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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| Company (Name) | Email |
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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 |
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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?

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| --- | --- | --- |
| 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 |
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## 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.

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| 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. |
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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.

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| Company | Which case? | Comments |
| MediaTek | Case a | We did not see the value of this discussion at either SI or WI stage. |
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# 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 behavior) | 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 signaling 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?

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| --- | --- | --- |
| 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. |
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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.

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| --- | --- | --- |
| 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**. |
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## 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 behavior) | 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 signaling 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?

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| --- | --- | --- |
| 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. |
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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.

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| --- | --- | --- |
| 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**. |
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# 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.**