and destination. |
| InterDigital | Yes |  |
| ASUSTeK | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | See comments | We think the key point is E2E bearer ID is used to determine egress RLC channel. The other details can be discussed till we have a full picture of data routing and UE identification/bearer mapping/configuration. |
| CATT | Yes |  |
| LG | Yes |  |
| vivo | Yes | It is simple to follow U2N design. |
| Fujitsu | Yes |  |
| Samsung | Yes | OK with Xiaomi’s modification although we think this is assumed anyway. |
| ZTE | No | For option 1, relay UE need to identify SL-SRB and SD-SRB for shared BEARER ID when determine the egress RLC channel. While in Option 2, Relay UE forwards data based on the mapping relationship of ingress RLC channel and egress RLC channel, it does not need to determine SL-SRB or SL-DRB as option 1 does.  In addition, Option 2 may reduce the configuration signalling overhead if two SLRBs are mapped to the same ingress RLC channel and the same egress RLC channel.  So we prefer Option 2. |
| Ericsson | Yes |  |
| CMCC | Yes |  |

**Summary:**

**…..**

**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. (Rapp: In option 5, a local pair ID for a pair between source UE and target U is included in each hop. Namely, common ID for a pair= local pair ID)

From signaling overhead point of view, option 1/2/5 are better than option 3/4. The merit of Option 3/4 is forward compatibility for supporting Multi-hop. Option 1/2 should be enhanced if multi-hop should be supported. If pair ID based Option5 is used for multi-hop, how to ensure unique for each hop should be enhanced. In WID, there is a ‘Note’ for U2U objective as follows.

***Note 1A: This work should take into account the forward compatibility for supporting more than one hop in a later release.***

