**3GPP TSG-RAN WG2 Meeting #120 R2-221xxxx**

**Toulouse, France, 14th - 18th Nov. 2022**

**Source: Apple**

**Title:****Summary of AI 8.9.4, Multi-path relaying**

**Agenda Item:** **8.9.4**

**Document for:** **Discussion and Decision**

# Introduction

This contribution provides summary of contributions under 8.9.4 on multi-path relaying. The summary aims to consolidate common issues across all the submitted contributions listed in reference.

# Discussion

### 2.1 Confirm working assumption on adaptation layer of Scenario 2

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| R2-2211282 | CATT | Proposal 2: For Scenario 2, take Figure-1 and Figure-2 as the baseline UP/CP protocol stack  Proposal 5: Confirm the following working assumptions as agreements:  - Bearer identification except LCID is not needed in L2 PDU over Uu link in Scenario 2. Only 1:1 bearer mapping is supported over Uu link for the indirect path.  - Without the adaptation layer over Uu link in scenario 2, a PDCP PDU can be delivered to an intended PDCP entity or RLC entity for support of more than one RB over Uu link e.g. by configuring 1:1 bearer mapping and different Uu RLC channels for relay UE local traffic and relay traffic for PDU delivery.  - Do not specify adaptation layer over Uu link for scenario 2 in RAN2. |
| R2-2211536 | Ericsson | Proposal 7 Confirm the working assumptions for not specifying an adaptation layer over the Uu-link for Scenario-2. |
| R2-2211677 | vivo | Proposal 19 For Scenario-2, RAN2 confirm the WA into agreement, i.e. “Bearer identification except LCID is not needed in L2 PDU over Uu link in Scenario-2. Only 1:1 bearer mapping is supported over Uu link for the indirect path. Detailed mapping configuration is left to the WI phase”. |
| R2-2211752 | Huawei | Proposal 1. Confirm the following working assumptions from last meeting:  • Bearer identification except LCID is not needed in L2 PDU over Uu link in Scenario 2. Only 1:1 bearer mapping is supported over Uu link for the indirect path.  • Without the adaptation layer over Uu link in scenario 2, a PDCP PDU can be delivered to an intended PDCP entity or RLC entity for support of more than one RB over Uu link e.g. by configuring 1:1 bearer mapping and different Uu RLC channels for relay UE local traffic and relay traffic for PDU delivery.  • Do not specify adaptation layer over Uu link for scenario 2 in RAN2. |
| R2-2211787 | LG | Proposal 15: Confirm the following working assumption:  Proposal 3A: Bearer identification except LCID is not needed in L2 PDU over Uu link in Scenario 2. Only 1:1 bearer mapping is supported over Uu link for the indirect path. FFS how to configure the mapping.  Proposal 3B: Without the adaptation layer over Uu link in scenario 2, a PDCP PDU can be delivered to an intended PDCP entity or RLC entity for support of more than one RB over Uu link e.g. by configuring 1:1 bearer mapping and different Uu RLC channels for relay UE local traffic and relay traffic for PDU delivery.  Proposal 9B: Do not specify adaptation layer over Uu link for scenario 2 in RAN2. |
| R2-2212156 | Spreadtrum | Proposal 3: Confirm the work assumption that do not specify adaptation layer over Uu link for scenario 2 in RAN2. |
| R2-2212737 | Intel | Proposal 15. Confirm the WA of the following: a) the support of 1:1 bearer mapping with details to be discussed in WI phase; b) mapping of a PDCP PDU without adaptation layer c) no need to specify adaptation layer over Uu link for scenario 2. |

A few companies have provided the protocol stack for scenario 2 in the paper which assumes there is no SRAP layer for the user plane protocol stack in Scenario 2.

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| R2-2212563 | Sharp | Proposal 4. RAN2 considers DC-like protocol stack for scenario 2 of multi-path as a baseline.  Proposal 7. RAN2 assumes that the protocol stack shown in Fig.4 can be used for scenario 2 as baseline. |
| R2-2211699 | CMCC | Proposal 3: Agree the UP and CP protocol stack as Figure 2-1 and Figure 2-2, for scenario 2. |

All of the above papers support to confirm the WA for Scenario 2 (i.e., no Uu SRAP layer). There is no papers opposing the WA directly. Only a few papers raise the issue and potential solutions about consequence of absence of SRAP, e.g, how to ensure the sufficiency of LCID space for Uu link and how to differentiate SRB/DRB, which are listed as below:

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| R2-2212814 | Samsung | Proposal 6: To allow SRAP absence at Uu in scenario 2, RAN2 is kindly asked to discuss the scheme of ensuring the total number of bearers at relay/remote UE will not exceed the limitation of RLC channel. |
| R2-2211699 | Apple | Proposal 5: For MP Scenario 2, RAN2 discuss to limit the maximal number of DRBs of remote UE (to be relayed) is 14. |
| R2-2211787 | LG | Proposal 16: Restriction to 1:1 mapping between one receiving/transmitting PDCP entity of the remote UE and one LCID value of DL/UL MAC PDU from the relay UE is ensured by gNB’s configuration. |
| R2-2212563 | Sharp | Proposal 8. Forscenario2, gNB configures same LCID between the RB of Remote UE and the corresponding RB of Relay UE. |
| R2-2211536 | NEC | Proposal 9: RAN2 to discuss whether to configure SRB and DRB on the indirect path simultaneously for Scenario#2.  Proposal 10: RAN2 to discuss how to differentiate SRB from DRB for Scenario 2, if they are configured on the indirect path simultaneously. |
| 11752 | Huawei | Proposal 12. In scenario 2, without adaptation layer in indirect link, split bearer (with 1:1 bearer mapping) can be supported as below:  ‐ For UL:   remote UE’s PDCP entity delivers a packet to Uu RLC entity or to non-3GPP connection based on network configuration;   relay UE passes a packet received from the non-3GPP connection to corresponding Uu RLC channel based on the configured mapping between E2E bearer and Uu RLC channel for the remote UE.  ‐ For DL:   relay UE passes a packet received from a Uu RLC entity to the non-3GPP connection based on the configured mapping between E2E bearer and Uu RLC channel for the remote UE;   remote UE delivers the packet received on the non-3GPP connection to the PDCP associated with the E2E bearer.  ‐ How to indicate E2E bearer ID in the non-3GPP connection is left to UE implementation.  ‐ The mapping configuration for remote UE and relay UE is stage-3 issues, which is left to normative work. |

**Rapp Summary:**

Majority of companies are OK to confirm the WA and it is also true that when SRAP is not used for Scenario 2, the number of RBs can be supported in Uu RLC channel is limited. But that issue can be discussed in normative phase. Also, it make sense to move the “FFS how to configure the mapping” part in the WA to postpone to the normative phase work.

1. **[Easy] RAN2 confirms the following WA for Scenario 2.**

* **Bearer identification except LCID is not needed in L2 PDU over Uu link in Scenario 2. Only 1:1 bearer mapping is supported over Uu link for the indirect path. FFS how to configure the mapping.**
* **Without the adaptation layer over Uu link in scenario 2, a PDCP PDU can be delivered to an intended PDCP entity or RLC entity for support of more than one RB over Uu link e.g. by configuring 1:1 bearer mapping and different Uu RLC channels for relay UE local traffic and relay traffic for PDU delivery.**
* **Do not specify adaptation layer over Uu link for scenario 2 in RAN2.**

1. **[Easy]How to configure 1:1 mapping (e.g., how to ensure a proper 1:1 mapping within the limited LCID space) can be discussed in normative phase.**

### 2.2 Mode 1 RA Support for remote UE in Multi-path relay

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| R2-2211281 | CATT | Proposal 16: For remote UE using multi-path, both resource allocation mode 1 and mode 2 can be supported in PC5 interface. |
| R2-2212737 | Intel | Proposal 17. Discuss whether a Remote UE configured with multi-path uses only resource allocation mode 2 or allowed to use both mode 1 and mode 2. If agreed, details can be discussed during WI phase. |
| R2-2211787 | LG | Proposal 12: SL mode 1 based on the direct link as currently specified can be configured for the remote UE configured with multi-path relaying. |
| R2-2212562 | Sharp | Proposal 10. For scenario 1, RAN2 should discuss whether Remote UE can perform resource allocation mode 1. |
| R2-2212866 | Lenovo | Proposal 11: Remote UE can use mode 1 SL transmission resources from direct path and mode 2 SL transmission resources from the serving cell on the indirect path, in a multipath scenario. |

**Summary:**

Quite a few companies intend to allow mode 1 RA to be used for remote UE configured in MP Scenario 1. The rapporteur understands that the reason for R17 to only use mode 2 RA for Layer-2 U2N remote UE because the remote UE cannot receive SL grants (e.g., via PDCCH). The problem no longer exists for the multipath case. So, it should be quite straight-forward to support mode 1 RA for MP case in Rel-18.

1. **[Easy]Mode 1 RA is supported for the remote UE configured with multi-path in Scenario 1.**

### 2.3 DC vs. CA modelling for MP & PCell location(at least for Scenario 1)

The proposals are summarized for “at least for scenario 1” because some companies split the discussion of scenario 1 and 2 in two different papers.

