3GPP TSG-RAN WG2 Meeting #116-e R2-211xxxx

Electronic Meeting, November 1 – 12, 2021

Agenda: 8.7.2.1

Source: InterDigital

Title: Summary of [AT116-e][622][Relay] Remaining proposals from relay control plane (InterDigital)

Document for: Discussion, Decision

# 1 Introduction

The following email discussion was triggered at RAN2#116-e, and the results are summarized in this discussion

* [AT116-e][622][Relay] Remaining proposals from relay control plane (InterDigital)

 Scope: Attempt to converge the proposals for discussion from R2-2109928 and the proposals from R2-2111368.

 Intended outcome: Report to CB session

 Deadline: Tuesday 2021-11-09 0800 UTC (can be extended to Thursday if needed)

# 2 Discussion

## 2.1 Proposals from R2-2109928

For the remaining proposals from R2-2109928 [1], rapporteur suggests to focus on the “easy proposals on UAC and timers” and the “more difficult agreements and aspects to be discussed with high priority” and to skip the “agreements/aspects that can be down-prioritized” for the purposes of this email discussion.

### 2.1.1 Proposals on UAC and Timers

Proposals 16, 17, and 18 had significant support in the email discussion [1], and were marked as easy agreements. Rapporteur therefore suggest that for the sake of progress we agree to these unless there are significant concerns on them.

Proposal 16 from [1] is as follows:

* *Proposal 16: Relay UE does not perform UAC check for the remote UE’s data. [20/23]*

The proposal had majority support and aligns with the preference from CT1. Rapporteur suggests we can agree with the proposal in its current form, and comments are invited only if companies have significant concerns with the proposal.

**Q1.1) Can we agree with proposal 16 from R2-2109928: The relay UE does not perform UAC check for the remote UE’s data.**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments (if company answered No due to significant concerns) |
| Qualcomm | Y |  |
| OPPO | Y |  |
| Xiaomi | Yes, with comments | We agree with the proposal. Furthermore, we want to clarify all transmission from remote UE should not be checked, regardless of data or RRC signaling, i.e. SRB or DRB. |
| CATT | Y |  |
| ASUSTeK | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y |  |
| Apple | Y |  |

Proposal 17 from [1] is as follows:

* *Proposal 17: Remote UE uses different timers (FFS: value and/or name) for access (T300-like), resume (T319-like) and re-establishment (T301-like) compared to those for legacy Uu procedures [23/23]*

While all companies agreed that different times for access, resume, and re-establishment compared to legacy are needed for relay, a few companies indicated that this could be done by configuring a different value of the existing timer to the UE, rather than having a new timer. For this reason, the FFS in the proposal was included. Since then, it was noted by several companies by email, as well as in company contributions, that these timers are configured in SIB, and a separate IE would be needed to configure a different value of each timer for relay and non-relay connection. In addition, the conclusion of the service continuity discussion (where T304 is discussed) proposes a new timer. To align with that discussion, rapporteur suggests agreing to proposal 17 without the FFS.

**Q1.2) Can we agree that remote UE uses different timers for access (T300-like), resume (T319-like) and re-establishment (T301-like) compared to those for legacy Uu procedures?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments (if company answered No due to significant concerns) |
| Qualcomm | Y | Minor suggestion: maybe we can add “IEs in SIB” to make it clear?*Remote UE uses different timers Ies in SIB (FFS: value and/or name) for access (T300-like), resume (T319-like) and re-establishment (T301-like) compared to those for legacy Uu procedures* |
| OPPO | Y |  |
| Xiaomi | N | We understand all these timers shall be extended due to larger delay than direct link. On the other side, we also notice the delay for these timers seems to be the same. Therefore, maybe it’s more efficient to configure one common extend value. Remote UE could extend these timers by adding the common extend value. In this method, only one parameter is needed. |
| CATT | Y |  |
| ASUSTeK | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y |  |
| Apple | Y |  |

Proposal 18 from [1] is as follows:

* *Proposal 18: Basing RRC timers (T300-like, etc) on the RRC state of the relay UE is not supported in this release. [19/23]*

There was clear majority to not support this enhancement in this release. Rapporteur suggests that we agree with proposal 18 and invites companies to express comments only if there are significant concerns on such agreement.

**Q1.3) Can we agree with proposal 18 from R2-2109928: Basing RRC timers (T300-like, etc) on the RRC state of the relay UE is not supported in this release.**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments (if company answered No due to significant concerns) |
| Qualcomm | Y |  |
| OPPO | Y(agree) |  |
| Xiaomi | Y |  |
| CATT | Y |  |
| ASUSTeK | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y |  |
| Apple | Y |  |

### 2.1.2 Proposals on Short Message and SI Forwarding

The discussion on short message and SI forwarding in [1] resulted in a set of proposals requiring further discussion. Firstly, for a remote UE in RRC\_CONNECTED, the following is proposed.

* *Proposal 8: RAN2 further discusses whether, for an RRC\_CONNECTED remote UE, a) the relay UE forwards short message to the remote UE for the remote UE to perform dedicatedSIBRequest [12/23] b) the network forwards SIB to each remote UE when the SIB changes; [5/23] or c) the relay UE, following reception of the short message, forwards only the SI that the remote UE requires (based on prior knowledge) [6/23]*

From the three options in the proposal, the one with the smallest support (5/23 companies) is that the network forwards SIB to each remote UE when SIB changes. It was commented by a few companies in the email discussion and in contributions to this meeting that the network may not be able to know all of the SIBs required by a remote UE (e.g., when a remote UE first enters RRC\_CONNECTED). Furthermore, in Uu, despite the remote UE being able to receive SIB from dedicated signalling from the network, the UE can still know about SI changes and request SIB. Rapporteur therefore suggests that option b) is removed, keeping in mind that this option is always possible by network implementation, but that it should not be relied on exclusively if we want to be consistent with Uu.

