

[RAN94e-R18Prep-12] Sidelink relay enhancements - Version 0.0.4
RAN

3GPP TSG RAN#94e

RP-212672

Electronic Meeting, December 6 - 17, 2021

Agenda Item: 8A.2

Source: LG Electronics

Title: Moderator's summary of discussion [RAN94e-R18Prep-12]

Document for: Report

1 Initial round

1.1 General

1.1.1 Item type

Please specify your view on whether sidelink relay enhancements need to start as a study item or a work item (including the need of potential study phase).

Feedback Form 1: Company input on the item type

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| 1 – Apple Europe Limited We prefer work item w/o study phase because SL relay has already been studied in R17 |
| 2 – AT&T Work item without a study phase is preferred. |
| 3 – Guangdong OPPO Mobile Telecom. We understand SL Relay needs to be started as a work item. |
| 4 – Ericsson LM Start a work item directly. If multi-path relaying is an objective, then that part should have a study phase. |
| 5 – InterDigital France R&D We prefer starting with a work item directly. |
| 6 – Beijing Xiaomi Mobile Software Work item is preferred |

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| <p>7 – LG Electronics Inc.</p> <p>This area can start as a WI but some objectives that were not fully studied before may require a study phase.</p> |
| <p>8 – China Mobile Com. Corporation</p> <p>we prefer starting with WI.</p> |
| <p>9 – HuaWei Technologies Co.</p> <p>We support starting with a WI.</p> |
| <p>10 – Lenovo Mobile Com. Technology</p> <p>Directly working will be fine since some study in most areas has already taken place.</p> |
| <p>11 – Spreadtrum Communications</p> <p>We prefer a work item.</p> |
| <p>12 – Sony Europe B.V.</p> <p>We understand SL Relays should be a Work item</p> |
| <p>13 – CATT</p> <p>We think SL relay can start as a work item directly.</p> |
| <p>14 – NEC Corporation</p> <p>We prefer to start WI phase directly since the design in Rel-17 can be used as baseline for both U2U and U2N relay.</p> |
| <p>15 – Fujitsu Limited</p> <p>Fujitsu: We support to start with a WI.</p> |
| <p>16 – vivo Mobile Communication Co.</p> <p>Start as a work item directly.</p> |
| <p>17 – Nokia Corporation</p> <p>In our view it depends on the scope. If focused and sufficiently limited scope is agreed, SL relay enhancements can continue as work item. However, if the scope is wide, it is better to study with study item. We prefer limited scope.</p> |
| <p>18 – ZTE Corporation</p> <p>We think work item is fine.</p> |
| <p>19 – CEWiT</p> <p>We support to start with work item directly</p> |

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| <p>20 – Fraunhofer IIS</p> <p>SL relay has been studied before the WI phase in Rel-17. Therefore, it can start with a WI.</p> |
| <p>21 – Philips International B.V.</p> <p>This area can start as a WI but some objectives that were not fully studied before may require a study phase.</p> |
| <p>22 – Qualcomm Incorporated</p> <p>It can be a Work Item with study phase, as most of the objectives are just continuations of the Rel-17 work. A few new aspects, including the multi-path relay support, would require some study first.</p> |
| <p>23 – Futurewei Technologies</p> <p>It can start as a WI.</p> |
| <p>24 – ROBERT BOSCH GmbH</p> <p>Support starting with a WI for sidelink relay enhancements.</p> |
| <p>25 – MediaTek Inc.</p> <p>We prefer to start with a WI, following on the study that was already done in Rel-17.</p> |
| <p>26 – Intel Korea</p> <p>We think SL Relay enhancements could be started as a work item with an optional short study phase at the beginning to discuss and finalize/narrow the scope of Multi-path if it is agreed to be part of the WID and if the scope is still not clear. We have not evaluated/explored this sub-topic during the Rel-17 study item when UE-to-UE relay and service continuity were studied in detail.</p> |
| <p>27 – Samsung R&D Institute UK</p> <p>It can be started as a work item.</p> |

1.1.2 Justification

This is to discuss how to fill the justification section of the potential SID/WID. The moderator thinks that at least the section can mention the outcome of Rel-17 SI and the limitation of Rel-17 WI in addressing what has been identified during the study. Please specify your view on the contents that need to be included in the justification section.

Feedback Form 2: Company input on the justification in the SID/WID

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| <p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We have submitted one draft in RP-211971, which have included some points mentioned by moderator above. Specifically, it is necessary to highlight in justification that SL Relay is helpful / designed for V2X, Public Safety and commercial use cases.</p> |
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2 – Ericsson LM

From a use case point of view, UE-to-UE relaying is relevant for and demanded by public safety entities. We think this should be captured in the justification.

3 – Apple Europe Limited

Agree with the rapporteur to begin with the gap between R17 SI scope and R17 WI. Also, we want to emphasize that the SL relay study aims to support multi-hop, multi-path relay scenarios for competing with mesh networking solutions created by other SDOs with alternative PHY/MAC technology . So, supporting Sidelink UE to UE relay and multi-hop relay extensions are quite important.

4 – InterDigital France R&D

In addition to the gap between Rel17 SI scope and R17 WI, we should also mention that SL relay should eventually support a mesh network solution for which both multipath and multihop are important.

5 – Beijing Xiaomi Mobile Software

The leftover in R17 should be mentioned, e.g. mobility restriction.

6 – LG Electronics Inc.

The baseline is to mention the outcome of Rel-17 SI and those not included in Rel-17 WI.

7 – China Mobile Com. Corporation

We agree with the rapporteur that star it from the leftover issues of R17.

8 – HuaWei Technologies Co.

We think the SL relay is designed for V2X, public safety and commercial use cases and the proposed topics here are to fulfill such requirements from important commercial needs and are not limited to R17 leftovers.

9 – CATT

We agree with the moderator, and as mentioned in our contribution RP-2112249, the justification include filling the gap between the Rel-17 SI and WI, e.g., there are motivations from different service types point of view, also from the applicable scenario point of view. Also, we need to mention additional justification for multipath, e.g., to achieve better reliability and throughput.

10 – Fujitsu Limited

We can start with the left-over issues and the limitation of Rel-17 WI not meeting the requirements of the important use cases.

11 – vivo Mobile Communication Co.

It is necessary to highlight the use cases of SL Relay e.g., whether V2X, Public Safety and commercial use cases all fall into the WID scope and make it clear for each use case the corresponding requirements e.g. coverage extension, reliability, power saving optimization etc.

12 – Nokia Corporation

Modertor’s proposal is acceptable to us.

13 – CEWiT

It is better to start with leftover from Rel-17 and some additional features

14 – ZTE Corporation

We may start from the scenarios that Rel-17 U2N had no time to address, such as the inter-gNB mobility, indirect to indirect path switch. In addition, the SL relay with multi-path may be considered. Then the UE-to-UE relay scenario need to be considered for V2X, public safety and commercial cases, such as factory automation.

15 – Philips International B.V.

Release 17 did not address many remaining topics, such as multi-hop relays, multi-path support, UE-to-UE relays, power saving, support for RedCap and CIoT devices, inter-gNB handover, etc. All of these topics have corresponding service requirements (e.g. as document by SA1 in TS 22.261) and many have been identified for SA2 release 18 phase 2 as well. So it should be easy to make a section listing all the topics that have not been addressed in release 17.

16 – Qualcomm Incorporated

Besides mentioning the Rel-17 WI status and missing items, reference to Rel-18 SA2 WG study item proposal can also be added, as some work may trickle down to RAN.

17 – Futurewei Technologies

The gap between R17 SI and R17 WI can be the starting point.

18 – ROBERT BOSCH GmbH

We agree to focus on new topics like U2U, multi-hop and multipath, where they are all linked to V2X, PS, and commercial use cases. However, some essential left-overs and limitations of Rel-17 U2N relay need to be addressed.

19 – MediaTek Inc.

The Rel-17 SI/WI gap is the natural starting point, as suggested by the moderator. The justification should identify not only public safety as a use case but also V2X and commercial use cases. (Long platoons and smart buildings are respective examples for U2U relay.) Multihop, if included, provides greater coverage extension; multi-path, if included, allows meeting reliability targets for challenging services (as discussed in Rel-17 in RAN2). The mobility limitations from Rel-17 can be addressed as a natural process of bringing relayed services to where they perform comparably to direct-path services. We also see that the direction of evolution of the sidelink is toward a mesh topology: a multi-hop, multi-path blend of U2U and U2N links, allowing service data to travel along the most expedient path.

20 – Intel Korea

The justification could suggest that a Rel-17 Study Item of “Study on NR Sidelink Relay” has been carried out by 3GPP in RAN2, which covers the enhancements and solutions necessary to support the UE-to-UE coverage extension similar to that done for U2N relaying in Rel-17; it needs to cover the fact that service continuity for U2N relaying is supported for intra-gNB scenarios and inter-gNB is an extension to be covered/supported in Rel-18; as well as the need to increase reliability using multi-path support.

We could also cover the support of both Layer-2 and Layer-3 relaying to provide uniform solutions as compared to U2N relaying since both solutions have been studied and found to be feasible and recommended from RAN2 and SA2 perspectives.

21 – Samsung R&D Institute UK

Ongoing Rel-17 WI on SL relay does not support a scenario to extend the coverage of direct communication among UEs with no Uu coverage. This is one critical scenario to support in public safety when NW is collapsed. So RAN need to further work on SL relay to extend UE-to-UE coverage.

22 – Verizon UK Ltd

Agree with modertor’s proposal and may also want to address commercial use cases in this WID as well, like coverage/capacity expansion.

1.1.3 Others

If any, please specify other discussion topics relevant to the general aspect.

Feedback Form 3: Company input on other topics relevant to the general aspect

1 – Ericsson LM

Given that there is a parallel discussion on SL enhancements in Rel-18, we think that it is important to keep the scope of the WI limited.

In our view, specifying SL UE-to-UE relays, if they include L2 solutions, is not compatible with other enhancements.

2 – Philips International B.V.

The Sidelink Relay SI/WI should be aligned with SA WG2 release 18 proposals for ProSe phase 2. The Sidelink Relay SI/WI should also closely cooperate with the sidelink enhancements SI/WI.

3 – ROBERT BOSCH GmbH

Many open topics are still not answered for SL relay in Rel-17, even for U2N, e.g.:

- relation between SL relay and power saving
- whether and how Sidelink relay can perform inter UE coordination.

When multi-hop is specified, the following considerations need to be discussed:

- resource allocation
- congestion control
- HARQ feedbacks

We believe SL relay in Rel-18 requires more RAN1 involvements.

1.2 UE-to-UE relay

This section is to discuss potential objective for UE-to-UE relay. The conclusion from [RAN93e-R18Prep-06] was as follows:

- Limit the scope to the single hop operation while taking into account the forward compatibility for supporting more than one hop in a later release.
- Discuss whether Layer-2 and/or Layer-3 relay need to be considered. Discuss whether to limit the scope to unicast
- Leading WG: RAN2, Secondary WG: TBD. SA/CT impact is expected

Please indicate overall view on the inclusion of UE-to-UE relay in SID/WID.

Feedback Form 4: Company input for the overall view on the inclusion of UE-to-UE relay

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| 1 – AT&T We are ok with a Rel-18 scope for UE-UE Relay to focus on L2 + single-hop operation (with forward compatibility for multi-hop operation) |
| 2 – Guangdong OPPO Mobile Telecom. U2U Relay should be included in the item. |
| 3 – Ericsson LM Yes we think UE-to-UE relay should be included. |
| 4 – Apple Europe Limited We support to include the UE-to-UE relay. |
| 5 – InterDigital France R&D We are ok with inclusion of this item in the work. |
| 6 – Beijing Xiaomi Mobile Software We agree U2U relay could be included |
| 7 – LG Electronics Inc. We think UE-to-UE relay is an important feature and should be included in Rel-18. |
| 8 – China Mobile Com. Corporation We are fine with current conclusion for U2U relay. |
| 9 – HuaWei Technologies Co. We are fine to consider so in Rel-18. |

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| <p>10 – Lenovo Mobile Com. Technology</p> <p>We strongly support U2U relay. This was left out in the middle in Rel. 17 and we expect OOC U2U will play a key role in industry, commercial and public safety domains.</p> |
| <p>11 – Spreadtrum Communications</p> <p>UE-to-UE relay should be included in the item.</p> |
| <p>12 – Sony Europe B.V.</p> <p>Yes we think U2U should be in the scope</p> |
| <p>13 – CATT</p> <p>We support to include the UE-to-UE relay in this item.</p> |
| <p>14 – NEC Corporation</p> <p>Layer-2 U2U relay with unicast is preferred. And the study on single-hop operation is of higher priority and we can move on to multi-hop scenario if time permission.</p> |
| <p>15 – Fujitsu Limited</p> <p>We support to include UE-to-UE relay and we are OK with limiting the scope to unicast.</p> |
| <p>16 – vivo Mobile Communication Co.</p> <p>We are fine to include both L2&L3 UE-to-UE relay, but with the single-hop operation prioritized.</p> |
| <p>17 – Nokia Corporation</p> <p>We are ok to include it and the moderator’s proposal for the scope is acceptable for us.</p> |
| <p>18 – CEWiT</p> <p>We support to consider UE-to-UE relay in Rel-18</p> |
| <p>19 – ZTE Corporation</p> <p>We are fine to consider UE-to-UE relay. Both the UE type relay and gNB type relay may be considered. Single hop and unicast operation can be prioritized.</p> |
| <p>20 – Fraunhofer IIS</p> <p>We support to include UE-to-UE relay.</p> |
| <p>21 – Philips International B.V.</p> <p>We are fine to include both L2&L3 UE-to-UE relay, with unicast operation prioritized.</p> |
| <p>22 – Qualcomm Incorporated</p> <p>The UE-to-UE Relay should be included in Rel-18 Sidelink Relay enhancements. This is a left-over topic from Rel-17 and the work should try to reuse the work already done in Rel-17.</p> |

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| <p>23 – Futurewei Technologies</p> <p>We support to include UE-to-UE relay in the scope of Rel-18 WI.</p> |
| <p>24 – ROBERT BOSCH GmbH</p> <p>UE-to-UE relay should be in Rel-18</p> |
| <p>25 – MediaTek Inc.</p> <p>UE-to-UE relay is well motivated for Rel-18, not only for public safety but also for V2X and commercial use cases.</p> |
| <p>26 – Intel Korea</p> <p>We are supportive of U2U relay inclusion in the WID as it is an important feature for public safety. L2 and L3 U2U relaying for coverage extension of a sidelink connection between two UEs was already studied extensively in RAN2 but not included as part of Rel-17 WID due to work scope reduction.</p> |
| <p>27 – Samsung R&D Institute UK</p> <p>UE-to-UE relay should be included with limiting the scope to single hop.</p> |
| <p>28 – Continental Automotive GmbH</p> <p>We support UE-to-UE relay in Rel. 18.</p> |

1.2.1 Operation scenarios

What is your view on the conclusion from [RAN93e-R18Prep-06] in terms of the number of hops? It is the moderator’s understanding that “one hop UE-to-UE relay” refers to the scenario “source UE -> relay UE -> destination UE.”

Feedback Form 5: Company input on the number of hops

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| <p>1 – AT&T</p> <p>We have the same understanding as the moderator.</p> |
| <p>2 – Ericsson LM</p> <p>To keep the scope reasonable, focus on one hop UE-to-UE relay in Rel-18. We share the moderator’s view on one hop.</p> |
| <p>3 – Apple Europe Limited</p> <p>We think it is unnecessary to limit the scope to single-hop relay. The work can begin with single-hop solution based on SI conclusions, which should not take too much time. Then RAN WGs can continue work on multi-hop extensions in the same release.</p> |
| <p>4 – InterDigital France R&D</p> <p>We think multihop extensions can be considered for this release.</p> |

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| <p>5 – Beijing Xiaomi Mobile Software</p> <p>We think single hop should be done first.</p> |
| <p>6 – LG Electronics Inc.</p> <p>We are fine with limiting the work scope to one hop UE-to-UE relay in order to mitigate the work load problem.</p> |
| <p>7 – China Mobile Com. Corporation</p> <p>We agree with single hop only for R18 and share the same understanding as moderator.</p> |
| <p>8 – HuaWei Technologies Co.</p> <p>We are fine to consider single hop only for Rel-18.</p> |
| <p>9 – Lenovo Mobile Com. Technology</p> <p>More than 1 hops should be included, most features from a single hop must be reusable for multi-hop. To be useful in OOC multi-hop will play a key role.</p> |
| <p>10 – Spreadtrum Communications</p> <p>We agree to limit the scope to one hop UE-to-UE relay.</p> |
| <p>11 – Sony Europe B.V.</p> <p>Same understanding as the moderator</p> |
| <p>12 – CATT</p> <p>We share the same understanding as the moderator regarding the scenario. In terms of the number of hops, we think we can focus on 1 hop in Rel-18 to limit the work load.</p> |
| <p>13 – Fujitsu Limited</p> <p>We are fine with one hop UE-to-UE relay.</p> |
| <p>14 – NEC Corporation</p> <p>We share the same understanding with moderator about ‘one hop UE-to-UE relay’ and suggest to studying one hop operation first.</p> |
| <p>15 – vivo Mobile Communication Co.</p> <p>Limit the scope to one hop in R18. Agree with the moderator’s understanding on one hop UE-to-UE relay.</p> |
| <p>16 – Nokia Corporation</p> <p>We have the same understanding as the moderator.</p> |
| <p>17 – ZTE Corporation</p> <p>We share the same understanding with moderator.</p> |

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| <p>18 – CEWiT</p> <p>We feel Single hop relay should be focused first and multihop can be considered as second priority.</p> |
| <p>19 – Fraunhofer IIS</p> <p>We are fine to start with single hop considering a forward compatibility to multi-hop.</p> |
| <p>20 – Philips International B.V.</p> <p>We agree with CATT</p> |
| <p>21 – Qualcomm Incorporated</p> <p>The work should focus on one hop UE-to-UE Relay case, i.e. only 1 relay UE between the source UE and destination UE.</p> <p>Multi-hop case would require a study with requirements from upper layer WGs, e.g. SA2.</p> |
| <p>22 – Futurewei Technologies</p> <p>We can start with 1-hop UE-to-UE relay. The support of multi-hop should be considered together with UE-to-network relay.</p> |
| <p>23 – ROBERT BOSCH GmbH</p> <p>We have the same understanding as the moderator, this is the single-hop or one-hop relay.</p> |
| <p>24 – MediaTek Inc.</p> <p>We think ultimately multihop will be important, and we should at least have it in mind for Rel-18. Considering the need to limit the work scope, it could be OK to start from the single-hop case, but we should consider forward compatibility to multihop even if we don't specify it in the first release.</p> |
| <p>25 – Intel Korea</p> <p>The UE-to-Network relaying in Rel-17 supports only a single hop for relaying. It would be beneficial to include multi-hop support to extend the coverage. This feature can be simultaneously considered for both U2N and U2U relaying cases.</p> <p>However, we are ok to consider single hop as baseline if most companies have this preference.</p> |
| <p>26 – Samsung R&D Institute UK</p> <p>The scope should be limited to single hop. Can consider forward compatibility for more than one hop in a later release.</p> |
| <p>27 – TOYOTA Info Technology Center</p> <p>We are OK with one-hop UE-to-UE relay.</p> |
| <p>28 – Continental Automotive GmbH</p> <p>We consider convenient to start with the one-hop scenario in Rel. 18.</p> |

What is your view on the UE-to-UE relay scenario in terms of Layer-2 and/or Layer-3 relay? And what is your

view on the cast types to be included in this SI/WI?

Feedback Form 6: Company input on the L2/L3 relay and cast types

1 – AT&T

We are ok to focus on the L2 relay design and unicast traffic. However, in order to support public safety use cases we also believe multicast support should not be precluded.

