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

Electronic Meeting, 25th January – 5th February 2021

Agenda: 8.7.2.1

Source: InterDigital

Title: Summary of [AT113-e][605][Relay] Continuation of L2 architecture issues (InterDigital)

Document for: Discussion, Decision

# 1 Introduction

The following email discussion was triggered at RAN2#113:

* [AT113-e][605][Relay] Continuation of L2 architecture issues (InterDigital)

Scope: Discuss the priority 2 proposals P6, P15-P19 from R2-2102091 and implement the agreements on the priority 1 proposals. Work towards conclusions if possible.

Intended outcome: Endorsable TP

Deadline: Tuesday 2021-02-02 1200 UTC (for TP availability)

The summary of this email discussion is discussed in this document.

# 2 Continuation of L2 Architecture Issues

Based on the scope of the email discussion, it is divided into three subsections:

* Discussion of priority 2 proposals
* Implementing the agreements on the priority 1 proposals
* Working towards conclusion

## 2.1 Discussion of Priority 2 Proposals

When a remote UE in RRC\_IDLE/RRC\_INACTIVE performs a connection establishment via the relay UE, the relay UE needs to initiate its own connection establishment if it is not in RRC\_CONNECTED. This occurs in step 2 of figure 4.5.5.1-1 of TR 38.836 (“If the relay UE had not started in RRC\_CONNECTED, it would need to do its own connection establishment as part of this step.”)

In [19], two options are provided for how the relay UE knows to initiate the connection establishment in this case. When referring to the TR, the first RRC message by the remote UE is handled using a L2 configuration defined in the specifications:

*“For both in-coverage and out-of-coverage cases, when the Remote UE initiates the first RRC message for its connection establishment with gNB, the PC5 L2 configuration for the transmission between the Remote UE and the UE-to-Network Relay UE can be based on the RLC/MAC configuration defined in specifications.”*

Reception of a message on the PC5-RLC channel defined for the first RRC message can therefore trigger connection establishment when the relay UE is in RRC\_IDLE/RRC\_INACTIVE.

