3GPP TSG-RAN WG2 Meeting #116 Electronic draft R2-2111532

Elbonia, November, 2021

**Agenda item: 8.4.3**

**Source: LGE (Rapporteur)**

**Title: [AT116-e][032][eIAB] RLF indications**

**WID/SID: NR\_IAB\_enh-Core**

**Document for: Discussion and Decision**

# 1. Introduction

This offline discussion aims to make progress on BH RLF indication as outlined below:

* [AT116-e][032][eIAB] RLF indications (LGE)

      Scope: Progress Type-2/3 RLF indications and related functionality, based on contributions to this meeting. Identify agreements, discussion points, can also capture open issues. Attempt to close open issues.

      Intended outcome: Report

      Deadline: Tuesday W2 (online CB)

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

Phase 1: to settle scope what is agreeable etc, deadline: Thursday W1 Nov 4 1200 UTC

Phase 2: to discuss further details and formulate agreeable proposals, deadline: Thuesday W2 Nov 9 10:00 UTC.

## 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:

|  |  |
| --- | --- |
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# 2. Phase-I Discussion

## 2.1 Triggering of Type-2 indication

### 2.1.1 For dual-connected node

We first discuss triggering condition of type-2 indication for the IAB node connected to dual parents. Referring to the contributions in Annex, there are several options being identified, but those options can be classified into two options, option1 and option2, as follows:

* Option1) when the node detects BH RLF on both BHs (i.e., when it initiates RRC re-establishment)
* Option2) when the node detects BH RLF on any BH and further condition, if introduced, is met

The underlying principle of option1 would be that, as long as the IAB node has at least one available BH link, it does not notify the BH failure event to child node(s) but try actions to make child nodes remain transparent to the occurrence of BH RLF. Upon detecting BH RLF on one BH, the node would trigger MCG/SCG failure information procedure to recover from the failure, and at the same time, the node is required to re-route packet flows that are, otherwise, blocked by the BH failure, by using alternative BH available. However, if the IAB node cannot re-route all or some packet flows subject to the BH failure or if the failure recovery procedure is not prompt, these packets flows would suffer from increased latency.

The underlying principle of option2 would be that BH failure should be notified to child node(s) earlier so that the child node(s) can take actions quickly to minimize performance degradation, by performing, e.g., local re-routing, if possible. While the option2 may yield potential gains enabled by earlier actions of child nodes, it should be addressed what actions need to be done by child nodes upon receiving type-2 indication and how to avoid unnecessary actions of child nodes. For example, when a node receives a type-2 indication from its parent node, it is not clear whether the node should trigger local re-route or not, because the node may have no idea whether its parent node is already performing local re-routing or not. This gives the idea that option2 may require introduction of additional condition(s) that should be satisfied to trigger type-2 indication, so as to trigger type-2 indication only when necessary.

#### **Q1. Which option do you prefer between option1 and option2? Please provide your reasoning for your preference.**

|  |  |  |
| --- | --- | --- |
| Company | Option1/2 | Comment |
| Huawei, HiSilicon | Option 2 | Type-2 indication itself is an enhancement to Rel-16 RLF indication. We would like to have a complete solution, and no need to leave room for further enhancements. Option2 seems better in terms of performance. |
| Kyocera | Option 2 | We think Option 2 has better performance than Option 1. Also, Option 2 can be aligned with the single connection case, in terms of IAB-node behaviour. |
| Qualcomm | Option 1 | In Rel-16 we defined INTRA-donor-DU local rerouting. In Rel-17 we define INTER-donor-DU local rerouting under same or different CUs. Why do we define local rerouting if we shall not use it and instead send type-2 indication with BAP routing IDs included? |
| vivo | Option 1 | Agree with QC. But we are also fine to leave it to implementation. |
| Samsung | Option 1 | We think option 1 is enough for now for the simplicity even there might be an increased latency issue. |
| Intel | Option 1 with comment | In general, we agree that type-2 RLF indication is triggered when both BH link is temporarily unavailable due to RLF.  However, we would like to note that option 1 also includes the scenario when MCG link (only) is BH RLF while fast recovery is not configured. In this scenario, even BH RLF is only detected on MCG link, the alternative BH (SCG link) is not available as it is released together with MCG link.  Hence, we suggest to revise option 1 based on RRC procedure, which is suitable for both single-connected and dual-connected IAB-node:  Option 1: when the nodes initiates RRC re-establishment procedure |
| Fujitsu | Option1 | In our opinion, whether all or some packet flows can be re-routed via alternative BH available depends on IAB-donor configuration and IAB-donor can configure this based on QoS requirement to avoid unexpected delay for traffic with strict latency requirement.  In addition, RLF indication is carried by BAP PDU without security protection. Option 1 provides a tradeoff between security and performance.  So, we prefer Option 1. |
| ZTE | Option 2 | We prefer option 2 considering that in the case when the dual connected node detects BH RLF on one BH, the other link may be unavailable for local re-routing. In this case, type 2 RLF indication needs to be triggered to child MT so that local re-routing or other actions could be taken if possible. |
| CATT | Option 1 | Type-2 RLF indication should not be triggered in DC when one link is available. |
| Apple | Option 1 | Option 1 helps limit complexity. Option 2 may be an enhanced solution in the long term for a complete solution. |
| Nokia | Option 2 | Option 1, being tied to Re-establishment, seems very suboptimal e.g. in the case of SCG RLF for an IAB node in EN-DC |
| Futurewei | Option 2 | If Type-2 RLF indication is only triggered in case of a simultaneous failure of both BH links, we might as well not standardize this indication. Such a simultaneous link failure would be so rare this indication would never be triggered. |
| ETRI | Option 2 | We have more preference on option 2, since it may provide preparation time to child IAB node. |
| Ericsson | Option 1 |  |
| LGE | Option 2 | We prefer option2 since it can provide better performance |
| Lenovo | Option1 with comment | If RLF of MCG is detected (rather than BH RLF on both), UE will perform re-establishment procedure. In addition, we need to further consider fast MCG link recovery. If fast MCG link recovery is configured and MCG fails, UE will perform fast MCG link recovery before performing re-establishment procedure. |

Q1 summary

* Option1: 8 companies
* Option2: 7 companies

Company views are split almost equally between option1 and option2.

###### **Observation1: For triggering condition of type2 BH RLF indication by dual-connected node, RAN2 needs to discuss which option to choose between the two options:**

#### **Option1) when the node detects BH RLF on both BHs (i.e., when it initiates RRC re-establishment)**

#### **Option2) when the node detects BH RLF on any BH and further condition, if introduced, is met**

In case option2 is considered as triggering condition of type-2 indication, we should further discuss if additional condition needs to be introduced. The following options are considered:

* Option2a) when the node detects BH RLF on any BH without considering additional condition
* Option2b) when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic (further detailed condition is FFS)
* [please specify other option, if preferred]

In option2a, detection of BH RLF on any BH is a sufficient condition to trigger type-2 indication.

In option2b, there is additional condition to be satisfied to trigger type-2 indication, and the condition is in general relate to whether the node detecting BH RLF can perform local re-routing or not. Depending on the details of the condition, several variants are possible for option2b, hence, if RAN2 goes for option2b, we need to further discuss the exact condition, which we can discuss later, if necessary.

#### **Q2. Which option do you prefer between option2a and option2b (and possibly other option)? Please provide your reasoning for your preference.**

|  |  |  |
| --- | --- | --- |
| Company | Option2a/option2b | Comment |
| Huawei, HiSilicon | Option 2b | It can be based on IAB implementation what routing IDs should be indicated to its child nodes for local rerouting. |
| Kyocera | Option 2b | We assume Option 2b should also include the case at least one route is unavailable due to the BH RLF. We think Option 2b can apply the same behaviour to EN-DC case and NR-DC case. |
| Qualcomm | None | Why can’t a node perform local rerouting if local rerouting in all scenarios (intra-donor-DU, intra-CU inter-donor-DU, inter-CU inter-donor-DU) is supported? |
| Vivo | None |  |
| Samsung | None |  |
| Intel | None |  |
| Fujitsu | Option2b | Option2b is preferred if we go for option 2. |
| ZTE | Option 2b | In case option 2 is the triggering condition, local rerouting may be performed on the other BH link. However, it is possible that local rerouting couldn’t be performed by the dual-connected IAB node, e.g., if IP tunnel between donor Dus hasn’t been established or couldn’t be established. In this case, type 2 RLF indication needs to be triggered to child MT so that local re-routing or other actions could be taken if possible. If option 2a is adopted, unnecessary type 2 RLF indication would be triggered which would lead to misunderstanding at child node. |
| CATT | Option 2b |  |
| Apple | Option 2b | Option 2b is preferred if we go for option 2. |
| Nokia | 2b | Addresses correctly also e.g. the case of SCG RLF for an IAB node in EN-DC. |
| Futurewei | Option 2b | In addition to the comment from companies above, it seems that option 2b would also address the concerns of companies that prefer Option 1 for Q1 above. In other words, if re-routing by the parent node is possible the Type-2 RLF indication would not be triggered. If re-routing by the parent is not possible (e.g. due to RLF of both BH links) then a Type-2 RLF indication would definitely be triggered. |
| ETRI | Option 2b |  |
| Ericsson | Option 2b |  |
| LGE | Option 2b | Option2b can avoid sending unnecessary BH RLF indication to child nodes. |
| Lenovo | Option 2b |  |

Q2 summary

* None: 4 companies (All of these companies prefer option1 in Q1)
* Option2a: 0 companies
* Option2b: 12 companies

###### **Observation2: RAN2 agree that if option2 is chosen in Proposal1, option2b should be chosen.**

###### **Option2b: Dual connected node triggers type-2 indication 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**

Another possible option is to support both option1 and option2 for Q1, and which option to use is left to network implementation, i.e. option3 below can be suggested.

* Option3) The IAB node is configured by a donor node with either of option1 or option2, i.e., both options are supported in specifications and which option to use is left to network implementation.

With option3, a donor node needs to configure each IAB node with either option1 and option2. This option may be preferred as an exit solution just in case option1 and 2 are semi-equally preferred and their technical merits and drawbacks are not relatively outstanding.

