3GPP TSG-RAN WG2 Meeting #123 R2-230xxxx

Toulouse, France, 21– 25 August 2023

**Agenda item:** **7.9.4**

**Source: Nokia (Rapporteur)**

**Title: Offline 402 on A.I 7.9.4 Multi-path relaying**

**WID/SID: NR\_SL\_relay\_enh-Core - Release 18**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the summary of contributions under A.I 7.9.4 Multi-path relaying. Please note that the proposals related to signalling procedure will be discussed separately in [Post122][403][Relay] Procedures for multi-path relay (LG), thus not included in this summary.

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Nokia (Rapporteur) | Sunyoung LEE | sunyoung.lee@nokia.com |
| Apple | Zhibin Wu | Zhibin\_wu@apple.com |
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# 3 Discussion

## Issue 1. Working assumptions

The working assumptions that need to be confirmed are:

Working Assumption 1. For Scenario-1/2, MP remote UE is configured with a single cell group, i.e., MCG, for the direct path, and SL configuration, for the indirect path.

Working Assumption 2. For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. And UE switches the primary path to the indirect path for reporting after direct path failure, and this switching is limited to the case where duplication is not configured as in legacy.

Working Assumption 3. 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.

The following proposals are related to issue 1:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 1. R2 confirm the WA that: For Scenario-1/2, MP remote UE is configured with a single cell group, i.e., MCG, for the direct path, and SL configuration, for the indirect path.  Proposal 9. R2 confirm the WA as: For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. And UE switches the primary path to the indirect path for reporting after direct path failure, and this switching is limited to the case where duplication is not configured as in legacy. |
| R2-2307227 | Xiaomi | Proposal 2: Revisit the working assumption from last meeting and agree primary RLC entity of the MP split bearer could be configured on either direct path or indirect path |
| R2-2307550 | Vivo | Proposal 8. 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. |
| R2-2307553 | CATT | Proposal 1: RAN2 to confirm the WA: For Scenario-1/2, MP remote UE is configured with a single cell group, i.e., MCG, for the direct path, and SL configuration, for the indirect path.  Proposal 6: RAN2 to confirm the WA: For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. The remote UE switches the primary path to the indirect path to report direct path failure after direct path failure is detected |
| R2-2307745 | Qualcomm | Proposal 1: Confirm the WA: For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path.  Proposal 2: Same as existing MCG fast recovery, UE can send MCGFailureInformation over indirect path of slit SRB1 in case MCG is failure. |
| R2-2308120 | Spreadtrum | Proposal 3: Confirm the WA: For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. This does not preclude having the case where the UE switches the primary path to the indirect path for reporting after direct path failure. |
| R2-2308206 | Huawei | Proposal 1: Confirm the WA that for scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. This does not preclude having the case where the UE switches the primary path to the indirect path for reporting after direct path failure. |
| R2-2308323 | CMCC | Proposal 2: Confirm WA: primary path of the split SRB1 and SRB2 is always configured on direct path.  Proposal 3: Supporting primary path switching from direct path to indirect path, when direct path failure. |
| R2-2308427 | Ericsson | Proposal 3. Confirm the WA, for Scenario-1/2, MP remote UE is configured with a single cell group i.e., MCG for the direct path, and SL configuration, for the indirect path.  Proposal 4. Confirm the WA, for Scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. This does not preclude having the case where the UE switches the primary path to the indirect path for reporting after direct path failure |
| R2-2308749 | Nokia | Proposal 1: For both scenario 1 and 2, the UE switches the primary path from the direct path to the indirect path upon detection of failure on the direct path |
| R2-2307946 | China Telecom | Proposal 2: For Scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. And the UE could switch the primary path to the indirect path for reporting after direct path failure. |
| R2-2308222 | Sharp | Proposal 13. For scenario 2, primarypath of split SRB1 can be set to indirect path when the UE performs direct path failure recovery. |

**Summary 1:** 1 company propose to revisit an WA2. There are a number of proposals for each WA to confirm it. Rapporteur’s understanding is that the only part that RAN2 needed further discussion was whether the UE switches the primary path to the indirect path for failure report after the direct path fails if duplication is not configured for split SRB1, which seems agreeable.

Proposals for agreement:

**Proposal 1-1: RAN2 confirm the working assumption below:**

**For Scenario-1/2, MP remote UE is configured with a single cell group, i.e., MCG, for the direct path, and SL configuration, for the indirect path.**

**For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. And UE switches the primary path to the indirect path for reporting after direct path failure, and this switching is limited to the case where duplication is not configured as in legacy.**

**For Scenario 2, 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.**

## Issue 2. Bearer types and primary path

### 2.1. Support of non-split SRB on the indirect path

The following proposals are related to issue 2-1:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307227 | Xiaomi | Proposal 1: Non-split SRB on indirect path is supported |
| R2-2307363 | OPPO, Samsung, China Telecom, Huawei, HiSilicon, Ericsson, vivo, CMCC | Proposal 1. Non-split SRB1 and 2 over indirect path is not supported in Scenario 1.  R2-2308472 Ericsson  Proposal 2. For Scenario-1, non-split SRB1/2 can only be configured over the direct path.  R2-2307093 OPPO  Proposal 10. To align Scenario-1 with Scenario-2, RAN2 revert the agreement on allowing indirect-path-only SRB1 and SRB2 configuration, i.e., they can be configured either on direct-path-only, or on both paths.  R2-2307946 China Telecom  Proposal 1: For Scenario 1, non-split SRB1 and 2 over indirect path is not supported.  R2-2308206 Huawei  Proposal 2: Non-split SRB1/SRB2 configured only on the indirect path is not supported in scenario 1. |
| R2-2307553 | CATT | Proposal 7: For multi-path scenario 1, non-split SRBs can be configured on the indirect path. |
| R2-2307745 | Qualcomm | Proposal 3: Non-split SRB1 is configured only on direct path. |
| R2-2307857 | Apple | Proposal 1. For Scenario 1, non-split SRB1/2 in an indirect path is supported. |
| R2-2308120 | Spreadtrum | Proposal 4: For scenario 1, non-split SRB1 and SRB 2 over indirect path is not supported. |
| R2-2308222 | Sharp | Proposal 12. For scenario 2, non-split SRBs need not to be configured on indirect path. |
| R2-2308383 | InterDigital | Proposal 1: RAN2 confirms previous assumptions that non-split SRB1/SRB2 can be configured on either direct or indirect path (up to network choice). |
| R2-2308222 | Sharp | Proposal 12. For scenario 2, non-split SRBs need not to be configured on indirect path. |
| R2-2308749 | Nokia | Proposal 4: Non-split SRB on the indirect path is not supported. |

**Summary 2.1:** In RAN2#122, it was agreed that 'For scenario 1, SRB1 and SRB2 are not decoupled in terms of support of non-split SRB on indirect path, i.e., if SRB1 can be supported on indirect path, so can SRB2'. However, as RAN2 further agreed to have PCell always on the direct path if multi-path, the issue of support of non-split SRB on the indirect path has raised again.

Majority companies (13 out of 18) suggest not to support non-split SRB on the indirect path for scenario 1, one company suggests not to support non-split SRB on the indirect path for scenario 2, which was already agreed in RAN2#121bis. Rapporteur’s understanding is that commonality for scenarios 1 and 2 would need to be achieved unless significant problem is identified.