2 – Ericsson LM

We propose to specify only L3 relays. We think that L3 relaying can meet the basic set of requirements with the smallest amount of work and the highest chances of being implemented and deployed. If market demands better performing solutions, 3GPP can consider the introduction of L2 relaying in a later release.

We propose limiting the scope to unicast. We do not see the relevant of relays for other traffic types than unicast.

3 – Apple Europe Limited

We are fine to consider both L2 and L3, but RAN work on the Layer 3 UE-to-UE relay solution shall be limited to relay discovery, relay (re)selection, and relay authorization, according to the R17 SI conclusions.

Regarding the cast-type, we think both unicast and groupcast can be considered. AS layer broadcast via relay has no obvious advantages than OTT(over-the-top) solutions, so we think support of broadcast is not needed.

4 – InterDigital France R&D

We think both L2 and L3 can be considered, but L3 work in RAN2 should be limited to the common parts (as it was for Rel16). For the cast type, it may be best to start with unicast and leave groupcast to future releases.

5 – Beijing Xiaomi Mobile Software

We think either L2 or L3 is fine, as long as the requirement can be met. We think it's unnecessary to specify two types of relay, if the use case/scenarios are same to both L2 and L3 relay.

6 – LG Electronics Inc.

We think both L2 and L3 relays should be considered in Rel-18 similarly to the UE-to-Network relay case. For the cast types, we think the work scope can be limited to the unicast which would be relatively simple to specify in our view. UE-to-UE relay for groupcast and broadcast may require a quite different approach as a single relay UE may not be able to cover all the destination UEs, and also there can be resource consumption issue if multiple relay UEs begin to relay a single original packet.

7 – China Mobile Com. Corporation

Both L2 and L3 U2U relay can be considered and the common part of them can be studied with high priority, such as relay selection and reselection, discovery and authorization.

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| <p>8 – HuaWei Technologies Co.</p> <p>We share similar views as Ericsson, in Rel-18 we can focus on L3 U2U relay with unicast only.</p> |
| <p>9 – Lenovo Mobile Com. Technology</p> <p>We prefer L2 relay and for all cast types.</p> |
| <p>10 – Spreadtrum Communications</p> <p>We prefer to support both L2 and L3 relays in Rel-18. For the cast type, although we think groupcast might be useful in some cases, we prefer to focus on unicast in Rel-17 and leave groupcast to future release.</p> |
| <p>11 – Sony Europe B.V.</p> <p>L2 relay and unicast</p> |
| <p>12 – CATT</p> <p>We think both L2 and L3 relay can be considered in Rel-18. L3 relay has limited RAN impact so the effort is anyway small for RAN. Regarding the cast type, we think unicast should have higher priority, and if time allowed, groupcast and broadcast can also be included considering the public safety requirements.</p> |
| <p>13 – NEC Corporation</p> <p>We suggest that U2U scope focuses on Layer-2 and single-hop relay. For cast type, both unicast and multicast can be considered.</p> |
| <p>14 – Fujitsu Limited</p> <p>We think that both Layer-2 U2U relay and Layer-3 U2U relay can be supported in this release. For cast type, unicast can be considered first.</p> |
| <p>15 – vivo Mobile Communication Co.</p> <p>We think both L2 and L3 UE-to-UE relay can be included. This is also inline with the principle in R17 where we start both L2 and L3 UE-to-Network relay.</p> <p>With regards to the cast types, we suggest at least unicast type should be studied.</p> |
| <p>16 – Nokia Corporation</p> <p>The moderator’s scope proposal is acceptable for us but it is also ok for us to focus on L3 SL relay enhancements</p> |
| <p>17 – CEWiT</p> <p>We support both unicast as well as groupcast scenario</p> |
| <p>18 – ZTE Corporation</p> <p>Both L2 and L3 UE-to-UE rely may be considered. However, according to the study in Rel-17, L3 UE-to-UE relay has very little impact on RAN. So RAN should focus on the specification work of L2 UE-to-UE relay. We may start from the unicast operation. Other cast type may be considered only if time allows.</p> |

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| <p>19 – Fraunhofer IIS</p> <p>We think that both, unicast and multi-cast, should be supported.</p> |
| <p>20 – Philips International B.V.</p> <p>We agree with Interdigital and LG</p> |
| <p>21 – Qualcomm Incorporated</p> <p>It was already agreed in Rel-17 that L3 UE-to-UE relay can be supported with upper layer enhancements, e.g. that is defined in SA2. On the other hand, L2 UE-to-UE relay will require further RAN2 study to complete the design and further align with SA2 design.</p> <p>Support of unicast relay has been the assumption for Rel-17 work. To expand the cast type will require confirmation from SA2 regarding the use case and requirements.</p> |
| <p>22 – Futurewei Technologies</p> <p>Both L2 and L3 can be considered, but L3 work in RAN2 should be limited to the common parts as in Rel-17.</p> |
| <p>23 – ROBERT BOSCH GmbH</p> <p>Focus on L2, unicast, and groupcast (very important for automotive)</p> |
| <p>24 – MediaTek Inc.</p> <p>We would prefer L2 only, as we don't see value in L3 U2U relay. There is no design on offer for L3 U2U that can provide end-to-end security or service continuity (and regarding security, we understand that public safety actors have indicated they have use cases where the relay is not necessarily a trusted device), so it isn't a viable solution for commercial use cases; we think it has a risk of becoming a paper feature.</p> <p>We tend to think work could start from unicast, but groupcast is also important for V2X and PS use cases and should be considered if possible.</p> |
| <p>25 – Intel Korea</p> <p>We think that both L2 and L3 relay need to be considered aligned with U2N relaying, but it needs SA2 input; for U2U relaying itself, we see unicast traffic to be most applicable; we do not see strong motivation for broadcast/groupcast support.</p> |
| <p>26 – Samsung R&D Institute UK</p> <p>Layer-3 relay is preferred but we are fine to work on layer-2 relay. Broadcast/groupcast should be supported for public safety scenario.</p> |
| <p>27 – Continental Automotive GmbH</p> <p>For us, both options should be in-scope.</p> |

1.2.2 Objective details

If UE-to-UE relay is agreed to be included in the SID/WID, what is your view on the detailed objectives? The moderator proposes to take those listed in RP-211050 for UE-to-Network relay as the starting point (i.e., relay

discovery and (re)selection, Relay and Remote UE authorization, end-to-end QoS management, service continuity, adaptation layer design, control plane procedures) and discuss what to add/remove. The moderator notes that potential enhancements for UE-to-Network relay will be discussed separately so suggest focusing on the mechanisms used in UE-to-UE relay.

Feedback Form 7: Company input on the detailed objectives of UE-to-UE relay

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| <p>1 – AT&T</p> <p>We are fine with the moderator’s suggestion as the starting point of the WID objectives.</p> |
| <p>2 – Guangdong OPPO Mobile Telecom.</p> <p>We do not think all the bullets in R17 SL Relay WID has to be copied for U2U Relay. As concluded in the R17 study item, captured in TR 38.836, 1) for both L2 and L3 U2U Relay, there is no AS impact from QoS, so the QoS management is not needed; and 2) service-continuity was not concluded for U2U at all, thus not even studied / captured in TR 38.836, so no need either. And please note that the adaptation layer design and CP procedure is only needed for L2 relay, but not L3 relay.</p> |
| <p>3 – Ericsson LM</p> <p>For L3 relaying, we think that only two objectives are necessary:</p> <ul style="list-style-type: none"> · Relay discovery and (re)selection [RAN2, RAN4] · Relay and Remote UE authorization [RAN3] <p>For L2 relaying, we agree with the moderator’s proposal.</p> <p>If both L2 and L3 relaying were agreed, prioritizing common work would be appropriate, like in Rel-17.</p> |
| <p>4 – Apple Europe Limited</p> <p>Here is the example objective list reflecting our view on U2U relay work:</p> <p>Work Item objectives on aspects for UE-to-UE relay for both single-hop and multi-hop:</p> <ol style="list-style-type: none"> 1. Specify mechanism for U2U relay discovery and (re)selection [RAN2] 2. Specify mechanisms for Relay and Remote UE authorization [RAN3] 3. Specify mechanisms for U2U Adaptation layer design for Layer 2 relaying [RAN2] 4. Specify Control Plane procedures for Layer 2 relaying [RAN2, RAN3] |
| <p>5 – InterDigital France R&D</p> <p>We are fine with the moderator’s suggestion as starting point.</p> |
| <p>6 – Beijing Xiaomi Mobile Software</p> <p>Agree with moderator</p> |

7 – LG Electronics Inc.

We think all the features are necessary except QoS and service continuity, i.e., we need to cover relay discovery and (re)selection, Relay and Remote UE authorization, adaptation layer design, and control plane procedures. We understand QoS and service continuity in UE-to-UE relay have not been studied in the study item and we are not sure if it is a relevant scope.

8 – HuaWei Technologies Co.

We think discovery and relay (re)selection is needed irrespective whether it is L2 or L3 relay. Regarding L2 relay, additional QoS management and CP procedures are needed, but we do not see service continuity is required.

9 – China Mobile Com. Corporation

For L2 and L3 U2U relay:

1. Specify discovery and relay (re)selection [RAN2]
2. Specify authorization for relay UE and remote UE [RAN3]

For L2 U2U relay:

3. Specify control plane procedure, e.g. RRC management, SI delivery, paging and access control [RAN2, RAN3]
4. Specify mechanisms for U2N Adaptation layer design [RAN2]
5. Specify mechanisms for E2E QoS management [RAN2]
6. Specify mechanisms for service continuity [RAN2]

10 – Spreadtrum Communications

We are fine with the moderator's suggestion, but we need to emphasize that QoS and service continuity are not needed.

11 – CATT

In our understanding, there are differences between U2N and U2U relay. So we cannot reuse the objectives for U2N relay, e.g., the bullets on service continuity and QoS need to be dropped. In addition, we think there are some user plane impacts, e.g., which resource allocation mode can be used for U2U relay, etc.

Hence we'd suggest to add user plane procedures to the objective. As an example, we copy the bullets in RP-212249 for detailed objective for U2U relay:

Specify mechanisms to support U2U Relay:

- a) Specify mechanisms common for both L2 and L3 U2U Relay:
 - Relay discovery and (re-)selection;
 - Relay and Remote UE authorization .
- b) Specify mechanisms specific for L2 U2U Relay:
 - Specify mechanisms for Relay Adaptation layer design ;
 - Specify Control Plane and User Plane procedures.

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| <p>12 – NEC Corporation</p> <p>We are ok to use technique issues listed for U2N relay as the starting point.</p> |
| <p>13 – Fujitsu Limited</p> <p>We are fine with the moderator’s suggestion.</p> |
| <p>14 – vivo Mobile Communication Co.</p> <p>Support both L2 and L3 with the following bullets:</p> <ul style="list-style-type: none"> a. relay discovery and (re)selection b. Authorization c. PC5 adaptation layer d. QoS management e. CP procedures e.g., for PC5 link management and radio bearer configuration |
| <p>15 – Nokia Corporation</p> <p>Moderator’s scope proposal is acceptable. This may require a study phase.</p> |
| <p>16 – CEWiT</p> <p>We feel Single hop relay should be focused first and may be later on as Rel. progress multi-hop can be considered</p> |
| <p>17 – CEWiT</p> <p><i>Kindly ignore last comment. Its in wrong section. Sorry for inconvenience</i></p> <p>We agree with the proposal made by moderator</p> |
| <p>18 – ZTE Corporation</p> <p>Potential objectives for UE-to-UE relay are as follows:</p> <p>Specify mechanisms for proximity discovery, routing path detection and selection [RAN2, RAN3]</p> <p>Specify mechanisms for control plane and user plane protocol stack design [RAN2]</p> <p>Specify mechanism for control plane procedure, e.g., connection management of relayed connection, bearer mapping and E2E QoS management [RAN2, RAN3]</p> <p>Specify mechanism for UE authorization [RAN3]</p> |
| <p>19 – Fraunhofer IIS</p> <p>We agree with the moderator’s suggestion.</p> |
| <p>20 – Philips International B.V.</p> <p>We agree with Vivo</p> |

21 – Qualcomm Incorporated

For Relay discovery, the AS layer mechanism should reuse the existing relay discovery design from AS layer perspective.

For Relay (re) selection, AS layer criteria can be studied besides the upper layer inputs.

End-to-end QoS management requires inputs from SA2, but should reuse the Rel-17 sidelink design.

Service continuity concept for UE-to-UE relay is not clearly defined. This needs to be confirmed by SA2 first.

Adaption Layer design and AS layer control plane procedures should be led by RAN2, after the above designs are clear.

22 – Futurewei Technologies

We are fine with Apple's suggestion.

23 – ROBERT BOSCH GmbH

We believe Rel-18 sidelink relay enhancements should involve more RAN1 enhancements, e.g.,:

- congestion control
- HARQ feedback
- resource allocation (e.g., multi-hop relay)
- inter-UE coordination

24 – MediaTek Inc.

We generally agree with Apple's list of objectives, except that we think service continuity should also be considered (just as in U2N, if there is a service offered end-to-end, it doesn't make sense to interrupt the service because of switching the relay used for transport).

25 – Intel Korea

We think that the study item TR 38.836 could also be used as input for detailed objectives. Service continuity was not necessarily considered for U2U relaying. We do not prefer the scenario of service continuity while switching from direct sidelink communication to U2U relaying based sidelink communication as there is no central entity to perform/control the path switching. The following can be considered:

Work Item objectives on aspects common to both L2 and L3:

1. Specify mechanisms for U2U relay discovery and (re)selection for L3 and L2 relaying [RAN2, RAN4]
 - a. Re-use LTE relay discovery and (re)selection as baseline
2. Specify mechanisms for Relay and Remote/destination UE authorization for L3 and L2 relaying [RAN3]
 - a. Re-use LTE as baseline

Work Item objectives specific to Layer-2 (L2) relaying:

3. Specify mechanisms for E2E, QoS management [RAN2]
4. Specify mechanisms for U2U Adaptation layer design [RAN2]
 - a. For bearer mapping and Remote UE identification, incl. RAN related security aspects if any
5. Specify Control Plane procedures for U2U (e.g. connection management) [RAN2]

26 – Samsung R&D Institute UK

The objectives can include the followings:

U2U relay discovery and (re)selection, U2U relay UE and remote UE authorization

If Layer-2 relay is included, L2 specific features e.g., PC5 adaptation layer design, control plane procedures if any RAN impact is identified by SA2

27 – Continental Automotive GmbH

Agree with the moderator.

Can we confirm RAN2 as the leading WG and the existence of SA/CT impact for this objective? What is your view on the secondary WGs?

Feedback Form 8: Company input on the WGs and SA/CT impact

1 – AT&T

Yes, RAN2 should be the lead WG.

2 – Guangdong OPPO Mobile Telecom.

RAN2 as the leading WG, and SA/CT impact exists. We foreseen impact on RAN3 for authorization and RAN4 for discovery/relay-(re)selection part.

3 – Ericsson LM

Leading WG: RAN2

Secondary WGs: RAN3, RAN4

SA/CT impact: Yes – SA2, SA3, CT1

4 – Apple Europe Limited

RAN2 is the leading WG, and there are SA/CT impact. RAN3/4 can be secondary WGs

5 – InterDigital France R&D

Leading WG: RAN1, Secondary WG: RAN1, RAN3, RAN4

6 – Beijing Xiaomi Mobile Software

RAN2 as leading WG, RAN3, RAN4 as secondary WGs. There is impact to SA/CT at least from discovery message point of view.

7 – LG Electronics Inc.

We can confirm RAN2 as the leading WG, RAN3/4 as secondary WGs. SA/CT impact is expected.

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| <p>8 – HuaWei Technologies Co.</p> <p>We think this depend on the type of U2U relay. For L2 U2U relay, RAN2 should be the leading WG. If it is L3 U2U relay, SA2 could be the leading WG. In any case, the coordination with SA/CT is needed, and involvement of RAN3 is also needed.</p> |
| <p>9 – Lenovo Mobile Com. Technology</p> <p>Yes, RAN2 should lead it.</p> |
| <p>10 – China Mobile Com. Corporation</p> <p>Leading WG: RAN2; Secondary WGs: RAN3, RAN4.</p> |
| <p>11 – Spreadtrum Communications</p> <p>RAN2 is the leading WG and SA/CT impact is expected. RAN3/4 is the secondary WGs.</p> |
| <p>12 – Sony Europe B.V.</p> <p>Yes Ran2 should be leading WG</p> |
| <p>13 – CATT</p> <p>Agree that RAN2 is the leading WG, and secondary WGs may include R1,R3,R4. Also there is also need for SA and CT involvement.</p> |
| <p>14 – NEC Corporation</p> <p>Yes, RAN2 should be the leading WG. And SA2 can be the secondary WG since some schemes for U2U such as relay discovery can be handled by this group.</p> |
| <p>15 – Fujitsu Limited</p> <p>Yes, RAN2 should be the leading group and SA/CT impact should be considered.</p> |
| <p>16 – vivo Mobile Communication Co.</p> <p>The situation is similar to R17 SL relay, i.e., RAN2 as the leading WG, RAN3 and RAN4 as the secondary WG, and SA/CT impact can be foreseen at least for discovery and security related part.</p> |
| <p>17 – Nokia Corporation</p> <p>Moderator’s proposal to have the RAN2 as the leading WG is acceptable to us but involvement of other groups including SA/CT is also needed.</p> |
| <p>18 – CEWiT</p> <p>RAN2 as lead RAN3 and RAN4 as secondary</p> |

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| <p>19 – ZTE Corporation</p> <p>Yes, we think RAN2 should be the leading WG.</p> |
| <p>20 – Philips International B.V.</p> <p>We agree with Vivo</p> |
| <p>21 – Qualcomm Incorporated</p> <p>RAN2 can lead the work from AS layer perspective. System level design has to be coordinated with SA2. Security aspects for UE-to-UE Relay needs SA3 inputs.</p> |
| <p>22 – Futurewei Technologies</p> <p>Yes, RAN2 should be the leading WG.</p> |
| <p>23 – ROBERT BOSCH GmbH</p> <p>RAN2 can be in the lead; however, RAN1 and RAN3 are secondary groups.</p> |
| <p>24 – Intel Korea</p> <p>Yes, RAN2 can be the leading WG and RAN3, RAN4 can be secondary WG; it is to be noted that for the U2U relaying objective, there is a lot of SA/CT impact;</p> |
| <p>25 – MediaTek Inc.</p> <p>We agree with others that RAN2 is the lead WG. Involvement of RAN1 depends on how we coordinate with the sidelink enhancements WI; in Rel-17, we put all the PHY sidelink enhancements in the RAN1-led WI. But if there are lower-layer enhancements that are truly relay-specific, then RAN1 would be a secondary WG. We foresee significant SA2 interaction.</p> |
| <p>26 – Samsung R&D Institute UK</p> <p>RAN2 as leading WG. SA/CT impacts exist.</p> |
| <p>27 – Continental Automotive GmbH</p> <p>We confirm RAN2 as leading WG.</p> |

1.2.3 Others

If any, please specify other discussion topics relevant to the UE-to-UE relay aspect.

**Feedback Form 9: Company input on other topics relevant to
UE-to-UE relay**

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| 1 – Intel Korea |
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1.3 Service continuity enhancements

This section is to discuss potential objective for service continuity enhancements. The conclusion from [RAN93e-R18Prep-06] was as follows:

- The target scenarios are inter-gNB mobility and indirect-to-indirect path switching.
 - Continue discussion on whether the indirect-to-indirect path switching will include the inter-gNB mobility case.
- Leading WG: RAN2, Secondary WG: RAN3. SA/CT impact is expected

Please indicate overall view on the inclusion of service continuity in SID/WID.