**Proposal 6** from the initial summary document [29] was generated based on the above and is repeated below.

**Q1.1 Do you agree with the following proposal?**

**For L2 UE to NW relay, the relay UE in RRC\_IDLE/RRC\_INACTIVE triggers connection establishment when it receives the first message from the remote UE (RRCSetupRequest or RRCResumeRequest).**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO | Y with comment | Although the intention is agreeable, we would like to clarify that relay UE does not have to check the RRC message content, i.e., the as long as the relay UE receives some message from remote UE on the LCID/SRB dedicated for L2 forwarding, the connection establishment can be triggered if has not.  Actually, this point is also to extend the compatibility of the procedure, i.e., not only for RRC setup/resume, we need to consider other procedures triggering relay UE to establish connection, e.g., handover (i.e., *RRCReconfigurationComplete*), and re-establishment (i.e., *RRCReestablishmentRequest*) |
| Sharp | No | In TS 23.752 solution#7 is considered as a baseline for L2 based relay and it inclues that 6.7.2.5.2 Connection Management Connection Management for the UE-to-Network Relay UE follows at least the principles and procedures defined in TS 23.501 [6] and TS 23.502 [8].  Connection Management for the Remote UE follows the principles and procedures defined in TS 23.501 [6] and TS 23.502 [8].  The UE-to-Network Relay may only relay data/signalling for the Remote UE(s) when the UE-to-Network Relay is in CM-CONNECTED/RRC Connected states. If the UE-to-Network Relay in CM\_IDLE state receives the PC5 connection request from the Remote UE for relay, the UE-to-Network Relay shall trigger Service Request procedure to enter CM\_CONNECTED state before relaying the signalling.  And solution#28 which is considered as a baseline for L3 based relay includes that 6.28.1.2 PC5 connection establishment After UE-to-Network Relay discovery, the Remote UE may decide to establish a PC5 connection with a UE-to-Network Relay. The PC5 connection establishment reuses the Direct Communication procedure as described in clause 6.3.3 of TS 23.287 [5], with the following enhancements:  - The Remote UE determines the PDU session requirements (e.g. S-NSSAI, DNN, PDU Session Type, SSC mode) and includes the PDU session requirements in the Direct Communication Request message during the PC5 connection establishment procedure. How to determine the PDU session requirements is based on, e.g. URSP rules (pre-configured or received from PCF during previous Remote UE registration procedure as step 0 in Figure 6.6.2-1). The Remote UE only provides standardized S-NSSAI (as specified in clause 5.15.2 of TS 23.501 [6]) in the Direct Communication Request when the Remote UE and the UE-to-Network Relay belong to different HPLMNs.  So we think the solutions concluded in SA2 could be the way forward, i.e. the relay UE in RRC\_IDLE/RRC\_INACTIVE triggers connection establishment when receiving the PC5 connection request from the Remote UE for relay, such a PC5 connection request could be Direct Communication Request message |
| Xiaomi | No | We also see other triggers for relay UE to initiate RRC connection establishment. For example, remote UE could send assistant information to relay UE when establishing connection. Upon the reception of the assistant information, relay UE could trigger the connection establishment. The trigger condition could be discussed in WI. |
| Spreadtrum | Yes with comments | Relay UE triggers RRC connection establishment when there is data forwarding request from the Remote UE and the data has to be forwarded to the gNB in RRC\_CONNECTED mode. Otherwise, Relay UE shall stay in IDLE/INACTIVE mode even PC5 connection is established. |
| Ericsson (Min) | No | As xiaomi mentioned that, there may be many different triggers for the relay UE to switch to connected mode. RAN2 shall not study those triggers case by case, or trigger by trigger. Neverthless, more thorough studies are needed before draw any agreement. Therefore, it would be beneficial to capture this (in the TR) as remaining issues/FFS for RAN2 to further study. |
| Sony | Yes | We agree to the intention and details can be discussed in WI. |
| Qualcomm | See comments | We agree that the intention of this proposal, but the proposal wording looks like stage-3 details. And as Sharp/Xiaomi mentioned, there may be other signaling/trigger that RAN2 has not discussed. The proposal is one feasible solution.  For progress, we suggest to revise the wording more general (stage 2 level) and leave the discussion of signaling (i.e. what is the message to trigger relay RRC establishment) to WI phase. For example:  **For L2 UE to NW relay, the relay UE in RRC\_IDLE/RRC\_INACTIVE may trigger connection establishment when it receives some message from the remote UE. The details of message from the remote UE can be discussed in WI phase.** |
| InterDigital | Yes | For Xiomi’s comments, we the question/paper was considering only the case where the remote UE is initiating connection establishment from IDLE/INACTIVE. For Sharp’s comment, the question/paper was considering the case where the remote UE is PC5-RRC connected already.  We think a revision similar to what QC mentioned would be agreeable – otherwise, we can simply leave it to the WI phase for described the details. |
| Nokia | Yes | We think that both PC5 connection request and UL RRC message from a Remote UE that has a PC5 connection should trigger a RRC connection establishment in the Relay UE.  But also have sympathy for Ericssons comment that we should not study such triggers case by case. |
| vivo | Yes, with comments | To be more precise, the relay UE in RRC\_IDLE/RRC\_INACTIVE triggers connection establishment when it receives the first message using a default L2 configuration on PC5 from the remote UE (*RRCSetupRequest* or *RRCResumeRequest*).  We also agree with OPPO that relay UE does not have to check the RRC message content. Instead, a default LCID is specified (e.g., LCID=4) for this PC5 RLC channel which is different from the existing LCIDs (0,1,2,3) for PC5-S and PC5-RRC signaling, then the UE can know this message is for triggering connection establishment. |

RAN2 agreed to support SI request/delivery for a remote UE in all RRC states. For an out of coverage remote UE, this necessarily means requesting/receiving system information via the relay UE. In [13], it is suggested to confirm this understanding (from the point of view of SI request).