Proposals for agreement:

**Proposal 2.1: For scenario 1, non-split SRB on the indirect path is not supported.**

### 2.2. Linkage between SRB1 and SRB2

The following proposals are related to issue 2.2:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2308103 | ZTE | Proposal 1. For scenario 1, the bearer type (i.e. direct bearer, indirect bearer, or multi-path split bearer) of SRB1 and SRB2 may be configured by the gNB independently. It is not necessary to mandate the same bearer type configuration of SRB1 and SRB2. |
| R2-2308472 | Ericsson | Proposal 1. For Scenario-1, SRB1 and SRB2 are always configured on the same path. |

Some agreements and working assumptions that are relevant to issue 2.2 are:

* In RAN2#121bis: The bearer type configuration is provided per SRB. It is up to network implementation whether to configure SRB1 and SRB2 with same or different bearer types (within the bearer types that are supported)'.
* In RAN2#122: For scenario 1, SRB1 and SRB2 are not decoupled in terms of support of non-split SRB on indirect path; i.e., if SRB1 can be supported on indirect path, so can SRB2.
* In RAN2#122: WA that, for scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. This does not preclude having the case where the UE switches the primary path to the indirect path for reporting after direct path failure.

**Summary 2.2:** Given above agreements and WA, it requires more discussion whether different bearer type can be configured for SRB1 and SRB2, e.g., [split SRB1 + non-split direct SRB2] or [non-split direct SRB1 + split SRB2]. If non-split indirect SRB1/2 is supported, this also needs to be considered.

Proposal for discussion:

**Proposal 2.2: RAN2 discuss whether different bearer types can be configured for SRB1 and SRB2.**

### 2.3. Primary path of split DRB

The following proposal is related to issue 2.3:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2308749 | Nokia | Proposal 5: For split DRB, primary path can be either the direct or the indirect path. |

**Summary 2.3:** So far, RAN2 discussed/agreed the primary path for split SRB1/2. For split DRB, RAN2 agreed in Ran2#122 that data threshold is to be optionally used. It would be better to clarify whether primary path for DRB can be either direct or indirect path.

Proposal for discussion:

**Proposal 2.3: RAN2 discuss whether the primary path of the split DRB can be set to either the direct path or the indirect path, or is fixed to the direct path as split SRB.**

## Issue 3. Path failure report

### 3.1. Direct path failure report

The following proposals are related to issue 3.1:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 12. For Scenario-1/2, when reporting direct-path failure via indirect-path via MFI message, no need to introduce additional IE. |
| R2-2307387 | NEC | Proposal 1. RAN2 consider to include the measurement result of the PC5 link quality of the indirect link into MCGFailureInformation.  Proposal 2. RAN2 should discuss whether to include the measurement result of other candidate relay UEs into MCGFailureInformation. |
| R2-2307745 | Qualcomm | Proposal 8: No additional IE needs to be introduced in MCGFailureInformation message for reporting direct-path failure via indirect-path. |
| R2-2307751 | Kyocera | Proposal 2. In case of RLF on the direct path, the remote UE should inform the gNB of the failure over the indirect path with OOC indication as an additional IE in MCGFailureInformation.  Proposal 3. The remote UE should have the option to include the SL-RSRP measurements when sending the MCGFailureInformation to the gNB. |
| R2-2308749 | Nokia | Proposal 2: Buffer size information is included when reporting the RLF. |

**Summary 3.1:** In RAN2#122, RAN2 agreed to use MCGFailureInformation for direct path failure report. 2 companies propose no addition IE is required while 3 companies propose additional information that can be included in MCGFailureInformation such as measurement and buffer size information. Rapporteur suggests to discuss further as not enough companies view can be found in the contributions.

Proposal for discussion:

**Proposal 3.1: RAN2 discuss whether or what additional information can be included in MCGFailureInformation when reporting the direct path failure.**

### 3.2. Indirect path failure report

The following proposals are related to issue 3.2:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 13. For Scenario-1, when reporting indirect-path failure via direct-path, use SidelinkUEInformationNR, without introducing new IEs.  Proposal 14. For Scenario-2, when reporting indirect-path failure / establishment via direct-path, use a same new message. |
| R2-2307227 | Xiaomi | Proposal 8: Reuse MCGFailureInformation to report the indirect path failure information. |
| R2-2307550 | Vivo | Proposal 5. RAN2 to confirm that SidelinkUEInformation is reused to report SL radio link failure of indirect path for Scenario 1. |
| R2-2307553 | CATT | Proposal 2: For Scenario-1/2, remote UE reports indirect path failure via MCGFailureInformation or a new message. |
|  |
| R2-2307745 | Qualcomm | Proposal 9: For both of Scenario-1 and 2, introduce a new message to indicate indirect path failure. |
| R2-2307946 | China Telecom | Proposal 3: For multi-path relaying in Scenario 1, upon detection of PC5-RLF on the indirect path or upon reception of Uu RLF indication from the relay UE, SidelinkUEInformationNR message can be used to report the indirect path failure to the gNB via direct path if available. |
| R2-2307947 | China Telecom | Proposal 2: For multi-path relaying in Scenario 2, upon detection of UE-UE link failure on the indirect path, MCGFailureInformation message can be used to report the indirect path failure to the gNB via direct path if available. |
| R2-2308103 | ZTE | Proposal 4. Re-use MCGFailureInformation to report the PC5-RLF. |
| R2-2308222 | Sharp | Proposal 3. For reporting PC5-RLF of remote UE or Uu-RLF of relay UE, new message should be used to indicate candidate relay information. |

**Summary 3.2:** Three options are on the table, i.e., MCGFailureInformation, SidelinkUEInformationNR, or a new message. For each option, companies propose different additional information to be reported together.

The following proposals are related to additional information that companies proposed:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307227 | Xiaomi | Proposal 6: Remote UE shall report failure cause and measurement results of candidate cell/relay UE.  Proposal 7: The failure cause of indirect path includes SL-RLF, relayUE-Uu-RRC-Failure, relayUE-Uu-RLF. Failure cause of direct path can reuse the legacy values in MCGFailureInformation |
| R2-2307550 | Vivo | Proposal 4. For both Scenario 1&2, UEAssistanceInformation is reused to report the indirect path failure information without fast recovery timer and new failure types are introduced, e.g. relay UE Uu failure and inter-UE failure for Scenario 2. |
| R2-2307553 | CATT | Proposal 3: Introducing new failure types (SL RLF, ideal connection RLF, Uu RLF of relay UE) in MCGFailureInformation or the new message. |
| R2-2307745 | Qualcomm | Proposal 9: For both of Scenario-1 and 2, introduce a new message to indicate indirect path failure. |
| R2-2307947 | China Telecom | Proposal 3: If MCGFailureInformation message is agreed for indirect path failure reporting in scenario 2, additional failure indication might be needed to distinguish the failure of direct path or indirect path. |
| R2-2308103 | ZTE | Proposal 5. Add a new failure type value of indirect path failure in MCF failure type, no need to differentiate detailed PC5 failure type. |
| R2-2308222 | Sharp | In legacy, candidate relay information is only included in SL-MeasResultListRelay-r17. Therefore, new RRC message should be used to indicate candidate relay information since the information is new.  Proposal 2. In case of indirect path failure, candidate relay information should be sent to gNB for subsequent MP operation. |

Rapporteur suggests discussing which message is to be used by considering e.g., different additional information that can/should be reported together with each message.

