**3GPP TSG-RAN WG2 Meeting #122 R2-230xxxx**

**Incheon, Korea, 22nd – 26th May 2023**

**Source: vivo (Moderator)**

**Title:****Summary of AI 7.9.3 on service continuity**

**Agenda Item:** **7.9.3**

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

# Introduction

This contribution summarizes contribution submitted on service continuity enhancements for L2 U2N relay under AI 7.9.3.

Besides, a couple of documents (i.e., R2-2305419 and R2-2304681) to move into the service continuity AI are also considered.

# Down-selection for UL and DL lossless data delivery solutions

## UL lossless data delivery

At the last RAN2#121bis-e meeting, RAN2 has reached the following agreements on uplink lossless data delivery issue for service continuity. Based on the following agreement, it’s observed that **only solutions U3 and U5 will be further considered for UL lossless data delivery for path switch.**

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| Agreements:For uplink lossless data delivery for path switch, continue considering solutions U3 and U5 from R2-2304305. Other solutions are not pursued. |

Related company proposals at this meeting are summarized in the following table.

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| **Company** | **Tdoc** | **Proposal** |
| **OPPO** | R2-2304755 | Observation 1 Solution-U3 introduces additional buffering burden and QoS impact to the remote UE.Observation 2 Uu RLF can be seen as a corner case in inter-gNB as R17 intra-gNB case.Observation 3 The source gNB maintains the relay UE to continue the UL data (of the remote UE) delivery after remote UE’s handover is the legacy network behaviour.Observation 4 For UL, S-gNB can based on existing tools to know when to stop data forwarding and releasing the relay UE.Observation 5 Solution-U3 causes resource-waste and redundant data forwarding.Proposal 1 For uplink lossless data delivery for path switch, RAN2 agree solution U5 from R2-2304305. |
| **CANON** | R2-2305025 | Observation 1: The efficiency of solution U3 may be impacted by some potential PDCP SDUs discarding at the remote UE due to potential discard timer expiry.Observation 2a: Solution U6 may prevent unnecessary buffering at remote UE.Observation 2b: When applying solution U6, there is a risk of experiencing PDCP status report reception failure at the remote UE. Proposal 1: RAN2 to consider the solution U3 as a potential solution for the lossless inter-gNB path switch.Proposal 2a: For UL transmission, during path switching, when considering solution U3, the discard timer of the remote UE should be (re)configured so as to prevent the discarding of PDCP SDU that need to be retransmitted. To do so, the two following options may be considered:- Option 1: the source gNB configures the remote UE PDCP discard timer to a value that would ensure a lossless data delivery for path switch e.g., an infinity value;- Option 2: the remote UE suspends its discard timer. The remote UE may suspend its discard timer upon reception of a path switch command from the source gNB or upon sending some measurement report to the source gNB.Proposal 2b: For UL transmission, when considering solution U3, once the path switch has completed, the discard timer of the remote UE should be resumed to a normal usage. To do so, the two following options may be considered:- Option 1: the target gNB (re)configures the remote UE’s PDCP discard timer once the retransmitted missing PDCP SDUs have been received from the remote UE;- Option 2: the remote UE resumes its PDCP discard timer after retransmission of the missing PDCP SDUs to the target gNB.Proposal 3: RAN2 to consider the solution U6 as a potential solution for the lossless inter-gNB path switch.Proposal 4: RAN2 to consider a complete solution based on both U6 and U3 so as to minimize buffering constraintsProposal 5: RAN2 not to pursue the solution U5 for the lossless delivery issue. |
| **ZTE** | R2-2305044 | Observation 1: U5 could not be used as an independent solution to ensure UL data lossless delivery considering Uu hop may not be always in good quality and the PC5 link may be released by remote UE before relay UE transmits all buffered remote UE’s packets to source gNB.Proposal 6: For uplink lossless data delivery for path switch, solution-U3 is taken as the baseline, U5 can be taken as a complement with no spec impact. |
| **Apple** | R2-2305063 | Observation 1 Solution U5 is not based on PDCP status report.Observation 2 In absence of any further signalling or coordination between L2 relay UE and gNB, Solution U5 does not ensure the UL packets buffered in L2 relay UE can be delivered to source gNB successfully.Proposal 1 Only Solution U3 is adopted for UL lossless delivery.Proposal 2 RAN2 share the solution U3 to RAN3 for confirmation and possible optimizations in inter-gNB operations to help reduce redundancy. |
| **InterDigital** | R2-2305182 | Observation 7: Retransmitting PDUs not ACKed in the PDCP status PDU received (immediately) after a path switching from indirect ensures the target gNB can get the missing PDUs in a timely fashion and is independent of the backhaul Uu conditions between the source relay UE and the source gNB before and after the path switching.Observation 8: Keeping the source relay UE transmit the pending packets to the source gNB after the path switching and forwarding them to the target gNB is mainly an implementation based solution, but it has several shortcomings (e.g., slow, not clear for how long the target waits for the missing packets from the source, will not work in scenarios where the path switching is triggered due to problem with the backhaul or the backhaul degrades or is lost after the path switching, etc.,)Proposal 5: For the UL, U3 (PDCP retransmission based on PDCP status report from the target gNB) to be adopted as the solution for lossless path switching from indirect. |
| **LG** | R2-2305209 | Observation 4: The solution-U3 is remote UE implementation and the solution-U5 is the source/target gNB implementation.Proposal 2: We support U3 and U5 within the condition without spec impact. |
| **Xiaomi** | R2-2305217 | Proposal 3: U5 is selected to ensure uplink lossless delivery. |
| **China Telecom** | R2-2305234 | Observation 1: Regarding solution U5, a new end marker from the relay UE to the source gNB is needed to indicate the end of relaying data for the remote UE after all the packets received from the remote UE are successfully received by the source gNB, in order to ensure UL lossless delivery.Proposal 1: Adopt solution U3 to resolve UL lossless delivery for inter-gNB i2x path switch.Proposal 2: The control PDU for PDCP status report can be enhanced to indicate the UE to retransmit the PDCP SDUs which have not been successfully delivered. |
| **vivo** | R2-2305247 | Observation 1 In Solution U3, it requires much higher capacity on UE buffer memory than the legacy Remote UE.Observation 2 In Solution U5, the Relay UE’s Uu link quality deterioration, especially during path switch procedure, can be deemed as corner case.Proposal 1 For uplink lossless data delivery for path switch, RAN2 tries to first agree U5. Reconsider whether U3 is also needed additionally. Proposal 1a If solution U5 is agreed as in P1, whether/how to capture the new NW behaviour is up to RAN3 decision Proposal 1b If solution U3 is agreed in addition to U5, FFS whether/how to capture the new Remote UE behaviour as shown in Table 1, e.g., with NOTE in TS 38.323. |
| **CATT** | R2-2305280 | Observation 1: For UL data in inter-gNB i2d/i2i path switch, the target gNB cannot know whether and when the data via source link can be forwarded from the source gNB without coordination between gNBs, and the in-order delivery may be delayed.Proposal 1: Solution-U3 (Remote UE’s PDCP retransmission based on DL PDCP Status Report from target gNB) which can reduce latency of the data delivery is proposed to be used for UL data in inter-gNB i2x path switching. |
| **Nokia** | R2-2305420 | Proposal 1: RAN2 to discuss the enhancement of solution U3 by introducing a simple indication from the relay UE to the remote UE whether there is data received from the remote UE and acknowledged over PC5 interface but not been delivered to the source gNB over Uu interface successfully.Proposal 2: RAN2 to agree not to pursue U5 as the solution for lossless data delivery in UL. |
| **Ericsson** | R2-2305549 | Proposal 5 Support Solution U3 (i.e., remote UEs PDCP retransmission is based on DL PDCP SR from the target gNB) for UL lossless data delivery. No specification impact is foreseen |
| **Spreadtrum** | R2-2305552 | Proposal 4: In the inter-gNB i2x path switch cases, adopt Solution-U3 for UL lossless delivery. |
| **NEC** | R2-2305585 | Proposal 4:Solution-U3 (as described in R2-2304305) is selected to avoid data loss for UL transmission during path switch.  |
| **CMCC** | R2-2305619 | Observation 1: Solution-U3 can not solve the uplink lossless delivery, unless a proper discard timer is configured. Observation 2: Buffer size at PDCP transmitting entity and the transmission latency should be considered when long discard timer is configured.Observation 3: Solution-U5 is too much relay on network implementation, and the impacts to Xn interface need further discussion in RAN3.Proposal 1: Indicator from relay UE or gNB to remote UE can be introduced to inform the UL data transmission condition. Proposal 2: Indicator can be triggered during the inter-gNB i2x handover only. |
| **Qualcomm, OPPO, Xiaomi** | R2-2305764 | Observation 1: Currently, PDCP status report is used for discarding those PDCP packets which are received successfully in the gNB but the RLC ACK are lost during RRC re-establishment or HO.Observation 2: In U3, UE is required to buffer all the transmitted PDCP packets (regardless of they are transmitted successfully or not) till receiving PDCP status report or discard timer expires. The buffered transmitted PDCP packets will occupy the PDCP layer memory quickly and there is no or less memory for newly incoming packets buffering and processing.Observation 3: The inappropriate discard timer setting will lead to data loss for new packets and the already transmitted packets.Summary of U3: Solution U3 has the following disadvantages and is not an implementable solution.- Has system performance impact on latency, packet loss rate, throughput- QoS requirements will not be guaranteed due to inappropriate discard timer setting and less PDCP memory space used for new packets processing.- UE has to buffer more data even if the data has been received by NW.- BSR calculation has to be changed.Observation 4: Relay UE Uu failure during path switching is rare caseObservation 5: Relay UE Uu failure is not inter-gNB specific issue and can happen in intra-gNB path switch case and non-path switch case. Then the optimization for Uu failure case is out of Rel-18 scope.Observation 6: It is existing gNB behavior used for intra-gNB path switching in which the gNB should keep Remote UE context in Relay UE for a while to let the Relay UE continue to transmit UL data. Also, gNB may keep the remote UE context to prepare potential reestablishment in existing path switch/handover failure.Observation 7: Currently, it is not specified when UL data forwarding tunnel should be released, then it should be possible to release the UL data forwarding tunnel by target gNB implementation e.g. setting a release timer by implementation.Summary of U5: The gap between intra-gNB and inter-gNB path switching is UL data forwarding. Solution U5 reuses existing mechanism of intra-gNB path switching and UL data forwarding, can achieve UL lossless without specification impact.Proposal 1: Solution U3 is not pursued.Proposal 2: Solution U5 is adopted to address UL data loss. |
| **Huawei** | R2-2305979 | Observation 4: Solution-U5 may cause HFN synchronization issues if forwarding occurs after receiver status is frozen in the source gNB. It is difficult for the source gNB decide when to freeze the receiver status.Proposal 7: Solution- U3 is pursued to avoid UL data loss. FFS the following options for Solution-U3:Option 1: A new DL PDCP Status Report can be introduced, e.g. a new type of DL PDCP Status Report can trigger the remote UE’s PDCP entity to retransmit the missing SDU. Option 2: Legacy DL PDCP Status Report is used but a new behaviour to the remote UE is added in the specification, e.g., the first DL PDCP Status Report received by the remote UE after PDCP reestablishment can trigger the remote UE to retransmit the missing SDU. |
| **MediaTek** | R2-2306260 | Proposal 1: Adopt U5 (Source Relay UE continues to transmit UL data to source gNB and gNB forwards to the target gNB) for inter-gNB UL service continuity. |
| **Sharp** | R2-2306381 | Observation 1. solution U3 can be achieved by combination of legacy procedure and new PDCP procedure as follows;Step1(legacy). Remote UE changes the path and retransmits RLC non-ACKed packets via new path.Step2(legacy). Target gNB send PDCP status report to remote UE.Step3(legacy). Remote UE discards some buffered packets based on the PDCP status report.Step4(new). Remote UE retransmits buffered packets via new path regardless whether ACKs of packet are confirmed by lower layer.Proposal 1. RAN2 introduces new PDCP procedure of step4 and new condition to trigger step4.Observation 2. There are two alternatives to implement step4Alt1. Retransmission is performed in the status reporting receive operation procedure (TS38.323-5.4.2). Remote UE retransmits buffered packets after discarding based on the received status report.Alt2. Retransmission is triggered by re-establishment/recovery procedure after the status reporting receive operation procedure. When a packet is indicated as non-Acked packet by the PDCP status report from target gNB, remote UE considers the packet as non-Acked regardless whether ACK of the packet is confirmed by lower layer. And target gNB triggers re-establishment/recovery procedure for retransmission.Proposal 2. The new PDCP procedure of step4 should be performed in the status reporting receive operation procedure (TS38.323-5.4.2).Proposal 3. gNB triggers the new PDCP procedure of step4 by explicit signaling.Proposal 4. It is up to NW implementation whether NW makes Source Relay UE to continue transmission of UL data to source gNB (Solution U5). |

According to above company proposals, Rapporteur observes that there is no clear majority view on UL lossless data delivery solutions:

**Solution U5**

* supported by **8** companies (OPPO, ZTE, LG, Xiaomi, vivo, Qualcomm, MediaTek, Sharp)
* opposed by **3** companies (CANON, Apple, Nokia)

**Solution U3**

* supported by **13** companies (CANON, ZTE, Apple, InterDigital, LG, China Telecom, CATT, Nokia, Ericsson, Spreadtrum, NEC, Huawei, Sharp)
* opposed by **3** companies (Qualcomm, OPPO, Xiaomi)

Moreover, based on above company observations, it’s observed that **the technical concerns of solution U3 and solution U5 are identified as follows in Table 1**:

**Table 1 Technical concerns of solution U3 and solution U5**

|  |  |  |
| --- | --- | --- |
|  | **Solution U3** | **Solution U5** |
| **Technical concerns** | * introduces additional buffering burden and thus requires large UE storage, which may not be supported by low capability UE
* causes resource-waste and redundant data forwarding
* the efficiency may be impacted by some potential PDCP SDUs discarding at the remote UE due to potential discard timer expiry
* has system performance impact on latency, packet loss rate, throughput
* QoS requirements will not be guaranteed due to inappropriate discard timer setting and less PDCP memory space used for new packets processing
* UE has to buffer more data even if the data has been received by NW
* BSR calculation has to be changed
 | * could not be used as an independent solution considering Uu hop may not be alwys in good quality and the PC5 link may be released by remote UE before relay UE transmits all buffered remote UE’s packets to source gNB
* requires signalling or coordination between relay UE and source gNB to know e.g., whether all the remaining packets of remote UE are delivered, when to stop data forwarding and release the relay UE etc.
* may cause HFN synchronization issues if forwarding occurs after receiver status is frozen in the source gNB. It is difficult for the source gNB decide when to freeze the receiver status
 |

Moreover, from Remote UE/NW implementation perspective, it’s mentioned by several companies (see highlighted green) that **solution U3/U5** can both be agreeable and one complements the other as follows:

* **solution U5** can be complementary to solution U3 in case some old buffered PDCP SDUs are discarded at the remote UE side e.g.., due to the Remote UE’s PDCP buffer overflow or discard timer expiry. In such a case, relying on solution U5 to perform PDCP re-transmission by the source relay UE and data forward from the source gNB to target gNB.
* **solution U3** can be complementary to solution U5 in case source relay UE’s Uu link quality deterioration or Uu RLF. In such a case, relying on solution U3 to buffer the PDCP SDUs for which the successful delivery has been confirmed by PC5 RLC layer at the remote UE side and perform PDCP re-transmission to target gNB by the remote UE.

Considering the discussions happening in the last two meetings, it seems the proponents of one camp are not fully convinced on the effectiveness/benefit of the solution proposed by the other camp. As a result, it seems not possible to draw a conclusion simply based on companies’ preference (no clear majority’s preference was seen either), and the most important thing at this stage is to see whether there is really critical technical con existing for either solution as proposed for companies above, in order to judge which one to survive or both to adopt. Therefore, Rapporteur would like to make the following proposals for further discussion.

**Proposal 1 [For discussion] For uplink lossless data delivery for path switch, RAN2 to conclude whether to agree on solution U5 only, solution U3 only or both solutions, by taking into account of the identified technical concerns of U3 and U5 as shown in Table 1.**

As to the potential specification impact on solution U5, companies have divergent views on whether/how to specify the new NW behaviour e.g., source gNB and target gNB interactions to stop data forwarding and release the relay UE. Considering the potential specification impact is mainly related to RAN3 domain, Rapporteur suggests that we don’t touch the solution details for now and see if the following P2 is agreeable.

**Proposal 2 [For discussion] If solution U5 is agreed as in P1, inform RAN3 of RAN2 conclusion and up to RAN3 on potential spec impact (if any) between source gNB and target gNB.**

As to the potential specification impact on solution U3, companies have divergent views on whether/how to specify the new UE behaviour of buffering the PDCP SDUs for which the successful delivery has been confirmed by PC5 RLC layer for potential retransmission. The potential specification impact is mainly related to RAN2 domain. Moreover, it’s clarified that the remote UE behaviour may only be recommended UE behaviour with best efforts, but not mandatory to all remote UEs with different UE storage capabilities. Rapporteur suggests that we can discuss if the following P3 is agreeable.

**Proposal 3 [For discussion] If solution U3 is agreed as in P1, FFS whether/how to capture the new Remote UE behaviour due to solution U3 in RAN2 Spec (e.g., with NOTE or normative text in TS 38.323).**

## DL lossless data delivery

At the last RAN2#121bis-e meeting, RAN2 has reached the following agreements on downlink lossless data delivery issue for service continuity. Based on the following agreement, it’s observed that **only solutions D3, D4 and D5 will be further considered for DL lossless data delivery for path switch.**

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| Agreements:For downlink lossless data delivery for path switch, Solution-D4 is taken as the baseline solution and keep Solution-D3/D5 on the table for further decision at the next meeting. |

Related company proposals at this meeting are summarized in the following table.

|  |  |  |
| --- | --- | --- |
| **Company** | **Tdoc** | **Proposal** |
| **OPPO** | R2-2304755 | Observation 6 Solution-D4 may have RAN3 impact, so whether it is a feasible solution needs RAN3 confirmation.Proposal 2 For downlink lossless data delivery for path switch, RAN2 agree solution D3 or D5 from R2-2304305. Or if RAN2 cannot make a decision, send LS to RAN3 to ask preference. |
| **CANON** | R2-2305025 | Observation 3: Solution D4 efficiency may be impacted by some potential PDCP SDUs discarding at the source gNB due to potential discard timer expiry.Proposal 6: Based on D4 solution, the target gNB requests the source gNB to forward missing DL packets when detecting a SN mismatch between the PDCP status report received from the remote UE and the last SN status transfer received from the source gNB.Proposal 7a: For DL transmission, when considering solution D4, the discard timer of the source gNB should be disabled during path switching operation in order to prevent the discarding of PDCP SDUs that need to be retransmitted. To do so, the two following options may be considered:-Option 1: The source gNB configures its discard timer to a value that would ensure a lossless data delivery for path switch e.g., infinity value;-Option 2: The source gNB suspends its discard timer upon reception of a path switch acknowledgement from the target gNB or upon the sending of a path switch command to the remote UE.Proposal 7b: For DL transmission, after path switch, the discard timer of the source gNB should be resumed to a normal usage:-Option 1: source gNB configures its PDCP discard timer after the forwarding of the missing PDCP SDUs to the target gNB;-Option 2: source gNB resumes its discard timer after the forwarding of the missing PDCP SDUs to the target gNB.Proposal 8: RAN2 to consider a complete solution based on both D4 and D3 so as to minimize buffering constraints while minimizing the effects of PDCP status report reception failure at the source gNB.Proposal 9: RAN2 not to pursue the solution D5 for the lossless delivery issue. |
| **Apple** | R2-2305063 | Observation 3 Solution D5 does not utilize the PDCP status report from remote UE, thereby adding wasteful overhead in inter-gNB interface.Observation 4 Solution D3 adds delay and uncertainty about path switching procedure, while not able to guarantee the delivery of PDCP status report from remote UE to source gNB.Proposal 3 Only Solution D4 is adopted for DL lossless delivery.Proposal 4 RAN2 share the solution D4 to RAN3 for confirmation and request for possible enhancements in inter-gNB operations to ensure the feasibility of lossless DL delivery. |
| **InterDigital** | R2-2305182 | Observation 9: Solution D3 requires (RAN2) specification changes, may not be reliable and is not future proof.Observation 10: Solution D4 requires (RAN3) specification changes but is reliable and future proof.Observation 11: Solution D5 is purely an implementation of the source gNB, but it may lead to unnecessary transmission of packets over Xn as it is not based on PDCP status from the UE.Proposal 6: For the DL, D4 (Enhanced Data forwarding from source gNB to target gNB per target gNB request to be adopted as the solution for lossless path switching from indirect.Proposal 7: If proposal 6 is agreed, send an LS to RAN3 regarding the decision. |
| **LG** | R2-2305209 | Observation 5: Downlink solution D3 can be left to source gNB implementation without a spec impact. Proposal 3: RAN2 needs to send LS to the RAN3 to ask whether RAN3 will support the downlink solution D4.Proposal 3: Whether to support D5 is up to RAN3. |
| **Xiaomi** | R2-2305217 | Proposal 4: D3/D5 is selected to ensure uplink lossless delivery. It’s up to RAN3 to decide whether support D4.Proposal 5: Send LS to RAN3 about RAN2 decision to support U5 and ask whether support D4. |
| **China Telecom** | R2-2305234 | Proposal 4: Adopt solution D4 to resolve DL lossless delivery for inter-gNB i2x path switch.Proposal 5: If solution D4 is adopted, RAN2 send LS to RAN3 to inform RAN2’s decision and ask RAN3 to consider Xn data forwarding details. |
| **vivo** | R2-2305247 | Observation 3 Solution D3 is less preferred than the other two solutions because the successful transmission of the PDCP Status Report from the Remote UE to the Source gNB right before path switch is not so reliable.Observation 4 For solution D4 and solution D5, they both only have impact to Xn interface, which is better to be decided by RAN3.Proposal 2 For downlink lossless data delivery for path switch, solutions D3 is not pursued. Final down-selection from solutions D4 and solution D5 are up to RAN3 decision. |
| **CATT** | R2-2305280 | Observation 2: For DL data in inter-gNB i2d/i2i path switch, solutions in source gNB will introduce additional time delay for HO procedure.Proposal 2: Solution-D4 (Enhanced Data forwarding from source gNB to target gNB per target gNB request (legacy PDCP status report based)) and Solution-D5 (Proactive Data forwarding from source gNB to target gNB) are proposed to be used for DL data in inter-gNB i2x path switching. And Solution-D5 which has less delay impact to the HO procedure is more preferred. |
| **Nokia** | R2-2305420 | Proposal 3: RAN2 to re-evaluate solution D4 due to the potential data loss caused by the extra delay introduced by this solution.Proposal 4: RAN2 to agree not pursue D3 as the solution for lossless data delivery in DL.Proposal 5: RAN2 to agree solution D5 as baseline solution with the enhancement to introduce the indication from the relay UE to the gNB whether there is DL data received by the relay UE that has not been delivered to the remote UE successfully. |
| **Ericsson** | R2-2305549 | Proposal 4For DL lossless delivery, down select between:Solution D3: the PDCP SR can be sent to the source gNB and it can perform the required data forwarding to the target gNB. FFS the trigger condition for the PDCP SR to the source gNB and, Solution D5: Proactive Data Forwarding between source gNB and target gNB with no specification impact. |
| **Spreadtrum** | R2-2305552 | Proposal 5: In the inter-gNB i2x path switch cases, adopt Solution-D5 for DL lossless delivery.  |
| **NEC** | R2-2305585 | Proposal 5:Solution-D4 (as described in R2-2304305) is selected to avoid data loss for DL transmission during path switch, and solution-D3 and solution-D5 are excluded. |
| **CMCC** | R2-2305619 | Proposal 3: Excluding solution-D3 for downlink lossless delivery.Proposal 4: Indicator for missing data and data forwarding procedure after RAN HO Completion shall be introduced as solution-D4.Proposal 5: Data forwarding procedure after RAN HO Completion shall be introduced as solution-D5.Proposal 6: Ask RAN2 to inform solution-D4 and solution-D5 to RAN3, and left the final decision to RAN3. |
| **Huawei** | R2-2305979 | Observation 5: Solution -D3 will not work due to the deteriorating link quality between the remote UE and the relay UE.Observation 6: Solution -D5 cannot guarantee the lossless data transfer during the path switch. Proposal 8: Solution- D4 is pursued to avoid DL data loss via a complementary data forwarding based on the target gNB request. |
| **MediaTek** | R2-2306260 | Proposal 2: Adopt D4 (Enhanced Data forwarding from source gNB to target gNB per target gNB request (legacy PDCP status report based)) for inter-gNB DL service continuity. |
| **Sharp** | R2-2306381 | Proposal 5. RAN2 should reduce RAN3 impact as much as possible and downselects the solution from the table.Observation 3. Remote transmits the PDCP status report to target gNB based on reception status at the time of receiving path switching command.Observation 4. Remote UE cannot receive stacking packets at source relay UE after receiving path switching command.Observation 5. With respect to D4, there is a significant impact on RAN3, e.g. new inter-gNB operation and storing packets for a long time is needed, but there is no waste of backhaul traffic.Observation 6. For D5, it increases backhaul traffic from source gNB to target gNB.Observation 7. For determination the packets to be transferred to target gNB, it is useful for source gNB to acquire PDCP status report of remote UE (D3).Observation 8. Combination of D3 and D5 incurs a little of waste of backhaul traffic but does not need inter-gNB operation.Observation 9. To optimize D3, i.e. to transmit PDCP status report without PDCP data recovery or PDCP re-establishment, new condition of transmission of PDCP status report is needed. Proposal 6. RAN2 to send an LS to RAN3 to select solution from D4 and D3+D5 with RAN2’s analysis. |

According to above company proposals, Rapporteur observes that company views on DL lossless data delivery solutions are split as follows:

**Solution D3**

* supported by **4** companies (OPPO, CANON, Xiaomi, Ericsson)
* opposed by **6** companies (Apple, InterDigital, vivo, Nokia, CMCC, Huawei)

**Solution D4**

* supported by **11** companies (Apple, CANON, InterDigital, LG, China Telecom, vivo, CATT, NEC, CMCC, Huawei, MediaTek)
* opposed by **1** companies (Nokia)

**Solution D5**

* supported by **9** companies (OPPO, LG, Xiaomi, vivo, CATT, Nokia, Ericsson, Spreadtrum, CMCC)
* opposed by **4** companies (CANON, Apple, InterDigital, Huawei)

Given that the supporting companies on solution D4 and/or D5 (17 in total) are far more than the supporting companies on solution D3 (4), and the opposing companies on solution D3 express concerns that the successful transmission of the PDCP Status Report from the Remote UE to the Source gNB right before path switch is not so reliable and may not work due to the deteriorating link quality between the remote UE and the relay UE. Therefore, Rapporteur suggests to directly discuss the following proposal.

**Proposal 4 [For discussion] For downlink lossless data delivery for path switch, RAN2 to down-select between solution D4 and solution D5, and inform RAN3 of RAN2 decision.**

## Extend lossless solutions to Intra-gNB i2i path switch case

Related company proposals at this meeting are summarized in the following table.

|  |  |  |
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| **Company** | **Tdoc** | **Proposal** |
| **China Telecom** | R2-2305234 | Proposal 3: Reuse the UL lossless delivery solution for the inter-gNB i2x path switch to resolve UL lossless delivery for intra-gNB i2x path switch. |
| **CATT** | R2-2305280 | Proposal 3: For data delivery during intra-gNB i2i path switching:-For UL, both Solution-U3 and Solution-U5 can be adapted;-For DL, how to support lossless data delivery can be depend on gNB implementation. |

As intra-gNB i2i path switch is also in the scope of Rel-18 WID, Rapporteur thinks that we can simply confirm that the uplink & downlink lossless delivery solution(s) for inter-gNB path switch (based on the outcome of discussion in Section 2.1 and Section 2.2) can be reused to intra-gNB i2i path switch, when applicable.

**Proposal 5 [For discussion] RAN2 to discuss whether the uplink & downlink lossless delivery solution(s) to be agreed for inter-gNB path switch cases are applied to intra-gNB i2i path switch (when applicable).**

# RAN2 impact based on SA2 LS

At RAN2#119bis-e agreement, there is an FFS issue that needs to be revisited, see in red as following:

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| --- |
| Agreement:Proposal 4 (modified) For i2i scenario, serving/candidate U2N relay UEs, when SL-RSRP is unavailable, SD-RSRP is used as the measurement quantity. Wording can be revisited if it is determined that L2IDs for U2U and U2N are always different (so that candidate U2N relay UEs would never have SL-RSRP available). |

Based on SA2 LS (R2-2302445), it’s concluded in the Answer 2 that the L2 ID used for U2U communication would be different from the L2 ID for U2N services. And companies submit contributions to discuss the above FFS as shown in the following table.

|  |  |  |
| --- | --- | --- |
| **Company** | **Tdoc** | **Proposal** |
| **ZTE** | R2-2305044 | Proposal 1: For i2i scenario, for serving U2N relay UEs, when SL-RSRP is unavailable, SD-RSRP is used as the measurement quantity. For candidate U2N relay UEs, SD-RSRP is used as the measurement quantity. |
| **vivo** | R2-2305247 | Proposal 3 RAN2 to revise the original proposal 4 agreed for i2i scenario as “Proposal 4 (modified) For i2i scenario, for serving~~/candidate~~ U2N relay UEs, when SL-RSRP is unavailable, SD-RSRP is used as the measurement quantity. And for candidate U2N relay UEs, only SD-RSRP is used as the measurement quantity. ~~Wording can be revisited if it is determined that L2IDs for U2U and U2N are always different (so that candidate U2N relay UEs would never have SL-RSRP available).~~” |
| **Spreadtrum** | R2-2305552 | Proposal 1: SD-RSRP is used as the only measurement quantity for the candidate relay UEs in the case of indirect-to-indirect path switch. |

As above, Rapporteur suggests to reword the above agreement at RAN2#119bis-e meeting as follows:

**Proposal 6 [Easy] RAN2 to revise the original proposal 4 agreed for i2i scenario as “Proposal 4 (modified) For i2i scenario, for serving~~/candidate~~ U2N relay UEs, when SL-RSRP is unavailable, SD-RSRP is used as the measurement quantity. And for candidate U2N relay UEs, only SD-RSRP is used as the measurement quantity. ~~Wording can be revisited if it is determined that L2IDs for U2U and U2N are always different (so that candidate U2N relay UEs would never have SL-RSRP available).~~”.**

# RAN2 impact based on RAN1&RAN4 LS

## Measurement Event Z2

At RAN2#121 meeting, RAN2 made an agreement as follows:

|  |
| --- |
| Agreement:Event Z2 will not be specified unless the issue of comparing SL-RSRP and SD-RSRP can be resolved. LS to RAN1/RAN4 to ask about the feasibility of such comparisons, clarifying that there is not yet consensus on whether to support the event. |

Based on RAN1 LS (R2-2304617) and RAN4 LS (R2-2304637), companies submit contribution to discuss measurement Event Z2 in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Tdoc | Proposal |
| ZTE | R2-2305044 | Proposal 2: RAN2 confirms that Event Z2 (Candidate L2 U2N Relay UE becomes an offset better than serving L2 U2N Relay UE) is not supported. |
| InterDigital | R2-2305182 | Observation 1: Support of event Z2 would provide the network with the same flexibility as Uu when configuring measurements.Observation 2: The network is able to estimate the difference in transmit power between a relay UE’s discovery and data resulting from different ways of taking pathloss into account.Observation 3: The network is able to estimate the difference in transmit power between a relay UE’s discovery and data due to CBR-based power control.Observation 4: The network is able to estimate the difference in transmit power between a relay UE’s discovery and data when these are configured in different pools.Observation 5: Although RAN1 indicated that SL-RSRP and SD-RSRP cannot be compared, RAN2 consideration of the network being able to account for discrepancy may not have been accounted for. Proposal 1: Support event Z2: candidate L2 U2N Relay UE becomes an offset better than serving L2 U2N Relay UEProposal 2: Event Z2 can be configured with two offsets, one for comparing between SD-RSRP, or between SL-RSRP, and another for comparing SD-RSRP with SL-RSRP |
| Xiaomi | R2-2305217 | Proposal 1: Not introduce comparison between SL-RSRP and SD-RSRP based event Z2.Observation 1: Remote UE can obtain the SD-RSRP of serving relay UE without additional effort.Proposal 2: Introduce SD-RSRP based event Z2: Candidate L2 U2N Relay UE becomes an offset better than serving L2 U2N Relay UE. |
| vivo | R2-2305247 | Proposal 4 RAN2 to confirm that measurement Event Z2 is not pursued. |
| CATT | R2-2305280 | Proposal 4: Do not consider Event Z2 (Candidate L2 U2N Relay UE becomes an offset better than serving L2 U2N Relay UE) as a candidate event for RRM measurement. |
| Spreadtrum | R2-2305552 | Proposal 2: Do not support Event Z2 for indirect-to-indirect path switch. |
| NEC | R2-2305585 | Proposal 1:RAN2 to define multiple offsets for Event Z2 if Event Z2 is accepted by RAN2. |
| Huawei | R2-2305979 | Observation 1: Impact of SL path loss can be neglected when there is a large distance between remote UE and serving relay UE Observation 2: The impact of the priority of data and discovery message can be estimated by gNB. Observation 3: The impact of the pool configuration and sidelink CA configuration of data and discovery message can be avoided by gNB. Proposal 1: Comparison of SL-RSRP and SD-RSRP for the measurement event Z2 can be supported as the gNB can configure appropriate offset for such comparison through implementation. |
| MediaTek | R2-2306260 | Proposal 3: RAN2 don’t support event Z2. |
| Samsung | R2-2306374 | Observation 1: Comparison of same measurement quantity could also have transmission power difference issue.Observation 2: Network can handle transmission power difference on comparison of same measurement quantity.Observation 3: Comparison of same measurement quantity can be used for the purposes of triggering a measurement report under network control.Proposal 1: RAN2 is kindly asked to confirm that comparison of SL-RSRP and SD-RSRP measurement cannot be used for the purposes of triggering a measurement report.Proposal 2: RAN2 is kindly asked to discuss that event Z2 can be introduced with restriction on single measurement quantity to determine fulfilment of entering or leaving condition. |
| Sharp | R2-2306383 | Observation 1: According to the LS response from RAN1 and RAN4, it is not recommended to compare SD-RSRP and SL-RSRP for the purposes of triggering a measurement report.Observation 2: The following issues needs to be resolved to compare between SD-RRSPs.1.AS does not ensure that serving relay UE discovery can be performed.2.Remote UE cannot recognize whether the discovery message is sent from Serving Relay UE or not, because a Source L2 ID of discovery and source L2 ID of unicast communication are different.Proposal 1: RAN2 should discuss whether the comparison between SD-RSRPs can be used for triggering a measurement report.Observation 3: Current Event Z2 has the following issues1.If the quality of PC5 is sufficiently high, but the quality of Uu is low, it cannot be said that service continuity is ensured.2.Even if the serving link quality is sufficiently high, measurements reporting may be triggered .Proposal 2: RAN2 will not introduce Event Z2 unless the issues involved in this event are resolved. |
| Nokia | R2-2305419 | Observation 1: Specifying a Z2 event is not trivial due to the power imbalance between SL-RSRP and SD-RSRP measurements.Proposal 1: RAN2 discuss how the comparison of SL-RSRP and SD-RSRP considering the different transmission powers can be handled in the new Z2 event. |

As to support direct comparison of SL-RSRP and SD-RSRP, there will be complexity and a lot of efforts to resolve the identified issues by RAN1/RAN4 at first. Based on above company proposals, the following options are proposed on whether/how to support measurement Z2:

* **Option 1:** NOT introduce measurement event Z2 (supported by 6 companies i.e., ZTE, vivo, CATT, Spreadtrum, MediaTek, sharp)
* **Option 2:** introduce measurement event Z2 with restriction on direct comparison of SD-RSRP only (supported by 2 companies i.e., Xiaomi, Samsung)
* **Option 3:** introduce measurement event Z2 with two offsets respectively on direct comparison of SD-RSRP only and direct comparison of SD-RSRP only (supported by 2 companies i.e., InterDigital, NEC)
* **Option 4:** introduce measurement event Z2 and up to gNB implementation to configure an appropriate offset (supported by 1 company Huawei)

As there is clear majority on preference for the above option 1, rapporteur would like to adopt the following proposal as a way forward.

**Proposal 7** **[Easy] RAN2 to agree that measurement event Z2 (i.e., Candidate L2 U2N Relay UE becomes an offset better than serving L2 U2N Relay UE) is not introduced.**

## Measurement Event (Z1, X1, X2)

Other measurement Events than Z2 are also discussed as below table, but only by one company.

|  |  |  |
| --- | --- | --- |
| **Company** | **Tdoc** | **Proposal** |
| **vivo** | R2-2305247 | **Measurement Event Z1**Proposal 5 The threshold configuration in RRC signalling for measurement Event Z1 includes:* two separate SL-RSRP and SD-RSRP threshold value for threshold1
* one SD-RSRP threshold value for the threshold2

Proposal 5a If the U2N Remote UE has available SL-RSRP measurement results with the serving U2N Relay UE, it applies the SL-RSRP threshold value for threshold1 and the SD-RSRP threshold value for the threshold2 to evaluate Event Z1.Proposal 5b If the U2N Remote UE has no available SL-RSRP measurement results with the serving U2N Relay UE, it applies the SD-RSRP threshold value for threshold1 and the SD-RSRP threshold value for the threshold2 to evaluate Event Z1. |
| **InterDigital** | R2-2305182 | **Measurement Event X1, X2**Observation 6: Configuration of measurement events (X1, X2) agreed in Rel17 can result in triggering measurement reports at significantly different conditions when the UE changes from measuring the serving relay using SL-RSRP to SD-RSRP and vice versa.Proposal 3: Introduce the possibility of configuring a second threshold in each of measurement events X1 and X2. Proposal 4: A Rel18 UE, when configured with two different thresholds for any of X1 or X2 uses one threshold when relay measurements are based on SL-RSRP and another threshold when relay measurements are based on SD-RSRP.  |

**Rapporteur view: As there is no enough information to make the summary proposal, Rapporteur proposes to list them for information and can be further revisited later.**

# FFS on emergency service relaying

Company proposals related to FFS issue on emergency service relaying are listed in the following table.

|  |  |  |
| --- | --- | --- |
| **Company** | **Tdoc** | **Proposal** |
| **ZTE** | R2-2305044 | Observation 2: From upper layer’s perspective, relay UE shall use cause “emergency” if it needs to establish RRC connection when remote UE establishes a PC5 link associated with dedicated emergency RSC with the relay UE.Observation 3: When RRC connection establishment/resume is triggered by reception of SL-RLC1, the main point is upon receiving cause “emergency” from upper layer, how relay UE’s AS layer sets the cause value.Proposal 9: When RRC connection establishment/resume is triggered by reception of SL-RLC1 for emergency service, relay UE’s AS layer sets the cause value in accordance with the information (i.e. cause “emergency”) received from upper layer. |
| **vivo** | R2-2305247 | Proposal 6 RAN2 to confirm that it’s up to Rel-18 U2N Relay UE implementation to set cause value to emergency in case of emergency service relaying in SL-RLC1 case for path switch. |

Meanwhile, R2-2304759 in AI 7.24.2 also discusses the same FFS issue.

**Rapporteur view: As per chairman guideline from offline, handle the related contributions (i.e., P9 of R2-2305044, P6 of R2-2305247) together with R2-2304759 in AI 7.24.2. And thus, skip the summary proposal.**

# Stage-2 level basic procedures

The following company proposals provide views on the basic procedures that can be captured in the Stage 2 spec.

|  |  |  |
| --- | --- | --- |
| **Company** | **Tdoc** | **Proposal** |
| **ZTE** | R2-2305044 | **Timing to send RRCReconfiguration to the source relay UE**Proposal 5: RAN2 to discuss when the source gNB to configure the source relay UE to release the remote UE related configuration during inter-gNB i2d/i2i path switch:- Option 1: Upon receiving UE context release about remote UE from the target gNB, the source gNB sends RRC reconfiguration to relay UE to release remote UE related configuration.- Option 2: The RRC reconfiguration to the relay UE can be sent any time after the RRC reconfiguration to remote UE based on source gNB implementation.**Intra-gNB indirect-to-indirect path switching** Proposal 8: Capture the procedure of switching from indirect to indirect path as illustrated above in stage 2 spec. |
| **Spreadtrum** | R2-2305552 | **Timing to send RRCReconfiguration to the source relay UE**Proposal 3: As in Rel-17, Source gNB can send RRCReconfiguration message to source Relay UE to release the configuration of relay channel(s) at any time after the source gNB sends the RRCReconfiguration message with sync to the remote UE.**Inter-gNB indirect-to-direct path switch**Proposal 6: RAN2 agrees that the measurement configuration, measurement reporting and measurement events for intra-gNB indirect-to-direct path switch are reused for inter-gNB indirect-to-direct path switch.Proposal 7: Take the procedures in Figure 1 for inter-gNB indirect-to-direct path switch.**Inter-gNB direct-to-indirect path switch**Proposal 8: RAN2 agrees that the measurement configuration, measurement reporting and measurement events for intra-gNB direct-to-indirect path switch are reused for inter-gNB direct-to-indirect path switch.Proposal 9: Take the procedures in Figure 2 for inter-gNB direct-to-indirect path switch. **Intra-gNB indirect-to-indirect path switch**Proposal 10: Take the procedures in Figure 3 for intra-gNB indirect-to-indirect path switch.**Inter-gNB indirect-to-indirect path switch**Proposal 11: Take the procedures in Figure 4 for inter-gNB indirect-to-indirect path switch. |
| **CMCC** | R2-2305619 | **Intra-gNB indirect to indirect path switching**Proposal 7: It is proposed to agree the overall procedure in Fig.4 as a baseline to support intra-gNB indirect to indirect path switching. |
| **Huawei** | R2-2305979 | **Inter-gNB indirect-to-direct path switching**Proposal 2a: In inter-gNB indirect-to-direct path switching, the HO preparation between source gNB and target gNB is performed in the same way as legacy inter-gNB HO, without additional RAN2/RAN3 spec impact.Proposal 2b: Agree the above procedure in Figure 1 as a baseline for inter-gNB indirect-to-direct path switching procedure which can be contained in the clause 16.12.6.1 of TS 38.300. **Inter-gNB direct-to-indirect path switching**Proposal 3: Agree the above procedure in Figure 2 as a baseline for Inter-gNB direct-to-indirect path switching which can be contained in the clause 16.12.6.2 of TS 38.300. **Intra-gNB indirect-to-indirect path switching**Proposal 5: Agree the above procedure in Figure 3 as a baseline for intra-gNB indirect-to-indirect path switching which can be contained in the new sub-clause “16.12.6.x Switching from indirect to indirect path” of TS 38.300.**Inter-gNB indirect-to-indirect path switching**Proposal 6: Agree the above procedure in Figure 4 as a baseline for inter-gNB indirect-to-indirect path switching which can be contained in the new sub-clause “16.12.6.x Switching from indirect to indirect path” of TS 38.300. |
| **NEC** | R2-2305585 | **Timing to send RRCReconfiguration to the source relay UE**For inter-gNB I2D path switching and inter-gNB I2I path switching, when to reconfigure the source Relay UE should be considered to guarantee the successful delivery of the path switch command.Proposal 2: RAN2 to consider when to reconfigure Relay UE to release the configuration of relay channel(s) for inter-gNB I2D path switching and inter-gNB I2I path switching. |

**Rapporteur view: The Stage 2 level general procedure (including diagram, step description, etc.) is up to TS 38.300 running CR discussion.**

# Other proposals

This section summarizes other proposals which can be deprioritized or postponed in this meeting from Rapporteur’s perspective (mainly related to e.g. stage-3 details, other WG impacts. other mob. enhancement not ever touched in previous meetings, etc.).

## Stage 3 signalling details

### Potential Uu impact

Related proposals about potential Uu signalling impacts are listed as below.

|  |  |  |
| --- | --- | --- |
| Company | Tdoc | Proposal |
| ZTE | R2-2305044 | **Path switch configuration**Proposal 3: For inter-gNB i2d path switch, the contents in RRC Reconfiguration message for Remote UE is the same as legacy NR RRC Reconfiguration with sync.Proposal 4: For inter-gNB d2i and i2i path switch, the sl-PathSwitchConfig within ReconfiguraionWithSync can be reused to indicate the path switch configuration for remote UE. Details can be discussed in stage 3. |
| Ericsson | R2-2305549 | Proposal 2 Reuse the Rel-17 measurement reporting framework i.e., report consists of candidate U2N relay UE IDs, candidate U2N relay UE’s serving cell ID and the sidelink measurement quantity information |
| Huawei | R2-2305979 | Proposal 4: Introduce the Allowed-List/Block-List to restrict candidate relay UE’s serving cell. |
| Sony | R2-2305521 | Proposal 2: RAN2 to agree that relay UE is configured with events X1, X2, Y1 and Y2 independently from remote UE.Proposal 4: RAN2 to discuss how the serving gNB be aware of the target relay’s serving gNB. |
| CATT | R2-2305280 | Proposal 5: Clarify the legacy Event Y2 (Candidate L2 U2N Relay UE becomes better than threshold) can also be used for i2i path switching. |
| NEC | R2-2305585 | **Failure handling for inter-gNB path switching**Proposal 3:RAN2 to consider the failure of PC5 unicast link establishment during path switching to trigger the RRC Reconfiguration failure procedure. |

Rapporteur view: Stage 3 details without Rapporteur’s suggestion at this meeting.

### Potential Xn impact

The related proposals that have potential Xn impact are summarized here. Rapporteur observes that the following proposals may also be coupled with the RAN3 discussion.

|  |  |  |
| --- | --- | --- |
| Company | Tdoc | Proposal |
| Apple | R2-2305063 | **HANDOVER REQUEST and HANDOVER REQUEST ACK**Proposal 5 When Target gNB selects the final target relay UE from a list of candidate relays supplied by the source gNB, SL measurements of the candidate relay UE(s) are used by source gNB to rank the list of candidate relays served by target gNB, and target gNB are required to take the rank and RRC state into account when choosing the final target relay UE.Proposal 6 Target gNB prepares the following configuration depending on target relay UE’s RRC state and send to source gNB in the transparent RRC container of the HANDOVER REQUEST ACK message: * For target relay UE in CONNECTED state, the prepared configuration includes SRAP bearer mapping configuration, L2 ID and local ID of the remote UE.
* For target relay UE in IDLE/INACTIVE state, the prepared configuration includes L2 ID and local ID of the remote UE.

Proposal 7 RAN2 send a LS to RAN3 to manifest the impact of possible wasteful L2 Relay UE preparation during the direct-to-indirect path switching procedure if HANOVER REQUESTs are triggered to multiple target gNBs in parallel and ask for RAN3 clarification. |
| LG | R2-2305209 | **Inter-node RRC message**Observation 1: Target gNB knows the RRC state of the candidate relay UEs. Observation 2: If the candidate relay UE is in RRC\_CONNECTED, the target gNB also knows Uu RSRP of the candidate relay UEs.Observation 3: Even if the PC5 RSRP of a candidate relay UE is better than the PC5 RSRP of any others, the target gNB can select the other relay UE among the candidate as a target relay UE considering the RRC state and the Uu RSRP.Observation 4: RAN3 agreed that the source gNB sends a list of the candidate relay UE IDs belonging to the same target cellProposal 1: The source gNB sends PC5 RSRP measurement results on the candidate relay UEs to the target gNB via inter-node RRC message. |
| CATT | R2-2305280 | **Final path type decision**Proposal 6: The target gNB is allowed to change the path type.**Inter-node RRC message**Proposal 7: The candidate relay UE ID(s) and the related measurement result(s) can be sent to the target gNB via inter-node message, besides the legacy candidate cell information. |
| Ericsson | R2-2305549 | **Source vs Target gNB decision on Target U2N relay UE**Proposal 1For d2i and i2i scenarios, RAN2 to acknowledge RAN3’s agreement that the source gNB sends a list of candidate relay UEs belonging to the same target cell to the target gNB with the target gNB making the final decision.  |

Rapporteur view: wait for more RAN3 progress without rapporteur’s suggestion at this meeting.

## Other mobility enhancements

Related company proposals at this meeting are summarized in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Tdoc | Proposal |
| Nokia | R2-2305420 | **simultaneous relay UE’s inter-gNB HO and connected remote UE’s path switching**Observation 1: The remote UE benefits from being able to perform path switching instead of initiating RRC connection re-establishment when the connected relay UE performs HOProposal 6: RAN2 to agree the remote UE can be configured to perform path switching instead of initiating RRC connection re-establishment when the connected relay UE performs HO.Observation 2: The path switch command for the remote UE and HO command for the relay UE are independent messages, and it is not possible for the gNB to ensure the path switch configuration arrives before the HO command.Proposal 7: RAN2 to discuss how to deliver the remote UE’s RRC reconfiguration message to the relay UE when the serving gNB configures the relay UE to perform inter-gNB HO and the remote UE’s path switching, simultaneously.**selection of relay UE in RRC\_IDLE or RRC\_INACTIVE state**Proposal 8: RAN2 to discuss how to enhance the selection of a relay UE in RRC Idle/Inactive state for service continuity during path switching to indirect path; e.g., by allowing the gNB to page candidate relay UEs in RRC\_IDLE/INACTIVE or by allowing the final selection of relay UE to be up to remote UE by indication of gNB.**relay UE’s cell reselection or HO during indirect path switching of the remote UE**Observation 3: In case the camping/serving cell of the selected target relay UE changes during path switching (e.g., UE in RRC\_IDLE/INACTIVE has performed cell reselection to a new cell), the RRCRreconfigurationComplete message of the remote UE will be relayed to the new cell (instead of the previous camping/serving cell), causing failure of the remote UE’s indirect path switching.Proposal 9: RAN2 to discuss the solutions to avoid the path switching failure caused by the relay UE’s cell reselection or by the relay UE’s handover during remote UE’s indirect path switching.**prolonged inter-gNB signaling over Xn interface for inter-gNB path switching**Observation 4: Missing of the RRCReconfiguration message by the remote UE due to prolonged path switching preparation time caused by inter-gNB path switching may cause path switching failure, which will impact the remote UE’s service continuity.Proposal 10: RAN2 to discuss whether/how to allow early RRCReconfiguration message to the remote UE for path switching and/or to use the target relay UE to assist the remote UE’s inter-gNB path switching. |
| Ericsson | R2-2305549 | **selection of relay UE in RRC\_IDLE or RRC\_INACTIVE state**Proposal 3For inter-gNB d2i and i2i scenarios, the following should be agreed about the paging-based mechanism to transit the target U2N relay UE in IDLE/INACTIVE state to the CONNECTED state:a.In RRC\_INACTIVE state, RAN2 to confirm that it is up to gNB implementation to page the target U2N relay UE before the path switch command is sent to the remote UE.b.In RRC\_IDLE state, RAN2 to not pursue the enhancements required for the paging solution. |
| Apple | R2-2305063 | Proposal 8 CHO-like path switching solution can be discussed only if time permits after the discussion on the basic solutions.Proposal 9 RAN2 agree that DAPS like solution is not in the scope.  |
| Sony | R2-2305521 | Proposal 1: RAN2 to agree that conditional handover is supported in Rel-18 UE sidelink relay for switching from direct to indirect path as well as switching from indirect to direct path. Rel-16 CHO procedure is the baseline.Proposal 3: RAN2 to support group handover for service continuity in Rel-18 UE sidelink relay. |

Basically, Rapporteur thinks the above proposals are enhancements on top of the baseline Rel-17 U2N service continuity framework and thus suggest to deprioritize them in Rel-18.

**Proposal 8 [Lower priority] RAN2 to deprioritize discussion on the addressing the following mobility issues to support remote UE’s path switch in Rel-18.**

* **simultaneous relay UE’s inter-gNB HO and connected remote UE’s path switching**
* **selection of relay UE in RRC\_IDLE or RRC\_INACTIVE state**
* **relay UE’s cell reselection or HO during indirect path switching of the remote UE**
* **prolonged inter-gNB signaling over Xn interface for inter-gNB path switching**
* **CHO-like path switching solution for remote UE**
* **DAPS like path switch solution for remote UE**
* **group handover for relay UE and remote UE(s)**

# Conclusion

The summary concludes with the following proposals:

**[Easy]**

**Proposal 6 [Easy] RAN2 to revise the original proposal 4 agreed for i2i scenario as “Proposal 4 (modified) For i2i scenario, for serving~~/candidate~~ U2N relay UEs, when SL-RSRP is unavailable, SD-RSRP is used as the measurement quantity. And for candidate U2N relay UEs, only SD-RSRP is used as the measurement quantity. ~~Wording can be revisited if it is determined that L2IDs for U2U and U2N are always different (so that candidate U2N relay UEs would never have SL-RSRP available).~~”.**

**Proposal 7 [Easy] RAN2 to agree that measurement event Z2 (i.e., Candidate L2 U2N Relay UE becomes an offset better than serving L2 U2N Relay UE) is not introduced.**

**[For discussion]**

**Proposal 1 [For discussion] For uplink lossless data delivery for path switch, RAN2 to conclude whether to agree on solution U5 only, solution U3 only or both solutions, by taking into account of the identified technical concerns of U3 and U5 as shown in Table 1.**

**Proposal 2 [For discussion] If solution U5 is agreed as in P1, inform RAN3 of RAN2 conclusion and up to RAN3 on potential spec impact (if any) between source gNB and target gNB.**

**Proposal 3 [For discussion] If solution U3 is agreed as in P1, FFS whether/how to capture the new Remote UE behaviour due to solution U3 in RAN2 Spec (e.g., with NOTE or normative text in TS 38.323).**

**Proposal 4 [For discussion] For downlink lossless data delivery for path switch, RAN2 to down-select between solution D4 and solution D5, and inform RAN3 of RAN2 decision.**

**Proposal 5 [For discussion] RAN2 to discuss whether the uplink & downlink lossless delivery solution(s) to be agreed for inter-gNB path switch cases are applied to intra-gNB i2i path switch (when applicable).**

**[Lower priority**]

**Proposal 8 [Lower priority] RAN2 to deprioritize discussion on the addressing the following mobility issues to support remote UE’s path switch in Rel-18.**

* **simultaneous relay UE’s inter-gNB HO and connected remote UE’s path switching**
* **selection of relay UE in RRC\_IDLE or RRC\_INACTIVE state**
* **relay UE’s cell reselection or HO during indirect path switching of the remote UE**
* **prolonged inter-gNB signaling over Xn interface for inter-gNB path switching**
* **CHO-like path switching solution for remote UE**
* **DAPS like path switch solution for remote UE**
* **group handover for relay UE and remote UE(s)**

Reference

1. R2-2304755 Discussion on lossless data forwarding for inter-gNB service continuity OPPO discussion Rel-18 NR\_SL\_relay\_enh-Core
2. R2-2305025 Discussion on lossless path switching for Sidelink Relay CANON Research Centre France discussion Rel-18
3. R2-2305044 Further discussion on service continuity for SL relay ZTE, Sanechips discussion Rel-18 NR\_SL\_relay\_enh-Core
4. R2-2305063 Discussion on Service continuity enhancement of L2 U2N relay Apple discussion Rel-18 NR\_SL\_relay\_enh-Core
5. R2-2305182 Remaining Issues on Service Continuity InterDigital discussion Rel-18 NR\_SL\_relay\_enh-Core
6. R2-2305209 SL U2N relay for the service continuity enhancement LG Electronics France discussion Rel-18
7. R2-2305217 Discussion on service continuity enhancement Xiaomi discussion
8. R2-2305234 Discussion on lossless delivery solution for inter-gNB path switching China Telecom discussion Rel-18 NR\_SL\_relay\_enh-Core
9. R2-2305247 Remaining issues on service continuity enhancement for L2 U2N relay vivo discussion
10. R2-2305280 Further Consideration on Service Continuity Enhancements for L2 U2N Relay CATT discussion Rel-18 NR\_SL\_relay\_enh-Core
11. R2-2305420 Discussion on L2 U2N relay service continuity issues for inter-gNB path switch Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_SL\_relay\_enh
12. R2-2305521 Service continuity enhancements for UE sidelink relay Sony discussion Rel-18 NR\_SL\_relay\_enh
13. R2-2305549 Discussion on Inter-gNB Service Continuity Ericsson España S.A. discussion Rel-18
14. R2-2305552 Service continuity enhancements support for L2 U2N relay Spreadtrum Communications discussion Rel-18
15. R2-2305585 Service Continuity Enhancements and Lossless Data Delivery NEC Corporation discussion NR\_SL\_relay\_enh-Core
16. R2-2305619 Discussion on service continuity CMCC discussion Rel-18 NR\_SL\_relay\_enh-Core
17. R2-2305761 Lossless Inter-gNB path switching Lenovo discussion Rel-18 NR\_SL\_relay\_enh-Core
18. R2-2305764 Evaluation and proposals on U3 and U5 Qualcomm Incorporated, OPPO, Xiaomi discussion NR\_SL\_relay\_enh-Core
19. R2-2305979 Discussion on Service Continuity Huawei, HiSilicon discussion Rel-18 NR\_SL\_relay\_enh-Core
20. R2-2306260 Remaining issues for service continuity MediaTek Inc. discussion Rel-18
21. R2-2306374 Discussion on Event Z2 Samsung discussion Rel-18 NR\_SL\_relay\_enh-Core
22. R2-2306381 remaining issues for i2x path switching with lossless delivery Sharp discussion Rel-18 NR\_SL\_relay\_enh-Core
23. R2-2306383 Discussion on remaining issues for path switching Sharp discussion Rel-18 NR\_SL\_relay\_enh-Core
24. R2-2305419 Discussion on reply LSs on RSRP issues (R1-2304211 / R2-2304617 and R4-2306366 / R2-2304637) Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_SL\_relay\_enh
25. R2-2304681 DRAFT LS for Draft LS to RAN3 on Lossless Path Switching for Sidelink Relay NEC LS out Rel-18 NR\_SL\_relay\_enh-Core To:RAN3
26. R2-2304759 Discussion on emergency cause value for SL Relay OPPO discussion Rel-18 NR\_SL\_relay\_enh-Core, TEI18