**Q3-1: Which option(s) is preferred from your side?**

|  |  |  |
| --- | --- | --- |
| Company | Option(s)  (1,2,3,4,5) | Comments |
| NEC | 2 or 4 |  |
| OPPO | 3 | All shortened ID (option-2, 4 , 5) has the issue that no matter which UE to allocate the shortened ID (end or relay UE), in an adhoc network where multiple end/relay UE co-exists and there might be overlapping role of end/relay UE on a same physical UE simultaneously, it is hard to avoid shorted ID collision issue anyway.  Option-3 doesn’t have the drawback of not forwards compatibility for multi-hop relay. |
| Xiaomi | Option 4 | For option 1/2, we think it cannot be easily extended to multiple hop, even if the first hop can include DST ID only and the last hop can include SRC ID only, the hops in the middle should include both Source and DST ID, otherwise the relay in the middle hops is not able to identify the Source and DST and then not able to find the next hop. While option 2 can be easily extended to support multiple hop.  For option 5, we think if a common ID solution is adopted, it should be the relay UE to allocate and configure this common ID to both source and destination remote UE in order to ensure the uniqueness for each pair via this relay UE. If there are multiple pairs via this relay UE, the configuration signalling will consume more bits compared with different ID solution since the association between a pair and local ID should be indicated while for the other solution only the association between the L2 ID and local ID is needed.  Also we think to avoid too much overhead, we should reuse local ID instead of L2 ID. |
| Apple | Option 3 and FFS option 4 | Option 1 is infeasible because SA2 has indicated that E2E L2 ID (non-relay) are not as same as L2 IDs used in relay L2 ID (in PC5 hops), so relay UE cannot translate the L2 IDs from MAC header to SRAP header.  Option 3 is feasible.  Option 4 is also feasible but RAN2 need design how local IDs are allocated. We need weight the gain of overhead reduction vs. the complexity to decide.  Option 2 is a further optimization based on Option 4, and we think there is no need to consider right now. |
| InterDigital | Option 3 | We should avoid introducing a new ID if it is not necessary. |
| ASUSTeK | 2 or 5 |  |
| Qualcomm | Option 2 or Option 5 | Local ID is existing SRAP layer header, in order to make SRAP layer commonality, it can be taken as baseline.  Option 5 does not correctly capture the solution. The solution should be one per-hop local ID to identify S-UE/D-UE pair on each hop. It is not one common ID used for all the hops. Propose to change Option 5 to:  **Option 5: A per-hop local ID for the pair of source UE and target remote UE included in each hop, the per-hop local ID is unique within one hop.**  Option 2 is same as Option 5 in case of one hop relay.  Option 1: the size is too large (24bits), cannot used for multi-hop relay  Option 3: there are some drawbacks:  - The header is too large (48bits)  - Layer-2 ID will be collision in multi-hop Relay. One UE may be configured many Layer-2 IDs for different RSCs (RSC size is 24 bits, theoretically, every UE can use all the Layer-IDs if interested will all RSCs ) and also for different communication types(U2N, U2U, discovery, PC5 communication have different Layer-2 IDs).  - The Remote UE does not know the Layer-2 of the peer Remote UE.  Option 4: should be split two sub-options: 1) the local ID is common for all hops; 2) the local ID is per-hop ID only used in one hop. For 1), it cannot be used for multi-hop if we assume there is no local ID assignment coordination on different hops. For 2), the motivation is same as our revised option 5, and it does not need two local IDs included in one hop. |
| Huawei, HiSilicon | Prefer Option 2,  Option 5/4 is acceptable | Our preference is to use AS defined local ID instead of L2 ID, for efficiency, because for U2U (even for multi-hop) the UE ID is not required to be unique globally, but only need to be unique within each per-hop unicast link. So using L2 ID is a waste of radio resource.  Then option 5 can be considered as a further enhancement on top of option 2 assuming the same local ID is allocated to source end UE and target end UE, so we are open to it. |
| CATT | Option3 as baseline, Option 5 can be further discussed | For U2U relay, the destination L2 ID of target remote UE and the source L2 ID of source remote UE are all needed. We can take option3 as baseline. Further, in order to achieve the purpose of saving the overhead of the adaptation layer header, a mapping from the combination of source remote UE L2 ID and target remote UE L2 ID to a shorter link identifier can be further discussed. |
| LG | Option 2 or 5 | We think useless signalling overhead should be reduced. In the case of multi-hop, multi-hop is not scope of WI and the optimized ID can be used for the multi-hop cases. It can be depends on the procedure how to decide local ID.  We think it’s not sure we think about the compatibility of the future release. And even the future release, the shorted ID/optimized ID method may be applied for the future release. |
| vivo | First priority: Option 3  Second priority:  Option 2 | Although option-3 has maximum signalling overhead, it has the following pros:   * future proof compatible, apply to both single hop and multi-hop scenario * avoid relay UE complexity to do the mapping * avoid specification work on how to perform ID allocation in AS layer (i.e., rely on L2 ID from upper layers) * low ID collision probability with 24-bit length   So we think it is better to adopt option-3 if large signaling overhead is not a big concern. Otherwise, option-2 is an alternative choice for its advantages to reuse U2N SRAP design which also has the minimized signaling overhead. |
| Fujitsu | 2 or 4 | Local ID can be used to save the overhead. |
| Samsung | Option 5, then Option 4 |  |
| ZTE | Option 3 | The L2 IDs of the source and destination remote UE are already defined in the legacy specification. No additional efforts is needed for the potential new ID allocation and negotiation. With both L2 IDs in the adapt header, relay UE can directly forward the packets without keep ID mapping and replacing the adapt header. And it is forward compatible for multi-hop U2U relay support. |
| Ericsson | Option 5 and local ID-based | It is also possible to just include the SRC ID like in U2N relays. Not sure if there is a technical drawback here |
| CMCC | Prefer 4,  Option 2 and 5 are acceptable. | We think the most important issue that needs to be considered is signalling overhead. Thus, we should agree to allocate UE local ID as agreement first.  As Option 4, we think it’s easy to implement and benefit for multi hop compatibility.  For the collision issue, if we use local ID allocation mechanism, it can not be avoided, we can further discuss how to reduce the impact. |

**Summary:**

**…..**

**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.**

If one of option 2, option 4 and option 5 is selected, please indicate which node (relay UE or source remote UE) assign this ID.

