**3GPP TSG-RAN2 #116bis-e R2-220xxxx**

**Electronic meeting, January, 2022**

**Agenda item:** **8.4.2.1** (NR\_IAB\_enh-Core)

**Source:** LG Electronics Inc.

**Title:** [AT116bis-e][048][eIAB] RLF indication (LG)

**Document for:** Discussion and Decision

# 1. Introduction

This contribution discusses BH RLF indication, in accordance with the following:

* [AT116bis-e][048][eIAB] RLF indication (LG)

 Scope: Take online agreements into account, treat remaining relevant contents in R2-2201692. Attempt agree offline. Can also capture open points.

 Intended outcome: Report, Agreements

 Deadline: EOM

The discussion consists of two phases, Phase 1 and Phase 2, and the deadline of each phase is given below:

* Phase 1: to agree on easy agreement and attempt to discuss further details of open issues,
Deadline: Friday Jan 21 0900UTC
* Phase 2: to formulate agreeable proposals and capture open issues and FFSes for offline agreement, Deadline: EOM

## **Contact**

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates who provide input to provide their contact information in this table:

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| LGE (Rapporteur) | sunghoon.jung@lge.com |
| Kyocera | masato.fujishiro.fj@kyocera.jp |
| Huawei, HiSilicon | Shiyulong5@huawei.com |
| Ericsson | Marco.belleschi@ericsson.com |
| Nokia, Nokia Shanghai Bell | malgorzata.tomala@nokia.com |
| Samsung  | June77.hwang@samsung.com |
| vivo | kimba@vivo.com |
| Fujitsu | yisu@fujitsu.com |
| Qualcomm | ghampel@qti.qualcomm.com |
| NEC | lisidong@labs.nec.cn |
| Apple | rrossbach@apple.com |
| Intel | ziyi.li@intel.com |
| Futurewei | mazin.shalash@futurewei.com |
| CATT | chenli@cictmobile.com |
| Interdigital | Oumer.teyeb@interdigital.com |

# 2. Discussion

## 2.0 Agreements

### Agreement in RAN2#116

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| --- |
| * Type 2 indication by dual-connected node is triggered when the node initiates RRC re-establishment resulting from BH RLF on both CGs or BH RLF on MCG with no fast MCG recovery.
* A node can transmit type-3 indication if re-establishment is successful. FFS whether to specify a detailed condition for success of re-establishment, e.g., successful transmission of RRC reestablishment complete. FFS whether to also include additional triggering condition such as successful transmission of ReconfigurationComplete, which is for the case the node initiates re-establishment and selects a CHO candidate cell and hence performs CHO successfully.
* A node can transmit type-3 indication only if it previously sent type-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.
* Upon reception of type-2 indication, the node should perform local re-routing if possible.
* Upon reception of type-3 indication, the actions (e.g. local re-routing) triggered upon reception of a previous type-2 indication should be reversed, if possible.
* FFS if Type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic (if agreed see R2-2111539 for more details)
* [032] For triggering condition of type-2 indication by a single-connected node, initiation of RRC re-establishment is a sufficient condition to trigger type-2 indication.
* [032]  Proposal 5\_alt: If option 2) is chosen in P1 (i.e. dual-connected node triggers type 2 indication when the node detects BH RLF on any BH link) and option 2 is chosen in P7 (i.e. Received type-2 indication is further propagated),  type-2 indication sent by a single-connected node includes routing ID information indicating which routing IDs are not available. FFS whether inclusion of routing ID can be omitted in some cases. Otherwise, type-2 indication sent by a single-connected node does not carry any further information related to BH RLF.
* [032]  Conditional mobility is not triggered by reception of type-2 indication.
* [032] For the need of further propagating received type-2 indication, FFS which option to take:

Option 1) Received type-2 indication is not propagated further (unless a normal type-2 triggering condition is met).Option 2) Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available.* [032] RAN2 does not specify UL transmission constraints (e.g. SR/BSR) to a node receiving the type-2 indication, i.e., whether the node can transmit uplink transmission is left to implementation of the node and also up to scheduling policy of a node transmitting the type-2 indication. FFS whether we need to add a Note in stage-2/3 CR.
* [032] RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., when how to set IAB-support indicator it is up to implementation. FFS whether we need to add a Note in stage-2/3 CR.
* [032] To agree that the following terms are used:

-  Type-2:  “BH RLF detection indication”, -  Type-3: “BH RLF recovery indication” , and- Type-4: FFS whether “BH RLF recovery failure indication” or existing name “BH RLF indication” |

Agreement in RAN2#116bs

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| * Type-2 indication by a dual-connected node is triggered when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic, i.e. NR RLF for ENDC scenario, (FFS UP Link RLF for CPUP split scenario 1).
* For these cases, the Type-2 indication is handled in the same way as for the case when both links goes down.
 |

## 2.1 Type-2 indication

### 2.1.1 Triggering of type-2 indication by dual-connected node.

During RAN2#116bis, RAN2 made the following agreement

* Type-2 indication by a dual-connected node is triggered when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic, i.e. NR RLF for ENDC scenario, (FFS UP Link RLF for CPUP split scenario 1).
* For these cases, the Type-2 indication is handled in the same way as for the case when both links goes down.

**Sanity check for agreement**

Before we start discussion of remaining open issues, the rapporteur suggests to review the first agreement in yellow to build a robust basis for further discussion. To be clear, the intention is not to challenge the yellow agreement but to clarify implications.

The intention of the first agreement above is that type-2 indication by a dual-connected node should not be triggered when there is BH failure on BH link but there is alternative BH link available to use for re-routing. The underlying assumption of this agreement was that the node is expected to re-route *all* affected traffic to the alternative link, and hence there is no need to pursue optimization for partial re-routing.

However, it may not be crystal clear if the node *is required* to re-route ‘all’ affected traffic or if the node is still allowed to skip re-routing for some affected traffic or to not perform local re-routing at all. Note that in Rel-16, local re-routing upon R16 BH RLF is not mandatory, and whether to perform local re-routing upon R16 BH RLF is gracefully left to implementation as specified below.

*TS 38.340:*

*NOTE: Data buffering on the transmitting part of the BAP entity, e.g., until RLC-AM entity has received an acknowledgement, is up to implementation. In case of BH RLF, the transmitting part of the BAP entity may reroute the BAP Data PDUs, which has not been acknowledged by lower layer before the BH RLF, to an alternative path in accordance with clause 5.2.1.3.*

In Rel-17, if re-routing of ‘all’ affected traffic upon failure of a single BH failure is mandatory for the node capable of local re-routing, there is no issue on the agreement since things work as intended. In contrast, if the node is allowed to re-route a *faction* of affected traffic or allowed not to perform local re-routing at all like Rel-16, the agreement may be misleading; the node will not trigger type-2 indication in case the node performs partial re-routing, because condition “it cannot perform re-routing for *any* traffic” is not literally met.

If execution of local re-routing of all affected traffic upon BH RLF is not mandatory in Rel-17, it seems that the aforementioned misinterpretation may be unavoidable. Note that upon reception of type-2 indication, a node *should* perform re-routing, if possible, i.e., local re-routing is mandatory and it further implies that *all* affected traffic should be re-routed. Companies are kindly requested to review the rapporteur understanding and provide comments.

**Q1. Do you agreed that, if execution of local re-routing of all affected traffic upon BH RLF is not mandatory for a node capable of local re-routing via alternative link, the node may perform *partial* re-routing upon BH RLF, resulting in no triggering of type-2 indication as per the current agreement?**

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| --- | --- | --- |
| Company | Y/N  | Comment |
| Kyocera | **Y** | We agree with the rapporteur’s understanding of the agreement. But we wonder if this is another case to be considered, i.e., the issue related to “mandatory/optional re-routing of all traffic” which is different scenario than EN-DC (and CP/UP separation). We also wonder if Type 2 Indication should be sent when at least one route is not re-routed.  |
| Ericsson | **N** | It is not clear why only some traffic should be rerouted via the alternative link. If one link is broken but the other is available, then the IAB node should aim at recovering all the traffic via the alternative link. It is not clear why it should not do it. Note also that the RLF situation should last for very short time, and the CU will make sure to restore the RLF-ed link as soon as possible. So any potential performance degradation over the alternative link due to the local re-routing should last for very short time. |
| ZTE | **Y**  | It was agreed in last RAN2 meeting that upon reception of type-2 indication, a node *should* perform re-routing, if possible. And from RAN3 perspective, whether to establish tunnels between donor DUs or when to establish tunnels are up to implementation. That implies that the local rerouting when the node detects BH RLF on a BH link is not mandatory.  |
| Nokia | **N** | We believe the Rel-17 enhancement intention is not to mandate re-routing of ‘all’ affected traffic upon failure of a single BH failure. There can be cases where only part of the traffic can be re-routed. Hence, some ambiguity seems to remain in the agreement.Nokia2: After further checking, we realized the agreement covers the case, when the node “cannot perform re-routing for any traffic”, which seems to exclude partial re-routing. Hence, the questioned (in Q1) partial re-routing does not seem to apply. |
| Samsung  | **Y but clarification needed** | We think the highlighted agreement is specific to the ENDC and CP/UP separation scenario 1. But anyway, applying this agreement to the normal NRDC case as it is, node only executing partial re-routing is not satisfying “cannot perform re-routing for any traffic”, so type2 indication is not triggered. But we believe that network implementation will cover the re-routing for the all affected traffic not only for partial re-routing. Why the network configure the partial one ?  |
| vivo | **N** | We also understand that there is mandate for re-routing, so we do not see why only some traffic should be rerouted via the alternative link and some cannot be re-routed. |
| Fujitsu | **Y** | We think the RAN2 agreement is clear. In our understanding, the agreement says that only in the stated DC scenarios (with one CG RLF), namely NR RLF in ENDC and BH RLF for CPUP split (FFS) scenario, the type2 BH RLF indication is triggered. In these scenarios, the local re-routing is impossible for any traffic. If partial local re-routing is possible, then the type2 BH RLF will NOT be triggered. |
| Qualcomm | **N** | We had local rerouting already in Rel-16 and it was not mandatory. It is not clear why it should be mandatory in Rel-17.  |
| NEC | Y | We agree that local re-routing of all affected traffic upon BH RLF is not mandatory. Local rerouting upon Type2 indication can be perform based on the QoS information and load of alternative link. |
| Apple | **Y** | The interpretation of the agreement with respect to added functionality in Rel-17 is not readily apparent, although we tend to think it still includes the former option B in the summary document (P1 in R2-2201692), as well as cases where only part of the traffic can be re-routed. Also the CP/UP separation scenario 1 is already possible over EN-DC in Rel-16. |
| Intel | **Y** | Based on our understanding, RLF indication representing BH link status. Since it is still possible to reroute partial/all traffic to the alternative BH link, this represents that there’s no RLF detected at that BH link. Hence, there’s no need to trigger type-2 indication even if the IAB-node performs re-routing for partial traffic. |
| Futurewei | **Y, but** | It is possible that the IAB node may not be able to reroute some traffic, but this seems like a corner case.We should focus on resolving the FFS scenarios. |
| CATT | **N** | According to the scenarios in current agreements, EN-DC and CP-UP separation, there is no partial traffic rerouting. And, in NR-DC case, even if “from RAN3 perspective, whether to establish tunnels between donor DUs or when to establish tunnels are up to implementation”, a smart IAB-donor should not configure DC but only allow partial traffics to be rerouted.Considering the timeline, we think a simple solution should be adopted and not to consider the case that partial traffic can be rerouted.  |
| LGE | **Y** | Q1 is not asking whether the local re-routing is mandatory or not. Q1 asks if the following statement is correct: “if local re-routing of partial traffic occurs upon failure of one BH, type-2 is not triggered, as per the current agreement”.  |
| IDT | **Y** | Our understanding is that if inter-CU rerouting is not a mandatory feature, then partial re-routing is unavoidable (i.e., only the traffic belonging to the same CU will be re-routed).  |

**Summary**

Y: 10 (or 11 or 12)

* These companies think that partial re-routing is possible. If partial re-routing is performed, type-2 triggering is not triggered as per the current agreement.

N: 5 (or 4 or 3)

* Some companies with “No” think that partial re-routing upon BH RLF should not be allowed, but only full re-routing is mandatory.

**Q2. For companies agreeing to Q1, do we need to mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link? Or would it be sufficient to know the consequence of partial local re-routing (i.e., no triggering of type-2 indication) and still allow partial re-routing as network implementation freedom?**

* **Option1: To mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link.**
* **Option2: To not mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link.**

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| Company | Option | Comment |
| Kyocera | **Option 2** | We don’t think it’s mandatory for IAB-node, but we wonder if Type 2 Indication should be sent even in this case (i.e., the IAB-node re-routes “some” traffic but it does not re-route “some other” traffic), as commented in Q1 above.  |
| Ericsson | **-** | We do not think the issue is about mandating or not mandating. It is more on why an IAB node implementation should not aim at “saving” all the traffic via the alternative link. As said above, the RLF situation should last for very short time, and the CU will make sure to restore the RLF-ed link as soon as possible. Hence any performance degradation on the alternative link should last for short time. |
| ZTE | **Option 2** | We don’t see the motivation to mandate local rerouting of all affected traffic since it’s possible that only part of affected traffic could be rerouted. IAB MT could determine whether local rerouting could be performed based on the routing and rewriting configuration.  |
| Nokia | **-** | We cannot mandate re-routing of all affected traffic as they can have multiple destinations and re-routing configurations may not exist for all. In the case of partial re-routing, Type-2 indication could be sent indicating the non-available routes/destinations. |
| Samsung  | **2** | We don’t know if there is big difference between allowing partial re-routing and allowing re-routing for all affected traffic in terms of network resource usage and signaling complexity. We think network can configure the rerouting configuration for the all the affected traffic even which is not mandated feature. For the spec point of view, we think not mandating seems consistent with the legacy, but actual implementation will be configured for the all the affected traffic.  |
| vivo |  | We do not see is the issue we are trying to resolve by mandating local rerouting. |
| Fujitsu |  | It depends on configuration. If a node is capable of local re-routing and there is an alternative path configured for this routing ID, then it will do local re-routing.  |
| Qualcomm | **None** | Why would this be mandatory in Rel-17 opposed to Rel-16? |
| NEC | Option 2 |  |
| Apple | Option 2 | Probably not a case to restrict IAB node implementation.  |
| Intel | **Option 2** | It’s the same as Rel-16, which can be left to implementation.  |
| Futurewei | **Option 2** |  |
| CATT | **-** | See Q1 |
| LGE | **Option 2** |  |
| Interdigital | **Option 2** | Our understanding is that the problem is where the IAB node supports local re-routing and whether it should be mandatory, but rather, if the routed traffic will be able to make it to the right destination. So if there is no inter-CU routing possibility, the network will not configure the IAB node to re-routing all traffic (no use to route the traffic all the way to first CU if that data can not be forwarded to the destination CU)  |

**Summary**

To mandate full local re-routing for traffic that are re-routable (2 or 4 not clear)

Not to mandate full local re-routing: 9 (or 10, not clear)

**Rapporteur suggestion.**

Most companies sem to agree that

* i) Local re-routing of *all* affected traffic among re-routable traffic should not be mandatory.
* ii) *Partial* re-routing upon BH RLF results in NO triggering of type-2 indication as per the current agreement.