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| R2-2212208 | OPPO, ZTE, Huawei, HiSilicon, MediaTek, | Proposal 1 When R2 decide on the applicability of PCell location on indirect path, takes R1/R4 impact into consideration. |
| R2-2211281 | CATT | Proposal 1: For Rel-18 multi-path, CA can’t be applied over indirect path.  Proposal 2: For Rel-18 multi-path, CA can be configured over direct path reusing legacy CA procedure.  Proposal 4: For Rel-18 multi-path, PCell of the UE can be one of cells of either direct path or indirect path.  Proposal 8: The terminologies "Primary path" and "Secondary path" are introduced for multi-path.  Proposal 9: The Primary path can be either the direct path or the indirect path, which is configured by gNB.  Proposal 10: PDCP control PDU transmits on the primary path/primary RLC entity same as legacy. |
| R2-2211414 | NEC | Proposal 1: Two single cell groups based Multipath Relay is allowed for the scenario that Remote UE and Relay UE served by different cells.  Proposal 2: Only a single cell group based Multipath Relay is allowed for the scenario that Remote UE and Relay UE served by the same cell.  Proposal 3: Only one MAC entity is assumed for to support Multipath Relay for the UE in case of intra-gNB operation.  Proposal 4: RAN2 to consider procedures for NR-DC management as the baseline to manage intra-gNB multi-path relaying, especially for intra-gNB multi-path relaying with Remote UE and Relay UE served by different cells of the same gNB.  Proposal 5: RAN2 to use the SN addition procedure to configure the SN together with the relay channel if the indirect path is added as the second path. |
| R2-2211537 | Ericsson | Proposal 1 The concept or notion of a PCell is not applicable to the indirect path  Proposal 2 In Scenario-1 and Scenario-2, for a remote UE operating in a multipath scenario, only one of the cells associated with the direct path of the remote UE should be considered as the PCell |
| R2-22-11403 | Intel | Proposal 6. RAN2 to conclude on the definition (if any) of “primary path” before defining primary RLC entity. |
| R2-2211677 | vivo | Proposal 1 For multi-path Scenario 1&2, RAN2 confirm not to introduce primary path concept per remote UE level.  Proposal 2 For multi-path Scenario 1&2, for simpler design, PCell defined for the remote UE is always one of the serving cells of remote UE’s Uu link.  Proposal 3 For Scenario 1&2, PCell and SRB1 (including primary path of SRB1) for remote UE are always on the same path.  Proposal 3a For Scenario 2, PCell and SRB1 (including primary path of SRB1) for remote UE are always on the direct path.  Proposal 8 For direct path addition after indirect path setup (i.e. Case B) in Scenario-1, RAN2 consider to support:  a) one of the serving cells of the added direct path can be reconfigured as PCell for the remote UE;  b) the added direct path can be reconfigured as the primary path at least for SRB1. |
| R2-2211699 | Apple | Proposal 2: Primary path is configured per-RB by NW (as supported with primary RLC entity). No need to introduce a control plane “primary path” concept or “per-UE primary path” concept. |
| R2-2211752 | Huawei Hisilicon | Proposal 2. RAN2 focus on the basic control plane and user plane procedures, and use the terms of first path/second path if needed. Whether to introduce the concept of “primary path” can be decided in normative work in case the requirement can be justified.  Uu RLM and PCell location  Proposal 3: For configuration case B, i.e. direct path is added on top of indirect path, RAN2 discusses PCell location among the following options:  o Option1: One of the Uu Cell is PCell  o Option2: One of the Uu Cell is SCell  o Option3: One of the Uu Cell is PSCell  o Option4: One of the Uu Cell is specially Cell (not PCell or PSCell) |
| R2-2211787 | LG | Proposal 1: The remote UE in MP operation receives PBCH/MIB on the direct path and directly acquires SFN from MIB on the direct path, if necessary.  Proposal 2: The remote UE in MP operation is always provided with PRACH configuration for the direct path.  Proposal 3: Both paths operating on the same cell group of the remote UE is supported for scenario 1 and 2.  Proposal 4: A same MAC entity can be supported for both NR SL of the indirect path and Uu link of the direct path for scenario 1, as currently specified for NR SL.  Proposal 5: Both paths of MP operation are always on MCG of the remote UE for scenario 1 and 2.  Proposal 6: PCell is always configured on a cell of the direct path of MP operation for scenario 1 and 2. If the remote UE is configured with CA/DC, support the case where one of the cells of direct path is PCell of the UE as currently specified. |
| R2-2211788 | Qualcomm | Proposal 1: Stick to current PCell definition and PCell can be either on direct or indirect path.  Proposal 2: PCell and SCell role change is not required at each time direct/indirect path is added or removed.  Proposal 3: If PCell is located on indirect path, the special cell on direct path is PSCell.  Proposal 4: Introduce a path terminology (e.g. primary path or anchor path) to distinguish the different path functions in control plane procedure during RAN2 discussion.  Proposal 5: The primary path or anchor path is the path PCell is located on.  Proposal 6: The path terminology used during RAN2 discussion does not has to be reflected in stage 3 specification.  Proposal 9: Whether one MAC entity or two entities are used for MP Relay can be left to UE implementation |
| R2-2211814 | ZTE | Proposal 2: The remote UE may regard the serving cell for the RRC establishment as PCell, no matter it is via direct path or indirect path.  Proposal 3: For the remote UE initially connects the network via direct path and then add indirect path, the cell of direct path is regarded as PCell. For the indirect path, remote UE only need to identify the relay UE and the serving cell of relay UE.  Proposal 4: The multi-path remote UE may regard the cell of direct path as PCell for multi-path remote UE.  Proposal 5: Multi-path remote UE can be configured with only one cell group and only one MAC entity. |
| R2-2211874 | Xiaomi | Proposal 3: Primary RLC entity of the MP split bearer for DRB could be configured on either direct path or indirect path.  Proposal 4: From control plane point of view, the two paths should be differentiated to anchor path and non-anchor path from following aspects,  - UE triggers RRC reestablishment if the anchor path fails.  - UE obtains SI only from anchor path, if the two paths connect to different cells.  Proposal 7: PCell can be on direct path or indirect path.  Proposal 8: RRC\_IDLE/RRC\_INACTIVE Relay UE shall enter RRC\_CONNECTED upon reception of the indication/configuration received from a remote UE, e.g. indication/configuration in RRCReconfigurationSidelink message. FFS the content of the indication/configuration. |
| R2-2212156 | Spreadtrum | Proposal 1: The primary and secondary path should be introduced in multi-path relaying for scenario 1 and scenario 2.  - For scenario 1: the Uu link is configured as primary path and the relay link is configured as secondary path, or the opposite.  - For scenario 2: the Uu link is configured as primary path and the link of non-standardized UE-UE connection is configured as secondary path. |
| R2-2212323 | MediaTek | Proposal 1: If a modelling for MP is needed, RAN2 to adopt CA model for MP discussion. |
| R2-2212699 | CMCC | Proposal 11: Only the direct path can be configured as the primary path and the indirect path can be configured as the secondary path for scenario 1 and 2, regardless indirect path or direct path is added as second path.  Proposal 12: SRB (re)configuration should be considered with the configuration of primary path and secondary path. |
| R2-2212722 | Nokia | Proposal 12: For scenario 1, PCell is on either the direct path or the indirect path, where the remote UE makes an RRC  connection.  Proposal 13: PCell is not changed/reconfigured by addition of another path.  Proposal 14: For scenario 2, PCell is on direct path. |
| R2-2212737 | Intel | Proposal 6. RAN2 to conclude on the definition (if any) of “primary path” before defining primary RLC entity. |
| R2-2212813 | Samsung | Proposal 3-1: RAN2 is kindly asked to discuss the necessity of differentiating two paths for CP and UP transmission first regardless of “primary path”.  Proposal 3-2: the CP&UP traffic be transmitted by differentiating two paths.  Proposal 3-3: RAN2 is kindly asked to use the term of “primary path” and “secondary path” to differentiate two paths.  Proposal 3-4: RAN2 is kindly asked to agree the following operations if the concept of primary path is agreeable:   Operation 1: the operation of primary path can be applicable for both scenario 1 and scenario 2.   Operation 2: during RRC setup/reestablishment/resume procedure, the path selected by UE is by default regarded as initial primary path.   Operation 3: after RRC setup/re-establishment/resume, the gNB can change the primary path via signaling.   Operation 4: the primary path is configured per bearer.   Operation 5: the primary path is by default used as data transmission, and the secondary path is triggered based on gNB’s configuration (details need further discussion).  Proposal 5-1: the PCell is the cell where the UE performs the RRC Setup/Resume/Reestablishment procedure or the one indicated by handover command.  Proposal 7-1: the primary RLC entity can be configured as the one serving either direct path or indirect path.  Proposal 7-2: the primary RLC entity can be the one serving the primary path (if defined). |
| R2-2212866 | Lenovo | Proposal 4: The concept of primary path for CP can be supported. |

**Summary:**

The modelling (CA vs DC) debate is very conceptual. It is hard to determine the modelling w/o evaluating the corresponding technical implications. Also, even if one modelling is preferred, it does not mean automatically inheriting all the related procedures. So, the rapporteur feels we still need to resolve some key issues first, instead of discussing modelling issue directly.

The first issue is PCell location, companies prefer to keep PCell on direct path ( Huawei, Ericsson, vivo, LG, ZTE), while other companies (Qualcomm, Nokia, CATT, Xiaomi ) think PCell can be on either path (e.g., depends on which path is used by UE to establish RRC connection). The drawback of restricting PCell on direct path is that UE has to switch PCell when a direct path is added on the top of indirect path. It has also been pointed out there could be some RAN1/RAN4 impact if PCell is not on Uu path, but this may also not be really a blocking issue. There is no majority view on this issue, so we suggest RAN2 to discuss

1. **[RAN2 to Discuss]Whether PCell location is on direct path only or can be on either path.**

The second issue is whether there is a per-UE, per-CP primary path (or “anchor path”) concept. Although some companies support to have this (Samsung, Qualcomm, Xiaomi, Lenovo). Some companies (Intel, Apple, vivo) are not convinced that there is a need for primary path concept at least from the per-UE perspective. The rapporteur think we need to understand the the benefits of this configured “primary path” per-UE (or per Control plane) level when compared with NW configure “primary RLC entity” per-SRB level. At least, the latter approach seems more flexible.

1. **[RAn2 to Discuss] RAN2 discuss the technical justification of Per-CP “Primary path” concept to determine whether to support it or not.**

Note that there is some debate among the contributions on whether primary path is always the direct path or can be either path, but the rapporteur thinks this is dependent on the above two issues, so there is no need for a separate proposal now.

### 2.4 PCell location (Scenario 2)

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| 11815 | ZTE | Proposal 2: For scenario 2, if the multi-path remote UE is only allowed to establish the RRC connection via the direct path, the multi-path remote UE regards the serving cell of direct path as PCell.  Proposal 3: For scenario 2, multi-path remote UE can be configured with only one cell group and correspondingly only one MAC entity.  Proposal 5: For scenario 2, remote UE only need to receive system information from direct path.  Proposal 6: For scenario 2, it is suggested that the remote UE may report the indirect path failure to gNB via direct path.  Proposal 7: For scenario 2, the remote UE can only perform RRC reestablishment via direct path. |
| R2-2212722 | Nokia | Proposal 14: For scenario 2, PCell is on direct path. |
| 11788 | Qualcomm | Proposal 19: if cases B, D are supported for Scenario 2, PCell can be on either direct path or indirect path. |
| 11874 | Xiaomi | Proposal 7: PCell can be on direct path or indirect path. |

**Summary:**

There are not many papers discussing this issue particularly for scenario 2. But it is obvious that if Case B/D are not supported, then the UE will always have direct path first, and PCell is supported to be on the direct path in this case. So, we should have an easy proposal as follow:

1. **[Easy] If case B and case D are not supported for Scenario 2, PCell is always on the direct path for Scenario 2.**