#### **Q3. Do you think option3 can be acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon |  | Acceptable but may not be necessary. We would like to see more views on this. |
| Kyocera | N | We prefer a single solution. |
| Qualcomm | N | Given that local rerouting is supported in all scenarios, there is no reason to support Option 2. This drops Option 3. |
| Vivo | No | This adds more complexity compared to the gain. |
| Samsung | N | We think option 1 is enough. |
| Intel | No | Similar as type-4 RLF indication, we think it would be good to specify the trigger condition. Otherwise, unnecessary routing changes will happen. |
| Fujitsu | N |  |
| ZTE | N | There is no benefit to support both options while introducing extra specification impact. |
| CATT | N |  |
| Apple | N | This will increase complexity even more. |
| Nokia | N | Specification impacts vs gain does not seem to justify the option |
| Futurewei | N | We think Option 2b is inclusive of Option 1. Therefore, this additional complexity in the spec seems unnecessary. |
| ETRI | N |  |
| LGE |  | Acceptable but may not be necessary |
| Lenovo | N |  |

Q3 summary

- option3 is acceptable: 2 companies

- option3 is not needed: 13 companies

###### **Observation#3: RAN2 agree that we only need to specify either option1 or option2, i.e., supporting both options with network configuration to use either of options is not needed.**

### 2.1.2 For single-connected node

For an IAB node connected to a single parent, RAN2 already agreed that the IAB node sends a type-2 indication to child node(s) if the node detects a BH RLF. Since the node then initiates re-establishment, it is equivalent to say that type-2 indication is triggered upon initiation of re-establishment for this case. Companies are invited to provide comments if the initiation of re-establishment is a sufficient condition or if additional condition should be introduced.

#### **Q4. Please provide comments if BH RLF detection and resulting initiation of RRC re-establishment is a sufficient condition for single-connected node to trigger type-2 indication? If not, please provide your view on what condition should be further introduced?**

|  |  |  |
| --- | --- | --- |
| Company | Y(sufficient) /N(insufficient) | Comment |
| Huawei, HiSilicon | Y |  |
| Kyocera | N | We prefer a common behaviour for both single/dual connection cases, so we think the triggering condition should be aligned with Option 2 above. |
| Qualcomm | Y |  |
| vivo | Yes |  |
| Samsung | Y |  |
| Intel | Y |  |
| Fujitsu | Y |  |
| ZTE | Y |  |
| CATT | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
| Futurewei | Y | Technically we agree with Kyocera’s comment that we would prefer to specify a common triggering condition in the spec. However, our observation is that alignment with Option 2 would still mean that BH RLF detection alone would be sufficient to trigger Type-2 RLF indication in the case of a single-connected IAB node. |
| ETRI | Y |  |
| LGE | Y |  |
| Lenovo | Y |  |

Q4 summary

* Y: 15
* N: 1

All companies except 1 agree that for a single-connected node, initiation of RRC re-establishment is a sufficient condition to trigger type-2 indication.

###### **Observation#4: RAN2 tend to agree that for a single-connected node, initiation of RRC re-establishment is a sufficient condition to trigger type-2 indication**

## 2.2 Contents of type-2 indication

### 2.2.1 For dual-connected node

We discuss contents of type-2 indication sent by a dual-connected IAB node. There are basically two options:

* Option x) Type-2 indication does not carry further information related to BH RLF
* Option y) Type-2 indication carries further information to shape the behaviour of the node receiving the type-2 indication.

From rapporteur’s understanding, if option1 is taken for Q1, the necessity to take option y seems to diminish and hence option x seems sufficient. On the other hand, if option2 is taken for Q1, the necessity or sufficiency of each option should be investigated depending on which sub-option of option2 for Q2 is taken.

#### **Q5. Which option do you prefer between option x and option y? Please provide your reasoning for your preference in relation to your choices for Q1 and Q2.**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Option for Q1  (copied for reference) | Option x/y | Comment |
| Huawei, HiSilicon | Option 2 | Option y | In line with Option 2 for Q1, at least routing ID should be indicated. |
| Kyocera | Option 2 | Option y | We prefer Type 2 Indication contains the Routing ID(s) which is affected by the BH RLF, since we think it’s useful for the child node to perform proper/efficient local rerouting. |
| Qualcomm | Option 1 | Option x | Type-2 indication should only be sent when parent node has no available link to do local rerouting (Option 1 for Q1). There is no reason then to include BAP routing IDs or other info. |
| vivo | Option 1 | Option x | Agree with the rapporteur that the necessity to take option y seems to diminish if we take Option 1 for Q1. |
| Samsung | Option 1 | x | We think option 1 is enough, and there is no need to carry other information for now. |
| Intel | Option 1 with comment | Option x | How to act (e.g. which routing ID to be rerouted locally) when receiving a type-2 RLF indication is child IAB-node’s decision by implementation, based on its own resource status, scheduling, and traffic priority.  One may propose to indicate routing ID or other granularity in the control PDU, however, RLF indication is different from flow control PDU where congested routing ID or BH RLC CH ID is included in the control PDU. In flow control feedback, considering the buffer and scheduling priority, different routing ID and BH RLC CH ID have different congestion status. However, for RLF indication, similar as type-4 RLF indication, type-2 RLF indication indicates the BH link status of the parent IAB-node.  As discussed in Q1, an IAB-node triggers type-2 RLF indication when RRC re-establishment procedure is initiated (i.e. both links are unavailable due to BH RLF). In this case, all traffic towards this IAB-node are impacted. The child IAB-node (i.e. the one receives the type-2 RLF indication) is able to defer the impacted routing IDs if the corresponding egress link towards the IAB-node which sends type-2 RLF indication.  Additionally, as discussed in Q7, it is proposed no need to include further information in type-2 RLF indication. We think it would be good to keep the same format and content between single-connected and dual-connected IAB-node.  Hence, there’s no need to carry further information related to BH RLF. |
| Fujitsu | Option1 | Option x) |  |
| ZTE | Option 2 | Option y | If option 2 for Q1 is adopted for the trigger condition, additional information (e.g. routing ID) may be included in the type 2 RLF indication to indicate the affected traffic. |
| CATT | Option 1 | Option x |  |
| Apple | Option 1 | Option x | If option 2 in Q1 is adopted then we prefer option y, otherwise option x is sufficient. |
| Nokia | Option 2 | Option y | Option x can be considered if RAN2 conclude that all upstream traffic originally meant for the RLF parent link can always be re-routed to the non-RLF parent link of the dual-connected IAB node. |
| Futurewei | Option 2 | Option x | We prefer not to complicate the spec too much. In any case, the conditions for a Type-2 RLF should be transient. In other words, the failed link should other recover, a Type-4 RLF is indicated by the node, or some other recovery action (e.g. re-routing or modification of routing by the donor) will take place. Therefore, we doubt the need to provide further detailed information in a Type-2 RLF indication. |
| ETRI | Option 2 | Option y | Same view with Kyocera and ZTE |
| Ericsson | Option 1 | Option X |  |
| LGE | Option 2 | Option y | Same view with Kyocera and ZTE |
| Lenovo | Option 1 with comment | Option x |  |

Q5 summary

* Option x: 9
* Option y: 6

All of the companies in preference to option1 for Q1 think that option x is sufficient.

Most of the companies in preference to option2 for Q1 think that option y is needed.

One company in preference to option2 for Q1 thinks that option x is sufficient.

###### **Observation#5: Whether type-2 BH RLF indication needs to carry further information related to BH RLF is conditional on the decision on Q1 as follows:**

###### **If option1 is chosen for Q1, type-2 BH RLF indication does not carry any further information related to BH RLF.**

###### **If option2 is chosen for Q1, type-2 BH RLF indication carries further information related to BH RLF.**

In case option y is considered in Q5, we should further discuss what information should be carried in type-2 indication. companies that prefer option y want to include information related to reachability within type-2 indication, and the intention of the information is to enable a node receiving the indication to choose proper actions e.g., local re-routing. Specifically, there are two options related to reachability on the table.

* Option y1) Type-2 indication includes routing ID information indicating which routing IDs are not available
* Option y2) Type-2 indication includes BAP destination information indicating which BAP-destinations are not reachable

#### **Q6. Which option do you prefer between option y1 and option y2? Please provide your reasoning for your preference**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Option for Q1  (copied for reference) | Option y1/y2 | Comment |
| Huawei, HiSilicon | Option 2 | Option y1 | Type 2 indication with routing ID seems more flexible. Even for the same BAP destination address, different routing IDs may be configured to be routed on different egress links. It is still possible some routing IDs are reachable and some are not even for the same BAP address, upon RLF in an egress link. |
| Kyocera | Option 2 | Option y1 and y2 | We prefer Option y1 in general, especially in case an IAB-node has only one destination. But in some cases, e.g., an IAB-node has different IAB-DUs as the destination, we think Option 2y is beneficial to optimize the signalling overhead. |
| Qualcomm | Option 1 | None | Not applicable to Option x. |
| Intel | Option 1 with comment | N/A | As we comment in Q5, either option y1/y2 needs to include every impacted routing ID and BAP destination information towards the IAB-node (i.e. the one triggers type-2 RLF indication) in the control PDU, as both BH links of this IAB-node are unavailable due to RLF. This introduces higher overhead to RLF indication control PDU. |
| Fujitsu | Option1 | Y1 | If option y is considered, we think Type-2 indication should include routing ID. Because local rerouting is based on routing ID rather than BAP destination. Routing IDs with the same destination address may have different reachability. For example, if inter-donor-DU local re-routing is needed, the routing-IDs belong to the previous routing-ID of BAP header rewriting for rerouting configuration can be reachable after rerouting, while other routing-IDs with the same destination are not reachable. |
| ZTE | Option 2 | Option y1 | Type 2 indication including routing ID is more accurate than including BAP address. For the same destination BAP address, some routing ID may be subject to the BH RLF while other routing ID may be not affected by the BH RLF. |
| CATT | Option 1 | Option y1 |  |
| Nokia | Option 2 | Option y2 | What seems to matter most is the reachability of the destination. |
| Futurewei | Option 2 | None | As a Type-2 RLF is indicating a transient condition (please see response to Q5 above), whether to perform rerouting or not upon reception of this indication is really tied to the QoS of the particular flow, rather than the routing ID. If the QoS of a flow is not particularly latency sensitive, there is probably no real urgency to respond to a Type-2 indication with any action.  We understand the motivation for the optimization that companies are proposing above, but it seems to us that the proposed optimizations are somewhat overkill for the scenario of a Type-2 RLF indication. |
| ETRI | Option 2 | Option y1 |  |
| Ericsson | Option 1 | None |  |
| LGE | Option 2 | Option y1 | Agree with Huawei |

Summary of Q6

- Option y1: 7

- Option y2: 2

5 companies in preference to option2 for Q1 prefer or accept option y1.

2 companies in preference to option2 for Q1 prefer option y2.

2 companies in preference to option1 for Q1 indicate their preference y1 (given that the answers are applicable only when option Y in Q5 is adopted).

###### **Observation#6: If RAN2 agreed that type-2 BH RLF indication carries further information, type-2 indication includes routing ID information indicating which routing IDs are not available.**

### 2.2.2 For single-connected node

For type-2 indication sent by a single-connected IAB node, we need to discuss if there is any necessity of benefit of including information related to BH RLF within the indication. It is rapporteur’s observation that most companies think that type-2 indication sent by a single connected node does not need to carry any further information related to BH RLF.

