**3GPP TSG-RAN WG2 Meeting #130 R2-250xxxx**

St Julian’s, Malta, 19-23 May 2025

**Agenda item: 8.13.1**

**Source: Samsung**

**Title: Summary on offline discussion on Rel-19 Relay Capability**

**WID/SID: NR\_SL\_relay\_multihop**

**Document for: Discussion and Decision**

# Introduction

This tdoc addresses the following e-mail discussion:

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| [Post130][401][Relay] Rel-19 relay capability (Samsung)  Scope: Develop draft CRs on relay capability for Rel-19, taking into account meeting agreements and resolving open issues where consensus can be found.  Intended outcome: Draft CRs to 38.306 and 38.331  Deadline: Long |

This post email discussion has two phases:

* **Phase 1**: Companies are invited to provide the comments and identify the issue that needs to be addressed, the deadline for phase 1 is  **Aug 1st, 2025 (10:00 UTC)**
* **Phase 2**: The CR will be provided according to the outcome of the phase 1 discussion, and the deadline for phased 2 is **Aug. 8th, 2025 (10:00 UTC)**

## Contact information

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| --- | --- |
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# Issue and discussion

In RAN2#130 meeting, the following agreements were reached:

Agreements:

Define a new capability for Rel-19 remote UE, e.g., remoteUE-MH-Operation-L2, with Rel-17 remote UE capability as a prerequisite.

As a baseline, implement the capability CR with a new capability for Rel-19 multihop relay UE, e.g., relayUE-MH-Operation-L2 with no distinction between last and intermediate cases. FFS if there is a need to distinguish last and intermediate (based, e.g., on the need for remote UE functionality in the intermediate relay).

There is no capability distinction between first and “non-first” intermediate relay UE.

Remote UE operation is a prerequisite for relay UE functionality (intermediate only if we decide to have the distinction between last and intermediate).

Meanwhile, the following proposals in R2-2504545 were not addressed during the meeting (P4 and P8 are removed since both are not applicable based on the current agreements):

Proposal 3: RAN2 is kindly asked to agree that the remote UE capability is the prerequisite of the capability of first/intermediate (non-first) relay UE.

~~Proposal 4: RAN2 is kindly asked to agree that the first relay UE capability is the prerequisite of the capability of intermediate (non-first) relay UE.~~

Proposal 5: RAN2 is kindly asked to agree the new band combination capability for multi-hop SL relay discovery, e.g., supportedBandCombListPerBS-MH-SL-RelayDiscovery.

Proposal 6: RAN2 is kindly asked to agree that capability for Rel-19 path switch, e.g., remoteUE-MH-PathSwitchOperation-L2-r18, which indicates the support of intra-gNB multi-hop indirect to direct path switching and intra-gNB multi-hop indirect to single-hop indirect path switching.

Proposal 7: RAN2 is kindly asked to discuss whether to define new capabilities for multi-hop L3 relay w.r.t L3 remote/first relay/intermediate relay(non-first)/last relay UE.

~~Proposal 8: RAN2 is kindly asked to discuss if the fast RRC setup scheme is agreed, whether a new capability w.r.t such optional feature is needed or not.~~

Thus, this discussion will be carried out starting from the above proposals.

**Issue 1: capability differentiation between last relay UE and intermediate relay UE**

This is related to “FFS if there is a need to distinguish last and intermediate (based, e.g., on the need for remote UE functionality in the intermediate relay)”. The discussion can consider the following aspects:

* **Aspect 1**: need of remote UE functionality of last relay UE
* **Aspect 2**: need of Uu functionality of intermediate relay UE. During online discussion, companies seem to think that the Uu functionality should be supported for intermediate relay UE.

In addition, according to RRC running CR, we have the following new IE defined for the intermediate relay UE for discovery with the editor note. This discussion is also related to how to conclude the editor note.