**Feedback Form 10: Company input for overall view on the
inclusion of service continuity enhancements**

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| 1 – AT&T |
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| We strongly support this objective as a critical part of the Rel-18 work item. Given that indirect-to-indirect path switching may be triggered by inter-gNB mobility, we believe it should also be considered as a scenario to be included in the work item scope. |
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| 2 – Guangdong OPPO Mobile Telecom. |
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| Service continuity should be included in the item. |
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| 3 – Ericsson LM |
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| Yes we are supportive in general, but please see next replies on the scenarios. |
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| 4 – Apple Europe Limited |
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| We support the work on R17 leftover of service continuity aspects for L2 U2N relay. |
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| 5 – InterDigital France R&D |
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| We support this work. |
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| 6 – Beijing Xiaomi Mobile Software |
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| Support this objective |
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| <p>7 – LG Electronics Inc.</p> <p>We think this topic is a leftover from Rel-17 WI and should be included in Rel-18 in order to complete the service continuity solutions in UE-to-Network relay.</p> |
| <p>8 – HuaWei Technologies Co.</p> <p>We are OK to accept this if the majority wants, even though we don't think this is of high priority.</p> |
| <p>9 – Lenovo Mobile Com. Technology</p> <p>Lenovo, Motorola Mobility View: Service Continuity must be a part of work in R18.</p> |
| <p>10 – China Mobile Com. Corporation</p> <p>We support this objective.</p> |
| <p>11 – Spreadtrum Communications</p> <p>We support to included this topic in Rel-18</p> |
| <p>12 – Sony Europe B.V.</p> <p>For service continuity, we think inter gNB mobility, resulting in indirect to indirect path switching, should be part of the WI</p> |
| <p>13 – CATT</p> <p>We support to include this in this item.</p> |
| <p>14 – NEC Corporation</p> <p>We are ok to consider indirect-to-indirect path switching for inter-gNB mobility case.</p> |
| <p>15 – Fujitsu Limited</p> <p>We support all the scenarios.</p> |
| <p>16 – vivo Mobile Communication Co.</p> <p>We support service continuity enhancement.</p> |
| <p>17 – Nokia Corporation</p> <p>It is ok for us to include service continuity enhancements to the scope.</p> |
| <p>18 – ZTE Corporation</p> <p>We support the service continuity enhancement and we think the inter-gNB indirect to indirect path switching should also be considered.</p> |
| <p>19 – Fraunhofer IIS</p> <p>We support this objective.</p> |

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| <p>20 – Philips International B.V.</p> <p>We are OK to accept this if the majority wants, even though we don't think this is of high priority, and we would prefer to spend our time/effort on other topics (see comments below)</p> |
| <p>21 – Qualcomm Incorporated</p> <p>This is a leftover topic from Rel-17, and RAN2 can led the work on it.</p> |
| <p>22 – Futurewei Technologies</p> <p>We support this objective.</p> |
| <p>23 – ROBERT BOSCH GmbH</p> <p>we support the objective.</p> |
| <p>24 – MediaTek Inc.</p> <p>This is a Rel-17 leftover that is important to address.</p> |
| <p>25 – Intel Korea</p> <p>We are supportive to include service continuity in the WID.</p> |
| <p>26 – Samsung R&D Institute UK</p> <p>We support service continuity in the WID.</p> |
| <p>27 – Continental Automotive GmbH</p> <p>Essential in our view.</p> |

1.3.1 Operation scenarios

The moderator understands that at least two scenarios were included in the conclusion of [RAN93e-R18Prep-06]; inter-gNB indirect-to-direct path switching (“UE 1 <-> relay UE A <-> gNB X” to “UE 1 <-> gNB Y”) and intra-gNB indirect-to-indirect path switching (“UE 1 <-> relay UE A <-> gNB X” to “UE 1 <-> relay UE B <-> gNB X”). And discussion continued on inter-gNB indirect-to-indirect path switching (“UE1 <-> relay UE A <-> gNB X” to “UE1 <-> relay UE B <-> gNB Y”). Please specify your view on the operation scenarios to be considered in this objective.

Feedback Form 11: Company input on the target operation scenarios

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| <p>1 – AT&T</p> <p>All the scenarios described by the moderator should be included.</p> |
| <p>2 – Guangdong OPPO Mobile Telecom.</p> <p>We understand all scenarios that are missing in R17 should be included for R18:</p> <p>1) for intra-gNB, the indirect-to-indirect switching</p> |

2) For inter-gNB, the direct-to-indirect switching, indirect-to-direct switching and indirect-to-indirect switching

3 – Ericsson LM

We have the same understanding as the moderator regarding the scenarios.

We think it is desirable to restrict the scope by considering the first two cases:

- inter-gNB indirect-to-direct path switching and
- intra-gNB indirect-to-indirect path switching

Inter-gNB indirect-to-indirect path switching can be left out in this release.

4 – Apple Europe Limited

We support all three scenarios described above.

5 – InterDigital France R&D

We support all of the scenarios.

6 – Beijing Xiaomi Mobile Software

We support all scenarios.

7 – LG Electronics Inc.

We think all the three scenarios are relevant for the mobility of a remote UE. For example, inter-gNB indirect-to-indirect path switching needs to be supported when an out-coverage remote UE moves across gNBs each of which has relay UE in its coverage. However we note that RAN2 deprioritized some of the scenarios during the study item by the following agreement made in RAN2#112e:

Proposal 1-3 (22/22): R2 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.

Therefore, we propose to have a study phase on the potential solutions for the service continuity enhancements.

8 – HuaWei Technologies Co.

We are fine to include inter-gNB indirect-direct path switching and intra-gNB indirect-indirect path switching. We don't see need to expand this part to include more scenarios.

9 – Lenovo Mobile Com. Technology

All three (direct <-> indirect and indirect <-> indirect) are relevant and useful.

10 – China Mobile Com. Corporation

We support all the scenarios.

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| <p>11 – Spreadtrum Communications</p> <p>We support all of the scenarios.</p> |
| <p>12 – Sony Europe B.V.</p> <p>All scenarios as described the moderator should be included</p> |
| <p>13 – CATT</p> <p>We share moderator’s understanding on the scenarios. We think all these cases can be considered in Rel-18. Besides one case, i.e., “inter-gNB direct-to-indirect path switching” should also be included.</p> |
| <p>14 – NEC Corporation</p> <p>Both of these two scenarios should be considered for inter-gNB case.</p> |
| <p>15 – Fujitsu Limited</p> <p>We support all the scenarios suggested by the moderator.</p> |
| <p>16 – vivo Mobile Communication Co.</p> <p>We can start with limited scope with:</p> <ul style="list-style-type: none"> - Inter-gNB indirect-to-direct path switching - Intra-gNB indirect-to-indirect path switching <p>Inter-gNB indirect-to-indirect path switching may not be necessary to be included in the WID.</p> |
| <p>17 – Nokia Corporation</p> <p>All the scenarios from the moderator should be included.</p> |
| <p>18 – CEWiT</p> <p>We support all the scenario</p> |
| <p>19 – ZTE Corporation</p> <p>We support all the scenarios.</p> |
| <p>20 – Fraunhofer IIS</p> <p>We support all scenarios.</p> |
| <p>21 – Philips International B.V.</p> <p>We agree with Ericsson and Huawei.</p> |
| <p>22 – Qualcomm Incorporated</p> <p>All cases should be addressed in Rel-18.</p> |

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| <p>23 – Futurewei Technologies</p> <p>We are fine with all scenarios identified by the moderator.</p> |
| <p>24 – ROBERT BOSCH GmbH</p> <p>support all operational scenarios proposed by the moderator.</p> |
| <p>25 – Intel Korea</p> <p>We are fine with considering both the inter-gNB mobility for indirect to direct/direct to indirect cases and intra-gNB indirect-to-indirect path switching scenarios for service continuity.</p> <p>We are open to supporting indirect-to-indirect for inter-gNB scenario if there is majority view, although we think there may be challenges to supporting it.</p> |
| <p>26 – MediaTek Inc.</p> <p>In addition to the noncontroversial cases (inter-gNB direct<->indirect and intra-gNB indirect<->indirect), we think the inter-gNB case for indirect<->indirect is important. A remote UE that is losing its relay UE cannot be certain of always finding a new relay UE in the same gNB, and we think the indirect<->indirect service continuity should be addressed with a unified solution that covers intra- and inter-gNB.</p> |
| <p>27 – Samsung R&D Institute UK</p> <p>The missing scenarios from R17 WID SL relay can be considered: 3 inter gNB mobility scenarios and indirect to indirect mobility for intra gNB scenario.</p> |
| <p>28 – Continental Automotive GmbH</p> <p>We support moderator proposal.</p> |

1.3.2 Objective details

If service continuity enhancements are agreed to be included in the SID/WID, what is your view on the detailed objectives? Will it be okay to have a simple objective such as “Specify mechanisms for service continuity for the scenarios ...” or do we need to have more specific objectives in the SID/WID?

Feedback Form 12: Company input on the detailed objectives

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| <p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We have provided draft in RP-211971. Specifically, good to clarify this is for L2 U2N Relay only.</p> |
| <p>2 – Ericsson LM</p> <p>We think a simple formulation is fine so far as it clearly limits the scope to the agreed scenarios.</p> |
| <p>3 – Apple Europe Limited</p> <p>We think it is better to put those scenarios in the objective to avoid ambiguity.</p> |

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| <p>4 – InterDigital France R&D</p> <p>A simple formulation should be sufficient.</p> |
| <p>5 – Beijing Xiaomi Mobile Software</p> <p>For now, simple formulation may be enough</p> |
| <p>6 – LG Electronics Inc.</p> <p>As we propose a study phase for this topic, a simple objective would be enough like “study potential solutions for service continuity enhancement in order to support the mobility scenarios of inter-gNB indirect-to-direct path switching, intra-gNB indirect-to-indirect path switching, and the inter-gNB indirect-to-indirect path switching.” It can be a 9-month study phase and detailed scope for the normative work can be determined after it.</p> |
| <p>7 – HuaWei Technologies Co.</p> <p>If service continuity enhancements is to be included in the SID/WID, we think a simple objective to clearly indicate the scenarios would be good enough</p> |
| <p>8 – Spreadtrum Communications</p> <p>A simple formulation is fine.</p> |
| <p>9 – CATT</p> <p>We can make it simple, the following is provided in our paper RP-212249</p> <p><i>Specify mechanisms for service continuity enhancements for L2 U2N Relay:</i></p> <p>a) <i>For inter-gNB case, specify mechanisms for the path switching from direct to indirect, from indirect to direct and from indirect to indirect [RAN2, RAN3];</i></p> <p>b) <i>For intra-gNB case, specify mechanisms for path switching from indirect to indirect [RAN2].</i></p> |
| <p>10 – NEC Corporation</p> <p>It is ok to have a simple object with a list of scenarios.</p> |
| <p>11 – Fujitsu Limited</p> <p>We are fine with the simple formulation for now.</p> |
| <p>12 – vivo Mobile Communication Co.</p> <p>For the moment a simple formulation is just fine.</p> |
| <p>13 – Nokia Corporation</p> <p>Moderator’s proposal for the scope is acceptable for us. Spelling out the scenarios in the scope could save some time in RAN2.</p> |
| <p>14 – CEWiT</p> <p>We feel it is good to have simple formulation.</p> |

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| <p>15 – ZTE Corporation</p> <p>It is suggested to list the scenarios that need to be considered in Rel-18.</p> |
| <p>16 – Qualcomm Incorporated</p> <p>Simple formulation is fine as the starting point.</p> |
| <p>17 – Futurewei Technologies</p> <p>A simple formulation of objective is fine, with a clarification that it is targeted at L2 relay.</p> |
| <p>18 – Intel Korea</p> <p>We can follow U2N WID and provide simple objective but outline the specific scenarios that we support service continuity for as per feedback to previous question (inter-gNB, intra-gNB, etc). We also can mention to use the work done in Rel-17 WI can be used as baseline for this objective. Example wording is provided below:</p> <p>Specify mechanisms for service continuity</p> <ul style="list-style-type: none"> -Inter-gNB cases (indirect to direct and direct to indirect) - intra-gNB indirect to indirect switching [RAN2] |
| <p>19 – MediaTek Inc.</p> <p>The simple formulation is OK as long as it's clear that it relates to the L2 U2N case.</p> |
| <p>20 – Samsung R&D Institute UK</p> <p>Specify Layer-2 U2N relay service continuity mechanisms for indirect to indirect mobility scenario within the same gNB</p> <p>Specify Layer-2 U2N relay service continuity mechanisms for mobility scenarios (direct to indirect, indirect to direct, indirect to indirect) for inter-gNB</p> |

Can we confirm RAN2 as the leading WG, RAN3 as the secondary WG, and SA/CT impact for this objective?

Feedback Form 13: Company input on the WGs and SA/CT impact

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| <p>1 – AT&T</p> <p>Yes, RAN2 should be the lead WG.</p> |
| <p>2 – Guangdong OPPO Mobile Telecom.</p> <p>Agree with moderator.</p> |
| <p>3 – Ericsson LM</p> <p>We agree with the moderator's assessment.</p> |

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| <p>4 – Apple Europe Limited</p> <p>Yes, agree with the rapporteur.</p> |
| <p>5 – InterDigital France R&D</p> <p>We agree with the moderator.</p> |
| <p>6 – Beijing Xiaomi Mobile Software</p> <p>Agree with moderator</p> |
| <p>7 – LG Electronics Inc.</p> <p>We can confirm this.</p> |
| <p>8 – HuaWei Technologies Co.</p> <p>Agree with moderator.</p> |
| <p>9 – Lenovo Mobile Com. Technology</p> <p>Yes.</p> |
| <p>10 – China Mobile Com. Corporation</p> <p>Agree with moderator.</p> |
| <p>11 – Spreadtrum Communications</p> <p>Yes, agree with the moderator.</p> |
| <p>12 – Sony Europe B.V.</p> <p>Yes</p> |
| <p>13 – CATT</p> <p>Agree with the moderator.</p> |
| <p>14 – NEC Corporation</p> <p>Yes, RAN2 should be the leading WG. And RAN3 can be the secondary WG to handle some inter-gNB issues.</p> |
| <p>15 – Fujitsu Limited</p> <p>Yes. We agree with the moderator.</p> |
| <p>16 – vivo Mobile Communication Co.</p> <p>Agree with moderator.</p> |
| <p>17 – Nokia Corporation</p> <p>We agree with the moderator’s proposal to have RAN2 as the leading WG.</p> |

| |
|---|
| <p>18 – CEWiT</p> <p>We agree with moderator</p> |
| <p>19 – ZTE Corporation</p> <p>Yes</p> |
| <p>20 – Qualcomm Incorporated</p> <p>Yes. Same as the consideration in form 8.</p> |
| <p>21 – Futurewei Technologies</p> <p>Yes, we agree with the moderator.</p> |
| <p>22 – Intel Korea</p> <p>Yes, agree with the moderator.</p> |
| <p>23 – MediaTek Inc.</p> <p>Agree with moderator.</p> |
| <p>24 – Samsung R&D Institute UK</p> <p>RAN2 as leading WG, RAN3 as secondary WG. SA/CT impacts exist.</p> |
| <p>25 – Continental Automotive GmbH</p> <p>RAN2 should be the leading WG.</p> |

1.3.3 Others

If any, please specify other discussion topics relevant to the service continuity enhancements aspect.

Feedback Form 14: Company input on the other topics relevant to service continuity enhancements

| |
|--|
| <p>1 – Apple Europe Limited</p> <p>we need also consider any leftover for intra-gNB case. For example, Rel-17 may not have a complete solution for the direct-to-indirect handover for the case when target Relay UE is in IDLE/INACTIVE.</p> |
| <p>2 – vivo Mobile Communication Co.</p> <p>For robust UE service continuity, CHO based service continuity should considered.</p> |
| <p>3 – ROBERT BOSCH GmbH</p> <p>We agree with Apple and vivo; Rel-17 left-over, e.g., service continuity, intra-gNB direct-to-indirect handover, and CHO, should be considered.</p> |

4 – MediaTek Inc.

In general, we think Rel-17 leftovers should be handled—e.g., if Apple are correct and not all RRC states are covered in Rel-17, that should be rectified in Rel-18.

1.4 Multi-path relay

This section is to discuss potential objective for service continuity enhancements. The conclusion from [RAN93e-R18Prep-06] was as follows:

- Limit the scope to the combination of one direct path and one indirect path while taking into account the forward compatibility for supporting other scenarios in a later release.
 - Discuss further whether the scenario will include the case where a UE is connected via the indirect path to a cell different from its serving cell of the direct path.

Please indicate overall view on the inclusion of multi-path relay in SID/WID. The moderator asks companies to provide detailed motivation of the multi-path relay. There seem multiple motivations each of which may require different mechanism (e.g., reliability enhancement by sending the same user data over multiple paths, data rate enhancement by split the user data into multiple paths, etc.).

Feedback Form 15: Company input for the overall view on the inclusion of multi-path relay

1 – AT&T

We support the inclusion of multi-path relaying in the work item. Reliability is important, especially considering that service continuity is another important objective (and in some practical deployment scenarios the direct path and indirect path may use different low/high frequency bands). However load balancing is equally important given that at the edge of the cell a direct path's bandwidth compared to the indirect path may be limited. So both should be considered as motivations for this objective.

2 – Guangdong OPPO Mobile Telecom.

Multi-path relay should be included in the item. The motivation includes enhancement on throughput (i.e., split the CP and/or UP data into multiple paths) and robustness (e.g., sending the same CP and/or UP data over multiple paths)

3 – Ericsson LM

We are not supportive of including this objective. We think the scope of this item can be quite large while the benefits (in terms of new use cases addressed etc.) are far from clear.

If agreed as a topic for Rel-18, we think a dedicated study phase is necessary. RAN may later modify the scope of the WI to include detailed objectives based on the outcome of the study.

4 – Apple Europe Limited

First, we think the multi-path solution needs to be only for Layer 2 relays. Second, we think the multi-path solution needs to be designed in a way which is forward-compatible with multi-hop relay solutions because multi-hop provide more room for path selections. Otherwise, we may have a very customized and limited solution for single hop relay case, but then need start over for multi-hop relay design.

Finally, it is suggested to focus on multi-path for U2N relay first in WI work, using R17 U2N relay design as the starting point.

5 – InterDigital France R&D

We think multi-path relay should be included for robustness and throughput, while taking power consumption considerations into account.

6 – Beijing Xiaomi Mobile Software

We are not sure about multi-path. Considering indirect can't provide reliable transmission as direct link, the gain on reliability is unclear to us.

7 – LG Electronics Inc.

We firstly note that this multi-path relay was not a part of Rel-17 SI and no conclusion has been made on its benefit or feasibility. Considering that some other Rel-17 leftovers may not have a chance in Rel-18, this objective can be considered with a lower priority. From technical perspective, we think there is room for reliability enhancement by sensing the same user data over multiple paths as this is a sort of packet duplication whose motivation is well understood. But the motivation of data rate enhancement is unclear especially when the multiple paths share the same spectrum. In the data flow from the remote UE to gNB for example, either SL transmission or UL transmission would take place at the remote UE in a given time instance, which implies that the two paths cannot be simultaneously used for the data transmission. Then the achievable data rate by the data split may not be larger than just selecting the one with better efficiency.

8 – Lenovo Mobile Com. Technology

Multipath is very important to meet future reliability of 6 or 7 Nines.

9 – Spreadtrum Communications

We think multi-path should be included in Rel-18 for benefits on robustness and reliability.

10 – Sony Europe B.V.

We are not sure about multi path to be included in the scope as the benefits are not very clear.

11 – CATT

We support to include multi path relay in the work item, as there are benefits in terms of reliability and throughput.

12 – NEC Corporation

We are ok to introduce multi-path relay and suggest that schemes to boost throughput to be considered first since the nearest relay UE generally can be selected to maintain good channel quality.