#### **Q7. Do you agree that type-2 indication sent by a single-connected node does not need to carry any further information related to BH RLF?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | Y/N, can be up to implementation | There is another related question: do we allow an IAB node (single-connected) to send a type-2 indication to its descendent nodes, if it has received a type-2 indication from its parent with e.g. BAP routing ID?  If this is allowed, the single-connected node may send a type-2 indication from with information such as BAP routing ID. |
| Kyocera | Y | We prefer the common solution for single/dual connection cases as much as possible. So, we think it should be clarified that Type 2 Indication including no information is considered as all routes are unavailable. |
| Qualcomm | Y | The type-2 indication should not carry further info, whether propagated or not. |
| Vivo | Y |  |
| Samsung | Y |  |
| Intel | Y |  |
| Fujitsu | Y | We agree that type-2 indication does not need to carry any further information. |
| ZTE | N | Case 1: the type 2 indication is triggered by the single-connected node  Additional information such as BAP routing ID needs to be included in the type 2 indication in case that type 2 RLF indication could be propagated to descendant nodes. Otherwise, descendant nodes would be not aware of the affected traffic considering that the downstream node of the node who triggers the type2 RLF indication may be dual connected.  Case 2: the type 2 indication is not triggered by the single-connected node  If routing ID is contained in the type 2 RLF indication, and if the propagation of type 2 indication is allowed, the single-connected node should include the corresponding routing ID in the type 2 indication to be sent to its child-MT after receiving the type 2 indication.  As we can see, routing ID needs to be included in the type 2 RLF indication sent by a single-connected node in the above two cases. On the other side, it is preferred to have a unified design for both single and dual connected node. |
| CATT | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
| Futurewei | Y |  |
| ETRI | Y |  |
| Ericsson | Y |  |
| LGE | Y |  |
| Lenovo | Y |  |

Q7 summary

* Y: 15
* N: 1
* Up to implementation: 1

###### **Oservation#7: Most companies think that type-2 indication sent by a single-connected node does not need to carry any further information related to BH RLF**

## 2.3 Behaviours upon reception of type-2 indication

### 2.3.1 Local re-routing

RAN2 agreed that type-2 indication may be used to trigger local re-routing of a node receiving the indication. This is the case when the node receiving the indication is dual-connected.

The first question in this subcases is whether we need to specify rules related to triggering of local re-routing or not, i.e., followings two approaches are considered:

* Approach 1) Upon reception of type-2 indication, it is left to implementation of the node whether to trigger local re-routing
* Approach 2) RAN2 specifies rule(s) to govern local re-routing by the node upon reception of type-2 indication

In the first approach, whether to trigger local re-routing upon reception of type-2 indication is left to implementation. If a node receiving type-2 indication is able to determine what local re-routing actions are currently desirable based on the type-2 indication (and implicit information derived from the answer for Q1 and Q5), approach1 can work. In contrast, if the node cannot determine whether/what local re-routing actions should be triggered, approach1 would result in inefficient or even unreliable routing behaviours.

In the second approach, RAN2 need to discuss when to trigger local re-routing and which traffic to be re-routed. This discussion is tightly coupled with the discussion results for Q1 and Q5. We may need to investigate the rules on a case-by-case basis, unless a generic rule is developed, which we can discuss further, if necessary.

#### **Q8. Which approach do you prefer between approach 1 and 2? Please provide your reasoning for your preference. If approach2 is preferred, please specify your preferred rule.**

|  |  |  |
| --- | --- | --- |
| Company | Approach 1/2 | Comment and preferred rule in case of approach2 |
| Huawei, HiSilicon | Approach 2) | Usually we specify clear behevior for UE side (similarly for IAB-MT), to avoid bad implemention resulting in waste of resources. In this case, we don’t see the complexity to specify the behavior, e.g. the problematic link can be seen as unavailable for routing, as in RLF. Therefore we don’t see a need to leave it to implementation. |
| Kyocera | Approach 2 | We assume Approach 2 does not bring significant specification efforts. We assume the child node’s BAP layer just considers the route(s), which is indicated by Type 2 Indication, as unavailable. |
| Qualcomm | Approach 2 | Local rerouting upon reception of type-2 indication should be applied whenever possible. Otherwise, the node won’t transmit on an available link which can only cause service interruption. |
| vivo | Approach 2 | Similar view with HW. |
| Samsung | 2 | We don’t know then why RAN2 is making and discussing the RLF type 2 indication without its usage. Already rerouting in inter-donor-DU, inter-CU migration and/or dual connection with different CUs is discussed wherein the type2 indication is also considered as the cause. So, it seems there is enough possibility to align this type 2 indication to other BAP related operation. |
| Intel | Approach 2 with clarification | Whether IAB-node can trigger local rerouting upon reception of type-2 RLF indication need to be configured by IAB-donor CU, i.e. during initiation or reconfiguration. Additionally, if an alternative link is available, triggering local rerouting upon reception of type-2 RLF indication can reduce service interruption in the upstream. Specifying local rerouting upon type-2 RLF indication is beneficial.  However, how the intermediate IAB-node perform local rerouting upon reception of type-2 RLF indication is upto implementation if an alternative path/next hop is available, i.e. which traffic to be re-routed.  Hence, we propose to update approach 2 as followings:  Approach 2) Upon reception of type-2 indication, local re-routing is triggered when there’s an alternative avaiable path. It is left to implementation of which traffic to be re-routed. |
| Fujitsu | Approach2 | We prefer a definite rule to trigger local re-routing.  Since we prefer Option 1 in Q1 and Option x in Q5, the trigger for local re-routing is the reception of a type-2 RLF indication, and the traffic to be re-routed is the traffic whose BAP routing ID has the Next Hop BAP Address referring to the parent which sends the type-2 RLF indication.  If we consider Option 2 in Q1, and y1 in Q6, local re-routing can also be triggered at reception of type-2 RLF indication, and the traffic to be re-routed is the traffic with the BAP routing ID included in the type-2 RLF indication and whose Next Hop referring to the parent which sends the type-2 RLF indication.  To support local rerouting, R16 principle can be used. Donor-CU may configure multiple routing IDs with the same destination for local re-routing.  In R17, donor-CU may further configure one or multiple routing IDs with different donor-DU(s) as destination for inter-donor-DU re-routing. In this scenario, a BAP header rewriting is needed when local re-routing is triggered. |
| ZTE | Approach 2 | We prefer that IAB-MT behaviour is specified clearly. |
| CATT | Approach 2 |  |
| Apple | Approach 2 |  |
| Nokia | Approach 2 | Approach 1 would seem to allow local re-routing also when not at all called for.  Preferred rule: 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. |
| Futurewei | Approach 2 | We believe that the donor DU should configure the local rerouting behaviour of the child IAB node in case it received a Type-2 RLF indication. However, we think the configuration should be at the granularity of BH RLC channel, as the BH RLC channel is related to flow QoS requirements. |
| ETRI | Approach 2 |  |
| LGE | Approach 2 | It is important to make the overall network operations predictable.  Preferred rule: local re-routing is performed only for traffic indicated by the BH RLF indication as unreachable |
| Lenovo | 2 |  |

Q8 Summary

* Approach1: 0
* Approach2: 15

###### **Observation#8: RAN2 can agree to specifies rule(s) to govern local re-routing by the node upon reception of type-2 indication, instead of leaving the reception behaviours left to implementation of the node**

Next question is if a donor node should be able to have at least the capability of enabling or disabling local re-routing of an IAB node receiving type-2 indication. This question is applicable for both approaches for Q8.

#### **Q9. Do you think that a donor should be able to configure each node with whether local re-routing upon reception of type-2 indication is ALLOWED (in approach 1)/ENABLED (in approach2) or NOT?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | N | Just not clear what would be behavior if the IAB node receives a type-2 indication but is not allowed/enabled to perform local rerouting.  If there is no other behaviors, shouldn’t the parent refrain from sending type-2 indication instead of disabling the child node to do local-rerouting? |
| Kyocera | Y | We think the donor’s controllability is important for managing topology-wide objectives. |
| Qualcomm | N | Agree with HW that in case of RLF, local rerouting should be performed whenever possible. |
| Vivo | Prefer No | We assume the BAP header re-writing table is configured to each IAB-node, therefore it seems to be the IAB-node’s role to decide whether/how to perform local re-routing (with no extra configuration needed) upon reception of Type-2 indication. |
| Samsung | N | In specification perspective, it is the simplest to follow R16 operation where type4 indication means that the link is unavailable, and routing will find the backup path based on the unavailability. For type 2 case is the same, i.e., we can just specify in BAP that type 2 indication means that the link is unavailable. Then BAP routing will do local re-routing based on unavailability. In this perspective, local re-routing itself is mandatory but decision on unavailability based on type 2 indication might be considered to be configurable or not. We are ok with the configurability of type2 indication itself but once type 2 indication is received, the decision of unavailable link on that is quite aligned with legacy operation. |
| Intel | N |  |
| Fujitsu | Y |  |
| ZTE | N |  |
| CATT | N |  |
| Apple | Y |  |
| Nokia | N | We fail to see strong motivation for this |
| Futurewei | Y | Agree with Kyocera’s comment |
| ETRI | Y |  |
| LGE | Y |  |
| Lenovo | N |  |

**Q9 summary**

* **Y: 6**
* **N: 9**

###### **Observation#9: 9 of 14 companies think donor’s controllability of enabling/disabling local re-routing triggered by reception of type-2 indication is not clearly motivated.**

### 2.3.2 Conditional mobility triggering

RAN2 agreed that conditional mobility is supported for IAB nodes. However, RAN2 has not concluded whether type-2 indication may be used to trigger conditional mobility.

From rapporteur’s understanding, if it is the case that a dual-connected node receives type-2 indication, there is no benefit to trigger CHO/CPC, because local re-routing is much more desirable in this case. So rapporteur assumes that our focus for this discussion must be the case when a single-connected node receives type-2 indication.

The discussion on conditional mobility triggering is formulated as similar to the discussion in section 2.3.2 with one different additional approach3, we have the approaches:

* Approach 1) Upon reception of type-2 indication, it is left to implementation of the node whether to trigger conditional mobility (given that the node is already configured with conditional reconfiguration)
* Approach 2) RAN2 specifies rule(s) to govern triggering of conditional mobility upon reception of type-2 indication
* Approach 3) conditional mobility cannot be triggered by reception of type-2 indication

Approach1 may be undesirable in terms of topological stability, since the resulting topology may be somehow less predictable.

Approach2 may be beneficial for keeping network topology more predicable than approach1. RAN2 needs to discuss detailed rules to decide when to trigger conditional mobility. For example, we need to decide whether the node triggers conditional mobility only if the node receives type-2 indication or it conditionally triggers conditional mobility based on the received type-2 indication.

Approach3 is to entirely remove the possibility that type-2 indication triggers conditional mobility.