**Q3-2: If local ID for each remote UE or common ID for the pair is agreed, which node (relay UE or source remote UE or …) is responsible for the ID assignment?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | local ID or common ID | Source remote UE/relay UE/… | Comments |
| NEC | Local ID | Relay UE |  |
| OPPO | We do not understand the diff between local and common ID, if both are shortened ID (<24bits) | See comment | Regardless of which UE (relay, end) to do the allocation, in an adhoc network where multiple end/relay UE co-exists and there might be overlapping role of end/relay UE on a same physical UE simultaneously, it is hard to avoid shorted ID collision issue anyway. |
| Xiaomi | Common ID is also local ID? Just associated with the pair, so agree with OPPO, it is not clear on the difference | Relay UE | We agree with OPPO on the collision issue. But we still prefer to use local ID instead of L2 ID considering the overhead. We can further discuss how to solve the collision issue. |
| Apple | Local ID | Relay UE |  |
| InterDigital | Local ID | Relay | However, we do not prefer the approach of local ID. |
| ASUSTeK | Local ID for 2, or common ID for 5 | Relay UE |  |
| Qualcomm | Local ID | Could be relay UE or Remote UE | If only single-hop considered in this release, then the easy solution that one common local ID for the two hops can be used which is same as U2N. It should be rare case |
| Huawei, HiSilicon | Local ID | Different UE role in different option | In option 2 and 4, we prefer to let Tx UE to assign local ID for Rx, which is similar to the method used by upper layer for self-assigned L2 ID. But it should be feasible to let relay UE do it.  In option 5, only relay UE is feasible to assign a common local ID for Tx and Rx UEs. |
| CATT | Common ID for option5 | Either |  |
| LG | Local ID/common ID | Relay UE | We think common ID means a link ID between SRC remote UE and DST remote UE. We are understanding it is the same case if the local ID of 1st-hop and 2nd-hop is decided same value. |
| vivo | Local ID | Relay UE | Unlike the R17 L2 U2N relay which is under control of serving gNB, it is more reasonable to allow the relay UE to allocate the local UE ID for the remote UE as the remote UE may not always have Uu RRC connection. Relay UE has better understanding for both hops, and it can e.g. independently allocate a local UE ID based on the numbering of Target Remote UE(s) for transmission over the 1st hop, and a local UE ID based on the numbering of Source Remote UE(s) for transmission over the 2nd hop. |
| Fujitsu | Local ID | Relay UE |  |
| Samsung | OK with either local ID or ‘common ID’ (which we understand refers to a pair ID) | Relay UE | We also acknowledge the collision issue raised by OPPO. |
| ZTE |  |  | We prefer to reuse L2 ID. |
| Ericsson | Local ID, common ID | Relay UE |  |
| CMCC | Local ID | Source remote UE or relay UE |  |

**Summary:**

**…..**

## 2.3 E2E PC5 link

|  |  |
| --- | --- |
| Tdoc Number | Proposals |
| **[R2-2302492](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302492.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302601.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302701.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302836.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303005.zip)**  ZTE, Sanechips | Proposal 6: PC5 RLC channel(s) for E2E SL-SRBs is configured by per hop PC5 unicast link. |
| **[R2-2303340](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303340.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303486.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303572.zip)**  Spreadtrum | Proposal 14: E2E PC5-RRC is supported via E2E upper layer connection establishment procedure. |
| **[R2-2303648](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303648.zip)**  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. |

**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.**

It was agreed that end-to-end PC5 RRC connection between source remote UE and target remote UE is supported. In legacy direct PC5 link (TS38.300), there is one-to-one correspondence between the PC5-RRC connection and the PC5 unicast link. Is there a one-to-one correspondence between the end-to-end PC5-RRC connection and the end-to-end PC5 unicast link?

**Q4-1: Do companies agree that a one-to-one correspondence between end-to-end PC5 RRC connection and end-to-end PC5 unicast link is supported as legacy?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| NEC | Yes |  |
| OPPO | Yes |  |
| Xiaomi | Yes |  |
| Apple | Yes |  |
| InterDigital | Yes |  |
| ASUSTeK | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |
| LG | Yes |  |
| vivo | Yes |  |
| Fujitsu | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| CMCC | Yes |  |

**Summary:**

**…..**

**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.**

In legacy PC5 link, a PC5-RRC connection is considered to be established after a corresponding PC5 unicast link is established as specified in TS 23.287. Which option can be considered as ‘an end-to-end PC5 RRC connection is successfully established’?