13 – HuaWei Technologies Co.

In Rel-17, single path U2N relay is specified, which solve the coverage issue to some extent. However, that may not be robust enough for throughput and reliability, which is critical for some use cases. To enhance that, multi-path relay should be included in Rel-18.

14 – Fujitsu Limited

We support to include multi-path relay, which is helpful for high reliability and high throughput.

15 – China Mobile Com. Corporation

From our point view, it is not clear whether the approaches to be specified in SL relay can fulfill the scenario and requirement of the UE aggregation. Consequently, an explicit study scope for generic UE aggregation is needed for Rel-18, whereby the first task is to indentify whether the required functions and procedure of UE aggregation can be supported with multi-path in SL relay.

If UE aggregation could work well as a subset of multi-path in relay, multi-path relay can be continued with other objectives independent from UE aggregation; otherwise, the specific study of supporting of generic UE aggregation is needed besides multi-path in SL relay.

16 – Nokia Corporation

It is ok for us to include multi-path relay to the scope. Moderator’s proposal for the scope is acceptable for us. Also for this multi-path objective the following sub-objective could be added: “Discuss whether L2 and/or L3 need to be addressed”.

17 – ZTE Corporation

Multi-path U2N relay may be considered in Rel-18 if time allows.

18 – Philips International B.V.

Reliability is an essential requirement for us, so we certainly support this topic to be included.

19 – Qualcomm Incorporated

Multi-path relay should be in scope of Rel-18 study.

Both reliability enhancements and rate enhancements should be covered. However, reliability enhancement does not necessarily mean duplicating the data over multiple paths.

20 – Futurewei Technologies

We are fine with including the support of multi-path as an objective, for higher throughput and reliability.

21 – ROBERT BOSCH GmbH

We support multi-path only as a second priority.

22 – Intel Korea

If the SL relay item is constrained for time then we would prioritize the U2U relaying and service continuity objectives over multi-path. If it is preferred to be included in the SID/WID, we generally prefer to limit the scope to avoid workload issues, therefore we prefer to support only same cell scenario. At the same time, we support to have a short study phase dedicated to this topic to analyze its feasibility and the needed enhancements (i.e. the different mechanisms listed by the moderator).

23 – MediaTek Inc.

We support including multi-path for reliability.

24 – Samsung R&D Institute UK

We are not in favor of including multi-path relay in the WID. During Rel-17 SI phase on NR sidelink-based relay, the enhancements and solutions were studied for sidelink/network coverage extension. Reliability enhancement or data rate enhancement were not in the scope of Rel-17 SL relay study.

25 – Continental Automotive GmbH

Not a priority in our view for Rel. 18.

1.4.1 Operation scenarios

What is your view on the conclusion from [RAN93e-R18Prep-06] in terms of the set of paths (i.e., one direct path and one indirect path)? And what is your view on the issue of whether a UE can be connected via the indirect path to a cell different from its serving cell of the direct path?

Feedback Form 16: Company input on the target operation scenarios

1 – AT&T

We are Ok with the RAN#93e conclusion as the starting point. On the issue of whether a UE can be connected via the indirect path to a cell different from its serving cell of the direct path, we believe that this can be handled by applying dual connectivity principles which are well established for regular UEs and now also IAB as well in Rel-17. So we do not see any major concerns with including this as well in the work item scope.

2 – Guangdong OPPO Mobile Telecom.

For the set of path, we agree direct + indirect combination should be of primary priority. Yet the indirect + indirect combination should be considered as well with a secondary priority.

And for whether a UE can be connected via the indirect path to a cell different from its serving cell of the direct path, as replied in the pre-RAN#93 meeting discussion, we do not think “same cell” is a feasible restriction considering that Sidelink is compatible with CA in Uu interface, i.e., the remote UE should be able to work in CA mode for the direct link, so that either we at least need to change the question to “whether a UE can be connected via the indirect path to a cell different from its serving cell(s) of the direct path” or “whether a UE can be connected via the indirect path to a gNB different from its serving gNB of the direct path”.

3 – Ericsson LM

We think the work, if agreed, should be limited to:

- Two paths (indirect + direct)
- Same cell case

This would reduce the workload while providing the basic functionality. Further enhancements may be considered in a future release.

4 – Apple Europe Limited

We are fine with starting with intra-cell "direct+indirect" scenario first.

5 – InterDigital France R&D

We can start with the intra-cell case only for this release.

6 – LG Electronics Inc.

In order to mitigate the work load issue, we are fine with the scope limitation discussed before, i.e., one direct path and one indirect path both connected to the same cell.

7 – Lenovo Mobile Com. Technology

We do "not" see the need for "UE can be connected via the indirect path to a cell different from its serving cell of the direct path".

8 – Spreadtrum Communications

We prefer to limit the work to include intra-cell direct+indirect case only.

9 – CATT

Firstly, we agree the case of one direct path and one indirect path should be included. Regarding to the scenario, considering the specification effort, we can start from intra-cell or intra-gNB case.

10 – NEC Corporation

DC-link schemes can be adopt to maintain only one RRC entity for remote UE. Thus we are ok to the scenario captured in [RAN93e-R18Prep-06].

11 – HuaWei Technologies Co.

We are fine to start with direct + indirect path from the same cell.

12 – Fujitsu Limited

We can start with one direct path and one indirect path in intra-cell scenario for this release.

13 – Nokia Corporation

From our perspective it is ok that UE is connected via two different cells.

| |
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| <p>14 – ZTE Corporation</p> <p>We may start from the one direct path+ one indirect path scenario. Both intra-cell and intra-gNB scenario may be considered.</p> |
| <p>15 – Philips International B.V.</p> <p>We agree direct + indirect combination with same cell should be of primary priority. Yet the indirect + indirect combination and different cells should be considered as well with a secondary priority.</p> |
| <p>16 – Qualcomm Incorporated</p> <p>In general, we support the conclusion of addressing at least the case of one direct path and one indirect path via the Relay for the Remote UE.</p> <p>The study can focus on the case where the direct path and indirect path are connected to the same cell.</p> <p>Specifically, this should cover the case of same CU, with same or different DUs. Additionally, it should also cover the case of MR-DC support.</p> |
| <p>17 – Futurewei Technologies</p> <p>We can start with one direct path and one indirect path both connected to the same cell.</p> |
| <p>18 – Intel Korea</p> <p>We prefer to limit the scope to avoid workload issues, therefore we prefer to support only same cell scenario wherein the UE is connected to the direct path and indirect path within the same cell to avoid complexity. At the same time, we support to have a short study phase dedicated to this topic to analyze its feasibility.</p> |
| <p>19 – MediaTek Inc.</p> <p>It would be OK to start from the simple scenario (direct+indirect, intra-gNB), but the more expansive cases should be in scope if time permits.</p> |

1.4.2 Objective details

If multi-path relay is agreed to be included in the SID/WID, what is your view on the detailed objectives? Will it be okay to have a simple objective such as “Specify mechanisms for multi-path relay for the scenarios ...” or do we need to have more specific objectives in the SID/WID? The moderator thinks that the detailed objectives might depend on the mechanisms addressing the target motivation discussed above.

Feedback Form 17: Company input on the detailed objectives of multi-path relay

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|---|
| <p>1 – Guangdong OPPO Mobile Telecom.</p> <p>We have provided draft in RP-211971. Specifically, good to clarify this is for L2 U2N Relay only.</p> |
| <p>2 – Ericsson LM</p> <p>If agreed as a topic for Rel-18, we think a dedicated study phase is necessary. RAN may later modify the scope of the WI to include detailed objectives based on the outcome of the study.</p> |

Objectives for the SI:

- Feasibility and benefits of multi-path using relaying for:
 - o Increased data rates.
 - o Increased reliability through multi-path diversity.

3 – Apple Europe Limited

Here is the example objective reflecting our view:

for **UE-to-Network and UE-to-UE Relay**:

Specify mechanisms for **multiple paths** support for Layer 2 relaying, including direct + indirect path

4 – InterDigital France R&D

The objective should indicate that the motivation is for robustness and throughput, while taking power consumption considerations into account.

5 – LG Electronics Inc.

If this topic is included in the WID, we think a study phase is necessary. In addition, we can focus on the reliability enhancement if no other strong motivation can be found. Similarly to what we proposed for the service continuity, we can have a 9-month study phase for “study potential solutions for multi-path relay where the same user data is sent over two paths, one direct path and one indirect path both connected to the same cell.”

6 – Lenovo Mobile Com. Technology

We should include objectives that target a specific reliability class e.g., PQI 91 etc.

7 – CATT

The following is provided in our paper RP-212249, as an example

Specify mechanisms to support multi-paths in order to improve the reliability and peak data rate for L2 U2N Relay [RAN2].

8 – NEC Corporation

It is okay to have a simple objective for L2N relay.

9 – HuaWei Technologies Co.

We understand this is mainly for L2 U2N relay, and CATT’s proposal looks good to us. If the scenarios to be supported are agreed, this can be added in the objective.

10 – Fujitsu Limited

Currently we can start with the simple formulation.

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| <p>11 – Nokia Corporation</p> <p>Moderator’s proposal for the scope is acceptable for us. Also for this multi-path objective the following sub-objective could be added: “Discuss whether L2 and/or L3 need to be addressed”.</p> |
| <p>12 – ZTE Corporation</p> <p>It is suggested to list the multi-path scenario that need to be supported in Rel-18.</p> |
| <p>13 – Philips International B.V.</p> <p>We agree with the formulation proposed by Oppo.</p> |
| <p>14 – Qualcomm Incorporated</p> <p>The objective should clarify that the multi-path means a direct path to the network and an indirect path to the network via the relay.</p> |
| <p>15 – ROBERT BOSCH GmbH</p> <p>We have the same view as Apple (however, the topic is of a second priority)</p> |
| <p>16 – Futurewei Technologies</p> <p>It is fine to have a simple formulation of objective with clarification that it is targeted at L2 UE-to-network relay.</p> |
| <p>17 – Intel Korea</p> <p>Yes, we can follow U2N WID by providing simple objective, however include the specific scenario that is targeted. We need a short study phase for this objective to identify/align on the different sub-topics to support the scenario. Example wording is provided below:</p> <p>Study and specify mechanism(s) to support multi-path operation using one direct path and one indirect (layer-2 relay) path [RAN2]:</p> <ul style="list-style-type: none"> - Limited to intra-cell cases |
| <p>18 – MediaTek Inc.</p> <p>OK to have a simple formulation, but of course it should clearly identify the applicable cases (whichever ones we settle on).</p> |

What is your view on the leading/secondary WGs and SA/CT impact?

Feedback Form 18: Company input on the WGs and SA/CT impact

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| <p>1 – Guangdong OPPO Mobile Telecom.</p> <p>RAN2 as the leading WG, and with SA/CT impact.</p> |
| <p>2 – Ericsson LM</p> <p>Leading: RAN2</p> |

| |
|---|
| <p>Secondary: RAN3, (possibly) RAN1, (possibly) RAN4</p> <p>Impact to SA/CT: Yes</p> |
| <p>3 – Apple Europe Limited</p> <p>Leading by RAN2. No strong view on SA/CT impacts. RAN3 could be a potential secondary WG if inter-cell case is to be considered.</p> |
| <p>4 – InterDigital France R&D</p> <p>Leading: RAN2, Secondary: RAN3, (possibly) RAN1, (possibly) RAN4, Impact to SA/CT: Yes</p> |
| <p>5 – LG Electronics Inc.</p> <p>RAN2 will be the leading WG and SA/CT impact is not expected.</p> |
| <p>6 – Lenovo Mobile Com. Technology</p> <p>RAN2 leads this.</p> |
| <p>7 – Spreadtrum Communications</p> <p>RAN2 is the leading WG and SA/CT impact is expected</p> |
| <p>8 – CATT</p> <p>Leading WG is RAN2. There is SA/CT impact. Whether this impacts R3 depends on whether inter-gNB multi-paths are supported or not</p> |
| <p>9 – NEC Corporation</p> <p>RAN2 is the leading WG and with SA/CT impact.</p> |
| <p>10 – HuaWei Technologies Co.</p> <p>We think RAN2 shall be the leading WG. If it is limited to one cell case, there may be no impact on other groups, it depends on which scenarios are finally in the scope.</p> |
| <p>11 – Fujitsu Limited</p> <p>RAN2 is the leading WG, and RAN3 can be the secondary WG. It has SA/CT impact.</p> |
| <p>12 – Nokia Corporation</p> <p>OK for RAN2 to be the leading WG</p> |
| <p>13 – China Mobile Com. Corporation</p> <p>Leading WG: RAN2</p> |
| <p>14 – ZTE Corporation</p> <p>RAN2 is the leading WG with potential impacts with SA2/CT.</p> |

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|--|
| <p>15 – Qualcomm Incorporated</p> <p>RAN2 can lead the study, with RAN3 support. Depending on the solution identified, we would need to coordinate with SA2/CT regarding the potential impacts.</p> |
| <p>16 – ROBERT BOSCH GmbH</p> <p>Leading by RAN2 secondary: RAN1 and RAN3 Impact to/from: SA2</p> |
| <p>17 – Futurewei Technologies</p> <p>RAN 2 should be the leading WG.</p> |
| <p>18 – Intel Korea</p> <p>Leading WG: RAN2; we don't think there is much (if any) impact to other WG for this objective.</p> |
| <p>19 – MediaTek Inc.</p> <p>RAN2 as lead group, RAN3 secondary. It might be possible to address this without SA/CT impact, but it would be safest to keep them in the loop.</p> |

1.4.3 Others

If any, please specify other discussion topics relevant to the multi-path relay aspect.

Feedback Form 19: Company input on the other topics relevant to multi-path relay

1.5 Others

This section is to collect any other views not included in the sections above.

Feedback Form 20: Company input on the other aspects of sidelink relay enhancements

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| <p>1 – Apple Europe Limited</p> <p><u>Support of multi-hop U2N relay:</u></p> <p>For UE-to-NW relay, it is important to extend the single-hop solution to multi-hop solutions to make U2N relay more useful in larger coverage holes (e.g., rural areas, long tunnels). Note that Rel-17 U2N relay design has already make PC5 adaptation layer and Uu adaptation layer easily extendable. In other words, forward-compatibility with multi-hop relay is already considered in user plane design in Rel-17 UE-to-NW design. Thus, it is reasonable to include this work in Rel-18 instead of further delaying it to Rel-19.</p> |
| <p>2 – InterDigital France R&D</p> |

We agree with Apple regarding support of multihop U2N relay. Power savings enhancements (which were not considered in Rel17) should also be considered (e.g. SL-DRX for sidelink applicable to relay case).

3 – Philips International B.V.

We agree with Apple and Interdigital on the multi-hop relaying and the power saving. Both are very important topics for us and would be aligned also with what is being proposed in SA WG2 ProSe phase 5.

4 – Qualcomm Incorporated

A few other topics can be considered for the Sidelink Relay enhancement in Rel-18:

- Multi-hop support of Sidelink UE-to-Network Relay;
- Support of RedCap UEs by Sidelink UE-to-Network Relay (incl. capability, discovery, and conn. negotiation).
- Support of SL DRX for Sidelink Relay operation (if not completed in Rel-17).

5 – ROBERT BOSCH GmbH

Impact of: power saving, inter-UE coordination and HARQ feedback need to be considered. At least for multi-hop relay, impact on resource allocation and congestion control need to be considered.

6 – MediaTek Inc.

We also think that multi-hop U2N can be supported in Rel-18.

7 – Continental Automotive GmbH

For us, end-to-end QoS management is another important aspect to be considered in Rel. 18.

1.6 Summary and moderator's proposal

1.6.1 General

Summary on SI vs. WI:

- Start as a work item
 - Apple, AT&T, OPPO, Ericsson, InterDigital, Xiaomi, China Mobile, Huawei, Lenovo, Spreadtrum, Sony, CATT, NEC, Fujitsu, vivo, ZTE, CEWiT, Fraunhofer, Futurewei, Bosch, MediaTek, Samsung
 - Study phase (e.g., for multi-path)
 - Ericsson, LGE, Philips, Qualcomm, Intel,
- Depending on scope
 - Nokia

Moderator's proposal: Continue this email thread with the assumption that sidelink relay enhancements start as a WI. A potential study phase can be discussed for some specific objectives.

Summary on justification:

- Submitted draft in RP-211971, RP-2112249
- Use case include V2X, public safety, commercial use cases
- Competition with alternative PHY/MAC technologies supporting mesh networking solutions
- Reference to Rel-18 SA items

Moderator’s proposal: Discuss the text provided in the draft WID.

Summary on others:

- Consider a parallel discussion on Rel-18 SL enhancements
 - L2 U2U relay may not be compatible with other enhancements
- Alignment with SA WG2 Rel-18 proposals
- SL relay in Rel-18 requires more RAN1 involvement

Moderator’s proposal: Consider the input in the relevant objectives.

1.6.2 UE-to-UE relay

Summary on the inclusion of the objective:

- Include this objective
 - AT&T, OPPO, Ericsson, Apple, InterDigital, Xiaomi, LGE, China Mobile, Huawei, Lenovo, Spreadtrum, Sony, CATT, NEC, Fujitsu, vivo, Nokia, CEWiT, ZTE, Fraunhofer, Philips, Qualcomm, Futurewei, Bosch, MediaTek, Intel, Samsung, Continental

Moderator’s proposal: Continue this email thread with the assumption that UE-to-UE relay is included in the WI.

Summary on the operation scenarios:

- Okay to limit the scope to one hop (25)
 - AT&T, Ericsson, Xiaomi, LGE, China Mobile, Huawei, Spreadtrum, Sony, CATT, Fujitsu, NEC, vivo, Nokia, ZTE, CEWiT, Fraunhofer, Philips, Qualcomm, Futurewei, Bosch, MediaTek, Intel, Samsung, Toyota, Continental
- Multi-hop extensions need to be considered (3)
 - Apple, InterDigital, Lenovo,
- L2 and/or L3

- L2 only (6)
 - AT&T, Lenovo, Sony, NEC, Bosch, MediaTek,
- L3 only (2)
 - Ericsson, Huawei
- Both L2 and L3 (12 14)
 - Apple, InterDigital, LGE, China Mobile, Spreadtrum, CATT, vivo, ZTE, Philips, Qualcomm(?), Futurewei, Intel, Samsung, Continental(?)
- Either one is fine (1)
 - Xiaomi
- Cast type
 - Unicast only (12)
 - Ericsson, InterDigital, LGE, Huawei, Spreadtrum, Sony, CATT, vivo, ZTE, Philips, Qualcomm, Intel,
 - Unicast and groupcast/broadcast (8 9)
- AT&T, Apple, Lenovo, NEC, CEWiT, Fraunhofer, Bosch, MediaTek(?), Samsung,

Moderator's proposal: Limit the scope to one hop relay while taking into account the forward compatibility for supporting more than one hop in a later release.

Moderator's proposal: Assume that both L2 and L3 relays are included and at least unicast is included in the scope. Continue discussion on whether to include groupcast and broadcast.

Summary on the objective details:

- The list in RP-211050 is fine or can be starting point
 - AT&T, InterDigital, Xiaomi, China Mobile, NEC, Fujitsu, CEWiT, Fraunhofer, Continental,
- Remove QoS
 - OPPO, Apple, LGE, Spreadtrum, CATT, Futurewei, MediaTek,
- Remove service continuity
 - OPPO, Apple, LGE, Huawei, Spreadtrum, CATT, vivo, Philips, Futurewei, Intel,
- Add user plane procedures (e.g., which resource allocation mode can be used)
 - CATT, ZTE
- L2/L3 common part => discovery & (re-)selection, authorization
 - Needs to be prioritized
 - Ericsson
- Study phase is required

- Nokia
- AS layer mechanism should reuse exiting sidelink design
 - Qualcomm (for discovery, QoS)
- More RAN1 involvement is necessary
 - Bosch

Moderator’s proposal: Discuss the objective based on relay discovery and (re)selection, Relay and Remote UE authorization, adaptation layer design, and control plane procedures text provided in the draft WID.