**Q2.1) When the remote UE is in RRC\_CONNECTED, and the relay UE receives a short message, which of the following is preferred relay UE behaviour. Companies are asked to comment on the reason(s) why one or more approach is preferred and/or if any approach is not feasible/acceptable.**

1. **Relay UE forwards short message to the remote UE with the understanding that the remote UE then performs dedicatedSIBRequest to the gNB**
2. **Relay UE forwards SI to the remote UE without forwarding the short message**
3. **the network forwards SIB to each remote UE when the SIB changes**
4. **The network forward the SIB index (i.e. “x” in SIBx) to remote UE when SIBx changes**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments (please explain why an option is preferred, or at least why an option is not feasible/acceptable) |
| Qualcomm | A or B with modification | On original option c) in proposal (*forwards only the SI that the remote UE requires (based on prior knowledge)*), our concern is that it will put a new restriction on relay UE to track SIB interest for a CONNECTED remote UE. We do not think it is a valid requirement because only IDLE/INACTIVE remote UE sends SIB interest to relay UE according to current agreement and dedicatedSIBRequest is transparent to relay UE.So, we will be fine with B) if below clarification can be agreed:1. **Relay UE forwards SI to the remote UE without forwarding the short message based on its implementation. Relay UE is not required to track SIB interests of remote UE.**

If such clarification is not agreed, we only accept A). |
| OPPO | Option C with comments | We don’t agree to remove one option directly without discussion!As rapporteur also said, “**option (NW forwarding updated SIBs) is always possible by network implementation**”, we don’t understand why the easiest option which can always feasible and have minimal spec impact is removed! And for the argument “when a remote UE first enters RRC\_CONNECTED, NW may not know the SIBs required by a remote UE”, we don’t think the issue is valid since the remote UE can request SIBs whenever it needs includes it first enters RRC\_CONNECTED. As for the other options, we are reluctant to support since the network forwarding approach is sufficient:* Besides, for Option A, it is not preferred since the necessity of short message on Uu interface comes from the design of modification-period (MP) based SI delivery, yet the MP concept is not used at PC5 interface, so that the short message is not useful either. Otherwise, there would be further specification effort in order for remote UE to understand the MP boundary, which leads to the Option A solution unnecessarily complicated.
* For Option B, it is not preferred since relay UE doesn’t know the requested SIB of the remote UE, i.e. the dedicatedSIBRequest is transparent to relay UE.
 |
| Xiaomi | A | Option A is more aligned with legacy procedure. And there is little impact to both relay and remote UE, since anyway relay shall monitor short message.On the other side, the premise of option B is relay UE is aware of remote UE’s interest in all SIBs. This is infeasible for following reasons,1. Relay UE can’t know CONNECTED remote UE’s interest, since  dedicatedSIBRequest  is transparent to relay UE.
2. For IDLE/INACTIVE remote UE, it’s agreed to introduce SI request on sidelink. But we understand SI request is triggered only when remote UE doesn’t store valid SIB, as legacy. IDLE/INACTIVE remote UE, which has stored latest SIB, would not send SI request to relay UE. In this case, relay UE would not know remote UE’s interest.
 |
| CATT | B | Common solution for IDLE/INACTIVE/CONNECTED remote UE. |
| ASUSTeK | A | Remote UE may change its interest in the originally required SIB(s). If the updated SIB(s) is still needed, Remote UE can reuse the mechanism of sending dedicatedSIBRequest as legacy. |
| MediaTek  | B | We prefer to have a unified solution for IDLE/INACTIVE/CONNECTED remote UEs. We think option B should be based on a mechanism to allow Relay UE to know the SIB interest before the SIB forwarding, which actually reduce the SL overhead.  |
| InterDigital | A | The main reason is we think the relay UE should not get involved in acquiring changed SI for the remote UE when the remote UE is in RRC\_CONNECTED. This is aligned with legacy, and other behavior associated with remote UE in RRC\_CONNECTED. |
| Apple | D | We agree with OPPP that both Option A and B are not power-efficient. The most straight-forward way is to tell the index of SIB which has been changed, and let the remote UE itself to decide whether it wants to retrieve it or not.  |

For a remote UE in RRC\_IDLE/RRC\_INACTIVE, there seems to be a majority support for the relay UE forwarding the SI itself upon reception of the short message.

* Proposal 9: For the remote UE in RRC\_IDLE/RRC\_INACTIVE, short message is not forwarded by the relay UE to the remote UE [15/23]

Rapporteur suggests we try to go with the majority in this case, unless there is significant technical issues.

**Q2.2) When the remote UE is in RRC\_IDLE/RRC\_INACTIVE, and the relay UE receives a short message, do you agree that the Relay forwards SI to the remote UE without forwarding the short message?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments (if company answered No due to significant concerns) |
| Qualcomm  | Y |  |
| OPPO | Y |  |
| Xiaomi | Y | Forwarding short message is more aligned with legacy procedure. And there is little impact to both relay and remote UE, since anyway relay shall monitor short message.On the other side, the premise of not forwarding short message is relay UE is aware of remote UE’s interest in all SIBs. This is infeasible for following reason,For IDLE/INACTIVE remote UE, it’s agreed to introduce SI request on sidelink. But we understand SI request is triggered only when remote UE doesn’t store valid SIB, as legacy. IDLE/INACTIVE remote UE, which has stored latest SIB, would not send SI request to relay UE. In this case, relay UE would not know remote UE’s interest. |
| CATT | Y |  |
| ASUSTeK | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y |   |
| Apple | See comment | We agree the short message itself is not forwarded as it contains too less information. But instead of forwarding SI, NW informs the index of SIB which has been changed, and let the remote UE itself to decide whether it wants to retrieve it or not. |

Assuming there are cases (at least IDLE/INACTIVE) where the relay UE forwards the SI and not the short message, the email discussion tried to discuss which SI is forwarded. For PWS, there was majority view that the relay UE forwards the PWS SIB after reception of the short message:

* Proposal 10: When short message forwarding is not performed by the relay UE, the relay UE forwards the PWS SIBs being broadcast after receiving the PWS notification [19/23].