#### **Q10. Which approach do you prefer between approach 1, 2, and 3? Please provide your reasoning for your preference. If approach2 is preferred, please specify your preferred rule.**

|  |  |  |
| --- | --- | --- |
| Company | Approach 1/2/3 | Comment and preferred rule in case of approach2 |
| Huawei, HiSilicon | Approach 3 | To be realistic, we shouldn’t add any more items to Rel-17 eIAB in order to finish this WI timely. |
| Kyocera | Approach 2 | We think CHO is useful in case the child node has only single connection, i.e., local rerouting cannot be performed. In Rel-16, the IAB-MT performs CHO execution upon Type 4 Indication, if it select a CHO candidate cell. If Approach 2 is supported, the IAB-MT can perform CHO earlier than Rel-16, but it has two options in one procedural flow. So, we think the donor configures the IAB-MT whether CHO is triggered by reception of Type 2 Indication. |
| QC | Approach 3 | CHO should not be triggered since the node may recover from RLF. If recovery fails, CHO will be triggered by type-4 indication. |
| Vivo | Approach3 | If other approaches are agreed, an IAB-MT may perform CHO and connect to a new target parent node even if the parent node recovers from BH RLF at a later point, this requires additional configurations on both Routing (for BH link) and RRC (for Uu interface) of the descendant node(s). |
| Samsung | 2 | Single connected case, type 2 indication means there is no connection with the network/donor for a while. We think this feature is configurable by the donor. If donor doesn’t want that level of interruption, it can configure CHO per type2, or it will not otherwise. We think there is enough benefit to use CHO, and already CHO is allowed without type2 indication,i.e., in normal case, there is no drawback specific to IAB case which cannot be bearable.  Regarding the rule, we think at least, the target cell on CHO should be evaluated on whether enough signal strength is guaranteed. Since only type2 indication cannot give that information, IAB node’s should evaluate that by itself. Like A4 event can be used for that evaluation, and this is configured separately specific for IAB. |
| Intel | Approach 3 | We don’t think type-2 RLF indication should trigger CHO with following reasons:  1) Upon receiving type-2 RLF indication from its parent node, a dual-connected IAB-node can trigger local rerouting if the other link is still available, CHO is not necessary.  2) The parent IAB-node (i.e. IAB-node sents type-2 RLF indication) can be recovered from RLF soon. The delay can further be reduced if this IAB-node is also configured with CHO.  3) If CHO is executed when receiving type-2 RLF indication, the delay of service interruption includes RRC reconfiguration of CHO-performing IAB-node and its descendant IAB-nodes, BAP routing configuration update, scheduling information update, and RACH procedure delay (if new parent is under a different IAB-donor CU), which is longer than RLF recovery of its parent IAB-node.  4) Execute CHO upon receiving type-2 RLF indication will introduce more signalling overhead compared with waiting for parent IAB-node RLF recovery. |
| Fujitsu | Approach2 | We think that the reception of type-2 indication may trigger conditional mobility under some conditions.For example, local rerouting cannot be performed or congestion occurs at the alternative path. Also, radio link quality for conditional candidate can be considered. |
| ZTE | Approach 3 | We share the same view with QC that CHO should not be triggered upon type 2 RLF indication since the node may recover from RLF. |
| CATT | Approach 3 |  |
| Apple | Approach 2 |  |
| Nokia | Approach 3 | Triggering conditional mobility from type-2 indication seems hasty because the indication reflects a temporary state that ends with either type 3 (confirming that no mobility needed) or type 4 (which may trigger conditional mobility). |
| Futurewei | Approach 3 | A Type-2 RLF is indicating a transient condition. This should not be a trigger for mobility. |
| ETRI | Approach 3 |  |
| LGE | Approach 3 | Agree with Futurewei.  Given the possibility of BH recovery, CHO may be non-essential or possibly only increase unnecessary topological change with a marginal gain. |
| Lenovo | 2 | the reception of type-2 indication may trigger conditional mobility under some conditions e.g S-criteria can be met be candidate cell. |

Q10 summary

* Approach1: 0
* Approach2: 4
* Approach3: 10

###### **Observation#10: There is a clear majority that conditional mobility is not triggered by reception of type-2 indication.**

Next question is if a donor node should be able to have at least the capability of enabling or disabling   
CHO triggering by a node receiving type-2 indication. This question is applicable for apprach1 and 2, but not for approach 3.

#### **Q11. Do you think that a donor should be able to configure each node with whether CHO upon reception of type-2 indication is ALLOWED (in approach1)/ENABLED(in approach2) or NOT?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | N | Let us do CHO for IAB in future, although we are also interested in CHO. |
| Kyocera | Y | We think the donor should configure the IAB-MT whether it performs CHO or not, upon reception of Type 2 Indication. If it’s disabled, the IAB-MT performs CHO execution upon reception of Type 4 Indication as in Rel-16. |
| Qualcomm | N | CHO should not be triggered since the node may recover from RLF. If recovery fails, CHO will be triggered by type-4 indication. |
| Samsung | Y | Donor should be able to handle this feature per it’s own determination since some level of interruption due to RLF might be bearable by some operator/donor. It that case this feature needs to be disabled. |
| Intel | N |  |
| Fujitsu | Y |  |
| ZTE | N | CHO should not be triggered upon type 2 RLF indication since the node may recover from RLF. |
| CATT | N | Type 2 indication is a temporary state. It is possible to recovery after Type 2. |
| Apple | Y |  |
| Nokia | N | No specific agreement is needed for such possibility |
| Futurewei | N |  |
| ETRI | N |  |
| LGE | N | Agree with QC. |
| Lenovo | N |  |

**Q11 summary**

* **Y: 4**
* **N: 10**

###### **Observation#11: There is a clear majority that there is no need for a donor node to configure nodes whether conditional mobility is triggered by reception of type-2 indication.**

### 2.3.3 Further propagation of received type-2 indication downwards

For the case an IAB node receives type-2 indication, it is FFS whether the node should be able to further propagate the indication downward based on some condition. That is, two options are considered:

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

From the rapporteur’s understanding, option2 is to address the case where the node receiving type-2 indication is single-connected and hence incapable of local re-routing but there is at least one descendent node that is dual-connected. By propagating the indication to the descendent node, local re-routing can be triggered by the descendent node. While this controlled propagation may increase the chance of local re-routing by exploiting the descendent nodes’ capability, we should evaluate whether such potential gain can justify potential side-effects, if any, such as increased signaling overhead and diverged routing.

#### **Q12. Which option do you prefer between option 1, 2, and 3? Please justify your preference.**

|  |  |  |
| --- | --- | --- |
| Company | Option1/2 | Comment |
| Huawei, HiSilicon | Option 3- Leave it to IAB implementation | It is better to leave it to IAB node implementation whether/when to trigger type-2 indication after receiving a type-2 indication from its parent. |
| Kyocera | Option 2 |  |
| Qualcomm | Option 2 | Type-2 indication should be delivered down to the first child/downstream node that can perform local rerouting. |
| vivo | Option 1 | The descendant nodes can evaluate its own situations and check if the triggering condition for type-2 at this IAB-node is met or not, the pure propagation of type-2 indication is not needed. |
| Samsung | 1 | We think this propagation of type 2 indication feature cannot coexist with CHO upon type 2 indication since once Cho is executed upon type 2 indication, there is no need to find other route such as via descendent nodes.  If the option 2’s operation and behavior are the same as rapporteur’s comment, we need to specify that the path using descendent IAB node also should be a backup path based on that descendent IAB node’s situation, i.e., having the other BH link. But as we know backup path is configured by the CU proactively not on-demand. Moreover, how many hops can be allowed to be included in this backup path via descendent node also should be discussed. Moreover, if this is working, then the interrupted packets should go back to the downstream direction, which introduce again the latency. So we don’t know how this new latency and usage of the resources can be better than just waiting in the IAB node and transmitted by new parent node sought by CHO. |
| Intel | Option 1 | As we comment in Q10, the parent IAB-node can be recovered from RLF soon. Also, it is possible that local rerouting is performed at the IAB-node who receives a type-2 RLF indication. In this scenario, the grandchild-node will not be aware of ancestor nodes’ RLF, as its upstream traffic are not impacted (locally rerouted by its own parent IAB-node).  If type-2 RLF indication is propagated to descendant IAB-node, it will increase signaling overhead as well as lead to an uncontrollable behaviour of routing.  Hence, we prefer type-2 RLF indication has the same propagation as type-4 RLF indication, i.e. single hop. |
| Fujitsu | Option1 |  |
| ZTE | Option 2 | Type 2 indication should be propagated to descendant nodes so that corresponding actions could be taken at descendant nodes to avoid service interruption. |
| CATT | Option 1 | Type-2 RLF indication introduces a temporary state for the child IAB node. The time duration between type-2 RLF indication reception and type-3/4 RLF indication reception should not be long. So forwarding type-2/3 RLF indication to the descendant nodes is an unnecessary optimization. |
| Apple | Option 2 |  |
| Nokia | Option 2 |  |
| Futurewei | Option 1 | Agree with comments from CATT and vivo |
| ETRI | Option 1 |  |
| LGE | Option 1/2 | Option2 has some benefit, but the benefit is produced in limited cases.  Option1 is simple but it cannot exploit the local re-routing of descendent nodes.  Given the pros and cons, we are neutral. |
| Lenovo | Option 1 |  |

Summary Q12

- Option 1:8

- Option2: 6

- Option3 (left to implem): 1

###### **Observation#12: There are split views on the need of further propagating received type-2 indication. RAN2 needs to discuss 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 the type-2 indication, the node should propagate the indication to the child if it has no alternative path available.**

### 2.3.4 Disabling UL transmission

For the case an IAB node receives type-2 indication, it is FFS whether the node should suspend UL transmission. Two options can be considered:

* Option 1) Specify that UL transmission constraints are enforced as mandatory (e.g. SR/BSR are suspended, FFS for details)
* Option 2) It is left to implementation of the node receiving the type-2 indication and also up to scheduling policy of the node transmitting the type-2 indication.
* Option 3) A donor configures each IAB node with whether UL transmission should be suspended or not.

In option1, RAN2 needs to specify UL transmission constraints imposed by reception of type-2 indication. For instance, the IAB node suspend UL transmission including SR/BSR and other uplink physical channels.

In option2, RAN2 does not specify UL transmission constraints imposed by reception of type-2 indication. It is entirely left to implementation of IAB nodes that transmit/receive the indication.

In option3, it is up to a donor’s configuration whether UL transmission constraints should be enforced or not.