### 2.5 Support/Configuration of Split-bearer

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| 11207 | OPPO | Proposal 10 For scenario-1 of multi-path Relay, for PDCP duplication, R2 follows legacy design as a baseline, including at least 1) all RLC entities have the same RLC mode, 2) PDCP control PDUs are not duplicated and always submitted to the primary RLC entity. 3) RRC can set the duplication state (but always activated for SRB).  Proposal 16 R2 confirms split SRB can be configured with or without duplication as in legacy, for scenario-1. |
| 11537 | Ericsson | Proposal 5 For Scenario-1, with a MP split SRB for SRB1/SRB2:  a. In DL, it is up to network implementation to select the direct path, indirect path or both paths for transmission.  b. In UL, transmission can be performed only on the direct path as the baseline or on both paths if duplication is configured.  Proposal 7 For Scenario-2, with a MP split SRB for SRB1/SRB2:  a. In DL, it is up to network implementation to select the direct path, indirect path or both paths for transmission.  b. In UL, transmission can be performed only on the direct path or on both paths if duplication is configured. |
| 12813 | Samsung | Proposal 2-1: MP split bearer without duplication is supported for SRB/DRB. |
| 11633 | InterDigital | Proposal 1: Split SRB1/SRB2 for multipath can be configured with a primary RLC entity on either the direct path or the indirect path  Proposal 2: Split SRB1/SRB2 for multipath can be configured as duplicated or non-duplicated  Proposal 3: DL transmission on split SRB1/SRB2 without duplication can be performed on either primary or non-primary path  Proposal 4: UL transmission on split SRB1/SRB2 without duplication can be performed on the primary path. FFS if it can be performed on the other path and the associated conditions.  Proposal 5: At least the split bearer threshold mechanism is supported for a split DRB without duplication in multipath for determining when a UE can transmit data to the non-primary path. FFS if any differences with legacy DC split bearer threshold approach.  Proposal 6: For a split bearer without duplication, the network controls the amount of data routed by the UE to each of the primary and secondary paths when the split bearer threshold is exceeded. |
|  | ZTE | Proposal 8: For the multi-path split bearer, either the direct path or indirect path may be configured as the primary path. |
| 11784 | Xiaomi | Proposal 5: If duplicate or split SRB is not configured, the path carrying SRBs is anchor path.  Proposal 6: If duplicate or split SRB is configured, the anchor path is indicated by gNB. |
| 12562 | Sharp | Proposal 6. The primary RLC entity of the MP split bearer for DRB can be configured on any of the paths for scenario 1 and scenario 2.  Proposal 9. For scenario 1 and 2, split bearer with/without duplication. |
| 12722 | Nokia | Proposal 8: For SRB, if MP split RB is configured, duplication is always activated, i.e., split operation is not supported.  Proposal 10: For MP split bearer, if duplication is not activated, PDCP PDU is transmitted to either RLC entity regardless of data volume, i.e., data volume threshold is not used.  Proposal 11: In sidelink multipath relay, primary RLC entity is not introduced. |
| 12737 | Intel | Proposal 3. In scenario 1, multi-path split bearer is supported for SRB1 and SRB2. Support for SRB4 can be concluded during WI phase.  Proposal 4. In scenario 2, multi-path split bearer is supported for SRB1 and SRB2 to enable duplication. If direct path RLF is detected, SRB1 and SRB2 are suspended until direct path is re-established.  Proposal 6. RAN2 to conclude on the definition (if any) of “primary path” before defining primary RLC entity. |
| 12699 | CMCC | Proposal 14: Split SRB can be supported for both SRB1 and SRB2 on the secondary path in multi path.  Proposal 15: Split SRB can be configured with secondary path Addition and/or Modification procedure.  Proposal 16: Split SRB solutions can be applied for both scenario 1 and scenario 2. |
| 12866 | Lenovo | Proposal 9: Both legacy data volume threshold for split bearer and some enhancements can be considered to support MP split bearer in multi-path relaying case. |

**Summary:**

The majority view of the papers supports the split SRB configuration w/ or w/o duplication, except Nokia argues that split SRB is always activated for duplication because there is no need of offloading for SRB. As majority view is to reuse legacy NR mechanism, the rapporteur understands that NW can always configure duplication for a split SRB because the duplication state is always active and cannot be dynamically controlled for SRB. So, if NW does not want split SRB w/o duplication, it can always configure duplication with split SRB. Intel also wants to discuss SRB4 separately in normative phase. Maybe we can agree that the legacy split SRB configuration is used as a baseline and further restriction to be discussed in the normative phase.

1. **[Easy] R2 confirms that split SRB can be configured with or without duplication as in legacy as a baseline. Further restrictions can be discussed in normative phase.**

However, there are some debate on whether the data volume threshold for split bearer is useful . Some companies (InterDigital, Lenovo) think this can be reused. But Nokia think this is not needed. Since there are not many companies have shared views on this, it is suggested to further discuss.

1. **[RAN2 to discuss] data volume threshold for split bearer (SRB/DRB) is used or not.**

Note that the configuration of primary RLC entity of the SRB is depends on the foregoing discussion on the “Primary/anchor path” concept. So, we do not discuss it separately here.

### 2.6 Path change cases for Scenario 2 (Case B, D, E, G)

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| 11207 | OPPO | Proposal 18 R2 not purse case-B (direct path addition), D (direct path release) and E (direct path change w/o indirect path change), for scenario-2. |
| 11282 | CATT | Proposal 1: The following cases are proposed to be not supported for Scenario 2:  - B. The remote UE configured only on the indirect path adds the direct path under the same gNB;  - D. The remote UE configured with multi-path releases the direct path;  - E. The remote UE configured with multi-path changes the serving cell of the remote UE for the direct path while keeping the serving relay UE for the indirect path under the same gNB;  - G: The remote UE configured with multi-path changes to a new relay UE for the indirect path while keeping the direct path under the same gNB. |
| 11874 | Xiaomi | Proposal 9: Following cases can be supported for scenario 2 by reusing the solution in scenario 1,  B. The remote UE configured only on the indirect path adds the direct path under the same gNB;  D. The remote UE configured with multi-path releases the direct path;  E. The remote UE configured with multi-path changes the serving cell of the remote UE for the  direct path while keeping the serving relay UE for the indirect path under the same gNB;  Proposal 10: Following case is not supported,  G. The remote UE configured with multi-path changes to a new relay UE for the indirect path while keeping the direct path under the same gNB. |
| R2-2211536 | Ericsson | Proposal 3 For Scenario-2, RAN2 to not pursue cases B, D, E.  Proposal 4 For Scenario-2, RAN2 to consider supporting case G. |
| R2-2212722 | Nokia | Proposal 2: For scenario 2, RAN2 assumes there is always a direct path.  Proposal 3: For scenario 2, Case B/D/E are not supported but case G is supported via C+A. |
| R2-2211403 | Intel | Proposal 3. In scenario 2, indirect path cannot be configured until direct path is available.  Proposal 3.1. The addition of direct path under the same gNB after configuration of indirect path (i.e. B in FFS Proposal 1-2C in [1]) is not considered feasible  Proposal 4. In scenario 2, for the Remote UE configured with multipath, releasing the direct path (i.e. D in FFS Proposal 1-2C in [1]) is not supported.  Proposal 5. In scenario 2, for the Remote UE configured with multipath, changing the serving cell for the direct path while keeping the serving relay UE for the indirect path (i.e. E in FFS Proposal 1-2C in [1]) is not supported.  Proposal 6. In scenario 2, the remote UE configured with multipath changing to a new Relay UE for the indirect path while keeping the direct path under the same gNB (i.e. G in FFS Proposal 1-2C in [1]) is out of 3GPP scope and not supported. |
| R2-2212563 | Sharp | Proposal 1. For scenario 2, RAN2 does not support the following case:  B. The remote UE configured only on the indirect path adds the direct path under the same gNB;  D. The remote UE configured with multi-path releases the direct path;  Proposal 2. For scenario 2, if RAN2 agrees with P.1, does not support the case (E):  E. The remote UE configured with multi-path changes the serving cell of the remote UE for the direct path while keeping the serving relay UE for the indirect path under the same gNB;  Proposal 3. For scenario 2, RAN2 support the case (G) by using (A+C):  G. The remote UE configured with multi-path changes to a new relay UE for the indirect path while keeping the direct path under the same gNB. |
| 11815 | ZTE | Proposal 1: For scenario 2, it is not necessary to consider case B, D, E, G in Rel-18. |
| 11678 | vivo | Proposal 3 For Scenario-2, whether/how to support Case B & D can be left to WI phase.  Proposal 4 For Scenario-2, Case E needs to be supported and a single procedure like legacy PCell change is more preferable.  Proposal 5 For Scenario-2, Case G does not need to be supported in Release 18. |
| 11752 | Huawei | Proposal 14. The following cases are not supported for Scenario 2:  • B. The remote UE configured only on the indirect path adds the direct path under the same gNB;  • D. The remote UE configured with multi-path releases the direct path;  • E. The remote UE configured with multi-path changes the serving cell of the remote UE for the direct path while keeping the serving relay UE for the indirect path under the same gNB;  Proposal 15. The following case is supported for Scenario 2 if more than one candidate relay UEs have the paired relation with the remote UE, i.e. relay change is possible:  • G. The remote UE configured with multi-path changes to a new relay UE for the indirect path while keeping the direct path under the same gNB. |
| 11783 | China Telecom | Proposal 3: For Scenario 2, the following path management cases (i.e. case B, D, E and G) are not supported in this release. |
| 11788 | Qualcomm | Proposal 18: For Scenario 2, the following cases B, D should be supported.  B. The remote UE configured only on the indirect path adds the direct path under the same gNB;  D. The remote UE configured with multi-path releases the direct path;  Proposal 22: The following cases E and G can be supported for Scenario 2, and the mechanism defined for Scenario 1 can be taken baseline. For indirect path change, the service continuity on indirect path to indirect path for intra-gNB can be used as baseline with Remote UE including candidate Relay UE in SidelinkUEInformationNR. And it is up to Remote UE implementation to determine the candidate Relay UE.  E. The remote UE configured with multi-path changes the serving cell of the remote UE for the direct path while keeping the serving relay UE for the indirect path under the same gNB;  G. The remote UE configured with multi-path changes to a new relay UE for the indirect path while keeping the direct path under the same gNB. |
| 12813 | Samsung | Proposal 1-1: Same as scenario 1, the cases B/D/E/G can be supported in scenario 2 unless the necessity of direct path is justified for the UE-UE link establishment. |
| 12699 | CMCC | Proposal 9: Case B and D can be excluded, for scenario 2.  Proposal 10: Case E, G can be supported for this release, for scenario 2. |

**Summary:**

For Case B and Case D:

**Yes: 3** (Samsung, Xiaomi, Qualcomm) vs.  **No: 10** (OPPO, CATT, Ericsson, Nokia, Huawei, Intel, ZTE, China Telecom, CMCC, Sharp)

For Case E:

**Yes: 5** (Samsung, Xiaomi, Qualcomm, CMCC, vivo) vs. **No 9** (OPPO, CATT, Ericsson, Nokia, Huawei, Intel, ZTE, China Telecom, Sharp)

For case G:

**Yes: 7** (Huawei, Qualcomm, Samsung, CMCC, Ericsson, Nokia, Sharp) vs **No: 6** (vivo, CATT, ZTE, Intel, China Telecom, Xiaomi)

Based on the majority view, the rapporteur has the following proposals:

1. **[RAN2 to discuss] For Scenario 2, Case B, D and E are not supported.**
2. **[RAN2 to discuss] For Scenario 2, Case G is supported.**

