3GPP TSG-RAN WG3 #114-e R3-215905

Online, 1-11 Nov 2021

Agenda Item: 13.4.1

Source: Nokia (moderator)

Title: Summary of Offline Discussion on CB: # 1307\_IAB\_Res\_Multiplex

Document for: Approval

# Introduction

**CB: # 1307\_IAB\_Res\_Multiplex**

**- Can the WA agreed at RAN3-113e be confirmed?**

**- Can any down selection of Options 1, 2, 3 be done in light of the LS from RAN1?**

**- Any convergence on the information to be exchanged over Xn?**

**- Any need for information to be exchanged over F1?**

(Nok - moderator)

Summary of offline disc [R3-215905](https://ericsson-my.sharepoint.com/personal/filip_barac_ericsson_com/Documents/WORK/3GPP.exe/Meetings/RAN3%23114-e.exe/1.%20IAB/CBs.exe/CB%20%23%201307_IAB_Res_Multiplex/Inbox/R3-215905.zip)

The discussion has two phases:

**Phase 1: Identify potentially achievable agreements for online discussion.**

**Phase 2: TBD**

The deadline for Phase 1 is Thursday, Nov 4th, 23:59:59 UTC. This allows the moderator to prepare some proposals on Friday for Monday’s online session.

The deadline for Phase 2 is the same as for all email discussions, i.e., Tuesday, Nov 9th, 12:00:00 UTC.

# For the Chairman’s Notes

**Propose to capture the following Agreement:**

**…**

# Phase 1 Discussion

## Issue 1: non F1-terminating donor needs to be aware of boundary IAB-DU configuration

Last RAN3 meeting agreed following WA:

WA: The F1-terminating donor of the boundary node forwards the boundary IAB node’s multiplexing info and the boundary IAB-DU’s activated cell list to the non-F1-terminating donor, via following XnAP procedures:

- retrieve UE context procedure,

- handover preparation procedure,

- SN addition procedure,

- MN initiated SN modification procedure

- SN initiated SN modification procedure

Contribution ([2][3][4][6]) propose to confirm the WA.

**Q1-1: Do you agree to confirm the above WA as Agreement?**

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| **Company** | **Comment** |
| **Ericsson** | **Yes.** |
| Lenovo | Agree. |
| Samsung | Prefer to NUA message. However, we can follow majority view. |
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Contribution ([2]) propose to enable XnAP signalling the exchange of the following information pertaining to boundary IAB node:

* Activated cell list.
* H/S/NA resource configurations.
* DL/UL resource configurations.
* Multiplexing info.
* Cell specific signal/channel configurations, including at least: SSB information, CORESET 0, and RACH configurations) from/for different parent nodes.

Contribution ([3]) propose XnAP signaling is enhanced to transfer boundary IAB-DU resource configuration, including TDD configuration, HSNA configuration, cell specific signal/channel configuration from F1-terminating donor to non-F1 terminating donor.

Contribution ([6]) propose XnAP TP to transfer the activated cell list and the multiplexing capabilities between the IAB-DU’s cell and the cells configured on the collocated IAB-MT.

**Q1-2: Please share your view on following information to be exchanged over Xn interface:**

* Activated cell list.
* H/S/NA resource configurations.
* DL/UL resource configurations.
* Multiplexing info.
* Cell specific signal/channel configurations, including at least: SSB information, CORESET 0, and RACH configurations) from/for different parent nodes.

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| **Company** | **Comment** |
| **Ericsson** | **Agree** |
| Lenovo | Agree with the information to be exchanged over Xn interface. All the information above is beneficial for non-F1 termination donor to avoid resource configuration conflict at boundary IAB node. |
| Samsung | Agree |
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Contribution ([3][4]) propose to introduce New XnAP message to transfer updated IAB-DU configurations from the F1-terminating donor to the non F1-terminating donor in inter-donor migration/RLF recovery scenarios. FFS whether UE associated or non-UE associated message is introduced.

**Q1-3: Please share your view on whether need new XnAP procedure to transfer updated IAB-DU configurations from the F1-terminating donor to the non F1-terminating donor in inter-donor migration/RLF recovery scenarios.**

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| **Company** | **Comment** |
| **Ericsson** | **Disagree.** In our view, partial node migration due to load balancing and RLF recovery is a short-term scenario, where updates are unlikely.  Even if there would be a need for configuration update, the updates of descendant node configurations can be done via F1AP, but the updates should not deviate too much from the semi-matched configuration, since that would break the concept of semi-matched configuration. The new CU is responsible for resource allocation of the boundary MT, and any update should not deviate too much from the semi-matched configuration either. That means that, even in this case, **there would be no need to inform the non-F1-terminating donor.**  Note that configuration update in the scenarios of interest here always causes service interruption. |
| Lenovo | Agree with Ericsson that partial migration/RLF recovery is only a short-term case, and it may be revoked after source link has turnback to be available. In addition, source donor CU is unnecessary to update the configuration of boundary IAB-DU since the boundary IAB node does not have the connection to source parent node after migration and its configuration will not be affected by the change of source topology.  Therefore, no need to introduce new XnAP procedure to transfer updated IAB-DU configurations. |
| Samsung | We can discuss this later. |
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In case a new XnAP procedure is needed, contribution ([3]) discusses the further impact when this new XnAP procedure is a UE-associated procedure, or non-UE-associated procedure.