**Q4-2: Which option is preferred from your side?**

|  |  |  |
| --- | --- | --- |
| Company | Option1/2/… | Comments |
| NEC | Option-2 |  |
| OPPO | See comment | Following legacy, we can consider PC5-RRC connection is established after the PC5-S procedure has been finished, is that aligned with option-1? |
| Xiaomi | Option 1 | Since the PC5 RRC connection between the source remote UE and the target remote UE is E2E, it is more reasonable to consider the PC5-RRC connection as established the when E2E PC5 link is established. This option is also the same as in legacy. |
| Apple | Option 1 |  |
| InterDigital | Option 1 | This is simply legacy and should be respected for E2E case also. |
| ASUSTeK | Option 1 | We think legacy concept should be still followed. |
| Qualcomm |  | Confused about this proposal. Both options are needed for different layer configurations. |
| Huawei, HiSilicon | Option 1 | We understand E2E connection is established after per-hop unicast establishment, i.e. per-hop PC5 RRC connection is already there. |
| CATT | Option 1 |  |
| LG | Option 1 |  |
| vivo | Option 1 with comments | If following legacy design, PC5-RRC connection is considered to be established when the corresponding PC5 unicast link establishment is completed.  However, legacy design is under the premise that the SL-SRB configurations for the PC5 RRC connection are all specified so the PC5 RRC messages can be transmitted or received as soon as the PC5 unicast link is established.  When it comes to L2 U2U case, we think the question is that whether the SL-SRB configurations for the E2E PC5 RRC connection are all specified or not. If the ANS is YES, then it’s straightforward to think that the E2E PC5 RRC connection is established when the corresponding E2E PC5 unicast link is established. However, if the ANS is NO, we still need additional procedures (which probably rely on the per-hop PC5 RRC singnalling exchange) to get the SL-SRB configurations for the E2E PC5 RRC connection, then it’s more reasonable to say that the E2E PC5 RRC connection is established when the E2E SL-SRB3 is configured, which is after the corresponding E2E PC5 unicast link is established.  Based on analysis, we suggest to make some clarification on Option 1. For example: at least E2E PC5 unicast link is established. FFS whether the SL-SRB is configured or specified for the E2E PC5 RRC connection. |
| Fujitsu | Option 1 |  |
| Samsung | Option 1 but please see comment | Our understanding is as follows: after relay discovery, hop-by-hop PC5 unicast links and hop-by-hop RRC connections are established between remote UE(s) and relay UE. The E2E PC5 unicast link is then established between two remote UEs using the procedures in NR SL communication, and PC5 RRC connection is there between the two remote UEs as in R16 NR SL. We assume this is aligned with Option 1? |
| ZTE | Option 1 | It is suggested to follow legacy mechanism. |
| Ericsson | Option 1 |  |
| CMCC | Option 1 | We think it;s better to follow legacy R17 U2N design. Once E2E PC5 unicast link is set up, which implicitly implies the PC5-RRC connection is established as well. |

**Summary:**

**…..**

## 2.4 QoS split

|  |  |
| --- | --- |
| Tdoc Number | Proposals |
| **[R2-2302601](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302601.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302643.zip)**  OPPO | Proposal 13 As L3 U2U relay, rely on PC5-S procedure for the QoS split decision of L2 U2U relay. |
| **[R2-2302701](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302701.zip)**  Intel | Proposal 6. Wait for SA2 progress before discussing end-to-end QoS handling for U2U relaying. |
| **[R2-2302836](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302836.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302922.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302997.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303005.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303340.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303486.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303545.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303572.zip)**  Spreadtrum | Proposal 11: source End UE or source End UE’s serving gNB perform QoS split. |
| **[R2-2303608](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303608.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303782.zip)**  Xiaomi | Proposal 22: Rely on the UE itself to perform QoS split. FFS source remote UE or relay UE. |
| **[R2-2303990](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303990.zip)**  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:**

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

The above proposals are discussing how to perform QoS split in L2 U2U relay operation. In L2 U2N relaying, it is up to gNB implementation 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.