### 2.7 Single Procedure for Case E/G in Scenario 1?

|  |  |  |
| --- | --- | --- |
| 11207 | OPPO | Proposal 1 For use-case E (direct path change w/o indirect path change) and G (indirect path change w/o direct path change), do not support single switch procedure, for scenario-1. |
| 11281 | CATT | Proposal 3: gNB can release-and-add the direct path in a single RRCReconfiguration message while keeping indirect path for Scenario 1. |
| 11403 | Intel | Proposal 1. In scenario 1 for remote UE operating in multi-path, change of relay UE under the same gNB is handled via single switch procedure using indirect-indirect path switching with service continuity as baseline. Details considered during WI phase.  Proposal 2. In scenario 1 for remote UE operating in multi-path, the remote UE can change the direct path to a different cell of the same gNB via a single procedure unless a problem is identified. Details considered during WI phase. |
| 11536 | Ericsson | Proposal 1 In Scenario-1, for Case G, for the same gNB, support the replacement of the indirect path while keeping the direct path using the Rel-18 intra-gNB i2i path switch procedure. Further details can be discussed in the WI phase.  Proposal 2 In Scenario-1, RAN2 to agree to the following:  a. In case E, when the direct path changes to a different cell, release the indirect path.  b. If the direct path changes to a different cell of a different gNB, release the indirect path |
| 11678 | vivo | Proposal 1 For Scenario-1, Case G is supported via separate release-and-add (A+C in separate reconfigurations) as baseline in Rel-18. Whether/how to support via a single switch procedure (e.g. similar to i2i service continuity) is left to the WI phase.  Proposal 2 For Scenario-1, Case E is supported via separate release-and-add (B+D in separate reconfigurations) as baseline in Rel-18. Whether/how to support Case E via a single switch procedure is left to the WI phase. |
| 11699 | Apple | Proposal 1: For Case G in MP Scenario 1, a single indirect path switching procedure is supported. Whether gNB uses this single procedure or “release +add” is up to gNB implementation. |
| 11752 | Huawei | Proposal 13. Support cases E and G via separate release-and-add for scenario 1, and further check whether a single procedure for these cases would be supported in stage 3. |
| 11783 | China Telecom | Proposal 1: For indirect path change case in Scenario 1(i.e. Case G), a single switch procedure would be supported. The intra-gNB i2i path switch procedure for service continuity could be taken as a baseline.  Proposal 2: For direct path change case in Scenario 1(i.e. Case E), leave the discussion on whether to support a single procedure for this case to the normative work phase. |
| 11874 | Xiaomi | Proposal 1: Support single procedure of path switch for following cases,  E. The remote UE operating in multi-path changes the direct path to a different cell of the same gNB while using the serving relay UE for the indirect path under the same gNB.  G. The remote UE operating in multi-path changes to a new relay UE for the indirect path while keeping the direct path under the same gNB. |
| 12722 | Nokia | Proposal 1: For scenario 1, the case E and G are supported by B+D and C+A, respectively, and further optimization via single procedure is not discussed in this release. |
| 12813 | Samsung | Proposal 1-2: both direct path change and indirect path change can be realized via either the single procedure or the separate procedure. |
| 11814 | ZTE | Proposal 1: For scenario 1, it is suggested to consider single procedure for case G and E. |
| 12866 | Lenovo | Proposal 1: Intra-gNB Relay change via a single switch procedure while the remote UE keeps the direct path under the same gNB should be supported.  Proposal 3: Intra-gNB cell change via a single procedure while the remote UE keeps the indirect path under the same gNB should be supported. |
| 12699 | CMCC | Proposal 8: For scenario 1, only separate release and add procedure is considered for case G and E. |

**Summary:**

For Case G, most companies support to use a single procedure (e.g. based on the one used for Rel-18 intra-gNB i2i path switching), expect CMCC and Nokia. Huawei wants to further check whether a single procedure for these cases would be supported in stage 3

For Case E, there is no clear majority view.

This is not a very critical issue, so we can discuss if time allows. But we can also delay this issue for Case E and Case G to normative phase. Hope this can be acceptable by all companies as low priority.

1. **[Low priority]Whether a single procedure can be supported for Case E & Case G.**

### 2.8 SRB1/2 configuration (Scenario 1)

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| --- | --- | --- |
| 11207 | OPPO | Proposal 15 R2 confirms the SRB configuration (which path(s) to use) is a per-bearer configuration, for scenario-1. |
| R2-2211281 | CATT | Proposal 14: For scenario 1, SRB1 and SRB2 can’t be configured on the different paths. |
| R2-2211537 | Ericsson | Proposal 3 For Scenario-1, SRB1 and SRB2 should not be configured on different paths from one another.  Proposal 4 For Scenario-1, without a MP split SRB, SRB1/SRB2 can be transmitted only on the direct path or only on the indirect path. |
| 11677 | vivo | Proposal 4 For Scenario 1&2, split SRB1 can be configured with non-duplication case.  Proposal 5 For Scenario 1&2, SRB2 can be configured on either the same path or different path with SRB1, which is up to NW configuration. |
| 11752 | Huawei | Proposal 10. For scenario 1, SRB1 and SRB2 can be configured on different paths. |
| 11699 | Apple | Proposal 3: For MP Scenario 1, SRB1 and SRB2 can be configured in different path.  . |
| 11814 | ZTE | Proposal 6: For scenario 1, the bearer type (i.e. direct bearer, indirect bearer, or multi-path bearer) of SRB1 and SRB2 may be configured by the gNB independently.  Proposal 7: It is not necessary to mandate the same bearer type configuration of SRB1 and SRB2. |
| 11874 | Xiaomi | Proposal 2: SRB1 and SRB2 configured on different paths from one another is not supported. |
| 11788 | Qualcomm | Proposal 8: SRB1 and SRB2 are configured on the anchor path (if introduced) i.e. the path PCell is located on. (For Scenario 1) |
| 12562 | Sharp | Proposal 7. For scenario1, SRB1 and SRB2 can be configured on different paths from one another. |
| 12722 | Nokia | Proposal 4: For scenario 1, SRB1 and SRB2 are always configured on the same path. |
| 12737 | Intel | Proposal 1. For scenario 1, SRB1 and SRB2 can be configured on different paths from one another up to gNB implementation. |

**Summary:**

The company views are split while 7 companies think SRB1/2 can be configured in different paths while 5 companies oppose this in Scenario 1.

1. **[RAN2 to discuss]** **Whether SRB1/2 can be configured in different path for Scenario 1**

### 2.9 SRB1/2 Configuration Scenario 2

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| --- | --- | --- |
| 11207 | OPPO | Proposal 19 For scenario 2, SRB1 and SRB2 can be configured on the direct path or both paths, but not on indirect path only. |
| 11282 | CATT | Proposal 7: For scenario 2, SRB1 and SRB2 can only be configured on the direct path for the non-duplication case. |
| 11537 | Ericsson | Proposal 6 For Scenario-2, without a MP split SRB, SRB1 and SRB2 need not be configured only over the indirect path. |
| 11677 | vivo | Proposal 4 For Scenario 1&2, split SRB1 can be configured with non-duplication case.  Proposal 5 For Scenario 1&2, SRB2 can be configured on either the same path or different path with SRB1, which is up to NW configuration |
| 11874 | Xiaomi | Proposal 2: SRB1 and SRB2 configured on different paths from one another is not supported. |
| 11699 | Apple | Proposal 4: For MP Scenario 2, only direct path only or “direct + indirect duplication” is supported for SRB1/SRB2 |
| 11752 | Huawei | Proposal 11. For scenario 2, PDCP duplication can be supported for SRB1 and SRB2. |
| 11814 | ZTE | Proposal 4: For scenario 2, in addition to direct bearer, indirect bearer and multi-path bearer may be configured for the SRB1 and SRB2. |
| 11788 | Qualcomm | Proposal 20: For scenario 2, SRB1 and SRB2 can be configured either the direct path or indirect path or both path. |
| 12562 | Sharp | Proposal 8. For scenario 2, SRB1 and SRB2 can be configured on both path (as split SRB). |
| 12722 | Nokia | Proposal 5: In scenario 2, SRB1 and SRB2 are only configured on direct path. |
| 12737 | Intel | Proposal 2. For scenario 2, SRB1 and SRB2 can only be configured on the direct path i.e. they cannot be configured on both paths. |

**Summary:**

The views are divergent, but the key difference is that for non-split SRB, some companies think SRB1/2 on indirect path shall not be allowed (OPPO, Apple, Ericsson, Nokia, Intel, CATT) .

The majority think at least SRB split with duplication is to be supported, which is already covered by the earlier proposal in section 2.5.

1. **[RAN2 to discuss] Whether SRB1/2 is allowed to be configured only on indirect path for Scenario 2.**

### 2.10 UE Inactive AS Context for remote UE

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| --- | --- | --- |
| 11207 | OPPO | Proposal 5 R2 not pursue that remote UE stores the indirect path configuration in UE Inactive AS context, for scenario-1.  Proposal 6 R2 confirms remote UE can resume directly into multi-path based on legacy RRCResume signaling (i.e., gNB provides SL RLC channel and SRAP configuration for direct path configuration in RRCResume, and UE resume the direct path configuration from Inactive AS context), for scenario-1. |
| R2-2211281 | CATT | Proposal 5: The UE resumes directly into multi-path relay is not supported. |
| 11282 | CATT | Proposal 9: For scenario 2, when the remote UE enters RRC\_INACTIVE, it can store the indirect path configuration.  Proposal 10: For scenario 2, upon receiving the RRCResume message, if UE does not support maintaining the multi-path configurations upon connection resumption, it can release the indirect path configurations from the UE Inactive AS context if stored. |
| R2-2211536 | Ericsson | Proposal 5 For Scenario-1 and Scenario-2, the remote UE can store both the direct path configuration and indirect path configuration to perform a multipath resumption by first establishing a direct/indirect path. Details of the indirect path configuration can be left to the WI phase. |
| 11677 | vivo | Proposal 8 For Scenario-1, NOT Support storing indirect path configuration for potential resume directly into multi-path operation.  Proposal 9 For Scenario-2, Support storing indirect path configuration for potential resume directly into multi-path operation. Details can be discussed during WID phase. |
| 11752 | Huawei | Proposal 8: Upon a UE (configured with multi-path earlier) is released to inactive state, it does not store SRAP and PC5 Relay RLC channel configuration of indirect path (same as Rel-17). |
| 11814 | ZTE | Proposal 11: The remote UE may store the SDAP/PDCP configuration of indirect bearer and split bearer as UE inactive AS context. The SRAP, PC5 RLC channel configuration of indirect path can be released. |
| 12737 | Intel | Proposal 11. Remote UE storing indirect path configuration and resuming directly into multi-path configuration is not supported in this release for both scenario 1 and scenario 2. |

**Summary:**

The clear majority view is that when remote UE resume from INACTIVE state, it will not be able to resume to MP path directly. Ericsson thinks there are some merits to resume both paths for Scenario 2 as remote UE is most likely to be only associated with a specific relay UE, but Ericsson also agrees that both paths cannot be resumed at the same time. So, we may have an easy proposal for Scenario 1 for this issue:

1. **[Easy] Remote UE storing indirect path configuration and resuming directly into multi-path configuration is not supported for scenario 1.**

As whether it is beneficial for INACTIVE remote UE to store indirect path configuration for Scenario 2, this is a bit more controversial. ZTE, Ericsson, Vivo and CATT supports to store it while other companies disagree. So, some further discussion is needed.