Proposal for discussion:

**Proposal 3.2: For scenario 1 and 2, RAN2 discuss which message is used for report of indirect path failure from 1) MCGFailureInformation, 2) SidelinkUEInformationNR, and 3) a new message.**

### 3.3 Others

The following proposals are related to issue 3.3:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307991 | Lenovo | Proposal 3: If the remote UE detects Uu RLF on the direct path when UE is performing the second indirect path addition procedure, UE reports the failure information once the indirect path is successfully added.  Proposal 7: If the remote UE detects PC5 RLF or receives the notification message/PC5 unicast release message from relay UE on the indirect path when UE is performing the second direct path addition procedure, UE reports the failure information once the direct path is successfully added. |
| R2-2308749 | Nokia | Proposal 3: RAN2 discuss if the gNB can configure a condition not to send the RLF report even if the UE detects the RLF on one path while another path can be used for transmission of the RLF report. |

**Summary 3.3:** Rapporteur’s understanding is that RAN2 discussed the report of direct path failure for the remote UE being operating with multi-path. It seems not clear how to handle the path failure which occurs during additional path addition procedure. The proposals from [R2-2307991] suggests reporting the path failure which occurs during additional path addition to the gNB after the direct/indirect path addition is completed.

Strictly applying the previous agreements, rapporteur’s understanding is that the remote UE will initiate RRC connection re-establishment because additional path may not yet be available, and the remote UE cannot send the failure report immediately. Above proposals may require the UE to delay the generation of failure report as RRC has neither the buffer nor the retransmission. Rapporteur’s suggestion is to discuss whether this is an issue to be resolved and how to solve it if it is an issue.

Proposal for discussion:

**Proposal 3.3.1: RAN2 discuss whether failure detection on the existing path while additional path addition is an issue to be resolved. FFS how to resolve it if RAN2 agree to resolve it.**

Design principle for failure report in Sidelink multi-path operation is reporting the failure of one path if the other path is available. The proposal from [R2-2308749] is addressing an issue that failure report may not be useful/necessary in some cases and allows failure report only when it is expected to be useful/necessary, which can be controlled by the gNB. Rapporteur’s understanding is that measurement events would help gNB’s decision on path change/removal, but minimizing gNB involvement by pre-configuring some conditions might be worth to discuss when considering the nature of sidelink. Therefore, it is suggested to discuss further.

**Proposal 3.3.2: RAN2 discuss whether the gNB can configure a condition not to report the RLF.**

## Issue 4. Path addition/change/removal

### 4.1. T304-like timer: Direct path addition/change failure

The following proposals are related to issue 4.1:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 5. In case of T304-like timer expiry (during direct path addition and change), UE fallback to prior configuration. And at least for split SRB1, if SRB1 on indirect path is not suspended, trigger report to network via indirect path to report the failure via a RRC message. Otherwise, RRC Re-establishment is initiated. |
| R2-2307387 | NEC | Proposal 4. U2N remote UE would initiate RRC re-establishment procedure upon the T304-like timer expired, when it performing direct path addition/change. Proposal 7. Reuse T304 timer for direct path addition/change. |
| R2-2307403 | Fujitsu | Proposal 6: The remote UE sends a failure indication to the gNB via the indirect path when the T304-like timer expires.  Proposal 7: The remote UE falls back to the original single path configuration when the T304-like timer expires. |
| R2-2307550 | Vivo | Proposal 13 For Scenario-1, RAN2 to agree that T304-like timer for direct path addition and change reuses the existing timer T304. |
| R2-2307553 | CATT | Proposal 12: Reuse T304 timer for MP direct path addition or indirect path modification configuration procedure. Proposal 13: For Rel-18 multi path, the remote UE shall fallback to continue using the indirect path configuration used prior to the reception of RRCReconfiguration message and inform network about the reconfiguration with sync failure when T304 is expired. |
| R2-2307745 | Qualcomm | Proposal 17: When T304-like timer for direct path addition and change expires, UE informs network about the reconfiguration failure by initiating MCGFailureInformation message Proposal 19: Reuse the existing T304 timer for direct path addition and change; introduce a new timer for indirect path addition and change. |
| R2-2307857 | Apple | Proposal 13. When T304-like or T420-like timer for MP configuration procedure expires, remote UE will fall back to its prior configuration. Proposal 14. For T304-like and T420-like timer in path addition or path change procedure, RAN2 introduce new timer(s). |
| R2-2307991 | Lenovo | Proposal 4: T304 can be reused for the direct path addition procedure. Proposal 5: Once the timer for the second direct path addition (e.g T304) expires, the remote UE reports the failure information to the network via the available indirect path. Proposal 6: Once the timer for the direct path addition expires, the remote UE initiates re-establishment procedure if the first indirect path is suspended or unavailable. |
| R2-2308103 | ZTE | Proposal 11. For direct path addition, upon the T304-like timer expiry, remote UE use the the configuration prior to direct path addition message and initiate a failure information reporting procedure. Proposal 12. Re-use T304 for direct path addition and change. |
| R2-2308206 | Huawei | Proposal 10: RAN2 confirms that T304 and its start/stop condition as well as timer expiry handling are reused during direct path addition/change procedure. |
| R2-2308222 | Sharp | Proposal 4. Remote UE should revert back to indirect path when the T304-like timer for direct path expires. Proposal 7. New T304/T420-like timers should be specified. Proposal 8. Remote UE should send failure information upon T304/T420-like timer expires. |
| R2-2308224 | Samsung | Proposal 3-1: The expiry of T304-like timer triggers RRC re-establishment procedure if SRB1 over indirect path is not configured, or triggers the MCGFailureInformation over indirect path if SRB1 over indirect path is allowed |
| R2-2308472 | Ericsson | Proposal 5. Define new T304-like and T420-like timers for direct and indirect path addition/change respectively. Proposal 6. Upon expiry of T304-like and T420-like timers, the remote UE can send the addition/change failure to the gNB via the direct or indirect path. The remote UE should not trigger RRC re-establishment. |

**Summary 4.1:** There seems to be slightly stronger preference (6 out of 9) on defining T304-like new timer over reusing the existing T304 timer. Rapporteur considers that defining a new timer may be agreeable as most of the companies seem to agree that the timer operation will reuse existing T304 timer operation.

For the timer expiry, 1 company proposes to initiate RRC connection re-establishment, 6 companies propose to revert back to the indirect single path operation, and 9 companies propose to send the failure report to the gNB. Some companies propose to initiate RRC connection re-establishment by taking the availability of SRB1 over the indirect path into account, i.e., when SRB1 over the indirect path is not available. Although the proposed behaviours are similar, it may need more discussion to clearly understand the conditions and the related behaviours. Rapporteur thinks that the issue 4.1 may be relevant to the conditions as well.

For start/stop, 1 company proposes that it can be reused from T304 while rapporteur think the detailed conditions may depend on the conclusion of signalling procedure discussion, which is to be discussed from separate email discussion. Therefore, it might be better to discuss start/stop condition once the signalling procedure discussion is concluded.