**Q5-1: Which layer (AS layer or upper layer e.g PC5-S) is responsible for QoS split?**

|  |  |  |
| --- | --- | --- |
| Company | AS layer or Upper layer | Comments |
| NEC | Upper layer |  |
| OPPO | Upper layer | Why not reuse the procedure that have been defined for L3 but rather to design another procedure in addition in another WG for the same reason? |
| Xiaomi | Upper layer |  |
| Apple | AS layer | We think QoS split needs to consider PC5 link quality issues based on AS layer measurements (e.g., SL-RSRP, CBR), this is better to be done by AS layer. |
| InterDigital | AS layer | Similar to U2N relaying where the gNB determines the split, the AS layer should determine the split for U2U case. |
| ASUSTeK | Upper layer |  |
| Qualcomm | Upper layer (ProSe layer) | Aligned with L3 U2U, and ProSe layer has QoS profiles |
| Huawei, HiSilicon | AS layer | SA2 has concluded that For Layer-2 UE-to-UE Relay, RAN WGs will define how the E2E QoS will be handled and split over the PC5 links, which is captured in SA2 TR. |
| CATT | AS layer | Same view as HW. |
| LG | AS layer | Similar to U2N, split QoS can be configured by RRC signal. |
| vivo | Upper layer for L3 U2U  AS layer for L2 U2U | SA2 has specified QoS splitting procedure for L3 U2U relay, which is performed by L3 U2U relay UE as specified in clause 5.6.3.1. Moreover, no extra RAN2 impact are foreseen since each hop is a complete legacy PC5 link and PC5 QoS parameters splitting and distribution is up to higher layer(s), i.e. in the scope of SA2.  However for L2 U2U relay, we think SA2 leaves it to RAN2 to make the decision. We prefer AS layer to decide the QoS splitting for L2 U2U case because AS layer is at the best position to get the real-time knowledge of radio link status and congestion situation (e.g., based on PC5 RSRP and CBR measurement results) over the two hops and guarantee the E2E QoS |
| Fujitsu | Upper layer |  |
| Samsung | Could discuss both options, and align with SA2 |  |
| ZTE | AS layer | If remote UE performs QoS split, AS layer is preferred, i.e. QoS split can perform together with RLC channel configuration, no need to communicate with SA2 to introduce new procedure/do enhancement for remote UE to perform QoS split. |
| Ericsson | AS layer | For L2 relays, the AS layer can perform the QoS split as the configuration can be provided by the RRC layer |
| CMCC | AS layer | We need to consider different PC5 links condition to decide QoS split regardless which hop to perform QoS split. For this reason, we prefer AS layer to perform L2 U2U QoS split. |

**Summary:**

**…..**

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

* **Option 1: source remote UE**
* **Option 2: relay UE**
* **Option 3: TX UE per hop**

The second question is which node can perform QoS split. Based on the contributions, there is no consensus for the second question. The majority propose one of source remote UE and relay UE to perform QoS split.