1. **[RAN2 to discuss] Whether to support Remote UE storing indirect path configuration or not and use it to resume to MP configuration for Scenario 2.**

### 2.11 SI Acquisition

|  |  |  |
| --- | --- | --- |
| 11207 | OPPO | Proposal 2 R2 confirm Remote-UE operating in MP Relay can obtain short message via direct path as in legacy, if PCell is on direct path and CSS is configured, no specific enhancement is needed, for scenario-1.  Proposal 3 R2 confirms for RRC\_CONNECTED Remote-UE operating in MP Relay, if PCell is on direct path and CSS is configured, it can acquire SIB based on legacy spec, with all tools available (SIB acquisition via CSS and via dedicated RRC, and SIB request via MSG1, RRCSystemInfoRequest, DedicatedSIBRequest), for scenario-1.  Proposal 4 R2 confirms for RRC\_CONNECTED Remote-UE operating in MP Relay, if PCell is not on direct path (whether this is a valid scenario is pending PCell location discussion decision) or CSS is not configured, it can acquire SIB based on legacy spec, yet with part of tools available (SIB acquisition via dedicated RRC, and SIB request via DedicatedSIBRequest), for scenario-1. |
| 11536 | Ericsson | Proposal 6 For Scenario-1 and Scenario-2, no enhancements are needed to perform SI acquisition over the direct and indirect path. Reuse legacy and Rel-17 procedures, no spec impact is foreseen. |
| 11633 | InterDigital | Proposal 14: SI Request and/or Acquisition via either direct or indirect path is supported for a remote UE in RRC\_CONNECTED configured with multi-path  Proposal 15: A remote UE in RRC\_INACTIVE with multipath configured via two different cells should request and/or acquire SI only the path associated with its PCell. |
| 11787 | LG | Proposal 7: If CSS for SI is configured within the active BWP on the direct path on PCell, the remote UE performs direct system information acquisition on PCell as currently specified in 38.331. If not, the gNB can alternatively provide system information on DCCH to the remote UE via any path.  Proposal 8: If CSS for Paging is configured within the active BWP on the direct path on PCell, the remote UE in RRC\_CONNECTED monitors paging on PCell for updated system information or ETWS/CMAS indication, as currently specified in 38.331. If not, the gNB can alternatively provide updated system information or warning message(s) on DCCH to the remote UE via any path. |
| 11814 | ZTE | Proposal 12: For scenario 1, the multi-path remote UE in RRC\_Connected may receive SIB 12/13/14 from either direct or indirect path. For the other SIBs, the multi-path remote UE in RRC\_Connected receives them from direct path if necessary. |
| 11788 | Qualcomm | Proposal 7: For MP relay, the control plane procedures are clarified as following.  - The SIs of the cells on non-anchor path are transmitted to the UE using RRCReconfiguration message.  - Remote UE can report indirect path/direct path failure over direct path/indirect path if direct path/indirect path is not suspended. Otherwise, initiate RRC re-establishment procedure.  - UE performs RRC re-establishment procedure on PCell according to clause 5.3.7 in TS 38.331 with MP relay context released.  - In Inactive state, Remote UE camps on PCell or indicated cell in RRCRelease message in response to an RRCResumeRequest or an RRCResumeRequest1. |
| 12813 | Samsung | Proposal 6-1: it is gNB’s implementation to determine the path used for system information transmission. |

**Summary:**

It is agreed that MP configuration is only applicable to UE in RRC\_CONNECTED state. So, for remote UEs in IDLE/INACTIVE, legacy procedures shall be used for SI acquisition. It is not very clear what “A remote UE in RRC\_INACTIVE with multipath configured” means in the proposal in R2-2211633. The rapporteur inclined to not have any proposal for IDLE/INACTIVE UE’s SI acquisition.

Then, for Qualcomm proposal, the rapporteur understands that this is equivalent to regarding the cell in non-anchor path as PSCell. As this is controversial, we need to wait for the outcome of the discussion on anchor path and primary path.

For RRC\_CONNECTED remote UE. LG and OPPO has discussed the case when CSS is configured in active BWP. For sure in this case, the UE can obtain SI acquisition with the legacy procedure.

1. **[Easy] If PCell is on direct path, and CSS for SI is configured within the active BWP, the remote UE can perform direct system information acquisition on PCell as currently specified in 38.331.**

But for other case, the rapporteur feel the solutions/tools are entangled with PCell location issue, “Primary/anchor path” issue and SRB1 configuration (split/direct/indirect) issue, so it is hard to draw any meaningful proposal now. Maybe we can revisit this in normative stage.

### 2.12 Path failure reporting (Trigger of RRC Reestablishment)

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| --- | --- | --- |
| 11207 | OPPO | Proposal 8 For scenario-1 of multi-path Relay, in case of Uu-RLF, if SRB1 is configured on PC5, suspend the direct path transmission and trigger report to network via indirect path to report the failure via MCGFailureInformation message. Otherwise, if SRB1 is not configured on PC5, RRC Re-establishment is initiated.  Proposal 9 For scenario-1 of multi-path Relay, in case of PC5-RLF, if SRB1 is configured on Uu, suspend the indirect path transmission and trigger report to network via direct path to report the failure via SidelinkUEInformation message. Otherwise, if SRB1 is not configured on Uu, RRC Re-establishment is initiated.  Proposal 21 For scenario-2 of multi-path relay, in case of failure detected on UE-UE link (by implementation), remote (or relay) can report the inter-UE connection failure to network. |
| R2-2211281 | CATT | For Scenario 1:  Proposal 6: UE should initiate RRC re-establishment procedure when both indirect path and direct path are failure.  Proposal 7: UE in multi-path relay can reestablish either indirect path or direct path. Reestablishment both indirect path and direct path is not supported.  Proposal 17: When the remote UE using multi-path detects failure on one path, it can send RLF report to gNB via another path.  Proposal 18: MCGFailureInformation message is used to inform the network about RLF on direct path or SL RLF/Uu RLF of relay on indirect path.  Proposal 19: Introducing new failure types for SL RLF and Uu RLF of relay UE. |
| 11282 | CATT | For Scenario 2:  Proposal 8: For scenario 2, if the UE-UE link failure, the relay UE or the remote UE can indicate the failure to gNB through direct link. |
| 11633 | InterDigital | Proposal 7: RLM/RLF on any of the two paths in multipath can be disabled or relaxed based on network configuration.  Proposal 8: Recovery procedure(s) (e.g., similar to MCGFailure/SCGFailure) should be specified to allow a UE to maintain the NW connection upon failure of one of the two paths in multi-path.  Proposal 9: The UE supports both an MCGFailure-like procedure (i.e., the UE waits for reconfiguration following the failure) and SCGFailure-like procedure (i.e., the UE can continue operation without a reconfiguration following the failure) following RLF when split SRB is configured.  Proposal 10: Upon detection of RLF on the path on which non-split SRB is configured, the remote UE can perform a re-establishment-like procedure via the other path. FFS on details. |
| 11677 | vivo | Proposal 6 For Scenario 1&2, Remote UE declares RLF based on the PCell failure or failure occurrence on the primary path of SRB1 only.  Proposal 10 For Scenario 1&2, if ONLY direct path failure is detected by remote UE, the remote UE does not perform RRC re-establishment procedure, but rather notify the failure information to the network via indirect path (the relay UE).  Proposal 10a: Remote UE’s failure information can be sent to network using split SRB1, if configured.  Proposal 11 For Scenario 1&2, if ONLY indirect path failure is detected by remote UE, the remote UE does not perform RRC re-establishment procedure, but rather the UE can directly report the failure information to network on direct path.  Proposal 12 For Scenario 1&2, if BOTH direct path failure AND indirect path failure are detected by remote UE, the remote UE performs RRC re-establishment procedure. |
| 11787 | LG | Proposal 11: If configured, the remote UE can report the direct path failure to the gNB via the indirect path upon direct path failure, while the remote UE can report the indirect path failure to the gNB via the direct path upon indirect path failure, regardless of the primary path is defined or not. |
| 11752 | Huawei | Proposal 4: In scenario 2, the remote UE detects RLF over UE-to-UE interface by UE implementation and the failure information can be reported via Uu signalling for network decision on multi-path release. |
| 11783 | China Telecom | Proposal 6: Upon detection of RLF or path failure on one path, the remote UE in both Scenario 1 and 2 can report the path failure information on the other path if available. |
| 11788 | Qualcomm | Proposal 7: For MP relay, the control plane procedures are clarified as following.  - The SIs of the cells on non-anchor path are transmitted to the UE using RRCReconfiguration message.  - Remote UE can report indirect path/direct path failure over direct path/indirect path if direct path/indirect path is not suspended. Otherwise, initiate RRC re-establishment procedure.  - UE performs RRC re-establishment procedure on PCell according to clause 5.3.7 in TS 38.331 with MP relay context released.  - In Inactive state, Remote UE camps on PCell or indicated cell in RRCRelease message in response to an RRCResumeRequest or an RRCResumeRequest1. |
| 11814 | ZTE | Proposal 13: For scenario 1, when RLF is detected on one of the path, it is suggested for remote UE to report one path failure via the other path. Only if both path are not available or suspended, the remote UE may perform the RRC re-establishment on either the direct path or indirect path when both paths are available. |
| 11874 | Xiaomi | Proposal 12: RAN2 do not consider failure recover triggered by ideal connection failure. |
|  | Sharp | Proposal 1. For performing Uu RLM and SL RLF detection simultaneously in multi-path operation, U2N Remote UE connecting to gNB via “only” U2N Relay UE suspends Uu RLM.  Proposal 2. If MP remote UE detects Uu RLF, indicate Uu RLF to gNB via indirect path. FFS what information message is used for indication.  Proposal 3. If MP remote UE has no SRB on indirect path, PC5-RRC message can be used for failure information indication.  Proposal 4. When MP remote UE detects indirect path failure including PC5 failure, non-3GPP link failure and relay Uu failure, indicates indirect path failure to gNB via direct path.  Proposal 5. RAN2 to discuss how to indicate indirect path failure to gNB while in scenario 2. |
| 12722 | Nokia | Proposal 6: If failure is detected in any of Uu link of the remote UE, UE-to-UE link, or Uu link of the relay UE, the remote UE does not initiate re-establishment but report the failure as long as one path is not suspended and carries SRB. The UE initiates re-establishment only when there is no alive path which carries SRB.  Proposal 7: When the remote UE reports the failure of one path, RAN2 discuss what information is further reported, e.g., path information, link quality information, and/or buffer status. |
| 12737 | Intel | Proposal 5. For DL data transmission, when multi-path is enabled and duplication is not enabled for a Remote UE, and when both direct and indirect paths are available, it is up to network implementation to choose which of the two paths is used.  Proposal 8. In scenario 1, gNB can configure a) which path should be used for RLF (direct/indirect/both), and b) which path is used for RRC re-establishment upon failure of that path(s) regardless of which path (direct or indirect) is used for RRC connection establishment.  Proposal 9. In scenario 2, direct path should be used for RLF detection and re-establishment upon failure.  Proposal 10. Upon UE-UE link failure in scenario 2, either remote UE or relay UE can inform the gNB to release indirect path configuration. Details can be decided during WI phase |
| 12813 | Samsung | Proposal 4-1: the RRC Reestablishment should be triggered if both paths are failed.  Proposal 4-2: if the failure is detected at one path, the triggering of RRC reestablishment procedure can be discussed based on the following two options:   Option 1: depending on split SRB configuration, i.e., the RRC reestablishment is triggered when the remaining path is configured for SRB1   Option 2: depending on gNB configuration, i.e., the RRC reestablishment is triggered when the path(s) indicated by gNB fails. |
| 12027 | Lenovo | Proposal 5: UE reports the failure to the serving gNB via the direct path if still available once the following failure on the second path happens while UE is performing the indirect path addition procedure:  - The remote UE receives the notification message from relay UE.  - The remote UE detects RLF on PC5 link.  Proposal 6: RAN2 to discuss the failure case that the remote UE detects Uu RLF on the direct path when UE is performing the second indirect path addition procedure.  Proposal 7: RAN2 to discuss the failure case on the indirect path happens when UE is performing the direct path addition procedure:  - The remote UE receives the notification message from relay UE in the indirect path.  - The remote UE detects RLF on PC5 link in the indirect path.  Proposal 8: When UE is operating in multi-path Relay scenario, UE reports failure information to the serving gNB via the available path when the following failure case happens.  - Uu RLF on direct path;  - Sidelink RLF on indirect path;  - Reception of notification message from relay UE;  - Reception of PC5 unicat lease message from relay UE.  Proposal 9: When UE operating in multi-path Relay, UE initiates re-establishment procedure only when both paths are not available. |