#### Proposal 1: (For agreement) Execution of local re-routing of *all* affected traffic among re-routable traffic upon BH RLF is not mandatory. As per the current agreement, *partial* re-routing upon BH RLF results in no triggering of type-2 indication as per the current agreement.

**EN-DC/CP-UP separation**

Currently Type-2 triggering condition for CP-UP separation scenarios is FFS. Based on the online discussion, the following question can be asked directly:

**Q3. For dual-connected node with CP-UP split, should type-2 indication be triggered when one CG providing UP fails?**

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| Company | Y/N  | Comment |
| Kyocera | **Y, but…** | We think the agreement can cover the case anyway, i.e., “*when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic*”.  |
| Huawei, HiSilicon |  | To make the CP-UP/EN-DC case and the NR-DC case general condition, we prefer to use “when CG(s) provide F1-over-BAP fails”In NR-DC, it is triggered when both CG providing F1-over-BAP failures, including both CP and UP.In CP-UP/EN-DC case, it is triggered when the CG both CG providing F1-over-BAP failures, including only UP. |
| Ericsson |  | Agree with Huawei |
| ZTE | **Yes**  |  |
| Nokia | **Y** | The agreement cover the case anyway |
| Samsung  | **please see the comment** | In first, we wonder if ENDC (or NRDC) CP-UP separation architecture has any part of SA mode IAB topology in the middle, like dotted box in below figure:, If this is valid scenario, then it is meaningful to have type 2 indication for re-routing, and the answer for Q3 could be Y. Otherwise we don’t think type 2 indication is necessary since there is no alternative path for re-routing in any IAB node. Please note that 38.300 has ENDC architecture description where IAB node has only single NR BH and LTE link, even there is no explicit restriction though. And I remember CP-UP split scenario from RAN3 also was to use only single BH for each IAB node.  |
| vivo |  | Agree with Huawei |
| Fujitsu | **See comment** | The local re-routing is still possible in CP-UP split scenario, if the other leg has BH link. So it depends on the scenario and BH configuration. |
| Qualcomm | **Yes** | It should be:**For a dual-connected node configured with CP-UP split, type-2 indication is triggered when the CG providing F1-over-BAP fails.**Note that there is only one CG that provides F1-over-BAP. |
| NEC | See comment | Same view with Samsung. In CP-UP split scenario, there is only one BH link for IAB backhaul link for each IAB node. Type 2 indication is a BAP layer indication. We understand there is no RLF indication in non IAB backhaul link. Before we discuss this issue, some clarification is needed.  |
| Apple | Yes | But some clarification is needed, as pointed out by others. |
| Intel |  | Agree with Huawei’s update. |
| Futurewei |  | Agree with comments from Huawei and Qualcomm |
| CATT |  | Agree with comments from Huawei and Qualcomm |
| LGE | Yes | Fine with further clarification on what UP refers to (QC and Huawei suggestion). |
| Interdigital |  | Agree with Huawei |

#### Proposal 2: (For agreement) For a dual-connected node configured with CP-UP split, type-2 indication is triggered when the CG providing F1-over-BAP fails.

Consider the case that type-2 indication was triggered by failure of a BH link providing UP (e.g., SCG failure in EN-DC and CU split architecture) but the other link has just failed prior to the recovery of the previously failed BH link. In that case, since the concerned node experiences failure on both BH links, it initiates re-establishment, which may trigger another type-2 indication. These successive type-2 indications are not useful to child nodes since there is no extra information conveyed by later indication. Furthermore, the second indication may further propagate to descendent nodes depending on topology. So, rapporteur would like to ask the following question:

**Q4. In case failure of one BH link triggered type-2 indication (but not re-establishment) and recovery has not been completed, should the failure of the other BH link trigger another type-2 indication or not?**

* Option1: The failure of the other BH link triggers another type-2 indication.
* Option2: The failure of the other BH link should not trigger another type-2 indication

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| Company | Option  | Comment |
| Kyocera | **-** | We prefer Option 2 if there is no additional information in the second Type 2 Indication, but we assume it still depends on other discussion.  |
| Ericsson | **-** | What is the scenario here? Is it CP/UP split? If only one link is configured with the BH, then the type-2 should be transmitted only when that link fails.  |
| ZTE |  | It depends on the trigger condition of type 2 indication for dual connected MT in NR-DC non CP-UP separation scenario. If type 2 indication is allowed to be triggered upon detection of BH RLF on one BH link and it cannot perform re-routing in NR-DC non CP-UP separation scenario, the failure of the other BH link triggers another type-2 indication, i.e. option 1. Otherwise, option 2 is more reasonable.  |
| Nokia | **Option 2** | The 2nd Type-2 indication do not have to be sent as the 1st one has already indicated the BH (non-)availability. |
| Samsung  | **2** | But, before the conclusion on this question, we think there should be the clarification on CP-UP split architecture as in Q3 comment.  |
| vivo |  | We do not think the failure of the other BH link should trigger another type-2 indication, we also think the scenario may need some clarification as pointed out by Ericsson. |
| Fujitsu | **Option 2** | We should avoid a storm of type-2 indications. |
| Qualcomm | **-** | The question is not clear. For ENDC and CP-UP separation, there is only one BH link. Type-2 indication is sent when it fails. It is not clear why we are spending time on this discussion. |
| NEC |  | Same comment as Q3 |
| Apple |  | This may depend on the content of the type-2 indication, whether it can carry routing information as to which link has failed (e.g., in NR-DC). If it does then another type-2 indication (as in option 1) might make sense. In general, we think that option 2 is simpler. |
| Intel | **Option 2** | Once the type-2 RLF indication is triggered by the first RLF of the UP BH link, the corresponding action(s) (e.g. local rerouting, etc) has been taken by the child IAB-node which receives it. There’s no meaning to send another type-2 RLF indication again.  |
| Futurewei |  | Not clear we really need to specify this level of detail. If an implementation selects to do either option, it is not clear that this would change any behavior on the part of a child node. |
| CATT |  | Option 2 but not clear the real scenarios. |
| LGE | **Option1 but** | Unless option1 makes a big trouble, option1 is fine. Option2 can be considered if option1 makes a big trouble.  |
| Interdigital | **Option 1** | The two type-2 failure indications may be sent/relevant to different child nodes or different destination node. |

**Summary**

Option1: 2 (LGE, IDT)

Option2: 5 (Kyocera, Nok, Sam, Apple, Intel)

Depends on other discussion: 5 (Kyocera, ZTE, Apple, Samsung, NEC)

Not clear about the scenario: 4 (ERI, vivo, QC, Futurewei, CATT):

**Rapporteur suggestion**

This discussion is moved to section ‘2.4 OTHER’ with the following proposal.

#### Proposal 3: (Further discussion) RAN2 to discuss the case where failure of first BH link had triggered type-2 indication (but not re-establishment) and there happens a failure on other link prior to the recovery of the first BH link, yielding re-establishment, which then triggers another type-2 indication. FFS this is a valid case or how to handle/prevent the second type-2 indication.

**Q5. If Option2 is chosen, how to block triggering of another type-2 indication?**

* Option1: Revise a triggering condition such that same node does not trigger type-2 indications successively.
* Option2: Others

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|  Company | Option  | Comment |
| Kyocera | **Option 2** | We wonder if the previous agreement, i.e., trigger upon RRC Reestablishment, is no longer needed, since the new agreement, i.e., “*when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic*” can cover the case. |
| ZTE | **Option 2**  |  |
| Nokia | **Option 1** | There is no need to specify “ blocking” condition. Procedures on handling the (first) triggering condition should be self-explanatory that the status is valid. The behaviour could be clarified. If the triggering condition explicitly states the RLF on a BH link (which the CP link isn’t), that could also solve the ambiguity. |
| Samsung  | **2** | But, before the conclusion on this question, we think there should be the clarification on CP-UP split architecture as in Q3 comment. |
| Fujitsu | **Option 1/2** | Option 1: only one type 2 BH RLF indication is triggered before a Type 3 BH RLF indication is generatedOption 2: a prohibit timer-based mechanism |
| Qualcomm | **See comment** | We don’t need this discussion. There is no problem if a child node receives multiple type-2 indications in a row.  |
| NEC |  | Same comment as Q3 |
| Intel | **Option 2** | We think we can just limit the IAB-node to send only one type-2 RLF indication to the child IAB-node(s). Once a type-2 RLF indication has been sent, no other condition would trigger another one.This can be handled by implementation to not sending a new type-2 RLF indication. |
| Futurewei |  | Agree with QCM. We don’t need to over specify this. |
| LGE | **Option 1** | It is better to define triggering conditions such that no redundant type-2 indication is triggered |

### 2.1.2 Further propagation of type-2 indication

In RAN2#116, RAN2 made the following agreements:

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| * [032] For the need of further propagating received type-2 indication, FFS which option to take:

Option 1) Received type-2 indication is not propagated further (unless a normal type-2 triggering condition is met).Option 2) Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available. |

Hence, RAN2 needs to decide on one of following options:

* Option 1: Received type-2 indication is not propagated further.
* Option 2: Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available.

On complexity of each option, option1 is simpler, but the difference of complexity between options seems small.

On achievable gain of each option, in option1, the chance of local re-routing triggered by type-2 indications is limited to one-hop descendent nodes. Option2 allows for more chance of re-routing at lower descendent nodes to circumvent upper node(s) experiencing BH failure(s). The difference of achievable gain between two options may not be small, but the actual gain would be largely dependent on architecture/topology of concerned IAB networks. If most of nodes in IAB network are dual-connected and local re-routing are universally available at every node, the difference of achievable gain will diminish. If IAB network is a complex mixture of single-connected nodes and dual-connected nodes or it is (partially) based on EN-DC or CP-UP separation architecture, the difference becomes noticeable; option2 can provide better performance due to its full exploitation of the potential of local re-routing capabilities at lower descendent nodes.

Note that there are sharply split views (7 vs 6) as expressed in contributions in [1]-[16]. To make a decision, it seems necessary to collect acceptance level of each option as well as polling of preferred option.

**Q6. Please express your preferred option and acceptance of the other option.**

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| --- | --- | --- | --- | --- |
| Company | Preferred option | Is Option1 acceptable? Y/N  | Is Option2 acceptable? Y/N | Comment/JustificationPlease specify reasoning for NO acceptance; Otherwise your acceptable answer may be considered as Yes.  |
| Kyocera | **Option 2** | **(Y)** | Y | We agree with the rapporteur’s analysis that Option 2 would provide better performance with small additional complexity. Though, we don’t refuse Option 1, if the progress is achieved by such a compromise.  |
| Huawei, HiSilicon | **Option 1** |  | N |  |
| Ericsson | **Option 1** |  | N | The time interval between type-2 and type-3/4 is very little, hence the propagation just brings overhead and no clear gain. By the time a descendant node gets the type-2, a parent node may have already recovered its link or re-established.  |
| ZTE | **Option 2** | **N** |  | The situation at descendant node is similar as the IAB node which detects BH RLF. Specifically, the descendant node may cannot perform local rerouting for affected traffic, e.g. inter-donor rerouting is not available, UP link fails in EN-DC or CU-UP separation case. In these cases, descendant node needs to propagate type 2 indication to its child nodes.  |
| Nokia | **Option 2** | **N (for some scenarios)** | Y | DC may not be available in wider scale in the IAB networks, hence Opt.2 would provide benefits. Furthermore, propagation enables descendant nodes stop/slow down UL traffic which may be lost if RLF/re-routing eventually happens. |
| Samsung  | **Option 1** |  | **See comments** | Same comment as in Q3, i.e., first we would like to know the mixture of SA mode and ENDC can be valid scenario. If this is valid then we can accept option 2. Otherwise we don’t have any clue to use propagation. We are just curious that rapporteur’s justification that the gain of option 2 can be amplified on ENDC/CPUP separation case in this aspect.  |
| Vivo | **Option 1** |  | N |  |
| Fujitsu | **Option 1** |  | Y |  |
| Qualcomm | **See comment** | **N** | YSee comment | We should first agree that the IAB-node may propagate type-2 indication.The conditions can be discussed next (if needed) |
| NEC | **Option 1** |  | N | The Child IAB-node can trigger Type2 indication by its own condition. So we think RAN2 don’t need to discuss any other additional condition for further forwarding the Type2 indication. |
| Apple | **Option 2** | **(Y)** | Y | Similar view as the rapporteur, Kyocera, and Nokia. Option 2 is preferred. |
| Intel | **Option 1** | **Y** | N | We think RLF indication only reflects its own BH link radio condition. Also, it is highly possible that BH RLF may be recovered soon, then the original link could be reused. Further propagating type-2 RLF indication to descendant IAB-nodes would introduce extra overhead for sending type-2/3 RLF indication via many hops during a very short period.For the complex and mixture scenario mentioned by rapporteur above, if there are many child IAB-nodes in the middle of the topology are single-connected nodes, it is also possible that when the original IAB-node is recovered from the BH RLF, the propagated type-2 RLF is still passing to the descendant IAB-node. However, this would be a wrong indication due to multi-hop delay. |
| Futurewei | **Option 1** | **Y** | N | Futurewei |
| CATT | **Option 1** | **Y** | N |  |
| LGE | **Option 1** |  | Y | We slightly prefer Option1 just for its simplicity. Further enhancements along with Option2 can be considered later releases.  |
| Interdigital | **Option 2** | **Y** | Y | We prefer option 2, but option 2 can have a drawback in the case of multiple hops (as the data will end up being buffered many hops from the node experiencing the problem, thus increasing latency). Thus, our preferred approach is to have it network configurable. |

**Summary**:

Option1 (no propagation is supported): 10

* Option2 is acceptable: 2

Option2 (propagation is supported) : 6

* Option1 is acceptable: 2

**Rapporteur suggestion:**

10 companies think that no further propagation is necessary, while 6 companies think further propagation is needed.