Companies which did not agree with the proposal indicated that a remote UE may not support PWS (e.g. IOT UE).

**Q2.3) Can we agree that assuming short message forwarding is not performed by the relay UE, the relay UE forwards the PWS SIBs to remote UEs which support PWS after reception of the PWS notification?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments (if company answered No due to significant concerns) |
| Qualcommm  | N | If you check SA2 spec, emergency service support in L2 relay is NOT supported in Rel-17. And supporting emergency service for L2 relay is being proposed as one objective of Rel-18 in SA2. From our perspective, we prefer no restriction on SIB forwarding (i.e. any SIB can be forwarded as UE implementation). However, please note that some companies are still proposing to restrict some SIB forwarding for unsupported features (e.g. SIB13/14, PosSIB in Q5.1, Q6.3). If such restriction is agreed, we think this proposal should also be aligned (i.e., PWS SIBs is not forwarded to remote UE because it doesn’t support emergency service in this release). Since this proposal is to mandate relay UE to forward SIBs whose functions are NOT supported in Rel-17 (i.e., emergency service), we oppose to agree this proposal. If this proposal is agreed due to majority view, we think it is necessary to send LS to SA2 to check issue.  |
| OPPO | Y |  |
| Xiaomi | No | It’s unclear how relay UE can acknowledge remote UE’s capability on Uu. Currrently, only the sidelink related capability is exchanged on sidelink. |
| CATT | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y | Regardless of the support of emergency notification, we should have a unified SIB forwarding mechanism already in this release. |
| Apple | No | We agree with Qualcomm that emergency service is not supported by remote UEs.Also, we are skeptical that whether it is power-efficient to relay UE just blindly flooding the PWS message to its connected remote UEs (e.g., behave like a gNB), especially when it knows the PWS messages are redundant and has already been received by the remote UEs earlier. |

Finally, for non PWS SIBs, it was not decided which SI is to be forwarded by the relay UE when the short message is received.

**Q2.4) Assuming short message forwarding is not performed by the relay UE, which non-PWS SI does the relay UE forward to the remote UE?**

1. **All changed SI**
2. **A subset of the changed SI that is applicable to the remote UE**
3. **A subset of the changed SI based on relay UE implementation**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm  | A) or C) | We do not accept B). It is not a valid requirement for relay UE to track SIB interest of remote UE because only IDLE/INACTIVE remote UE sends SIB interest to relay UE according to current agreement and dedicatedSIBRequest is transparent to relay UE. |
| OPPO | A) Or B) | No strong view |
| Xiaomi | A | Relay UE is unable to acknowledge remote UE’s interest in all SIBs. If short message is not forwarded, relay UE has to forward all changed SI to avoid remote UE miss changed SI. |
| CATT | A |  |
| MediaTek  | B | A mechanism is needed to allow Relay UE to know the SIB interest before the SIB forwarding, which actually reduce the SL overhead. |
| InterDigital | B | We think the relay UE can learn the SIB interests of the remote UE via PC5. Using this knowledge would greatly reduce SL overhead. |
| Apple | See comment | Although short message forwarding is inefficient, the UE can put the index of the changed SIBs into a small PC5-RRC message, so that remote UE can decide whether it wants to retrieve or not based on its own interest of SIBs. |

### 2.1.3 Proposals on Sending Remote UE Paging on PC5-RRC

Proposal 7 from [1] indicated the need to further discuss how to deliver paging to the remote UE:

* *Proposal 7: RAN2 further discusses whether the PC5-RRC message delivering paging to the remote UE contains a) the entire paging record; b) the UE ID of the UE being paged only; c) the paging type only.*

The outcome, in terms of preference of companies for each approach, was as follows:

* a) the entire paging record – 10 companies
* b) UE ID of the remote UE being paged only – 7 companies
* c) paging type only – 8 companies

The main difference in opinion is based on whether we should prioritize resource efficiency versus whether we should prioritize simplicity of the relay:

* The companies preferring resource efficiency (7+8 = 15 companies) indicate that forwarding the entire paging record is not needed and would create unnecessary overhead on SL.
* The companies preferring simplicity (10 companies) indicate that it would be simpler to forward the entire paging record to the remote UE rather than regenerating a new message

Rapporteur observes that for the efficiency argument, the paging record can in fact contain the paging of multiple UEs (which are not necessarily connected to the same relay) and so may be a large message. The main reason for paging multiple UEs with a single

Rapporteur observes that for the simplicity argument, the relay UE is sending the paging message in PC5-RRC and so is anyways creating a new message on PC5-RRC (different than the Uu paging message/record). Furthermore, the transmission of the paging message to the remote UE is not transparent, as the relay still needs to determine which remote UE to send paging to by decoding the Uu paging message.

Rapporteur therefore sees more technical merit to the efficiency argument, and to make progress in this discussion, suggests we agree that the relay only sends paging information relevant to that specific remote UE, when paging is sent to a remote UE over PC5 (which is also aligned with the majority view).