Summary on the involved WGs:

- RAN2 leading WG, SA/CT impact exists
 - AT&T, OPPO, Ericsson, Apple, Xiaomi, LGE, Lenovo, China Mobile, Spreadtrum, Sony, CATT, NEC, Fujitsu, vivo, Nokia, CEWiT, ZTE, Philips, Qualcomm, Futurewei, Bosch, Intel, MediaTek, Samsung, Continental
- Secondary WGs
 - RAN3 (e.g., for authorization)
 - OPPO, Ericsson, Apple, Xiaomi, LGE, China Mobile, Spreadtrum, CATT, CEWiT, vivo, Philips, Bosch, Intel
 - RAN4 (e.g., for discovery/(re-)selection requirements)
 - OPPO, Ericsson, Apple, Xiaomi, LGE, China Mobile, Spreadtrum, CATT, CEWiT, vivo, Philips, Intel
 - RAN1
 - CATT, Bosch, MediaTek,
- Depends on the relay type
 - Huawei

Moderator’s proposal: Continue discussion on the WID assuming that RAN2 is the leading WG, RAN3 and RAN4 are secondary WGs, and SA/CT impact is expected.

Summary on the others:

- the work done during Rel-17 SI is used as a baseline

1.6.3 Service continuity enhancements

Summary on the inclusion of the objective:

- Include this objective
 - AT&T, OPPO, Ericsson, Apple, InterDigital, Xiaomi, LGE, Huawei, Lenovo, China Mobile, Spreadtrum, Sony, CATT, NEC, Fujitsu, vivo, Nokia, ZTE, Fraunhofer, Philips, Qualcomm, Futurewei, Bosch, MediaTek, Intel, Samsung, Continental

Moderator's proposal: Continue this email thread with the assumption that service continuity enhancements are included in the WI.

Summary on the operation scenarios:

- inter-gNB indirect-to-direct path switching
 - AT&T, OPPO, Ericsson, Apple, InterDigital, Xiaomi, LGE, Huawei, Lenovo, China Mobile, Spreadtrum, Sony, CATT, NEC, Fujitsu, vivo, Nokia, CEWiT, ZTE, Fraunhofer, Philips, Qualcomm, Futurewei, Bosch, Intel, MediaTek, Samsung, Continental
 - Also include inter-gNB direct-to-indirect path switching
 - OPPO, CATT, Intel
- intra-gNB indirect-to-indirect path switching
 - AT&T, OPPO, Ericsson, Apple, InterDigital, Xiaomi, LGE, Huawei, Lenovo, China Mobile, Spreadtrum, Sony, CATT, Fujitsu, vivo, Nokia, CEWiT, ZTE, Fraunhofer, Philips, Qualcomm, Futurewei, Bosch, Intel, MediaTek, Samsung, Continental
- inter-gNB indirect-to-indirect path switching
 - AT&T, OPPO, Apple, InterDigital, Xiaomi, LGE, Lenovo, China Mobile, Spreadtrum, Sony, CATT, NEC, Fujitsu, Nokia, CEWiT, ZTE, Fraunhofer, Qualcomm, Futurewei, Bosch, Intel, MediaTek, Samsung
 - Not in this release
 - Ericsson, Huawei, vivo, Philips

Moderator's proposal: Assume that all the following scenarios are included.

- inter-gNB indirect-to-direct path switching and inter-gNB direct-to-indirect path switching
- intra-gNB indirect-to-indirect path switching
- inter-gNB indirect-to-indirect path switching

Summary on the objective details:

- A simple formulation is fine
 - Ericsson, InterDigital, Xiaomi, Huawei, Spreadtrum, CATT, NEC, Fujitsu, vivo, Nokia, CEWiT, ZTE, Qualcomm, Futurewei, Intel, MediaTek, Samsung
 - Several companies commented on the list of scenarios, targeting L2 relay, etc.
- Have a study phase
 - LGE

Moderator’s proposal: Discuss the objective based on a simple formulation discussed in the initial round.

Summary on the involved WGs:

- Confirm RAN2 as the leading WG, RAN3 as the secondary WG, and the existence of SA/CT impact
 - AT&T, OPPO, Ericsson, Apple, InterDigital, Xiaomi, LGE, Huawei, Lenovo, China Mobile, Spreadtrum, Sony, CATT, NEC, Fujitsu, vivo, Nokia, CEWiT, ZTE, Qualcomm, Futurewei, Intel, MediaTek, Samsung, Continental

Moderator’s proposal: Continue discussion on the WID assuming that RAN2 is the leading WG, RAN3 and RAN4 are secondary WGs, and SA/CT impact is expected.

Summary on the others:

- Consider other leftovers from Rel-17 such as direct-to-indirect handover for the case when target Relay UE is in IDLE/INACTIVE
- Consider CHO based service continuity

Moderator’s proposal: Companies are invited to provide views on whether to consider these aspects in the discussion of the draft WID.

1.6.4 Multi-path relay

Summary on the inclusion of the objective:

- Include this objective
 - Yes (16): AT&T, OPPO, Apple, InterDigital, Lenovo, Spreadtrum, CATT, NEC, Huawei, Fujitsu, Nokia, ZTE, Philips, Qualcomm, Futurewei, MediaTek
 - Motivation
 - Reliability/robustness
 - ◆ AT&T, OPPO, InterDigital, LGE, Lenovo, Spreadtrum, CATT, Huawei, Fujitsu, Philips, Qualcomm, Futurewei, MediaTek
 - Load balancing

- ◆ AT&T
- Throughput enhancement
 - ◆ OPPO, InterDigital, CATT, NEC, Huawei, Fujitsu, Qualcomm, Futurewei
- No or low priority (8): Ericsson, Xiaomi, LGE, Sony, Bosch, Intel, Samsung, Continental

Moderator’s proposal: Discuss further on whether to include multi-path relay focusing on the motivations of reliability/robustness and throughput enhancements.

Summary on the operation scenarios:

- Limit the scope to “one direct path and one indirect path”
 - Yes: AT&T, Ericsson, Apple, InterDigital, LGE, Spreadtrum, CATT, NEC, Huawei, Fujitsu, ZTE, Qualcomm, Futurewei, Intel
 - No: OPPO, Philips, MediaTek
- A UE can be connected via the indirect path to a cell different from its serving cell of the direct path
 - Yes: AT&T, Nokia, Philips, MediaTek
 - No: Ericsson, Apple, InterDigital, LGE, Lenovo, Spreadtrum, CATT, NEC, Huawei, Fujitsu, ZTE(?), Qualcomm, Futurewei, Intel
 - Rewording is necessary (e.g., change “cell” to “cell(s)” or “gNB”)

Moderator’s proposal: Assume that the scope is limited to “one direct path and one indirect path connected to the same cell or gNB if multi-path relay is included in the WID.

Summary on the objective details:

- Study phase is necessary
 - Ericsson, LGE, Intel
- Several companies commented that the scenario and motivation should be mentioned

Moderator’s proposal: Discuss whether a study phase is necessary.

Summary on the involved WGs:

- RAN2 leading WG
 - OPPO, Ericsson, Apple, InterDigital, LGE, Lenovo, Spreadtrum, CATT, NEC, Huawei, Fujitsu, Nokia, China Mobile, ZTE, Qualcomm, Bosch, Intel, MediaTek
- SA/CT impact
 - Yes

- OPPO, Ericsson, InterDigital, Spreadtrum, CATT, NEC, Fujitsu, ZTE, Bosch
 - Not clear
 - LGE
- Secondary WGs
 - RAN3, RAN1, RAN4
- Some companies commented that secondary WGs will depend on the detailed scope.

Moderator’s proposal: Assume that RAN2 is the leading WG and there is potential SA/CT impact.

1.6.5 Others

Summary:

- Multi-hop UE-to-Network relay needs to be supported
 - Apple, InterDigital, Philips, Qualcomm, MediaTek
- Power saving needs to be considered
 - InterDigital, Philips, Qualcomm
- RedCap UE needs to be considered for UE-to-Network relay
 - Qualcomm
- Impact of power saving, inter-UE coordination and HARQ feedback need to be considered
 - Bosch
- end-to-end QoS management
 - Continental

Moderator’s proposal: Discuss whether there are rooms to include the additional objectives mentioned here.

2 Intermediate round

The moderator submitted a draft WID v000 based on the discussion during the initial phase. It is proposed to discuss the detailed contents of the sidelink relay enhancements using this draft WID. Please focus on the convergence of the areas/objectives together with some discussion on the justification.

2.1 Justification

Please provide feedback on Section 3 Justification in the draft WID v000. Please note that

- The current text is based on the outcome of Rel-17 SI and limited scope of Rel-17 WI. RP-211971 and RP-212249 were considered as references.
- Whether the text on the multi-path relay (marked in yellow) will remain in the final submission will depend on whether the corresponding objective will be kept in Section 4.

Feedback Form 21: Feedback on the justification

1 – Apple Europe Limited

We are fine with the rapporteur’s input on UE-to-UE relay and service continuity. However, for multi-path relay (yellow part), it is unclear why only “direct+indirect” path is mentioned here for justification, especially considering that we do not mention specific scenarios for other two objectives (U2U and service continuity) . So, my suggestion is to manifest that in a more general way, such as “*the path diversity becomes available with the introduction of UE-to-NW relay and UE-to-UE relay in the sidelink relay topologies. Generally, there are scenarios can be considered to exploit multi-path connectivity to enhance reliability and/or throughput.*”

2 – InterDigital France R&D

We are fine with the current text for justification for the objectives they allude to, but we think justification is required for all the objectives.

3 – CATT

We think the current version provided by the moderator is generally fine. Maybe we could do some further fine tuning in a later stage when the objectives are more stable.

4 – LG Electronics Inc.

We support the text as the starting point.

5 – Qualcomm Incorporated

It should be clarified that for this “In particular, it supports only UE-to-Network relay and its service continuity solution is limited to intra-gNB direct-to-indirect and indirect-to-direct path switching.”, the limitation is only for Layer-2 UE-to-Network Relay.

The justification should also mention the SA2 study for Rel-18, and the potential enhancements required at AS layer (e.g. support of MBS traffic, multi-hop, etc.).

6 – MediaTek Inc.

The justification text is generally good as a baseline. We agree with Apple’s comment about the multi-path aspect, and in general we think fine-tuning of the justification can continue as we finalise the objectives.

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| <p>7 – Intel Korea</p> <p>We are fine with the text. One minor comment is whether to mention again that both L2 and L3 U2U are to be supported.</p> |
| <p>8 – ZTE Corporation</p> <p>We are basically fine with the justification text.</p> |
| <p>9 – ROBERT BOSCH GmbH</p> <p>We are fine with the text.</p> |
| <p>10 – CEWiT</p> <p>We are fine with the current text from moderator</p> |

2.2 Objectives

2.2.1 UE-to-UE relay

Please provide feedback on Objective 1 in Section 4 of the draft WID v000. In particular, further discussion would be helpful regarding the following points:

- Whether to limit the scope to unicast
- Whether to prioritize L2 and L3 common parts in the first few WG meetings
- Whether to include other L2 specific aspects

Feedback Form 22: Feedback on the UE-to-UE relay objective

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| <p>1 – FirstNet</p> <p>In sub-section 1.2.1 (as indicated in Initial round) ‘Operation Scenarios,’ or in sub-section 1.2.3 (as indicated in Initial round) or any other relevant section/sub-section, include a requirement “The network operator shall be able to define the maximum number of hops supported in their networks when using relay UEs (in support of multi-hop extensions).” (Reference: 3GPP TS 22.278).</p> |
| <p>2 – Kyocera Corporation</p> <ul style="list-style-type: none"> - We would prefer that groupcast is also supported in addition to unicast. - We’re fine to prioritize common parts of L2 and L3 U2U relay. - As in the case for U2N relay, U2U relay should also support multipaths (multiple relay UEs). |
| <p>3 – Apple Europe Limited</p> <p>Groupcast is also a valid scenario for U2U relay and worth considering.</p> <p>We are fine to prioritize the common part as same as what has been done in Rel-17.</p> |

Regarding other L2 specific work, we think user plane procedures may not be limited only to PC5 adaptation layer, so it is better to keep a placeholder for this part.

4 – Ericsson LM

We are generally fine with objective 1:

- We are supportive of restricting the scope to unicast.
- We are supportive of prioritizing common aspects. Assuming that the work would start in RAN2 between RAN#95 and RAN#96, we think it would be reasonable to extend this prioritized common phase until RAN#97.
- We do not see the need for including any other L2 aspect

5 – AT&T

We believe group cast needs to be included in the scope of Rel-18, especially for public safety use cases. We are OK to start with L2/L3 common aspects and L2 specific items can be added if needed based on the progress of the work.

6 – Guangdong OPPO Mobile Telecom.

For “Whether to prioritize L2 and L3 common parts in the first few WG meetings”, we are fine to do that as we did in R17, e.g., “RAN2 to strive for completion of the common parts (objective 1-A) by RAN#98 (December)” (here our understanding is R2 start R18 work after R#96 (2022-June), so that R#98 is after two quarters work in WG)

For “Whether to include other L2 specific aspects”, if there is any (as commented by others in first round), it seems more fit into ”QoS” aspect of L2 instead of general UP procedure, although so far we have not identified other obvious missing part for L2 relay yet for QoS.

7 – InterDigital France R&D

- It would be beneficial to specify that all coverage cases for source/destination/relay UEs should be covered. We think other L2 aspects need to be discussed, such as how to split SL QoS over the links, and how to ensure QoS is met for all the coverage cases. Prioritizing L2 and L3 common parts may be beneficial, but is not critical – this can be left to the discretion of the session chairman to ensure progress. Finally, if the preference is to limit the scope to single hop, we think we can possibly cover also groupcast within this WI and are ok to extend if there is support from other companies.

8 – HuaWei Technologies Co.

We are fine in general with the objective 1. We support to limit the scope to unicast, and also agree L2/L3 common parts can be prioritized.

9 – CATT

- We support limiting to unicast considering the work load.
- We support prioritizing the work that is common to L2/L3. For example, we can say ‘ to be prioritized until RAN#98’ based on the current timeline.

- Regarding the 3rd bullet in L2 relay specific part, we think it important to list user plane procedures here (to mainly cover the resource allocation aspects). We think that is more accurate than “QoS aspects” although there might be some relation.

10 – LG Electronics Inc.

We think the scope can be limited to unicast. UE-to-UE relay for groupcast/broadcast will require quite different solutions but has not been studied enough. Rel-17 UE-to-Network relay is basically based on unicast in the PC5 part and it would be straightforward to expand it to UE-to-UE relay for unicast.

We support prioritizing L2 and L3 common part as in Rel-17.

We think the current WID is enough for Rel-18 UE-to-UE relay and no additional aspects need to be added.

11 – Qualcomm Incorporated

- This objective : ” ii. Relay and remote UE authorization [RAN3]” does not seem to be justified. Given this is UE-to-UE relay, it is unclear how RAN3 should be involved in the authorization.
- This objective ”iii. [Other aspects like user plane procedures?]” is required, especially, there is a need to study the potential hop-by-hop link vs. end-to-end link handling.

12 – vivo Mobile Communication Co.

- 1) Support to limit the scope to unicast only.
- 2) Similar as Rel-17, prioritize L2 and L3 common parts in the first few WG meetings.
- 3) Add End-to-end QoS management under the Layer-2 relay specific part.

13 – MediaTek Inc.

We generally see this objective as an acceptable baseline. On the specific points:

- We consider that there are legitimate use cases for groupcast. Maybe the WI can start with unicast but also keep groupcast in scope.
- We don't see a strong reason to prioritise the common L2/L3 work. In Rel-17, this was an artifact of the discussion about whether to specify L2, L3, or both, but there doesn't seem to be the same level of concern in U2U about being able to finish both parts (the L3 impact in RAN is quite minimal).

14 – Intel Korea

Agree with Rapporteur to limit scope; although we are OK to prioritize common parts during initial meetings, we tend to also agree with Mediatek view that there is no strong reason to focus only on the common parts first.

15 – Samsung R&D Institute UK

We are fine to prioritize common part.

We think that groupcast can be included for public safety usage.

As concluded in study phase, there may be no RAN2 impact on control plane procedures. So it needs further consideration which control plane procedure aspects are included in the objective as user plane procedures

16 – China Mobile Com. Corporation

We are fine to support to limit the scope to unicast and prioritize L2 and L3 common parts in the first few WG meetings.

L2 specific aspects for U2U can be also included.

17 – Sony Europe B.V.

We are ok with the objectives and good if groupcast can be included as well.

18 – ZTE Corporation

We prefer to start from unicast design for UE-to-UE relay. For the groupcast and broadcast may be considered in later release.

We think it is not necessary to prioritize the common part for L2 and L3 UE-to-UE relay. Since most of companies agree to support both L2 and L3 U2U relay from the beginning and the target is to complete both of them, it is suggested to list the sub-objectives without further prioritization within U2U.

For the L2 specific aspect, we think the service continuity support may be added as one of the objectives for U2U relay.

19 – Spreadtrum Communications

Groupcast needs to be included in the scope of Rel-18.

We are fine to prioritize the L2 and L3 common parts.

20 – NEC Corporation

We prefer to include groupcast as well as unicast. We are ok to prioritize L2 and L3 common parts. For L2 U2U relay, we need to specify adaptation layer and control plane procedures.

21 – ROBERT BOSCH GmbH

We need to prioritize groupcast; without groupcast the U2U relay will not be suitable for many automotive use case.

We are fine to prioritize common L and L3 parts. We would like to specify ADAPT layer for L2 relay as well.

22 – Lenovo Mobile Com. Technology

We see no reason to restrict scope to Unicast only. Groupcast SL communications are generally more valuable from actual field adoption perspective e.g., in the area of public safety, in industry like for cooperative carrying, in vehicular communication like for platooning etc.

23 – Fraunhofer IIS

We think that it would be beneficial to consider groupcast as well as it is essential for many automotive use cases.

We would opt for prioritization of L2 and L3 common parts in the first WG meetings.

Besides, we suggest to add QoS management for L2 specific part.

24 – Philips International B.V.

- We prefer to prioritize unicast over groupcast and broadcast
- We are ok with prioritizing L2 and L3 common parts in the first WG meetings
- For L2 we would like to include a sub-objective for QoS management. Similar to what we have right now in the Relay WID in Rel-17 (RP-211050)

25 – CEWiT

We are in support to include unicast and also prefer to include groupcast

2.2.2 Service continuity enhancements

Please provide feedback on Objective 2 in Section 4 of the draft WID v000. In particular, further discussion would be helpful regarding the following points:

- Whether to include inter-gNB indirect-to-indirect path switching
- Whether to include other aspects such as target relay UEs in IDLE/INACTIVE, CHO based service continuity, etc.

Feedback Form 23: Feedback on the service continuity enhancements objective

1 – Kyocera Corporation

- Our preference is that inter-gNB indirect-to-indirect path switching should be supported,
- In case target relay UEs in IDLE/INACTIVE are not yet supported in Rel-17, it should be in Rel-18.
- We also think CHO should be supported.

2 – Apple Europe Limited

We are fine to include “inter-gNB indirect-to-indirect” case.

We support to have a place holder for “any leftover work in Rel-17 for intra-gNB scenarios (e.g., target relay UE in IDLE/INACTIVE, or CHO). Hopefully, there will be more clarity on this by RAN#94 in December.

3 – Ericsson LM

We are generally fine with objective 2:

- We are not supportive to include inter-gNB indirect-to-indirect path switching.
- We think that the ‘other aspects’ above are optimizations for a later release. Many of those aspects such as CHO have not been studied in Rel-17.