It is clear that both options work. Option2 can provide higher local re-routing opportunities, but some company think that the benefit would not be large in the sense that the potential gain depends on topology. The complexity of option2 is slightly higher than option1, but the difference of complexity between options is fairly small. So, it is hard to find a clear cut to derive a decision. In this case, the rapporteur suggests that RAN2 adopts a simpler solution, which is option1 given that option1 is already a majority view, unless there is a strong argument that necessitates the support for further propagation.

#### Proposal 4: (For discussion) Further propagation of type-2 indication is NOT supported.

**Q7. In case further propagation of type-2 indication is supported, do you agree that, when propagation condition is met, the received tye-2 indication is simply forwarded to child nodes without regeneration at the forwarding node?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N  | Comment |
| Kyocera | **Maybe Y** | We assume it depends on the other discussions.  |
| ZTE | **N**  | That depends on the content of the type 2 indication. In our view, if unavailable routing ID is included in the type 2 indication, and the descendant nodes perform rerouting only for part of the affected traffic, then it needs to removes some routing IDs in the received type 2 indication and re-generate a new type 2 indication. |
| Nokia | **N** | No regeneration might be sufficient for Single connected node.However, for an IAB-node in DC, if it receives type-2 from one parent indicating that no destination is achievable, while some destinations are achievable, simple forwarding does not provide actual/accurate status. |
| Fujitsu | **Y** | With the new RAN2 agreement on the type-2 trigger in DC case, we think there is no need to include routing ID in the type-2 indication. Therefor a simple forwarding is enough. |
| Qualcomm |  | This is an implementation issue. |
| Apple | Maybe | Simple forward without modification to the content of the received type-2 indication may be OK, provided that such content is meant to be there in the first place. |
| LGE | Y | Our answer is YEs just to make mechanisms simpler. There are indeed cases where regenerative type-2 indication gives benefit or avoids unnecessary re-routing, but this optimization can be considered later releases.  |
| Interdigital | Y |  |

**Summary**

Option1 (simple forwarding): 5 (including Apple)

Option2 (possibly re-generation): 2

Other (up to implementation): 1

**Rapporteur suggestion**

Two companies think that a simple forwarding may be insufficient. According to ZTE, if an intermediate node upon reception of type-2 indication performs local re-routing only for a part of affected traffic, it may need to re-generate type-2 indication and then propagate the type-2 indication further. However, given the proposal1 in section 2.1.1 is agreed, it is the rapporteur’s view that if the intermediate node can perform local re-routing for some traffic upon reception of type-2 indication, it will not further propagate type-2 indication, because the agreed condition “it cannot perform local re-routing for any traffic” is deemed to be applied to further propagation of type-2 indication as well, in addition to initial triggering of type-2 indication, and in the concerned case which ZTE addresses, the condition is not met, so no further propagation happens.

#### Proposal 5: (For agreement) (5 versus 2) propagation of type-2 indication is supported, the received tye-2 indication is simply forwarded to child nodes without regeneration at the forwarding node.

### 2.1.3 Content of type-2 indication

In principle, two options are available on the content of type-2 indication:

* Option1: Type-2 indication does not include any routing information.
* Option2: Type-2 indication includes some routing information.

As per the current agreements a node triggers type-2 indication only when it cannot serve traffic by any means. That is, type-2 indication itself without any further information therein clearly indicates that UL data forwarding is temporarily unavailable. This observation seems valid for type-2 indications triggered by single-connected node and dual-connected node. Therefore, RAN2 can conclude that, as a baseline, type-2 indication does not include any routing information.

**Q8. Do you agree to option1 as baseline?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Option for type-2 triggered by single-connected node  | Option for type-2 triggered by dual-connected node | Comment |
| Kyocera | **Yes** | No | As the baseline, we’re fine with Option 1 for single-connected node according to the current agreement. But for dual-connected node, we still think it depends on other discussions. Though, we’re fine even for dual-connected node, if Type 2 Indication does not include any information, then the child node considers all the traffics are not re-routed at its parent.  |
| Ericsson | **Yes** | Yes |  |
| ZTE | **No**  | **No**  | It depends on whether further propagation of type 2 indication is supported. If it’s supported, routing ID information needs to be included in the type 2 indication triggered by both single and dual connected MT assuming that its descendant node may be dual-connected. Otherwise, descendant node cannot differentiate which route is not available.  |
| Nokia | **Option 1** | Option 2 | In DC there are different scenarios how the re-routing can be done. Then available routing information would be beneficial. |
| Samsung  | **Option 1** | Option 1 |  |
| vivo | **Yes** | Yes |  |
| Fujitsu | **Option 1** | Option 1 | Agree with rapporteur. |
| Qualcomm | **Y** | Y | Type-2 indication doesn’t carry any information since we haven’t agreed on any information it should carry. |
| NEC | **Y** | Y |  |
| Apple | **Y** | N | Moreover, if we have down propagation then inclusion of routing ID information might make sense.  |
| Intel | **Option 1** | Option 1 |  |
| Futurewei | **Y** | Y | We are fine as a baseline and seems consistent with other agreements in this meeting. |
| CATT | **Yes** | Yes |  |
| LGE | **Yes** | Yes | Our answer is Yes just to make mechanism simpler.  |
| Interdigital | **Option 1** | Option 2 | In the case of DC, sending a type-2 indication that will block all traffic while only some traffic is affected is an overkill. |

Assuming that type-2 indication needs to include any routing information as baseline, it is good to elaborate other cases to check the assumption can still hold valid. If companies see any other important case that requires inclusion of some information in type-2 indication, please specify the case. These cases can be discussed in offline phase-II, if time permits.

**Q9. Please specify other cases that require routing information (or other information) to be included in type-2 indication.**

|  |  |
| --- | --- |
| Company | Description  |
| Kyocera | As in Q1/Q2, if it’s not mandatory to re-route all traffic, we assume it’s an implementation choice not to re-route some traffic due to e.g., congestion on the alternative link. In this case, not all the routes are the affected routes. So, we think Type 2 Indication includes the Routing IDs which the IAB-node does not re-route.  |
| ZTE | The current agreement doesn’t preclude that type 2 indication could be triggered when the node detects BH RLF on a BH link and it cannot perform re-routing for part or all affected traffic in NR-DC non CU-UP separation scenario. Assuming that type 2 indication could be triggered when the node detects BH RLF on a BH link and it cannot perform re-routing in NR-DC non CU-UP separation scenario, routing ID information needs to be included in the type 2 indication. Otherwise, child/descendant node cannot differentiate which route is not available.  |
| Nokia | Destination information could be sufficient. If re-routing at descendant nodes is possible, they would select anyway another entry in the routing table with different path ID. |
| Qualcomm | No information needs to be included on type-2 indication since rerouting can be implemented. RAN2 should not specify additional functionality that has the purpose to fix poor implementations. |
| Interdigital | We agree with Nokia that destination information is sufficient. |

**Summary**

|  |  |  |
| --- | --- | --- |
|  | Single-connected | Dual-connected |
| Option1 | 14 | 10 |
| Option2 | 1 | 5(3 companies indicate opt for routing ID, and 2 companies opt for destination ID) |

#### Proposal 6: (For agreement) (14 versus 1) For type-2 indication triggered by a single-connected node, type-2 indication does not include any routing information (such as unavailable routing IDs).

#### Proposal 7: (For discussion) (10 versus 5) Type-2 indication triggered by a dual-connected node does not include any routing information.

### 2.1.4 Behaviour upon reception of type-2 indication

**Whether to specify type-2 RX behaviors**

RAN2 agreed the following for behaviors upon reception of type-2 indication.

|  |
| --- |
| * Upon reception of type-2 indication, the node should perform local re-routing if possible.
* Upon reception of type
* [032] RAN2 does not specify UL transmission constraints (e.g. SR/BSR) to a node receiving the type-2 indication, i.e., whether the node can transmit uplink transmission is left to implementation of the node and also up to scheduling policy of a node transmitting the type-2 indication. FFS whether we need to add a Note in stage-2/3 CR.
* [032] RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., when how to set IAB-support indicator it is up to implementation. FFS whether we need to add a Note in stage-2/3 CR.
 |

To resolve FFS, the following questions are asked.

**Q10. Do you support to add a NOTE on the following in specifications, and if so, which spec is most suitable?**

* **type-2 indication may trigger deactivation of IAB-supported in SIB**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N | Spec # (if Y) | Comment |
| Kyocera | **N** |  | We assume the condition is “Reception of type-2 indication may trigger…”. The IAB-support IE in SIB1 is handled by IAB-DU, so we don’t have strong motivation to add NOTE for this.  |
| Huawei, HiSilicon | **N** |  |  |
| Ericsson | **N** |  | It is something that the implementation can take care of, similar to what happens when type-4 is received/generated. |
| ZTE | **N**  |  | Since these actions are left to implementation. We prefer that they are not captured in the specification.  |
| Nokia | **N** |  | Can be left for implementation |
| Samsung  | **Y** | **38.340 or 38.300** | In 38.340, Type 2 indication’s consequence can be noted, or in 38.300, RLF section can further describe on type 2 indication. |
| vivo | **N** |  |  |
| Fujitsu |  |  | No strong view. |
| Qualcomm | **Y** |  | The IAB-node should not accept attachment of new child nodes when it has BH RLF.  |
| NEC | **N** |  |  |
| Apple | **Y** |  | A note is not absolutely needed but still seems reasonable. Agree with Samsung. |
| Intel | **Y** | **TS38.300** |  |
| Futurewei | **N** |  |  |
| CATT | **N** |  |  |
| LGE | **N** |  | This is one possible implementation, which we do not need to specify.  |
| Interdigital |  |  | No strong view |

**Summary**

Have a Note: 4

No Note: 10

No strong view: 2

**Rapporteur suggestion**

Based on the clear majority view, it is proposed that:

#### Proposal 8. (For agreement) There is no need to specify a NOTE that type-2 indication may trigger deactivation of IAB-supported in SIB

**Q11. Do you support to add a NOTE on the following in specifications, and if so, which spec is most suitable?**

* **type-2 indication may trigger deactivation/reduction of SR and/or BSR transmissions at the receiving node?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N | Spec # (if Y) | Comment |
| Kyocera | **Y** | **38.300** | We assume the condition is “Reception of type-2 indication may trigger…”. It’s IAB-MT behaviour, so the NOTE is useful to clarify the allowed implementation options.  |
| Huawei, HiSilicon | **N** |  |  |
| Ericsson | **N** |  | Same view as previous question |
| ZTE | **N**  |  | Since these actions are left to implementation. We prefer that they are not captured in the specification.  |
| Nokia | **N** |  | It will be implementation specific solution, thus no strong desire to capture in specification |
| Samsung  | **Y** | **38.321** |  |
| vivo | **Y** | **38.300** |  |
| Fujitsu |  |  | No strong view. |
| Qualcomm | **Y** |  | This is a reasonable behavior that should be captured on St2, at least as a “may” |
| NEC | **N** |  |  |
| Apple | **Y** | **38.300** |  |
| Intel | **Y** | **TS38.300** |  |
| Futurewei | **N** |  |  |
| CATT | **N** |  |  |
| LGE | **N** |  | This is one possible implementation, which we do not need to specify. |
| Interdigital | **Y** |  |  |

**Summary**

Have a Note: 7

No Note: 8

No strong view: 1

7 companies see the value of having a NOTE, while 8 companies do not. There is no clear majority. For this case, the rapporteur assumes that most companies agree that the behaviour to be specified in the Note is one possible behaviour, so having a NOTE is a possible way forward, which is not expected to encounter a strong objection.

#### Proposal 9. (For agreement) To specify a NOTE that a type-2 indication may trigger deactivation/reduction of SR and/or BSR transmissions at the receiving node.

In [12], it is proposed that a single connected IAB node should suspend routing to a parent node, upon reception of type-2 indication, as excerpted below:

*“IAB-MT with single parent should suspend routing any data to its parent node, upon receiving Type-2 indication on BH link level”*

*“IAB-MT with single parent should suspend routing any data to its parent node, upon receiving Type-2 indication on BH link level”*

However, in the last RAN2 meeting, RAN2 agreed not to specify UL transmission constraints upon type-2 indication:

|  |
| --- |
| * [032] RAN2 does not specify UL transmission constraints (e.g. SR/BSR) to a node receiving the type-2 indication, i.e., whether the node can transmit uplink transmission is left to implementation of the node and also up to scheduling policy of a node transmitting the type-2 indication. FFS whether we need to add a Note in stage-2/3 CR.
 |

It is not clear if the proposal in [12] is contradicting the above RAN2 agreement. According to Huawei comment clarified in [19], the above RAN2 agreement is about MAC layer UL transmission, but the proposal in [12] is about BAP layer routing.

**Q12. Do you support to specify suspending routing data to a parent node, upon receiving type-2 indication, and if so, which spec is most suitable?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N | Spec # (if Y) | Comment (If Y, please describe what to specify) |
| Kyocera | **Y** | 38.340 | We think NOTE is an option to clarify this behaviour, but we think the details would depend on other discussion, i.e., whether Type 2 Indication includes the affected route information.  |
| Ericsson | **N** |  | Not critical issue. Also note that the local routing is not a mandatory action upon type-2 RLF. It could be instead that the IAB node implementation just slows down uplink transmission waiting for the parent to recover. So it is ok to leave to implementation as captured in the agreement above. |
| ZTE | **N** |  | It could be up to implementation. In R17, IAB node is static, which implies that the BH RLF recovery would probably succeed. So suspending routing any date upon receiving type 2 indication may lead to unnecessary service interruption.  |
| Nokia | **N** |  | If RLF indicates routes/destinations unavailable, the other destination would still be available for UL traffic. No need to specify. |
| Samsung  | **Y** | 38.300 | In RLF section, it can be specified “when child node receives type 2 RLF indication from single parent node, it might suspend the routing any data to that parent node.” Putting something in BAP spec, it is subtle and complicated to specify above operation since definition of “available path” should be redefined, and there also should be condition specified on the single parent node.  |
| Fujitsu | **No** |  | Up to implementation, similar to the MAC layer UL transmission. |
| Qualcomm | **N** |  | We already discussed this matter. This is up to implementation |
| NEC | **Y** |  |  |
| Apple | **Y** | 38.300 | A note to clarify can be useful, even though it’s up to implementation. |
| Intel | **N** |  | It’s also left to implementation. |
| Futurewei | **N** |  | Agree with Ericsson. This is not critical. |
| CATT | **N** |  | Up to implementation. |
| LGE | **N** |  | This is only about one possible implementation, which we do not need to specify. |
| Interdigital | **Y** |  |  |

**Summary**

Specify: 5

No need to specify: 9

**Rapporteur suggestion**

There is a majority view that the behaviour needs not specified. Also, there is a view that this was already discussed. Hence, it is suggested that RAN2 does not specify the behaviour, i.e. the behaviour is up to implementation.

