3GPP TSG-RAN WG3 #117-e R3-225029

Online, Aug 17 – 25, 2022

Agenda Item: 13.1

Source: Qualcomm (Moderator)

Title: Summary of CB: #IAB1\_General

Document for: Discussion

# Introduction

This paper captures the following CB discussion:

|  |
| --- |
| **CB: # IAB1\_General****- Discussion on connectivity of a Mobile IAB node to a stationary intermediate IAB-node or to an IAB-donor****- Depending on the outcome, discuss on the need for optimization/enhancements for multi-hop and/or single hop use cases** **- Need for new authorization information for mobile IAB?****- Clarification on the sentence “Solutions should support UE HO and DC” and the fact it refers to UE procedures**(Qualcomm - moderator)[NWM] Summary of offline disc R3-225029 |

The CB has the following phases:

**Phase I：Converge on open issues. Deadline is Friday, 19th August, 2022, 23:59 UTC.**

**Phase II：If needed.**

The following contributions are included in this CB:

|  |  |  |
| --- | --- | --- |
| [R3-224375](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224375.zip) | Discussion on general mobile IAB aspects (Nokia, Nokia Shanghai Bell) | discussion |
| [R3-224428](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224428.zip) | Discussion on multi-hop backhauling for mobile IAB (Lenovo) | discussion |
| [R3-224495](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224495.zip) | Clarifications of Rel-18 Mobile IAB Work Item Scope (Ericsson) | discussion |
| [R3-224502](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224502.zip) | Workplan for Rel-18 mobile IAB (Qualcomm Inc. (Rapporteur)) | Work Plan |
| [R3-224786](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224786.zip) | Discussion on multi-hop scenario for mobile IAB-node (Intel Corporation, Qualcomm, Huawei, Ericsson, Nokia, InterDigital) | discussion |
| [R3-224825](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224825.zip) | Discussion on potential complexity of single-hop and multi-hop scenarios (samsung) | discussion |

# For the Chairman’s Notes

**Proposal 1-1:** **Rel-16/17 IAB can support mobile IAB-node connectivity to a stationary intermediate node.**

**Proposal 1-2:** **Enhancements/optimizations that are specific to multi-hop backhauling should be precluded for mobile IAB.**

**Proposal 1-3:** **Optimizations/enhancements for single-hop mobile IAB are deprioritized.**

**Proposal 2:** **RAN3 will not discuss separate authorization for mobile IAB without request by SA2.**

**Proposal 3:** M**obility of dual-connected IAB-nodes is out of scope.**

**Proposal 4: RAN3 to wait for RAN2 on how to prevent the mobile IAB-node to connect to another mobile IAB-node.**

# Discussion - Phase I

## 3.1 Connectivity of a mobile IAB-node to a stationary intermediate node vs. to an IAB-donor

RAN Plenary #96 added the following note to the WID [1]:

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| --- |
| *Note: At the beginning of the work period, RAN3, RAN2 should discuss the potential complexity of a scenario where a mobile IAB node connects to a stationary (intermediate) IAB node, with respect to the scenario where a mobile IAB node connects directly to an IAB-donor.* |

We will first address if mobile IAB-node connectivity to stationary intermediate nodes can be supported, and then potential enhancements/optimizations.

**Issue 1: Support of mobile IAB-node** **connectivity to stationary intermediate IAB-nodes**

According to R3-224786 (Intel Corporation, Qualcomm, Huawei, Ericsson, Nokia, InterDigital), R3-224495 (Ericsson), and R3-224825 (Samsung), Rel-16/17 IAB can already support connectivity of mobile IAB-nodes to stationary intermediate nodes. Therefore, multi-hop backhauling via Rel-16/17 IAB should not be precluded for the mobile IAB-node.

According to R3-224428 (Lenovo), the mobile IAB-node should only connect to the IAB-donor since multi-hop connectivity will require new NG-based IAB-MT HO procedures in case Xn interconnectivity is not available. The contribution, however, does not identify any problem for the mobile IAB-node’s connectivity to a stationary intermediate node in case Xn ***is*** available, i.e., as it is assumed for Rel-17 IAB.

R3-224825 (Samsung) emphasizes that there are benefits to single-hop as well as multi-hop scenarios for mobile IAB. For these reasons, multi-hop backhauling should not be precluded.

Therefore, based on these contributions, Rel-16/17 IAB should be able to support mobile IAB-node connectivity to a stationary intermediate IAB-node as the baseline.