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| | *SL-RelayUE-ConfigMH* field descriptions | | --- | | ***sd-RSRP-ThreshDiscConfigMH***  Indicates the threshold of SD-RSRP for an Intermediate U2N Relay UE to evaluate AS layer conditions for discovery. The Intermediate U2N relay UE applies the value of this field to evaluate AS layer conditions to decide whether to forward the discovery solicitation message when performing the multi hop U2N Relay Discovery with Model B as specified in TS 23.304 [65]. |   Editor Note: FFS if these thresholds can also be used by Last U2N Relay UE to check AS condition before sending discovery response message to the intermediate Relay UE |

*Question 1: Is there a need to have capability differentiation between last relay UE and intermediate relay UE?*

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| Company | Yes/No | Comments |
| OPPO | Yes | For aspect 1, we understand it is not reasonable to mandate the last relay deploy remote function.  For aspect 2, the key point is not the whole Uu functionality, but the relay Uu function, to be more specific, the Uu SRAP entity. Since for the intermediate relay UE, it only needs the PC5 SRAP entity.  Therefore, we think is more safe and also flexible to allow independent UE capability for intermediate relay and last relay, and we understand it has very little spec impact. |
| Xiaomi | Yes | Share the same view with OPPO that the separate capabilities are needed. The main point is whether to support Uu SRAP or PC5 SRAP functionality for both types of UE, and it’s obviously that Uu SRAP is not mandatory requirement for the intermediate relay UE. |
| Qualcomm | Yes | Same view as OPPO. |
| Huawei, HiSilicon | No | We don’t foresee a scenario where UEs support only the PC5 interface without also supporting Uu interface functionality. |
| Apple | Prefer No | In my view, Rel-19 last relay UE and intermediate relay UE shares the same capability. They just happen to be in different locations of the multi-hop relay topology.  Rel-19 remote UE can have a separate capability. |
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If there is a need to differentiate between last relay UE and intermediate relay UE, the resultant issue is how to indicate such capability. Two options can be considered:

* **Option 1**: define two new capabilities, LastRelayUE-MH-Operation-L2, and IntermediateRelayUE-MH-Operation-L2, where the remoteUE-MH-Operation-L2 is the prerequisite of IntermediateRelayUE-MH-Operation-L2;
* **Option 2**: keep relayUE-MH-Operation-L2 for both last relay UE and intermediate relay UE, while for intermediate relay UE, the remoteUE-MH-Operation-L2 also indicates.

*Question 2: How to indicate the capability of last relay UE and intermediate relay UE, if the capability differentiation is needed? If other options except the above Option 1&2 can be figured out, please indicate it below.*

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| Company | Option 1 or 2 | Comments |
| OPPO | Option 1 | Option-1 is clearer and more flexible.  Option-2 mandate the Intermediate relay to deploy last relay functionality |
| Xiaomi | Option 1 | Option 1 is preferred, which is clear. |
| Qualcomm | Option 1 | Option 1 is clearer since the two types of relay UEs has different functionalities. |
| Huawei, HiSilicon | Option 2 | We believe that defining two capabilities—one for the MH Relay UE and one for the MH Remote UE—is sufficient. A UE can take on different roles depending on its location within the cell coverage.  A device that does not support the Uu interface should not be considered a UE. Introducing such a device would require defining a new device type, which could lead to fragmentation within the industry. |
| Apple | Option 2 | Option 2 is cleaner and make sure every intermediate relay UE can also serve as a last relay UE, which is very important in public safety scenario. |
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**Issue 2: band combination capability for multi-hop relay discovery**

In Rel-17, we have the supportedbandcombListPerBC-SL-RelayDiscovery which indicates, for a particular Uu band combination, the PC5 Relay discovery on which the UE supports simultaneous transmission/reception of PC5 data and Uu uplink/downlink respectively. Rel-19 may need a separate capability for multi-hop SL relay discovery.

*Question 3: is there a need to define the new band combination capability for multi-hop relay discovery?*

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| Company | Yes/No | Comments |
| OPPO | No | We understand the MH U2N Relay/Remote will also support single-hop U2N operation, so seems the new BC is not needed:   * For MH Remote UE, it can also act as single hop remote; * For MH Intermediate relay, since there is a common understanding that the remote capability should be the prerequisite; * For MH Last relay, it can also act as single hop U2N Relay. |
| Xiaomi | No | *supportedBandCombListPerBC-SL-RelayDiscovery-r17* can be reused for Rel-19 MH relay discovery. |
| Qualcomm | No | From AS layer, there is no need to have separate capabilities. |
| Huawei, HiSilicon | No | We could leverage the existing single-hop band combination capabilities. |
| Apple | No |  |
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**Issue 3: Capability for Rel-19 path switch**

In Rel-19, the path switch supports intra-gNB path switch with four scenarios, 1) MH indirect to direct (scenario A), 2) MH indirect to single-hop (scenario B), 3) direct to MH indirect (scenario C), and 4) single-hop indirect to MH indirect (scenario D). The following agreements were reached for path switch:

Agreements:

RAN2 will not address cases of service continuity towards a relay path with intermediate relays in idle/inactive under the current WID.

