3GPP TSG-RAN WG2 Meeting #112-e R2-20xxxxx

E-meeting, November 2 to 13, 2020

Agenda Item: 8.4.3

Source: Qualcomm Incorporated (Email discussion rapporteur)

**Title:** [AT112-e][031][eIAB] Topology Adaptation (QC)

Document for: Discussion

# Introduction

The document handles:

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| * [AT112-e][031][eIAB] Topology Adaptation (QC)   Scope: A) Confirm at least easy agreeable proposals captured in R2-2009292 (short deadline), make modifications to the proposals if needed for final agreement.  B) From R2-2009292 and input contributions below put applicable solution proposals on the table, with a short principal solution description, how the solution is intended to help and possibly comments on complexity, if applicable. In case there are many solutions, initial focus could be on promising and widely proposed/supported solutions. Further discussion and decision making is expected on-line week 2.  Intended outcome: Report  Deadline: Ready Nov 11 (for on-line discussion Nov 11), Intermediate deadlines by Rapporteur. |

As outlined by chairman, this email discussion has two parts.

* Part A): **Deadline: Nov 6**
* Part B): **Deadline: Nov 11**

This document only covers Part B.

# 3 Phase B: Applicable solution proposals

The following topics have been selected for further discussion since they received broad support.

## 3.1 CHO

**The following enhancements where proposed in contributions to R2#112-e:**

R2-2009262 (Interdigital): Consider additional triggering conditions such as BH RLF, load, latency

R2-2009387 (ZTE), R2-2009652 (Huawei) and R2-2008849‎ (CATT): RAN2 needs to discuss the triggering for the migration of UEs and descendent nodes, whose backhaul link is fine.

R2-2009887 (Sony): Consider event A4 for CHO trigger (in addition to A3 and A5)

R2-2010150 (Ericsson):Preparation needs to includeUEs and descendent nodes for admission control

R2-2010233 (Kyocera) and R2-2008849‎ (CATT): Type 2/4 RLF indication may trigger CHO.

R2-2008849‎ (CATT): preemptive configuration‎ of CHO includes the default BAP routing configuration and IP address that is routable ‎via the target IAB-donor-‎DU.

**Additional aspects raised during post-111-e email discussion:**

KDDI: Consider pre-emptive configuration or BH routing to reduce service interruption.

Futurewei: Confirming Ericsson’s point that UEs and descendent IAB-nodes need to be included in preemptive preparation.

Rapporteur’s views:

Preemptive preparation of UEs/descendent nodes

If CHO is considered as an alternative to handover, admission control and resource planning needs to be included in the preparation for the entire subtree. This comes at a high cost especially since BH links are not assumed to fail frequently, and CHO execution is therefore expected to occur rarely.

It is also possible to consider CHO as an alternative to BH RLF recovery, i.e., it is conducted in case the source path deteriorates too fast to perform centrally controlled handover. In the case of RLF recovery, the context of UEs and descendant nodes can be pulled after reestablishment, i.e., without preparation. Since this scenario is more applicable to BH links, it makes sense to not include UEs and descendant nodes into the CHO preparation for IAB-MT.