4 – AT&T

We support including inter-gNB indirect-to-indirect path switching. We also agree with the comments from Apple that leftover items can be addressed after the upcoming WG meeting.

5 – Guangdong OPPO Mobile Telecom.

For “whether to include inter-gNB indirect-to-indirect path switching”, we strongly support it since we do not see the extra spec effort to support it after we support inter-gNB direct/indirect path switching.

For “Whether to include other aspects such as target relay UEs in IDLE/INACTIVE”, it is in the scope of R17 SL Relay WID already and should be handled in R17. But in case eventually it is not, it should be accomplished in Rel-18. Yet before the decision, we need to see the result of R17 work first.

6 – InterDigital France R&D

We think it is not so critical to cover the inter-gNB indirect-to-indirect path switching, as this seems to be a not so common case. It would be best to spend time on improving the reliability of the switching, by considering relay UEs in IDLE/INACTIVE as well as CHO. DAPS mobility applied to relaying can also be considered in this work if companies feel it is beneficial.

7 – HuaWei Technologies Co.

The objective 2 looks ok to us in general. As commented before, we do not believe the inter-gNB indirect-indirect path switch scenario needs to be addressed for Rel-18. In addition this service continuity has been discussed several rounds and the listed objectives are already an output where most companies agree, thus we cannot accept including more aspects now without clear justification.

8 – CATT

- As said in previous round we think inter-gNB indirect-to-indirect path switching should be supported since it is an important mobility scenario. Also from work load point of view we think it is doable.
- For the other aspects, we do not see any urgency.

9 – LG Electronics Inc.

We are fine with keeping inter-gNB indirect-to-indirect path switching in the scope. We think other service continuity enhancements are not so urgent and need to be revisited in a later release.

10 – Qualcomm Incorporated

It should be discussed whether there is a need to address the following scenario:

Inter-gNB indirect-to-indirect path switching (i.e., “UE1 <-> relay UE A <-> gNB X” to “UE1 <-> relay UE A <-> gNB Y”)

11 – vivo Mobile Communication Co.

- 1) NOT include bullet D. or add note to De-prioritize bullet D, i.e., Inter-gNB indirect-to-indirect path switching (i.e., “UE1 <-> relay UE A <-> gNB X” to “UE1 <-> relay UE B <-> gNB Y”)
- 2) Suggest to include CHO based service continuity for robustness.

12 – MediaTek Inc.

We think the inter-gNB case of indirect-indirect switching should be included. The possibility that the target relay UE in idle/inactive would be excluded from Rel-17 also seems valid, and if this happens, we think it should be handled in Rel-18.

We are not exactly sure what the impetus to include CHO is. It might be feasible to do, but is there a strong motivation?

13 – Intel Korea

We are OK to deprioritize this scenario of inter-gNB indirect to indirect path switching to focus on other scenarios.

We prefer not to include details such as RRC state restrictions and CHO based service continuity which can be decided during WI phase based on complexity (we have not studied CHO), R17 support of target IDLE/INACTIVE relay UEs for intra-gNB scenarios and available time.

14 – China Telecommunication Corp.

We strongly support to include inter-gNB indirect-to-indirect path switching. This is also an important mobility scenario for the operator using sidelink relay to extend NR coverage. And we agree with OPPO that no extra spec effort to support it after supporting inter-gNB direct/indirect path switching.

We support to include other aspects such as target relay UEs in IDLE/INACTIVE, CHO based service continuity. We also support DAPS based service continuity.

15 – Samsung R&D Institute UK

We are fine with the objective 2 as proposed by the moderator.

16 – China Mobile Com. Corporation

We support include inter-gNB indirect-to-indirect path switching and other aspects such as target relay UEs in IDLE/INACTIVE. For CHO based service continuity, we do not have strong view.

17 – Sony Europe B.V.

We are supportive of both objectives

18 – ZTE Corporation

We support the inter-gNB indirect-to-indirect path switching study in Rel-18.

For the target relay UEs in IDLE/INACTIVE, we think it may be considered in Rel-18.

For the CHO, we think that it is of secondary priority. It is not the most fundamental feature to support in Rel-18.

19 – Spreadtrum Communications

We are supportive to include inter-gNB indirect-to-indirect path switching.

We don't think any other aspects need to be included in Rel-18.

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| <p>20 – NEC Corporation</p> <p>We support the inter-gNB indirect-to-indirect path switching case. We prefer to include leftover issues from Rel-17 such as target relay UEs in IDLE/INACTIVE, CHO based service continuity, etc.</p> |
| <p>21 – ROBERT BOSCH GmbH</p> <p>We support to include all the stated items.</p> |
| <p>22 – Lenovo Mobile Com. Technology</p> <p>Aspect of inter-gNB indirect-to-indirect path switching is desirable but not a must since we assume the U2U should anyway work even in OOC areas i.e., even without any gNB support for mobility.</p> |
| <p>23 – Fraunhofer IIS</p> <p>We are fine with supporting CHO-based service continuity which improves the reliability when switching between relays/gNBs.</p> |
| <p>24 – Philips International B.V.</p> <p>Inter-gNB indirect-to-indirect path switching can be deprioritized or excluded from the SI/WI.</p> |
| <p>25 – CEWiT</p> <p>We are fine to include inter-gNB indirect-to-indirect path switching as it is important in mobility scenario.</p> |

2.2.3 Multi-path relay

Please provide feedback on Objective 3 in Section 4 of the draft WID v000. In particular, further discussion would be helpful regarding the following points:

- Whether to include this objective and whether to have a study phase if included.
- How to limit the operation scenario if the objective is included.
- Secondary WGs

Feedback Form 24: Feedback on the multi-path relay objective

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| <p>1 – Kyocera Corporation</p> <p>We should support multipath for L2 relay to improve reliability and throughput.</p> |
| <p>2 – Nokia Denmark</p> <p>we suggest also to target L3. It means mainly SA2/CT1 work, but some RAN support may be needed.</p> |
| <p>3 – Apple Europe Limited</p> <p>We do not think a study phase is needed for multi-path work. The scenario for this objective could be limited to Layer 2 intra-gNB “direct+indirect” U2N case. For this scenario, No RAN3 work is needed.</p> |

4 – Ericsson LM

Regarding objective 3:

- We think that a study phase is necessary. It is clear from the inputs of the different companies that there are different views on the applications, let alone technical solutions.
- We think it is reasonable to limit the scope of the study to multi-path relaying for:
 - o Increased data rates.
 - o Increased reliability through multi-path diversity.
- For simplicity, we think that the restriction should be applied to the same cell or the same gNB.

5 – AT&T

We support multi-path relaying for intra-gNB or inter-gNB use cases without the need for a study phase. The starting point can be dual connectivity (already supported for IAB, so it can be done in a release).

6 – Guangdong OPPO Mobile Telecom.

For “Whether to include this objective and whether to have a study phase if included”, we support this objective, and for whether a study phase is needed, we do not see the need since so far the discussion in this email thread is still limited to PC5-based relay.

For ”How to limit the operation scenario if the objective is included”, as clarified in first round, considering the support on CA on Uu interface, it should be same gNB

7 – InterDigital France R&D

We think this work can be included in the WID, and we can directly start normative work, as there was some discussion on the scenarios for this already in the SI of Rel17 (although not captured in the TR). The scope limitation already provided by the moderator is a good starting point and is consistent with how we handled service continuity in Rel17.

8 – HuaWei Technologies Co.

We think multi-path U2N relay enhancement shall be included for Rel-18 as it improve the throughput/reliability/robustness as summarized in the justification section by the moderator. This is crucial for the overall performance for SL relay to support a wider range of application and services.

Similarly as others, we do not think a study phase is needed as the benefits is straightforward and mechanism to support multi-path relay is also quite simple. The remaining work is more for specifications based on Rel-17 L2 relay. We are fine to limit the scenario to a UE using a direct and an +indirect path connecting to the same gNB.

9 – CATT

- We do not think it necessary to have a study phase, if we limit the scope to “indirect + direct paths within the same gNB”.
- In order to reach an agreeable work scope, we are OK to prioritize indirect/direct multi-path within the same gNB.

10 – LG Electronics Inc.

We still think multi-path relay should be of a lower priority as its benefit is unclear and not analyzed thoroughly. Especially for the motivation of throughput enhancement, we assume that multiple paths will share the same resources and thus selecting the best path will be optimal from the efficiency point of view. It seems difficult to conclude on whether there is a potential to further improve throughput by using multiple paths (some of them are sub-optimal) before conducting proper study.

Considering this, if this objective is to be included in WID, either it should start with a study phase or it should include only reliability enhancement whose motivation is relatively clear.

11 – vivo Mobile Communication Co.

Before discussing whether to include Multi-path in the SI/WI, we should first clarify the scope of multi-path for what purpose, for example link reliability or throughput. For example, we should consider which of the following cases would be considered in the SI/WI:

- Multi path for control plane:
 - o Split SRB
 - o SRB Duplication
- Multi-path for user plane:
 - o Data duplication, e.g., PDCP duplication
 - o Split DRB
 - o Data aggregation, e.g., PDCP data split and UL data aggregation on indirect link and direct link.

We think, for a first version of multi-path we should consider the simple case of multi-path for control plane for robust RRC connection of remote UE. In relay scenario, the direct link may not be very reliable due to radio condition, especially where the remote UE is at cell edge, thus, in such case UL data aggregation may not be very efficient.

Additionally,

1) "Layer-2 relay" should be clear as "Layer-2 UE-to-Network relay"

2) If the scope is limited to "intra-cell or intra-gNB direct path+indirect path", Ok to start as one of the WID objectives. Otherwise, start to have a study phase first.

12 – Qualcomm Incorporated

This objective should be included and there should be a study phase for it.

It is fine to limit the scope to the case of the connections are to the same gNB, i.e. regarding this "[cell or gNB]", the term "gNB" is preferred. Also, it should be also clarified if MN+SN case is in scope.

Secondary WG should be RAN3.

13 – MediaTek Inc.

This area can go directly to normative work based on discussion that already took place in Rel-17. We can accept the restriction to the same gNB, but we think it's important to have multi-path available for reliability/robustness.

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| <p>14 – Intel Korea</p> <p>We are not strong proponent of this topic and overall prefer to limit the scope to avoid workload issues.</p> <p>At the same time, if we agree to it, we support to have a short study phase at the beginning of the work item, dedicated to this topic.</p> |
| <p>15 – China Telecommunication Corp.</p> <p>We strongly support to include this objective. We think a study phase for this is not needed.</p> <p>We think one direct/ indirect path+one indirect path under the same gNB can be prioritized.</p> |
| <p>16 – Samsung R&D Institute UK</p> <p>We think that we need a study on multi-path relay to get clear understanding on scenarios, potential solutions and any impacts to other WG including RAN3 if multi-path relay is included as one objective.</p> |
| <p>17 – Sony Europe B.V.</p> <p>We still think that multi path should be low priority</p> |
| <p>18 – NEC Corporation</p> <p>We are ok to include mutli-path relay as one objective. If this objective is accepted, we suggest to start this objective with the case of one indirect path and one direct path.</p> |
| <p>19 – Spreadtrum Communications</p> <p>We support multi-path for intra-gNB direct + indirect only.</p> |
| <p>20 – ZTE Corporation</p> <p>For the multi-path relay, we think both L2 and L3 relay can be considered.</p> <p>It is suggested to include this objective in Rel-18 and we think it can directly go to WI phase.</p> <p>It is suggested to support multi-path relay within the same gNB.</p> |
| <p>21 – Lenovo Mobile Com. Technology</p> <p>We see the requirement from FirstNet “The network operator shall be able to define the maximum number of hops supported in their networks when using relay UE” as sensible and think that to make OOC U2U support useful more than one Hops will be key requirement.</p> |
| <p>22 – Fraunhofer IIS</p> <p>We support multi-path relay to be included in the WI description since it can improve reliability and throughput.</p> |
| <p>23 – Philips International B.V.</p> <ul style="list-style-type: none"> - We strongly think that multi-path is needed to improve reliability and robustness. We think that a study phase is needed first to converge in the exact objectives for multi-path |

- The operation scenario can be discussed as part of the SI
- Secondary WGs: RAN3 and possibly RAN1 and RAN4

24 – China Mobile Com. Corporation

We think that we need a study on multi-path relay to get clear understanding on scenarios, potential solutions

25 – CEWiT

We support multipath relay and feel it is better to start with small study to define the scope clearly

2.2.4 Other core part objectives

Please provide feedback on the core part objectives other than those listed in the draft WID v000. Please note that several proposals were collected during the initial phase including multi-hop UE-to-Network relay, power saving consideration, RedCap consideration, inter-UE coordination and HARQ feedback consideration, end-to-end QoS, etc.

Feedback Form 25: Feedback on the other core part objectives

1 – Apple Europe Limited

We support to include Multi-hop UE-to-Network Relay as an additional objective, which is important for coverage extension. We also support SL DRX for Sidelink Relay operation, if not concluded in Rel-17.

2 – Ericsson LM

We are not supportive of further objectives.

3 – AT&T

We support both Multi-hop UE-to-Network Relay and SL DRX for Sidelink Relay as important extensions which were not considered in Rel-17.

4 – InterDigital France R&D

In addition to multi-hop UE to NW relay, we think power savings considerations are the most important to ensure adoption of the relaying solution for public safety and commercial applications beyond V2X. We don't think the current SL-DRX mechanism can be applied directly for the remote – relay link in UE to NW relay, and the remote UE in IDLE/INACTIVE is therefore required to monitor PC5 continuously. Power consumption at the relay UE is also a concern.

5 – HuaWei Technologies Co.

As explained also in 2.2.2, we do not support to have additional objectives.

6 – CATT

Given the discussions so far, we do not see a strong need to include additional objectives.

7 – LG Electronics Inc.

We think no more objectives should be added.

8 – Qualcomm Incorporated

- Multi-hop may be needed if SA2 agrees that in their Rel-18 study.
- The Rel. 17 NR lays the foundation for the support of connected industries using UEs with reduced capabilities and a small form factor. An important subset of use cases, e.g., data collection using sensors in a wide-area IOT network, however, is required to meet larger range and more stringent battery life requirements compared to those supportable by the direct UE-to-network communication. Extending SL relay to support redcap remote/relay UEs therefore is crucial to address the requirements of connected industries. Hence, in our view, the following enhancements are also of high priority and can be easily supported without much additional standards work. These should be considered in Rel.18:
 - *Sidelink for remote/relay redCap UEs:*
 - o *SL Redcap capability definition, identification, and negotiation*
 - o *Relay discovery and (re)selection enhancements to consider RedCap capabilities*
 - o *Redcap Remote UE Access control*
 - *Additional power saving enhancements:*
 - o *Support of eDRX/ SL DRX adjustment under SL relay (if not supported in Rel17)*

9 – MediaTek Inc.

We continue to see value in multi-hop for addressing deep coverage holes. On the power saving issues raised by some other comments, we think this depends somewhat on RAN2 outcomes—if existing SL power saving mechanisms are not applicable to relay scenarios in Rel-17, then something needs to be done in Rel-18.

10 – China Telecommunication Corp.

We support to have multi-hop UE-to-Network relay as an additional objective, which is important to extend NR coverage, especially for high frequency band.

It is reasonable to reduce relay UE's power consumption burden due to serving remote UE. Thus, power saving consideration can also be another additional objective.

11 – Samsung R&D Institute UK

We do not think that any more objectives are needed.

12 – ZTE Corporation

Considering limited time, it is suggested to keep a reasonable scope of SL relay. We think no more objectives should be considered in Rel-18.

13 – ROBERT BOSCH GmbH

We strongly support: power saving consideration (RAN2/1), inter-UE coordination (RAN1/2), HARQ feedback consideration (RAN1/2), and end-to-end QoS (RAN2).

| |
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| <p>14 – Lenovo Mobile Com. Technology</p> <p>RAN should strive to put real numbers when it comes to QoS requirements e.g., what reliability level will this new WI be targeted to support instead of hiding under “high reliability” or similar.</p> |
| <p>15 – Continental Automotive GmbH</p> <p>We support to include end-to-end QoS management as part of the core objectives for meeting V2X service requirements.</p> |
| <p>16 – Fraunhofer IIS</p> <p>We support to consider also multi-hop relay, power saving considerations including SL DRX operation and HARQ feedback in U2U relay.</p> |
| <p>17 – Philips International B.V.</p> <p>We need to make sure that we align with SA2’s proposal to work on multi-hop UE-to-Network relays, so we support adding multi-hop also to RAN2’s SL relay enhancements WI/SI.</p> <p>We also support adding the topic of power saving. Power saving is essential in our opinion, in particular for battery operated devices in hard to reach places. And of course, we should also consider RedCap support, including any new power saving enhancements that they may define during release 18 for Redcap. It would be very bad in our opinion if RedCap devices would not be able to support Sidelink relays with proper power saving, and would severely decrease the number of use cases and would hamper deployment of sidelink relays. Furthermore, since the topic of Sidelink DRX for relays and discovery is unlikely to be finished in release 17, we should at least include a placeholder to cater for sidelink DRX support for relays and discovery.</p> |
| <p>18 – CEWiT</p> <p>We are fine with the current objective addition to it we are in support of power saving aspects</p> |

2.2.5 Performance part objectives

Please provide feedback on the performance part objectives in the draft WID v000.

Feedback Form 26: Feedback on the performance part objective

| |
|---|
| <p>1 – Ericsson LM</p> <p>We are generally fine with this part.</p> |
| <p>2 – LG Electronics Inc.</p> <p>We are fine with the objective in the draft WID.</p> |
| <p>3 – Qualcomm Incorporated</p> <p>Fine with the proposal.</p> |

4 – Samsung R&D Institute UK

We are fine with the proposal.

5 – CEWiT

We are okay with the proposal.

2.2.6 Others

Please provide feedback on any other aspects of the objectives in the draft WID v000.

Feedback Form 27: Feedback on any other aspects related to the objectives

| |
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| |
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2.3 Others

Please provide feedback on the draft WID v000 other than Section 3 and 4.

Feedback Form 28: Feedback on the draft WID other than Section 3 and 4

1 – Ericsson LM

We would like to know whether the study part would be captured in a TR or not. We think it is preferable to have a TR.

2.4 Summary and moderator’s proposal

2.4.1 Justification

Summary: It was observed that the text in V000 can be used as a starting point. Several comments were received on possible updates.

Moderator’s proposal: The text is updated based on the input and the moderator proposes to continue discussion using it.

2.4.2 UE-to-UE relay

Summary (25 input)

- Whether to limit the scope to unicast
 - Yes (8): Ericsson, Huawei, CATT, LGE, vivo, Intel, China Mobile, Philips
 - Add groupcast (13): Kyocera, Apple, AT&T, InterDigital, MediaTek, Samsung, Sony, Spreadtrum, NEC, Bosch, Lenovo, Fraunhofer, CEWiT

- Whether to prioritize L2 and L3 common parts in the first few WG meetings
 - Yes (15): Kyocera, Apple, Ericsson, AT&T, OPPO, Huawei, LGE, vivo, Intel, Samsung, China Mobile, Spreadtrum, NEC, Bosch, Philips
 - No (2): MediaTek, Intel
- Whether to include other L2 specific aspects
 - No other aspects (2): Ericsson, LGE
 - General user plane procedure (3): Apple, CATT, Qualcomm
 - QoS (5): OPPO, InterDigital, vivo, Fraunhofer, Philips
- Other comments
 - Multi-hop relay: FirstNet
 - Multi-path relay: Kyocera
 - Relay and remote UE authorization
 - Not necessary: Qualcomm
 - Control plane procedures
 - Not necessary: Samsung
 - Necessary: NEC

Moderator’s proposal:

- It is proposed to continue discussions on whether to limit the scope to unicast. The moderator understands slight majority prefers adding groupcast but there are still considerable number of companies supporting the limitation. The moderator wonders if the group can keep the study outcome “For UE-to-UE Relay, it is assumed that the Remote UE has an active end-to-end connection via only a single Relay UE at a given time.” in 5.1 of TR 38.836, and the relay (re-)selection criteria is common for unicast and groupcast. If this is the case, the moderator thinks that supporting both cast types might be straightforward; otherwise another round of relay selection study might be necessary for groupcast.
- It is proposed to prioritize the L2 and L3 common part until RAN#98.
- Considering “QoS handling for L2 UE-to-UE Relay is subject to upper layer” in 5.5.2 of TR 38.836, the moderator proposes to have a placeholder for QoS handling. The moderator observes no other strong support for additional L2 specific enhancements and thus proposes to stop the related discussion unless a critical issue is identified.
- It is proposed to continue discussion on the objectives details (e.g., whether each sub-bullet is necessary or not) using the draft WID v001.