#### Proposal 10. (For agreement) RAN2 does not specify suspending routing data to a parent node in case of receiving type-2 indication.

## 2.2 Type-3 indication

### 2.2.1 Triggering type-3 indication

RAN2 agreed that type-3 is triggered upon successful re-establishment

|  |
| --- |
| * A node can transmit type-3 indication if re-establishment is successful. FFS whether to specify a detailed condition for success of re-establishment, e.g., successful transmission of RRC reestablishment complete. FFS whether to also include additional triggering condition such as successful transmission of ReconfigurationComplete, which is for the case the node initiates re-establishment and selects a CHO candidate cell and hence performs CHO successfully.
 |

There are other cases where a node initiates re-establishment but ends up with other procedure such as CHO or RRC setup. This is because the node may execute CHO during re-establishment if configured with CHO candidate(s) or the node may receive RRC setup in response to RRCReestablishmentRequest.

In [3][18], it is proposed to add triggering conditions of type-3 indication for those cases, i.e., there are two candidates for new type-3 triggering conditions.

* A: To trigger type-3 indication upon successful CHO executed during re-establishment [3].
* B: To trigger type-3 indication upon successful RRC setup complete as a result of re-establishment [18]

The rapporteur notes that [1] also addresses the case CHO is executed during re-establishment but takes a different approach, where it proposes to not trigger type-2 indication upon executing CHO to a cell chosen by cell selection during re-establishment. The intention of this proposal seems to avoid triggering unnecessary type-2 indications. From the rapporteur understanding, this proposal complicates triggering condition of type-2 indication; if the node is not configured with CHO, it triggers type-2 indication immediately upon initiation of re-establishment. On the other hand, if the node is configured with CHO, the node needs to *defer* triggering of type-2 indication until checking whether the selected cell during re-establishment is a CHO candidate cell or not. So the rapporteur proposes not to pursue the direction in [1].

**Q13. Do you agree to add A and B as triggering condition of type-3 indication?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N for A | Y/N for B | CommentIf N, please specify desired behaviors for the concerned case.  |
| Kyocera | **Y** | Y |  |
| Huawei, HiSilicon | **N** | N | The general description “upon recovered” is sufficient. |
| Ericsson | **N** | N | Agree with Huawei. From a stage-2 perspective it is just enough to state “upon BH link recovery” |
| ZTE | **Y** | N | For condition B, we think it’s already included in the condition of “success of RRC reestablishment”. In TS 38.331, it is specified that:The connection re-establishment succeeds if the network is able to find and verify a valid UE context or, if the UE context cannot be retrieved, and the network responds with an RRCSetup |
| Nokia | **-** | - | Both refer to the successful re-establishment case, hence should not be categorized as ‘new’ triggers for triggering type-3 RLF indication. These seem to be covered cases by the previously agreed trigger. |
| Samsung  | **Y** | Y |  |
| vivo | **N** | N | Agree with Huawei. |
| Fujitsu | **Y** | Y |  |
| Qualcomm |  |  | RRC setup complete as part of re-establishment is still re-establishment.We need to add: A node can transmit type-3 indication after successful execution of CHO. |
| NEC | **N** | N | Agree with Huawei |
| Intel | **Y** | Y |  |
| CATT | **N** | N | Agree with Huawei |
| LGE | **Y** | Y | For B, agree with ZTE.  |
| Interdigital | **Y** | Y |  |

**Summary**

|  |  |  |
| --- | --- | --- |
|  | Case A | Case B |
| Trigger type-3  | 15 | 15 |
| Not trigger type-3 | 0 |  |

**Rapporteur suggestion**

Based on the summary of company input on Q13, there is consensus that type-3 should be triggered for both cases; a) upon successful CHO executed during re-establishment and b) upon successful RRC setup complete executed during re-establishment. So as baseline, the rapporteur suggests to have the following agreement as baseline.

#### Proposal 11a: (For agreement) Type-3 indication is triggered upon successful CHO executed during re-establishment or upon successful RRC setup complete as a result of re-establishment.

For the case of successful RRC setup executed during re-establishment, it is agreeable that there is no need to specify any new triggering condition for this, since the existing successful re-establishment already covers this case in the current specification. So, it is proposed:

#### Proposal 11b: (For agreement) No need to introduce a successful RRC setup complete during re-establishment as triggering condition of type-3 indication. (It is already clear in the current spec that RRC re-establishment succeeds if RRC setup initiated during re-establishment is successful)

However, RAN2 needs to further discuss if successful CHO executed during re-establishment should be explicitly specified as type-3 triggering condition or if generic condition “upon recovery of BH RLF” that we already agreed is sufficient.

#### Proposal 11c: (For discussion) RAN2 to further discuss if successful CHO executed during re-establishment should be introduced as an explicit triggering condition of type-3 indication or if genetic condition “upon recovery” from BH RLF is sufficient.

### 2.2.2 Further propagation of type-3 indication

RAN2 needs to discuss whether to support propagation of type-3 indication accordingly. In principle, if further propagation of type-2 indication is supported, further propagation of type-3 indication should be supported so that the local re-routing at lower descendent nodes triggered by the propagated type-2 indication should be reversed. If type-2 propagation is supported but type-3 propagation is not supported, local re-routing triggered at descendent node cannot be reverted.

**Q14. Do you agree that if further propagation of type-2 indication is supported, further propagation of type-3 indication should be supported. If not, further propagation of type-3 indication is not supported.**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, specify your view) |
| Kyocera | **Y** |  |
| ZTE | **Y** |  |
| Nokia | **Y** | There should be a “clearance” for the Type-2 indication when the re-establishment has been successful. Then the descendant node(s) will become aware of the original link to be again available. |
| Fujitsu | **Y** | Depends on the result of Q6. |
| Qualcomm  | **Y** |  |
| Apple | **Y** |  |
| LGE | **Y** |  |
| Interdigital | **Y** |  |

If further propagation of type-3 indication is agreed, RAN2 should determine conditions for further propagation of type-3 indications. The rapporteur thinks the following condition can be considered as a baseline.

* Type-3 further propagation condition: A node forwards received type-3 indication, if it previously propagated type-2 indication.

**Q15. Do you agree that a node forwards received type-3 indication, if it previously propagated type-2 indication?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, specify your view) |
| Kyocera | **Y** |  |
| ZTE | **Y** |  |
| Nokia | **Y** |  |
| Fujitsu | **Y** |  |
| Qualcomm |  | This is up to implementation. |
| Apple | **Y** |  |
| LGE | **Y** |  |
| Interdigital | **Y** |  |

**Rapporteur suggestion**

Based on company input on Q14 and Q15, the rapporteur suggests two alternative agreements:

#### Proposal 12\_alt1: (For conditional agreement) (if further propagation of type-2 indication is supported), further propagation of type-3 indication should be supported, where that a node forwards received type-3 indication, if it previously propagated type-2 indication.

#### Proposal 12\_alt2: (For conditional agreement) if further propagation of type-2 indication is not supported, further propagation of type-3 indication is not supported.

### 2.2.3 Content of type-3 indication

If RAN2 agree that type-2 indication does not include any routing information, type-3 indication does not need to include any routing information as well.

**Q16. Do you agree that type-3 indication does not include any routing information**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, specify your view) |
| Kyocera | **Y with comment** | We think it still depends on other discussion. Though, we assume Q16 in case it’s concluded Type 2 Indication does not include any information.  |
| Ericsson | **Y** |  |
| ZTE | **N** | It depends on the discussion of the content of type 2 indication.  |
| Nokia | **Y** |  |
| Samsung  | **Y with comment** | Same view with Kyocera |
| Fujitsu | **Y** | Same as type-2 indication. |
| Qualcomm | **Y** | **Why do we spend time discussing what a message SHOULD NOT include instead of focusing on WHAT IT SHOULD include?**  |
| Apple |  | It needs to match whatever is the content of type 2 indication. |
| Intel | **Y** |  |
| Futurewei | **Y** |  |
| CATT | **Y** |  |
| LGE | **Y** | We |
| Interdigital | **N** | If we agree type-2 can contain routing information, then the corresponding type-3 may also contain that. |

**Rapporteur suggestion**

Based on the company input, we have two conditional agreements; Alt1 is to not include any routing information in type3, which should be agreed if RAN2 agrees that type-2 does not include any routing information. Alt2 is to include routing information (e.g. recovered routing IDs) in type-3, which should be agreed if RAN2 agrees that type-2 includes routing information (e.g., unavailable routing IDs).

#### Proposal 13\_alt1: (For conditional agreement) Type-3 indication does not include any routing information.

#### Proposal 13\_alt2: (For conditional agreement) Type-3 indication includes routing information indicating recovered routing ID(s).

### 2.2.4 Clarification of type-3 triggering condition - successful re-establishment

RAN2 discussed whether to further clarify successful re-establishment as type-3 triggering condition, and several contribution [2][3][4][10][14][16] provides proposals on this. Options are given as follows:

* Option1: No further clarification
* Option2: Upon successful transmission of RRCReestablishmentComplete message
* Option3: When RRC sends the RRCReestablishmentComplete message to lower layers for transmission

As summarized in [19], more companies prefer not to further clarify the condition. So it is proposed to agree to Option1. If companies see severe problem with Option1, please express your reasoning.

**Q17. Do you agree that no further clarification is needed for successful re-establishment as triggering condition of type-3 indication?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, please express your reasoning ) |
| Kyocera | **Y** |  |
| Huawei, HiSilicon | **Y** |  |
| Ericsson | **Y** |  |
| ZTE | **Y** |  |
| Nokia | **Y** | No dedicated additional clarification needs to be agreed, but stage 3 could clarify that the RLF Type-3 can be triggered when RRC sends the *RRCReestablishmentComplete* message to lower layers for transmission. |
| Samsung  | **Y** |  |
| vivo | **Y** |  |
| Fujitsu | **Y** |  |
| Qualcomm |  | **Why do we spend time discussing what clarification is NOT NEEDED instead of focusing on the clarification that WOULD BE NEEDED?** |
| NEC | **Y** |  |
| Intel | **Y** |  |
| Futurewei | **Y** |  |
| CATT | **Y** |  |
| LGE | **Y** |  |
| Interdigital | **Y** | To add to what Nokia has stated, the UE may receive an RRCSetup in response to a re-establishment request. Thus, in addition to the reestablishment complete, setup complete is also relevant.  |

#### Proposal 14: (For agreement) No further clarification is needed for successful re-establishment as triggering condition of type-3 indication.

## 2.3 Terminology

The terminology of type-4 indication is FFS, i.e., we need to discuss to use either of:

* Option1: BH RLF recovery failure indication
* Option2: BH RLF indication

The summary [x] summarizes the proposals in company contributions:

|  |  |  |
| --- | --- | --- |
| Company | Classification  | Proposal |
| [1] | **Option 1** |  |
| [4] | **Option 1** | **RAN2 use the new terms “BH RLF recovery failure indication” for Type-4 RLF indication.** |
| [12] | **Option 2** | **The terminology of Type-4 indication “BH RLF indication” should NOT be changed in R17****If RAN2 deems to use “BH RLF recovery failure indication” for type 4 indication, R16 CRs should also be agreed** |
| [16] | **Option 1** | **Type-4 indication is referred to as “BH RLF recovery failure indication” from Rel-17. No changes to Rel-16 specifications are needed** |

More companies prefer to use “BH RLF recovery failure indication” for type-4 indication at least from Rel-17. So it is proposed to agree to option1.

Since this name “BH RLF recovery failure indication” is different from “BH RLF indication” which we have used since Rel-16, RAN2 should assess if there is any problem or action to resolve this misalignment across releases.

**Q18. Do you agree to the following?**

* To use “BH RLF recovery failure indication” for type-4 indication from Rel-17. RAN2 assess if there is any serious issue due to misalignment between Rel-16 and Rel-17 on the name, and if there is any action needed to resolve the misalignment (e.g., having CRs from Rel-16)

|  |  |  |
| --- | --- | --- |
| Company | Y/N  | Comment |
| Kyocera | **N** | We slightly prefer to keep the name as it is. Though, we don’t see any technical problem if the Rel-17 name is different from Rel-16, so we can accept renaming if majority wants. In this case, we’re fine to have Rel-16 CR, if needed.  |
| Huawei, HiSilicon | **N** | We should make decision this meeting.Prefer not to change the term for type4 indication.If changed, R16 CRs are definitely needed. |
|  Ericsson | **N** | Agree with Huawei. We should avoid changing legacy definitions especially if related functionalities are not affected. Since the type-4 indication procedures/definitions are very clear from the legacy stage-2 and RRC, the terminology should be not be changed unnecessarily.  |
| Nokia | **Both options are acceptable** | This is specification clarity issue |
| Samsung  | **Y** | Although we prefer Option 1 above listed, if needed, RAN2 can discuss on the severity on any case.  |
| Vivo | **Option 1 is fine** | Agree with Nokia |
| Fujitsu | **Y** |  |
| Qualcomm |  | **We believe the goal of this discussion is to make progress on issues that are FFS rather than declaring them again as FFS.** |
| NEC | **Y** | In the legacy spec, there is only type-4 RLF indication. So it would not be confusion that type-4 RLF indication use “BH RLF indication” as the terms. However RAN2 already agreed the Type-2 and type-3 RLF indication. To avoid the confusion, we suggest to change the terms of Type-4 RLF indication to “BH RLF recovery failure indication”. |
| Apple | **Y** | We prefer to update the name to “BH RLF recovery failure indication” for type-4 indication from Rel-17. Rel-16 only has single type of BH RLF indication, Rel-17 has 3 types of BH RLF indications, so a better differentiation is appreciated. |
| Intel | **N** | We prefer the name of type-4 RLF indication between Rel-16 and Rel-17 are co-existent.  |
| CATT | **N** | We’d better not to change the name in legacy version. |
| LGE |  | No strong view, follow majority view |
| Interdigital |  | No strong view, both options are fine with us. |

**Summary**

To keep existing name: 8 (including no strong view)

To use BH RLF recovery failure indication: 9 (including no strong view)

**Rapporteur suggestion**

There is no clear majority. There are pros and cons for each way forward. The rapporteur observes that there has been a slight majority to use “BH RLF recovery failure indication” as observed during AT#116bis offline and AT#116 offline at least for Rel-17 and onward. Given this, to make progress, the rapporteur suggests to use BH RLF recovery failure indication from Rel-17, since this gives more clarity on its functionality, given new RLF indication types introduced in Rel-17.