**Proposal 100: CHO can be applied for the IAB-MT without preparation for UEs and descendant nodes.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We agree with Proposal 100. |
| **Sony** | Agree with the proposal |
| **Ericsson** | **We are skeptical about this proposal.**  **If the target DU/CU does not need to be prepared for the incoming CHO migration, and if the contexts of UEs and IAB nodes can be fetched after reestablishment, then what is the difference compared with a regular reestablishment procedure? Also, how can the target CU accept/reject a CHO preparation blindly without knowing the UEs and descendant IAB nodes that are going to be migrated?**  **Note also that in Rel.16 CHO, when the UE gets an RLF, and the cell selected for reestablishment is part of the CHO configuration, then the UE does not transmit an RRCReestablishmentRequest, rather it sends an RRCReconfigurationComplete directly as it would do for an handover.  Actually, if P100 is accepted for CHO, the consequences will be very strange both from the IAB node side and from the NW. That would imply that the IAB node that experiences RLF will transmit the RRCReconfigurationComplete, even though the CU has not yet admitted the served UEs/descendant nodes. If eventually many UEs will be rejected by the target CU, what was the point for the IAB node to have attached to this CU? What advantage would CHO give over a normal reestablishment procedure? Also from the NW side, it will be very strange for the CU to perform a context fetch from the source after reception of RRCReconfigurationComplete, rather than after RRCReestblishmentRequest as it typically happens. Again, it is not clear what benefit CHO offers over reestablishment.**  **Also latency-wise and signaling-wise, it is not clear how the above procedure could be better than a normal reestablishment, given the huge amount of signaling and the complexity needed to fetch and process the contexts of hundreds/thousands of UEs.**  **Therefore, if the target can be unprepared (as this proposal assumes), we do not see how the CHO can offer better performances than a regular reestablishement procedure. If the problem is how to make available the context(s) at the target early enough to avoid signaling storm and latency issues (e.g. as hinted in P101 below), we are fine to study it, but that is a separate problem, that neither P100 nor CHO would solve.** |
| **ZTE** | **Agree with proposal 1.** |
| **Samsung** | **We agree with this proposal.**  **We have sympathy on rapporteur’s comment that preparation including UEs’ and descendant nodes’context management and radio resource preparation on every CHO preparation seems to be costly and this could make CHO hard to be adopted. In our thought, design of CHO in IAB needs to focuse on the fast link recovery between failed IAB-MT to the donor CU. Therefore, first IAB-MT executes CHO without consideration of UEs and descendant nodes and further the signaling for DU configuration and descendant IAB nodes/UEs configuration can be given through the recovered link.**  **From the resource management perspective, already failed IAB MT’s current configurations like BH RLC channels can show the estimate of the load expected after HO. So, looking only at the status of migrating node (i.e., failed IAB-MT) might not make big difference to the considering all the subtree.**  **At the same time, we feel that the proposal from rapporteur is from the inter donor migration cases. We wonder if the same worry can be applicable to the intra-donor CHO case. Since R3’s progress needs to be the discussion on inter-donor CHO case, we think first we focus on intra-donor case solution.** |
| **LG** | **We do not see a problem of apply existing CHO . We do not think further optimization based on CHO “without” preparation is essential.** |
| **Interdigital** | **It is a bit unclear on how this can be discussed separately from proposal 101. What does it mean if proposal 100 is agreed but 101 is not? Does that mean the CHO will result only in the HO of the MT’s RRC connection to the new target and further HOs/reconfigurations are required to setup all the needed backhaul channels, F1 connections, RRC connections, etc over the new path? Is the idea to make sure we won’t risk RLF or HOF over the BH of the concerned node, but can risk latency increase for the overall HO process (i.e. when considering the total time needed to handover all descendant UEs/IAB nodes)?.** |
| **CATT** | **We support this proposal.** |
| **Apple** | We share the views of IDC and Ericsson. How should the target gNB be prepared. The current BH recovery mechanism is reactive. The rapporteur proposal is more proactive but would need source gNB UE BH context. The only advantage we see is in terms of latency of the IAB-DU mobility process. However, if this infact helps the establishment of the BH context of the UEs is unclear. |
| **AT&T** | The benefits of CHO will be limited if no additional preparation is done from descendant IAB-nodes and UEs. We are fine to start with the baseline CHO procedure for IAB-MT and then consider additional enhancements to further improve the benefits of using CHO for IAB. |

Preemptive preparation of BAP routes, UL/DL mappings, BH RLC channels

While preparation for UEs and descendent nodes creates a large resource cost, it would be fairly easy to have the target IAB-donor prepare BAP routes, DL mappings and BH RLC channels beforehand. This would reduce interruption time in case the CHO is executed. Since these configurations are not used until the IAB-node and its subtree is migrated, they do not create a transport resource cost. In the same manner, BAP routes, UL mappings and BH RLC channels can be preemptively configured on the subtree for the new topology.

This enhancement should be aligned with RAN3 efforts on inter-donor reconfiguration for IAB-MT handover, dual-connectivity and BH RLF recovery, which also require these reconfigurations.

**Proposals 101: For CHO of the IAB-MT, preemptive configuration of BAP routes, DL/UL mappings and BH RLC channels to be considered for the target topology and the migrating subtree after RAN3 has made progress on topology adaptation procedures.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We agree with Proposal 101. We’re wondering if it’s related to not only RRC but also F1. |
| **Sony** | We share the same view on the benefits of pre-emptive preparations, therefore we think RAN2 can make progress on this and then liaison with RAN3 of our progress. |
| **Ericsson** | **We are OK to discuss this, but we do not understand why this enhancement should be studied only in the context of CHO.**  **A conventional reestablishment procedure can also benefit from the above enhancement, and it would not have all the shortcomings that CHO has, as mentioned in our reply above, e.g. IAB node sending RRCReconfigurationComplete before the CU performs admission control.** |
| **ZTE** | **Agree to wait for RAN3’s progress.** |
| **Intel** | Agree to wait for RAN3’s progress. |
| **Samsung** | **We agree with this proposal.**  **CHO (and even normal HO) in IAB can be split into RRC related step and other configuration like F1-AP / DU. We can focus on the design of fast link recovery functionality of CHO first, and if RAN3 make their progress on F1-AP/DU configuration aspects, then we can further consider the IAB specific optimization.** |
| **LG** | **We do not understand the meaning of “preemptive” configuration and the relation between “preemptive” configuration and on-going RAN3 work.** |
| **Interdigital** | Not clear what is meant by ‘pre-emptive’ here. Do the concerned nodes have to do admission control beforehand when the CHO is configured, or they have do it after the CHO is executed? If it is beforehand, then it is not really pre-emptive. If it is afterwards, then how can one assure that they will be still valid when the CHO is executed? (E.g. between the CHO configuration and CHO execution, resource situation could have changed considerably and some of the BH RLC channels can’t be established) |
| **CATT** | We think the preemptive preparation for the UEs and descendent nodes has benefit to reduce the interruption. But the detail configuration for CHO can be depended by RAN3’s progress. Thus, we suggest modifying the proposal as follows.  **For CHO of the IAB-MT, preemptive configuration of BAP routes, DL/UL mappings and BH RLC channels can ~~to~~ be considered for the target topology and the migrating subtree. The details configuration can be discussed after RAN3 has made progress on topology adaptation procedures.** |
| **Apple** | Lets wait until RAN3’s progress and agree to rapporteur’s proposal. |
| **AT&T** | Agree with Ericsson that such enhancement may be applicable more broadly. |