Proposal for agreement:

**Proposal 4.1.1: A new T304-like timer is defined for the direct path addition/release.**

**Proposal 4.1.2: Start/stop condition will be discussed after the signalling procedure for direct path addition/change is concluded. Basic assumption is to reuse the T304 start/stop condition.**

Proposal for discussion:

**Proposal 4.1.3: For the expiry of the new T304-like timer, RAN2 discuss the followings:**

* **In which condition the UE reports the failure of the direct path addition/change**
* **In which condition the UE reverts to the indirect single path operation**
* **In which condition the UE initiates RRC connection re-establishment**

### 4.2. T420-like timer: Indirect path addition/change

The following proposals are related to issue 4.2:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| Tdoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 6. T420-like timer, for indirect path addition and change, can be stopped upon PC5-RRC connection establishment, i.e., upon reception of DCA message, if SRB1 is not configured on indirect path.  Proposal 7. In case of T420-like timer expiry (during indirect path addition and change), for non-split SRB1 on direct path and for split SRB1, if SRB1 on direct path is not suspended, trigger report to network via direct path to report the failure via a RRC message. |
| R2-2307941 | NEC | Proposal 5. For U2N multi-path scenario, U2N remote UE could report the measurement result of other candidate relay UEs via direct link when T420-like timer is expired.  Proposal 6. The stop condition of T420 timer could be reused for T420-like timer.  Proposal 8. Reuse T420 timer for indirect path addition/change. |
| R2-2307403 | Fujitsu | Proposal 3: When the remote UE receives an indication from the relay UE that the relay UE has successfully connected with the gNB, the remote UE stops the T420-like timer.  Proposal 4: The remote UE sends a failure indication to the gNB via the direct path when the T420-like timer expires.  Proposal 5: The remote UE falls back to the original single path configuration if indirect path addition fails. |
| R2-2307550 | Vivo | Proposal 14. For Scenario-1, RAN2 to confirm that if remote UE’s SRB1 is configured only on the direct path, the T420-like timer is NOT started for indirect path addition and change.  Proposal 15. For Scenario-1, RAN2 to agree the following T420-like timer table for indirect path addition and change (see in Table 2).  Table 2. T420-like timer table for direct path addition and change.  START: If split SRB1 with duplication enabled is configured: Upon reception of the RRCReconfiguration message including indirect path addition or change config.  STOP: Upon successfully sending RRCReconfigurationComplete message (i.e., PC5 RLC acknowledgement is received from target L2 U2N Relay UE).  Expiry: Report indirect path addition or change failure to the network via UE Assistance Information procedure. |
| R2-2307553 | CATT | Proposal 9: For Rel-18 multi-path, the remote UE shall stop T420-like timer upon successfully receiving RRCReconfigurationSidelink with sl-RLC-ChannelToAddModListPC5-r17 message from the relay UE.  Proposal 10: Reuse T420 for MP indirect path addition or indirect path modification configuration procedure.  Proposal 11: For Rel-18 multi path, the remote UE shall fallback to continue using the direct path configuration used prior to the reception of RRCReconfiguration message and inform network about the reconfiguration failure when T420 expired. |
| R2-2307745 | Qualcomm | Proposal 18: UE stops T420-like timer for indirect path addition and change on the condition of RRCReconfigurationComplete message is acknowledged by gNB or by the Relay UE. |
| R2-2307857 | Apple | Proposal 13. When T304-like or T420-like timer for MP configuration procedure expires, remote UE will fall back to its prior configuration.  Proposal 14. For T304-like and T420-like timer in path addition or path change procedure, RAN2 introduce new timer(s).  Proposal 15. For indirect path addition/change, before sending RRCReconfigurationComplete message, remote UE stop T420-like timer when remote UE receives the PC5-RRC notification confirming that the indirect path is ready to use. |
| R2-2307991 | Lenovo | Proposal 1: Once the timer for the second indirect path addition (e.g T420) expires, the remote reports the failure information to the network via the available direct path.  Proposal 2: Once the timer for the indirect path addition expires, the remote UE initiates re-establishment procedure if the first direct path is suspended or unavailable. |
| R2-2308103 | ZTE | Proposal 13. The T420-like stop condition for indirect path addition/change is upon establishing PC5 RRC connection with relay UE.  Proposal 14. Upon T420-like expiry, the remote UE can use the configuration prior to indirect path addition/change message.  Proposal 15. Re-use T420 for indirect path addition/change. |
| R2-2308206 | Huawei | Proposal 9: For indirect path addition/change, ‐ T420 and similar start condition is reused.  ‐ When RRCReconfigurationComplete message is sent by remote UE to relay UE via SL-RLC1, the existing stop condition is reused; otherwise, new stop condition needs to be specified. ‐ Upon timer expiry, indirect path failure reporting is triggered. |
| R2-2308222 | Sharp | Proposal 5. Remote UE should revert back to direct path when the T420-like timer for indirect path expires. Proposal 6. Remote UE stops T420-like timer upon successfully sending RRCReconfigurationComplete message (i.e., PC5 RLC acknowledgement is received from target L2 U2N Relay UE or Uu RLC acknowledgement is received from a serving cell). Proposal 7. New T304/T420-like timers should be specified. Proposal 8. Remote UE should send failure information upon T304/T420-like timer expires. |
| R2-2308224 | Samsung | Proposal 3-2: The T420-like timer is stopped when  - The PC5 connection is successfully established if the RRCReconfigurationComplete message is transmitted via direct path only  - The successful transmission of RRCReconfigurationComplete message over PC5 link if the RRCReconfigurationComplete message is transmitted via indirect path.  Proposal 3-3: The expiry of T420-like timer trigger the indirect path addition/change failure reporting. |

**Summary 4.2:** Not many companies provided whether to define T420-like new timer or reuse the existing T420 timer. 2 companies propose to reuse the existing T420 timer, but rapporteur’s view is that new timer can also be defined if a new T304-like timer is defined.

For timer stop condition, various options are proposed, and they can be categorized as follows:

* Option 1. Reuse T420 condition, i.e., upon successful sending of RRCReconfigurationComplete message
* Option 2. When PC5-RRC connection establishment is completed
* Option 3. When relay UE is successfully connected to the gNB
* Option 4. When PC5-RRC connection establishment completes, and relay UE is successfully connected to the gNB

Rapporteur’s view is that once RAN2 decides stop condition, the detailed message to be used for starting condition of T420-like timer can be discussed further. Note that even for option 1, there are different proposals how to consider the successful sending of RRCReconfigurationComplete message. Thus, it is suggested to take the step-by-step approach.

For timer start condition, it seems straightforward that the T420-like timer starts when the indirect path addition/change procedure starts, e.g., upon reception of the RRCReconfiguration message including the indirect path addition/change configuration. Rapporteur thinks the detailed message to be used can be discussed later. Rapporteur thinks that the issue 4.1 may be relevant to the conditions as well.

For the timer expiry, similar to T304-like timer, there are proposals to send the failure report and possibly with measurement results of other candidate relay UEs to the gNB, revert back to the direct single path operation, and initiate RRC connection re-establishment for a certain condition. Rapporteur’s suggestion is to discuss further in which condition what the UE does.

Proposal for agreement:

**Proposal 4.2.1: The T420-like timer starts when the indirect path addition/change procedure starts. FFS which message is used in detail.**

Proposals for discussion:

**Proposal 4.2.2: Discuss whether a new T420-like timer is defined or the existing T420 timer is reused for the indirect path addition/change.**

**Proposal 4.2.3: For the expiry of the T420-like timer, RAN2 discuss the followings:**

* **In which condition the UE reports the failure of the indirect path addition/change**
* **In which condition the UE reverts to the direct single path operation**
* **In which condition the UE initiates RRC connection re-establishment**
* **Whether additional information needs to be reported to the gNB**