#### Proposal 15a: (For agreement) To use a new name “BH RLF recovery failure indication” for type-4 indication from Rel-17.

As some companies already indicated, if we decide to rename type-4 indication, RAN2 needs to discuss if we should have Rel-16 CRs to avoid inconsistency of terminologies.

#### Proposal 15b: (For discussion) RAN2 to discuss the need of R16 CRs to rename “BH RLF indication” to “BH RLF recovery failure indication”.

## 2.4 Other

### 2.4.1 Network controllability

In [17][18] they propose to introduce network (CU) configurability to control whether type-2 indicatin can be triggered or propagated. This issue was discussed during [AT116][32][BH RLF] and most companies think that network configuration for these is unnecessary, but no explicit agreement was captured. Hence, it seems good to explicitly conclude here, and the same applies to network controllability for type-3 indication.

**Q19. Do you agree that no network configurability on type-2 and 3 triggering/propagation is needed?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Kyocera | **N** | We think the network controllability is useful to manage the topology in general. As another example, if it comes to the deployment having Rel-16 node and Rel-17 node, in our understanding the parent node does not know whether its child nodes support Type 2/3 Indications. So, we assume the donor needs to configure the parent nodes whether to send Type 2/3 indication to its child node.  |
| Huawei, HiSilicon | **Y** | Type4 was never controlled by CU in R16. |
| Ericsson | **N** | We agree with Kyocera that it is better to have NW controllability, especially in those cases in which the child node does not perform any action upon type-2/3 reception (e.g. child Rel-16 node). However, we are also ok to follow the majority view. |
| ZTE | **Y** | The same principle as in R16 type 2 indication could be used for type 2/3 indication.  |
| Nokia | **Y** | Network configuration is unnecessary |
| samsung | **N** | We think this type of feature can be used for enhancement of UP latency reduction. In other words, not essential but for the optional feature.  |
| Vivo | **Y** |  |
| Fujitsu | **Y** |  |
| Qualcomm | **Y** | We also don’t have configurability of type-4 indication. |
| NEC | **Y** |  |
| Apple | **N** |  |
| Intel | **Y** |  |
| Futurewei | **N** | Agree with Kyocera |
| CATT | **Y** |  |
| LGE | **Y** | We see some value of having such network controllability, but we can live without that. For instance, if the concerned child node is a R16 node, received type-2 indication will be simply discarded, and the consequence of this case is not really different from the case where the concerned child node is R17 node but single-connected, given that no further propagation of type-2 indication is supported.  |
| Interdigital | **Y** |  |

**Summary**

Network configurability of type-2/3 indication: 5

No network configurability of type-2/3 indication: 11

**Rapporteur suggestion**

There is a clear majority view that network-configurability on type-2/3 is not essential. While it is argued that the configurability may be used to prevent unnecessary type-2/3 indications (e.g., child nodes are Rel-16), it is also true that nothing is really broken without such configurability. Several companies also indicated that that we do have no such configurability for type-4 either.

#### Proposal 16 (For agreement) No network configurability on triggering/propagation of type-2/3 indication is needed.

### 2.4.2 Re-establishment to a different IAB-donor-CU

In [2], it is proposed that

*“If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node”*

**Q20. Do you support the proposal in [2] that “If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node”?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Kyocera | **Maybe Y** | We think if the IAB-node re-established to a different donor, the routing configurations of the (former) child nodes would be updated by the (original) donor. Also, Rel-17 will support inter-CU re-routing. So, it’s a bit unclear whether Type 4 Indication is needed from the child node’s perspective. Though, we think it’s simple the parent sends Type 4 Indication in this case, since the child node simply declares BH RLF on this link. We’re just wondering how the parent node identifies whether it re-established to a different donor.  |
| Huawei, HiSilicon | **N** | We have the inter-CU partial migration/recovery. There is no impact on the traffic path after partial migration/recovery. |
| Ericsson | **N** | Agree with Huawei. Additionally, even if the partial migration is not supported, the target CU can anyhow reconfigure all the descendant nodes so that they can continue operating under the same migrating node without affecting the underneath topology. |
| ZTE | **N** | In our understanding, the goal of inter-donor RLF recovery procedure discussed in R17 is to avoid reestablishment at descendant nodes.  |
| Nokia | **N** | The RRC re-establishment does not guarantee that BH RLF/re-routing for all traffic is resolved |
| Samsung  | **N** | During R16 discussion, companies didn’t introduce the method to control the cell selection to access the same donor node upon re-establishment procedure, and the reason was that implementation can control the IAB node to select the parent node cell under the same donor. This analogy can be applied here too. |
| Vivo | **N** | There is no need to send such indication |
| Fujitsu | **N** | UL inter-donor-DU re-routing can address this issue. |
| Qualcomm | **N** | **Absolutely NO. If an IAB-node re-establishes at a different donor-CU, then the inter-donor-CU recovery procedure developed by RAN3 kicks in.**  |
| NEC | **N** |  |
| Apple | **N** |  |
|  Intel | **N** | We think this scenario is not supported in Rel-17 as inter-donor CU full migration is not supported. |
| Futurewei | **N** |  |
| CATT | **Y, proponent** | Note in inter-topology, the non-F1- terminated CU doesn’t know the subtree of the boundary node.Regarding above comments, should we agree that the boundary node shall not re-establish to a different donor-CU? If yes, I can accept. |
| LGE | **N** |  |

**Summary**

Y: 2

N: 13

**Rapporteur suggestion**

There is a clear majority view (13 versus 2) that RRC re-establishment to a different IAB-donor-CU should not necessarily trigger type-4 RLF indication. So,

#### Proposal 17 (For agreement) RRC re-establishment to a different IAB-donor-CU should not be introduced as triggering condition of type-4 RLF indication.

### 2.4.3 Other triggers for reverting local re-routing.

In [11], it proposes to introduce other condition for the IAB-node to revert the actions triggered by a previous Type 2 Indication other than reception of type-3 indication. A possible condition proposed in [11] is

*“when the routing configuration on the IAB-node is updated by the donor, e.g., due to an update for load balancing, handover or RRC Reestablishment. After the configuration update, the parent node may no longer be able to send Type 3 Indication, or the child node cannot receive Type 3 Indication, due to the new configuration, e.g., since the parent node is no longer the parent of child”*

**Q21. Do you support the proposal in [11] that, “if routing configuration update should be able to trigger the IAB-node to revert the actions triggered by a previous Type 2 BH RLF Indication”?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Kyocera | **Y** | We think the updated routing configuration solved the BH RLFs within the topology, so it would be straightforward for the IAB-node to revert the actions triggered by reception of Type 2 Indication (i.e., without reception of Type 3 Indication).  |
| Ericsson | **N** | The use case is not very clear. If the parent changes, it means that this child IAB node has been handed-over/re-estblished to another parent, and hence it needs anyhow to be reconfigured. So the previous local routing triggered by type-2 reception will be automatically overridden by the new routing configuration. |
| ZTE | **N** | We are wondering why the actions triggered by a previous Type 2 need to be reverted after routing configuration update if the parent node is no longer the parent of child. In our view, the routing path should be regarded as not available in this case.  |
| Nokia | **N** | This may be a marginal scenario to optimize, while it might be an error prone modification to the basic Rel-17 operations. If CU is involved, it can also re-configure the receiving node of the RLF indication |
| Samsung  | **N** | During recovery of the parent node, the routing configuration cannot be received, or at least, only after the recovery completion the new configuration should be applied. So the concerned scenario seems not valid. |
| Vivo | **N** |  |
| Fujitsu | **N** | The proposal is unclear. If the parent node is no longer the parent of the child, how can the child revert the actions (route to the previous parent) triggered by a previous type-2 indication? |
| Qualcomm | **N** | The child node should obviously follow new CU configurations followed after type-2 indication. There is no need to discuss the obvious.  |
| NEC | **N** |  |
| Intel | **N** | When new routing configuration received from IAB-donor CU, IAB-node should always follow the new routing configuration. It is not clear what does it mean by “revert the actions” if the original routing path is no longer available in the new routing configuration.  |
| Futurewei |  | Agree with QCM. Seem obvious. No need to discuss |
| CATT |  | I think the question may be if a type-3 indication must be transmitted before the reconfiguration signaling? |
| LGE | **N** | The use case is not clear to us; wonder how local re-routing is still possible in that case.  |
| Interdigital | **Y** |  |

#### Proposal 18 (For agreement) Routing configuration update should not be used as triggering of reverting the actions triggered by a previous Type 2 BH RLF Indication

### 2.4.4 Issues not addressed above

Companies can kindly propose other open issues that are not addressed above but considered *important* for completion of R17 IAB BH RLF indication functionality. If time permits, we can discuss the issues during offline phase-II or at least to check if the issue is worth discussing, and if so, we can incorporate the issue into “open issue list” to be complied after the meeting as Chair proposed. To allow a quick and clear understanding of the proposed issue, companies are requested to propose issues by clearly describing that 1) issues to address, 2) solution to propose, 3) consequence if the proposed solution is not adopted in the following table:

**Q22. Issues proposed to discuss:**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Issues to address | Solution to propose | Consequence if the proposed solution is not adopted |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# 3. Phase II discussion

The rapporteur summary of company input and corresponding rapporteur’s suggestion are provided in each question/sub-section of section 2 above. Below are the draft proposals suggested by the rapporteurs, copied for your easier reference.

During the phase II discussion, we attempt to make agreements. Unresolved issue will be added into open issue list as RAN2 chair suggested, unless most companies think that the issue needs not be further discussed or solved.

## 3.1 A list of draft proposals

Checking RAN2 agreement for harmonized RAN2 understanding

#### Proposal 1: (For agreement) Execution of local re-routing of *all* affected traffic among re-routable traffic upon BH RLF is not mandatory. As per the current agreement, *partial* re-routing upon BH RLF results in no triggering of type-2 indication as per the current agreement.

#### Proposal 2: (For agreement) For a dual-connected node configured with CP-UP split, type-2 indication is triggered when the CG providing F1-over-BAP fails.

Type2 indication

#### Proposal 4: (For discussion) (10 versus 6) Further propagation of type-2 indication is NOT supported

#### Proposal 5: (For agreement) (5 versus 2) If propagation of type-2 indication is supported, the received tye-2 indication is simply forwarded to child nodes without regeneration at the forwarding node.

#### Proposal 6: (For agreement) (14 versus 1) Type-2 indication triggered by a single-connected node does not include any routing information (such as unavailable routing IDs).

#### Proposal 7: (For discussion) (10 versus 5) Type-2 indication triggered by a dual-connected node does not include any routing information.

#### Proposal 8. (For agreement) There is no need to specify a NOTE that type-2 indication may trigger deactivation of IAB-supported in SIB

#### Proposal 9. (For agreement) To specify a NOTE that a type-2 indication may trigger deactivation/reduction of SR and/or BSR transmissions at the receiving node.

#### Proposal 10. (For agreement) RAN2 does not specify suspending routing data to a parent node in case of receiving type-2 indication.

#### Proposal 3: (For discussion) RAN2 to discuss the case where failure of first BH link had triggered type-2 indication (but not re-establishment) and there happens a failure on other link prior to the recovery of the first BH link, yielding re-establishment, which then triggers another type-2 indication. FFS this is a valid case or how to handle/prevent the second type-2 indication.

Type-3 indication

#### Proposal 11a: (For agreement) Type-3 indication is triggered upon successful CHO executed during re-establishment or upon successful RRC setup complete as a result of re-establishment.

#### Proposal 11b: (For agreement) No need to introduce a successful RRC setup complete during re-establishment as triggering condition of type-3 indication. (It is already clear in the current spec that RRC re-establishment succeeds if RRC setup initiated during re-establishment is successful)

#### Proposal 11c: (For discussion) RAN2 to further discuss if successful CHO executed during re-establishment should be introduced as an explicit triggering condition of type-3 indication or if genetic condition “upon recovery” from BH RLF is sufficient.

P12 are conditioned on P4:

#### Proposal 12\_alt1: (For conditional agreement) (if further propagation of type-2 indication is supported), further propagation of type-3 indication should be supported, where that a node forwards received type-3 indication, if it previously propagated type-2 indication.

#### Proposal 12\_alt2: (For conditional agreement) if further propagation of type-2 indication is not supported, further propagation of type-3 indication is not supported.

P13 are conditioned on P6 and P:

#### Proposal 13\_alt1: (For conditional agreement) Type-3 indication does not include any routing information.

#### Proposal 13\_alt2: (For conditional agreement) Type-3 indication includes routing information indicating recovered routing ID(s).

#### Proposal 14: (For agreement) No further clarification is needed for successful re-establishment as triggering condition of type-3 indication.

Other issues

#### Proposal 15a: (For agreement) To use a new name “BH RLF recovery failure indication” for type-4 indication from Rel-17.

#### Proposal 15b: (For discussion) RAN2 to discuss the need of R16 CRs to rename “BH RLF indication” to “BH RLF recovery failure indication”.

#### Proposal 16 (For agreement) No network configurability on triggering/propagation of type-2/3 indication is needed.

#### Proposal 17 (For agreement) RRC re-establishment to a different IAB-donor-CU should not be introduced as triggering condition of type-4 RLF indication.

#### Proposal 18 (For agreement) Routing configuration update should not be used as triggering of reverting the actions triggered by a previous Type 2 BH RLF Indication

## 3.2 Question for draft proposals for agreements:

In this sub-clause, collective questions are asked for draft proposals that are marked as “**for agreement**” above.

Before ASN.1 review kick-off, RAN2 has limited time for discussion, which include this offline and one more meeting (RAN2#117). Hence, we need to focus on making progress on important issues, rather than pursuing small optimization. In this sense, companies are kindly requested to be more constructive in various manners. But, in any case RAN2 need to address technical concerns appropriately, if clearly raised and understood by this group, so that RAN2 decisions are more robust and future-proof.

First, the question #a intends to harmonize RAN2’s understanding related to local re-routing and related type-2 triggering with respect to the agreement made during [AT-116bis][048].

#### Question #a: For P1 and P2, please express your view by indicating your acceptance (Y) or no acceptance (N). If N, please specify your concern. No input or your answer indicating N without specifying your concern in detail will be considered as “Y”.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | P1(Y/N) | P2(Y/N) | Comments |
| NEC | Y | Y |  |
| Huawei, HiSilicon | N? | Y | P1: in phase1, “not mandatory” is confirmed by companies, but the consequence seems not the case. We are not clear on the spec impact of the 2nd half “*As per the current agreement, partial re-routing upon BH RLF results in no triggering of type-2 indication as per the current agreement.*”P2: The proposal is fine. In addition, the proposal can be general for all MR-DC case, e.g. NR-DC, EN-DC,Proposal 2: (For agreement) For a dual-connected node, e.g. configured with CP-UP split/NR-DC/EN-DC, type-2 indication is triggered when all the CG(s) providing F1-over-BAP fail. |
| Intel | Y | Y | For Proposal 2, agree the changes proposed by HW. |
| Samsung  | Y | N | In the original P2, it is unclear that F1-over-BAP is for CP or UP or both. For the modified one from HW, “For a dual-connected node, configured with CP-UP split, type-2 indication is triggered when all the CG(s) providing F1-over-BAP fail” this means that the only failure of CG providing F1 UP over BAP doesn’t trigger type-2 indication (only triggered when both CG failed). We are ok with this. But companies needs to check if this is their intended operation. |
| ZTE | N | Y | For proposal 1, what’s the intention of the second sentence? It seems it is an observation rather than a proposal. Actually, current agreement doesn’t preclude this case, i.e. type 2 indication is triggered by partial re-routing upon BH RLF. So we suggest to remove the second sentence. |
| Ericsson | Y | Y | For P1, we believe that the second sentence is ok to be kept, since it further clarifies when the type-2 should be transmitted.For P2 agree with HW rewording. |
| Apple | Y | N | For Proposal 2, it is unclear whether F1-over-BAP is for CP or UP or both. Our preference is to have type-2 indication triggered when only one BH links fails. |
|  |  |  |  |

Second, the question #b intends to collect agreeable proposals related to type-2 indication.

#### Question #b: For P5, P6, P8, P9, P10, please express your view by indicating your acceptance (Y) or no acceptance (N). If N, please specify your concern. No input or your answer indicating N without specifying your concern in detail will be considered as “Y”.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Company | P5(Y/N) | P6(Y/N) | P8(Y/N) | P9(Y/N) | P10(Y/N) | Comments |
| NEC | N | Y | Y | Y | Y | P5 and P4 are mutually exclusive. Many companies supporting P4 have not answered P5, so we suggest not going through P5 for now. |
| Huawei, HiSilicon | N | Y | Y | N | Y | We disagree P9 to specify this. “trigger deactivation/reduction of SR and/or BSR transmissions” is not clear MT behavior.For P10, we are OK to compromise. |
| Intel | N | Y | N | Y | Y | For P5, it is proposed based on the pre-condition that further propagation of type-2 indication is supported. It cannot be agreed before discussion of proposal 4.For P8, both P8 and P9 are agreed as possible behavior of an IAB-node which receives type-2 RLF indication may perform. We think both P8 and P9 need to be captured as note in the stage-2 spec.  |
| Samsung  | N | Y | N | N | Y | P5 is the conditional one. First, we need to agree on doing or not doing type 2 indication propagation.P8 and P9, we don’t agree not stating anything on deactivation of IAB supported in SIB. At least, if P9 is accepted, then this deactivation method also should be accepted.P10, we don’t have strong view on this, if majority wants, we are ok. |
| ZTE | N | N | Y | N | Y | For P5, it depends on the content of the type 2 indication. If unavailable routing ID is included in the type 2 indication, and the descendant node is able to perform rerouting only for part of the affected traffic, then it needs to removes some routing IDs in the received type 2 indication and re-generate a new type 2 indication.For P6, it depends on whether further propagation of type 2 indication is supported. If it’s supported, routing ID information needs to be included in the type 2 indication triggered by both single and dual connected MT assuming that its descendant node may be dual-connected. Otherwise, descendant node cannot differentiate which route is not available. For P9, the behaviour upon reception of type 2 indication is up to implementation. There is no need to specify, which is similar as P8 and P10.  |
| Ericsson | N | Y | Y | N | Y | P4 should be considered, since P5 depends on P4.For P9, we agree with Huawei, from a specification perspective it is unclear what that really means. This type of behaviors should be left to implementation.  |
| Apple | N | Y | N | N | N | P5: Same view as Intel and Samsung.P8-10: Our preference is to add a note in the specification for clarity. For P10 we do not have a strong view, ok to compromise. |
|  |  |  |  |  |  |  |

Second, the question #c intends to collect agreeable proposals related to type-3 indication.

#### Question #c: For P11a, 11b, P12, P13, P14, please express your view by indicating your acceptance (Y) or no acceptance (N). If N, please specify your concern. No input or your answer indicating N without specifying your concern in detail will be considered as “Y”.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Company | P11a(Y/N) | P11b(Y/N) | P12(Y/N) | P13(Y/N) | P14(Y/N) | Comments |
| NEC | Y | Y | Alt2 | Alt1 | Y |  |
| Huawei, HiSilicon | N | Y | alt2 | Atl1. | Y | Fine with P11b, but it is not needed.P13, we are OK to compromise.P14 is the general principle we used since R16. Note that P11a is conflict with P14.P14 should be clarified as “No further clarification in the specification is needed for successful re-establishment as triggering condition of type-3 indication.” |
| Intel | Y | Y | Alt2 | Alt1 | Y |  |
| Samsung  | Y | Y | Alt2 | Alt1 | Y | P12, there are two sub proposals, P12\_alt1 and alt2. This also conditioned on type2 propagation supported or not. Since we agree that no propagation, we support P12\_alt2. With the same analogy, we support P13\_alt1 based on that type 2 indication doesn’t include any other information. |
| ZTE | Y | Y | Y | N | Y | For P13, it depends on the content of the received type 1 indication. The conditions for Alt 1 and Alt 2 are missing in P13.  |
| Ericsson | Yes but P14 and P11a should be merged | Y | Alt2 | Alt1 | Y | P11a is ok as a principle, but it should be merged with P14 to clarify the spec impact of P11a. |
| Apple |  |  | Alt1 | Alt2 |  | P12 and P13 are conditioned on P4 and P7, respectively, we prefer to support propagation. No strong view on P11/14. |
|  |  |  |  |  |  |  |

Second, the question #d intends to collect agreeable proposals related to other issues.

#### Question #d: For P15a, P16, 17, 18, please express your view by indicating your acceptance (Y) or no acceptance (N). If N, please specify your concern. No input or your answer indicating N without specifying your concern in detail will be considered as “Y”.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Company | P15a(Y/N) | P16(Y/N) | P17(Y/N) | P18(Y/N) | Comments |
| NEC | Y | Y | Y | Y |  |
| Huawei, HiSilicon | N | Y | Y | Y? | For P15, there is no majority in phase 1. P15a is not acceptable, unless we agree the R16 CRs to align the terminology. **P15a and P15b has to be decided together in this meeting.**P18 should be “Not support any reverting the actions triggered by a previous Type 2 BH RLF Indication” |
| Intel |  | Y | Y | Y with comment | For P15, agree with HW that P15a and P15b need to be decided together. For P18, we think routing configuration update is not relevant to reverting actions triggered by a previous type-2 BH RLF indication. As commented, when receiving new routing configuration, the IAB-node should always follow the configuration. Therefore, we suggest rewording P18 as:“The IAB-node follows the new Routing Configuration updated by IAB-donor CU for traffic routing, which overrides local rerouting triggered by previous type-2 BH RLF indication.” |
| Samsung  | Y | Y | Y | Y |  |
| ZTE | Y | Y | Y | Y |  |
| Ericsson | N | Y | Y | Y | For P15a, we agree with Huawei. Nothing is broken, and all the specifications (38.300, 38.331, 38.340) are very clear and consistent on when the type-4 RLF should be generated/handled. Hence, there is no ambiguity at all. Especially for the stage-3, this change would look unmotivated, i.e RRC specification would likely not be impacted by the new type-2/3 RLF, but still it would be required to implement such a terminology change to align with other specs. Given this and also considering that there is no clear majority from phase 1 (8 vs. 9), we cannot agree to this proposal. |
| Apple | Y | N | Y |  | P16: Configurability is useful to manage the topology, one example is to prevent unnecessary type-2/3 indications (e.g., child nodes are Rel-16). No strong view on P18. |
|  |  |  |  |  |  |

## 3.3 Question for draft proposals for discussion

In this sub-clause, questions are asked for draft proposals that are marked as “for discussion”.

**Proposal 4: (For discussion) (10 versus 6) Further propagation of type-2 indication is NOT supported.**

#### Question #e: Can you accept P4? If not, please specify your reasoning.

|  |  |  |
| --- | --- | --- |
| Company | P4(Y/N) | Comments |
| NEC | Y |  |
| Huawei, HiSilicon | Y | No time to discuss the details. |
| Intel | Y |  |
| Samsung  | Y |  |
| ZTE | N | There is clear benefit of further propagation of type 2 indication and the specification effort is not big. If descendant nodes are not aware of the BH RLF in the upstream, they would continue routing the affected traffic, which would lead to overflow at the IAB node which detects BH RLF. Moreover, if the BH RLF recovery fails, the buffered data need to be discarded which will lead to service interruption. The situation at descendant node is similar as the IAB node which detects BH RLF. Specifically, the descendant node may cannot perform local rerouting for affected traffic, e.g. inter-donor rerouting is not available, UP link fails in EN-DC or CU-UP separation case. In these cases, descendant node needs to propagate type 2 indication to its child nodes.  |
| Ericsson | Y |  |
| Apple | N | Propagation is beneficial as it can provide better performance. |
|  |  |  |

Rapporteur’s Note. If there remains a strong objection on P4, then this issue will be added into open issue list for further discussion at next meeting

**Proposal 7: (For discussion) (10 versus 5) RAN2 to discuss if we can agree that type-2 indication triggered by a dual-connected node does not include any routing information.**

#### Question #f: Can you accept that type-2 indication triggered by a dual-connected node does not include any routing information. If not, please specify your reasoning.

|  |  |  |
| --- | --- | --- |
| Company | P15a(Y/N) | Comments |
| NEC | Y |  |
| Huawei, HiSilicon | Y | OK to compromise. |
| Intel | Y |  |
| Samsung  | Y |  |
| ZTE | N | It depends on P4, if further propagation of type-2 indication is supported, routing information needs to be included in the type 2 indication. Otherwise, descendant node cannot differentiate which route is not available.  |
| Ericsson | Y |  |
| Apple | N | For dual connected mode, the inclusion of some routing information is beneficial for performance / provide the correct status in DC. |
|  |  |  |

Rapporteur’s Note. If there remains a strong objection on P7, then this issue will be added into open issue list for further discussion at next meeting.

#### Question #g: Can you agree to add the following issue into open issue list for further discussion?

* **Proposal 3: (For discussion) RAN2 to discuss the case where failure of first BH link had triggered type-2 indication (but not re-establishment) and there happens a failure on other link prior to the recovery of the first BH link, yielding re-establishment, which then triggers another type-2 indication. FFS this is a valid case or how to handle/prevent the second type-2 indication.**

|  |  |  |
| --- | --- | --- |
| Company | View(Y/N) | Comments |
| NEC | Y |  |
| Huawei, HiSilicon | N | This is a corner case and should not be in the open issue list, which should be the high priority one to be completed in the last meeting. |
| Samsung  | N | As we know, there was clear minority (only 2) to support option 1 (the failure of the other BH link triggers another type2 indication). 5 support option 2, and 5 said it depends on the scenario discussion. And other 4 curious on the scenario. In our view, if the scenario is CP/UP split case, then the scenario of P3 doesn’t happen. If the scenario is normal NRDC, then local re-routing will handle all the affected traffic and there would be no type 2 indication to the child node. So the scenario of P3 isn’t valid. |
| ZTE | N | We share the same view with Huawei.  |
| Ericsson | N | Agree with Huawei. This issue is not critical for the completion of the WI, and we should not spend time on it. |
| Apple | Y | We are okay to capture this issue as open, but it seems a corner case and should be low priority. Maybe it can be handled in maintenance phase? |
|  |  |  |

#### Question #h: Can you agree to add the following issue into open issue list for further discussion?

* **Proposal 11c: (For discussion) RAN2 to further discuss if successful CHO executed during re-establishment should be introduced as an explicit triggering condition of type-3 indication or if genetic condition “upon recovery” from BH RLF is sufficient.**

|  |  |  |
| --- | --- | --- |
| Company | View(Y/N) | Comments |
| NEC | N🡺Y? | We think successful execution of CHO is the triggering condition of type-3 indication. The question is corrected so that it is triggering type-3 indication. Given the correction, I think the answer from NEC can be modified to YES, as reflected in the left column .  |
| Huawei, HiSilicon | N | We don’t need to specify such details. |
| Intel | N | Ok to not specify the details |
| Samsung  | Y | P11c itself has all the possible solution in it, i.e., CHO execution as an explicit triggering condition of type 3 OR just ‘upon recovery’ is sufficient as type 3 triggering. We think the issue of P11c can be determined as either the former or the latter in this meeting. But it seems now no time for this discussion in this meeting, so this would be in the open issue. There should be any condition to trigger type3. Otherwise, there is no condition to trigger type 3.  |
| ZTE | Y |  |
| Ericsson | N | If we agree P14, what is the remaining issue? It can be just captured in the stage-2 spec that the type-3 is sent upon successful BH recovery, irrespective of whether the reestablishment was in a CHO candidate cell or not. |
| Apple | Y |  |
|  |  |  |

