3GPP TSG-RAN WG2 #113e R2-210xxxx

Electronic meeting, 25th January – 5th February 2021

Agenda Item: 8.7.2.2

Source: Ericsson

Title: Summary of [AT113-e][606][Relay] Continuation of L3 architecture issues

Document for: Discussion, Decision

# 1 Introduction

This document is to handle the following email discussion:

* [AT113-e][606][Relay] Continuation of L3 architecture issues (Ericsson)

Scope: Discuss the “to be discussed” proposals P2/P3/P8/P9 from the L3 summary, and implement the agreements. Work towards conclusions if possible.

Intended outcome: Endorsable TP

Deadline: Tuesday 2020-02-02 1200 UTC

Regarding the deadlines, I would like to set the following 2 deadlines:

1) First deadline on **Friday Feb 29 0700 UTC** for providing comments to the proposals.

2) Second deadline on **Tuesday Feb 2 1200 UTC** to provide comment of the TP (with implemented agreements and conclusions for L3).

# 2 Contact information

|  |  |
| --- | --- |
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# 3 L3 open issues

## 3.1 QoS for L3 UE-to-Network relay

According to the summary in R2-2102247 and what has been agreed, the following EN will be deleted:

*Editor note: whether other QoS solution (e.g. whether gNB can perform PDB split) is introduced depends on SA2.*

Another aspect to look into for the QoS handling is how to update the text of the RAN2 TR 38.836 in order to be fully aligned with what SA2 has concluded and added in their TR 23.752. In fact, according to the latest SA2 conclusion, there is no solution other than #24/#25 for the QoS handling.

According to the latest SA2 conclusion in S2-2009541

For QoS handling, following aspects in **Solution #24 and Option #2 of Solution #25** are selected as basis for normative work:

- L3 Relay can be configured with the 5QIs and PQIs mapping. Based on the mapping or, in case of a non-configured mapping of a requested QoS parameter, based on its implementation, the L3 relay translates the Uu QoS parameters to PC5 QoS parameters and vice versa.

- To support the dynamic QoS handling, relay UE determines the Uu QoS parameters and PC5 QoS parameters by taking into account the end-to-end QoS requirements provided by remote UE based on its configured QoS mapping information or, in case of a non-configured mapping of a requested QoS parameter, based on its implementation, and initiates PDU session modification procedure and L2 link modification procedure to setup corresponding QoS Flows over Uu and PC5.

- The SMF of the L3 Relay provides the corresponding QoS rules and flow level QoS parameters to the L3 Relay as part of the PDU session establishment or modification procedures as defined in TS 23.502 [8], clause 4.3.2 and 4.3.3. Alternatively, reflective QoS control over Uu as defined in TS 23.501 [6], clause 5.7.5.3 can be leveraged for dynamic QoS handling of Remote UE to save on signalling between SMF and L3 Relay.

- Based on signalled QoS rules (via SMF) or derived QoS rules (Uplink Uu via reflective QoS), the UE-to-Network Relay may use the L2 Link Modification procedures as defined in TS 23.287 [5], clause 6.3.3.4 to either move the corresponding ProSe service(s) to the mapped existing PC5 QoS flow or to set up a new PC5 QoS flow.

Thus, the following text can be updated as follow in TR 38.836, clause 4.6.2.

4.6.2 QoS

[…]

SA2 captured two solutions for QoS support of L3 UE-to-Network Relay:

1) Relay UE sets separate Uu QoS parameters and PC5 QoS parameters in option-2 of solution#25 of TR 23.752 [6].

2) End-to-End QoS support in solution#24 of TR 23.752 [6], where Relay UE can obtain a mapping between PQI and 5QI from SMF/PCF.

[…]

**Question 1.** Do companies agree to have to have the proposed change in TR 38.836, clause 4.6.2 in order to align the RAN2 TR with the SA2 conclusion for the QoS handling of L3 UE-to-Network Relay?

|  |  |  |
| --- | --- | --- |
| Company | Agree (y/n) | Comments |
| MediaTek | N | RAN2 TR can simply say, refer to SA2 TR 23.752 for the QoS handling of L3 UE-to-Network Relay |
| OPPO | Y | Proponent (R2-2100110) |
| Nokia | Yes |  |
| InterDigital | N | Agree with MediaTek. |
| Fraunhofer | Yes |  |
| Ericsson | Yes |  |
| Futurewei | N | Agree with MediaTek. Or quote relevant part from TR 23.752. |
| vivo | Yes |  |
| Qualcomm | Yes or suggestion from MediaTek | We think it is a small issue (or even not an issue since TR has cited [6] and it has no RAN2 impact). Either way is fine. RAN2 can just follow majority to close this issue. |
| Intel | Yes |  |
| Sharp | Yes |  |
| Huawei, HiSilicon | N | Agree with MediaTek to refer to SA2 spec. We should be careful on the aspects involving both RAN2 and SA2 work, otherwise it may mislead other groups. |
| CATT | Yes | Agree with OPPO. |
| LG | Yes |  |
| Philips | N | Agree with MediaTek |
| Spreadtrum | No | Agree with MediaTek. |