### 4.3. Measurement events/conditions

The following proposals are related to issue 4.3:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307745 | Qualcomm | Proposal 11: The existing measurement report event, e.g. Event Y2 reported by Remote UE can be used for indirect path addition.  Proposal 12: The existing measurement report event, e.g. Event A4 reported by Remote UE can be used for direct path addition.  Proposal 13: The existing measurement report event, e.g. Event X2 or Event A2 reported from Remote UE can be used for indirect path removal or direct path removal respectively.  Proposal 14: The existing Relay UE Uu link situation change (e.g. Uu RLF, A2 reporting, HO) could trigger indirect path removal.  Proposal 15: The newly introduced Z1 measurement event for indirect-indirect path swithing is reused to trigger indirect path change.  Proposal 16: No new measurement report events will be introduced for indirect/direct path addition, removal or change. |
| R2-2307857 | Apple | Proposal 9. RAN2 confirms that Path addition/release in Rel-18 MP can be driven by traffic demand changes and/or UE mobility.  Proposal 10. In Scenario 1 and Scenario 2, support remote UE sending an RRC message to request new multi-path configuration or change of multi-path configuration.  Proposal 11. In Scenario 2, , introduce a new Uu RRC message to allow remote UE to request indirect path addition or release.  Proposal 12. In Scenario 2, when remote UE sends the indirect path additional request message, it also reports the C-RNTI of the relay UE. |
| R2-2308324 | CMCC | Proposal 9: Ask RAN2 to discuss the trigger events for indirect path addition in scenario 2. |
| R2-2308472 | Ericsson | Proposal 7. Discuss the measurement events/conditions under which a multipath connection can be setup i.e., indirect/direct path addition. |

**Summary 4.3:** RAN2 has not yet discussed measurement events/conditions that can be applied to path addition/change/removal in consideration of multi-path. 1 company sees no need of new measurement report event because the existing ones can be used. It would be good to check the companies understanding and make conclusion.

Proposal for discussion:

**Proposal 4.3: RAN2 discuss whether the existing measurement events are sufficient for path addition/change/removal in multi-path operation. If not, discuss what events need to be introduced.**

## Issue 5. Relay UE’s handover

The following proposals are related to issue 5:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 11. For the relay UE handover case, rely on network to release configuration of relay UE at remote UE before relay UE handover. R2 not pursue remote UE suspending the indirect path upon reception of notification message indicating relay UE handover |
| R2-2307227 | Xiaomi | Proposal 3: Rely on remote UE to suspend indirect path upon reception of notification message indicating handover. NW can still release the multipath afterwards. |
| R2-2307941 | NEC | Proposal 3. U2N remote UE suspends the indirect path upon reception of notification message indicating relay UE handover. |
| R2-2307991 | Lenovo | Proposal 2: In the case of relay UE handover, remote UE will suspend the indirect path upon reception of notification message due to relay UE handover. |
| R2-2307550 | Vivo | Proposal 11. It is left to network implementation to guarantee release indirect path from a remote UE before its relay UE performs handover procedure. Proposal 12. From the perspective of remote UE, it will suspend the related indirect path upon reception of relay UE’s handover notification if its E2E SRB1 is still available. Otherwise (SRB1 not available), remote UE triggers RRC re-establishment. |
| R2-2307751 | Kyocera | Proposal 5. In case the serving relay UE experiences handover, the network should release configuration of relay UE at remote UE before relay UE handover. |
| R2-2307857 | Apple | Proposal 2. For relay UE handover case in Scenario 1 (and Scenario 2 if applicable), rely on network to release MP configuration at remote UE before relay UE is handed over. |
| R2-2308120 | Spreadtrum | Proposal 6: Rely on network to release configuration of relay UE at remote UE before relay UE handover. |
| R2-2308206 | Huawei | Proposal 3: In case of urgent HO for relay UE, gNB may not release the indirect configuration at remote UE before relay UE handover, in this case the relay UE can release the PC5 unicast link or send notification as in Rel-17, and then the remote UE shall suspend the indirect path transmission. |
| R2-2308224 | Samsung | For multiple path case, the gNB can release the indirect path before the relay UE handover. |
| R2-2308749 | Nokia | Proposal 9: In case of relay UE’s handover, the network releases the configuration of the relay UE at the remote UE before the relay UE’s handover, which requires neither network restriction nor additional UE behaviour to be specified in the specification. |
| R2-2308163 | Sony | Proposal 1: Network release configuration of relay UE at remote UE. |

**Summary 5:** There are two options from the last meeting- 1) to rely on network to release configuration of relay UE at remote UE before relay UE handover, or 2) rely on remote UE to suspend the indirect path upon reception of notification message indicating relay UE handover. Rapporteur considers that there is still no clear majority while not all companies provided their view, hence, proposes to further discuss.

Proposal for discussion:

**Proposal 5: When the remote UE receives notification message indication relay UE’s handover, RAN2 discuss two options:**

1. **to rely on network to release configuration of relay UE at remote UE before relay UE handover**
2. **rely on remote UE to suspend the indirect path upon reception of notification message indicating relay UE handover**

## Issue 6. Remaining issues for Scenario 2

### 6.1. Support of case G in scenario 2

The following proposals are related to issue 6.1:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 18. For Scenario-2, RAN2 down-prioritizes direct-path-change (case-G). |
| R2-2307553 | CATT | Proposal 15: For scenario 2, Case 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) is not supported. |
| R2-2307857 | Apple | Proposal 8. Case G is not supported for Scenario 2. |
| R2-2307947 | China Telecom | Proposal 1: For Scenario 2, the indirect path change case (i.e. case G) is not supported in this release. |
| R2-2308206 | Huawei | Proposal 14: Indirect path change (i.e. Case G) should be supported in scenario 2 to enable at least indirect path failure recovery, in which case the remote UE can report more than one relay UE’s information to network. |
| R2-2308323 | CMCC | Proposal 8: Supporting indirect path change for scenario 2. |
| R2-2308222 | Sharp | Proposal 14. For scenario 2, RAN2 to postpone the decision whether to support the case (G) until the indirect path change procedure (stage-2) is confirmed:   * 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. |

**Summary 6.1:** In scenario 2, support of case G is motivated by multiple relay UEs which can be detected by one remote UE, i.e., multiple candidate relay UEs for a remote UE.

The following proposals are related to multiple candidate relay UE:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307553 | CATT | Proposal 14: For scenario 2, more than one relay UE for a remote UE is not supported. |
| R2-2308206 | Huawei | Proposal 14: Indirect path change (i.e. Case G) should be supported in scenario 2 to enable at least indirect path failure recovery, in which case the remote UE can report more than one relay UE’s information to network. |
| R2-2308224 | Samsung | Proposal 5-2: RAN2 is kindly asked to discuss the method of reporting the candidate relay UEs in scenario 2 considering the remote UE has the capability of detecting multiple relay UEs. |

Rapporteur’s understanding is that the signalling procedure for case G in scenario 2 wouldn’t be much different from that for case G in scenario 1. Thus, the standardization work might not be significant. However, it seems that many companies are still not convinced why case G needs to be supported in Rel-18. Support of case G in scenario 2 might not be essential given that ideal link is assumed between UE-to-UE link. Thus, rapporteur’s suggestion would be to deprioritize this case in scenario 2.