#### Question #i: Can you agree to add the following issue into open issue list for further discussion?

* **Proposal 15b (For discussion) RAN2 to discuss the need of R16 CRs to rename “BH RLF indication” to “BH RLF recovery failure indication”.**

|  |  |  |
| --- | --- | --- |
| Company | View(Y/N) | Comments |
| NEC | Y | R16 and R17 are better aligned. |
| Huawei, HiSilicon | Y | It is better to decide in this meeting. |
| Intel | Y | As commented before, it should be discussed together with P15a. |
| Samsung  | N | This issue also can be determined in the online session. So don’t add to the open issue list. |
| ZTE | Y |  |
| Ericsson | N | We should not change old frozen specifications for the sake of new specifications, unless there is a fundamental issue/problem that affects core functionalities. Since this is certainly not the case, we should not spend time on such discussion. |
| Apple | Y |  |
|  |  |  |

# 4. Conclusion

# 5. Reference and Proposals therein

### [1] R2-2200196 QC

Open isuses on IAB RLF indications Qualcomm Incorporated discussion Rel-17 NR\_IAB\_enh

**Observation: Based on RAN3 agreement, inter-donor-DU local rerouting can always be configured via a static IP tunnel.**

**Proposal 1: If a dual-connected node observes BH RLF on only one link, which is either the SCG link or it is the MCG link with fast MCG recovery supported, type-2 RLF indication should not be transmitted.**

**Proposal 2: A type-2 indication may be propagated by the receiving node if the node has no alternative path for local rerouting.**

**Proposal 3: Add a note to stage-2 CR that a type-2 indication may trigger deactivation of IAB-supported in SIB and deactivation/reduction of SR and/or BSR transmissions at the receiving node.**

**Proposal 4: Type-2 RLF indication is not sent after RLF detection with subsequent CHO execution.**

**Proposal 5: Type-4 RLF indication is referred to as *BH RLF recovery-failure indication*.**

### [2] R2-2200323 CATT

Discussion on RLF Indications CATT discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: There is no obstacle of IAB capability for data rerouting in intra-CU inter-DU topological redundancy and inter-donor-CU topological redundancy.**

**Observation 2: Since NR DC is used to enable route redundancy in the BH, no reason for IAB-donor-CU to configure DC but not allow data rerouting.**

**Proposal 1: Type-2 RLF indication should not be triggered when one link is failed and the other is available with DC configuration.**

**Proposal 2: BAP control PDU format of type-4 RLF indication can be reused for type-2 and type-3 RLF indications, and 2 new PDU type values should be applied to indicate type-2 and type-3 RLF indication.**

**Observation3: The conditions of successful re-establishment are clear in RRC specification and there is no need to address extra details.**

**Proposal 3: For type-3 RLF indication triggered by successful re-establishment, there is no need to specify detailed conditions for success of re-establishment.**

**Observation 4: If IAB-node re-established to a different IAB-donor-CU, the sub-tree cannot be identified by the new IAB-donor-CU.**

**Proposal 4: If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node.**

**Proposal 5: Propagation of type-2/type-3 RLF indication should not be supported.**

### [3] R2-2200351 INTEL

Open issues on IAB-node RLF indication Intel Corporation discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1 If local rerouting is supported at dual-connected IAB-node which detects BH RLF on any BH link, local rerouting can be performed first without sending type-2 RLF indication. Triggering local rerouting at both IAB-node which detects BH RLF and its child IAB-node is not necessary.**

**Observation 2 Local rerouting at dual-connected IAB-node can always be supported via configuration/reconfiguration by IAB-donor CU.**

**Observation 3The alternative BH link for local rerouting is considered as unavailable if it is congested. A dual-connected IAB-node should also trigger type-2 RLF indication if alternative BH link is congested.**

**Observation 4MCG link in EN-DC is not available for local rerouting, as it’s a LTE link. A dual-connected IAB-node should also trigger type-2 RLF indication if alternative BH link is MCG link in EN-DC.**

**Observation 5 Define unavailable BH link for local rerouting when any of the following conditions apply:**

**1) BH RLF; 2) receives type-4 RLF indication; 3) receive type-2 RLF indication; 4) receive flow-control feedback for congestion indication; 5) only available link is MCG link in EN-DC.**

**Proposal 0: Define unavailable BH link for local rerouting when any of the following conditions apply:**

**1) BH RLF; 2) receives type-4 RLF indication; 3) receive type-2 RLF indication; 4) receive flow-control feedback for congestion indication; 5) only available link is MCG link in EN-DC.**

**Proposal 1 Type 2 indication by dual-connected node is triggered when the node initiates RRC re-establishment resulting from BH RLF on both CGs or BH RLF on MCG with no fast MCG recovery or alternative BH link for local rerouting is unavailable.**

**Proposal 2 For inter-donor DU re-routing, local rerouting at dual-connected IAB-node can only be configured by IAB-donor CU when IP tunnel between source and target IAB-donor DU is successfully established.**

**Observation 6 The IAB-node which receives the type-2 RLF indication will not generate a type-2 RLF indication to its child IAB-node, as BH RLF is not detected on both CGs or MCG with no fast MCG recovery.**

**Observation 7 UL congestion can be avoided by deactivation of iab-support in SIB or reduction of SR/BSR transmission. There’s no need to further propagate type-2 RLF indication for the same purpose.**

**Proposal 3 IAB-node will not propagate type-2 RLF indication to its child IAB-node.**

**Proposal 4 Detailed condition for successful of re-establishment refers to “upon successful transmission of RRCReestablishmentComplete message”.**

**Proposal 5 Type-3 RLF indication is triggered upon successful transmission of RRCReconfigurationComplete message if the selected target cell during re-establishment is a CHO candidate cell.**

### [4] R2-2200405 NEC

Discussion on left issue of Type-2/3 RLF indication NEC discussion Rel-17 NR\_IAB\_enh-Core

**Proposal 1: It should be supported that type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic.**

**Proposal 2: BAP routing ID(s) of the traffic which needs to be re-routed is contained in the type 2 BH RLF indication.**

**Proposal 3: Propagation of type-2 indication should not be supported.**

**Proposal 4: RAN2 does not need to specify the detailed condition of successful re-establishment for transmitting Type-3 RLF indication.**

**Proposal 5：RAN2 use the new terms “BH RLF recovery failure indication” for Type-4 RLF indication.**

### [5] R2-2200562 Fujitsu

Control plane behavior at receiving BH RLF detection indication Fujitsu discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: Local re-routing cannot handle IAB-MT’s SRB.**

**Proposal 1: If a split SRB is configured, pdcp-Duplication of its PCDP entity is not configured, and the BH RLF detection indication is from MCG, then set the primaryPath to refer to SCG.**

**Proposal 2: ULInformationTransferMRDC is enhanced to carry the RRC messages which was intended to send on the link towards the parent who sends the BH RLF detection indication.**

**Proposal 3: F1-C can be enhanced to carry RRC messages.**

### [6] R2-2200563 Fujitsu

A mechanism to avoid a storm of BH RLF indication Fujitsu discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: There is no security protection for Type 2 BH RLF indication.**

**Observation 2: The trigger(s) to generate a Type 2 BH RLF indication should be restricted.**

**Proposal 1: A mechanism is introduced to avoid a storm of Type 2 BH RLF indications.**

**Proposal 2: RAN2 to select one from the following options to avoid a storm of Type 2 BH RLF indications:**

* **Option 1: only one type 2 BH RLF indication is triggered before a Type 3 BH RLF indication is generated**
* **Option 2: a prohibit timer-based mechanism**

### [7] R2-2200564 Fujitsu

RLF indication and flow control feedback from boundary node Fujitsu discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: The buffer for the previous routing ID and that for the corresponding new routing ID in the inter- -CU BAP Header Rewriting info should be shared.**

**Proposal 1: If the available buffer size of a routing ID among the new routing IDs in the inter-CU BAP Header Rewriting info for DL is low, the IAB node:**

* **Look up the previous routing ID of this routing ID in inter-CU BAP Header Rewriting info.**
* **Deliver the flow control BAP PDU containing the buffer size of this routing ID as well as the previous Routing ID to the egress link corresponding to the non-F1-terminating CU.**

**Proposal 2: If the available buffer of a routing ID is low and there is no inter-CU BAP Header Rewriting info for DL or the routing ID is not among the new routing IDs, the IAB-node delivers the flow control BAP PDU containing that routing ID to the egress link corresponding to the F1-terminating CU.**

**Proposal 3: If RLF is detected on the link corresponding to the non-F1-terminating CU, the boundary node:**

* **Determine the Routing ID(s) affected.**
* **Look up the previous routing ID(s) of the affected routing ID(s) in the inter-CU BAP Header Rewriting info for UL.**
* **Deliver the type-2 RLF indication including the previous routing ID(s) to child node.**

**Proposal 4: If RLF is detected on the link corresponding to the F1-terminating CU, or the inter-CU BAP Header Rewriting info for UL is not configured, the IAB-node determines the routing ID(s) affected and includes the routing ID(s) in the type-2 RLF indication to child node.**

### [8] R2-2200806 vivo

Remaining Issues of BH RLF vivo discussion Rel-17 NR\_IAB-Core

**Proposal 1 Where type-2 indication by dual-connected node can be triggered when (1) the node detects BH RLF on any BH link and (2) it cannot perform re-routing for affected traffic Type-2 indication may carry information of the BAP routing ID**

**Proposal 2 Type-2 indication may carry information of the BAP routing ID**

**Proposal 3 In case the IAB node cannot perform traffic re-routing on a configured link, the type-2 indication should not be propagated**

**Proposal 4 If Type-2 indication is triggered and if no alternative path is available, the node may perform re-establishment.**

**Proposal 5Type 3 BH RLF indication can be triggered in case of successful ReconfigurationComplete message transmission.**

**Proposal 6Type 3 BH RLF indication should indicate if the donor-DU has switched or not.**

**Proposal 7 When Type 3 BH RLF indicating with no topology change (i.e. no donor-DU switch) has been received, an IAB node can perform data transmission/routing as before receiving the corresponding Type 2 BH RLF indication.**

**Proposal 8 When Type 3 BH RLF indication indicating the donor-DU switch is received, the IAB node is allowed generate new BAP data PDU for UL transmission only after its BAP routing table is reconfigured.**

### [9] R2-2200837 CANON

Discussion on RLF indication enhancements CANON Research Centre France discussion Rel-17 NR\_IAB\_enh-Core D:\LG 전자\1. 3GPP 표준화 업무\3GPP WGs\3GPP RAN2\3GPP RAN2 기고문\MY\_TDOC\docs\R2-2110344.zip

**Proposal 1: A BH RLF indication may convey a list of BAP path ID(s) or BAP Routing ID(s) impacted by the RLF.**

**Proposal 2: Upon reception of a BH RLF indication from a parent IAB-node, an IAB node without any alternative path should forward the RLF indication to its own child IAB node(s).**

### [10] R2-2201051 Nokia

RLF indications and re-routingenhancements Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: If all possible traffic with MCG as the primary next hop can be rerouted via SCG, there is no need to send a BH RLF Type-2 indication provided that the fast MCG recovery is supported.**

**Observation 2: If all possible traffic with SCG as the primary next hop can be rerouted via MCG, there is no need to send a BH RLF Type-2 indication.**

**Observation 3: If an IAB node in DC, regardless of whether it detects MCG RLF or SCG RLF, indicates to its child nodes nothing more than that it is trying to recover from RLF, its child nodes may trigger local re-routing (and/or alter IAB-support indication in SIB, or reduce SR/BSR transmissions) unnecessarily.**

**Observation 4:Rel-16 IAB does not allow re-routing of downstream data having reached an IAB node with all downlink hops toward a given destination unavailable.**

**Observation 5: Local rerouting can be done at the IAB node if there is an alternative route to the same destination node.**

**Observation 6:In case of BH RLF, BH RLF indication may be sent to the child nodes. Rerouting may be possible at a child IAB node if an alternative path exists when the BH RLF indication is received.**

**Observation 7:Since the BAP entity may only reroute the BAP Data PDUs, which were not acknowledged by the lower layer, to an alternative path, it is not possible at the child IAB node to locally reroute the BAP PDUs which were successfully sent to the parent IAB node but not to the ancestor in case of a BH failure between the parent and ancestor nodes.**

**Proposal 1. Type-3 indication does not need to carry additional information for re-routing (CU sends routing re-configuration to the child/descendant nodes, if needed).**

**Proposal 2. The success of the re-establishment can be declared when RRC sends the RRCReestablishmentComplete -message to lower layers for transmission.**

**Proposal 3. To cover EN-DC scenarios and to have proper support for CP-UP split (Scenario 1), the RLF Type-2 indication is triggered also in case SCG fails and MCG cannot provide connection for BH data.**

**Proposal 4: In case MCG failure has been detected (i.e., for a node in DC when RRC sends the MCG failure to the MN and T316 is started) and not all possible traffic can be locally rerouted, the IAB-node shall transmit a BH RLF Type 2 indication to its child nodes.**

**Proposal 5: In case SCG failure has been detected (i.e., for a node in DC when RRC sends the SCG failure to the MN) and not all possible traffic can be locally rerouted, the IAB-node shall transmit a BH RLF Type 2 indication – “Trying to recover” to its child nodes.**

**Proposal 6: In case the SCG failure has been solved or is no longer relevant (e.g., after Secondary Node Modification or Secondary Node Change or after a Secondary Node Release with a change of the BH routing configuration so that all BAP destinations are reachable) and the node has previously sent a BH RLF Type 2 indication, the IAB-node shall transmit a BH RLF Type 3 indication – “BH link recovered” to its child nodes.**

**Proposal 7: To cope with all RLF scenarios the IAB-node should send RLF indication when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic, as suggested with Option 2b.**

**Proposal 8: For the case that only part of the traffic cannot be rerouted, the type-2 RLF indication shall contain a list of BAP-destinations (from the indicating node’s routing configuration) that are unreachable due to the RLF. The absence of this list indicates that no upstream destination is reachable via the indicating node.**