**Q5-2: If AS layer is selected, which option is preferred from your side?**

|  |  |  |
| --- | --- | --- |
| Company | Option1/2/… | Comments |
| NEC | Option-2 |  |
| OPPO | Option-2 | We do not see there is a need to deviate from L3 design, i.e., up to relay to do the split. |
| Xiaomi | Option 2 | Since we have agreed to simplify the gNB involvement as compared to the U2N case, we think at least we should not rely on source remote UE/relay UE’s serving gNB for QoS split.  Then whether it is source remote UE or relay UE to perform QoS split, we think both can work. If it is source remote UE to split, some assistance information on second hop, e.g., CBR, measurement report, transmission latency is needed. While if it is relay UE to perform split, E2E QoS information from the source remote UE is needed.  To avoid the discussion on the assistance information of the second hop, it seems easier to go with relay UE solution. |
| Apple | Option 2 | Relay UE is well positioned to decide the PDB split for both PC5 hops. |
| InterDigital | Option 1 | For L2 relay, the relay UE is not aware of the QoS information so it may be best for the source to decide this based on QoS information and any information received from the relay related to the second hop. |
| ASUSTeK | Option 2 |  |
| Qualcomm | Option 2 | Relay UE can have the link status on the two hops, and can provide more proper splitting based on the link status. |
| Huawei, HiSilicon | Option 1 | Similar view as InterDigital. |
| CATT | Option 1 | For U2U relay, considering the connection is initiated by the source remote UE, it is nature that the source remote UE is in charge of handling end-to-end QoS to hop-by-hop QoS for U2U relay. |
| LG | Option 2 |  |
| vivo | Option 2 or option-3 | QoS splitting and handling can be performed in a centralized way and have a unified node for L2 and L3 U2U, i.e. by the relay UE, since the relay UE can know the status of two links at the same time.  Option-3 is added as it’s more aligned with legacy TX UE centric mechanism, which can also be extensive to multi-hop scenario. Option-3 is also acceptable to us. |
| Fujitsu | Option 2 |  |
| Samsung | Option 2 |  |
| ZTE | Option 1 or 3 | For single hop U2U relay, maybe it is better for relay UE to perform QoS split who knows the PC5 link quality of both hops. However, it is not forward compatible with multi-hop U2U relay. So considering multi-hop, we prefer the source UE to decide the first hop QoS while the relay UE decides the next hop QoS and so on. |
| Ericsson | Option-2 |  |
| CMCC | Option 2 | Both methods are feasible and all related to message interaction between source remote UE and relay UE:   1. For Option1, then relay UE needs to tell source remote UE about the second hop PC5 link quality. 2. For Option2, then remote UE needs to tell relay UE about the E2E QoS information.   AS SA2 has decided relay UE is responsible for L3 U2U QoS split. Thus, we prefer to keep aligned with SA2 that using relay UE to perform QoS split in L2 U2U relay as well. |

**Summary:**

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## 2.5 End-to-end security

|  |  |
| --- | --- |
| Tdoc Number | Proposals |
| **[R2-2302643](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2302643.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303486.zip)**  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](file:///D:\\OneDrive%20-%20Lenovo\\3GPP\\RAN2\\TSGR2_121bis\\Docs\\R2-2303935.zip)**  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. |

**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.**

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. One company thinks 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, end-to-end bearer ID is proposed to be used as input.

**Q6: Do companies agree that end-to-end bearer ID is used as input for the L2 U2U relay ciphering and deciphering at PDCP? Whether LS is sent to SA3 for checking feasibility?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Yes/No | LS needed? | Comments |
| NEC | yes | No |  |
| OPPO | Yes | Yes |  |
| Xiaomi | Yes | Yes | Better to check with SA3. |
| Apple | Yes | Yes |  |
| InterDigital | Yes | Yes |  |
| ASUSTeK | Yes | Yes |  |
| Qualcomm | Yes | Yes |  |
| Huawei, HiSilicon | No, there is no bearer ID defined for PC5. If companies are referring to configuration index, the length of the index (9bits because maxNrofSLRB=512) is not the same as LCID (5 bits because maxLC-ID=32). | No strong view | We do not see LS is necessary, but ok to follow majority view. |
| CATT | Yes | Yes | For HW’s comment, just wonder what is the gap? Even if the number of length is different, just to guarantee that the mapping from RB to LCID is unified is enough. |
| LG | Yes | Yes |  |
| vivo | Yes | Yes | As mentioned by rapporteur, we understand in U2U case, the LSB 5 bits of LCID is no long suitable to be used as the input for security. We think it should be OK to use e2e bear ID and this should be confirmed by SA3. |
| Fujitsu | Yes | Yes |  |
| Samsung | Yes | Yes |  |
| ZTE | Yes | Yes |  |
| Ericsson | See comments | No | Not sure what is different from currently procedures |
| CMCC | Yes | Yes |  |

**Summary:**

**…..**

# Conclusion

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