**Q3.1) Can we agree that the PC5-RRC message delivering paging to the remote UE contains either the UE ID of the remote UE being paged, or the paging type, and that we will further select from one of these two options?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments (if company answered No due to significant concerns) |
| Qualcomm |  | We can follow majority view. However, we have a clarification question: In MUSIM, we agreed paging record can include voice indication. We know L2 relay should not support MUSIM in this release. However, if Q3.1 is agreed (i.e. only UE ID or paging type), how can we handle such forward compatibility issue? Rapporteur: I believe the same would apply – the voice indication would need to be included into the PC5-RRC message. |
| OPPO | See comment | Update our view: the whole paging message can be directly forwarded to the remote UE without need to further discuss/debate on the post-processing operation at relay UE. |
| Xiaomi | N | We think both should be included in delivered paging. UE ID could be indicated for forward compatibility of multi hop relay. Paging type is essential for remote UE to decide which procedure to initiate.Furthermore, if PC5-RRC message could be broadcast, multiple UE IDs and associated paging type could be included, in case multiple remote UEs are paged. |
| CATT | N | Relay UE should deliver paging to the remote UE contains both the UE ID and the paging type. The remote UE’s behaviour is different based on ue-Identity included in the received paging message. For RRC\_IDLE remote UE, it needs to forward the ue-Identity and accessType (if present) to the upper layers. For RRC\_INACTIVE remote UE, if ue-Identity included in the PagingRecord is ng-5G-S-TMSI, it needs to forward the ue-Identity and accessType (if present) to the upper layers and back to RRC\_IDLE. For RRC\_INACTIVE remote UE, if ue-Identity included in the PagingRecord is fullI-RNTI, it initiates the RRC connection resumption procedure. |
| ASUSTeK | N | We share the same view with OPPO. Besides, for simple work on Remote UE side, if the whole paging message is directly forwarded to Remote UE, the current RRC spec for handling Paging message received on PCCH can be reused for handling Paging message received from Relay UE. |
| MediaTek  | Y | We share the same view as the rapporteur |
| InterDigital | Y | UE already knows its UE ID, so no need to send this information back. However, we are ok with sending both if companies want to ensure forward compatibility with multihop. |
| Apple | Y | Agree with the analysis by the rapporteur |

Assuming the statement in 3.1 is agreeable, companies are asked to give their preference between the approaches.

**Q3.2) Between the two options assumed in 3.1, which do companies prefer?**

1. **UE ID of the remote UE being paged only**
2. **Paging type**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm | B) if Q3.1 can be agreed | If Q3.1 is agreed, we prefer B) due to lower overhead |
| OPPO | None | Please our reply to Q3.1 |
| Xiaomi | Both | UE ID could be indicated for forward compatibility of multi hop relay. Paging type is essential for remote UE to decide which procedure to initiate. |
| CATT | Both | Same commens as for Q3.1. |
| MediaTek  | A and B |  |
| InterDigital | No preference | Either or both (for multihop compatibility) are acceptable. |
| Apple | B | We prefer B for low overhead. Regarding multi-hop U2Ncase, we think this UE ID information may need to protected for privacy, so we are not sure UE-ID has to be disclosed to an intermediate U2N relay UE which does not monitor the PO.  |

## 2.2 Proposals from R2-2111368

### 2.2.1 Proposals for Potential Agreement

In the summary of the control plane [2], a number of potential easy agreements were identified. Apart from proposal 24, which simply confirms an existing agreement and may not be necessary to repeat, rapporteur would like to check that we can firstly agree to the following proposals, or whether there are any significant concerns:

* *Proposal 12. As a baseline, in-coverage Remote UE is allowed to acquire some necessary SIB over Uu irrespective of its PC5 connection to Relay UE.*
* *Proposal 22. Agree that Remote UE needs to know the PCI of Relay UE’s serving cell. FFS how Remote UE obtains the PCI of relay UE’s serving cell.*
* *Proposal 25. Agree that Relay UE can notify Remote UE ID (i.e. 5G-S-TMSI/I-RNTI) information to the gNB via dedicated RRC message for paging delivery purpose.*

**Q4.1) Can we agree to proposals 12, 22, and 25 above from the control plane summary (please respond no if there are significant concerns with any of these proposals)?**

|  |  |  |
| --- | --- | --- |
| Company | Response(Y/N)  | Comments (if company answered No due to significant concerns) |
| Qualcomm | Y |  |
| OPPO | Y |  |
| Xiaomi | Yes |  |
| CATT | Y |  |
| ASUSTeK | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y |  |
| Apple | Y |  |

### Proposals with Majority View

Regarding which SIB can be requested, majority view from the contributions is that the remote UE can request any SIB. Some companies indicated that some SIBs (e.g. SIB1) should not be possible to request.

* Proposal 1. [Majority view, 6(any), 1(except SIB1), specific SIBs(2), updated SIB only (1)] The Remote UE could request any SIB to be forwarded from Relay UE in an on-demand manner. FFS whether request of any specific SIBs is not allowed.

**Q5.1) Which SIB can the remote UE request from the relay UE?**

1. **Any SIB**
2. **Any SIB except some specific SIBs (please indicate which ones)**

|  |  |  |
| --- | --- | --- |
| Company | Response | Comments  |
| Qualcomm | A) | We understand the concern is that functionalities of some SIB(s) (e.g., SIB11 on EMR) are not supported by L2 relay in this release. However, we don’t think spec should put a restriction on which SIB(s) the remote UE can’t request. We believe that L2 relay will support more NR features in future, and such restriction will cause unnecessary spec work. Meanwhile, we also think it is necessary to clarify that it doesn’t mean the remote UE needs to support the feature related to the request SIB. |
| OPPO | A |  |
| Xiaomi | A | We think it’s up to remote UE’s implementation to request which SIB. For relay UE, it makes no difference to support specific or all SIB forwarding. Therefore, a common framework is preferred. |
| CATT | A |  |
| ASUSTeK | A |  |
| MediaTek  | A |  |
| InterDigital | A | Agree with QC |
| Apple | A |  |

Regarding establishment cause value, the majority view from company contributions was to not introduce a new establishment cause value:

* Proposal 15. [Majority view, 8-1] Agree that the Relay UE reuses existing establishment/resume cause value when Relay UE enters RRC\_CONNECTED only for relaying purpose.