**Q1-4: In case a new XnAP procedure is needed, Please share your view on whether this is a UE-associated (UA) procedure or a non-UE-associated (NUA) procedure.**

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| **Company** | **Comment** |
| **Ericsson** | Support for **configuration update is not needed**, as explained above.  Moreover, the argumentation in [3] is based on releasing or not releasing the context after the release message. Since we cannot mandate node behavior (whether the node shall release the context or not), does it mean that both UA and NUA procedure should be defined for the configuration update? |
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Contribution ([7]) proposes to send a LS to RAN1 to confirm RAN3 agreements:

*the F1-terminating donor needs to transfer the boundary IAB-DU’s cell configurations to the non-F1 terminating donor, which includes H/S/NA resource configurations, DL/UL resource configurations, the multiplexing info, and cell specific signal/channel configurations of boundary IAB-DU’s cells.*

**Q1-5: Please share your view on the reply LS to RAN1 on RAN3 agreement.**

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| **Company** | **Comment** |
| **Ericsson** | **Probably not needed**. We can liaise RAN1 if we need their input for something, but this is for info only. |
| Lenovo | Seems unnecessary. And it can be discussed later after we have made some conclusions on Q1-2. |
| Samsung | Not now. |
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**Summary:**

Suggest following proposal:

**Proposal**

## Issue 2: parent node is aware of boundary IAB-DU cell configurations

Last RAN3 meeting agreed following WA:

WA: parent node is aware of boundary IAB-DU cell configurations via the F1AP GNB-DU RESOURCE CONFIGURATION message

Contribution ([2][3][4][5]) proposed to confirm the WA.

**Q2-1: Do you agree to confirm the above WA as Agreement?**

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| **Company** | **Comment** |
| **Ericsson** | Yes, this is our proposal as well. |
| Lenovo | Agree. |
| Samsung | Yes |
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For RAN1 agreement “In DC scenarios, support per-child MT link-NA resource configuration.” Contribution ([2][4][5]) proposes F1AP signalling to be extended to support per-child MT configuration. Contribution ([5]) proposes Per-child MT link-NA resource configurations can be provided by the donor CU to a parent and child IAB-DU via delta signaling of the time domain configuration in the gNB-DU Cell Resource Configuration which also includes a list of associated child IAB-MT IDs (e.g. gNB-DU UE F1AP ID).

**Q2-2: Please share your view on enhancing F1AP signaling to support per-child MT link-NA resource configuration in DC scenario, and the detail of the enhancement, e.g. includes a list of associated child IAB-MT IDs (e.g. gNB-DU UE F1AP ID).**

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| **Company** | **Comment** |
| **Ericsson** | The proposal is generally OK, but we should discuss this alternative vs. the alternative of reusing the current signaling. Backwards compatibility should also be considered. |
| Lenovo | Since per-child MT link-NA resource configuration has been already agreed by RAN1, F1AP signaling should be enhanced to support it.  As for the detail signaling design, e.g. group signaling of multiple associated child IAB-MTs, can be discussed later after consolidated parameter sent from RAN1. |
| Samsung | Agree to enhance it. The details can be further discussed |
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**Summary:**

Suggest following proposal:

**Proposal**

## Issue 3: support for FDM

Contribution ([2]) propose to wait for RAN1 conclusion.

Contribution ([4]) propose: F1AP signalling to be extended with H/S/NA configurations per RB set to support intra-carrier FDM.

Contribution ([5]) propose: The frequency-domain H/S/NA configuration of an IAB-DU provided by the donor CU can be updated via delta signalling for RB sets in a given slot which have a different H/S/NA resource type from the corresponding time domain H/S/NA configuration in the gNB-DU Cell Resource Configuration.

**Q3: Please share your view on support for FDM, e.g. wait for RAN1, or agree high level aspects, etc.**

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| **Company** | **Comment** |
| **Ericsson** | We proposed to wait for RAN1. For instance, one FDM-related FFS is about having a per-BWP H/S/NA configuration which can have impact on signal design. So, RAN3 is not ready not to start with F1AP discussion about how to signal one/many H/S/NA configuration.  For this meeting we can try to make some high-level agreements based on the RAN1 LS in R3-215793 that provides the higher layer parameters for RAN3 to support. Stage3 however, requires some further consideration. |
| Lenovo | It’s within the scope of RAN1. We need to wait for further inputs from RAN1. |
| Samsung | Wait for RAN1 |
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**Summary:**

Suggest following proposal:

**Proposal.**

## Issue 4: Resource compatibility between the two parents

In RAN3#112-e, RAN3 send a LS to RAN1 asking for RAN1 feedback on IAB resource multiplexing and 3 options:

For scenario 1 and 2, RAN3 considers the following solutions (other solutions are not precluded) for the resource coordination between the parent link and the child link:

* Option 1: The child node’s gNB-DU cell resource configuration is matched to the parent node’s gNB-DU’s resource configuration.
* Option 2: The parent node’s gNB-DU resource configuration is matched to the child node’s gNB-DU’s resource configuration.
* Option 3: A boundary node should connect only to a new parent with which it has a non-conflicting TDD and H/S/NA pattern beforehand.