**Q1-1: Do you agree that as the baseline, Rel-16/17 IAB can support mobile IAB-node connectivity to a stationary intermediate node. If not, please explain why this could not be supported?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | 1. The complexity is lowest if we reuse what we already have. Any restriction to single hop for mobile IAB would add complexity.2. On Lenovo’s issue: In the absence of Xn, enhancements are also needed for single hop. Moving information from Xn to Ng is independent of single- vs. multi-hop backhauling. |
| **Ericsson** | Yes, but rewording is needed | We should **remove the word “baseline”** from any proposal derived from this question because it sounds as if there will be enhancements. |
| Huawei | Yes | Agree Ericsson |
| Lenovo | No | If we support both single-hop and multi-hop backhauling in R18, maybe we need to design two separate full migration procedures separately for the mobile IAB-node. Since in case mobile IAB-node pertaining to an intermediate IAB-node in state of partial migration, the mobility of the mobile IAB-node has impacts on three IAB-donors. |
| Nokia | Yes | Agree with Ericsson |
| Xiaomi | Yes with comments | We agree to support the scenario, but no enhancements are needed in R18 for mobile IAB-node connectivity to a stationary intermediate node, considering the timeframe. We generally OK with the proposal as E/// suggested, remove the word “baseline”, furthermore, we want it to be clear, no more enhancements are needed in R18 including backhauling enhancements mentioned in issue2 and other potential enhancements as well. |
| ZTE | Yes  | Agree with Ericsson to remove “as the baseline” from the proposal.  |
| Fujitsu | Yes | In this way, we may reuse existing IAB procedures as much as possible |
| Deutsche Telekom | Yes | Ok with the proposal to remove “baseline”.  |
| Intel | Yes | Agree with Ericsson. |
| Samsung | Yes | Agree with Qualcomm. |
| AT&T | Yes |  |
| MITRE | Yes |  |

**Summary:**

**12/13** companies agree with the spirit of the question. 5 of these companies would prefer to remove the reference to “baseline”.

**1/13** company does not agree based on the concern that RAN3 may have to introduce two separate full migration procedures. This concern is not shared by other companies.

**Proposal 1-1:** **Rel-16/17 IAB can support mobile IAB-node connectivity to a stationary intermediate node**

**Issue 2: Enhancements/optimizations for multi-hop backhauling of mobile IAB-node**

According to R3-224786 (Intel Corporation, Qualcomm, Huawei, Ericsson, Nokia, InterDigital) and R3-224495 (Ericsson), enhancements/optimization that are specific to multi-hop backhauling should be precluded for mobile IAB. The authors believe that such enhancements/optimizations are implicitly precluded in Rel-18 mobile IAB WID, since they were already discussed in Rel-17 and then deprioritized in Rel-17.

**Q1-2: Do you agree that enhancements/optimizations that are specific to multi-hop backhauling should be precluded for mobile IAB? Please provide reasons for your view.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | The WI should primarily focus on the mobility of the IAB-node together with its UEs.Performance issues related to multi-hop are not specific to mobile IAB since they also apply to stationary networks. Such issues were already discussed in Rel-17. The WID explicitly states:*Note: Solutions should avoid touching upon topics where Rel-17 discussions already occurred and where the topic was excluded from Rel-17, except for enhancements that are specific to IAB-node mobility.* |
| **Ericsson** | Yes |  |
| Huawei  | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes  |  |
| Fujitsu | Yes |  |
| Deutsche Telekom | Yes |  |
| Intel | Yes |  |
| Samsung | See comments | We think the issues of latency and signaling overhead will become more serious when mobile IAB node is considered, and enhancements can bring a better performance for full migration. However, it is OK to preclude it if time is not enough. |
| AT&T | No | Prefer to consider any multi-hop specific enhancements on a case-by-case basis if a simple solution can be achieved. |
| MITRE | Yes |  |

**Summary:**

**12/13** companies agree that enhancements/optimizations specific to multi-hop backhauling should be precluded for mobile IAB. One of these companies believes that enhancements might bring better performance for full migration, but they are fine to preclude it if time is not enough.

**1/13** company would like to consider multi-hop-specific enhancements on a case-by-case base.

There is not enough support for multi-hop-specific enhancements.

**Proposal 1-2:** **Enhancements/optimizations that are specific to multi-hop backhauling should be precluded for mobile IAB.**

**Issue 3: Enhancements/optimizations for single-hop backhauling of mobile IAB-node**

According to R3-224375 (Nokia), optimizations should be studied for single-hop backhauling of mobile IAB-nodes. The contribution claims that for single-hop backhauling, BAP may not be needed, for instance. Therefore, such optimizations may be beneficial for dedicated mobile-IAB deployments.