Trigger for migration of UEs and descendent nodes following IAB-MT’s CHO execution

After the IAB-MT has decided to execute CHO, the migration of UEs and descendent nodes could follow the same procedures as presently defined by RAN3 for IAB-MT’s RLF recovery and/or handover. RAN2 should therefore wait for RAN3 to make further progress and then assess if further enhancements are necessary.

**Proposals 102: For migration of UEs and descendant nodes following IAB-MT’s CHO execution, RAN2 to wait for further progress by RAN3 on inter-donor topology adaptation procedures.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We agree with Proposal 102. We think RAN2 should wait for RAN3’s progress. |
| **Sony** | Agree with the proposal |
| **ZTE** | Agree to wait for RAN3’s progress. |
| **Intel** | Agree to wait for RAN3’s progress. |
| **Samsung** | **Agree on this proposal since baseline operation on inter-donor topology adaptation is not yet progressed. First baseline migration procedure gets stable, then we can further consider CHO.** |
| **ETRI** | Agree to wait for RAN3’s progress. |
| **LG** | **We are fine to have this proposal, but the intention of this proposal is not clear to us.** |
| **Interdigital** | Agree with the proposal |
| **CATT** | Agree with the proposal. |
| **Apple** | Agree with the proposal |

Additional triggering conditions

It has been proposed to add further CHO trigger conditions such as load/congestion, latency or type-2 RLF indication (if adopted). The rapporteur is skeptical that local decision on topology changes based on load/congestion and latency make a lot of sense. Topology changes typically require significant reconfiguration and should therefore occur rarely. Load-/congestion- or latency-related typically vary on a short time scale and should be mitigated by other means than topology adaptation. If there are longer-term load/congestion or latency problems, which require mitigation via means of topology reconfiguration, the IAB-donor itself can conduct this reconfiguration. The IAB-donor further has global visibility and can make much better decisions than the individual IAB-node.

For BH RLF, the situation is different as it cuts off the IAB-donor from implementing centralized reconfiguration decisions. It certainly makes sense to trigger CHO upon reception of type-4 recovery failure indication. It remains to be discussed of type-2 indication can also trigger CHO. This will be part of the discussion on further enhancements to RLF indications.

**Proposals 103: Rel-16 RLF indication to be considered as CHO trigger.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We agree with Proposal 103. |
| **Sony** | Agree with the proposal |
| **Ericsson** | **In our view, this is already covered in legacy Rel.16 (please see below). Nothing in current RAN2 specification seems to preclude an IAB node to perform a CHO upon RLF, as a normal UE would do. Regarding load/congestion situation, we agree with the Rapporteur.** 5.3.10.3 Detection of radio link failure The UE shall:  ………  2> if connected as an IAB-node, upon BH RLF indication received on BAP entity from the MCG; or  2> upon consistent uplink LBT failure indication from MCG MAC while T304 is not running:  ……  6> initiate the connection re-establishment procedure as specified in 5.3.7. 5.3.7 RRC connection re-establishment **……..**  1> perform cell selection in accordance with the cell selection process as specified in TS 38.304 [20], clause 5.2.6. 5.3.7.3 Actions following cell selection while T311 is running Upon selecting a suitable NR cell, the UE shall:  …..  1> if *attemptCondReconfig* is configured; and  1> if the selected cell is one of the candidate cells for which the *reconfigurationWithSync* is included in the *masterCellGroup* in *VarConditionalReconfig*:  2> apply the stored *condRRCReconfig* associated to the selected cell and perform actions as specified in 5.3.5.3; |
| **ZTE** | For CHO, A3 and A5 event based trigger has been specified in Rel-16. These CHO triggers can be re-used for IAB node. For the descendant IAB node, the radio link quality with parent node may not deteriorate. It is hard to reuse R16 legacy CHO trigger conditions based on RSRP/RSRQ/SINR. It should be noted that donor CU can not tell in advance which IAB node may experience link deterioration. The safest way is to configure every IAB node for potential CHO. It means that both IAB node and descendant node may receive the CHO configuration. In this case, it is better to design new indications to trigger the descendant node to perform CHO.  On the other hand, if RLF is detected, UE may re-select the cells included in the CHO configuration and apply the CHO. Similarly, for IAB node, if it detects the RLF and is configured with CHO, it can performs CHO. With regard to the descendant nodes, if it is single connected and receives the Type-4 RLF indication, we think CHO could be triggered.  In a sum, we think Rel-16 RLF indication may be considered to trigger CHO. However, it is not enough. New indication other than RLF should be considered to notify descendant node to perform CHO. |
| **Intel** | We agree with the proposal |
| **Samsung** | **We agree with this proposal, since it is obvious that there is no way to continue communication without any sound link. We also don’t expect that other trigger quantity like congestion, load, latency becomes critical cause for the migration, and those can be further resolved by BAP layer configurations. At least, RLF indication in Rel-16 can be used for the link broken surely.** |
| **LG** | **Fine with this proposal, and the necessity can be further discussed.** |
| **Interdigital** | We agree with the proposal. |
| **CATT** | Agree with the proposal. |
| **Apple** | Agree to rapporteur’s proposal. |
| **AT&T** | Agree with the proposal |

Additional trigger events

The claim has been made that there is a lot of benefit in including A4 events as CHO triggers. The rapporteur will include this proposal here and expects companies to reply.

**Proposals 104: Type-4 event to be considered for CHO trigger conditions.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We think “Type-4 event” is Event A4 (Neighbour becomes better than threshold) here, e.g., it’s not Type 4 BH RLF Indication which was introduced in Rel-16. We’re not sure how Event A4 works for the parent’s BH RLF and how CHO is useful for load balancing. |
| **Sony** | Agree with the proposal and think it should be event A4. According to the topology adaptation target, CHO should be triggered even when the serving cell is good enough in order to maintain multiple viable routes and to reduce the service interruption time. Furthermore, topology adaptation due to load balancing may not necessarily be triggered by radio link degradation. Then A4 type event should be considered for CHO trigger in Rel-17 IAB. |
| **Ericsson** | **A4 event was not considered in Rel.16 for CHO configuration. We do not see the need to introduce it for IAB** |
| **ZTE** | Disagree. Type-4 event means the neighbour becomes better than threshold. It doesn’t make sense for the migrating IAB to perform CHO based on that since its serving cell may be too good to perform HO. If the CHO is used for congestion mitigation purpose, congestion based trigger may be considered instead of link quality. |
| **Intel** | In IAB network, we should CHO may be allowed in multiple scenarios, such as RLF, congestion, fairness, load balancing, etc. We suggest conditions to trigger CHO in IAB network FFS. |
| **Samsung** | **We are confused by “type-4 event” in the proposal whether this means e.g. A4 or RLF type-4 indication.**  **If the proposal means A4 event, then we agree with the proposal. This is essential to adopt CHO in IAB. Legacy CHO events are only A3/A5 which are considering source cell quality. However in IAB case, reception of RLF indication means just loss of connection between its parent node and CU irrespective of source cell link quality. i.e., IAB-MT’s parent node’s cell is still good in the radio quality. So A3/A5 based event cannot be fulfilled in many case. RLF indication only can say the HO is necessary but can’t say which cell is the best cell then. For finding the best cell, there should be another condition to select the best target cell. The minimum on the selection of target cell is again signal quality. The simplest one is to use A4 event. So IAB MT receives RLF indication, and if A4 event is fulfilled at the same time, then this IAB node can handover to that selected cell.**  **If type-4 event in the proposal is RLF type-4 indication, then we also agree with this proposal.** |
| **LG** | **Fine with this proposal, and the necessity can be further discussed.** |
| **Interdigital** | As Sony has pointed out, it is beneficial to support CHO for reasons other than radio conditions of the serving cell becoming worse than a neighbor, e.g. load balancing, and thus we support this proposal in principle as it enables that. |
| **CATT** | We disagree with this proposal. Share the same view as ZTE. |
| **Apple** | Agree to the proposal and as multiple others have mentioned should be A4. |

## 3.2 RLF indication

**The following enhancements where proposed in contributions to R2#112-e and post-R2#111-e email discussion:**

Most contributions and comments to the post-R2#111-e discussion evolved around the following definition of RLF indications introduced at some point in time during Rel-16:

**Type 1 – “Plain” notification:** Indication that BH link RLF is detected by the child IAB-node.

**Type 2 – “Trying to recover”:** Indication that BH link RLF is detected, and the child IAB-node is attempting to recover from it.

**Type 3 – “BH link recovered”:** Indication that the BH link successfully recovers from RLF.

**Type 4 – “Recovery failure”:** Indication that the BH link RLF recovery failure occurs.

**Type 4x – “Indicating child nodes to perform RLF procedure”:** it is up to implementation on the parent node on when to send this indication.

Based on this definition, all Rel-17 contributions referred to Type 2 and Type 3 indications as potential enhancements to be considered, while Type 4 represents the indication defined in Rel-16.

