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

Electronic Meeting, 25th January – 5th February 2021

Agenda: 8.7.2.1

Source: InterDigital

Title: TP for [605]

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, in R2-2102098 (+summary in R2-2102110)

 Deadline: Tuesday 2021-02-02 1200 UTC (for TP availability)—extended to 2021-02-04 0200 UTC to finalise TP in R2-2102116

This document captures the TP to TR 38.836 for new text for the L2 conclusion section and agreements from [605], as provided in the Appendix.

# 2 TP to TR 38.836

*----------------------------------------------First Change- Section 6 – New Text for L2---------------------------------------*

## 6 Conclusion

## 6.1 Evaluation and Conclusion of UE-to-Network Relay

### 6.1.1 Layer-2 Relay

RAN2 has studied L2 UE-to-Network relay and has concluded that L2 UE-to-Network relay meets all of the objectives of the NR Sidelink Relay SID [ref TBD]. Specifically, RAN2 has reached the following conclusions:

#### 6.1.1.1 Relay discovery and (re)selection

Discovery was studied for L2 UE-to-Network Relay and the baseline solution for L2 relay is the same as for L3 relay. For L2 U2N Relay, the Relay UE should always be connected to a SL capable gNB. Further details of discovery configuration for the remote UE can be discussed in the normative phase.

Relay (Re)selection was studied for L2 UE-to-Network Relay and the baseline solution for L2 relay is the same as for L3 relay. In addition, for RRC\_CONNECTED remote UE in L2 UE-to-Network Relay, gNB decision on relay (re)selection is considered in the normative phase.

#### 6.1.1.2 Relay and remote UE authorization

Both Relay and Remote UE separately follow Rel-16 V2X design (TS 23.287), and no RAN2 impact is expected.

#### 6.1.1.3 QoS management

The general QoS handling for L2 UE-to-Network Relay was studied. The gNB implementation can handle the QoS breakdown over Uu and PC5 for end-to-end QoS enforcement. Details of handling in case PC5 RLC channels with different e2e QoS are mapped to the same Uu RLC channel can be discussed in the normative phase. The end-to-end QoS enforcement can be supported. The gNB is aware of AS conditions of sidelink and Uu link, based on which the QoS breakdown can be flexible and tailored to such conditions (e.g. can be used to adapt the QoS breakdown when there is congestion on sidelink). In case of OOC, remote UE operates using the configuration provided in SIB or dedicated RRC signaling with overall better QoS performance than using pre-configuration. QoS can be enforced for each bearer as the gNB can decide whether an E2E bearer is admitted or not depending on the current congestion.

#### 6.1.1.4 Service continuity

L2 UE-to-Network Relay uses RAN2 aspects of Rel-15 NR handover procedure as a baseline. The AS layer service continuity (i.e. lossless and in-sequence delivery of PDCP PDU with similar performance like legacy HO) can be guaranteed during path switch in L2 U2N relay by involving also relay UEs (e.g. PDCP PDUs packet forwarding between relay UE and gNB and between serving and target relay UEs) in the path switch procedure.

#### 6.1.1.5 Security

In case of L2 UE-to-Network Relay, at AS layer, the security (confidentiality and integrity protection) is enforced end to end by legacy PDCP layer between the endpoints at the Remote UE and the gNB.

#### 6.1.1.6 Protocol stack design

The protocol stack and Uu adaptation layer function were studied for L2 UE-to-Network Relay. Whether the adaptation layer is also supported at the PC5 interface between Remote UE and Relay UE can be discussed in the normative phase. In L2 U2N Relay architecture, the remote UE is visible to the gNB, and the remote UE has its own PDU sessions. It supports the gNB configured/controlled bearer mapping at the relay UE between multiple E2E bearers of a remote UE and/or different remote UEs to one Uu RLC channel, which could also save on the RLC bearers in Uu.

#### 6.1.1.7 CP procedures

Both connection establishment procedure and path switching procedures were captured for L2 UE-to-Network Relay. The establishment of Uu SRB1/SRB2 and DRB of the remote UE is subject to legacy Uu configuration procedures. It supports the remote UE’s RRC connection management, which can provide dedicated RRC configuration to remote UE, reduce the interruption/avoid data loss due to RLF recovery, and speed up RRC connection and data resume, etc. Further details of the steps for path switch procedure (e.g. measurements, message content) and potential differences on the Uu interface for inter-gNB cases may be discussed in the normative phase.

The Option 2 as studied in TR36.746 for FeD2D paging is selected as the baseline paging relaying solution for L2 UE-to-Network Relay. By supporting paging, for remote UE in RRC\_IDLE/RRC\_INACTIVE, the DL data reachability can be supported during remote UE’s mobility.

The system information (i.e SI) request from remote UE and forwarding mechanism from Relay UE to Remote UE was studied L2 UE-to-Network Relay. Specifically, the relay UE can forward system information to the remote UE via broadcast, groupcast or unicast. On-demand SI request is supported for all RRC states. The detailed mechanism for such SI request and forwarding and the exact system information that can be relayed to Remote UEs can be discussed at normative phase. It supports the SI delivery in case remote UE is OCC, which supports remote UE using SIB provided configuration.