2.4.3 Service continuity enhancements

Summary (25 inputs)

- Whether to include inter-gNB indirect-to-indirect path switching

- Include (14): Kyocera, Apple, AT&T, OPPO, LGE, MediaTek, China Telecom, Samsung(?), China Mobile, Sony(?), ZTE, Spreadtrum, NEC, Bosch(?), CEWiT
 - Not include (7): Ericsson, InterDigital, Huawei, CATT, vivo, Intel, Philips,
 - Discussion necessary: Qualcomm
- Whether to include other aspects such as target relay UEs in IDLE/INACTIVE, CHO based service continuity, etc.
- relay UEs in IDLE/INACTIVE
 - Yes (8): Kyocera, Apple, AT&T, InterDigital, China Telecom, China Mobile, ZTE, NEC
 - CHO
 - Yes (8): Kyocera, Apple, AT&T, InterDigital, vivo, China Telecom, NEC, Fraunhofer
 - DAPS mobility
 - Yes (2): InterDigital, China Mobile
 - No more aspects (8)
 - Ericsson, Huawei, CATT, LGE, Samsung(?), Sony(?), Spreadtrum, Bosch(?)
 - Need to see Rel-17 progress (especially “relay UEs in IDLE/INACTIVE”) (2)
 - OPPO, MediaTek
 - Some details can be decided during the WI phase (1)
 - Intel

Moderator’s proposal

- As majority companies support including “Inter-gNB indirect-to-indirect path switching,” the moderator proposes to keep it in the draft WID while the moderator understands that further discussion is necessary for the convergence. The moderator asks if there is a way to address concerns of opposing companies, e.g., by treating this scenario as a second priority after finalizing the other scenarios and reusing solutions for them.
- For the other aspects discussed in this round, the moderator proposes to stop the discussion on whether to write them in the WID with the understanding that such details can be decided in the WGs once the WI starts.

2.4.4 Multi-path relay

Summary (25 inputs):

- Whether to include this objective and whether to have a study phase if included.
 - Include (15): Kyocera, Apple, AT&T, OPPO, InterDigital, Huawei, CATT, vivo, MediaTek, China Telecom, NEC, Spreadtrum, ZTE, Fraunhofer, Philips,
 - Not include: LGE, Sony,
 - Study phase necessary (8): Ericsson, LGE, Qualcomm, Intel, Samsung, Philips, China Mobile, CEWiT
 - Also consider L3: Nokia, ZTE

- How to limit the operation scenario if the objective is included.
 - Intra-gNB direct + indirect: Apple, Ericsson, OPPO, Huawei, CATT, vivo, Qualcomm, MediaTek, China Telecom, Spreadtrum, ZTE
- Secondary WGs
 - RAN3: Qualcomm, Samsung,
 - RAN1, RAN4: Philips

Moderator's proposal:

- Considering the wide support, it is proposed to assume that an objective is added to the WID. However, the moderator observes that many companies agreed the need of a study phase, with the understanding that even L2 and L3 relay can be studied in it. Therefore, it is proposed to have a study phase focusing on the two motivations, reliability and throughput improvements. If a study phase is agreeable, discuss whether a TR needs to be created.
- Most companies are fine with the limited scenario Intra-gNB direct + indirect, so it is proposed to keep this scope.
- More discussion seems necessary on the secondary WGs. The moderator wonders whether RAN3 needs to be involved if the scenario is limited to intra-gNB case.

2.4.5 Other core objectives

Summary (18 inputs):

- Multi-hop UE-to-Network Relay
 - Apple, AT&T, InterDigital, Qualcomm, MediaTek, China Telecommunication, Fraunhofer, Philips (8)
- SL DRX for Sidelink Relay operation
 - Apple, AT&T, InterDigital, Qualcomm, MediaTek, China Telecommunication, Bosch, Fraunhofer, Philips, CEWiT (10)
- RedCap UEs
 - Qualcomm, Philips (2)
- Inter-UE coordination
 - Bosch (1)
- HARQ feedback consideration
 - Bosch (1)
- End-to-end QoS

- Bosch, Continental, Fraunhofer (3)
- No further objectives
- Ericsson, Huawei, CATT, LGE, Samsung, ZTE (6)

Moderator’s proposal:

- Most of the topics have been discussed since the August email discussion, but the moderator still observes that the support does not outweigh those who do not want to introduce them mainly due to the work scope concerns. So the moderator proposes to stop the discussion on additional objectives.
- The moderator thinks that SL DRX for sidelink relay operation can be an exception as this was not discussed before and its support in Rel-17 is not clear yet. The moderator proposes to leave a place holder in WID to check the situation at RAN#94.

2.4.6 Others

Summary on the other parts

- The responded companies were okay with the performance part objective.
- One company asked whether a TR is necessary if the WI will have a study phase.

3 Final round

The moderator updated the draft WID in V001. Please provide your feedback on the moderator’s proposal and the draft WID.

3.1 Justification

Please provide your feedback on the following proposal and the text in the draft WID v001.

Moderator’s proposal: The text is updated based on the input and the moderator proposes to continue discussion using it.

Feedback Form 29: Feedback on the justification

1 – Apple Europe Limited

Since the ”SL DRX for sidelink relay” is added as an additional objective. Maybe we should also add some text for justification for this topic.

2 – Ericsson LM

We are fine with the proposed text but suggest removing the part in yellow/brackets. The potential benefits are still to be established.

3 – InterDigital France R&D

We are fine with the latest text, but also suggest adding a justification for the SL DRX for sidelink relay work.

4 – LG Electronics Inc.

We are fine with the text and the yellow parts can be revisited after the objectives become stable. We understand SA2 endorsed a SID for ProSe enhancement in Rel-18 but it can be added later if it finally approved in SA plenary.

5 – HuaWei Technologies Co.

We are fine with the text proposed by the moderator, and we disagree with Ericsson that it should be removed. the benefits to throughput and reliability are straight forward and have been acknowledged widely.

6 – MediaTek Inc.

We are OK with the latest text, but of course it will need to be aligned with the final objectives. We think the highlighted text is appropriate for the multi-path objective.

7 – Guangdong OPPO Mobile Telecom.

Same view as MediaTek. For the DRX part, since it is still a pending bullet, we can revisit it later after the coming R2 meeting concludes on this aspect.

8 – Qualcomm Incorporated

The justification seems to be fine. It can be updated based on the developments in RAN2 and SA2 till Dec plenary.

9 – CATT

We are generally fine with the current form of the justification. Also we support to keep the yellow part on multipath as its motivations have been discussed extensively and well understood. A minor rewording for the yellow part is 'via ~~multiple~~ direct and/or indirect paths' to avoid potential confusion that there are more than two paths.

Then for the placeholder of SA2 impact, maybe we could add a note somewhere in this WID, to say that the justification/objectives are subject to further updates based on coordination with SA2 on their corresponding item before final approval.

10 – Samsung R&D Institute UK

HJ We think that the texts in bracket should be removed at this time. The justification text can be added if objectives become stable later.

11 – ZTE Corporation

We are basically fine with the justification part. For the multi-path part, the text of "via multiple direct and/or indirect paths" has three implications: 1) via multiple direct paths; 2) via multiple indirect paths; 3) via multiple direct and indirect path. However, most of the companies support to consider the combination of one direct path + one indirect path. It is suggested to change the text of "via multiple direct and/or indirect paths" into "via direct and indirect path", which is more aligned with the common interest.

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| <p>12 – Philips International B.V.</p> <p>We agree with the revised text</p> |
| <p>13 – Fraunhofer IIS</p> <p>We are fine with the proposed text for the justification section and would propose to add to this section the support of DRX in SL Relay operation.</p> |
| <p>14 – CEWiT</p> <p>We are fine with the revised proposal</p> |

3.2 UE-to-UE relay

Please provide your feedback on the following proposal and the text in the draft WID v001.

Moderator’s proposal:

- It is proposed to continue discussions on whether to limit the scope to unicast. The moderator understands slight majority prefers adding groupcast but there are still considerable number of companies supporting the limitation. The moderator wonders if the group can keep the study outcome “For UE-to-UE Relay, it is assumed that the Remote UE has an active end-to-end connection via only a single Relay UE at a given time.” in 5.1 of TR 38.836, and the relay (re-)selection criteria is common for unicast and groupcast. If this is the case, the moderator thinks that supporting both cast types might be straightforward; otherwise another round of relay selection study might be necessary for groupcast.
- It is proposed to prioritize the L2 and L3 common part until RAN#98.
- Considering “QoS handling for L2 UE-to-UE Relay is subject to upper layer” in 5.5.2 of TR 38.836, the moderator proposes to have a placeholder for QoS handling. The moderator observes no other strong support for additional L2 specific enhancements and thus proposes to stop the related discussion unless a critical issue is identified.
- It is proposed to continue discussion on the objectives details (e.g., whether each sub-bullet is necessary or not) using the draft WID v001.

Feedback Form 30: Feedback on UE-to-UE relay

| |
|--|
| <p>1 – AT&T</p> <p>We are OK with the moderator’s proposal and strongly support keeping groupcast in scope.</p> <p>We can also go with the recommendation to ”keep the study outcome “For UE-to-UE Relay, it is assumed that the Remote UE has an active end-to-end connection via only a single Relay UE at a given time.” in 5.1 of TR 38.836, and the relay (re-)selection criteria is common for unicast and groupcast”</p> |
| <p>2 – Apple Europe Limited</p> <p>We also support to have groupcast for U2U relay. The rapporteur’s recommendation of ”keep the study outcome “For UE-to-UE Relay, it is assumed that the Remote UE has an active end-to-end connection via</p> |

only a single Relay UE at a given time.” ” is fine to us. We also share the view that groupcast does not need a separate relay (re)selection criteria by assuming R18 U2U relay UE will support both unicast and groupcast.

3 – Apple Europe Limited

We suggest to change bullet ”UE-to-UE relay adaptation layer design” under this objective to ”User plane support for U2U relay (e.g., PC5 adaptation layer design)”.

4 – Ericsson LM

We are generally fine with the proposal but:

- Still think that only unicast is relevant.
- QoS aspects are unclear without SA2 work.

5 – InterDigital France R&D

We are fine with the moderator’s proposal, and would agree with the assumption for groupcast suggested as a compromise for supporting groupcast in Rel18.

6 – LG Electronics Inc.

We prefer to limit the scope to unicast but the proposal is fine as a compromise.

7 – HuaWei Technologies Co.

We would like to limit the scope of U2U relay to unicast only. For groupcast, we don’t think RAN2 is able to make the final decision. In our understanding it requires SA2 conclusion and thus we suggest this is left to SA2 to decide. RAN WI does not need to include groupcast at this stage. If SA2 decides to support so, RAN can discuss this further.

8 – MediaTek Inc.

We support the inclusion of groupcast and think the moderator’s assumptions are a good way of managing the impact. On the QoS bullet, we are not exactly sure what needs to be done considering the Rel-17 study outcome; maybe it should be ”QoS handling if necessary, subject to SA2 progress”.

9 – China Mobile Com. Corporation

We are fine with moderator’s proposals, and we prefer to limit the objective scope to unicast only.

10 – Guangdong OPPO Mobile Telecom.

We would like to understand more on the impact on groupcast case due to this NOTE: firstly, the “end-to-end connection” is G-cast connection (yet we understood no real connection for G-cast) or U-cast connection? Secondly, whether this “a single Relay UE” means a single relay UE in a group for all group members or the selection relay UE is per group member? And thirdly, “and the relay (re)selection criterion is the same in unicast and groupcast” does it mean that the same AS criterion (i.e., signal quality based relay selection) or it is applicable to upper layer criterion for upper layer (which is up to SA2)? In general, would be good to clarify the intention of this NOTE for groupcast if it is to be supported. Furthermore, since this groupcast case was not studied in either SA2 or RAN2, does it require some study work (coordinated between SA2 and RAN2)?

11 – Qualcomm Incorporated

- Using "groupcast transmission mechanism" between source/target UE and the relay is different from supporting "relay for group communication". As also pointed out by moderator, the discovery and connection establishment procedure discussed in Rel-17 does not support UE-to-UE relay for "group communication". Therefore, we don't think supporting "groupcast" can be added to the objective before a proper study, involving also SA2.
- Prioritizing the common part for L2 and L3 Relay is fine.
- Again, we object to the objective of "Relay and remote UE authorization [RAN3]" as it is not justified for UE-to-UE relay.

12 – Intel Korea

We are fine with moderator's proposal including the aspect to keep the study outcome. We are also fine to keep Note 1B (typo in word 'unicast').

13 – CATT

Regarding the cast type we are basically fine with the moderator's suggestion. But one possibility is to leave this particular aspects FFS and then decide it in the coming RP meeting, based on necessary coordination with SA2.

Then regarding the formulation of the bullets, as commented in the previous round we think 'QoS handling' is not very clear and accurate. To us the Apple suggestion to change bullet "UE-to-UE relay adaptation layer design" under this objective to "User plane support for U2U relay (e.g., PC5 adaptation layer design)" is a good one. So then we have the following

- A. Layer-2 relay specific part
 - i. User plane support for U2U relay (e.g., PC5 adaptation layer design) [RAN2]
 - ii. Control plane procedures [RAN2]

14 – Spreadtrum Communications

We support groupcast and we are fine with the moderator's proposal and suggestion.

15 – vivo Mobile Communication Co.

We are fine with the proposal, as commented before we prefer to limit the objective scope to unicast only

16 – Lenovo Mobile Com. Technology

In our understanding, the current WI scope allows a remote UE to use a single relay UE to reach multiple destinations simultaneously; please confirm.

On a different point, we do not think the SI conclusion "For UE-to-UE Relay, it is assumed that the Remote UE has an active end-to-end connection via only a single Relay UE at a given time." prohibits using a relay to reach groupcast destination.

We are fine with prioritizing the L2 and L3 common part until RAN#98.

We can also agree with moderator to have a placeholder for QoS handling.

| |
|---|
| <p>17 – Samsung R&D Institute UK</p> <p>We are fine with the moderator’s proposal.</p> |
| <p>18 – NEC Corporation</p> <p>We support both unicast and groupcast, and we can prioritize unicast. We are fine to prioritize the L2 and L3 common part until RAN#98. We are fine to have a placeholder for QoS handling.</p> |
| <p>19 – ZTE Corporation</p> <p>We prefer to only study unicast for UE-to-UE relay in Rel-17. For the groupcast based UE-to-UE relay, the scenario needs to be further clarified.</p> |
| <p>20 – Philips International B.V.</p> <p>The only comment we have is about Note 1B. We understand that if multi-path is finally included Note 1B will have to be deleted</p> |
| <p>21 – Fraunhofer IIS</p> <p>We support the inclusion of groupcast and do agree with the moderator’s proposal. Moreover, we would keep the placeholder for QoS handling for L2 U2U relay until receiving the outcome of SA2 work.</p> |
| <p>22 – CEWiT</p> <p>We support groupcast as well and finw with moderator’s proposal</p> |

3.3 Service continuity enhancements

Please provide your feedback on the following proposal and the text in the draft WID v001.

Moderator’s proposal

- As majority companies support including “Inter-gNB indirect-to-indirect path switching,” the moderator proposes to keep it in the draft WID while the moderator understands that further discussion is necessary for the convergence. The moderator asks if there is a way to address concerns of opposing companies, e.g., by treating this scenario as a second priority after finalizing the other scenarios and reusing solutions for them.
- For the other aspects discussed in this round, the moderator proposes to stop the discussion on whether to write them in the WID with the understanding that such details can be decided in the WGs once the WI starts.

Feedback Form 31: Feedback on service continuity enhancements

| |
|---|
| <p>1 – Apple Europe Limited</p> <p>We do not think Scenario D ”Inter-gNB indirect-to-indirect” in the draft WID shall be treated as second priority. Logically, when scenario B&C are handled, the solution will take care of scenario D by default.</p> |
|---|

Any design working for B/C, but not working for D needs to be discouraged. So, putting Scenario D as a low priority gives the wrong message that somehow we could end up with a design working for B&C, but not for D in R18.

2 – Ericsson LM

We are fine with the proposal and accept 2.D with lower priority as a compromise, but prefer to state that no specific optimizations will be specified for this case.

3 – InterDigital France R&D

We agree with the moderator's suggestion to deprioritize the inter-gNB indirect-indirect case (if any additional work is involved), while leaving it to the WI as to whether to handle other aspects. The WID should indicate this way forward explicitly, however.

4 – LG Electronics Inc.

We are fine with the proposal.

5 – HuaWei Technologies Co.

We still do not think scenario 2D is essential and if to compromise, we think it should be clearly stated this is deprioritized among all the objectives, and no specific optimization for this scenario.

6 – MediaTek Inc.

We don't think objective 2D needs to be deprioritised; we should be able to design a unified solution that covers the intra- and inter-gNB cases, and treating one at lower priority invites a fragmented approach where we try to solve one piece of the problem at a time.

7 – Guangdong OPPO Mobile Telecom.

Same view as Apple and MediaTek that no need for lower priority for objective-2D, or at least we should aim at a general design applicable to all scenario, instead of fragmented approach.

8 – Qualcomm Incorporated

In our view, scenario D could be the most important case to address, as it could be the most realistic scenario in deployment. Comparing to scenario C, the addition seems to fall mainly into the scope of RAN3, and maybe that can be what the NOTE should clarify.

9 – Intel Korea

If majority of companies prefer scenario D, we are fine to accept the scenario in which case, we need not deem it as second priority. It is a fair point from Apple that the design for scenarios A, B & C should somewhat lead to the design for scenario D.

10 – CATT

We do not think 2D should be of lower priority. As commented this is quite important use case, and most of the design/solution reuse those of B/C. Extra effort may be mainly in the interface but it seems not much.

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|---|
| <p>11 – Spreadtrum Communications</p> <p>We do not think Scenario D shall be treated as second priority, but we agree the solution for other scenarios can be resumed as much as possible.</p> |
| <p>12 – vivo Mobile Communication Co.</p> <p>e are fine with A, B and C. we do not see the stringent requirement for D.</p> |
| <p>13 – Lenovo Mobile Com. Technology</p> <p>We can accept both the recommendations from the moderator here i.e., include “Inter-gNB indirect-to-indirect path switching,” as a second priority and leaving other details to WGs.</p> |
| <p>14 – China Telecommunication Corp.</p> <p>We think scenario D is also an important coverage extension scenario to be supported for the deployment. In our mind, it’s likely remote UE moves from one cell edge to another cell edge.</p> <p>On the other hand, we don’t see much effort needed for scenario D after scenario B/C being supported, and prefer unified design for all scenarios other than the fragmented approach.</p> |
| <p>15 – Samsung R&D Institute UK</p> <p>We are fine with the moderator’s proposal.</p> |
| <p>16 – NEC Corporation</p> <p>We are fine to deprioritize “Inter-gNB indirect-to-indirect path switching”. We are fine with the suggestion on how to treat the other aspects.</p> |
| <p>17 – ZTE Corporation</p> <p>It is suggested not to de-prioritize the inter-gNB indirect-to-indirect path switching. Based on the specification work of scenario B and C, we think scenario D could be supported without much additional specification work. It is not anticipated to leave this feature to R18.</p> |
| <p>18 – Philips International B.V.</p> <p>We agree with reducing the priority of scenario D</p> |
| <p>19 – Fraunhofer IIS</p> <p>We are fine with the proposal.</p> |
| <p>20 – CEWiT</p> <p>We support the moderator’s proposal</p> |

3.4 Multi-path relay

Please provide your feedback on the following proposal and the text in the draft WID v001.

Moderator’s proposal:

- Considering the wide support, it is proposed to assume that an objective is added to the WID. However, the moderator observes that many companies agreed the need of a study phase, with the understanding that even L2 and L3 relay can be studied in it. Therefore, it is proposed to have a study phase focusing on the two motivations, reliability and throughput improvements. If a study phase is agreeable, discuss whether a TR needs to be created.
- Most companies are fine with the limited scenario Intra-gNB direct + indirect ,so it is proposed to keep this scope.
- More discussion seems necessary on the secondary WGs. The moderator wonders whether RAN3 needs to be involved if the scenario is limited to intra-gNB case.

Feedback Form 32: Feedback on multi-path relay

1 – Apple Europe Limited

We are not sure about the study phase, but we can follow the majority view on this. We are fine with the scope limit suggested by the moderator, then RAN3 is not needed for the second WG as the work is to be limited to intra-gNB case.

2 – Ericsson LM

We are fine with the proposal.

3 – InterDigital France R&D

While we prefer multi-path starts immediately in WI, we are ok if majority prefer a study phase prior to this. The scope limitations are also fine for us.

4 – LG Electronics Inc.

We are fine with the proposal. We agree with Apple that RAN3 is not needed.

5 – MediaTek Inc.

We do not really see the need for a study phase on this topic, but the limitation in 3A is OK as a way of managing the scope.

6 – HuaWei Technologies Co.

We still don't see the necessity to have the study. The solution is straight forward. We are also unclear about adding L3 relay into multipath scope right now, this is a decision that SA2 should make as the major impact on L3 relay is in SA2. Only 2 companies mentioned so and we do not think it is well justified. For the L3 relay, gNB cannot see remote UEs and the path is rather a path that only the CN is visible, and the multi-path can only be done at CN level.

In summary, we still prefer to go directly as normative work. If the intention of the study is to figure out detailed solution design, we then suggest to update the objective as below:

1. [Study the benefit and potential solutions and specify solutions] for multi-path support in Layer-2 and Layer-3 UE-to-Network relay to enhance reliability and throughput in the following scenario [RAN2]:

A. A UE is connected to the same gNB using one direct path and one indirect path.

[Note 3A: Study on the benefit and potential solutions are to be completed in RAN#98 which will decide whether/how to start the normative work.]

7 – Guangdong OPPO Mobile Telecom.

We still do not see the need of study on this, or at least we should follow the change by Huawei (adding "and specify", and removing "Note-3A"). And we understand normally TR is more used for a SI and not used for study phase, yet we are open on that.

We do not think L3 should be added here, since the multiple path in CN level can already be implemented since R13 eD2D, there is nothing to be done (study or specify) now for R18. So same view as huawei on removing Layer-3 from the bullet.

RAN3 seems not needed for intra-gNB case.

8 – Qualcomm Incorporated

Given this is for UE-to-Network Relay, RAN3 involvement is needed even for the intra-gNB case, similar to that for Rel-17 work.

We also agree with others that Layer-3 Relay with both direct and indirect path is not for RAN to work on.

9 – Intel Korea

We agree to the current text proposed by the moderator. We prefer the study phase and limiting the scenario to intra-gNB. We are open to creating a TR. RAN3 as secondary WG is probably not necessary.

10 – CATT

Also we do not see strong need to have a study phase. As we commented in the previous round the benefits are quite clear and we are not sure what study need to be done for those.

Regarding the scope we are fine with the moderator's suggestion. And in our understanding, as it is intra-gNB so no need to impact R3.

11 – Spreadtrum Communications

we are fine with the current text.

12 – Lenovo Mobile Com. Technology

We do not think keeping just direct + 1 indirect path adds any value as in the most general case of OOC, the direct path is anyway not available. So, rather than "pretending" to add multi-path, we should add real multi-path support.

On starting with a Study, no strong opinion but to us it seems to be waste of precious time since individual WGs already have the necessary expertise to directly start the work; and, no one hopefully wants to do a feasibility check first.

13 – China Mobile Com. Corporation

We are fine with the proposal of moderator. We prefer study item and limit the case to intra-gNB direct + indirect. If multi-path is started without study phase, we suggest second priority for it and begin the work since september, 2022.

14 – China Telecommunication Corp.

We think study phase is not needed. We are still very interested in indirect+indirect and inter-gNB direct+indirect scenario, but we are fine with the majority view to limit the scope. We hope to solve them at least in the next release.

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| <p>15 – Samsung R&D Institute UK</p> <p>We think that the multi-path needs study phase if the objective on multi-path relay is included.</p> |
| <p>16 – NEC Corporation</p> <p>NEC: We prefer to focus on L2 relay for the research of multi-path relay for the study phase. We are fine with the limited scenario of Intra-gNB direct + indirect. And if only intra-gNB scenario is accept for WI, we are supportive to not involve RAN3 as the secondary WG.</p> |
| <p>17 – vivo Mobile Communication Co.</p> <p>We agree the moderator and other companies that a study phase is needed. And we think a study phase in 6 months period is reasonable.</p> |
| <p>18 – ZTE Corporation</p> <p>Actually, we think the SI phase for multi-path support is not necessary. However, we may follow majority view on this. For the L3 UE-to-Network relay, we think L3 remote UE should have the capability to divide its traffic transmission via direct and indirect path instead of only one path. It is necessary to study how to support this feature in Rel-18.</p> |
| <p>19 – Philips International B.V.</p> <p>We agree with adding multi-path relay and limiting its scope to intra-gNB direct+indirect</p> |
| <p>20 – Fraunhofer IIS</p> <p>We think that multi-path can be included directly in the work item and do not see any necessity of a study phase. However, if companies agree to start with a study phase we are also fine.</p> |
| <p>21 – CEWiT</p> <p>We are fine to start with work item directly as well as with some study if needed</p> |

3.5 Other core objectives

Please provide your feedback on the following proposal and the text in the draft WID v001.

Moderator's proposal:

- Most of the topics have been discussed since the August email discussion, but the moderator still observes that the support does not outweigh those who do not want to introduce them mainly due to the work scope concerns. So the moderator proposes to stop the discussion on additional objectives.
- The moderator thinks that SL DRX for sidelink relay operation can be an exception as this was not discussed before and its support in Rel-17 is not clear yet. The moderator proposes to leave a place holder in WID to check the situation at RAN#94.

Feedback Form 33: Feedback on the other core part objectives

1 – Apple Europe Limited

We still feel that multi-hop U2N relay is quite important for coverage extension, but we can follow the majority view on this. We hope this be handled in the future release with high priority.

Regarding the SL DRX for sidelink relay, we are fine to have a place holder for this in R18 in case R17 cannot complete this work. But then we also need a placeholder for this in the "justification" section.

2 – Ericsson LM

We are fine with the proposal.

3 – InterDigital France R&D

We are fine with moderator's suggestion. Regarding SL DRX, we think this will anyways be discussed at the upcoming RAN2 as to whether we will have time for this work in Rel17.

4 – LG Electronics Inc.

We support the proposal to stop discussion on the other potential objectives. The WID can have a place holder for SL DRX for relay, whose inclusion will be decided at RAN#94e.

5 – MediaTek Inc.

For the SL DRX topic, we support having a placeholder, and we understand that this issue should be clarified after RAN2#116-e (in time for RAN#94-e).

Same view as Apple about multi-hop U2N relay. We think this remains an important topic, and if it cannot be included in Rel-18 it should be handled at high priority in future.

6 – HuaWei Technologies Co.

We support to stop discussing other objectives. Regarding SL DRX for relay, we observed there are relevant contributions submitted to RAN2 Nov meeting, this can be decided later pending on RAN2 progress.

7 – Qualcomm Incorporated

- The SL DRX for sidelink relay should be considered for Rel-18, including potential adaption of Rel-17 SL DRX to support Relay operations (UE-to-Nw Relay and UE-to-UE relay).
- As for the additional topics on supporting RedCap UEs, we believe that should be discussed further as it can support an important market with minimum work, e.g. enhancements to discovery and capability indications. We should also have a placeholder, e.g. supporting different category of UEs with SL Relay.

8 – Intel Korea

We support the moderator's suggestion to stop discussion on additional objectives.

9 – CATT

We are fine with the moderator's proposal.

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| <p>10 – vivo Mobile Communication Co.</p> <p>We are fine with the moderator’s proposal.</p> |
| <p>11 – Lenovo Mobile Com. Technology</p> <p>SL-DRX when using relays must be addressed, as the moderator rightly noted that support for the same in Rel. 17 is unclear.</p> |
| <p>12 – China Telecommunication Corp.</p> <p>We are generally fine with the proposal. Since coverage enhancement/extension is always one of the most important work for the operator, we think multi-hop U2N relay should at least be handled with high priority in the next release if it cannot be specified in Rel-18.</p> |
| <p>13 – Samsung R&D Institute UK</p> <p>We support the moderator’s proposal to stop the discussion on additional objectives.</p> |
| <p>14 – NEC Corporation</p> <p>We prefer to limit the discussion on the objectives captured in current draft WID.</p> |
| <p>15 – ZTE Corporation</p> <p>We are fine with moderator’s proposal.</p> |
| <p>16 – Philips International B.V.</p> <p>We agree with the moderator on adding SL DRX as a placeholder since it is not clear yet if it will be covered in Rel-17. However, we prefer to formulate it as follows: Support of DRX operation for sidelink relay communication depending on which extent it has been specified in Release 17.</p> |
| <p>17 – Fraunhofer IIS</p> <p>We agree with the moderator’s proposal, also to add a placeholder for SL DRX support.</p> |
| <p>18 – CEWiT</p> <p>We are fine with the moderator’s proposal</p> |

3.6 Others

Please provide your feedback on the other part of the draft WID v001.

Feedback Form 34: Feedback on the other part

3.7 Summary and moderator's proposal

3.7.1 Justification

Summary on justification:

Most companies were fine with the current text as a starting point. The text can be refined until December considering the updates to the objectives (e.g., SL DRX for relay, SA2 ProSe SI approval, etc.).

Moderator's proposal:

It is proposed to update the justification text as follows and continue discussion at RAN#94e:

- "via multiple direct and/or indirect paths" into "via direct and indirect path" as ZTE suggested. And the sentence on the multi-path relay is added (with yellow mark for potential further discussion on the wording) with the assumption that the corresponding objective will remain in the WID.
- Add clarification in the placeholder of SA2 SI
- Add a placeholder for SL DRX

3.7.2 UE-to-UE relay

Summary on UE-to-UE relay (22 inputs):

- UE-to-UE relay adaptation layer design" to "User plane support for U2U relay (e.g., PC5 adaptation layer design)"
 - Apple, CATT
- Only unicast
 - Ericsson, Huawei (pending SA2), China Mobile, Qualcomm, vivo, ZTE
- QoS is unclear without SA2
 - Ericsson, MediaTek (add "if needed")
- Clarification is needed on the note for groupcast
 - OPPO, Lenovo
- Remove Relay and remote UE authorization [RAN3]"
 - Qualcomm

Moderator's proposal:

- Mark “UE-to-UE relay adaptation layer design” in yellow to discuss the need to take an alternative such as “User plane support for U2U relay (e.g., PC5 adaptation layer design)”
- Add “if needed” to QoS
- Mark “Relay and remote UE authorization” in brackets to discuss the necessity of this objective
- It is observed that most companies were fine with the approach where unicast and groupcast relay is supported under a common relay (re)selection mechanism. The original intention of Note 1B was to use a single relay which relays any cast type from a remote UE and it is proposed to update Note 1B to clarify this intention. If such restriction is not accepted, the moderator’s proposal is to drop groupcast in Rel-18 as it will imply that additional study is necessary to figure out the relay UE (re)selection for the groupcast and also discussion is necessary on how to handle a remote UE transmitting both unicast and groupcast which might lead to the discussion on multi-path relay in UE-to-UE relay.

3.7.3 Service continuity enhancements

Summary (20 inputs):

- Scenario D ”Inter-gNB indirect-to-indirect” as second priority
 - Yes
 - Ericsson (add no specific optimization), InterDigital, Huawei (add no specific optimization), vivo, Lenovo, Samsung, NEC, Philips, Fraunhofer, CEWiT
 - No
 - Apple, MediaTek, OPPO, Qualcomm, Intel, CATT, Spreadtrum, China Telecom, ZTE

Moderator’s Proposal:

- The moderator observed that companies still have different view on treating Scenario D as a second priority but in his understanding most companies responded that Scenario D can be simply supported using the solutions for the other scenarios. So it is proposed that the second priority part is deleted in Scenario D but it is supported by reusing solutions for the other scenarios without specific optimization.

3.7.4 Multi-path relay

Summary:

- Study phase (21 inputs)
 - Yes or okay
 - Apple, Ericsson, InterDigital, LGE, Intel, Spreadtrum, China Mobile, Samsung, NEC, vivo, ZTE, Fraunhofer, CEWiT
 - No
 - MediaTek, Huawei (okay if “specify” is added), OPPO (okay if “specify” is added), CATT, China Telecom

- Delete L3
 - Yes
 - Huawei, OPPO, Qualcomm, NEC
 - No
 - ZTE

Moderator’s Proposal:

- The moderator observes that there still exist different view on the study phase but he understands that more companies can accept it as compromise. So it is proposed to assume a study phase in finalizing the WID by deleting the brackets about the study phase. It was observed that some companies proposed to add “specify” to the objective but the moderator understands that the other companies raised questions on the benefit of multi-path relay and a study phase was proposed as a compromise. If the benefit of multi-path relay is straightforward as some proponents said, WGs can easily conclude that and RAN will naturally move to the normative work. So the moderator thinks adding “specify” is not critical in finalizing the WID.
- Further discussion seems necessary on including Layer-3 relay, so it is proposed to keep L3 in brackets.
- It is proposed to assume that no RAN3 involvement is needed for this objective for now with the understanding that RAN2 can still liaise with RAN3 once a relevant issue is identified.

3.7.5 Other core objectives

Summary: Most companies were fine with the previous proposal of stop discussing other topics while having a place holder for SL DRX.

Moderator’s Proposal:

- It is proposed to keep the temporary objective for SL DRX. Detailed wording needs to be prepared after the RAN2 progress in Rel-17.

4 Conclusion

The moderator drew those in the sub-sections as the conclusion of email discussion [RAN94e-R18Prep-12] Sidelink relay enhancements. A draft WID is submitted in RP-212712 and it is proposed to use it as the basis of the discussion in RAN#94e.

Moderator’s note: Text underlined in NWM and marked in yellow in draft WID means it is relatively less stable and should be finalized until RAN#94. Text in brackets means that convergence on its inclusion in WID is relatively weaker.

4.1 General aspects

Sidelink relay enhancements start as a work item in Rel-18. Some objectives may require a study phase. The leading WG is RAN2, and secondary WGs are RAN3 and RAN4. Coordination with SA/CT is expected.

4.2 Justification

3GPP RAN approved a study item “Study on NR Sidelink Relay” in Rel-17 in order to cover the enhancements and solutions necessary to support the UE-to-network Relay and UE-to-UE Relay coverage extension, considering wider range of including V2X, Public Safety and commercial applications and services. The study outcome was documented in 3GPP TR 38.836, and it contains potential technical solutions for the sidelink relay with a conclusion that both Layer-2 based Relay architecture and Layer-3 based Relay architecture are feasible and a recommendation for their normative work. However, the follow-up Rel-17 work item “NR Sidelink Relay” included only limited features due to the lack of time. In particular, it supports only UE-to-Network relay and its service continuity solution is limited to intra-gNB direct-to-indirect and indirect-to-direct path switching in Layer-2 relay.

[A study item for ProSe phase 2 is approved in SA in order to investigate further 5G system enhancements to support Proximity Services in Rel-18. RAN-side enhancements for sidelink relay is necessary in accordance with the SA work. => This part needs to be checked at RAN#94e]

For better support of the use cases requiring sidelink relay, further enhancements are necessary in order to introduce the potential solutions identified during the Rel-17 study item. To be specific, support of UE-to-UE relay is essential for the sidelink coverage extension without relying on the use of uplink and downlink. Service continuity enhancements in UE-to-Network relay are also necessary in order to cover the mobility scenarios not supported in the Rel-17 WI. In addition, support of multi-path relay, where a remote UE is connected via direct and indirect paths, has a potential to improve the reliability/robustness as well as throughput, so it needs to be considered as an enhancement area in Rel-18. [Another enhancement is to support sidelink DRX introduced in Rel-17 for power saving in sidelink relay operations. => This part needs to be checked at RAN#94e.]

4.3 Core part objectives

The objective of this work item is to specify solutions that are needed to enhance NR Sidelink Relay for the V2X, public safety and commercial use cases.

1. Specify mechanisms to support single-hop Layer-2 and Layer-3 UE-to-UE relay (i.e., source UE -> relay UE -> destination UE) for unicast [and groupcast] [RAN2, RAN3, RAN4].
 - a) Common part for Layer-2 and Layer-3 relay to be prioritized until RAN#98
 - i) Relay discovery and (re)selection [RAN2, RAN4]
 - ii) [Relay and remote UE authorization [RAN3]]
 - b) Layer-2 relay specific part
 - i) UE-to-UE relay adaptation layer design [RAN2]
 - ii) Control plane procedures [RAN2]
 - iii) QoS handling if needed, subject to SA2 progress [RAN2]

undefined Note 1A: This work should take into account the forward compatibility for supporting more than one hop in a later release.

[Note 1B: A remote UE is connected to only a single relay UE at a given time and the relay (re)selection criterion is the same in unicast and groupcast.]

2. Specify mechanisms to enhance service continuity for single-hop Layer-2 UE-to-Network relay for the following scenarios [RAN2, RAN3]:

- a) Inter-gNB indirect-to-direct path switching (i.e., “UE 1 <-> relay UE A <-> gNB X” to “UE 1 <-> gNB Y”)
- b) Inter-gNB direct-to-indirect path switching (i.e., “UE 1 <-> gNB X” to “UE 1 <-> relay UE A <-> gNB Y”)
- c) Intra-gNB indirect-to-indirect path switching (i.e., “UE 1 <-> relay UE A <-> gNB X” to “UE 1 <-> relay UE B <-> gNB X”)
- d) Inter-gNB indirect-to-indirect path switching (i.e., “UE1 <-> relay UE A <-> gNB X” to “UE1 <-> relay UE B <-> gNB Y”)

Note 2A: Scenario D is to be supported by reusing solutions for the other scenarios without specific optimizations.

- 3. Study the benefit and potential solutions for multi-path support in Layer-2 [and Layer-3] UE-to-Network relay to enhance reliability and throughput in the following scenario [RAN2]:

- a) A UE is connected to the same gNB using one direct path and one indirect path.

undefined Note 3A: Study on the benefit and potential solutions are to be completed in RAN#98 which will decide whether/how to start the normative work.

- 4. [Support of SL DRX for sidelink relay operation if not done in Rel-17] [RAN2]

[Note 4A: This objective is to be checked in RAN#94e.]

4.4 Performance part objective

Define RRM performance requirements for relay discovery and (re)selection in UE-to-UE relay [RAN4]