**Summary:**

Based on the above contribution, one common principle shared by many companies (OPPO, CATT, Interdigital, vivo, LG, Huawei, China Telecom, Qualcomm, ZTE, Nokia, Lenovo )is to allow remote UE to report one path failure to gNB via another path in an SRB (e.g., SRB1). Of course, this may need assume SRB1 is configured at that alternative path or split SRB1 is configured. Since only OPPO mentioned to use SRB1 in this case (as legacy procedure use SRB1 for MCG/SCGFailure), we can agree this principle but postpone the discussion on which exact message and which exact SRB is used. Note that the RLF failure here is limited to 3GPP-defined failure because it is unclear how non-3GPP link failure is to be detected.

1. **[Easy] Upon detection of 3GPP-defined RLF failure in one path, remote UE (configured with MP) can report path failure via the alternative path if SRB is configured on the alternative path or split SRB is configured. RAN2 further discuss which RRC message and which SRB is used for path failure reporting in the normative phase.**

The consequence of P17 is that the current RLF procedure needs to be relaxed (e.g., not triggering RRC reestablishment), as some companies pointed out. Also, when non-split SRB is configured on one path and that path fails, the failure cannot be reported and RRC reestablishment needs to be triggered. However, since RRC Reestablishment procedure is also linked to the “primary path” discussion, the rapporteur suggest to postpone all those issues to the normative phase.

1. **[Easy] Other multi-path impact on current RLF procedure and RRC Reestablishment procedure can be discussed in normative phase**

There is a few companies (Xiaomi, Sharp) discussing particular failure handling for Scenario 2 only for non-3GPP link failure. Since there are no enough views, the rapporteur suggest to discuss this with a low priority.

1. **[low priority] RAN2 discuss whether/how to handle non-3GPP ideal link failure.**

### 2.13 IDLE/INACTIVE Relay UE enters CONNECTED state

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| --- | --- | --- |
| 11207 | OPPO | Proposal 7 R2 discusses to use 1) Uu message (via SL\_RLC1 or other RLC channel as well) or 2) PC5-RRC message to trigger RRC\_INACTIVE / RRC\_IDLE relay UE to enter into RRC\_CONNECTED state . |
| R2-2211281 | CATT | Proposal 15: With regards to the solution for how to trigger the RRC\_IDLE/RRC\_INACTIVE target relay UE to initiate RRC connection establishment procedure, down-select from the following 3 alternatives:  - Alt 1: Upon the indication/configuration received from a remote UE, e.g. indication/configuration in RRCReconfigurationSidelink message;  - Alt 2: gNB configures RRCReconfigurationComplete message delivered via indirect path, e.g. configure duplication of SRB1 or change the primary RLC entity of SRB1 to indirect RLC entity;  - Alt 3: During discovery/PC5 unicast establishment for multi-path. |
| R2-2211536 | Ericsson | Proposal 8 For Scenario-1, RAN2 to down-select between the following options to trigger the relay UE in RRC\_IDLE/INACTIVE state to the RRC\_CONNECTED state.  a. Option-3: Upon indication/configuration received from a remote UE e.g., indication/configuration in RRCReconfigurationSidelink message  b. Option-5: During discovery/PC5 unicast establishment for multi-path  Proposal 9 RAN2 to consider network-based solutions in addition to UE-based solutions to trigger the relay UE in RRC\_IDLE/INACTIVE state to the RRC\_CONNECTED state. |
| 11677 | vivo | Proposal 13 For indirect path addition of Scenario-1, RAN2 to adopt a new PC5 RRC indication from remote UE to trigger the RRC\_IDLE/RRC\_INACTIVE target relay UE to initiate RRC connection establishment/resume procedure.  Proposal 14 For Scenario-2, RAN2 to confirm the WA into agreement, i.e., leave it to relay and remote UE implementation on how to trigger the RRC\_IDLE/RRC\_INACTIVE target relay UE to initiate RRC connection establishment procedure. |
| 11752 | Huawei | Proposal 6. In scenario 1, when an idle/inactive relay UE is added in case A, the remote UE can use the following solutions to trigger relay UE going into connected state, and further down-selection can be left to normative work.  ‐ Option 1: CP solutions, e.g. the relay UE can be triggered into RRC\_CONNECTED state if it receives the DCR (Direct Communication Request) message for multi-path relaying purpose, or the remote UE configures the relay UE to establish some PC5 Relay RLC channels for multi-path via sidelink RRC reconfiguration message, or an explicit indication can be send via a new PC5-S/sidelink RRC message.  ‐ Option 2: UP solutions, e.g. the remote UE can send the RRCReconfiguraitonComplete message via SL-RLC1 to relay UE to trigger it into RRC\_CONNECTED state even though duplication is not configured, or UL data is received by relay UE via a PC5 Relay RLC channel. |
| 11814 | ZTE | Proposal 10: The RRC\_IDLE/RRC\_INACTIVE target relay UE can initiate RRC connection establishment procedure based on gNB implementation, i.e., gNB configures RRCReconfigurationComplete message delivered via indirect path, e.g. configure duplication of SRB1 or change the primary RLC entity of SRB1 to indirect RLC entity. |
| 11633 | InterDigital | Proposal 12: When the relay UE is in RRC\_IDLE/RRC\_INACTIVE, remote UE transmission can initiate an RRC connection at the relay UE to support 1) addition/change of the indirect path at the remote UE; 2) initiation of UL data transmission by the remote UE to the indirect path  Proposal 13: Re-use the Rel17 method (Uu RRC message on SL-RLC0/SL-RLC1) for initiation of the RRC connection at the relay UE and study the use of a new method for the cases where Rel17 solution does not work. |
| 11788 | Qualcomm | Proposal 12: Use PC5 message to trigger the IDLE/Inactive target Relay UE to setup/resume RRC connection. |

**Summary:**

There are four options supported in the previous discussion in 119bis-e (Option 2 excluded)

|  |
| --- |
| Option-1: Upon the message received from a Remote UE via SL-RLC, not limited to SL-RLC1 |
| ~~Option-2: Other (please clarify the solution if this is selected)~~ |
| Option-3: Upon the indication/configuration received from a remote UE, e.g. indication/configuration in RRCReconfigurationSidelink message |
| Option-4: gNB configures RRCReconfigurationComplete message deliverd via indirect path, e.g. configure duplication of SRB1 or change the primary RLC entity of SRB1 to indirect RLC entity. |
| Option-5: During discovery/PC5 unicast establishment for multi-path |

Based on the above contributions for RAN2#120 meeting, there is no convergence of the solutions, here are some observations from the rapporteur.

First, option 5 is not a feasible solution because relay UE has no idea whether the discovery message or DCR message is sent by a MP remote UE or SP remote UE. If we want to make changes to the contents of those messages, then it will have SA2/CT1 impact, which can be easily avoided by pursue other options.

1. **[Easy] Deprioritize “Option-5 : During discovery/PC5 unicast establishment for multi-path.” For triggering IDLE/INACTIVE relay UE to enter CONNECTED state.**

It is not quite clear how the new proposal by Ericsson to consider paging works because remote UE so far only reports a “relay UE ID” to gNB. And this ID is not suitable for paging. So, the rapporteur suggest to still down selection from Option 1 (SL-RLC) or UP approach), Option 3 (PC5-RRC approach) and Option 4(RRCReconfiguraitonComplete).

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1. **[RAN2 to discuss] For triggering IDLE/INACTIVE relay UE to enter CONNECTED state, down select from Option 1 (SL-RLC or UP-based approach), Option 3 (PC5-RRC approach) and Option 4( RRCReconfiguraitonComplete-based approach)**

### 2.14 PDCP CPDU transmission

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| --- | --- | --- |
| 11207 | OPPO | Proposal 10 For scenario-1 of multi-path Relay, for PDCP duplication, R2 follows legacy design as a baseline, including at least 1) all RLC entities have the same RLC mode, 2) PDCP control PDUs are not duplicated and always submitted to the primary RLC entity. 3) RRC can set the duplication state (but always activated for SRB). |
| R2-2211752 | Huawei | Proposal 9. In both scenario 1 and scenario 2, legacy Control PDU submission mechanism in DC can be reused for PDCP duplication and PDCP split for DRB. |
| 12562 | Sharp | Observation 2. For PDCP control PDU submission, we think there is no motivation to restrict submission. |
| 12722 | Nokia | Proposal 9: For MP split bearer, if duplication is activated, PDCP control PDU and PDCP data PDU are all duplicated and transmitted to both RLC entities. |
| 11677 | vivo | Proposal 7 For Scenario-1, support CPDU transmission always on the primary RLC entity of the MP split DRB when PDCP duplication is activated. |
| 11814 | ZTE | Proposal 9: PDCP control PDU is only delivered via the primary RLC entity of the multi-path split bearer. |
| 12737 | Intel | Proposal 7. Similar to legacy, RAN2 agrees that duplication of control PDUs is not needed. gNB can configure which path carries the control PDUs e.g. the same/serving cell path or the direct path. |

**Summary:**

Intel, OPPO. Huawei, ZTE, vivo supports to reuse legacy CPDU transmission mechanism (e.g., duplication is not used), but Sharp and Nokia prefer no restrictions. Since there are only 7 companies have shared views, the rapporteur suggests to further discuss this issue, with low priority, as this is not a critical issue.