**Proposal 6.1: Support of case G in scenario 2 is deprioritized.**

### 6.2. Report of relay UE in RRC\_IDLE/INACTIVE

The following proposals are related to issue 6.2:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307550 | Vivo | Proposal 9. For Scenario 2, RAN2 assumes that remote UE can report the inter-UE relationship only after relay UE successfully entering RRC\_CONNECTED in this release. |
| R2-2307745 | Qualcomm | Proposal 22: For Scenario 2, RAN2 confirms target Relay UE can be in IDLE and Inactive state.  Proposal 23: Using the following ID to identify the candidate Relay UE in scenario 2   * If the Relay UE in IDLE state, Remote UE reports candidate Relay UE’s 5G-GUTI to identify the Relay UE   If the Relay UE is in Inactive state, Remote UE reports candidate Relay UE’s I-RNTI to identify the Relay UE |
| R2-2307857 | Apple | Proposal 3. Remote UE report relay UE ID while relay UE is in IDLE/INACTIVE state is not supported. |
| R2-2307947 | China Telecom | Proposal 4: In scenario 2, do not support remote-UE to report the RRC\_IDLE / RRC\_INACTIVE relay-UE ID for indirect path addition |
| R2-2308103 | ZTE | Proposal 6. Support RRC IDLE and INACTIVE Relay UE when remote UE report relay UE ID to gNB.  Proposal 7. Support to use S-TMSI as IDLE/INACTIVE relay UE ID. |
| R2-2308120 | Spreadtrum | Proposal 1: For scenario 2, do NOT support relay UE ID reporting for RRC\_IDLE/INACTIVE relay UE. |
| R2-2308206 | Huawei | Proposal 12: In order to avoid unnecessary RRC connection establishment at relay UE, idle/inactive relay information reporting should be supported for scenario 2.  Proposal 13: For idle/inactive relay information reporting in scenario 2, a new relay UE ID other than C-RNTI is used. How to assign/exchange the ID between remote UE and relay UE on non-3GPP connection is up to UE implementation. Remote UE triggers the idle/inactive relay UE to move into RRC\_CONNECTED state after receiving the indirect path configuration which indicates the relay UE ID. |
| R2-2308324 | CMCC | Proposal 4: For associated UEs in RRC\_IDLE/RRC\_INACTIVE, gNB pre-configured local ID can be used as UE identification.  Proposal 5: The RRC state can be taken into account when anchor UE reports the candidate associated UE or when gNB decides the associated UE. |

**Summary 6.2:** The WA 'For scenario 2, remote-UE reports the RRC\_CONNECTED relay-UE C-RNTI and serving cell ID (e.g., NCGI) for indirect path addition' may imply that the relay UE needs to make RRC connection prior to remote UE’s reporting of Relay UE’s ID. This implication is considered not efficient by the companies who propose to allow reporting of relay UE’s ID in RRC\_IDLE/INACTIVE as the gNB may decide not to configure the multi-path. It seems that RAN2 need further discussion.

Proposal for discussion:

**Proposal 6.2: RAN2 discuss whether the remote UE reports the RRC\_IDLE and RRC\_INACTIVE relay UE’s ID, and if so, which ID is used.**

## Issue 7. Packet duplication

### 7.1. General assumption

The following proposals are related to issue 7.1:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307857 | Apple | Proposal 19. RAN2 to further decide whether 3 legs (i.e. two in direct path and one in indirect path) needs to be supported |
| R2-2308382 | InterDigital | Proposal 4: RAN2 discuss whether there is sufficient diversity in remote UE duplicated transmissions when the remote UE and the relay UE use the same carrier on Uu.  Proposal 5: If sufficient diversity in the remote UE’s transmissions cannot be assumed, RAN2 introduces an UL carrier restriction at the relay UE when the relay UE transmits duplicated data from the remote UE. |
| R2-2307656 | Fraunhofer | Proposal 1: RAN2 to discuss how to enable throughput enhancements for a single bearer with at least one indirect path for multi-path relaying.  Proposal 2: RAN2 to discuss how the routing of data from a single bearer to associated component carriers is configured in order to allow throughput enhancements for multi-path relaying. |

**Summary 7.1.** 1 company proposes [R2-2307857] to discuss whether total 3 legs can be supported, i.e., 2 in direct paths and 1 in indirect path over PC5. Meanwhile, it is unclear whether the duplication over the relay UE’s Uu link should also be considered in Rel-18. 1 company proposes [R2-2308382] to consider carrier restriction over the relay UE’s Uu link as the same carrier may be used over remote UE’s Uu link and PC5 link. 1 company proposes [R2-2307656] to discuss CA duplication over indirect path via the Uu link of relay UE as indirect path can also be benefit from the diversity gain. Rapporteur’s understanding is that RAN2 has not discussed how many paths can be configured, or whether duplication over direct/indirect path is supported, which is also not clear from the WID description.

Proposal for discussion:

**Proposal 7.1: RAN2 discuss the followings:**

1. **Whether CA duplication is applied to the direct path of the remote UE. If yes, what is the maximum number of RLC entities over the direct path of the remote UE?**
2. **Whether CA duplication is applied to the Uu link of the relay UE. If yes, FFS how to support CA duplication over relay UE’s Uu link for MP split RB and non-split indirect RB.**

### 7.2. Activation/Deactivation

The following proposals are related to issue 7.2:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2308206 | Huawei | Proposal 15: The legacy duplication activation/deactivation MAC CE can be reused to indicate the activation/deactivation status of the PDCP duplication in both of scenario 1 and scenario 2.  Proposal 16: If the duplication RLC Activation/Deactivation MAC CE is to be reused, the definition of RLC\_i should be extended to consider the secondary SL RLC entity(ies) in scenario 1, and the non-3GPP link for scenario 2. |
| R2-2308749 | Nokia | Proposal 6: For Duplication RLC Activation/Deactivation MAC CE, RAN2 discuss which RLC entity the RLCi field indicates activation/deactivation.  Proposal 7: When an MP remote UE receives a Duplication Activation/Deactivation MAC CE, the MP remote UE activates or deactivates the secondary RLC entity, i.e., RLC entity corresponding to the non-primary path, and the primary RLC entity, which is an RLC entity for primary path, is not impacted.  Proposal 8: For Duplication RLC Activation/Deactivation MAC CE and Duplication Activation/Deactivation MAC CE in SL MP relay, RAN2 discuss whether to assign a new LCID or to update the field description without assigning any LCID. |

**Summary 7.2:** Given that single MAC is assumed for multi-path operation, it may require different interpretations on which RLC entity the received MAC CE is applied to.

For Duplication Activation/Deactivation MAC CE, 1 company thinks there is no problem while the other company sees there is a problem as single MAC entity will receive the Duplication Activation/Deactivation MAC CE from single scheduler and propose to apply the activation/deactivation only to the non-primary path.

For Duplication RLC Activation/Deactivation MAC CE, both companies propose to discuss how the RLC i field should be updated. Rapporteur’s understanding is that if RAN2 agree to support only two paths in discussion of issue 6.1, Duplication RLC Activation/Deactivation MAC CE may not need to be supported in Rel-18.

Proposal for discussion:

**Proposal 7.2: RAN2 discuss how the duplication is activated/deactivated to a certain RLC entity when the remote UE receives the Duplication A/D MAC CE or Duplication RLC A/D MAC CE using a single MAC entity.**

### 7.3 LCH-to-carrier mapping

The following proposals are related to issue 6.3:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 15. For scenario-1 of multi-path Relay, for PDCP duplication, RAN2 does not pursue LCH-to-carrier mapping restriction. |

**Summary 7.3:** 1 company proposes that LCH-to-carrier restriction is not required as different path is used, which seems to make sense but needs to be confirmed from the companies.