**Q5.2) Should a new establishment cause for relay UE entering RRC\_CONNECTED only for relaying purposes be introduced?**

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| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm |  | We think a new cause value is simpler, but we can majority view. However, we have a question: if INACTIVE remote UE uses cause value *rna-Update*, how an IDLE relay UE can determine which cause value to use in its R*RCSetupquest* (*rna-Update* can’t be included)?  |
| OPPO | Y | Old value does not help gNB to differentiate between legacy access and this new access type, so new value is helpful, and new value helps to solve the left issues, e.g., if old value is used, the FFS point is how to decide which existing value is to be used, we believe that would lead to further debate which is unnecessary, so new value seems to be clean solution. |
| Xiaomi | N | New cause value is not preferred for following reasons,1. New cause value can’t provide enough granularity for gNB to determine whether to allow or reject the access request. In legacy Uu, gNB determines whether to reject or accept the request based on the cause value. The key problem of new establishment cause value is the Relay UE would set new cause value to all remote UE’s request, regardless of its real cause value. gNB can’t make appropriate decision. gNB has to treat new cause value as highest priority, since relay support both emergency and commercial use case.
2. It is not future proof to introduce new cause value just for the SL relay UE RRC establishment purpose.
3. Similar issue had been discussed in IAB WI, It was agreed in RAN2#108 meeting that no new Cause values were defined for IAB. The situation for this relay UE establishment is the same as IAB.
4. Creating inequality or unfairness between L2 relays and L3 relays are to be avoided, unless if indeed necessary. For example, if a new RRC establishment cause is used in the Layer-2-specific U2N case, then Layer 2 Relay UE may be granted prioritized access by NW, but L3 relay UE will not have the same advantage because it does not use this new RRC establishment cause value.

Regarding QC’s question, One solution could be relay UE can select certain cause value, in case remote UE’s cause value can’t be reused by relay UE due to different RRC state or multiple remote UEs request. The mapping rule could be specified or up to relay UE’s implementation. |
| CATT | N with comments | RRC\_IDLE/ RRC\_INACTIVE relay UE initiates RRC establishment/resume procedure upon service request procedure from NAS. The cause value in RRC setup/resume request message is from higher layer as legacy procedure. The cause value of service request message of relay UE(introducing new value or reusing existing value) is decided by CT1. |
| MediaTek  | N |  |
| InterDigital | Y | We think a new value would be better so the gNB can distinguish between the accesses. |
| Apple | No |  |

### 2.2.3 Proposals for further discussion

Regarding proposals requiring further discussion, rapporteur would like to collect company opinion on the proposals where options were suggested by the rapporteur of [2].

a) PC5-RRC signaling for SI

* *Proposal 9. Discuss which option is preferable for the PC5-RRC message when Relay UE forwards SIB to Remote UE after PC5 connection establishment for SI request and response:*
	+ *Option a) New PC5-RRC messages; FFS message content/details (3)*
	+ *Option b) Existing RRCReconfigurationSidelink message (1)*

**Q6.1) Which PC5-RRC message is used by the remote UE to request SI from the relay UE after PC5 connection establishment?**

1. **New PC5-RRC message**
2. **RRCReconfigurationSidelink**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm  | A) |  |
| OPPO | A) | A PC5-RRC to mimic the SI request message at Uu. |
| Xiaomi | A | We see some difference between SI request and other configuration carried by RRCReconfigurationSidelink. New message is more aligned with SI request. T400 associated with RRCReconfigurationiSidelink may not be needed for SI request, since relay UE may spend longer time to require and forward SI or even not be able to acquire the SI due to capability restriction. |
| CATT | A | No strong view. Slightly prefer A. |
| ASUSTeK | A |  |
| MediaTek  | A |  |
| InterDigital | A |  |
| Apple | A |  |

**Q6.2) Which PC5-RRC message is used by the relay UE to send SI to the remote UE after PC5 connection establishment?**

1. **New PC5-RRC message**
2. **RRCReconfigurationSidelink**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm | A) |  |
| OPPO | B | Follow Uu method for dedicated SI forwarding. |
| Xiaomi | A | To align with the new PC5-RRC message of SI request. |
| CATT | A | No strong view. Slightly prefer A. |
| ASUSTeK | A |  |
| MediaTek  | A |  |
| InterDigital | A |  |
| Apple | A |  |

b) Voluntary forwarding of SI

Regarding proposal 5, it seems related to the discussion on short message, in the sense that if short message forwarding is not supported, then voluntary forwarding of SIBs is supported for the case of updated SIBs.

* Proposal 5. Discuss which option is preferable for the Relay UE to voluntarily forward SIBs to the Remote UE:

Option a) Relay UE can voluntarily forward without a request any SIB (4)

Option b) Relay UE should voluntarily forward without a request only specific SIBs, such as SIB1, SIB6, SIB7, SIB8 (4) and updated SIB(s) considering Remote UE’s prior request (9)

The remaining question is whether voluntary forwarding is supported for other cases.

**Q6.3) Are there any cases, other than the case SIB update determined by the relay UE, where the relay UE can voluntarily forward SIBs to the remote UE without request? If yes, please specify the case, and which SIB(s).**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm | Y | Similar to Q5.1, we don’t think spec should put a restriction on which SIB(s) the relay UE can’t voluntarily forward.If Option b) is agreed, we think: * SIB6/7/8 should be removed because emergency service is not supported in this release according to SA2 Rel-17 scoping. Forwarding them is just a waste of radio resource
* “updated SIB(s) considering Remote UE’s prior request” should also be removed. This is a useless specification because what is “Remote UE’s prior request” and its validity time can’t be tested.
 |
| OPPO | Y | Other than the SIBs updated (which our understanding are covered by Q2.1/2.2), at least SIB1 should be forwarded to remote UE. |
| Xiaomi | N | If SIB is not updated and not requested by remote UE, we don’t see the need to forward the SIB voluntarily. |
| CATT | Y | SIB1. |
| MediaTek  | N | We have the same understanding as Xiaomi. Meanwhile we prefer to specify a mechanism to allow Relay UE to know the which SIBs should be forwarded to the remote UEs |
| InterDigital | Y | We think apart from the SIB update case, the relay UE should also forward SIB to the remote UE after PC5-RRC connection is established. After establishment of this connection, we agree with Xiaomi that if SIB is not updated and not requested, there is no need for forward the SIB. |
| Apple | N | We think the SI retrieval needs to be initiated by remote UE. Voluntary forwarding is not power-efficient. |