1. **[low priority] Whether legacy PDCP Control PDU transmission mechanism is reused or not.**

# Conclusion

Easy

**Proposal 1 [Easy] RAN2 confirms the following WA for Scenario 2.**

**• Bearer identification except LCID is not needed in L2 PDU over Uu link in Scenario 2. Only 1:1 bearer mapping is supported over Uu link for the indirect path. FFS how to configure the mapping.**

**• Without the adaptation layer over Uu link in scenario 2, a PDCP PDU can be delivered to an intended PDCP entity or RLC entity for support of more than one RB over Uu link e.g. by configuring 1:1 bearer mapping and different Uu RLC channels for relay UE local traffic and relay traffic for PDU delivery.**

**• Do not specify adaptation layer over Uu link for scenario 2 in RAN2.**

**Proposal 2 [Easy]How to configure 1:1 mapping (e.g., how to ensure a proper 1:1 mapping within the limited LCID space) can be discussed in normative phase.**

**Proposal 3 [Easy]Mode 1 RA is supported for the remote UE configured with multi-path in Scenario 1.**

**Proposal 6 [Easy] If case B and case D are not supported for Scenario 2, PCell is always on the direct path for Scenario 2.**

**Proposal 7 [Easy] R2 confirms that split SRB can be configured with or without duplication as in legacy as a baseline. Further restrictions can be discussed in normative phase.**

**Proposal 14 [Easy] Remote UE storing indirect path configuration and resuming directly into multi-path configuration is not supported for scenario 1.**

**Proposal 16 [Easy] If PCell is on direct path, and CSS for SI is configured within the active BWP, the remote UE can perform direct system information acquisition on PCell as currently specified in 38.331.**

**Proposal 17 [Easy] Upon detection of 3GPP-defined RLF failure in one path, remote UE (configured with MP) can report path failure via the alternative path if SRB is configured on the alternative path or split SRB is configured. RAN2 further discuss which RRC message and which SRB is used for path failure reporting in the normative phase.**

**Proposal 18 [Easy] Other multi-path impact on current RLF procedure and RRC Reestablishment procedure can be discussed in normative phase**

**Proposal 20 [Easy] Deprioritize “Option-5 : During discovery/PC5 unicast establishment for multi-path.” For triggering IDLE/INACTIVE relay UE to enter CONNECTED state.**

To be Discussed

**Proposal 4 [RAN2 to Discuss]Whether PCell location is on direct path only or can be on either path.**

**Proposal 5 [RAN2 to Discuss] RAN2 discuss the technical justification of Per-CP “Primary path” concept to determine whether to support it or not.**

**Proposal 8 [RAN2 to discuss] data volume threshold for split bearer (SRB/DRB) is used or not.**

**Proposal 9 [RAN2 to discuss] For Scenario 2, Case B, D and E are not supported.**

**Proposal 10 [RAN2 to discuss] For Scenario 2, Case G is supported.Proposal 12 [RAN2 to discuss] Whether SRB1/2 can be configured in different path for Scenario 1**

**Proposal 13 [RAN2 to discuss] Whether SRB1/2 is allowed to be configured only on indirect path for Scenario 2.**

**Proposal 15 [RAN2 to discuss] Whether to support Remote UE storing indirect path configuration or not and use it to resume to MP configuration for Scenario 2.**

**Proposal 21 [RAN2 to discuss] For triggering IDLE/INACTIVE relay UE to enter CONNECTED state, down select from Option 1 (SL-RLC or UP-based approach), Option 3 (PC5-RRC approach) and Option 4( RRCReconfiguraitonComplete-based approach)**

Low priority

**Proposal 11 [Low priority]Whether a single procedure can be supported for Case E & Case G.**

**Proposal 19 [low priority] RAN2 discuss whether/how to handle non-3GPP ideal link failure.**

**Proposal 22 [low priority] Whether legacy PDCP Control PDU transmission mechanism is reused or not.**

# Proposals not included

As we focus on proposals critical to the completion of study, some proposals have to be postponed to the normative phase to discuss, unfortunately. Those proposals are listed below