**Proposal 7.3: RAN2 discuss whether LCH-to-carrier restriction is not required for packet duplication over sidelink multi-path.**

### 7.4 Discard of RLC ACKed PDCP PDU

The following proposals are related to issue 7.4:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307093 | OPPO | Proposal 16. For scenario-1 of multi-path Relay, for PDCP duplication, RAN2 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”. |
| R2-2308724 | AsusTek | Proposal 1. In case of PDCP duplication for Multi-path transmission Scenario 1, the PDCP entity shall not indicate to the other RLC entity over the direct path to discard the PDCP PDU when the RLC entity over the indirect path acknowledges the transmission of the PDCP PDU. |
| R2-2307941 | NEC | Proposal 2: For Scenario 1, to enable the duplicated PDCP PDU discarding, the influence of the SRAP layer should be considered.  Proposal 3: For Scenario 1, upon receiving an acknowledgement of one PDCP PDU from the AM RLC entity of the direct path, the PDCP entity should indicate the SRAP entity to delete the corresponding duplicated PDCP PDU.  Proposal 4: If the corresponding duplicated PDCP PDU has been forwarded to the (PC5) AM RLC entity of the indirect path by the SRAP layer, the SRAP layer should indicate the (PC5) AM RLC entity to delete the corresponding duplicated PDCP PDU.  Proposal 5: For Scenario 1, when receiving a positive acknowledgement for an RLC SDU, the (PC5) AM RLC entity of the indirect path should send an indication of successful delivery of the RLC SDU to the SRAP layer directly even if there is an SRAP layer above it.  Proposal 7: For Scenario 2, whether and how to enable the duplicated PDCP PDU discarding can be left to the UE implementation. |

**Summary 7.4:** 2 companies raised a question whether RLC ACKed PDCP PDU should be discarded in packet duplication over sidelink multi-path as RLC ACKed PDCP PDU doesn’t necessarily mean that it is successfully delivered to the gNB and, in MP relay, PDCP delivers the PDCP PDU to RLC via SRAP. 1 company shows what should be changed to pursue discard of ACKed PDCP PDU in sidelink multi-path by considering SRAP layer.

It would make sense to not pursue the discard of RLC Acked PDCP PDU as explained in [R2-2307093, R2-2308724] while the necessary change might not be small to keep the legacy behaviour. One issue that needs further discussion is whether to differentiate the RLC ACK received from direct path and the RLC ACK received from the indirect path as proposed in [R2-2308724].

Proposal for agreement:

**Proposal 7.4: In packet duplication, the PDCP entity shall not indicate to the Uu RLC entity to discard the PDCP PDU when the PC5 RLC entity acknowledges the transmission of the PDCP PDU. FFS for the case where Uu RLC entity acknowledges the transmission of a PDCP PDU.**

## Issue 8. Path/Flow control

The following proposals are related to issue 8:

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307182 | Lenovo | Proposal 5: The channel quality of Relay UE shall be considered when the remote UE selects a path to transmit UL data if the UL data volume is larger than the UL data split threshold. |
| R2-2307403 | Fujitsu | Proposal 11: Path activation/deactivation is supported in multi-path.  Proposal 12: MAC CE via the direct path is used for path activation/deactivation of the indirect path |
| R2-2307553 | CATT | Proposal 4: Path activation/deactivation is introduced for multi-path for scenario 1/2.  Proposal 5: Introduce Path Activation/Deactivation MAC CE over direct path to control the activation/deactivation of indirect path. |
| R2-2308382 | InterDigital | Proposal 1: Introduce flow control indications from a relay UE towards a remote UE in multipath.  Proposal 2: A multipath remote UE in mode 2 uses flow control indications from the relay UE to control the amount of data sent over the indirect path from a split bearers when the split bearer threshold is exceeded. Details are FFS. |
| R2-2308224 | Samsung | Proposal 4-1: RAN2 is kindly asked to agree  - the MAC CE of direct path can be used to dynamically activate/deactivate indirect path.  - when initially configuring the two paths, the gNB can configure the initial activation/deactivation status of indirect path to the UE. |
| R2-2308103 | ZTE | Proposal 3. Relay UE informs assistance information of indirect path to remote UE on how to split the packet |
| R2-2308163 | Sony | Proposal 2: RAN2 to discuss the support of fast activation/deactivation on PC5 link in addition to RRC signalling based multi-path change |

**Summary 8:** There are a number of proposals on path/flow control, which has been considered as low priority issues. Rapporteur’s view is that flow/path control is not essential job to be done in Rel-18 while the remaining work is not small given the remaining time until stage-3 freeze. Therefore, it is suggested to deprioritize the discussion on path/flow control.

Proposal for agreement:

**Proposal 8: RAN2 deprioritize the discussion on path/flow control.**

## Issue 9. SR/BSR aspects

|  |  |  |
| --- | --- | --- |
| Related proposals | | |
| TDoc Number | Company | Proposals |
| R2-2307182 | Lenovo | Proposal 8: Split bearer data can be reported in only one of the Uu or SL BSR to the cell on the direct path. Whether to use SL BSR or Uu BSR can be left to UE implementation.  Proposal 9: The buffer status for Indirect bearer and for SL only data may only be reported to cell on direct path using SL BSR reporting. |
| R2-2307941 | NEC | Proposal 1: For Scenario 1, when the indirect path of a MP split bearer is configured as the primary path, the total amount of date volume includes SRAP data volume. |
| R2-2308120 | Spreadtrum | Proposal 5: For scenario 1, if both Uu BSR and SL BSR are triggered and if one of the BSRs only contain(s) the information about the amount of data for split RBs, only the other BSR is sent. |
| R2-2308163 | Sony | Proposal 3: A relay UE is configured to allow to inflate its BSR in order to accommodate the expected UL data transmission scheduled via the sidelink |
| R2-2308723 | AsusTek | Proposal 1. For an indirect bearer in MP Scenario 2, the relay UE includes the data volume of the PDCP entity in the remote UE and the data volume of the RLC entity in the relay UE in a BSR for reporting to gNB. And, the remote UE can indicate the PDCP data volume to the relay UE via the non-standard connection based on UE implementation |
| R2-2308382 | InterDigital | Proposal 6: RAN2 discusses which SR/BSR mechanism is used to support mode 1 scheduling of a remote UE in multipath: 1) Remote UE uses Uu BSR and SL BSR independently for multipath data; 2) A single BSR and/or inter-dependant SL/Uu BSRs are used to report multipath data.  Proposal 7: A remote UE in multipath reports BSR associated with at least direct bearers and split bearers. FFS whether reporting of data associated with indirect bearer is required at the remote UE.  Proposal 8: RAN2 decide, for split bearers, whether to 1) report all data in the BSR; 2) report only a subset of the data (e.g., decided by the remote UE). |
| R2-2308749 | Nokia | Proposal 11: It is up to network not to assign the same LCG to Uu logical channel and SL logical channel, hence, no specification impact.  Proposal 12: The maximum number of LCGs for a MAC entity is 16 if multi-path is configured.  Proposal 13: The LCG ID for Uu LCG and SL LCG is from 0 to 7, hence, no specification impact |

**Summary 9:** While RAN2 understand that BSR MAC CE should be sent over the direct path, there are several contributions discussing further SR/BSR aspects e.g., how to avoid duplicate report for split RB, how to handle BSR in scenario 2, how to assign LCG. 1 company proposes to consider SRAP data volume. Rapporteur’s understanding is, however, that there is no buffer in SRAP layer as SRPA layer only perform routing the logical channel to proper RLC entity. Rapporteur’s view is that RAN2 may need to discuss e.g., how to trigger/send/cancel Uu BSR and SL BSR, and check if the current specification is clear, which would be essential for operation of multi-path relaying.