For L2 UE-to- Network relay, the Relay UE may provide UAC parameters to Remote UE for performing remote UE access control and RAN overload control. The access control check is performed at Remote UE using the parameters of the cell it intends to access. Remote UE access control can take SL congestion into account as the gNB is aware of the congestion status between remote UE and relay UE.

#### 6.1.1.8 Standards impact

Standardization impact from RAN2 perspective to support the operations of L2 UE-to-NW relay can be inferred from discussion in section 4.5, and in this conclusion. From RAN2 perspective, the standard support of L2 UE-to-Network Relay is mainly at RAN.

### 6.1.2 Layer-3 Relay

[…]

## 6.2 Evaluation and Conclusion of UE-to-UE Relay

### 6.2.1 Layer-2 Relay

RAN2 has studied L2 UE-to-UE relay and has concluded that L2 UE-to-UE relay meets all of the objectives of the NR Sidelink Relay SID [ref TBD]. Specifically, RAN2 has reached the following conclusions:

#### 6.2.1.1 Relay discovery and (re)selection

Discovery was studied for L2 UE-to-UE Relay and the baseline solution for L2 relay is the same as that of L3 relay.

Relay (Re)selection was studied for L2 UE-to-UE Relay and the baseline solution for L2 relay is the same as that of L3 relay.

#### 6.2.1.2 Relay and remote UE authorization

Both Relay and Remote UE separately follow Rel-16 V2X design (TS 23.287), and no RAN2 impact is expected.

#### 6.2.1.3 QoS management

The design of QoS support for L2 UE-to-UE relay are in the scope of SA2. No RAN2 impact of the solution captured in SA2 is identified thus far.

#### 6.2.1.4 Security

In case of L2 UE-to-UE Relay, the security is established at PDCP layer in an end to end manner between source remote UE and destination remote UE. The end-to-end security can be supported.

#### 6.2.1.5 Protocol stack design

The protocol stack and PC5 adaptation layer function (both first hop PC5 and second hop PC5) were studied for L2 UE-to-UE Relay.

#### 6.2.1.6 CP procedures

The connection establishment procedure was studied for L2 UE-to-UE Relay. RAN2 consider the SA2 solution in TR 23.752 as baseline. Further RAN2 impacts can be discussed in WI phase, if any.

#### 6.2.1.7 Standards impact

Standardization impact from RAN2 perspective to support the operations of L2 UE-to-NW relay can be inferred from discussion in section 4.5, and in this conclusion. From RAN2 perspective, the standard support of L2 UE-to-UE Relay is mainly at RAN.

### 6.2.2 Layer-2 Relay

[…]

## 6.3 Feasibility and Recommendation

Mechanisms for Layer-2 relay and Layer-3 relay have been studied and identified by RAN2, striving for minimum specification impact. 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. RAN2 recommends both L2 and L3 UE to NW and UE to UE relay can proceed to normative work.

*---------------------------------------------------------- End of First Change-----------------------------------------------------*

*---------------------------------------------------------- Second Change Section 4.5.5--------------------------------------------------*

### 4.5.5 Control Plane Procedure

#### 4.5.5.1 Connection Management

*---------------------------------------------------------- End Second Change --------------------------------------------------*

*---------------------------------------------------------- Third Change Section 5.5.3--------------------------------------------------*

### 5.5.3 Security

As described in section 6.9.1.2 of TR 23.752, in case of L2 UE-to-UE Relay, the security is established at PDCP layer in an end to end manner between UE1 and UE2. Security aspects require confirmation from SA3.

### 5.5.4 Control Plane Procedure

*---------------------------------------------------------- End Third Change --------------------------------------------------*

*---------------------------------------------------------- Fourth Change Section 4.5.4--------------------------------------------------*

### 4.5.4 Service Continuity

L2 UE-to-Nework Relay uses the RAN2 principle of the Rel-15 NR handover procedure as the baseline AS layer solution to guarantee service continuity (i.e. gNB hands over the remote UE to a target cell or target relay UE, including 1) Handover preparation type of procedure between gNB and relay UE (if needed), 2) RRCReconfiguration to remote UE, remote UE switching to the target, and 3) Handover complete message, similar to the legacy procedure).

Exact content of the messages (e.g. handover command) can be discussed in WI phase. This does not imply that we will send inter-node message over Uu.

Below, the common parts of intra-gNB cases and inter-gNB cases are captured. 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.

*---------------------------------------------------------- End Fourth Change --------------------------------------------------*

*---------------------------------------------------------- Fifth Change Section 4.1 --------------------------------------------------*

## 4.1 Scenarios, Assumptions and Requirements

[…]

The requirement of service continuity is only for UE-to-Network Relay, but not for UE-to-UE Relay in this release.

RAN2 have studied the mobility scenario of “between direct (Uu) path and indirect (via the relay) path” for UE-to-Nework relay. RAN2 focus on the mobility scenarios of intra-gNB cases in the study phase, and assume the inter-gNB cases will also be supported. For the inter-gNB cases, compared to the intra-gNB cases, potential different parts on Uu interface in details can be discussed in the WI phase.RAN2 deprioritize work specific to the mobility scenario of “between indirect (via a first relay UE) and indirect (via a second relay UE)” for path switching in the SI phase, which can be studied in the WI phase, if needed.

*---------------------------------------------------------- End Fifth Change --------------------------------------------------*

*---------------------------------------------------------- Sixth Change – Section 4.5.5.3------------------------------------------------*

#### 4.5.5.3 System Information Delivery

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.

On-demand SI request is supported for Remote UE for all RRC states (Idle/Inactive/Connected state). DedicatedSIBRequest procedure is re-used for the remote UE in RRC\_CONNECTED to request SI via the relay UE. For the remote UE in RRC\_IDLE/RRC\_INACTIVE, how on-demand SI procedure differs from legacy can be discussed in the WI phase.

A remote UE (IC or OOC) can request/receive SI via the relay UE when PC5-RRC connected to a relay UE. Reception via Uu for IC remote UE can be discussed in the WI phase.

*---------------------------------------------------------- End of Sixth Change ------------------------------------------------*

*---------------------------------------------------------- Seventh Change – Section 4.5.5.1 ---------------------------------*

#### 4.5.5.1 Connection Management

[…]

Step 1. The Remote and Relay UE perform discovery procedure, and establish PC5-RRC connection using the legacy Rel-16 procedure as a baseline.

Step 2. The Remote UE sends the first RRC message (i.e., *RRCSetupRequest*) for its connection establishment with gNB via the Relay UE, using a default L2 configuration on PC5. The gNB responds with an *RRCSetup* message to Remote UE. The *RRCSetup* delivery to the Remote UE uses the default configuration on PC5. If the relay UE had not started in RRC\_CONNECTED, it would need to do its own connection establishment upon reception of a message on the default L2 configuration on PC5. The details for Relay UE to forward the *RRCSetupRequest*/*RRCSetup* message for Remote UE at this step can be discussed in WI phase.

*---------------------------------------------------------- Seventh Change – Section 4.5.5.1 ---------------------------------*

# 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%3A%5CUsers%5Cfredamx%5CDesktop%5CLTE%5CRAN2%5C113%5CDocs%5CR2-2009230.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

# 5 Agreements Implemented by This TP

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).

Agreements:

Proposal 1.2 RAN2 confirm that on demand SI request is supported via a relay UE for OOC remote UE. No update to the TR is required,

[22/23 companies]

Proposal 1.5: DedicatedSIBRequest procedure is re-used for the remote UE in RRC\_CONNECTED to request SI via the relay UE.

[21/23 companies]

Proposal 1.6: For remote UE in RRC\_IDLE/INACTIVE, how on-demand SI procedure differs from legacy can be left to normative work. (21/23 companies)

[22/23 companies]

Proposal 2.1: Add the following sentence to the conclusion 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.”

Proposal 1.1: Change the wording of step 2 in Figure 4.5.5.1-1 as follows:

Step 2. The Remote UE sends the first RRC message (i.e., RRCSetupRequest) for its connection establishment with gNB via the Relay UE, using a default L2 configuration on PC5. The gNB responds with an RRCSetup message to Remote UE. The RRCSetup delivery to the Remote UE uses the default configuration on PC5. If the relay UE had not started in RRC\_CONNECTED, it would need to do its own connection establishment as part of this step. The details for Relay UE to forward the RRCSetupRequest/RRCSetup message for Remote UE at this step can be discussed in WI phase.

Is changed to:

Step 2. The Remote UE sends the first RRC message (i.e., RRCSetupRequest) for its connection establishment with gNB via the Relay UE, using a default L2 configuration on PC5. The gNB responds with an RRCSetup message to Remote UE. The RRCSetup delivery to the Remote UE uses the default L2 configuration on PC5. If the relay UE had not started in RRC\_CONNECTED, it would need to do its own connection establishment upon reception of a message on the default L2 configuration on PC5. The details for Relay UE to forward the RRCSetupRequest/RRCSetup message for Remote UE at this step can be discussed in WI phase.

[16/16 companies]

Proposal 3.3.1: Capture in the conclusion section for L2: “L2 Relay Meets all of the objectives of the SID.” (16/16 companies)

[16/16 companies]

Proposal 3.3.2: Capture in a common conclusion section for L2 and L3: “RAN2 recommends both L2 and L3 UE to NW and UE to UE relay can proceed to normative work” (16/16 companies)

[21/23 companies]

Proposal 1.3 A remote UE (IC or OOC) can request/receive SI via the relay UE when PC5-RRC connected to a remote UE. Reception via Uu for IC remote UE can be discussed in WI.

Capture in the TR: “Mechanisms for layer-2 relay have been studied and identified by RAN2, striving for minimum specification impact”, and a matching sentence for L3.