The main issues to be addressed refer to the conditions of the transmission of Type2/3 indications and the behavior of the receiving node.

R2-2009201 (Intel): RAN2 should ensure that an IAB node does not choose for reestablishment nodes that have failed. The IAB-node may modify SI to bar access to new IAB-node or UEs. The recovery failure indication may include information about ancestors that have failed.

R2-2010233 (Kyocera) proposed:

* The IAB-MT reduces/stops the scheduling request after it receives Type 2 Indication, and it resumes the scheduling request if the parent node no longer experiences BH RLF.
* Discuss other IAB-MT behaviour(s), e.g., local re-routing, while its parent node tries to recover its BH link.
* IAB-DU may send Type 2 BH RLF Indication when it initiates RRC Reestablishment rather than when it initiates one of RLF recovery procedures.
* Discuss whether/how to capture the IAB-DU behaviour.

R2-2010441 (LG) proposed:

* Upon reception of Type3, if multiconnected, apply local re-routing without changing the parent.
* If single-connected, apply early re-establishment or CHO execution to new parent.

R2-2008849‎ (CATT) proposed:

* When the IAB-node receives Type 2 BH RLF Indication, the IAB-node doesn’t ‎necessarily to perform cell re-selection.‎

Rapporteur’s views:

Support of Type2/3 indications

There is a lot of support for both types of indications. To ensure stable conditions as well as inter-vendor interoperability, the rapporteur insists that proper behavior is defined for the receiving node.

**Proposals 200: RAN2 to support Type-2 indication, which indicates that BH RLF has been detected, together with the behavior on the node receiving the indication.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We support Proposal 200. We think Type 1 and Type 2 are actually same, i.e., the IAB-MT initiates BH RLF recovery when it detects BH RLF, and assume Proposal 200 mixes them, i.e., it says Type 2 Indication (“Trying to recover”) is sent when BH RLF is detected (“Type 1”). |
| **Ericsson** | We are ok with type-2 indication, but we are doubtful about the gain of specifying actions upon reception.  Those should be two separate proposals to be discussed separately. |
| **ZTE** | We support the Type-2 indication. Whether the behavior of receiving node should be specified is FFS. |
| **Intel** | We agree to introduce Type-2 indication. |
| **Samsung** | **We agree with the proposal.** |
| **ETRI** | We support Type-2 indication. |
| **LG** | Support the proposal. |
| **Interdigital** | We agree with the proposal to introduce type-2 indication. |
| **CATT** | Agree with the proposal. |
| **Apple** | Agree to the proposal. |
| **AT&T** | We support Type-2 indication. The second part of the proposal about behavior is unclear. |

**Proposals 201: RAN2 to support Type-3 indication, which indicates that the BH link has recovered, together with the behavior on the node receiving the indication.**

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We agree the child node needs to know the parent recovered its BH RLF, if Type 2 Indication is introduced. However, we still think the child node can notice it if Type 2 Indication is transmitted repeatedly (e.g., via SIB1), even without the explicit Type 3 Indication. |
| **Ericsson** | We are ok with type-3 indication, but we are doubtful about the gain of specifying actions upon reception. Those should be two separate proposals to be discussed separately. |
| **ZTE** | We support the Type-3 indication. Whether the behavior of receiving node should be specified is FFS. |
| **Intel** | We are ok. Same view as E///. |
| **Samsung** | **We agree with the proposal.** |
| **ETRI** | We share with Ericsson and Intel’s view. |
| **LG** | Support the proposal. |
| **Interdigital** | We agree with the proposal to introduce a type-3 indication. |
| **CATT** | Agree with the proposal. |
| **Apple** | Agree to the proposal. |
| **AT&T** | We are also OK with Type-3 indication. Again, the second part of the proposal about behavior is unclear. |

Behavior of receiving node

The behaviors by the receiving node upon reception of Type 2 indication may include local rerouting, execution of CHO, early RLF reestablishment, discontinuation/reduction of UL scheduling requests, and barring of access for IAB-nodes and UEs. The rapporteur is fine with all of them except early RLF reestablishment. This behavior is already defined for Type 4 indication. Further, having all nodes in the subtree trying to concurrently recover will certainly not converge to a stable solution in short time. For Type-3 indication, the receiving node essentially reverts to the behavior before the reception of the Type-2 indication.

Proposal 202: For Type-2 indication, consider for the behavior of the receiving node to include local rerouting, execution of CHO, discontinuation/reduction of UL scheduling requests, barring of access for IAB-nodes/UEs, and propagation of the indication.