c) SI forwarding before PC5-RRC Connection

* Proposal 6. Discuss based on SA2 recent LS [R2-2111236], how to enable Remote UE to receive the list of non-serving PLMN IDs before PC5 connection establishment.
* Proposal 7a. Discuss whether Relay UE could support forwarding of some essential bits of system information besides agreed PLMN ID and cell ID to Remote UE before PC5 connection establishment.
* Proposal 7b. Discuss which options are preferable for the essential bits of system information besides list of non-serving PLMN IDs to be forwarded toward Remote UE before PC5 connection establishment:
	1. cellBarred from MIB
	2. intraFreqReselection from MIB
	3. cellAccessRelatedInfo from SIB1 (includes PLMN ID list)
	4. t300 (3bit), t319 (3bit), useFullResumeID (1bit) from SIB1
	5. UAC configuration (~217bit), optionally.
* Proposal 8. If proposal 7a is agreed, discuss which option is preferable to enable forwarding of system information before PC5 connection establishment:
	+ Option a) PC5 broadcast (2 + 2(either option) or 4)
	+ Option b) Relay discovery message (3+2 (either option) or 5)

**Q6.4) Can RAN2 confirm, based on SA2 LS R2-2111236, that the list of non-serving PLMN IDs need to be provided by the relay UE to the remote UE before PC5 connection establishment?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm | Y | As requested by SA2 |
| OPPO | Y |  |
| Xiaomi | Y |  |
| CATT | Y | For RAN aspect, remote UE needs to acquire the list of non-serving PLMN IDs to perform PLMN (re)selection in order to support RAN sharing. |
| ASUSTeK | Y |  |
| MediaTek  | Y |  |
| InterDigital | Y |  |
| Apple | Y |  |

**Q6.5) What other system information (in addition to list of non-serving PLMN IDs) should be provided by the relay UE to the remote UE before PC5 connection establishment?**

1. **cellBarred from MIB**
2. **intraFreqReselection from MIB**
3. **cellAccessRelatedInfo from SIB1 (includes PLMN ID list)**
4. **t300, t319**
5. **useFullResumeID**
6. **UAC configuration**
7. **Other**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm | A), C), D), E), F) | In our understanding, the intention is for OOC remote UE to initiate RRC establishment rather than relay reselection. Because OOC remote UE can’t acquire SIB from gNB directly, then OOC remote UE has to establish unicast PC5 connection to get these info, which is quite inefficient and time consuming because the serving cell of relay UE may not be a good choice for the remote UE. Thus, we prefer that these essential bit on RRC establishment can be acquired by OOC remote UE before PC5 link establishment. For the specific option:* A) is useful when relay UE is in CONNECTED state (so *cellBarred* is applied to relay)
* B) is useless because cell selection related IE can be obtained after PC5 establishment. For OOC remote UE, it anyway will not preform cell selection
* C), D), E) include essential IEs for OOC remote UE to initiate RRC establishment. And their payload size is small:
	1. *cellAccessRelatedInfo* has ~173bit (assume 3 PLMN share common TA, ranac and Cell ID)
	2. T300 has 3bit, T319 has 3bit, and *useFullResumeID* is 1bit
* For F (UAC), we agree that UAC is generally not performed before cell camping. However, it will be useful for OOC remote UE to avoid camping in an overload cell. Thus, we think UAC parameters can be optionally provided before PC5 connection.
 |
| OPPO | C | Only Option C (or more specifically, the PLMN ID and cell ID in the IE, although fine to include other IEs for simplicity) is essential for cell camping, our understanding is other Options can be received after PC5-RRC connection. |
| Xiaomi | C, D | For A, remote UE can’t camp on the cell whose cellBarred is set to ture. Relay UE shall not perform discovery in this case.For others except C, D, the remote UE can obtain these information after PC5-RRC established. Because, remote UE could first establish PC5-RRC, then to trigger Uu RRC procedures, such as establishement transmission or UAC.  |
| CATT | None | Remote UE can acquire all the information irrespective relay (re)selection after PC5 connection establishment. |
| ASUSTeK | A), C), D), E), F) |  |
| MediaTek  | A |  |
| InterDigital | A, C, D, E, F | Agree with QC |
| Apple | A, C, F |  |

**Q6.6) Which option is preferable for forwarding of system information before PC5 connection establishment?**

1. **Broadcast PC5-RRC message**
2. **Relay Discovery Message**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm | B) | For A), our concern is:* We don’t think RAN2 can complete spec work to design new groupcast/broadcast PC5 RRC message. It has RAN1 impacts because it is a new PC5-RRC message. However, there is no RAN1 TU, we think it is NO way to work it out in this release. And it has SA2 impacts at least on L2 ID management.
* If a new broadcast/groupcast PC5 RRC is agreed, it implies that remote UE is required to monitor two broadcast messages (i.e., discovery message and broadcast/groupcast PC5 RRC) before PC5 connection, which introduces extra complexity for remote UE.

For B), we can agree to use a RRC container in discovery message, to avoid further involvement with SA2. And it can be left to SA2 to decide whether they are included in discovery message or “Relay Discovery Additional Information”.  |
| OPPO | Both are fine with comments (and this Q is overlapping with [620]) | We can follow majority view, if discovery message is concluded, we think these Sis should be conveyed as an RRC container in discovery to avoid rely on other working-group to specify RAN2 conclusion.We understand this Q is overlapping with [620] (!) there seems no need for duplicated discussion. |
| Xiaomi | A and B | We understand the SI information before PC5 establishment can be categorized into two types. Type 1, used for relay (re)selection. Type 2, used for AS procedure, e.g. T300/T319, if agreed in Q6.5.For type 1, we understand RAN2 has agreed to include in discovery message.For type 2, we think it’s better to include these information in AS, which is broadcast PC5-RRC message. |
| CATT | B | Indeed, in [620],we discuss this issue with more options. But never mind, we can also discuss it here. |
| ASUSTeK | A | We prefer Option A since Option B requires more interworking with SA2.We share the same view with Xiaomi that AS related information should be carried by AS signaling e.g. broadcast PC5-RRC message. |
| MediaTek  | A | Prefer to not mix the two type of information. Otherwise it will increase the possibility to send discovery message (based on the pool configuration) |
| Apple | B | There is no message size limit of discovery message in 5G ProSe. We do not need a new message to contain some additional information. |

d) SI forwarding after PC5-RRC Connection

* Proposal 10. Further discuss if SIB forwarding using broadcast [and groupcast] from Relay UE is allowed after PC5 connection establishment.

**Q6.7) Should SIB forwarding using groupcast/broadcast from the relay UE to remote UE(s) be allowed after PC5 connection establishment?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm  | No | We think unicast is sufficient in this release. Whether to support groupcast/broadcast can be discussed in next release.  |
| OPPO | No with comment | Unicast is always the existing tool for this.In case there is a need for G/B-cast RRC, we at least disagree with G-cast. |
| Xiaomi | Y | If broadcast PC5-RRC message is introduced, it’s more efficient to use broadcast message, since multiple remote UE may be interested in the same SIB. |
| CATT | Y | To avoid SL resource waste due to the relay UE sends the same modified SI and/or PWS to every linked remote UEs via unicast, the modified SI and/or PWS can be transmitted via SL broadcast to reduce the SL signaling overhead. |
| ASUSTeK | N | We think unicast for SIB forwarding after PC5 connection establishment is sufficient since different Remote UEs may require different SIBs. |
| MediaTek  | Y but | We think groupcast can be allowed if one SIB is sent to multiple Remote UEs. But broadcast based approach may be not needed |
| InterDigital | Y | This can avoid a large number of SL transmissions for relays with a large number of remote UEs, when SIB is updated. |
| Apple | No | After PC5-RRC connection is established between the remote UE and relay UE, SL unicast is the most reliable way to deliver the SIB |

e) Informing gNB of connected remote UE information

* Proposal 13. If P25 is agreed, discuss which one of the following options is preferable to be used by Relay UE to notify Remote UE ID (i.e. 5G-S-TMSI/I-RNTI) information to the gNB via dedicated RRC message for paging delivery purpose:
	+ Option a) UE Assistance information (1)
	+ Option b) SidelinkUEInformation (2)
	+ Option c) New RRC message (1)

**Q6.8) If the relay UE notifies the gNB of remote UE information (i.e. 5G-S-TMSI/I-RNTI), which RRC message should be used?**

1. **UE Assistance Information**
2. **SidelinkUEInformation**
3. **New RRC Message**
4. **Other**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm | B) | As it is sidelink UE related information, we prefer to reuse SUI. |
| OPPO | A) | Since we agreed it will be up to NW configuration on whether the dedicated paging forwarding is applied, the UAI message gives more control to gNB on whether the 5G-S-TMSI/I-RNTI of the remote UE is needed. Furthermore, UAI has a better performance in terms of security compared to SUI, considering it is to carry the key information of remote UEs. |
| Xiaomi | B | SUI already includes some remote UE’s information, e.g. destination id. It’s more efficient to reuse the same message. |
| CATT | B | No strong view, slightly prefer B. |
| ASUSTeK | B |  |
| MediaTek  | B |  |
| InterDigital | B, but we can go with majority view |  |
| Apple | A | Agree with OPPO. We prefer to keep remote UE related information in UAI message. |

f) Establishment Cause Determination

* *Proposal 16. If proposal 15 is agreed, discuss which one of the following options is preferable for Relay UE to use for establishment/resume cause value when Relay UE enters RRC\_CONNECTED only for relaying purpose:*
	+ *Option a) Provided by its upper layer*
	+ *Option b) Received from Remote UE*

**Q6.9) How does the relay UE determine the establishment/resume cause value when the relay UE enters RRC\_CONNECTED for relaying purposes only?**

1. **Provided by upper layers**
2. **Received from the remote UE**

|  |  |  |
| --- | --- | --- |
| Company | Response  | Comments  |
| Qualcomm | B) | A) will need extra work in SA2/CT1. Because RAN2 can resolve it by ourself, we prefer not to bother them.  |
| OPPO | A | As our reply in Q5.2, a new cause value can save the further debate on how to decide with cause value to be used. In light of that, although both A/B are feasible, we have slightly preference over A.  |
| Xiaomi | B | It’s not clear whether upper layer could provide cause value of remote UE. Option A may have impact to upper layer. Option B is a AS procedure. |
| CATT | A | RRC\_IDLE/ RRC\_INACTIVE relay UE initiates RRC establishment/resume procedure upon service request procedure from NAS. The cause value in RRC setup/resume request message is from higher layer. |
| MediaTek  | A |  |
| InterDigital | B | In legacy, upper layers determines the cause value because it is initiating the establishment. In this case, the remote UE is initiating the establishment. |
| Apple | B | Agree with Xiaomi that it is better to limit this for AS layer work |

g) Inter-gNB re-establishment and resume

* *Proposal 17. Discuss whether Inter-gNB RRC Re-establishment for the Remote UE is allowed.*
* *Proposal 23. RAN2 discuss whether INACTIVE remote UE can Resume via Relay UE served by a different gNB or via a different gNB directly, i.e., inter-gNB resume is allowed.*