#### **Q13. Which option do you prefer between option 1, 2, and 3? Please justify your preference.**

|  |  |  |
| --- | --- | --- |
| Company | Option1/2/3 | Comment |
| Huawei, HiSilicon | None | The IAB-MT node should perform UL behaviors according to specifications, i.e. no transmission constraints. Please note that the IAB node may still need to transmit uplink data for some BAP routing ID even if it has received a type-2 indication. |
| Kyocera | Option 1 | We think RAN2 already agreed that “Type-2 RLF indication may be used to trigger deactivation or reduction of SR and/or BSR transmissions”, and it’s IAB-MT behaviour. So, we think it should be specified. |
| Qualcomm | Option 2 | The IAB-MT can reduce/stop SR/BSR up to implementation. |
| Vivo | Option 1 | Similar view with Kyocera |
| Samsung | 1 | If CHO upon type 2 is agreed, all these operations to be discussed on the specification can be resolved by following HO procedure. Otherwise, this can be specify. |
| Intel | Option 2 | Different from local rerouting, SR/BSR is an scheduling issue, which can be left to implementation. |
| Fujitsu | Option2 |  |
| ZTE | Option 2 | As agreed in RAN2#113e meeting, Type-2 RLF indication may be used to trigger deactivation or reduction of SR and/or BSR transmissions. In our view, whether deactivation or reduction of SR and/or BSR transmissions is performed upon type 2 RLF indication could be up to implementation. |
| CATT | Option 2 |  |
| Apple | Option 1 |  |
| Nokia | Option 2 | Does not limit nor preclude different implementation options |
| Futurewei | Option 2 | No need to change specification |
| ETRI | Option 2 |  |
| LGE | Option 2 | We think SR/BSR can be left to implementation. But once it is scheduled, we think it should transmit. |
| Lenovo | Option 1 |  |

Q13 summary

- Option1: 5

- Option2: 9

- None (no UL TX constraints): 1

###### **Observation#13: Majority companies think that whether to impose UL transmission constraints to a node receiving the type-2 indication is left to implementation of the node and also up to scheduling policy of the node transmitting the type-2 indication.**

### 2.3.5 Disabling IAB-support indicator

RAN2 agreed that type-2 indication may be used to disable IAB-support indication in SIB1. However, it is FFS whether disabling or not is left to implementation or mandated. Hence two options are considered:

* Option 1) RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., it is up to implementation.
* Option 2) IAB-support indicator shall be turned off upon reception of type-2 indication

With option2, upon reception of type-2 indication, the node prevents any new child node from accessing the node by turning off the IAB-support indicator until problematic situation is resolved. If the problematic situation is resolved, the node is expected to turn on the indicator, e.g., when it receives type-3 indication.

The rapporteur observes that

* Given that IAB topology is fairly static in Rel-17 (given that IAB nodes are static), toggling IAB-support indicator in case of receiving type-2 indication does not change the situation very much. This is because there would be not many child nodes attempting to access the concerned node, and hence togging the indicator as proposed in option2 may not change the consequence effectively.
* Even in case there are some access attempts from other nodes to the concerned node, disabling the IAB-support indicator as proposed in option2 may enforce other nodes to exclude the concerned node from access candidate longer than necessary, because they may consider the node as barred even after the problematic situation of the concerned node is resolved .

To make a sensible decision, proponents of the option2 is requested to justify if option2 is indeed beneficial, and at the same time, proponents of the option1 is requested to justify that option1 is sufficient. .

#### **Q14. Which option do you prefer between option1 and 2? Please justify your preference.**

|  |  |  |
| --- | --- | --- |
| Company | Option1/2 | Comment |
| Huawei, HiSilicon | Option 1 | Agree with Rapporteur’s analysis |
| Kyocera | Option 1 | We think it’s IAB-DU behaviour, so it can be left up to implementation. |
| Qualcomm | Option 1 | Agree with Rapporteur’s analysis |
| vivo | Option 1 | We agree with the rapporteur’s analysis. |
| Samsung | 2 | We think not only type 2 indicator but also type 4 (BH RLF recovery failure) indicator also need to be considered whether it can trigger to disable this IAB-support bit. In type 4 case, the situation would be worse than type 2 reception case, because there is no guarantee when this node can recovered to the connected mode. |
| Intel | N/A.  We prefer to disable iab-support indicator in ISB when type-4 RLF indication is triggered | Triggering the deactivation of IAB-support by type-2 RLF indication needs to modify system information twice, considering the BH link will be recovered soon and type-3 RLF indication is triggered. The first modification is to mute “IAB support” in SIB1 in order to bar the access to new IAB nodes when sending type-2 RLF indication. The second modification is to modify the system information back to “IAB-support” once RLF is recovered (when sending type-3 RLF indication). However, SIB modification can be very expensive, which makes deactivation of IAB-support by type-2 RLF indication inefficient.  Compared with type-2 RLF indication, type-4 RLF indication is more suitable, as the corresponding IAB-node will not be recovered soon. It is more appropriate to disable iab-support in SIB when type-4 RLF indication is triggered. |
| Fujitsu | Option1 |  |
| ZTE | Option 1 | Agree with the rapporteur’s analysis. We prefer that it is up to implementation. |
| CATT | Option 1 | Agree with Rapporteur’s analysis |
| Apple | Option 1 | Agree with Rapporteur’s analysis |
| Nokia | Option 1 |  |
| Futurewei | Option 1 |  |
| ETRI | Option 1 |  |
| LGE | Option 1 | Agree with Rapporteur’s analysis |
| Lenovo | See comments | Since RAN2 has agreed that Type-2 RLF indication may be used to trigger deactivation of IAB-supported in SIB, we need to capture this agreement somewhere. |

Q14 summary

* Option1: 12
* Option2: 2
* N/A (iab-support indicator in ISB when type-4 RLF indication is triggered): 1

###### **Observation#14: There is a clear majority view that RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., it is up to implementation.**

## Triggering of Type-3 indication

Most companies seem to think that a node can transmit type-3 indication only if it previously sent type-2 indication.

#### **Q15. Do you agree that a node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | Y |  |
| Kyocera | Y | However, we don’t see any big issue if Type 3 Indication is sent without previously sending Type 2 Indication, i.e., it’s not harmful from the child node point of view. So, we’re not sure if Q15 should be really specified. |
| Qualcomm | Y |  |
| vivo | Y |  |
| Samsung | Y |  |
| Intel | Y |  |
| Fujitsu | Y |  |
| ZTE | Y |  |
| CATT | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
| Futurewei | Y |  |
| ETRI | Y |  |
| LGE | Y |  |
| Lenovo | Y |  |

###### **Observation#15: RAN2 agree that a node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.**

Actual triggering condition of Type-3 indication is dependent of triggering condition of type-2 indication.

Let us first consider the case option1 is taken in Q1, i.e. type-2 indication is triggered if both BHs fail. Then the immediate question is as follow:

#### **Q16a. If option1 is considered in Q1, do you agree that a node can transmit type-3 indication if re-establishment is successful?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | Y |  |
| Kyocera | Y |  |
| Qualcomm | Y |  |
| vivo | Y |  |
| Samsung | Y |  |
| Intel | Y |  |
| Fujitsu | Y |  |
| ZTE | Y |  |
| CATT | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
| Futurewei | Y |  |
| ETRI | Y |  |
| LGE | Y |  |
| Lenovo | Y |  |

###### **Observation#16a: RAN2 agree that if option1 is considered in Q1, a node can transmit type-3 indication if re-establishment is successful.**

Regarding the exact condition to trigger type-3 indication in case option1 is taken for Q1, the following options are considered:

* *Option1) Upon successful transmission of RRC reestablishment complete*
* *Option2) [If option1 is not acceptable, please specify your preferred condition]*

#### **Q16b. Please specify exact condition to trigger type-3 indication in case option1 is considered in Q1**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Huawei, HiSilicon | Option 1 or generally say “upon completion of RRC reestablishement” | There is no need to be too specific in this case. |
| Kyocera | Option 1 |  |
| Qualcomm | Option 1 |  |
| vivo | Option 1 |  |
| Samsung | 1 | Upon successful transmission of RRC reestablishment complete message |
| Intel | Option 1 |  |
| Fujitsu | Option1 |  |
| ZTE | Option 1 |  |
| CATT | Option 1 |  |
| Apple | Option 1 |  |
| Nokia | Option 2 | Since the RRC Re-establishment procedure ends upon submission of the Complete to lower layers, we think this submission is enough to trigger type 3, instead of considering RLC ACK confirming success of the transmission. |
| Futurewei | Option 2 | This question seems somewhat hypothetical, as it is predicated on Option 1 in Q1. However, assuming this Option was agreed for Q1, then we think it should be based on completion of RRC re-establishment. |
| ETRI | Option 1 |  |
| LGE | Option1/2 | Fine with either “Upon successful transmission of RRC reestablishment complete” or “upon completion of RRC reestablishment” |
| Lenovo | Option 1 with comments | Besides option1, Upon reception of RRCReestablishment also can be considered as option. |

Q16b summary

* Option 12
* Option2: 3

###### **Observation#16b: For the detailed criteria of the success of re-establishment in observation#16a, UE transmits type-3 indication upon successful transmission of RRC reestablishment complete.**

Next let us consider the case option2 is taken in Q1, i.e. type-2 indication is triggered if at least one BH fails and possibly other condition is met, if specified. Then the immediate question is as follow:

#### **Q17a. If option2 is considered in Q1, do you agree that a node can transmit type-3 indication if the failed BH is recovered.**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | Y | Obvious we think. |
| Kyocera | Y |  |
| Qualcomm |  | We do not support option 2 in Q1. |
| Samsung |  | We don’t support option 2 in Q1. |
| Intel | N | We prefer option 1 in Q1 |
| Fujitsu | Y |  |
| ZTE | Y |  |
| CATT | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
| Futurewei | Y |  |
| ETRI | Y |  |
| LGE | Y |  |
| Lenovo | Y |  |

###### **Observation#17a: RAN2 can agree that if option2 is taken for Q1, a node can transmit type-3 indication if the failed BH is recovered.**

Regarding the exact condition to trigger type-3 indication in case option2 is taken for Q1, the following options are considered:

* *Option1)* 
  + *Upon reception of reconfigurationWithSync for MCG, if previous type-2 indication is triggered by BH failure on MCG.*
  + *Upon reception of RRCReconfiguration for SCG, if previous type-2 indication is triggered by BH failure on SCG.*
* *Option2)* 
  + *Upon the affected route(s) is available again.*
* *Option3) [If option1 is not acceptable, please specify your preferred condition]*

#### **Q17b. Please specify exact condition to trigger type-3 indication in case option2 is considered in Q1**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Huawei, HiSilicon | Option 1, or generally say “upon MCG/SCG recovered” | May not need to be specific |
| Kyocera | Option 2 | We think Type 3 Indication is sent when the affected route(s) is available again. |
| Qualcomm |  | We do not support option 2 in Q1. |
| samsung |  | We don’t support option 2 in Q1. |
| Fujitsu | Option1) | The contents of type-3 indication should be aligned with type-2 indication. |
| ZTE | Option 2 | We think option 2 is more accurate and straight forward. |
| CATT | Option 1 |  |
| Apple | Option 2 | Agree with ZTE |
| Nokia | Option 1 |  |
| Futurewei | Option 1 | Don’t the affected routes technically become available under the conditions of Option 1? |
| ETRI | Option 1 |  |
| LGE | Option 1/2 | Option2 seems generic. Option1 can also work, and Huawei’s suggestion is also fine. |
| Lenovo |  | For option 1, ‘Upon reception of reconfigurationWithSync for MCG or SCG’ can not be considered as successful. only after successful RACH, the switch can be considered as successful. |

Q17b summary

* Option1: 7
* Option2: 4
* No support of these options: 2 (they support option1 for Q1)

Option1 is a majority view. It seems that option2 needs option1 as precondition to work, i.e., opton2 is more specific condition. Currently, it is not clear if such specific condition is beneficial.