**Proposal 15** from the initial summary document [29] was generated based on the above and is repeated below.

**Q1.2. Do you agree with the following proposal?**

RAN2 to confirm that on-demand SI request is supported via the relay UE for OOC remote UE.

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO | Y |  |
| Sharp | Yes |  |
| Xiaomi | No | We’re not sure about the use case, considering on-demand SIBs are not useful to OOC UE. |
| Spreadtrum | Yes |  |
| Ericsson (Min) | Yes |  |
| Sony | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| Nokia | Yes | We must note that if we need other SIBs on-demand than the ones described in DedicatedSIBRequest message in connected state we need to discuss and agree this.  SIB-ReqInfo-r16 ::= ENUMERATED { sib12, sib13, sib14, spare5, spare4, spare3, spare2, spare1 } |
| vivo | Yes | Proponent.  The motivation to support OOC case is considered as following:  - RAN2 agreed that the serving cell of Remote UE follow the same as Relay UE after connection via Relay UE. For the benefit of coverage extension, the conclusion should be applicable to both IC and OOC cases.  - For sidelink reception from Relay UE, the Remote UE should know the resource configuration of Relay UE communication and/or discovery pools. Since the Relay UE must be an IC UE, the resource configuration of Relay UE communication and discovery pools follows SIB/dedicated signaling by network. In this sense, the remote UE should be able to achieve the resource configuration of Relay UE communication and/or discovery pools by triggering on-demand SI request if it requires relaying service from the Relay UE.  -For sidelink transmission to Relay UE, if on-demand SI request is not supported and the Remote UE uses pre-configuration, the Relay UE has to monitor resource pools in pre-configuration even though it is IC. This is not in line with the NR sidelink design for an IC UE to monitor pre-configured resources. |

For an IC UE, whether the remote UE requests SI directly from Uu or via the relay UE is further discussed in [6][13]. In both [6][13] it is indicated that one option would be to perform SI request via Uu when no PC5-RRC connection exists, and perform SI request via the relay UE when a PC5-RRC connection with the relay UE exists. This is inline with the assumptions already made for data transfer in the TR:

*For UE-to-Network Relay, relaying of unicast data between the Remote UE and the network can occur after a PC5-RRC connection is established between the Relay UE and the Remote UE.*

[13] also suggests that an alternative could be that the remote UE always triggers on-demand SI via direct Uu path and uses the indirect path only for exceptional cases. This seems to be a new topic/aspect which was not discussed in past meetings and seems unnecessary if we assume the baseline approach which is aligned with data transmission and for which the behaviour for the remote UE is the same for both IC and OOC. It is therefore suggested to not discuss such new approaches as part of the SI, in-line with the agreed way forward to address ENs/FFS and ignore new issues at this meeting.

**Proposal 16** from the initial summary document [29] was generated based on the above and is repeated below, while generalizing to both IC and OOC.

**Q1.3. Do you agree with the following proposal?**

**A remote UE (IC or OOC) requests/receives SI via the relay UE when PC5-RRC connected to a relay UE.**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO | Y |  |
| Sharp | Yes |  |
| Xiaomi | Yes for IC |  |
| Spreadtrum | Yes |  |
| Ericsson (Min) | No | If there is Uu avaialble, Uu shall be always prioritized over the SL. Therefore, it would be beneficial to capture this (in the TR) as remaining issues/FFS for RAN2 to further study |
| Sony | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| Nokia | No | We are not sure why the Uu should be restricted to not get the SI directly from Uu when it is IC. |
| vivo | Yes | We can have a unified solution for both OOC and IC cases. |

In the summary document, the following proposal was derived from company contributions:

Proposal 17 A remote UE can receive some system information from a relay UE (e.g. by broadcast/groupcast) before it initiates a PC5-RRC connection.