**Q1-3: Do you agree that enhancements/optimizations to single-hop backhauling should be studied for mobile IAB?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | Optimizations for single hop (e.g., drop BAP) are not specific to mobile IAB but they also apply to stationary networks. For that reason, they are not in scope for Rel-18 mobile IAB. |
| **Ericsson** | No | BAP would be needed on the m-MT side, but not on the m-DU side. |
| Huwei | No | We prefer that the R18 mobile IAB share the same protocol stack as the fixed IAB-node defined in previous release. |
| Lenovo | See comments | Optimizations for single-hop backhauling should be studied if we only support single-hop backhauling,For BAP of mobile IAB-node, mobile-MT shall have the BAP like fixed IAB-node in case of single-hop. |
| Nokia | Yes | There may be some misunderstanding. The mobile IAB does not need to support BAP, since it does not have child, and no “further” routing after mobile IAB.  |
| Xiaomi | Not sure | We prefer to study the basic mechanism for mobile IAB first, enhancements can be considered later. |
| ZTE | No  | In multi-hop scenario, BAP sublayer is definitely needed at mobile IAB-MT. Assume that both single-hop and multi-hop scenarios are supported, a unified radio protocol should be used for the two scenarios. Otherwise, another issue is how could mobile IAB node determine which protocol is to be used. |
| Fujitsu | No | We think the Rel-18 procedures for mobile IAB will be generic, not differentiating single-hop or multi-hop backhauling. No need to have separate design on single-hop scenario. |
| Deutsche Telekom | Perhaps | If optimizations resulting in less complexity of the Mobile IAB node are possible from the beginning, we shouldn’t exclude them. But our preference is to start with existing functionality and procedures. |
| Intel | No | We share the same view with HW that all IAB-nodes, including fixed IAB-nodes in Rel-16/17 and mobile IAB-nodes in Rel-18 to support the same protocol stack. Moreover, since the existing hop number of parent IAB-node is transparent to the accessed IAB-node, the accessed IAB-node cannot choose whether to establish BAP or not. |
| Samsung |  | Agree with Xiaomi. |
| AT&T | No |  |
| MITRE | No |  |

**Summary:**

**8/13** companies believe that enhancements/optimizations to single-hop backhauling for mobile IAB should not be studied.

**3/13** companies would like to study the basic mechanisms of mobile IAB first, but they do not want to rule out single-hop enhancements for a later stage of the WI.

**1/13** company would like to consider multi-hop-specific enhancements on a case-by-case base.

**1/13** company would like to consider single-hop specific enhancements in case only single-hop backhauling is supported for mobile IAB.

**1/13** company emphasizes that elimination of BAP might be a specific single-hop optimization.

5 companies might want to consider such single-hop enhancements. However, the majority is against such discussions. This means that there is not enough support for studies on single-hop enhancements.

**Proposal 1-3:** **Optimizations/enhancements for single-hop mobile IAB are deprioritized.**

## 3.2 Authorization of mobile IAB

R3-224375 (Nokia) proposes that RAN3 should discuss separate authorization for mobile IAB vs. stationary IAB. The contribution claims that such separate authorization may be necessary based on SA2 discussions during the SA2 Study Item on VMR. The moderator does not believe that RAN3 has to act on SA2 SI discussions unless SA2 has sent an LS to RAN with the request to consider certain aspects related to these discussions.

**Q2: Do you agree that RAN3 should discuss a separate authorization for mobile IAB? Please provide reasons why a separate authorization for mobile IAB would be (or not be) needed.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | See comment | As the baseline, mobile IAB should use the same authorization as Rel16/17 IAB. From RAN perspective, there is no obvious reason to introduce a separate authorization mechanism.RAN3 can still reconsider in case SA2 sends an LS to RAN on this topic. |
| **Ericsson** | No | RAN3 cannot specify authorization procedures, we can only provide signalling support, if SA2 reaches out to us. |
| Huawei | Not now | Agree with Ericsson |
| Lenovo | No | RAN3 may discuss this issue only after inputs from SA2. |
| Nokia | Yes | It is beneficial, e.g. a Rel-17 IAB should not be allowed to “mobile”. We are ok if majority want to wait for SA2.  |
| Xiaomi | Not now | We prefer to wait for SA2 |
| ZTE | Not now  | The discussion on authorization for mobile IAB should be triggered by SA2 if needed.  |
| Fujitsu | Not now | Agree with above companies. |
| Deutsche Telekom | Not now | No need to work on separate authorization procedures without a clear statement from other WGs (SA2 and SA3).  |
| Samsung | Not now | Agree with Ericsson |
| AT&T | Not now | Ok to wait for SA2 input if needed |
| MITRE | Not now |  |

**Summary:**

**10/11** companies do not want to discuss separate authorization for mobile IAB without request by SA2.

**1/11** believes that there is value in such mobile-IAB-specific authorization but is willing to wait for SA2.

**Proposal 2:** **RAN3 will not discuss separate authorization for mobile IAB without request by SA2.**

## 3.3 Clarification on DC procedures

The WID states [1]:

|  |
| --- |
| In Rel-18, mobile IAB supports the following functionality, applicable to FR1 and FR2:* …
* Solutions should support UE HO and DC.
 |

Some clarification is needed if “DC” only refers to UE procedures, or if it can also apply to IAB-MT procedures. According to R3-224495 (Ericsson) and R3-224353 (Huawei), the mobility of dual-connected IAB-nodes in not in Rel-18 scope.