###### **Observation#17b: For the detailed criteria of BH RLF recovery in observation 17a, RAN2 has the majority view that**

###### **a) MCG is considered as being recovered upon reception of reconfigurationWithSync for MCG; and**

###### **b) SCG is considered as being recovered upon reception of reconfiguration for MCG. FFS if further detailed condition, such as routing availability, should be considered.**

## Contents of type-3 indication

This issue can be discussed after RAN2 make progress on the above issues. So we skip this issue in the phase1 discussion.

## Behaviours upon reception of type-3 indication

Companies seem to have the common understanding that, upon reception of type-3 indication, the actions triggered upon reception of a previous type-2 indication may be reversed. While the details need further discussion, we can confirm if that is a general understanding in RAN2.

#### **Q18. Do you agree upon reception of type-3 indication, the actions triggered upon reception of a previous type-2 indication may be reversed, if possible?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Huawei, HiSilicon | Y |  |
| Kyocera | Y |  |
| Qualcomm | Y |  |
| Samsung | Y |  |
| Intel | Y |  |
| Fujitsu | Y |  |
| ZTE | Y |  |
| CATT | Y |  |
| Apple | Y |  |
| Nokia | Y |  |
| Futurewei | Y |  |
| ETRI | Y |  |
| LGE | Y |  |
| Lenovo | Y |  |

###### **Observation#18: RAN2 agree that upon reception of type-3 indication, the actions triggered upon reception of a previous type-2 indication may be reversed, if possible**

Then following question is whether we should mandate the reverse behaviours or whether it should be left to implementation.

* Approach 1) Upon reception of type-3 indication, it is left to implementation of the node whether to trigger a reverse action, if possible.
* Approach 2) RAN2 specifies rule(s) to govern whether/when reserve action is triggered by the node upon reception of type-3 indication

If companies think RAN2 should specify rules to govern behaviours upon reception of type-2 indication, they may think that reverse behaviours upon reception of type-3 indication also need to be specified. On the other hand, the behaviours upon reception of type-2 indication can be mostly left to implementation, the same approach can apply to behaviours upon reception of type-3 indication. Companies are requested to provide input on the approaches above.

#### **Q19. Which approach do you prefer between approach 1 and 2? Please provide your reasoning for your preference. If approach2 is preferred, please specify your preferred rule with justification. If other approach is preferred, please specify your preferred approach.**

|  |  |  |
| --- | --- | --- |
| Company | Approach 1/2(/other) | Comment |
| Huawei, HiSilicon | 2/Other | Our understanding is that upon receiving type 3 indication, the condition for IAB rerouting based on type 2 indication will not meet, and then the IAB node would come back to normal operation. |
| Kyocera | Approach 2 | We assume Approach 1 can work in most cases. However, in case the IAB-node has dual connections and it receives two Type 2 Indications from both links, we think one Type 3 Indication should not revert all behaviours triggered by the two Type 2 Indications. So, we assume some small rule is needed to be specified. |
| Qualcomm | Approach 2 | If type-2 triggers local rerouting, the node must revert to the original central routing configuration upon receiving the type-3 indication.  For SR/BSR transmission and toggling IAB support indicator, it is up to implementation. |
| vivo | Approach 2 | Share similar view with QC. |
| Samsung | 2 | We have the list of possible behavior regarding type 2 indication in this doc, such as local re-routing, CHO, propagation of the indication, disabling UL transmission, disabling IAB-support bit. Fallback of the local re-routing can be specified by noting that reception of type 3 indicates that egress link became available in BAP spec. For CHO, there is no need of fallback (reverting) of type 3 indication, and correspondingly no specification of reverse behavior. Regarding propagation of the type2 indication, the propagation of type 3 needs to be specified. However, disabling UL transmission can be implementation. |
| Intel | Approach 1 |  |
| Fujitsu | Approach2 | If the behavior upon receiving type-2 indication is specified only for local re-routing, it is straight to specify the behavior, i.e. local re-routing back to the recovered BH link upon receiving type-3 indication. |
| ZTE | Approach 2 | Similar as in Q8, considering that local re-routing is MT behaviour, the revert of local rerouting should also be specified clearly. |
| CATT | Approach 2 |  |
| Apple | Approach 2 |  |
| Nokia | Approach 2 | We foresee simple rules, but they need to account for all the actions allowed upon reception of type 2. E.g. resuming UL transmission to the parent link on which the type 3 was received, and IAB-support indication, if they are disabled. |
| Futurewei | Approach 2 |  |
| ETRI | Approach 2 |  |
| LGE | Approach 2 | Local re-routing triggered by type-2 indication should be reverted. |
| Lenovo | 2 |  |

Summary of Q19

* Approach1: 1
* Approach2: 14

###### **Observation#19: It is a clear majority view that RAN2 should specify rule(s) to govern whether/when reserve action is triggered by the node upon reception of type-3 indication, instead of leaving the behaviours up to implementation.**

## Terminology

There are proposals of terminologies for type-2/3/4 indications. We can consider two approaches

*Approach 1 is to define separate names for different indications. For example:*

* Type-2: “BH RLF detection indication” or something else (to be proposed below)
* Type-3: “BH RLF recovery indication” or something else (to be proposed)
* Type-4: “BH RLF recovery failure indication or something else (to be proposed below) or existing name (“BH RLF indication”)

Approach 2 is to use a generic name ‘BH RLF indication’ for them and distinguish them with type indicator

* Type-2: “BH RLF type X indication” or the similar (to be proposed below)
* Type-3: “BH RLF type Y indication” or the similar (to be proposed below)
* Type-4: “BH RLF type Z indication” or the similar (to be proposed below)

Note that we already use “BH RLF indication” for type-4 indication from Rel-16. Hence, care must be taken.

#### **Q20. Which approach do you prefer between two approaches?**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Company | Approach1/ Approach2 | Preferred name | | | Comment |
| Type-2 indication | Type-3 indication | Type-4 indication |
| Huawei, HiSilicon |  | BH RLF detection indication | BH RLF recovery indication | unchanged | For type-4, we need to ensure the alignment between R16 and R17 specs. Otherwise, it would cause confusions to readers. |
| Kyocera | Approach 2 | Type 2 BH RLF Indication | Type 3 BH RLF Indication | BH RLF Indication (i.e., same with Rel-16) | We slightly prefer to keep Rel-16 name for Type 4 Indication. We don’t think the names need to describe how it works exactly. So, we think Rel-17 BH RLF Indications are just Type 2 and Type 3. We don’t think there is no problem if Rel-16 BH RLF Indication does not have “Type” in its name. |
| Qualcomm |  | BH RLF detection indication | BH RLF recovery indication | BH RLF recovery failure indication | In Rel-16, only type-4 indication was defined. In Rel-17, both type-2 and type-4 indications are RLF indications so term BH RLF indication is general. |
| Vivo | Approach1 | BH RLF detection indication | BH RLF recovery indication | BH RLF recovery failure | Generally we keep the legacy text intact, but the wording ‘BH RLF indication’ is confusing when it appears with the other RLF indications, which might mislead to the understanding that this is a Type-2 indication (but actually is a Type-4). So we prefer to re-word Type-4 as BH RLF recovery failure so that the consistency among the RLF indication terminologies can be kept. |
| Samsung | Approach 1 | BH RLF detection indication | BH RLF recovery indication | Bh RLF recovery failure indication |  |
| Intel | Approach 1 | BH RLF detection indication | BH RLF recovery indication | BH RLF indication (unchanged) | We prefer use the same name of type-4 RLF indication to keep consistency in both Rel-16 and Rel-17 |
| Fujitsu | Approach1 |  |  | Existing name, i.e. “BH RLF indication” | We don’t want to change existing name for type-4 RLF indication. So, Approach 1 is preferred. |
| ZTE | Approach 1 | BH RLF detection indication | BH RLF recovery indication | BH RLF recovery failure indication | It is more clearer to use “BH RLF recovery failure indication” than legacy “BH RLF indication” for type 4 RLF indication. |
| CATT | Approach 1 | BH RLF detection indication | BH RLF recovery indication | BH RLF recovery failure indication |  |
| Apple | Approach 1 | BH RLF detection indication | BH RLF recovery indication | BH RLF recovery failure indication |  |
| Nokia | Approach 1 | “BH RLF detection indication” | “BH RLF recovery indication” | Unchanged – the existing name should be kept |  |
| Futurewei | Approach 1 |  |  |  | We are fine to go with the majority view here |
| ETRI | Approach 1 | BH RLF detection indication | BH RLF recovery indication | BH RLF recovery failure indication |  |
| LGE | Approach 1 | BH RLF detection indication | BH RLF recovery indication | Existing name |  |

**Q20 Summary**

- Approach 1: 14

- Approach 2: 1

###### Observation#20: RAN2 tend to agree that the following terms are used:

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

## 2.8 Other

We can start discussion on the following issues after RAN2 make progress on the above issues during this email discussion:

* Whether type-2 indication is mandatory or optional?
* Whether type-3 indication is mandatory or optional?
* Whether fast MCG recovery should be mandatory for DC capable IAB node?
* [Other issue to discuss? If so, please specify here]
  + Fujitsu: CP behavior upon receiving type-2 RLF indication. How to support IAB-MT’s RRC/NAS path change, similar to the local re-routing behaviour of backhaul data.

# 3. Phase-II Discussion

## 3.1 Observations

Please note that, for each question in Section 2, summary of company input and the corresponding observation made by the rapporteur based on the company input have been provided at the end of each question part. In the following, the observations made by rapporteur are all listed. In Section 3.3, the rapporteur suggests tentative proposals based on these observations.

A list of rapporteur observation

**Observation1**: For triggering condition of type2 indication by dual-connected node, RAN2 needs to discuss which option to choose between two options:

* Option1) when the node detects BH RLF on both BHs (i.e., when it initiates RRC re-establishment)
* Option2) when the node detects BH RLF on any BH and further condition, if introduced, is met

**Observation2**: RAN2 agree that if option2 is chosen in Proposal1, option2b should be chosen.

* Option2b: Dual connected node triggers type-2 indication 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

**Observation#3**: RAN2 agree that we only need to specify either option1 or option2 in observation1, i.e., supporting both options with network configuration to use either of options is not needed.

**Observation#4:** For triggering condition of type-2 indication by a single-connected node, RAN2 tend to agree that initiation of RRC re-establishment is a sufficient condition to trigger type-2 indication.

**Observation#5**: Whether type-2 BH RLF indication needs to carry further information related to BH RLF is conditional on the decision on Q1 as follows:

* If option1 is chosen for Q1, type-2 BH RLF indication does not carry any further information related to BH RLF.
* If option2 is chosen for Q1, type-2 BH RLF indication carries further information related to BH RLF.

**Observation#6**: If RAN2 agreed that type-2 BH RLF indication carries further information, type-2 indication includes routing ID information indicating which routing IDs are not available.

**Observation#7**: Most companies think that type-2 indication sent by a single-connected node does not need to carry any further information related to BH RLF.

**Observation#8**: RAN2 can agree to specify rule(s) to govern local re-routing by the node upon reception of type-2 indication, instead of leaving the reception behaviours left to implementation of the node.

**Observation#9**: 9 of 14 companies think donor’s controllability of enabling/disabling local re-routing triggered by reception of type-2 indication is not clearly motivated.

**Observation#10**: There is a clear majority that conditional mobility is not triggered by reception of type-2 indication.

**Observation#11**: There is a clear majority that there is no need for a donor node to configure nodes whether conditional mobility is triggered by reception of type-2 indication.

**Observation#12**: There are split views on the need of further propagating received type-2 indication. RAN2 needs to discuss 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 the type-2 indication, the node should propagate the indication to the child if it has no alternative path available.

**Observation#13**: Majority companies think that whether to impose UL transmission constraints to a node receiving the type-2 indication is left to implementation of the node and also up to scheduling policy of the node transmitting the type-2 indication.

**Observation#14**: There is a clear majority view that RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., it is up to implementation.

**Observation#15**: RAN2 agree that a node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.

**Observation#16a**: RAN2 agree that if option1 is considered in Q1, a node can transmit type-3 indication if re-establishment is successful.

**Observation#16b**: For the detailed criteria of the success of re-establishment in observation#16a, UE transmits type-3 indication upon successful transmission of RRC reestablishment complete.

**Observation#17a**: RAN2 can agree that if option2 is taken for Q1, a node can transmit type-3 indication if the failed BH is recovered.

**Observation#17b**: For the detailed criteria of BH RLF recovery in observation 17a, RAN2 has the majority view that

* MCG is considered as getting recovered upon reception of reconfigurationWithSync for MCG; and
* SCG is considered as getting recovered upon reception of reconfiguration for MCG. FFS if further detailed condition, such as routing availability, should be considered.

**Observation#18**: RAN2 agree that upon reception of type-3 indication, the actions triggered upon reception of a previous type-2 indication may be reversed, if possible

**Observation#19**: It is a clear majority view that RAN2 should specify rule(s) to govern whether/when reserve action is triggered by the node upon reception of type-3 indication, instead of leaving the behaviours up to implementation.

**Observation#20:** RAN2 tend to agree that the following terms are used:

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

## 3.2 Other issue

In Section 2.8, one company raises the following issue:

“ CP behavior upon receiving type-2 RLF indication. How to support IAB-MT’s RRC/NAS path change, similar to the local re-routing behaviour of backhaul data.”

#### **Q1. Companies are invited to provide their view, if any.**

|  |  |
| --- | --- |
| Company | Comment |
| Fujitsu | Control plane transmission (SRB of IAB-MT) is as important as backhaul data. We should design a similar approach for control plane transmission as local re-routing applied to the backhaul data when type-2 RLF indication is received. One example is that the primaryPath can be switched to SCG if split SRB is configured and the type-2 RLF indication is from MCG. We need more study on this issue. |
| Samsung | This seems from CP/UP separation scenario, but already reliability of RRC message signalling is handled without RRC level. We don’t know if there is any further critical problem further. But ok with further study if any. |
| ZTE | It is related with the CP/UP separation scenario. Perhaps split SRB2 or SRB3 could be used for the IAB-MT’s RRC/NAS transfer. We can discuss this issue later. |

## 3.3 Potential proposals

Based on the observations listed in Section 3.1, the rapporteur attempts to draw agreeable proposals to be included in the summary of this email discussion. Below is the list of tentative proposals given that all observations are agreeable. Please provide your input on the following tentative proposals.

Note that the most outstanding issue is a triggering condition of type-2 indication (choice between two options in Q1) for dual-connected node. Several other issues are dependent on the decision result of this issue. For now, however, company views are evenly split on this (see observation#1). From the rapporteur’s understanding, two options are both reasonable and feasible in Rel-17 from RAN2 specification point of view. Option1 seeks for simpler behaviours while option2 seeks for better performance. To facilitate our discussion on Q1 with a holistic picture, the rapporteur compiled the observations above (given that all observations are aggregable somehow) and produce two sets of baseline proposals, proposal set2 and proposal set 3, corresponding to each option for option1 and option2 respectively, below.

From the observation#1, #3

**Tentative *Proposal1: For triggering condition of type2 indication by dual-connected node, RAN2 needs to discuss which option to take from two options (but not supporting both with network choice):***

* ***Option1) when the node detects BH RLF on both BHs (i.e., when it initiates RRC re-establishment)***
* ***Option2) when the node detects BH RLF on any BH and further condition, if introduced, is met***

From the observation#1, #5, #15, #16a, #16b, #18, #19, if option1 is chosen in Proposal1, the following proposal set (2a to 2f) can be agreed.

**Tentative Proposal 2a: For a dual-connected node, type-2 indication is triggered *when the node detects BH RLF on both BHs (i.e., when it initiates RRC re-establishment)***

**Tentative *Proposal 2b: Type-2 indication does not carry any further information related to BH RLF.* Tentative *Proposal 2c: A node can transmit type-3 indication if re-establishment is successful, where the node considers the re-establishment to be successful upon successful transmission of RRC reestablishment complete.***

**Tentative *Proposal 2d: A node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.***

**Tentative *Proposal 2g: Upon reception of type-2 indication, the node should perform local re-routing if possible.***

**Tentative *Proposal 2h: 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.***

From the observation#1, #5, #6, #8, #9, #15, #17a, #17b, #18, #19, if option2 is chosen in Proposal1, the following proposal set (3a to 3g) can be agreed.

**Tentative *Proposal 3a: Dual connected node triggers type-2 indication 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***

**Tentative *Proposal 3b: Type-2 indication includes routing ID information indicating which routing IDs are not available.***

**Tentative *Proposal 3c: Upon reception of type-2 indication, the node should perform local re-routing if possible.***

**Tentative *Proposal 3d: Donor’s controllability of enabling/disabling local re-routing triggered by reception of type-2 indication is not introduced.***

**Tentative *Proposal 3e: a node can transmit type-3 indication if the failed BH is recovered, where the node consider the following condition:***

* ***MCG is considered as getting recovered upon reception of reconfigurationWithSync for MCG; and***
* ***SCG is considered as getting recovered upon reception of reconfiguration for MCG. FFS if further detailed condition, such as routing availability, should be considered.***

**Tentative *Proposal 3f: A node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.***

**Tentative *Proposal 3g: 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.***

Based on observation#4,

**Tentative *Proposal 4: 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.***

Based on observation#7,

**Tentative *Proposal 5: Type-2 indication sent by a single-connected node does not carry any further information related to BH RLF.***

Based on observation#10, 11

**Tentative *Proposal 6. Conditional mobility is not triggered by reception of type-2 indication.***

From observation#12,

**Tentative *Proposal 7: For the need of further propagating received type-2 indication. RAN2 needs to discuss 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 the type-2 indication, the node should propagate the indication to the child if it has no alternative path available.***

Based on observation#13

**Tentative *Proposal 8: 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.***

Based on observation#14,

**Tentative *Proposal 9: 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.***

Based on observation#20,

**Tentative *Proposal 10: To agree that the following terms are used:***

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

Based on company input for Q1 in Section 3.2,

***Tentative Proposal 11: FFS***

#### **Q2. Companies are invited to provide input on the proposals suggested above.**

|  |  |  |
| --- | --- | --- |
| Company | proposal # that cannot be acceptable | Comments  [proposal#: comment] |
| Apple | See comments | We do not agree to P2e and P2f, which seems to be against observation #8.  If option 2 is chosen, we are fine with all the proposals 3x.  In Q8, most companies indicated that RAN2 could agree to specify rules to govern local re-routing by the node upon reception of type-2 indication. Should we have a related proposal for that?  P8: In our understanding of the earlier RAN2 agreement, RAN2 should at least specify that Type-2 RLF indication \*may\* be used to trigger deactivation or reduction of SR and/or BSR transmissions.  Rapporteur: You are correct. P2e and P2f should be removed (these were intended for single-connected node but misplaced there). Now, the P2e and P2f are removed, and P2g and P2g are added. |
| Lenovo | See comments | **Tentative *Proposal1***  **Tentative Proposal 2a**  *If RLF of MCG is detected and SCG is available, UE will perform re-establishment procedure. However, in this case, it is not RLF on both legs. Our understanding is that the case (RLF of MCG is detected and SCG is available) is included in option1. We need to clarify it.*  *Rapporteur: Agree. Then we can modify the proposal2as as follows. We can remove the green part completely:*  **Proposal 2a: For a dual-connected node, type-2 indication 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.*** |
| vivo | See comments | * Some of the proposals are the same for each set, maybe they can be formulated as standalone proposasl independent to the selected Options, such as 2d/3f, 2g/3c, 2h/3g. * For P8 and P9, is it meant to have a NOTE for stage-2 spec or we just leave them as common understandings? We prefer the former one, which is also aligned with the previous agreements. * Rapporteur: P8 and 9 are modified, reflecting your comment. * We are fine for the rest of the proposals. |
| Fujitsu |  | Proposal 2c: we think that other triggers are not excluded. For example, RRC re-establishment is initiated and then a CHO candidate is selected during cell selection. In this case, *RRCReconfigurationComplete* message is sent. We propose the following change to proposal 2c:  **Tentative *Proposal 2c: A node can transmit type-3 indication if re-establishment is successful, where the node considers the re-establishment to be successful upon successful transmission of RRC reestablishment complete or RRC Reconfiguration complete.***  Rapporteur: P2c is modified, reflecting your comment.  Proposal 4: we suggest to keep the condition in Q4 unchanged, i.e. ***For triggering condition of type-2 indication by a single-connected node, BH RLF detection and resulting initiation of RRC re-establishment is a sufficient condition to trigger type-2 indication.*** |
| Samsung | Tentative P1  Tentative P6 | **Tentative P1 (type 2 indication mechanism):**  We are ok with either way, but I think setting up options for type 2 indication mechanism seems inappropriate. Actually, option 1 (type2 on RLF on both) and option 2 (type 2 on RLF over one link and re-routing is not available) are almost same. Option 2 also will send type2 indication when both link has RLF. What other causes are there when re-routing is not available than loss of other BH ? And how to specify that unavailability of re-routing, if there is other cause ?  **Tentative P6 (CHO upon type 2 indication):**  The companies counter arguments does not make sense at all. We discuss on single connected case in this proposal. So, the recover procedure upon RLF detection is sequentially: release most of radio resource configuration at MT, cell selection, random access to the selected cell, sending RRCReestablishmentRequest msg to that cell, receiving RRCReestablishment msg, sending RRCReestablishmentComplete msg to the cell, receiving RRCReconfiguration msg, and applying this RRCReconfiguration msg, and sending RRCReconfigurationComplete. Moreover the target cell must be changed to the new cell, there should be BAP, and BH configuration which can be obtained after RRCReconfiguration applying.  Compared to this, CHO upon type2 has only several procedure: random access to the candidate cell, applying stored RRCReconfiguration, and responds to the target cell with RRCReconfigurationComplete msg. Then there also be BAP, BH configuration.  Compare the cyan colour items, which is solely the increased latency on legacy RLF recovery.  Most of opponent companies seem to think that the node detecting RLF doesn’t move to the other parent cell, which is totally wrong. All the time, more procedure, and more latency will be invoked upon RRCReestablishment than HO procedure. That’s the reason that new feature for recovery using CHO instead of RRCReestablishment (we call “*attemptCondReconfig*” in RRC) was made in R16 MobilityEnh.  Rapporteur: P6 is modified, reflecting your comment. |
| ZTE | P5 | **Proposal#5:**  For P5, we think it’s dependent on P1(i.e. whether dual-connected node triggers type 2 indication when the node detects BH RLF on both BHs or on any BH link) and P7 (i.e. whether type-2/3 indication is propagated). 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 propagated), we think it is necessary to include some further information (e.g. routing ID) in the type 2 indication sent by a single-connected node in the two case as follows. On the other side, it is preferred to have a unified design for both single and dual connected node.  Case 1: the type 2 indication is triggered by the single-connected node  Additional information such as BAP routing ID needs to be included in the type 2 indication in case that type 2 RLF indication could be propagated to descendant nodes. Otherwise, descendant nodes would be not aware of the affected traffic considering that the descendant node of the node may be dual connected.  Case 2: the type 2 indication is not triggered by the single-connected node  If routing ID is contained in the type 2 RLF indication, and if the propagation of type 2 indication is allowed, the single-connected node should include the corresponding routing ID in the type 2 indication to be sent to its child-MT after receiving the type 2 indication.  So we suggest the following revision for P5:  Te*ntative Proposal 5: 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 propagated), type-2 indication sent by a single-connected node includes routing ID information indicating which routing IDs are not available. Otherwise, type-2 indication sent by a single-connected node does not carry any further information related to BH RLF*  Rapporteur: P5 is modified as per your comment. |
| Nokia |  | ***Tentative* Proposal1: “**RAN2 needs to discuss which option to take from” can be replaced by “FFS”  ***Tentative Proposal 2c: A node can transmit type-3 indication if re-establishment is successful, where the node considers the re-establishment to be successful upon successful transmission of RRC reestablishment complete.***    This proposal seems to imply that RLC ACK for the Re-establishment complete should be considered. We think that is unnecessary.    Rapporteur: P2c is modified, reflecting your comment.    **Tentative *Proposal 3e: a node can transmit type-3 indication if the failed BH is recovered, where the node consider the following condition:***   * ***MCG is considered as getting recovered upon reception of reconfigurationWithSync for MCG; and*** * ***SCG is considered as getting recovered upon reception of reconfiguration for MCG. FFS if further detailed condition, such as routing availability, should be considered.***     We assume the highlighted should say “for SCG”.  Rapporteur: Thank for spotting typo. It should be SCG. |

## 3.4 Comment resolution by rapporteur:

1. Lenovo wants to clarify for P1, the case that for option 1 in proposal1, when the node is not configured with fast MCG recovery, MCG failure alone leads to re-establishment, and this is also the case that option1 should cover. The rapporteur tend to agrees with this and suggests to modify the option1 in P1 as follows and make corresponding changes to proposal2a as well.

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| * ***Option1) when the node it initiates RRC re-establishment resulting from BH RLF on both CGs or BH RLF on MCG with no fast MCG recovery.*** |

1. ZTE indicates that on P5, whether single-connected node needs to include further information related BH RLF within type-2 indication should be dependent of discussion results of P1 and P7. For instance, in case a single connected node receives a type-2 indication from its parent node that is dual-connected, if the single-connected further propagates the indication to its descendent node that is dual-connected, the indication may also need to indicate unavailable route ID information so that the descendent node can use the information for local re-routing appropriately. The rapporteur thinks that this is a valid comment and hence suggests to modify the P5 as ZTE suggested as follows:

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| **Proposal 5:** 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 propagated), type-2 indication sent by a single-connected node includes routing ID information indicating which routing IDs are not available. Otherwise, type-2 indication sent by a single-connected node does not carry any further information related to BH RLF |

1. Fujitsu think that for P2c, other triggers are not excluded. For example, RRC re-establishment is initiated and then a CHO candidate is selected during cell selection. In this case, RRCReconfigurationComplete message is sent. The rapporteur agrees with this and hence modifies P2c as follows to confirm if this is also common understanding of other companies as well.

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| ***Proposal 2c: A node can transmit type-3 indication if re-establishment is successful, where the node considers the re-establishment to be successful upon successful transmission of RRC reestablishment complete. FFS whether to also include additional triggering condition such as successful transmission of ReconfiguratonComplete, which is for the case the node initiates re-establishment and selects a CHO candidate cell and hence performs CHO successfully.*** |

1. Vivo wants to clarify that for P8 and P9, whether it is meant to have a NOTE for stage-2 spec or we just leave them as common understandings. So the following FFS is added in P8 and P9.

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| ***Proposal 8: 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.***  ***Proposal 9: 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.*** |

1. Samsung think that companies opposing CHO upon reception of type-2 indication are technically incorrect. Samsung argues that for a single-connected node, triggering CHO upon reception of type-2 indication is much more efficient than triggering re-establishment. On this comments, the rapporteur however thinks that upon reception of type-2 indication, the node does not trigger re-establishment until receiving type-4 indication, so the rapporteur wonders if the comparison between CHO and re-establishment, argued by Samsung, is technically correct or if the rapporteur misunderstand Samsung’s argument. Please note that there is a clear majority that conditional mobility should not be triggered by reception of type-2 indication as indicated in Observation#10 (10 versus 4). However, for a sensible decision making, the rapporteur suggests to modify P6 as follows:.

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| ***Proposal 6. To discuss if conditional mobility should not be triggered by reception of type-2 indication.*** |

1. Nokia thinks that for P2C, RAN2 does not need to specify the detailed condition of successful re-establishment. Hence the relevant part of P2c is modified as follows:

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| **Proposal 2c: 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.** |

# 4. Conclusion

Below is the proposals constructed based on the company input received during phase1 and the resolution of comments as done in Section 3.4 during phase2.

In the following, the rapporteur assumes that there are two categories of the proposals.

* Category1: The yellow-highlighted proposals; company views are split on the relevant issues🡺 need online discussion.
* Category2: Other proposals; (a clear) majority view has been identified on the relevant issues 🡺 can be reviewed online and possibly agreed.

Also note that

* Proposal 2a to 2f can be possibly agreed if option 1 is agreed in P1
* Proposal 3a to 3g can be possibly agreed if option 1 is agreed in P1

***Proposal1: For triggering condition of type2 indication by dual-connected node, FFS which option to take from two options below (but not supporting both with network choice):***

* ***Option1) when the node initiates RRC re-establishment resulting from BH RLF on both CGs or BH RLF on MCG with no fast MCG recovery.***
* ***Option2) when the node detects BH RLF on any BH and further condition, if introduced, is met***

If option1 is chosen in P1, we can agree with the set of P2 proposals.

**Proposal 2a: For a dual-connected node, type-2 indication 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.***

***Proposal 2b: Type-2 indication does not carry any further information related to BH RLF.***

***Proposal 2c: 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 ReconfiguratonComplete, which is for the case the node initiates re-establishment and selects a CHO candidate cell and hence performs CHO successfully.***

***Proposal 2d: A node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.***

***Proposal 2e: Upon reception of type-2 indication, the node should perform local re-routing if possible.***

***Proposal 2f: 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.***

If option2 is chosen in P1, we can agree with the set of P3 proposals.

***Proposal 3a:* For a dual-connected node, type-2 indication is triggered *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 3b: Type-2 indication includes routing ID information indicating which routing IDs are not available.***

***Proposal 3c: Upon reception of type-2 indication, the node should perform local re-routing if possible.***

***Proposal 3d: Donor’s controllability of enabling/disabling local re-routing triggered by reception of type-2 indication is not introduced.***

***Proposal 3e: a node can transmit type-3 indication if the failed BH is recovered, where the node consider the following condition:***

* ***MCG is considered as getting recovered upon reception of reconfigurationWithSync for MCG; and***
* ***SCG is considered as getting recovered upon reception of reconfiguration for SCG. FFS if further detailed condition, such as routing availability, should be considered.***

***Proposal 3f: A node can transmit type-3 indication only if it previously sent typ-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.***

***Proposal 3g: 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.***

***Proposal 4: 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.***

***Proposal 5: Type-2 indication sent by a single-connected node does not carry any further information related to BH RLF.***

***Proposal 5:*** *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 propagated), type-2 indication sent by a single-connected node includes routing ID information indicating which routing IDs are not available. Otherwise, type-2 indication sent by a single-connected node does not carry any further information related to BH RLF*

***Proposal 6. To discuss if conditional mobility should not be triggered by reception of type-2 indication.***

***Proposal 7: For the need of further propagating received type-2 indication, RAN2 needs to discuss 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 the type-2 indication, the node should propagate the indication to the child if it has no alternative path available.***

***Proposal 8: 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.***

***Proposal 9: 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.***

***Proposal 10: To agree that the following terms are used:***

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

# Reference

[R2-2109784](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2109784.zip) Leftover proposals in Summary of [Post114-e][075][eIAB] Open Issues on Re-routing Huawei, HiSilicon discussion Rel-17 NR\_IAB\_enh-Core

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[R2-2110343](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110343.zip) Rel-17 BAP Operations CANON Research Centre France discussion Rel-17 NR\_IAB\_enh-Core

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[R2-2110888](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110888.zip) Remaining Issues Related to CP/UP Separation in IAB Network Ericsson discussion NR\_IAB\_enh-Core

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[R2-2111142](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2111142.zip) Resolving open issues on BH RLF indications LG Electronics discussion Rel-17

[R2-2111156](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2111156.zip) Further discussion on enhancement of local re-routing LG Electronics Inc. discussion Rel-17 NR\_IAB\_enh-Core

[R2-2111157](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2111157.zip) Remaining issues on enhancements of topology adaptation and congestion mitigation LG Electronics Inc. discussion Rel-17 NR\_IAB\_enh-Core