A further proposal has been made in the summary where it is highlighted as also Sol#45 provide a scheme to guarantee QoS support for L3 relay with N3IWF. Since this solution is missing from 3GPP TS 38.836, the proponent company would like to add it for the case of L3 UE-to-Network relay. However, it is good to point out that Sol#45 is not recommended by SA2 according to their conclusion in TR 23.752 and thus we fail to understand the benefit to say that this can be an option for RAN2. The proposal made in the summary is the following:

Proposal 3 RAN2 to capture in 3GPP TR 38.836 the Sol#45 within 3GPP TR 23.752 for the QoS support for L3 UE-to-Network relay with N3IWF.

**Question 2.** Do companies agree to have to capture in 3GPP TR 38.836 the Sol#45 within 3GPP TR 23.752 for the QoS support for L3 UE-to-Network relay with N3IWF?

|  |  |  |
| --- | --- | --- |
| Company | Agree (y/n) | Comments |
| MediaTek | N | RAN2 TR can simply say, refer to SA2 TR 23.752 for the QoS support for L3 UE-to-Network relay with N3IWF |
| OPPO |  | There is no conclusion on the QoS solution for N3IWF in SA2 yet, although yes #45 is the only solution in SA2 already (but this does not prevent some further update on this solution#45 before concluding). It would be safe for RAN2 to wait for SA2 on this since it is anyway an issue more of SA2 scope. |
| Nokia |  | RAN2 should add a simple sentence with a reference to solution of the SA2 TR as this has no AS impacts |
| InterDigital |  | RAN2 should leave this open until there is a conclusion from SA2. |
| Fraunhofer | N | Further clarity from SA2 would be necessary |
| Ericsson | N | SA2 did not recommend Sol#45 in its TR and thus we prefer to leave it out from the RAN2 TR. |
| Futurewei | N | SA2 hasn’t agreed to apply this to UE-to-Network relay. RAN2 should wait for SA2 conclusion. |
| Vivo | No | We just follow the SA2’s conclusions. |
| Qualcomm | No | Solution#45 is not in SA2 conclusion. |
| Intel |  | Solution#45 is considered relevant in SA2 TR, but there is no solid conclusion derived yet nor any evaluation done. We need to wait for SA2 conclusion. |
| Sharp | N | It should be based on conclusions from SA2. |
| Huawei, HiSilicon | FFS | We agree solution #45 is not concuded as a baseline solution of QoS in SA2. However, the N3IWF-based solution has been conclude as one solution of L3 relay in the last SA2 meeting, but there is no discussion on the QoS aspect in N3IWF-based solution in RAN2 yet. Thus, it has a good point that analysis on N3IWF solution in terms of QoS is needed in RAN2. |
| CATT |  | Solution #45 is not the SA2 conclusion, so we should treat it carefully. |
| LG | No | Solution#45 should SA2 conclusion to set it as RAN2 baseline. |
| Philips | No | Agree with MediaTek |
| Spreadtrum | No |  |

## 3.2 Path switching enhancement for L3 UE-to-Network relay

Was of the proposal on the summary was to have a potential enhancement of L3 UE-to-Network relay path switching. Everything starts with the observation that hop specific PDCP status transfer during indirect to direct path switching does not enable lossless service continuity in L3 U2N relay.

In L3 U2N relay, the relay UE is aware of the packet delivery status of both hops. Therefore, relay UE is able to maintain and provide PDCP SN status based on the packet delivery situation on both hops. To support lossless service continuity during indirect to direct path switching, the relay UE may be triggered to transfer PDCP SN status to the source entity using the existing SN status transfer signalling procedure. But the PDCP SN status should not only take into account the PDCP SDU delivery status on the first hop but also the PDCP SDU delivery status on the second hop. To achieve this, relay UE needs to map and associate the PDCP PDUs/SDUs delivered in the first hop and second hop as there is end-to-end PDCP entity in each hop for L3 U2N relay. To make the mapping and association of the PDCP PDUs/SDUs in two hops easier, it can be configured to have one-to-one mapping of radio bearers in SL and Uu for the traffic flow that requires lossless service continuity. Thus, the proposal made in the summary is:

Proposal 8 RAN2 to consider allowing the Relay UE to transfer PDCP SN status considering the second hop PDCP PDU/SDU delivery status during path switching in order to support lossless service continuity.

**Question 3.** Regarding Proposal 8, do you think:

Case a: The decision can be done in SI (please state whether you agree or not in the comment column).