Agreements:

For scenario C, the legacy path-switching command and procedure are reused for the Remote UE and the target first Relay UE. Upon receiving the path-switching command, the Remote UE performs the legacy UE behavior toward the target first Relay UE. The (first)intermediate/last Relay UE belonging to the target path should be in the RRC-connected state.

For scenario D, the legacy path-switching command and procedure are reused for the Remote UE and the first Relay UE in the target path. Upon receiving the path-switching command, the Remote UE performs legacy UE behavior toward the first Relay UE on the target path. The (first)intermediate/last Relay UE belonging to the target path should be in the RRC-connected state.

It can be observed that the path switch towards the paths containing relay UE in RRC\_IDLE/INACTIVE is not allowed in Rel-19, which is different from Rel-17 and Rel-18. It is better to define new path switch capability for Rel-19.

*Question 4: is there a need to define the new capability for path switch Rel-19, e.g., remoteUE-MH-PathswitchOperation-L2?*

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| Company | Yes/No | Comments |
| OPPO | No | We understand there is no new remote UE behavior for path switch compared to single hop case, so no new UE capability is needed.  For the support of path switch to IDLE/INACTIVE relay UE, we understand there is no need for UE capability to indicate it is not supported. |
| Xiaomi | No | Actually, for a Rel-19 relay UE that support path switch, NW will know path switch to an idle/inactive intermediate relay UE is not supported. No need to define a new capability. |
| Qualcomm |  | Assume No now. But would like to revisit after we complete service continuity, e.g. how to make sure the all the relay UEs in the target path are in CONNECTED state. |
| Huawei, HiSilicon | No | With the RRC state information included in the Discovery Message, Remote UEs will be able to identify and report the RRC\_CONNECTED Multihop Relay UE in the target path |
| Apple | No | I assume IDLE/INACTIVE relay is not to be considered in this release based on prior meeting agreements. |
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**Issue 4: L3 relay capability**

We have reached the following agreements to address L2 MH relay design in RAN2:

RAN2 will focus solely on the L2 Multi-hop Relay design within the scope of this work item. This does not exclude that some work (e.g., discovery conditions, transmission resources) could be reused in L3 without specific impact under our WI.

It is reasonable to not define the capability related to L3 relay.

*Question 5: is there a need to define the new capability for L3 relay in Rel-19?*

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| Company | Yes/No | Comments |
| OPPO | No |  |
| Xiaomi | No | Out of the scope. |
| Qualcomm | No |  |
| Huawei, HiSilicon | No |  |
| Apple | No |  |
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**Issue 5: Capability pre-requisite**

We have agreed the following pre-requisite:

* (already agreed) Remote UE capability is the pre-requisite of Rel-19 remote UE capability (i.e., remoteUE-MH-Operation-L2)
* Relay UE capability is the pre-requisite of Rel-19 relay UE capability (i.e., relayUE-MH-Operation-L2)

Depending on the discussion on new defined capability for Rel-19, the following potential pre-requisite can be considered:

* IntermediateRelayUE-MH-Operation-L2 (if defined, in Question 2): the pre-requisite is remoteUE-MH-Operation-L2
* remoteUE-MH-PathswitchOperation-L2 (if defined, in Question 4): the pre-requisite is remoteUE-MH-Operation-L2

*Question 6: Do you agree the above two additional pre-requisite if the corresponding capability is defined?*

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| Company | Yes/No | Comments |
| OPPO | See comment | For “Relay UE capability is the pre-requisite of Rel-19 relay UE capability (i.e., relayUE-MH-Operation-L2)” we understand Intermediate Relay doesn’t need to support all the R17 Relay (i.e., last relay) capability. |
| Xiaomi | Comment | Depends on the answer of Q1/Q2, if the answer is Yes, Rel-19 relay UE capability will be split into two capabilities (for intermediate relay or last relay UE), in which case Rel-17 Relay UE capability (support both Uu SRAP and PC5 SRAP) may not be the pre-requisite of Rel-19 intermediate relay UE capability. |
| Qualcomm | Yes with comments | Same comment as OPPO and Xiaomi. |
| Huawei, HiSilicon | No | The additional capabilities are not needed; therefore, the associated prerequisites are also unnecessary. Please refer to the comments above regarding the questions on additional capabilities. |
| Apple | See comment | Both are true if those capabilities are introduced. But we are not sure those capabilities are needed. |
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**Others**

*Question 7: Please indicate the additional capability, if any, which is not addressed in above discussion.*

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# 2 Conclusion