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **vivo** | Disagree to trigger CHO upon the reception of type2 indication, since it may result in suboptimal topology as type 4 indication can be used as the triggering condition.  Besides, as RLF is a rare case, it is preferred not to define the very complex procedure. It could be enough to define the UL data TX behavior and leave others for implementation. |
| **Kyocera** | We agree with Proposal 202. |
| **Ericsson** | **We agree with Vivo.**  **It is too early to discuss such aspects.** |
| **ZTE** | Upon receiving the Type-2 indication, IAB nod may perform early measurement of neighboring cells for potential re-establishment. We doubt if it is appropriate to perform CHO based on Type 2 indication since the link may recovery soon. Whether the data packet should be suspended or local re-routed could be further discussed. The reduction of UL SR, and access barring can be up to network implementation. |
| **Intel** | We agree with Vivo and E///, we should discuss the behavior after discussion of whether to adopt Type2/3. |
| **Samsung** | **We agree with the proposal.**  **WID says**   * Specification of enhancements to reduce service interruption due to IAB-node migration and BH RLF recovery.   **Service interruption time minimization can be achieved at least using type-4 indication as CHO trigger. However even this type-4 CHO always includes interruption time owing to re-establishment trial at its parent node. So if RAN2 wants to reduce interruption time more (and we think this is the natural demand for supporting high quality service to its subtree), aggressive solution is necessary. Whatever the final solution could be, there must be an indication of “bad link which could be long term” and one of apparent solution based on this indication could be CHO.** |
| **ETRI** | We have same view with vivo, Ericsson and Intel. |
| **LG** | **Fine with this proposal, and the details can be further discussed.** |
| **Interdigital** | We agree with what other companies have proposed above (i.e. first let’s agree whether to support the indicators or not, and we then can discuss the details of the IAB node behavior) |
| **CATT** | It’s too early to discuss this aspect. |
| **Apple** | Agree with Vivo, E/// and Intel. It is too early to discuss this. |

Proposal 203: For Type-3 indication, consider for the behavior of the receiving node to revert to the conditions before the reception of Type-2 indication.

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| vivo | It’s unclear what the behaviors are upon the reception of Type-2/3 indication, we can discuss this proposal later when those behaviors are specified. |
| **Kyocera** | We support the receiving node’s behavior in Proposal 203, but we think the important thing is for the IAB-MT to know when the parent’s BH has recovered, which doesn’t require the reception of Type 3 indication (also see our comment under Proposal 201). |
| **Ericsson** | **We agree with Vivo.**  **It is too early to discuss such aspects** |
| **ZTE** | The potential behavior upon receiving Type-3 indication need to be discussed case by case. For example, if the CHO is performed, it is hard to revert to the conditions before the reception of Type-2 indication. |
| **Intel** | We agree with Vivo and E///, we should discuss the behavior after discussion of whether to adopt Type2/3. |
| **Samsung** | **we think that this proposal is based on the assumption of proposal 202, i.e., IAB MT received type-2 indication is doing some behavior. Even though we agree the intention, we also think this proposal can be later discussed after the behavior of MT’s reception of type-2 is agreed.** |
| **ETRI** | We have same view with vivo, Ericsson and Intel. |
| **LG** | **Fine with this proposal, and the details can be further discussed.** |
| **Interdigital** | We agree with this proposal in a sense that whatever the IAB node has done on the reception of type 2 (once we have agreed on that), it should revert it on the reception of type 3 (as BH conditions have become normal again). |
| **CATT** | It’s too early to discuss this aspect. |
| **Apple** | Agree that it is too early to discuss this. |

Inclusion of information into the Type2/3 indication

The rapporteur does not see any benefit of adding information to these indications. Other companies may certainly have a different view. We can keep this aspect FFS.

Proposal 204: Inclusion of further information into the Type-2 or Type-3 indication is FFS.

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

|  |  |
| --- | --- |
| **Company** | **Comment** |
| **Kyocera** | We’re fine with Proposal 204. |
| **Ericsson** | **To be discussed later if Type2/3 indication is agreed.** |
| **ZTE** | **Agree** |
| **Intel** | **To be discussed later if Type2/3 indication is agreed.** |
| **Samsung** | **We agree with the proposal.**  **We also think there are possible values to include some information in the each type indication. But we haven’t discuss the detail behaviors on reception of each type indication. So this further can be discussed after some level of realization of behavior upon receiving each type indication is made. So we agree with the proposal.** |
| **LG** | **We don’t see this proposal is critical and urgent at this stage of discussion on RLF indication We can come back to discuss whether further information into the Type-2 or Type-3 indication is needed after making more progress on RLF indication.** |
| **Interdigital** | **Agree with the other companies view that this can be discussed if type 2/3 indications are agreed.** |
| **CATT** | **We are fine with this proposal.** |
| **Apple** | **Agree with the proposal.** |

## 3.3 Local rerouting

**The following aspects where proposed in contributions to R2#112-e:**

R2-2009652 (Huawei) and R2-2008849‎ (CATT)‎ claim that local rerouting allows congestion mitigation and load balancing.

R2-2009887 (Sony) claims that local rerouting can improve topology robustness in real-time radio environment, guarantee differentiated packet delivery according to their QoS profile, and simplify the route management framework, therefore reduce the signalling overhead. The IAB-node can select among local candidate routes configured by the CU.

R2-2010490 (Futurewei) proposes centralized configuration of multiple routes with priorities, among which the node can select. In this manner, topology-wide constraints can be guaranteed. Multiple routes with routing priorities were already discussed during Rel-16.

R2-2010671 (Nokia) proposes to introduce a discard timer on BAP layer, which is reset based on RLC ACK. Upon expiry of the timer, the packet can be locally routed.

Rapporteur’s views:

Centralized configuration of multiple routes

This allows the CU to keep control over local rerouting and to also select the subset of routes, where topology-wide constraints can be met.

Proposal 300: The IAB-donor-CU can configure multiple routes with same BAP routing ID, among which the IAB-node can select.

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| **Company** | **Comment** |
| **Kyocera** | We support Proposal 300, but we assume the donor configures multiple routes for a destination at this point. So, we wonder if the modeling should be FFS, e.g., whether the multiple routes have the same BAP Routing ID or these have different Path ID etc. |
| **Sony** | Agree with the proposal |
| **ZTE** | Disagree. The path id in BAP routing ID is used to differentiate different routing path towards a destination. It is strange that different routing paths are assigned the same path ID. On the other hand, it is suggested that the donor CU control the routes selection since donor CU may systematically considers the network topology and load condition. The local routing selection by IAB node may cause the dynamic change of load distribution and lead to sub-optimal route selection. |
| **Intel** | Agree with the proposal. |
| **Samsung** | **Similar proposals were circulated during Rel-16 discussions, where on top of this the CU could configure priorities of multiple routes with the same routing ID (your next proposal). This proposal is acceptable, and in our understanding the choice of the route is left to implementation if priorities are not included? Or will we be introducing certain limitations or recommendations, such as in P302?** |
| **LG** | **We are ok with intention of the proposal, but need some clarifications on the current proposal. From the current BAP specification perspective, BAP routing ID, which is comprised of BAP address and path ID, should be unique in the routing table at an IAB node. There could be multiple routes with same destination BAP address, not with same BAP routing ID.**  **Thus, if the rapporteur deliberately includes “multiple routes with same BAP routing ID” in the proposal, it should be clarify what “multiple routes with same BAP routing ID” means. If not, the correct wording would be as following.**  **“The IAB-donor-CU can configure multiple routes with same (destination) BAP address, among which the IAB-node can select.”** |
| **Interdigital** | The proposal is a bit confusing. Maybe the intention was to say that *the CU can configure an IAB node with multiple next hops in the forwarding table that are associated with the same BAP routing ID*? |
| **CATT** | We don’t think this proposal is valid. We prefer to re-use R16 local re-routing mechanism, i.e., the proposal can be updated as follows.  **The IAB-donor-CU can configure multiple routes with same BAP destination ~~routing~~ ID, among which the IAB-node can select.** |
| **Apple** | Agree with the proposal. |
| **AT&T** | We agree with CATT. The proposal should be updated to mean same BAP destination ID. Each path to the same destination should have a different path ID, thereby giving it a unique BAP routing ID. |

Routing priorities

While it is straightforward to a add route priority value to each routing entry, it is necessary to define the IAB-node’s behavior in case it can select among multiple routes with different priorities. The contributions indicate that the IAB-node would primarily select the highest priority route and resort to a lower-priority route if certain conditions are met. Some conditions proposed relate to congestion/load, expiration of an RLC retransmission timer, or reception of an RLF indication.

Proposal 301: The IAB-donor-CU can include a routing priority to each routing entry to constrain the IAB-node’s decision on local route selection.