|  |  |  |
| --- | --- | --- |
| 11307 | OPPO | Proposal 11 For scenario-1 of multi-path Relay, for PDCP duplication, allows dynamic duplication (de)activation controlled by MAC-CE delivery via direct link.  Proposal 12 For scenario-1 of multi-path Relay, for PDCP duplication, the legacy “Duplication Activation/Deactivation MAC CE” and “Duplication RLC Activation/Deactivation MAC CE” can be adopted.  Proposal 13 For scenario-1 of multi-path Relay, for PDCP duplication, R2 does not pursue LCH-to-carrier mapping restriction.  Proposal 14 For scenario-1 of multi-path Relay, for PDCP duplication, R2 discusses whether to pursue the legacy behavior of “When an RLC entity acknowledges the transmission of a PDCP PDU, the PDCP entity shall indicate to the other RLC entity(ies) to discard it”.  Proposal 17 For scenario-2 of multi-path relay, follow the conclusion for scenario-1 unless stated otherwise.  Proposal 20 For scenario-2 of multi-path relay, for single-direct-path to multi-path switching, remote (or relay) UE report the ID (FFS what the ID is) of the relay (or remote) UE to network, and network provides the configuration of the indirect path to remote (or relay) UE. It is up to relay/remote UE implementation to establish inter-UE connection before/upon network configuration. |
| R2-2211281 | CATT | Proposal 11: Path activation/deactivation is introduced for multi-path.  Proposal 12: Introduce Path Activation/Deactivation MAC CE over direct path to control the activation/deactivation of indirect path.  Proposal 13: Reuse Duplication Activation/Deactivation MAC CE over direct path to control the duplication activation/deactivation of DRBs. |
| 11282 | CATT | Proposal 3: Relay discovery/selection/reselection procedure is not needed for Scenario 2.  Proposal 4: For scenario 2, remote UE should report the association between remote UE and relay UE to gNB (e.g., report the relay UE identifier to gNB).  Proposal 6: For the UL, gNB configures the mapping between E2E bearer and the Uu RLC channel to remote UE and relay UE separately by RRC reconfiguration procedure.  Proposal 11: For Scenario 2, UL/DL transmission of relay UE is scheduled by network, how to perform the data transmission between relay UE and remote UE depends on implementation. |
| 11414 | NEC | Proposal 6: For intra-gNB multi-path relaying with Remote UE and Relay UE served by the same cell, RAN2 to further study on reusing NR-DC procedures or define new procedures.  Proposal 7: For Scenario 1, to enable the duplicated PDCP PDU discarding, the influence of SRAP layer should be considered.  Proposal 8: For Scenario 2, whether and how to enable the duplicated PDCP PDU discarding can be left to UE implementation.  Proposal 11: For Scenario 2, the 3GPP upper layer should be aware of the failure of the UE-to-UE link. And how to notify the 3GPP upper layer can be left to UE implementation. |
| 11633 | InterDigital | Proposal 11: When the remote UE is configured with multipath and in RRC\_CONNECTED, the relay UE can be moved to RRC\_IDLE/RRC\_INACTIVE if all data is routed via the direct path. |
|  | vivo | Proposal 15 For Scenario-2, RAN2 assumes that remote UE will report the inter-UE relationship only after relay UE successfully entering RRC\_CONNECTED in this Release.  Proposal 16 For Scenario-2, RAN2 to decide which Option(s) is agreeable for remote UE to report the inter-UE relationship (e.g., relay UE’s C-RNTI and serving NCGI) to the gNB:  - Option 1: remote UE oriented solution, i.e., remote UE autonomously reports the inter-UE relationship with the relay UE once it triggers the relay UE successfully entering RRC\_CONNECTED.  - Option 2: NW controlled solution, i.e., remote UE only reports the inter-UE relationship with the relay UE after the gNB indication (e.g., with target cell ID).  Proposal 17 For Scenario-2, if the inter-UE link failure is detected by remote UE or relay UE, remote UE or relay UE can notify the gNB about the inter-UE link failure.  Proposal 18 For Scenario-2, it’s up to the gNB how to handle the inter-UE link failure, e.g., suspend the DL transmission for the remote UE via indirect path, or trigger indirect path release procedure. |
|  | vivo | Proposal 6 For indirect path addition after direct path setup (i.e. Case A) in Scenario-1, the existing intra-gNB D2I switch procedure can be reused but skipping the step to release the direct path after indirect path addition.  Proposal 7 For direct path addition after indirect path setup (i.e. Case B) in Scenario-1, the existing intra-gNB I2D switch procedure can be reused but skipping the step to release the indirect path after direct path addition.  Proposal 9 If the PCell is one serving cell of the indirect path to be released for the remote UE with multipath (i.e. Case C) in Scenario-1, one of the serving cells of the direct path should be reconfigured as the PCell for the remote UE during the procedure.  Proposal 10 If SRB1/SRB2 are only on the indirect path to be released for the remote UE with multipath (i.e. Case C) in Scenario-1, SRB1/SRB2 should be reconfigured to the direct path during the procedure.  Proposal 11 If the PCell is one of the serving cells of the direct path to be released (i.e. Case D) in Scenario-1, one of the serving cells of the indirect path should be reconfigured as PCell for the remote UE during the procedure.  Proposal 12 If SRB1/SRB2 are only on the direct path to be released (i.e. Case D) in Scenario-1, SRB1/SRB2 should be reconfigured to the indirect path during the procedure.  Proposal 13 For path release cases (i.e. Case C & D) of Scenario-1, PDCP data recovery can be configured for the remote UE’s AM DRBs.    Proposal 14 For adding indirect path after direct path setup (i.e. Case A) in Scenario-2, the remote UE should send the inter-UE association information or indirect path request to the gNB.  Proposal 15 The inter-UE association information or indirect path request can comprise of the C-RNTI of the relay UE and the serving Cell ID of relay UE.  Proposal 16 For indirect path release case (i.e. Case C) of Scenario-2, PDCP data recovery can be configured for the remote UE’s AM DRBs. |
| 11814 | ZTE | Proposal 14: It is suggested to capture the indirect path addition signalling procedure.  Proposal 15: It is suggested to capture the direct path addition signalling procedure |
| 11815 | ZTE | Proposal 8: When gNB configure the relay UE with the Uu RLC channel used for relaying traffic of remote UE, the associated remote UE’s RB ID can be included in the Uu RLC channel configuration.  Proposal 9: Upon receiving the PDCP PDU from remote UE via UE-to-UE link, the relay UE may be aware of the associated remote UE’s RB ID based on implementation and then deliver the PDCP PDU to the corresponding Uu RLC channel for uplink transmission. |
| 12156 | Spreadtrum | Proposal 2: For multi-path via sidelink relay, SRAP is introduced for both control plane and user plane as shown in Figure 1-1&1-2. |
| 11722 | Nokia | Proposal 15: RAN2 study how to reduce the latency when the relay UE in RRC\_IDLE/INACTIVE makes RRC connection, for example, by providing relay UE’s RRC setup information to the remote UE in advance. |
| 11752 | Huawei | Proposal 5. For scenario 2, the remote UE reports one or more candidate relay(s) to gNB, and gNB decides whether to configure multi-path for the remote UE based on the paired relation in the remote UE’s authorization info.  Proposal 7. In scenario 2, the remote UE can trigger the RRC\_IDLE/RRC\_INACTIVE relay UE into RRC\_CONNECTED state before reporting the relay UE information to the network, which can accelerate the multi-path establishment procedure. |
| 11787 | LG | Proposal 9: Upon receiving a RRC reconfiguration for addition of direct path for a remote UE already having indirect path, the remote UE triggers RACH on the direct path. C-RNTI MAC CE is sent on MSG3 PUSCH or MSGA PUSCH for identification of the remote UE, where the C-RNTI of the remote UE is given by the RRC reconfiguration message.  Proposal 10: RAN2 is requested to further discuss which path is used for the remote UE to send the RRC reconfiguration complete message after receiving a RRC reconfiguration message for path addition.  Proposal 13: For multi-path Relay Scenario-2, RAN2 assumes that CN has no knowledge about semi-static relationship between the remote UE and the relay UE.  Proposal 14: For multi-path Relay Scenario-2, a UE informs the gNB about semi-static relationship between the remote UE and the relay UE by using C-RNTI according to one of the following options:  - Option 1: The relay UE in RRC\_CONNECTED informs the gNB about C-RNTI of the remote UE (after entering RRC\_CONNECTED, if not in RRC\_CONNECTED). How the remote UE informs the relay UE about C-RNTI of the remote UE over non-3GPP UE-to-UE link is left to UE implementation. How the relay UE not in RRC\_CONNECTED initiates RRC connection establishment procedure is left to UE implementation.  - Option 2: The remote UE in RRC\_CONNECTED informs the gNB about C-RNTI of the relay UE. How the relay UE initiate RRC connection establishment procedure, if not in RRC\_CONNECTED, and inform the relay UE about C-RNTI of the remote UE over non-3GPP UE-to-UE link is left to UE implementation. |
| 11783 | China Telecom | Proposal 4: To support indirect path change cases in Scenario 1, the new Event Z1 introduced for i2i indirect path switch can be used. Wait for the progress on i2i path switch topic to see whether Event Z2 is needed or not.  Proposal 5: For Scenario 2, the path management procedure of Scenario 1 can be taken as baseline and the details can be further discussed in the normative work phase. |
| 11788 | Qualcomm | Proposal 10: gNB can add the indirect/direct path based on the measurement report from the Remote UE triggered by existing event, e.g. Event Y2 for indirect path addition or Event A4 for direct path addition.  Proposal 11: It is up to gNB to select the target Relay UE whose serving cell is in the same gNB in case of indirect path addition; gNB selects the target cell which is in the same gNB as the Relay UE’s serving cell in case of direct path addition.  Proposal 13: gNB can remove the indirect or direct path based on the measurement report from the Remote UE triggered by existing events, e.g. Event X2 for indirect path removal or Event A2 for direct path removal.  Proposal 14: gNB can remove the indirect path based on the measurement report from the Relay UE triggered by existing events, e.g Event A2, in case that all of the serving cells are getting worse.  Proposal 15: Service continuity on indirect path to indirect path for intra-gNB can be reused as baseline for indirect path changes during MP relay operation with the same issue addressed in indirect path addition on how to trigger IDLE/Inactive Relay UE connection setup or resume.  Proposal 16: Exiting PCell/PSCell change procedure on direct path for intra-gNB can be reused as baseline for direct path change in MP relay operation, i.e. achieved by intra-gNB handover with Scell removal and addition in one RRCReconfiguration message.  Proposal 17: Deprioritize direct path and indirect path change simultaneously.  Proposal 21: gNB can add or release the indirect path based on the candidate Relay UE information received from the Remote on e.g. SidelinkUEInformationNR. And it is left to Remote UE implementation to determine the candidate Relay UE. |
| 12027 | Lenovo | Proposal 1: T420 can be reused for the indirect path addition procedure.  Proposal 2: T304 can be reused for the direct path addition procedure.  Proposal 3: Once the timer for the second path addition expires, the remote UE declares the second path addition failure. Remote UE reports the failure information to the network via the available path.  Proposal 4: Once the timer for the second path addition expires, the remote UE initiates re-establishment procedure if the first path is suspended or unavailable. |
| R2-2212700 | CMCC | Proposal 1：When gNB adds the indirect path to remote UE for scenario 2, the mapping between the radio bearer of remote UE and the RLC logical channel information of relay UE is contained in RRC reconfiguration message to remote UE and relay UE.  Proposal 2: Agree the UP and CP protocol stack as Figure 1-1 and Figure 1-2, for scenario 1.  Proposal 4: RAN2 is proposed to consider the DAPS-like protocol stack for scenario 2. |
| R2-2211935 | Sony | Proposal 1: Handover procedure with multi-path UE relay should be discussed and Rel-17 UE relay link switch and Rel-18 indirect to indirect link switch is the starting point. Inter-gNB scenario as well as both the indirect and direct path change scenario should be considered.  Proposal 2: gNB to transmit the CG configuration of relay UE to source UE when the relay UE is selected by gNB.  Proposal 3: Relay UE to transmit its CG configuration to source UE when the relay UE is selected by source UE. |
| 12562 | Sharp | Proposal 11. For scenario 2, NW does not need to configure sidelink grant for Relay UE and Remote UE.  Proposal 12. RAN2 can use the term “relay UE” and “remote UE”, but different expression is needed when describing in the specification if there are many differences between L2 U2N Relay and MP relaying. |
| 12563 | Sharp | Proposal 5. RAN2 assumes the non-3GPP of Remote UE has a virtual RLC entity for the RB and the PDCP entity of Remote UE for the RB transfers/receives the data to/from the virtual RLC entity.  Observation 3. RLC entity of Relay UE can transfer/receive the data to/from upper layers (PDCP) of Relay UE.  Proposal 6. RAN2 assumes the non-3GPP of Relay UE has a virtual PDCP entity for the RB and the RLC entity of Relay UE for the RB transfers/receives the data to/from the virtual PDCP entity. |
| 12699 | CMCC | Proposal 1：It is proposed to agree the flowchart in Fig.1 as baseline for remote UE adds indirect path for multi-path establishment for scenario 1.  Proposal 2：It is proposed to agree the flowchart in Fig.2 as baseline for remote UE adds direct path for multi-path establishment for scenario 1.  Proposal 3: Ask RAN2 to discuss the trigger event for multi-path establishment in scenario 2.  Proposal 4: It is proposed to agree the flowchart in Fig.3 as baseline for remote UE adds indirect path for multi-path establishment for scenario 2.  Proposal 5: It is proposed to agree the flowchart in Fig.4 as baseline for multi-path remote UE release indirect path for scenario 1.  Proposal 6: It is proposed to agree the flowchart in Fig.5 as baseline for multi-path remote UE release direct path for scenario 1.  Proposal 7: It is proposed to agree the flowchart in Fig.6 as baseline for multi-path remote UE release indirect path for scenario 2.Proposal 13: RAN2 is suggested to discuss fast link recovery for MP. |
| 12737 | Intel | Proposal 12. For scenario 1, gNB provides link quality thresholds for enabling multi-path at the Remote UE either via broadcast signalling or dedicated signalling. i.e. PC5 link quality threshold to enable candidate relay UE measurement report if already using direct path and Uu link quality threshold to enable the direct path measurement report if already using indirect path.  Proposal 13. In scenario 1, when direct path is added alongside indirect path, the indirect path is not affected and the Remote UE/Relay UE maintains the indirect path i.e. Remote UE or Relay UE’s AS layer does not release the corresponding PC5-RRC connection (and PC5 unicast link) after receiving RRC reconfiguration from gNB.  Proposal 14. In scenario 2, Remote UE or Relay UE can provide some information including at least the Relay UE ID and its serving cell information to the gNB to receive configuration for multi-path.  Proposal 16. Discuss whether to support flow control at the Relay UE in UL and/or DL when there are multiple paths. If agreed, details can be discussed during WI phase. |
| 12814 | Samsung | Proposal 1: the gNB should be aware of the UE-UE link type (3GPP, i.e., PC5, vs. non-3GPP).  Proposal 2: In scenario 2, the connection relationship between relay UE and remote UE can be changed, i.e., the remote/relay UE may have multiple relay/remote UE candidates for connection.  Proposal 3: RAN2 is kindly asked to discuss the ID used to identify relay/remote UE (including ID allocation).  Proposal 4: in scenario 2, the relay/remote UE can report the priority of the remote/relay UE to gNB instead of concrete measurement results.  Proposal 5: RAN2 is kindly asked to discuss which node (remote UE vs. relay UE) reports the measurement results of UE-UE link considering the restriction that one relay UE can be connected to one remote UE only.  Proposal 7: RAN2 is kindly asked to discuss the knowledge on the capability of gNB/relay UE/remote UE (e.g., support 3GPP UE-UE link only, support non-3GPP UE-UE link only, or both). |
| R2-2212866 | Lenovo | Proposal 2: Legacy timer T420 can be reused in the case of relay change.  Proposal 5: The following Inter-gNB handover associated with Multi-path should be discussed.  - Use Case 1: Multi-path in source gNB-> Only one path in target gNB;  - Use Case 2: One path in source->Multi-path in target gNB;  - Use Case 3: Multi-path in source gNB-> Multi-path in target gNB (different relays in the source gNB and target gNB);  Proposal 6: Inter-gNB handover of a remote UE together with the same relay UE in Scenario 2 should be discussed.  Proposal 7: The activation/deactivation of PDCP duplication for a DRB in multi-path relaying case can be dynamically controlled by the gNB.  Proposal 8: The Duplication Activation/Deactivation MAC CE can be reused. Proposal 10: Remote UE can use mode 2 SL transmission resources from both the serving cells in a multipath scenario.  Proposal 10: Remote UE can use mode 2 SL transmission resources from both the serving cells in a multipath scenario. |

# Reference

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[2] R2-2211208 Discussion on PCell location for Multi-path Relay OPPO, ZTE, Huawei, HiSilicon, MediaTek discussion Rel-18 NR\_SL\_relay\_enh-Core

[3] R2-2211281 Discussion on Multi-path for Scenario 1 CATT discussion Rel-18 NR\_SL\_relay\_enh-Core

[4] R2-2211282 Leftover issues on Multi-path scenario 2 CATT discussion Rel-18 NR\_SL\_relay\_enh-Core

[5] R2-2211403 Path management for Multi-path Relaying Intel Corporation discussion Rel-18 NR\_SL\_relay-Core

[6] R2-2211414 Considerations on Multipath of Sidelink Relay NEC Corporation discussion NR\_SL\_relay\_enh-Core

[7] R2-2211536 Remaining Issues on Multipath Relays for Scenario-1 and Scenario-2 Ericsson España S.A. discussion Rel-18

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[12] R2-2211699 Discussion on multi-path relaying support Apple discussion NR\_SL\_relay\_enh-Core

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[18] R2-2211815 Further discussion on the UE aggregation ZTE, Sanechips discussion Rel-18 NR\_SL\_relay\_enh-Core

[19] R2-2211874 Discussion on multi-path Xiaomi discussion

[20] R2-2211935 Multi-path relaying discussion Sony discussion Rel-18 NR\_SL\_relay\_enh

[21] R2-2212027 Second path addition and failure recovery for Scenario1 Lenovo discussion Rel-18

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[28] R2-2212722 Support of multipath relay Nokia Korea discussion

[29] R2-2212737 Control plane aspects for multi-path relaying Intel Corporation discussion Rel-18 NR\_SL\_relay-Core

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[31] R2-2212814 Discussion on specific issues for scenario 2 Samsung discussion Rel-18 NR\_SL\_relay\_enh-Core

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