**Proposal 9: RAN2 discuss if any issue needs to be discussed/resolved for BSR operation by focusing on essential issues from operation perspective than enhancement.**

# 4 Feedback

If you have any comments/feedback on the summary proposals, please provide them here:

|  |  |  |
| --- | --- | --- |
| Feedback | | |
| Company | Proposal | Comment |
| OPPO | 4.3.1 | Although it is correct, we believe it does not harm to go further, i.e., we can conclude to use RRCReconfiguration message, yet FFS on the dedicated IE that is to trigger the procedure. |
|  | 3.3.2 | As in legacy, the failure report is only allowed if T316 is configured, so just wonder if T316-being-configured can be seen as a tool to achieve this goal, or is it something different? Just for my understanding, thanks! |
|  | 4.2.3 | How about the following rewording to make it clearer (since single path operation may not necessarily be the configuration before the path switching procedure)  Proposal 4.2.3: For the expiry of the new T304-like timer, RAN2 discuss the followings:  - In which condition the UE reports the failure of the direct path addition/change  - In which condition the UE reverts to ~~the indirect single path operation~~ the configuration before the direct path addition/change  - In which condition the UE initiates RRC connection re-establishment |
|  | 4.3.3 | For the case of indirect path addition/change failure, different from the direct path case, we believe there is no need to do the configuration-reverting operation, since the configuration-reverting operation is eventually to benefit possible re-establishment procedure (i.e., to have a reference configuration), yet the indirect path would be released upon re-establishment initiation. The same logic holds for legacy SCG addition/change failure. So we suggest the following change  Proposal 4.3.3: For the expiry of the T420-like timer, Ran2 discuss the followings:  - In which condition the UE reports the failure of the indirect path addition/change  - whether and if yes In which condition the UE reverts to the direct single path operation  - In which condition the UE initiates RRC connection re-establishment  - Whether additional information needs to be reported to the gNB  And one more Q: for T420-like timer, do we need to discuss the stop condition? |
| Apple | 4.1.1 (or 4.2.1 as listed in the summary: the numbering is changed for 4.1 and 4.2 in the summary) | The proposal seems based on wrong statistics of company preference. |
| Apple | 4.1.2 | For the following two:  “- In which condition the UE reverts to the indirect single path operation  - In which condition the UE initiates RRC connection re-establishment  I think we can recommend based on a majority view as below: “  **When T304 expires, Remote UE falls back to indirect single path operation” as baseline and FFS whether there is any condition in which UE need initiates RRC reestablishment** |
| Apple | 4.2.1/4.2.2 | We think there are options for stop conditions of T420-like timer as listed in the rapporteur summary needs to be discussed, which seems more important than the two proposals listed here. |
| Apple | 4.2.3 | Similarly as the comment to 4.1.2, maybe we can agree the baseline is UE reverts to prior configuration. |
| Apple | 7.1 | For SL CA in indirect path, this is for V2X use case only in Rel-18. So, we prefer to recommend not to consider it. RAN2 can focus on whether/how many legs can be supported for Uu direct path in Multi-path relay case. |
| Apple |  | There is one open issue regarding the PC5-RRC trigger usage for indirect path addition case in Scenario 1 (which is also related to applicability of Rel-17/Rel-18 relay UE). Will this to be included in the summary document for RAN2 discussion |

# 5 Conclusion

## 5.1 Proposals for agreement

**Proposal 1-1:** RAN2 confirm the working assumption below:

For Scenario-1/2, MP remote UE is configured with a single cell group, i.e., MCG, for the direct path, and SL configuration, for the indirect path.

For scenario 1, primary path of the split SRB1 and SRB2 is always configured on direct path. And UE switches the primary path to the indirect path for reporting after direct path failure, and this switching is limited to the case where duplication is not configured as in legacy.

For Scenario 2, 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.

**Proposal 2.1:** For scenario 1, non-split SRB on the indirect path is not supported.

**Proposal 4.2.1:** A new T304-like timer is defined for the direct path addition/release.

**Proposal 4.2.2:** Start/stop condition will be discussed after the signalling procedure for direct path addition/change is concluded. Basic assumption is to reuse the T304 start/stop condition.

**Proposal 4.3.1:** The T420-like timer starts when the indirect path addition/change procedure starts. FFS which message is used in detail.

**Proposal 6.1:** Support of case G in scenario 2 is deprioritized.

**Proposal 7.4:** In packet duplication, the PDCP entity shall not indicate to the Uu RLC entity to discard the PDCP PDU when the PC5 RLC entity acknowledges the transmission of the PDCP PDU. FFS for the case where Uu RLC entity acknowledges the transmission of a PDCP PDU.

**Proposal 8:** RAN2 deprioritize the discussion on path/flow control.

## 5.2 Proposals for discussion

**Easily agreeable:**

**Proposal 2.2:** RAN2 discuss whether different bearer type can be configured for SRB1 and SRB2.

**Proposal 2.3:** RAN2 discuss whether the primary path of the split DRB can be set to either the direct path or the indirect path, or is fixed to the direct path as split SRB.

**Proposal 4.3.2:** Discuss whether a new T420-like timer is defined or the existing T420 timer is reused for the indirect path addition/release.

**Proposal 7.3:** RAN2 discuss whether LCH-to-carrier restriction is not required for packet duplication over sidelink multi-path.

**Need more discussion:**

**Proposal 3.1:** RAN2 discuss whether or what additional information can be included in MCGFailureInformation when reporting the direct path failure.

**Proposal 3.2:** For scenario 1 and 2, RAN2 discuss which message is used for report of indirect path failure from 1) MCGFailureInformation, 2) SidelinkUEInformationNR, and 3) a new message.

**Proposal 3.3.1:** RAN2 discuss whether failure detection on the existing path while additional path addition is an issue to be resolved. FFS how to resolve it if RAN2 agree to resolve it.

**Proposal 3.3.2:** RAN2 discuss whether the gNB can configure a condition not to report the RLF.

**Proposal 4.2.3:** For the expiry of the new T304-like timer, RAN2 discuss the followings:

* In which condition the UE reports the failure of the direct path addition/change
* In which condition the UE reverts to the indirect single path operation
* In which condition the UE initiates RRC connection re-establishment

**Proposal 4.3.3:** For the expiry of the T420-like timer, Ran2 discuss the followings:

* In which condition the UE reports the failure of the indirect path addition/change
* In which condition the UE reverts to the direct single path operation
* In which condition the UE initiates RRC connection re-establishment
* Whether additional information needs to be reported to the gNB

**Proposal 4.4:** RAN2 discuss whether the existing measurement events are sufficient for path addition/change/removal in multi-path operation. If not, discuss what events need to be introduced.

**Proposal 5:** When the remote UE receives notification message indication relay UE’s handover, RAN2 discuss two options:

1. to rely on network to release configuration of relay UE at remote UE before relay UE handover
2. rely on remote UE to suspend the indirect path upon reception of notification message indicating relay UE handover

**Proposal 6.2:** RAN2 discuss whether the remote UE reports the RRC\_IDLE and RRC\_INACTIVE relay UE’s ID, and if so, which ID is used.

**Proposal 7.1:** RAN2 discuss the followings:

1. Whether CA duplication is applied to the direct path of the remote UE. If yes, what is the maximum number of RLC entities over the direct path of the remote UE?
2. Whether CA duplication is applied to the Uu link of the relay UE. If yes, FFS how to support CA duplication over relay UE’s Uu link for MP split RB and non-split indirect RB.

**Proposal 7.2:** RAN2 discuss how the duplication is activated/deactivated to a certain RLC entity when the remote UE receives the Duplication A/D MAC CE or Duplication RLC A/D MAC CE using a single MAC entity.

**Proposal 9:** RAN2 discuss if any issue needs to be discussed/resolved for BSR operation by focusing on essential issues from operation perspective than enhancement.