**Q3: Do you agree that mobility of dual-connected IAB-nodes is out of scope? Please provide reasons for your view.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | The WID refers to UE-based DC procedures. This alone does not preclude mobility of dual-connected IAB-nodes. However, Rel-18 should focus on the baseline procedures for IAB-node mobility. Further refinements, e.g., such as mobility of dual-connected IAB-nodes, can be considered in later releases. |
| **Ericsson** | Yes | The WID text should be updated as follows:“Solutions should support UE HO and UE DC” |
| Huawei | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes | Agree with Ericsson. |
| Xiaomi | Yes |  |
| ZTE | Yes  | Agree with Ericsson’s rewording.  |
| Fujitsu | Yes | Agree with Qualcomm. |
| Deutsche Telekom | Yes | Agree with Ericsson and Qualcomm. |
| Intel | Yes |  |
| Samsung | Yes |  |
| AT&T | Reword | Ok with proposals from QC and Ericsson, but prefer to state that enhancements for mobile dual connected IAB nodes are not considered in Rel-18. |
| MITRE | No | We believe DC brings a lot of value to the mIAB node. For the single connection mIAB nodes mounted on high-speed trains, there will be frequent migrations with the short-range (e.g. FR2) stationary IAB donor nodes. Also, the short-range donor node coverage can be quite intermittent along the train route. In such cases, it is beneficial to have dual connectivity for the mIAB node. E.g. an NTN or long-range (FR1) donor can serve as the master node (MN) for the mIAB node which manages the mobility and limits the migration load. The MN can add short-range donors for the mIAB node as the secondary nodes (SN) depending on the availability. MN can also help with the mitigation of interference due to IAB node mobility. By excluding DC in Rel-18, we’re likely excluding simpler migration and interference management solutions.  |

**Summary:**

**11/13** companies believe that mobility of dual-connected IAB-nodes is out-of-scope.

**1/13** company would like to reword this to “enhancements for mobile dual-connected IAB-nodes are not considered in Rel-18”. The moderator believes that we cannot refer to enhancements in this context since there is no baseline mobile dual-connected IAB-node defined.

**1/13** company would like to consider mobility of dual-connected IAB-nodes since it can provide significant performance benefit, especially if a FR2 backhauling is combined with more reliable FR1 or NTN backhauling.

The moderator agrees that DC could provide benefits for mobile IAB-node. However, the mobility of a single-connected IAB-node needs to be understood first before we can expand to dual connectivity.

One company proposed a slight modification to the WID. Such discussions need to be performed in the RAN Plenary.

**Proposal 3:** M**obility of dual-connected IAB-nodes is out of scope.**

## 3.4 Other issues raised

The WID states [1]:

|  |
| --- |
| In Rel-18, mobile IAB supports the following functionality, applicable to FR1 and FR2:* …
* The mobile IAB-node should have no descendent IAB-nodes, i.e., it serves only UEs.
 |

According to R3-224375 (Nokia), RAN3 should wait for RAN2 on the means to prevent the mobile IAB-node to connect to another mobile IAB-node.

**Q4: Do you agree that RAN3 should wait for RAN2 on the means to prevent the mobile IAB-node to connect to another mobile IAB-node?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | Nokia is right in that this functionality needs to be supported. The most obvious solution, i.e., mIAB-DU does not broadcast “IAB-supported”, is in RAN2 scope. |
| **Ericsson** | Yes | This does not seem to be a RAN3 issue. |
| Huawei | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes  |  |
| Fujitsu | Yes |  |
| Deutsche Telekom | Yes |  |
| Intel  | Yes |  |
| Samsung | Yes |  |
| AT&T | Yes |  |
| MITRE | Yes |  |

**Summary:**

Full support.

**Proposal 4: RAN3 to wait for RAN2 on how to prevent the mobile IAB-node to connect to another mobile IAB-node.**

# Discussion - Phase II

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# References

[1] RP-221815, WID on Mobile IAB for NR, 3GPP TSG RAN#96, Budapest, Hungary, June 2022