Case b: This can be discussed in the WI phase via contributions.

|  |  |  |
| --- | --- | --- |
| Company | Which case? | Comments |
| MediaTek | Case a | Specific to L3 UE-to-Network Relay, we doubt the necessity of the provision of PDCP SN status during indirect to direct path switching. The mapping and association of the PDCP PDUs/SDUs in two hops may lead to the fact that it is not L3 relay solution any more.  We suggest to exclude the proposal from L3 relay solution. |
| OPPO | a | Do not support this (it seems more of the scope of L2 relay?) |
| Nokia | Case a | We think that this solution can be agreed as an optional UE-to-Network Relay feature |
| InterDigital | Case A | We do not support this for L3 relay, as it breaks the L3 architecture, and makes the gNB aware of the relay. |
| Fraunhofer | Case a | Agree with Nokia |
| Ericsson | Case a |  |
| Futurewei | Case A | Do not support this. As there is no one-to-one mapping relation between PC5 RB and Uu RB, we fail to see how it would work. |
| Vivo | Case b | Detailed solutions are not clear and evalutated now. We are fine to discuss in the WI phase via detailed solutions analysis by companies. |
| Qualcomm | Case a (if conclude not support),  or case b | We think it is not necessary and cause extra complexity to relay. As this is the first release of sidelink relay, we would like to preclude it and focus on basic operation of L3 relay.  So, we prefer to conclude that it is not supported in SI phase (i.e. case a). If majority prefer, we can accept to study it in WI phase (case b) but we don’t agree to capture it in TR or chair notes because we don’t see much common interests from multiple companies. |
| Intel | Case b | We think more discussion is needed to understand the exact impacts of the solution. |
| Sharp | Case b | It can be left to WI phase. We are also fine to go with the majority. |
| Huawei, HiSilicon | Case a | The solution is not crystal clear to us. For instance, how the relay UE map SN in the two hops, and how the handling from network side, does it mean the network should be aware of the remote UE? More details should be clarified. |
| CATT | Case a (if conclude not support),  or case b | We share the same view with QC. |
| LG | Case b | We need to further discussion to understand the effect. |
| Philips | Case b |  |
| Spreadtrum | Case a |  |

A further proposal was also for RAN2 to discuss further AS layer enhancements so to improve the path switch procedure. In such a case, the proposal formulated in the summary is:

Proposal 9 RAN2 to consider the study of optional AS layer-based solutions to enable PDCP SN status during path switch though service continuity is guaranteed by higher layers.

**Question 4.** Regarding Proposal 9, do you think:

Case a: The decision can be done in SI (please state whether you agree or not in the comment column).

Case b: This can be discussed in the WI phase via contributions.

|  |  |  |
| --- | --- | --- |
| Company | Which case? | Comments |
| MediaTek | Case a | We did not see the value of this discussion at either SI or WI stage. |
| OPPO | a | Do not support this (it seems more of the scope of L2 relay?) |
| Nokia | Case a | We think it is too late to start discussing any further enhancement in Rel-17 except the one discussed in Question 3 |
| InterDigital | Case a | We do not support this |
| Fraunhofer | B | We are okay to go with the majority. However, we believe further discussion could be warranted through contributions during the WI phase |
| Ericsson | Case a |  |
| Futurewei | Case A | L3 relay operates on QoS flow mapping, not RB mapping. We fail to see the use of PDCP SN in L3 relay. |
| Vivo | Case b | See the comment to Q3. |
| Qualcomm | Case a (if conclude not support),  or case b | Similar comments as Q3 |
| Intel | Case b | The TR currently has made working assumption that no AS layer solution will be studied for service continuity. We can keep it as is and come back during WI phase if required based on progress in SA2. |
| Sharp | Case b | It can be left to WI phase. We are also fine to go with the majority. |
| Huawei, HiSilicon | Case a | Before RAN2 desides if it can be left to WI or not, more clarifications are needed. |
| CATT | Case a (if conclude not support),  or case b | We share the same view with QC. |
| LG | Case b | Similar comments as Q3 |
| Philips | Case b |  |
| Spreadtrum | Case a |  |

# 4 Conclusions for the L3 architecture

The following agreements have been taken in the last online session:

Agreements:

Remove the whole section of Section 6 Comparison (including both 6.1 Comparison of UE-to-Network Relay and 6.2 Comparison of UE-to-UE Relay) from TR38.836.

Capture the evaluation/analysis of the layer-2 based and layer-3 based relay architecture in the conclusion section (i.e. section 7) respectively, taking the SID objectives into account as usual.

Further, based on the contribution in R2-2100170, the new section that needs to be filled in for the conclusion of the L3 architecture will look something like this:

6.1 Evaluation and Conclusion of UE-to-Network Relay

6.1.1 Layer-2 Relay

6.1.2 Layer-3 Relay

6.2 Evaluation and Conclusion of UE-to-UE Relay

6.2.1 Layer-2 Relay

6.2.2 Layer-3 Relay

Of course, in this discussion paper we will focus the analysis only to the L3 sections (highlighted in yellow).

## 4.1 Conclusion for L3 UE-to-Network Relay

According to current TR 38.836, TR 23.752, and to the contribution submitted in [R2-2100123](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100123.zip), the following conclusions for L3 UE-to-Network relay, illustrated in Table 1, can be identified.

Table 1. Conclusions for L3 UE-to-Network Relay

|  |  |  |  |
| --- | --- | --- | --- |
| Relay features | Operation assumption | UE impacts  (from RAN2 perspective) | RAN impacts  (from RAN2 perspective) |
| Relay/ Remote UE Authorization | Both Relay and Remote UE separately follow Rel-16 V2X design (i.e., according to TR 23.287) | No | No |
| Relay (re)selection | * Basically, reuse Rel-13 LTE design (i.e. remote UE controlled solution) * Relay and remote UE may be served by same or different gNB, either before or after remote UE connection via relay UE | Yes  (Support relay selection/reselection ignallin) | No  (Remote UE controlled relay selection/reselection. gNB can be legacy gNB not supporting relay operation) |
| Discovery | * Basically, reuse Rel-13 LTE design (model A/B) * gNB may not support relay operation (i.e. non-SL-relay-capable gNB) | Yes  (Support Discovery model A/B) | No  (gNB can be legacy gNB not supporting relay operation) |
| Protocol stack | Data exchange above IP layer | No | No |
| QoS | Support Hop-by-Hop (sol#25 according to TR 23.752) and End-to-End QoS (sol#24 according to TR 23.752) | No | No |
| Security | Support Hop-by-Hop and End-to-End solution (sol#23 according to TR 23.752) | No | No |
| Service continuity | This is guaranteed by upper layer (e.g., application layer) solution or with N3IWF architecture (sol#23/24 according to TR 23.752). | No | No |
| RRC Connection establishment | * Relay follows legacy RRC procedures; * Remote UE is transparent to RAN | No | No |
| Paging | No paging enhancement is required | No | No |
| SIB reception | No SIB reception enhancement is required | No | No |
| RRC state | Reuse Rel-16 RRC state mechanism | No | No |
| RLF/RLM | Follow legacy RLF/RLM for both remote UE and relay | No | No |
| PC5 signaling | Reuse Rel-16 V2X PC5 signaling | No | No |
| Uu RRC signaling | No new Uu ignalling required because remote UE is invisible to gNB | No | No |

**Question 5.** Do companies have any technical concerns on the conclusions provided in Table 1 for L3 UE-to-Network relay?

|  |  |  |
| --- | --- | --- |
| Company | Agree (y/n) | Comments |
| MediaTek | N | We suggest to reword the table in terms of the objectives of the SID of SL relay with the intention to see if L3 UE-to-Network relay meet the requirements in terms of:  A. Relay (re-)selection criterion and procedure;  B. Relay/Remote UE authorization;  C. QoS for relaying functionality;  D. Service continuity;  E. Security of relayed connection after SA3 has provided its conclusions;  F. Impact on user plane protocol stack and control plane procedure, e.g., connection management of relayed connection;  The UE impact and RAN impact can be added but shoud not be the focus. The focus is to evaluate and conclude if the abovementioned items are met.  Our proposed baseline text is as below (we have no need to take a table):  ***Relay discovery and (re)selection***  RAN2 assumed the model A and model B are to be supported, and the similar AS criteria of LTE relay will be reused. The details are left to WI.  ***Relay and remote UE authorization***  RAN2 confirmed the solution is up to SA2 and SA3 with no RAN2 impact foreseen.  ***QoS management***  RAN2 assumed it is subject to upper layer solutions defined by SA2.  ***Service continuity***  RAN2 makes working assumption that no AS layer solution will be studied to guarantee the service continuity, and leave it to the upper layer (e.g. application layer) solution.  ***Security***  Solution#23 of TR 23.752 [6] with N3IWF is feasible to meet end-to-end security requirements from RAN2 perspective.  ***Protocol stack design***  RAN2 assumed the CP and UP protocol stacks of L3 U2N relay are up to SA2.  ***CP procedures***  For CP procedures, PC5-RRC aspects of Rel-16 NR V2X PC5 unicast link establishment procedures can be reused to setup a secure PC5 unicast link. Further AS impacts (if any) can be discussed in WI phase. Whether new PC5-S signaling is also introduced depends on SA2. For path switch procedure, there is no solution discussed and concluded in RAN2 to perform path switch procedure from indirect link to direct link in case there is data transmission between remote UE and gNB via a relay UE.  **Standards impact**  There is few standards impact from RAN2 perspective to support the operation of L3 UE-to-Network Relay. RAN2 assumes the standards support of L3 UE-to-Network Relay is mainly at SA. |
| Nokia | No concerns | We think the table is technically correct |
| InterDigital |  | * We think conclusions should be considered from all the papers submitted * We think tabular format is not preferred and is better suited to a comparison section (which has been ruled out) |
| Fraunhofer | No |  |
| Ericsson | Yes | The content of the table is technically correct, but we agree that a suitable format would be to have paragraphs (i.e., same style as proposed by MediaTek). |
| Futurewei |  | Agree with MediaTek and InterDigital.  The conclusion should follow the SID objectives and reflect the aspects/issues RAN2 has studied and captured in TR. |
| Vivo | Yes |  |
| Qualcomm | Yes | For comments from MediaTek/InterDigital, we think the intention of this question is NOT to agree this table captured in TR, but provide a technique reference for Rapporteur how to draft the TP. We think this question is to check whether the table is technique correctly. It seems no technique concern was raised. The TP may be same format as proposed MediaTek, as Rapporteur clarified. |
| Intel | No concerns |  |
| Huawei, HiSilicon | See comments | Agree with MediaTek that the evaluation should be performed in terms of the objectives in SID, in this case the part of “PC5 signaling, Uu RRC signaling” should be removed, because the two aspects are not listed in SID and not explicitly discussed in SI.  For “Operation assumption”, it is not clear what it means, the table seems includes things not agreed in RAN2, e.g. for service continuity, RAN2 never discussed what upper layer solution is.  For “paging”, it should be replaced with “DL reachability”, and the conclusion should be “no support of DL reachability in L3 relay”.  For “RRC state”, there is no clear RAN2 conclusion, and this is under discussion in the offline604. More discussion is needed before capturing anything here.  In addition, we do not understand the intention of listing UE impact or RAN impact here. Considering we only have a general solution in SI, and more details need to be specify in WI, making judgement on UE/RAN impact is quite premature, and seems no help for the conclusion itself. So we suggest to remove the columns of “UE/RAN impact”. |
| LG | No concern |  |
| Philips | No | Agree with MediaTek that would be good to re-format the table and adapt it to the objectives of the SI |
| Spreadtrum | No |  |