**Q6.10) Should inter-gNB RRC Re-establishment for remote UE be supported?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm | Y | We have below justifications:1. No extra spec impact is foreseen:
	* Default PC5 configuration was agreed for the delivery of *RRCReestablishmentRequest.* Then, adaptation layer related configuration of remote UE is not required to be fetched by new gNB. Thus, we don’t see signalling change on inter-node message exchange.
	* As PDCP is End-to-End between remote UE and gNB, the legacy SN status transfer and path switch procedure in inter-gNB re-establishment can be reused.
2. It is unnecessary to specify re-establishment failure procedure due to inter-gNB which is artificial restriction:
	* According to TS 38.331, cell selection is triggered during RRC re-establishment procedure. And according to TS 38.304, best cell principle shall be followed by the UE during cell selection irrespective of inter-gNB or intra-gNB, due to coverage consideration.
	* Then, if the UE selects a different gNB for re-establishment, RAN2 need to specify a failure procedure due to the inter-gNB re-establishment. We don’t prefer to specify it because it is an artificial restriction.
 |
| OPPO | Y |  |
| Xiaomi | Y | We think the question is asking reestablishment via relay UE served by inter-gNB. We think it can be supported, since no large spec impact if foreseen. |
| CATT | Y | No technical issue and WID restriction on inter-gNB RRC Re-establishment for remote UE. |
| ASUSTeK | Y |  |
| MediaTek  |  | The proposal itself may need to clarify the concrete scenario since we prefer that group based mobility alike mechanism should be avoided in this release |
| InterDigital | Y | We see no additional spec impact to support this. |
| Apple | Y |  |

**Q6.11) Should resume by an INACTIVE remote UE to a relay served by a different gNB or a different gNB directly be supported (i.e. inter-gNB resume allowed)?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm | Y | Similar justification in Q6.10 |
| OPPO | Y |  |
| Xiaomi | Y | Same as Q6.10 |
| CATT | Y | No technical issue and WID restriction on inter-gNB RRC resume for remote UE. |
| ASUSTeK | Y |  |
| MediaTek |  | Same as Q6.10 |
| InterDigital | Y | Same as Q6.10 |
| Apple | Y |  |

h) Default configuration for Uu SRB0

* *Proposal 18. RAN2 discuss whether gNB should configure Relay UE’s Uu RLC carrying Remote UE’s SRB0 while sending Remote UE’s local/temporary ID towards the Relay UE i.e. default configuration is not needed for Uu RLC for SRB0.*

**Q6.12) Should default configuration for Uu RLC carrying SRB0 be specified?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm | Y | We prefer to specify a default configuration, but can follow majority |
| OPPO | N | The dedicated configuration is sufficient, no reason for the additional default configuration; Besides it is already agreed that “Relay UE is configured by gNB with the local/temp remote UE ID to be used in adaptation layer by RRCReconfiguration message before forwarding the first SRB0 UL message of the remote UE”.Proposal 15 (modified): Relay UE is configured by gNB with the local/temp remote UE ID to be used in adaptation layer by RRCReconfiguration message, after reporting the remote UE’s L2ID via SUI message to gNB and before forwarding the first SRB0 UL message of the remote UE. FFS if impact to the SUI contents is needed to enable this.  |
| Xiaomi | Y |  |
| CATT | Y |  |
| ASUSTeK | Y |  |
| MediaTek | N | “default configuration for Uu RLC carrying SRB0” may have an issue, when there was already Uu RLC(s) between Relay UE and gNB, which can carry the SRB0 already.  |
| InterDigital | Y | We prefer to specify a default configuration, but can follow majority. |
| Apple | N | The scenario mentioned by MTK need to be considered.  |

1. Uu RLF
* *Proposal 20. Upon Uu RLF, RAN2 discuss whether Relay UE sends new PC5-RRC message based indication to Remote UE.*

**Q6.13) Should a new PC5 RRC message be used for sending indication to the remote UE upon Uu RLF at the relay UE?**

|  |  |  |
| --- | --- | --- |
| Company | Response (Y/N) | Comments  |
| Qualcomm | N | We don’t see its benefit over the agreed “PC5-S message/indication”. |
| OPPO | N | We believe the agreed PC5-S is sufficient, no reason for the additional PC5-RRC signalling, and it is already agreed that “the sharing of unicast link between relay service and non-relay service in L2 relay is not considered.”Proposal 18: RAN2 does not consider the sharing of unicast link between relay service and non-relay service in L2 relay, and the related descriptions are to be removed from stage 2 running CR. |
| Xiaomi | Y with comments | We understand the indication should be carried in AS. Whether new or reuse existing message could be further discussed. If PC5-S is used to indicate the failure, remote UE has to release the PC5 connection. However, we understand remote UE should be allowed to keep PC5 connection, in certain cases. E.g. relay UE re-establish with the same cell or same gNB. |
| CATT | Y |  |
| MediaTek | Y | We do not think PC5-S should carry RLF indication, which is a AS layer issue. We need avoid to have unnecessary inter-layer interaction.  |
| InterDigital | Y | AS layer indication should be carried by PC5-RRC. Furthermore, depending on the behavior we want at the remote UE, sending the indication via PC5-S may be undesirable as it could lead to unnecessarily tearing down the PC5-RRC connection.  |
| Apple | Y | I think this is important for Layer 2 relay design. Otherwise, the benefit of Layer 2 vs Layer 3 is lost. |

# 3 Conclusion

# 4 References

1. R2-2109928 Summary of [POST115-e][610][Relay] Control Plane Procedures (InterDigital) - InterDigital
2. R2-2111368 – Summary of agenda item 8.7.2.1: Control Plane Procedures – Intel Corporation