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

|  |  |
| --- | --- |
| **Company** | **Comment** |
| **Kyocera** | We agree with Proposal 301. |
| **Sony** | Agree with the proposal |
| **Ericsson** | **We are not sure about the gain of indicating routing priorities, over a solution in which the IAB node simply selects the best alternative node on the basis of local measurements, e.g. on the basis of radio conditions, local congestions, etc.**  **Should not we also discuss the criteria needed to the IAB node to determine whether to perform a local re-routing or not?** |
| **ZTE** | Disagree. It is suggested to first discuss the scenarios for local route selection, identify the potential benefits and discuss whether it need to be supported in Rel-17. Without concrete scenarios in mind, it is hard to determine whether the priority is needed. On the other hand, other metrics instead of priority may be possible depending on the scenarios, such as hop count, latency, etc. |
| **Intel** | It’s not clear what is the impact of a routing priority from IAB donor CU to intermediate IAB node local rerouting. We suggest discussing “how should intermediate IAB node consider this routing priority during its local rerouting” first. |
| **Samsung** | **This is acceptable although it moves us away from local-decision making (in fact, this is not local rerouting at all, but a pre-defined selection among provided paths). However P302 seems to give more latitude to intermediate nodes.** |
| **LG** | **We think that there may be two ways to perform local route selection after some events occur.**  **- Option 1. Select one route by network implementation;**  **- Option 2. Select one route based on priority (like the proposal 301).**  **We understand that the option 2 is more centralized control and the IAB-donor CU can expect IAB node’s behavior after some events, e.g., BH RLF, occur because the IAB node should follow the pre-configured priority regardless of the current IAB node situation. However, considering that the radio/resource condition and circumstance of an IAB node is changed continuously, the pre-configured priority by the IAB-donor CU may not be the best choice in some cases. Probably, considering all situations, the IAB node can know the better route than the route having the highest pre-configured priority. Some companies think that the option 1 is enough. Thus, we would like to discuss first whether the additional information, i.e., routing priority, is needed for local route selection.**  **The changed wording is as follows:**  **“Routing priority to each routing entry to constrain the IAB-node’s decision on local route selection is FFS.”** |
| **Interdigital** | Not clear on how this priority is going to be used. For example, if the IAB node was configured with two possible hops for a given BAP routing ID, (e.g P1 towards node 1, and P2 towards node 2, where p1+p2=1), does it mean that the IAB node forwards a packet with the concerned BAP routing ID p1 percentage of the time towards node 1, and the rest towards node2? Is this done in a completely random fashion? |
| **CATT** | Disagree. This routing priority issue has been discussed in R16. However, the benefit and detail mechanism is unclear. We prefer to first discuss the scenarios and potential benefits for this routing priority enhancement. |
| **Apple** | Agree with others that we need to first discuss how this priority will be utilized. |
| **AT&T** | Agree with the proposal. Different paths to the same destination ID may be assigned different priorities by the CU. This does not preclude local decision making. The priority field may allow the CU to influence the IAB node’s local decision-making process. It may also enable the IAB node to make more informed local decisions. |

Proposal 302: RAN2 to discuss the IAB-node’s criteria for route selection with route priorities considering, e.g., congestion/load, expiration of RLC retransmission timer and reception of an RLF indication.

*Please provide your company’s view on this proposal. In case you are unhappy, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- |
| **Company** | **Comment** |
| **Kyocera** | We agree with Proposal 302. |
| **Sony** | Agree with the proposal |
| **Ericsson** | **See our comment to P301.** |
| **ZTE** | Disagree. It is suggested that RAN2 discuss the local route selection scenarios first and determine whether they should be supported in Rel-17. Based on these scenarios, we can further discuss the criteria. |
| **Intel** | See comment to P301. |
| **Samsung** | **If our understanding is correct, this is now “true” local decision making on the part of the IAB node? In other words, the node does not just choose the available route with highest priority, but rather takes into account local conditions (congestion/link status) not known to the CU? If so, we are supportive of this proposal.** |
| **LG** | **As explained above table, we think this proposal can be discussed after RAN2 confirming that routing priority is configured to each routing entry. Thus, this proposal may not be needed for now, i.e., prefer to remove this proposal.** |
| **Interdigital** | Not clear on the intention here. Are we trying to come up with some formula/rules for route selection that gets input of route priorities, load/congestion, BH RLF indication/detection, etc? |
| **CATT** | Disagree. See comment to P301. |
| **Apple** | Agree with others that we should first discuss the use of routing priority before we start discussion of this item. |
| **AT&T** | Agree |

# Conclusion

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# References

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| --- | --- | --- |
| R2-2008849 | Consideration on Topology adaptation enhancements | CATT |
| R2-2009007 | CHO for UE or IAB-MT on migration | Fujitsu |
| R2-2009201 | Enhancements to establish efficient topologies and backhaul failure recovery | Intel Corporation |
| R2-2009262 | On IAB Topology Adaptation | InterDigital |
| R2-2009292 | Report of email discussion on topology adaptation enhancements RAN2 scope | Qualcomm Incorporated |
| R2-2009330 | Consideration of Inter-CU IAB Migration | vivo |
| R2-2009387 | Considerations on topology adaptation enhancements | ZTE, Sanechips |
| R2-2009508 | Better Cell Selection for eIAB nodes for improved topology adaptation | Apple |
| R2-2009610 | Topology optimization in IAB | NEC |
| R2-2009652 | Consideration of topology adaptation enhancement for R17-IAB | Huawei, HiSilicon |
| R2-2009887 | Topology adaptation enhancements in IAB | Sony |
| R2-2010137 | Consideration on avoiding RLF recovery at former descendent nodes | Sharp |
| R2-2010158 | On WI scope and solutions for topology adaptation and inter-CU migration | Ericsson |
| R2-2010233 | Consideration of topology adaptation enhancements for eIAB | Kyocera |
| R2-2010441 | BAP Packet Duplication and BH RLF Indication Enhancements | LG Electronics France |
| R2-2010490 | RAN2 impacts of Rel.17 IAB topology adaptation enhancements | Futurewei Technologies |
| R2-2010671 | On topology adaptation enhancements | Nokia, Nokia Shanghai Bell |