In email discussion Post111-e 627, the mechanism for delivery of system information, and what information needs to be delivered was already discussed and the conclusion was that such details could be left to the WI phase, as per the TR text:

*“Relay UE can forward the system information to Remote UE via broadcast, groupcast, or dedicated PC5-RRC signalling. The detailed mechanisms of broadcast, groupcast and PC5-RRC signalling design and what system information can be relayed to Remote UEs can be discussed in WI phase.”*

Rapporteur believes there is no need to discuss this issue again, and that the previous conclusion can be maintained.

**Q1.4. Do you agree that proposal 17 in from the summary document ([29]) does not need further discussion as it was already concluded in RAN2#112 that such details are to be finalized in the WI stage?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO | Y |  |
| Sharp | Yes |  |
| Xiaomi | Yes |  |
| Spreadtrum | Yes |  |
| Ericsson (Min) | No | We think the issue is relevant, and shall be discussed during the SI phase. |
| Sony | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| Nokia | No | We think the issue is relevant for a SI discussion |
| vivo | Yes |  |

Also discussed in Post111-e 627 was the SI request mechanism for a remote UE.

For a remote UE in RRC\_CONNECTED requesting SI via the relay UE, it was observed in [5], [6], and [13] that the dedicatedSIBRequest procedure can be re-used to request and forward SI transparently to the relay UE. This was also the basic understanding of all companies in Post111-e 627.

**Proposal 18** from the initial summary document [29] was generated based on the above and is repeated below.

**Q1.5 Do you agree with the following proposal?**

**DedicatedSIBRequest procedure is re-used for the remote UE in RRC\_CONNECTED to request SI via the relay UE.**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO | Y |  |
| Sharp | Yes |  |
| Xiaomi | Yes |  |
| Spreadtrum | Yes |  |
| Ericsson (Min) | Yes |  |
| Sony | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| Nokia | Yes |  |
| vivo | Yes |  |

For a remote UE in RRC\_INACTIVE/RRC\_IDLE, the common understanding from Post111-e 627 was that MSG1-based SI request is not supported. The issue which remained from the email discussion was whether the legacy Uu RRC procedure for MSG3-based SI request can be re-used. In the summary of this email discussion, only one company indicated that the legacy MSG3-based SI request procedure for IDLE/INACTIVE remote UE could not be re-used because the relay UE would have no way of knowing the SI to be forwarded to the requesting remote UE, which was re-iterated in [5].

However, in [6], it was noted that the relay UE being aware of the SI request was an enhancement which allows the relay UE to send only the requested SI(s) to the requesting UE (e.g. using unicast on PC5). If the relay UE is unaware of the SI requested, the relay UE can simply send all SI being broadcasted by the network at a given time. Rapporteur therefore thinks that a procedure to make the relay UE aware of the SI requested by the remote UE is an enhancement to the legacy procedure and can be further discussed in the WI stage.