**Proposal 9: In case the MCG failure has been solved or is no longer relevant (e.g., after RRCReconfiguration with reconfigurationwithSync for the PCell or after MobilityFromNRCommand when all BAP destinations are reachable again) and the node has previously sent a BH RLF Type 2 indication, the IAB-node shall transmit a BH RLF Type 3 indication – “BH link recovered” to its child nodes.**

**Proposal 10: If a received Type-2 RLF indication contains a list of unreachable BAP destinations, local re-routing is allowed only for traffic addressed to the listed destinations.**

**Proposal 11. RAN2 to select Opt.2 (Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available) as the IAB-node behaviour when receiving Type-2 RLF indication.**

**Proposal 12. Destination/routing information can be omitted in the Type-2 indication if all destinations are unreachable via that link.**

**Proposal 13. Forwarded Type-2 indication is not changed in the intermediate IAB-node(s) forwarding the indication.**

**Proposal 14: Re-routing of downstream data having reached an IAB node with all downlink hops toward a given destination unavailable is supported by:**

* **1) BAP-routing paths with a parent node as next hop, or**
* **2A) uplink indication (not accompanying data) that certain destinations are unreachable, or**
* **2B) undeliverable-indication in the header of a BAP PDU returned to parent node.**

**Proposal 15: BAP PDUs are not discarded by the BAP entity until the expiry of a BAP discard timer despite the received RLC ACKs. In case of a received type-2 or type-4 BH RLF indication, buffered PDUs are rerouted by the child IAB node via an alternative path.**

### [11] R2-2201242 Kyocera

Remaining issues of BH RLF Indications for eIAB Kyocera discussion Rel-17 D:\LG 전자\1. 3GPP 표준화 업무\3GPP WGs\3GPP RAN2\3GPP RAN2 기고문\MY\_TDOC\docs\R2-2110204.zip

**Observation 1 In EN-DC, Type 2 BH RLF Indication needs to be sent upon SCG RLF (i.e., NR link), since local rerouting cannot be performed via MCG (i.e., LTE link), whereby this scenario does not experience BH RLF from both CGs (i.e., RRC Reestablishment is not initiated).**

**Observation 2 In NR-DC with CP/UP separation, e.g., MCG is only for CP while SCG is for UP, Type 2 BH RLF Indication needs to be sent upon SCG RLF (i.e., UP link) even if MCG is still good, similar to the EN-DC case in Observation 1.**

**Observation 3 The FFS solution “Type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic” is applicable to all the scenarios.**

**Proposal 1 RAN2 should agree that Type 2 BH RLF Indication is sent when at least one route is unavailable upon BH RLF on any link, i.e., when local re-routing cannot be performed, regardless of whether the IAB-node is configured with single connection or dual connection, and also regardless of whether EN-DC or NR-DC.**

**Observation 4 Upon reception of Type 2 BH RLF Indication, the child node can have the option if the “partial” local rerouting is performed for better load balancing (i.e., Option B).**

**Proposal 2 RAN2 should discuss whether the "partial” local rerouting is performed at the child node (i.e., Option B), when its parent in dual connectivity experiences BH RLF.**

**Proposal 3 RAN2 should agree that Type 2 BH RLF Indication indicates the Routing IDs that are unavailable due to BH RLF.**

**Proposal 4 RAN2 should agree that the child node considers the Routing IDs to be unavailable, if these Routing IDs are indicated in received Type 2 BH RLF Indication.**

**Proposal 5 RAN2 should agree that Type 3 BH RLF Indication is sent when at least one route becomes re-available upon successful BH RLF recovery.**

**Proposal 6 RAN2 should agree that Type e BH RLF Indication indicates the Routing IDs that are re-available due to successful BH RLF recovery.**

**Proposal 7 RAN2 should agree that the child node considers the Routing IDs to be available, if these Routing IDs are indicated in received Type 3 BH RLF Indication.**

**Proposal 8 RAN2 should discuss if there is any condition, other than Type 3 BH RLF Indication, for the IAB-node to revert the actions triggered by a previous Type 2 BH RLF Indication, e.g., when the routing configuration is updated.**

**Proposal 9 RAN2 should agree that the propagation of Type 2 Indication to descendant nodes is supported. FFS on detailed condition, e.g., forwarding only if the IAB-node does not perform any local rerouting.**

**Proposal 10 RAN2 should agree to add a Note in Stage-2/3 specifications that the IAB-MT deactivates or reduces SR and/or BSR transmissions when it receives Type 2 BH RLF Indication.**

**Observation 5 The handling of IAB-Support IE is up to IAB-DU implementation, as in Rel-16.**

### [12] R2-2201301 Huawei

RLF indication and local re-routing based on flow control Huawei, HiSilicon discussion Rel-17 NR\_IAB\_enh-Core

**Proposal 1: The terminology of Type-4 indication “BH RLF indication” should NOT be changed in R17.**

**Proposal 2: If RAN2 deems to use “BH RLF recovery failure indication” for type 4 indication, R16 CRs should also be agreed.**

**Proposal 3: For the dual connected IAB-node configured with CP-UP separation, the trigger condition to send type 2 indication on the BH link level should be upon RLF on the CG configured with “F1 over BAP”.**

**Proposal 4: IAB-node may trigger the Type-2 indication upon RLF on any CG.**

**Proposal 5: The granularity of Type-2 indication can include per routing ID level.**

**Proposal 6: When constructing the Type-2 indication BAP control PDU:**

**IAB-node includes the “BH link level” in the triggered Type-2 indication, in case of RRC re-establishment.**

**IAB-node includes the “routing ID level” in the triggered Type-2 indication, in case only some routing ID(s) is not be able to be routed to the next hop (e.g. not being able to be routed due to one CG RLF in NR-DC case).**

**Proposal 7: As in R16, the trigger conditions for type 2/3 will be captured in BAP specification, rather than in RRC, with just some general descriptions.**

**Proposal 8a: IAB-MT with single parent should suspend routing any data to its parent node, upon receiving Type-2 indication on BH link level.**

**Proposal 8b: IAB-MT with single parent should suspend routing data with the indicated routing ID to its parent node, upon receiving Type-2 indication on routing ID level.**

**Proposal 9a: IAB-MT with NR-DC dual parent does not consider the BH link as available for the purpose of local re-routing, upon receiving Type-2 indication on BH link level.**

**Proposal 9b: IAB-MT with NR-DC dual parent does not consider the BH link for the indicated routing ID as available for the purpose of local re-routing, upon receiving Type-2 indication on routing ID level on the BH link.**

**Proposal 10: RAN2 does not support the propagation of Type-2 indication (i.e. child node can trigger type-2 indication based on its own radio condition).**

**Proposal 11: The granularity of flow control feedback triggered local re-routing is per routing ID.**

**Proposal 12: An egress link may be not considered to be available for a BAP routing ID, if it is determined as congested based on the received flow control feedback.**

### [13] R2-2201306 Samsung

RLF indication related issues Samsung R&D Institute UK discussion

**Proposal 1. RAN2 agree that successful transmission of RRCReestablishmentComplete message can trigger type 3 indication to the former parent IAB node which sent type 2 indication.**

**Proposal 2. RAN2 agree that successful transmission of RRCReconfigurationComplete message can trigger type 3 indication to the former parent IAB node which sent type 2 indication when attemptCondReconfig was configured to this IAB node.**

**Observation 1. In the inter donor redundancy case, new routing ID written by header rewriting configuration cannot be understood by the source path topology since new routing ID is configured for the target path topology**

**Proposal 3. RAN2 discuss and conclude the availability of the new routing ID written by header rewriting configuration when local rerouting is executed with this routing ID.**

**Proposal 4. RAN2 discuss the solution and agree one of two: not executing the header rewriting (or fallback to the original routing ID) OR sending type 2 RLF indication to the child node(s).**

**Proposal 5. RAN2 discuss the pros and cons on propagation of type 2 indication, and decide the adoption of type 2 indication propagation feature.**

### [14] R2-2201349 ZTE

Remaining issues on RLF indication ZTE, Sanechips discussion Rel-17

**Proposal 1: Type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic, so that local re-routing or other actions could be taken at its child/descendant nodes if possible.**

**Proposal 2: There is no need to specify a detailed condition for success of re-establishment, i.e. it could be up to MT implementation.**

**Proposal 3: Type 2/3 indication should be propagated to descendant nodes so that corresponding actions could be taken at descendant nodes, e.g., local rerouting.**

**Proposal 4: BAP routing ID information needs to be included in the type2 indication sent by a single-connected node or a dual-connected node.**

**Proposal 5: BAP routing ID of path that has recovered needs to be included in type 3 RLF indication.**

**Proposal 6: For descendant nodes, if type 2 RLF indication has been sent to child IAB-MT, type 3 RLF indication needs to be transmitted to child IAB-MT after reception of type 3 RLF indication which includes BAP routing ID.**

### [15] R2-2201388 Futurewei

Open Issues for RLF indications for dual-connected IAB nodes Futurewei Technologies discussion

**Observation 1: A BH RLF detection indication (Type-2 BH RLF indication) warns descendant nodes of a transient condition which the IAB node is likely to recover from quickly.**

**Observation 2: To achieve preferential rerouting at an IAB node in response to receiving a BH RLF detection indication, it suffices for the indication to identify which of the parent IAB node’s UL BH links (MCG or SCG BH link) is not available. The IAB donor can configure the routing table of each child to trigger rerouting of specific routing IDs, if needed, in response to the BH RLF detection indication.**

**Proposal 1: RAN2 will minimize the complexity of the BH RLF detection indication solution.**

**Proposal 2: A dual-connected IAB node does not transmit a BH RLF detection indication if all the traffic routed via a backhaul link experiencing RLF can be rerouted via an alternate BH link.**

**Proposal 3: The BH RLF detection indication does not indicate routing ID information of traffic that can not be rerouted by an IAB node.**

**Proposal 4: Both the BH RLF detection indication and the BH RLF recovery indication transmitted by a dual-connected IAB node shall indicate the availability of its MCG and SCG BH links. The details of how this information is reported within the BH RLF indications, and how a child node is configured to react to this information is FFS.**

### [16] R2-2201468 LGE

 Resolving open issues on BH RLF indications LG Electronics discussion Rel-17

**Proposal 1: A dual-connected node triggers type-2 indication when if both conditions are met: a) when the node detects BH RLF on any BH and b) it cannot perform re-routing for affected traffic.**

**Proposal 2: Type-2 indication triggered by dual-connected node includes routing ID information indicating which routing IDs are not available.**

**Proposal 3: Type-2 indication triggered by single-connected node does not include routing ID information.**

**Proposal 4: Upon reception of type-2 indication, the node does not propagate type-2 indication, regardless of whether the node has no alternative path available.**

**Proposal 5: Type-3 indication can be triggered no earlier than submission of RRCReestablishmentComplete from RRC to lower layers.**

**Proposal 6: Type-3 indication can be triggered no earlier than a successful CHO to a cell during re-establishment procedure.**

**Proposal 7: Type-4 indication is referred to as “BH RLF recovery failure indication” from Rel-17. No changes to Rel-16 specifications are needed.**

### [17] R2-2201607 Ericsson

On Local Routing and Type 2/3 RLF Handling Ericsson discussion NR\_IAB\_enh-Core

**Observation 1 If IAB Rel-16 mechanism for local re-routing (due to RLF) is adopted for link congestion scenario, then IAB-donor-CU does not need to configure specific alternative egress link to be used for local congestion mitigation.**

**Observation 2 When a dual-connected parent IAB node experiences an RLF in one of the two upstream links, it can perform local re-routing of the traffic from the problematic link to the other available link.**

**Proposal 1 RAN2 agree to adopt the IAB Rel-16 re-routing mechanism for local link congestion case, i.e. the alternative link is selected among the entries in the routing table matching the BAP destination in the BAP header.**

**Proposal 2 RAN2 to ask RAN3 to introduce a threshold on the available buffer size for the purpose of local re-routing, that may be provided by the CU to the IAB node DU.**

**Proposal 3 The IAB node may enable local re-routing if the available buffer size is below the configured threshold.**

**Proposal 4 How to deal with the case in which all links in the DL are congested is left to the IAB node DL scheduler implementation.**

**Proposal 5 Local routing can imply re-routing of congested BH RLC channel ID(s) or of congested BAP routing IDs.**

**Proposal 6 Whether type-2 RLF can be transmitted or not by an IAB node is configurable by the CU.**

**Proposal 7 For a dual-connected parent IAB node, the type-2 RLF should be transmitted to the child IAB node only when both upstream links are unavailable due to BH RLF.**

**Proposal 8 The granularity of the type-2 RLF indication is per BH link, as the type-4 RLF.**

**Proposal 9 If the IAB node performs local routing upon reception of type-2 RLF or BH RLF, Rel-16 re-routing principles are used, i.e. the alternative link is selected among the entries in the routing table matching the BAP destination in the BAP header.**

**Proposal 10 A received type-2 RLF is not propagated.**

**Proposal 11 Specify in the stage-2 and BAP specification that the type-3 indication is transmitted upon successful BH RLF recovery.**

### [18] R2-2201644 InterDigital

On BH RLF indications in IAB InterDigital discussion Rel-17 NR\_IAB\_enh-Core Late

**Observation 1: Even if one of the backhaul links of a dual connected IAB node is functioning well, the IAB node may not be able to re-route the packets that were mapped originally mapped to the link being recovered.**

**Proposal 1: A dual connected IAB node will send a type-2 RLF indication to a child node upon detecting an RLF on the MCG or SCG link, if any destination BAP routing ID that is mapped to the failed link can not be rerouted via the other functioning link.**

**Proposal 2: Type-2 RLF indication may include information regarding the impacted destination BAP routing ID(s). If no such information is provided, child nodes will assume that all destination BAP routing IDs are not temporarily routable via the IAB node that sent the type-2 indication.**

**Proposal 3: A node receiving a type-2 RLF indication may propagate the indication further to a child node, if it is not able to reroute packets via an alternate link/path.**

**Proposal 4: The propagation of type-2 RLF indication is network configurable.**

**Proposal 5: A node that has sent a type-2 RLF indication will send a type-3 indication to child nodes upon sending one of the following messages to a target cell:**

* **RRCReestablishmentComplete**
* **RRCSetupComplete**
* **RRCReconfigurationComplete**

### [19] R2-2201692 Summary of AI 8.4.2.1 (BH RLF indication)