According to what is shown in Table 1, the following conclusions can be drawn for L3 UE-to-Network relay:

* No showstopper has been identified by RAN2 for L3 UE-to-Network solution.
* In line with what is stated in the objectives of the SID, the L3 UE-to-Network relay solution fulfil the SA requirements with minimum specification impact.
* RAN2 recommends L3 UE-to-Network Relay to proceed into normative work.

**Question 6.** Do companies agree that, regarding L3 UE-to-Network relay:

* No showstopper has been identified by RAN2 for L3 UE-to-Network solution.
* In line with what is stated in the objective of the SID, the L3 UE-to-Network relay solution fulfil the SA requirements with minimum specification impact.
* RAN2 recommends L3 UE-to-Network Relay to proceed into normative work.

|  |  |  |
| --- | --- | --- |
| Company | Agree (y/n) | Comments |
| MediaTek | N | We suggest to discuss Quesiton 5 before the discussion of Question 6. If we want to discuss Qusetion 6 now, we have the following suggestions:  Bullet one is not needed as RAN2 already confirmed that L2 and L3 are feasible during the online discussion at first session of R2#113e.  Bullet two should be reworded: RAN2 assumes that the L3 UE-to-Network relay solution fulfill the SA requirements taking accout of the conclusion of the SA2 study within 5G ProSe SI. RAN2 assumes the standards support of L3 UE-to-Network Relay is mainly at SA. There is few standards impact from RAN2 perspective.  On Bullet three with regard to recommendation for normative work, **we suggest to take a general recommendation section to cover both L2 and L3 UE-to-Network relay and recommend both for normative work**. |
| OPPO |  | The first bullet is OK (already confirmed online).  The second bullet on work load may need further evaluation at plenary level, together with the evaluation of load at SA/CT side.  The third bullet may be controversial in the sense that WG may be hard to do the down-selection at the current stage.. |
| Nokia | Yes |  |
| InterDigital | N | We suggest the second bullet to be reworded as follows (to address the concerns from OPPO):   * Mechanisms for layer-3 relay with minimum specification impact have been studied and identified by RAN2   We also prefer a general ecommendation for normative work of both L2 and L3 relay. |
| Fraunhofer | Yes |  |
| Ericsson | Yes |  |
| Futurewei | N | Bullet 1 is not needed, as it has already been agreed.  We fail to see the need of bullet two, but could go with what suggested by InterDigital.  Bullet 3 is out of the scope of this email discussion, per the chair’s instruction from the GTW session. |
| Vivo | Yes |  |
| Qualcomm | Yes |  |
| Intel | Yes with comment | We are fine with first point. We cannot conclude on second point as most solutions are in SA2 realm and we share OPPO’s concern somewhat. For the third point, we also think it would be good to have a general recommendation |
| Sharp |  | Agree with the feasiblity of L3 relay. RAN2’s recommendation can be discussed together with L2 relay. |
| Huawei, HiSilicon | No | On Bullet one, agree with MediaTek the bullet one is not needed as RAN2 already confirmed that L2 and L3 are feasible.  On Bullet two, agree with OPPO it should be evaluated together with SA/CT.  On Bullet three, it is not in the scope of this offline. And it would be more appropriate to have a general recommendation section to cover both L2 and L3 relay. |
| CATT |  | We share the same view with OPPO. |
| LG | Yes |  |
| Philips | Not entirely | Agree with bullet one  Regarding bullet two, we suggest to remove the term minimum: “In line with what is stated in the objective of the SID, the L3 UE-to-Network relay solution fulfil the SA requirements and requires less specification work than L2 from a RAN2 perspective“. L3 relay will require more work for SA2 than L2 but there is no need to mention this in the conclusions of TR 38.836.  Agree with bullet three |
| Spreadtrum | No | We agree with Huawei on bullet 3, with the recommendation gerneral for L2 and L3. |

## 4.2 Conclusion for L3 UE-to-UE Relay

According to current TR 38.836, TR 23.752, and to the contribution submitted in [R2-2100123](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100123.zip), the following conclusions for L3 UE-to-UE relay, illustrated in Table 1, can be identified.

Table 2. Conclusions for L3 UE-to-Network Relay

|  |  |  |  |
| --- | --- | --- | --- |
| Relay features | Operation assumption | UE impacts  (from RAN2 perspective) | RAN impacts  (from RAN2 perspective) |
| Relay/ Remote UE Authorization | Both Relay and Remote UE separately follow Rel-16 V2X design (TS 23.287) | No | No |
| Relay (re)selection | Basically, reuse Rel-13 LTE design (i.e. remote UE controlled solution) | Yes  (Support relay (re)selection ignallin) | No  (gNB can be legacy gNB not supporting relay operation) |
| Discovery | Basically, reuse Rel-13 LTE design (i.e. model A/B) | Yes  (Support Discovery model A/B) | No  (gNB can be legacy gNB not supporting relay operation) |
| Protocol stack | Support relaying of IP (sol#10 and sol#32 according to TR 23.752) and non-IP traffic (sol#49 according to TR 23.752) | No | No |
| QoS | End-to-End QoS support for Remote UE is provided via splitting the QoS between the two PC5 links by PCF | No | No |
| Security | Security protection of L3 UE-to-UE relay is in the scope of SA2 and SA3. No RAN2 impact is identified. | No | No |
| Service continuity | No requirement | No | No |
| RRC Connection establishment | Follows legacy RRC procedure if in-coverage | No | No |
| Paging | No paging enhancement is required | No | No |
| SIB reception | No SIB reception enhancement is required | No | No |
| RRC state | No restrictions are assumed on the RRC states of any Ues involved in UE-to-UE Relaying. | No | No |
| RLF/RLM | Follow legacy RLF/RLM for both remote UE and relay | No | No |
| PC5 signaling | Reuse Rel-16 V2X PC5 signaling | No | No |
| Uu RRC signaling | No new Uu ignalling required because remote UE is invisible to gNB | No | No |

**Question 7.** Do companies have any technical concerns on the conclusions provided in Table 2 for L3 UE-to-UE relay?

|  |  |  |
| --- | --- | --- |
| Company | Agree (y/n) | Comments |
| MediaTek | N | We suggest to reword the table in terms of the objectives of the SID of SL relay with the intention to see if L3 UE-to-UE relay meet the requirements in terms of:  A. Relay (re-)selection criterion and procedure;  B. Relay/Remote UE authorization;  C. QoS for relaying functionality;  D. Service continuity;  E. Security of relayed connection after SA3 has provided its conclusions;  F. Impact on user plane protocol stack and control plane procedure, e.g., connection management of relayed connection;  The UE impact and RAN impact can be added but shoud not be the focus. The focus is to evaluate and conclude if the abovementioned items are met.  Our proposed baseline text is as below (we have no need to take a table):  ***Relay discovery and (re)selection***  RAN2 assumed the model A and model B are to be supported, and the similar AS criteria of LTE relay will be reused. The details are left to WI.  ***Relay and remote UE authorization***  RAN2 confirmed the solution is up to SA2 and SA3 with no RAN2 impact foreseen.  ***QoS management***  For QoS management, RAN2 assumed the QoS handling is subject to upper layer.  ***Service continuity***  No AS layer solution is studied by RAN2.  ***Security***  RAN2 assumed the solutions are up to SA2 and SA3.  ***Protocol stack design***  RAN2 assumed the CP and UP protocol stacks of L3 U2N relay are up to SA2.  ***CP procedures***  RAN2 assumed the design is left to SA2.  **Standards impact**  There is few standards impact from RAN2 perspective to support the operation of L3 UE-to-UE Relay. RAN2 assumes the standards support of L3 UE-to-UE Relay is mainly at SA. |
| Nokia | No concerns | We think the table is technically correct |
| InterDigital |  | * We think conclusions should be considered from all the papers submitted * We think tabular format is not preferred and is better suited to a comparison section (which has been ruled out) |
| Fraunhofer | No |  |
| Ericsson | Yes | The content of the table is technically correct, but we agree that a suitable format would be to have paragraphs (i.e., same style as proposed by MediaTek). |
| Futurewei |  | Agree with MediaTek and InterDigital.  The conclusion should follow the SID objectives and reflect the aspects/issues RAN2 has studied and captured in TR. |
| Vivo | Yes |  |
| Qualcomm | Yes | For comments from MediaTek/InterDigital, we think the intention of this question is NOT to agree this table captured in TR, but provide a technique reference for Rapporteur how to draft the TP. We think this question is to check whether the table is technique correctly. It seems no technique concern was raised. The TP may be same format as proposed MediaTek, as Rapporteur clarified. |
| Intel | No concerns |  |
| Huawei, HiSilicon | See comments | The table of U2U should not be the same with U2N, because many aspects have not been discussed for U2U, thus should be removed, e.g. RRC Connection establishment, Paging, SIB reception, RRC state, RLF/RLM, PC5 signaling, Uu RRC signaling.  And same with our comments to U2N, we do not understand the intention of listing UE impact or RAN impact here. Considering we only have a general solution in SI, and more details need to be specify in WI, making judgement on UE/RAN impact is quite premature, and seems no help for the conclusion itself. So we suggest to remove the columns of “UE/RAN impact”. |
| LG | No concern |  |
| Philips | No | Agree with MediaTek that would be good to re-format the table and adapt it to the objectives of the SI |
| Spreadtrum | No |  |

According to what is shown in Table 1, the following conclusions can be drawn for L3 UE-to-UE relay:

* No showstopper has been identified by RAN2 for L3 UE-to-UE solution.
* In line with what is stated in the objective of the SID, the L3 UE-to-Network relay solution fulfil the SA requirements with minimum specification impact.
* RAN2 recommends L3 UE-to-UE Relay to proceed into normative work.

**Question 8.** Do companies agree that, regarding L3 UE-to-UE relay:

* No showstopper has been identified by RAN2 for L3 UE-to-UE solution.
* In line with what is stated in the objective of the SID, the L3 UE-to-UE relay solution fulfil the SA requirements with minimum specification impact.
* RAN2 recommends L3 UE-to-UE to proceed into normative work.

|  |  |  |
| --- | --- | --- |
| Company | Agree (y/n) | Comments |
| MediaTek | N | We suggest to discuss Quesiton 7 before the discussion of Quesiton 8. If we want to discuss Qusetion 8 now, we have the following suggestions:  Bullet one is not needed as RAN2 already confirmed that L2 and L3 are feasible during the online discussion at first session of R2#113e.  Bullet two should be reworded: RAN2 assumes that the L3 UE-to-UE relay solution fulfill the SA requirements taking accout of the conclusion of the SA2 study within 5G ProSe SI. RAN2 assumes the standards support of L3 UE-to-UE Relay is mainly at SA. There is few standards impact from RAN2 perspective.  On Bullet three with regard to recommendation for normative work, **we suggest to take a general recommendation section to cover both L2 and L3 UE-to-UE relay and recommend both for normative work**. |
| OPPO |  | Similar view as for Q6. |
| Nokia | Yes |  |
| InterDigital | N | We suggest the second bullet to be reworded as follows (to address the concerns from OPPO):   * Mechanisms for layer-3 relay with minimum specification impact have been studied and identified by RAN2 * We also prefer a general ecommendation for normative work of both L2 and L3 relay. |
| Fraunhofer | Yes |  |
| Ericsson | Yes |  |
| Futurewei | N | Bullet 1 is not needed, as it has already been agreed.  We fail to see the need of bullet two, but could go with what suggested by InterDigital.  Bullet 3 is out of the scope of this email discussion, per the chair’s instruction from the GTW session. |
| Vivo | Yes |  |
| Qualcomm | Yes |  |
| Intel | Yes with comment | Same comment as in Q6. |
| Sharp |  | Agree with the feasiblity of L3 relay. RAN2’s recommendation can be discussed together with L2 relay. |
| Huawei, HiSilicon | No | On Bullet one, agree with MediaTek the bullet one is not needed as RAN2 already confirmed that L2 and L3 are feasible.  On Bullet two, agree with OPPO it should be evaluated together with SA/CT.  On Bullet three, it is not in the scope of this offline. And it would be more appropriate to have a general recommendation section to cover both L2 and L3 relay. |
| CATT |  | Same comment as in Q6. |
| LG | Yes |  |
| Philips | Not entirely | Agree with bullet one  Regarding bullet two, we suggest to remove the term minimum: “In line with what is stated in the objective of the SID, the L3 UE-to-Network relay solution fulfil the SA requirements and requires less specification work than L2 from a RAN2 perspective“. L3 relay will require more work for SA2 than L2 but there is no need to mention this in the conclusions of TR 38.836.  Agree with bullet three |
| Spreadrum | No | Same as our comments in Q6. |

# 5 TP to be included in TR 38.836

To be provided.

# 6 Conclusion

Based on the discussion in the previous sections we propose the following:

# 7 ANNEX (From the summary in R2-2102247)

2.1 QoS for L3 UE-to-Network Relay

According to the contributions in [1,2,5], it is pointed out that according to the latest SA2 conclusion, the PDB split is performed by the SMF and thus there is no point to keep the editor note of whether the PDB split can be performed by the gNB.

According to the latest SA2 conclusion in S2-2009541

For QoS handling, following aspects in **Solution #24 and Option #2 of Solution #25** are selected as basis for normative work:

- L3 Relay can be configured with the 5QIs and PQIs mapping. Based on the mapping or, in case of a non-configured mapping of a requested QoS parameter, based on its implementation, the L3 relay translates the Uu QoS parameters to PC5 QoS parameters and vice versa.

- To support the dynamic QoS handling, relay UE determines the Uu QoS parameters and PC5 QoS parameters by taking into account the end-to-end QoS requirements provided by remote UE based on its configured QoS mapping information or, in case of a non-configured mapping of a requested QoS parameter, based on its implementation, and initiates PDU session modification procedure and L2 link modification procedure to setup corresponding QoS Flows over Uu and PC5.

- The SMF of the L3 Relay provides the corresponding QoS rules and flow level QoS parameters to the L3 Relay as part of the PDU session establishment or modification procedures as defined in TS 23.502 [8], clause 4.3.2 and 4.3.3. Alternatively, reflective QoS control over Uu as defined in TS 23.501 [6], clause 5.7.5.3 can be leveraged for dynamic QoS handling of Remote UE to save on signalling between SMF and L3 Relay.

- Based on signalled QoS rules (via SMF) or derived QoS rules (Uplink Uu via reflective QoS), the UE-to-Network Relay may use the L2 Link Modification procedures as defined in TS 23.287 [5], clause 6.3.3.4 to either move the corresponding ProSe service(s) to the mapped existing PC5 QoS flow or to set up a new PC5 QoS flow.

Therefore, the proponent companies suggest the following:

1. **Remove from 3GPP TR 38.836 the following note:  
   *“Editor note: whether other QoS solution (e.g. whether gNB can perform PDB split) is introduced depends on SA2.”***
2. **Align the description in 3GPP TR 38.836 with the SA2 conclusion regarding the QoS of L3 UE-to-Network Relay.**

However, it is worth noticing that the proponent company in [7] believe that large delays might be envisaged in communicating with the network functions like SMF/PCF for dynamic QoS handling thereby degrading the user quality of experience. For this reason, they believe that RAN2 should consider pursuing the gNB-based dynamic split handling of QoS characteristics during the work item phase.

A further proposal is made by a proponent company in [4] where it is highlighted as also Sol#45 provide a scheme to guarantee QoS support for L3 relay with N3IWF. Since this solution is missing from 3GPP TR 38.836, the proponent company would like to add it for the case of L3 UE-to-Network relay. Thus, is proposed:

1. **RAN2 to capture in 3GPP TR 38.836 the Sol#45 within 3GPP TR 23.752 for the QoS support for L3 UE-to-Network relay with N3IWF.**

2.5 Path switching enhancement for L3 UE-to-Network relay

The proponent company in [6] proposes a potential enhancement of L3 UE-to-Network relay path switching. Everything starts with the observation that hop specific PDCP status transfer during indirect to direct path switching does not enable lossless service continuity in L3 U2N relay.

In L3 U2N relay, the relay UE is aware of the packet delivery status of both hops. Therefore, relay UE is able to maintain and provide PDCP SN status based on the packet delivery situation on both hops. To support lossless service continuity during indirect to direct path switching, the relay UE may be triggered to transfer PDCP SN status to the source entity using the existing SN status transfer signalling procedure. But the PDCP SN status should not only take into account the PDCP SDU delivery status on the first hop but also the PDCP SDU delivery status on the second hop. To achieve this, relay UE needs to map and associate the PDCP PDUs/SDUs delivered in the first hop and second hop as there is end-to-end PDCP entity in each hop for L3 U2N relay. To make the mapping and association of the PDCP PDUs/SDUs in two hops easier, it can be configured to have one-to-one mapping of radio bearers in SL and Uu for the traffic flow that requires lossless service continuity. Thus, the suggestion is:

1. **RAN2 to consider allowing the Relay UE to transfer PDCP SN status considering the second hop PDCP PDU/SDU delivery status during path switching in order to support lossless service continuity.**

A similar proposal has been also made in [7] where the proponent company believe that some AS layer procedure is needed to enhance the path switch procedure. In such a case, the proposal is:

1. **RAN2 to consider the study of optional AS layer-based solutions to enable PDCP SN status during path switch though service continuity is guaranteed by higher layers.**