**Q1.6: Do you agree that proposal 19 in the summary document [29] suggests an enhancement that can be discussed in the WI stage?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO |  | We do not think this enhancement is needed.  But is fine to leave it to WI phase. |
| Sharp | Yes |  |
| Xiaomi | Yes |  |
| Spreadtrum | Yes |  |
| Ericsson (Min) | No | We think the issue is relevant, and shall be discussed during the SI phase. |
| Sony | Yes |  |
| Qualcomm |  | We don’t think it is an enhancement. Legacy Uu RRC procedure actually can’t work for IDLE/INACTIVE remote UE’s on-demand SIB acquisition. The reason is that legacy procedure of IDLE/INACTIVE UE’s on-demand SIB acquisition (specified in Rel-15) needs to receive Msg4 addressed with TC-RNTI as response before monitoring SIB. However, if remote UE is connected to relay, there is no Msg1/2 and thereby TC-RNTI can’t be obtained in Msg2. Thus, some spec change is needed if supporting IDLE/INACTIVE UE.  Because in current TR 38.836, we have captured that on-demand SIB works for IDLE/INACTIVE/CONNECTED remote UE. Thus, we understand we have to discuss it. Actually, we think proposal 19 is sufficient to resolve this issue in SI phase. But we are fine to discuss it WI phase if majority prefer this way. |
| InterDigital | Yes |  |
| Nokia | Yes |  |
| vivo | Yes, with comments | We think making the relay UE aware of the SI requested by the remote UE is beneficial. For example, the relay UE can avoid triggering unnecessary on-demand SI request to the network if the requested SI(s) of remote UE is part of the valid SI(s) that the relay UE stored. The relay UE can also combine its requested SI(s) and requested SI(s) of remote UE in one-shot on-demand SI request to the network. However, we agree detailed solutions for on-demand SI request procedure can be further discussed in WI phase. |

## 2.2 Agreements on Priority 1 Proposals

During the online session, the following agreements were made from priority 1 proposals.

Agreements:

Update the TR with the following changes:

- Remove “Editor’s note: Service continuity related CP procedure is captured in 4.5.4” from section 4.5.5

- Remove “Editor’s note: RAN2 needs to consider SA3 input” from section 5.5.3 and add the sentence “Security aspects require confirmation from SA3” to the text.

- Revise the following sentence as: “For the inter-gNB cases, compared to the intra-gNB cases, potential different parts on RAN2 Uu interface in details can be discussed in WI phase.” in section 4.5.4.

RAN2 confirm the decision of last meeting that L2 and L3 are both feasible for U2N and U2U, aligned with the LS sent to SA2 from RAN2#112-e (this is not a conclusion on the recommendation for normative work).

The first 3 agreements represent changes that can be made directly in the draft TP (in phase 2 of the email discussion) and does not require further discussion.

For the last agreement, the intent is to capture the decision for L2 and L3 relay (which was sent to SA2) into the RAN2 TR. In the LS to SA2 the following was indicated by RAN2:

*“RAN2 is studying Direct Discovery procedure, UE-to-Network Relay and UE-to-UE Relay solutions in the study on NR Sidelink Relay (FS\_NR\_SL\_Relay). In this study, both Layer-2 based Relay architecture and Layer-3 based Relay architecture are discussed in RAN2 and both have been found feasible, for which the latest study progress is summarized in TR 38.836 V0.1.1”*

It was suggested online to use the same wording as in the LS for the text captured in the conclusion section of the TR.

**Q2.1 Do you agree to the following wording for the text to be captured in the conclusions section of the TR?**

**“RAN2 has studied direct discovery procedure, UE-to-Network Relay, and UE-to-UE Relay solutions. In this study, both Layer-2 based Relay architecture and Layer-3 based Relay architecture have both been found feasible.”**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments |
| MediaTek | Yes |  |
| OPPO | Y |  |
| Sharp | Yes |  |
| Xiaomi | Yes |  |
| Spreadtrum | Yes |  |
| Ericsson (Min) | Yes |  |
| Sony | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| Nokia |  | We would propose to at least use the term „technical feasible“ to the conclusion, as we are still not convinced that it is practically feasible given the amount of items pushed to be WI.  Furthermore, we are not sure whether the inter-gNB case is thoroughly discussed. |
| vivo | Yes |  |

## 2.3 Working Towards Conclusions (Phase II)

A number of papers to RAN2#113 have presented conclusions relevant to L2 U2N and U2U relay [3][25][26][27][28]. These papers give concluding remarks on what was studied, technical evaluation/conclusion, and what is left for normative work.

Rapporteur intends to circulate a TP generated from the information in these papers as part of phase II discussion.

# 4 References

1. R2-2100111 Left issues on L2 Relay OPPO discussion Rel-17 FS\_NR\_SL\_relay
2. R2-2100124 Remaining issues on L2 U2N relay Qualcomm Incorporated discussion Rel-17
3. R2-2100169 Evaluation and Conclusion for L2 UE-to-Network Relay and L2 UE-to-UE Relay MediaTek Inc., Apple, Interdigital, Futurewei, Huawei, Hisilicon, Convida discussion Rel-17 FS\_NR\_SL\_relay
4. R2-2100202 Feasibility for Layer2 Relay CATT discussion Rel-17 FS\_NR\_SL\_relay
5. R2-2100300 Discussion on remaining issues on L2 UE-to-Network Relay ZTE Corporation discussion
6. R2-2100520 Remaining Control Plane Aspects for L2 Relays InterDigital discussion Rel-17 FS\_NR\_SL\_relay
7. R2-2100521 Discussion on L2 Relay Architecture and QoS InterDigital discussion Rel-17 FS\_NR\_SL\_relay
8. R2-2100535 Further discussions on L2 SL relay Ericsson discussion Rel-17 FS\_NR\_SL\_relay [R2-2009230](file:///C:\Users\fredamx\Desktop\LTE\RAN2\113\Docs\R2-2009230.zip)
9. R2-2100656 Remaining issues for L2 relay Spreadtrum Communications discussion Rel-17 FS\_NR\_SL\_relay[11]
10. R2-2100867 Discussion on Layer 2 Solutions for UE-to-NW relay and UE-to-UE relay Apple discussion Rel-17 FS\_NR\_SL\_relay
11. R2-2100910 Remaining issues on L2 relay Sony discussion Rel-17 FS\_NR\_SL\_relay
12. R2-2101107 Consideration on U2N relay and U2U relay Lenovo, Motorola Mobility discussion Rel-17
13. R2-2101179 Remaining issues on L2 U2N Relay vivo discussion Rel-17
14. R2-2101206 L3 vs L2 relaying Samsung, Ericsson, Nokia, Nokia Shanghai Bell discussion
15. R2-2101300 Inter-gNB Path Switching for L2 U2N Relay Intel Corporation discussion Rel-17 FS\_NR\_SL\_relay
16. R2-2101601 Open issues on L2 relay Xiaomi communications discussion
17. R2-2101623 Remaining issue on RRC state for L2 relay CMCC discussion Rel-17 FS\_NR\_SL\_relay
18. R2-2101754 Discussion on CP protocol stack for L2 U2U relay ASUSTeK discussion Rel-17 FS\_NR\_SL\_relay
19. R2-2101768 RRC status transition reporting procedure LG Electronics Inc discussion Rel-17 FS\_NR\_SL\_relay
20. R2-2101778 Further consideration of relay selection and reselection criteria LG Electronics Inc. discussion Rel-17 FS\_NR\_SL\_relay
21. R2-2101782 Clean-up of L2 sidelink relay Huawei, HiSilicon discussion Rel-17 FS\_NR\_SL\_relay
22. R2-2101785 Relay UE selection and reselection prioritization LG Electronics Inc. discussion Rel-17 FS\_NR\_SL\_relay
23. R2-2101788 Relay reselection using discovery message and sidelink unicast link LG Electronics Inc. discussion Rel-17 FS\_NR\_SL\_relay
24. R2-2101890 discussion on RRC procedures of L2 U2N relay ETRI discussion Rel-17 FS\_NR\_SL\_relay
25. R2-2100309 Comparison of L2 and L3 Relays ZTE Corporation
26. R2-2100616 Conclusion on the feasibility of L2 and L3 based Sidelink Relaying Intel
27. R2-2100123 Finalize the comparison and conclusion section of TR 38.836 Qualcomm
28. R2-2100980 Comparative Analysis of L2 and L3 SL Relay Architecture Ericsson, Samsung, Nokia, Nokia Shanghai Bell
29. R2-2102091 Summary Document for AI 8.7.2.1 InterDigital