For Scenario 2, RAN3 considers the following solutions (other solutions are not precluded) for the coordination between two parent links:

* Option 1: The gNB-DU cell resource configuration of the parent node controlled by the F1-terminating donor of the boundary node, is matched to another parent’s gNB-DU’s resource configuration.
* Option 2: The gNB-DU cell resource configuration of the parent node controlled by the non-F1-terminating donor of the boundary node, is matched to another parent’s gNB-DU’s resource configuration.
* Option 3: The secondary leg of a boundary node is established only towards a secondary parent whose H/S/NA configuration is compatible with the H/S/NA configuration of the master parent beforehand.

RAN1 reply LS ([1]) states:

RAN1 note that Option 1 and Option 2 may cause service interruption to child IAB nodes and associated UEs for network topologies without proper resource coordination and Option 3 is very restrictive.

RAN1 notes that all above options are feasible also for semi-matched configurations, where not all DL and UL slots match, albeit with a reduced performance. Additionally, reconfigurations of the parent and/or child resource configurations can align resource configurations before or during the inter-donor migration procedures and after to further align the migrating node(s) with its new parent node.

Contribution ([2]) proposes a modified version of Opt3, i.e., Option 4:

* For Scenario 1, the new parent has more or less compatible configuration with the one that the boundary node had prior to migration. Hence, Scenario 1 will unlikely require major reconfigurations at the boundary node and it descendants upon migration.
* For Scenario 2, the second parent link of the boundary node uses only a subset of resources assigned by the second parent, where this subset is compatible with the resource on the first parent link and the child link.

Contribution ([3][4]) propose option 1 and option 2 are both supported.

**Q4: Please share your view on which option(s) should be selected.**

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| **Company** | **Comment** |
| **Ericsson** | We prefer the abovementioned **Opt4.**  RAN1 LS indicates the **problems with service interruption** for Opt1 and Opt2, and these options should not be agreed because service interruption is a major issue in inter-donor topology adaptation.  Meanwhile, the agreed the semi-matched configuration in RAN1 has made Opt3 less restrictive, which is what we now call **Opt4.**  So, we propose (**Opt4**):   * For Scenario 1 (partial migration), the source and target can use **semi-matched configurations**, as indicated by RAN1 LS – note that in TDD networks the TDD patterns in the entire network are roughly aligned and small local deviations between individual network nodes are present. * For Scenario 2, the portion of resources on the second link that is incompatible with the first link is blanked, as per RAN1 agreement on per-child MT link-NA resource configuration. Please note that the boundary node will still have its first leg up and running and may not need all the resources that the new parent usually provides to its child nodes. |
| Lenovo | Based on the reply from RAN1, all above three options are technical feasible.  But for Option 3, since the time domain resource configuration is too flexible, it will be very difficult to find a target parent node or a second parent node which has a non-conflicting TDD and H/S/NA pattern.  And for Option 1 or Option 2 can be supported with further enhancements on service interruption reduction, if needed. |
| Samsung | Let’s start from option 1 or option 2. |
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**Summary:**

Suggest following proposal:

**Proposal.**

## Issue 5: Synchronous application of the new configuration

Contribution ([2]) propose to discuss how to ensure that the configurations are applied at the same time, in case RAN3 agrees to go for a solution requiring reconfiguration of boundary node. To avoid resource conflict, the new configuration application should be done in a synchronized way.

**Q5: Please share your view on whether RAN3 need to ensure that the configurations are applied at the same time.**

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| **Company** | **Comment** |
| **Ericsson** | **Yes.**  If RAN3 lands at the decision that resource configurations are updated during inter-donor topology adaptation, we need to ensure that they are applied at the same time. Otherwise, we will have a solution with large service interruption. |
| Lenovo | This issue always exists in the cases of reconfiguration of any IAB-MT or IAB-DU. We need to avoid the issue, but it’s left to implementation. |
| Samsung | In general, we could see the benefit of apply the configuration at the same time. However, how to achieve it can be discussed further. Before discussing this, let’s focus on some basic things listed above. |
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**Summary:**

Suggest following proposal:

**Proposal.**

## Any other issues

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# Phase 2 Discussion

# Conclusion, Recommendations

# References

1. R3-214672, Reply LS on IAB resource multiplexing (RAN1) LS in
2. R3-214827, Inter-Donor Resource Coordination in IAB Networks (Ericsson) discussion
3. R3-214928, Discussion on resource multiplexing in IAB (ZTE) discussion
4. R3-215348, Resource multiplexing (Nokia, Nokia Shanghai Bell) discussion
5. R3-215496, Enhancements for IAB resource multiplexing (AT&T) discussion
6. R3-215608, (TP for NR\_IAB\_enh BL CR for TS 38.423) IAB resource multiplexing (Huawei) other
7. R3-215614, [Draft] LS on IAB resource multiplexing (ZTE) LS out To: RAN1 CC: