**3GPP T****SG-RAN WG3 meeting #107-e R3-201146**

**E-meeting, 24 February– 6 March, 2020**

**Agenda Item:** 13.3.1

**Source:** Huawei

**Title:** Summary of offline discussion on CB: # 48\_Email048-IAB\_routing\_AOB

**Document for:** Discussion and Decision

# Introduction

This contribution is to summarize the offline discussion for the following CB:

**CB: # 48\_Email048-IAB\_routing\_AOB**

**- anything in 0760 to be captured/agreed, i.e. not already captured/agreed in other aspects?**

(HW)

Summary of offline disc [R3-201146](file:///D%3A%5CRAN3%5CRAN3-107%5CCBs%5CCB%20%23%2048_Email048-IAB_routing_AOB%5CInbox%5CR3-201146.zip)

The offline assigned by chairman will mainly cover the issues in contribution R3-200760[1], which aims at remaining issues for routing in IAB network. The discussion will be parted in to two phases:

**Phase 1**: Collection of viewpoints on remaining issues.

The deadline for Phase 1 is Tuesday, Feb. 25, 18:00 CET.

**Phase 2**: Concludes agreeable way forward and TP if any.

The deadline for Phase 2 is Thursday, Feb. 27, 18:00 CET.

# Discussion (phase 1)

Based on discussion in previous RAN2&RAN3 meetings, the UL and DL routing across wireless links rely on the routing function in BAP layer, which is configured with one or multiple routing entries. Each routing entry contains a BAP routing ID and a corresponding next hop node, and the BAP routing ID is composed by a BAP address and a BAP path ID. The BAP address in each DL packets indicates the access IAB node. But according to the above agreements, the processing of UL packets in the IAB donor is still FFS. The remaining issues are listed as follows.

## Issue 1: Whether to configure the BAP address to the IAB donor DU?

In RAN2 #108 meeting, we have the following agreement about BAP layer in IAB network [2]:

* *For both UL and DL, The BAP header for Data PDU has a length of 3B, which hold 1 D/C bit, 3 R bits, 10 bits for BAP address, and 10bits for BAP path ID (this overrides earlier agreement).*

For the DL transmission, each IAB node is configured with a BAP address, and the IAB node will use this BAP address to check whether it is the destination of the DL packets in wireless backhaul transmission. Obviously, the UL packet also carries a destination BAP address in the BAP header. And the length of BAP address in UL packet is agreed to be same as in the DL packet. About the UL processing in the BAP entity of IAB donor DU, there are two different options, which are

**Option 1. IAB donor DU always deliver the payload of any received BAP data PDU to upper layer.**

**Option 2, the IAB donor DU check the BAP address in received BAP data PDU and deliver those ones which contains same BAP address as the configured BAP address for the IAB donor DU.**

As shown in the endorsed stage 2 running CR of TS 38.300[3], the BAP entity for UL transmission terminates at the IAB donor DU. And no matter which node the BAP entity locates at, the data transmission modelling of BAP layer should be consistent. From such perspective, option 2 is more reasonable, since the IAB donor DU will use same data transmission model as the DL processing in each IAB node.

Otherwise, if option 1 is agreed, the BAP layer in the IAB donor DU performs a different data transfer modelling, i.e. skipping the BAP address checking step. In addition, in some abnormal case, if IAB donor DU receives some packets which not been forwarded correctly by previous links, option 1 will allow the IAB donor DU still forwarding these packet to upper layers (i.e. the IP layer), and the packets will still be routed in the IP domain of IAB donor DU. If the packets cannot be routed successfully in the IP domain, it will be discarded finally. In such case, it is better to discard these packets by the IAB donor DU before deliver to upper layer to avoid causing useless data forwarding in the IP domain.

Thus, from the rapporteur’s view, option 2 is suggested to be preferred, and it is straightforward that each IAB donor DU should be configured with a BAP address also. Since the BAP address is special for the IAB donor DU, and is not related to any specific child node or UE, non-UE associated F1AP signalling is recommended for such configuration.

However, we still need to collect companies view before get conclusions. Companies are encouraged to provide your views and comments into the tables for each issue list below.

***Q1: Between the above two options, which one do you prefer for UL packet processing in IAB donor DU?***

|  |  |  |
| --- | --- | --- |
| **Company**  | **Preferred option** | **Comments (if any)** |
| Huawei | Option 2 | The data transmission modelling of BAP layer for IAB node should be same as the BAP layer modelling in the IAB donor DU. |
| Samsung  | Option 2 |  |
| Nokia |  | This is in RAN2 scope. 38.340 is unclear on the processing in Donor-DU.  |
| Ericsson | Option 2 |  |
| ZTE | Option2 |  |
| QCOM | See comment | This is a RAN2 issue. |

***Summary for Q1: 4 companies prefer option 2, and 2 companies pointed out that this is RAN2 issue. It seems majority in favour of option 2, however, the rapporteur admits that the BAP operation is RAN2 scope, and will not suggest any potential proposals.***

***Q2: Do you think the IAB donor DU needs to be configured with a BAP address?***

|  |  |  |
| --- | --- | --- |
| **Company**  | **Yes/No** | **Comments (if any)** |
| Huawei  | Yes | IAB donor DU needs to be configured with its own BAP address if option 2 is preferred. |
| Samsung  | Yes  |  |
| Nokia |  |  |
| Ericsson | yes |  |
| ZTE | Yes |  |
| QCOM |  | CB # 43\_Email043-IAB\_Traffic\_at\_Donor\_and\_Intermediate\_nodes already discusses the message to be used to configure the address on the donor DU. Further, RAN2 has decided that they need the address on the IAB-donor DU. This means that we can drop Q2. (fortunately, everybody is in favour anyway). |

***Summary for Q2: All companies who provide valid answer to Q2 expressed the BAP address configuration to the IAB donor DU is necessary. But since RAN2 has agreed such configuration is needed in last online session. We don't need redundant proposal anymore.***

***Q3: What kind of signalling （i.e. UE associated or non-UE associated） is used for configuring BAP address to the IAB donor DU, and whether existing F1AP message or new F1AP message will be used, if your answer to Q2 is Yes?***

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| --- | --- | --- |
| **Company**  | **F1AP type for configuration: UE-associated or non-UE associated; existing ones or new one** | **Comments (if any)** |
| Huawei  |  New, non-UE associated | The BAP address is special for the IAB donor DU, and is not related to any specific child node or UE, non-UE associated F1AP signalling is recommended for such configuration. On the other hand, the BAP address is not useful for intra-donor F1 transmission, new F1AP message special for BAP layer configuration in the IAB donor DU is a better choice.  |
| Samsung  | Non-UE associated  | Slight prefer to existing one.  |
| Nokia | Existing, non-UE associated |  |
| Ericsson | Existing NUA signalling |  |
| ZTE | Existing, non-UE associated | The donor DU’s BAP address can be configured during F1 setup procedure. |
| QCOM |  | Again, this is already capture in CB # 43\_Email043-IAB\_Traffic\_at\_Donor\_and\_Intermediate\_nodes |

***Summary for Q3: All companies who provide valid answer to Q3 expressed the NUA F1AP signalling should be used, and 4 companies in favour of existing procedure while 1 prefer new one. Such configuration detail is also included in the CB #43 in parallel, so the rapporteur suggest to leave the signalling being addressed by CB#43, and no proposal is needed here .***

## Issue 2: The UL BAP address indicates IAB donor CU or IAB donor DU?

The agreements about the definition of BAP address is “*Each BAP address defines a unique destination (unique for IAB network of one Donor, either an IAB access node, or the IAB donor)*” [4]. For upstream destination, it has not been clarified whether the BAP address should identify an IAB donor CU or the IAB donor DU.

There are 3 options for this issue:

**Option 1. The BAP address in UL packets indicates the IAB donor DU**

**Option 2. The BAP address in UL packets indicates the IAB donor CU**

**Option 3. Vague meaning, i.e. no need to clarify which node the BAP address in UL packets indicates.**

At first, option 3 is not a good choice, since anyway the BAP address is used to identify some nodes, and it is too strange to not clarifying what this address means. Among the rest two options, using the BAP address to identify the IAB donor DU is reasonable since the BAP layer based routing will be performed across the wireless BH links, IP based routing will be used for the intra donor routing.

Otherwise, with option 2, i.e. if the BAP address is used to identify the IAB donor CU, each IAB donor DU will be responsible to forward packets with different BAP addresses carried in upstream packets, since the IAB donor CU-CP and IAB donor CU-UPs may have different BAP addresses. In such case, each IAB donor DU needs to be configured with multiple BAP addresses, such redundant configuration is not necessary, since one BAP address is enough for the IAB donor DU’s UL receiving.

Moreover, option 2 may result in another case that different IAB donor DU will be configured with same UL BAP address, and we know that the re-routing operation in intermediate IAB node will only relies on BAP address carried in the packets, then some packets may be re-routed to a different IAB donor DU from the original one, and the packets may be discarded by IAB donor DU or routers through source IP filtering if such mechanism is configured for the intra-donor transmission.

***Q4: Among the above three options of which node the UL BAP address indicates, which one do you prefer?***

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| --- | --- | --- |
| **Company**  | **Preferred option** | **Comments (if any)** |
| Huawei  |  Option 1 | BAP address is used to identify some node, vague value is strange. And option 2 will result in more than one BAP addresses to be configured to the IAB donor DU, which is not necessary. In addition, with option 2, some re-routed packets may be forwarded to another IAB donor DU which is different from the original one, and the packets may be discarded by the different IAB donor DU or other routers if source IP filtering is configured. Option 1 is the most straightforward choice among the three. |
| Samsung  | Option 3 | The IAB donor DU is configured with one or more BAP addresses, and IAB donor DU uses these configured addresses to check each received packets. To our understanding, whether this BAP address is per donor DU/CU/node or not does not have any technical benefit, and everything works well.  |
| Nokia  |  | Option 1 does not work in case of RLF. For example, IAB1 connects to Donor-DU1 and Donor-DU2. The routing ID for F1-U contains the DU1’s BAP address. In case RLF between IAB1 and DU1, the IAB1 will forward the UL data to DU2. Donor-DU2 will discard the UL data since the BAP address in the routing ID is not DU2’s BAP address. This is also related to the question whether the re-routing via different Donor-DU is allowed. This may depend on RAN2 design on the BAP, e.g. 38.340 is unclear on how to handle the UL data in the Donor-DU. This may only require some stage-2 text, so we prefer to wait for RAN2 decision.  |
| Ericsson | Option 1 | The UL traffic via donor DU is not necessarily destined to the donor CU. Also, donor CU stack has no BAP. |
| ZTE | Option 1 | We think donor DU should have a BAP address. Since we agreed to support multiple UL routing paths with multiple donor DUs, the UL data packets of IAB node MT might be routed via different paths or different donor DUs. So the BAP header should include donor DU’s BAP address for UL packet routing purpose. |
| QCOm | Option 3 | This is a configuration matter. The CU can decide how to manage the BAP address pool. There is no specification needed.Nokia has a valid point, i.e., in case of RLF, the packet could be rerouted to a different donor DU. However, the packet carries an incorrect source IP address and may therefore be discarded on the wireline network (due to ingress filtering).  |

***Summary for Q4:***

*3 companies select option 1, i.e. the configured BAP address indicates the IAB donor DU, 2 companies select option 3, i.e. vague meaning, and 3 companies mentioned this question relates to the inter-donor-DU re-routing. So it seems more discussion is needed.*

*The rapporteur think the essence of this problem is whether multiple donor DUs can share same BAP address (e.g. the BAP address indicates the connected CU), if they can, then the inter donor DU re-routing is supported. Otherwise, the inter donor DU re-routing is not supported. Two companies pointed out that the source IP address configuration discussed in issue 3 of CB#44 has impact also, i.e. the intention of introducing source IP address configuration is to avoid the incorrect operation that an IAB node send packet with source IP address 1 to the IAB donor DU2, but IP address 1 is anchored at IAB donor DU1. If the inter-donor DU re-routing is supported, such source IP address configuration is meaningless. Based on the analysis, we can have the following options to make some progress:*

*Option 1.The source IP address configuration is needed, we do not support inter-donor DU re-routing in R16, and the BAP address configured to the IAB donor DU identifies the IAB donor DU in the range of IAB donor CU.*

*Option 2. The source IP address configuration is unneeded, inter-donor DU re-routing can be supported, the BAP address configured to the IAB donor DU identifies the IAB donor CU.*

**Brief Summary for Phase 1 discussion:**

**For Q1, suggest to leave RAN2 handle that, Q2 has been addressed by RAN2’s agreements and Q3 is discussed by CB#43 in parallel, RAN3 only need to focus on Q4 based on the two options in summary part for phase 2 discussion.**

# Discussion for phase 2

According to the summary for phase 1, and the discussion about source IP configuration in CB#44, as well as the suggestion from the email discussion, the issues about the source IP address configuration will moved to be discussed here together with the inter-donor re-routing.

**Issue 1. Source IP address in UL mapping**

In case the source IP address on the UL packet is not consistent with the BAP route specified in the UL mapping, the packet may be subject to ingress filtering on the wireline network since it carries a “foreign” source address.

Besides, Qualcomm mentioned the source IP address selection should consider the Security association, but such mapping relationship is set in the IPsec negotiation phase, rather than configured by the CU. This should follow the legacy IPsec procedure, and we don’t need to touch this issue to make the status of this discussion to be more complicated, unless clear reason is stated.

**Issue 2. Support of UL rerouting to another donor DU in case of RLF**

All donor DUs must have same BAP address to enable donor-DU rerouting, which implies that source IP address on UL packets cannot be mapped to BAP address, but it must be mapped to the full set of UL BAP routing IDs.

In this scenario, the suitable source IP address which is anchored at the right IAB donor DU will be selected based on the BAP routing ID, but if packets is re-routed to another IAB donor DU, it will be discarded if ingress filtering mechanism is activated, and the inter-donor DU re-routing seems meaningless again.

Considering the above issue, the following options can be considered:

**Option 1: We support inter-donor DU re-routing, same BAP address is configured to different IAB donor DUs, the source IP address configuration is unnecessary.**

**Option 2: We do not support inter-donor DU re-routing, the BAP address configured to the IAB donor DU is donor DU specific. The source IP configuration is supported by one of the following methods:**

* **Option 2-1: CU selects source IP address from IP prefix to be used in UL mapping config.**
* **Option 2-2: CU inserts some mapping between UL BAP routing IDs and IP addresses in RRC message.**
* **Option 2-3: CU inserts mapping between IAB donor DU’s BAP address and allocated IP addresses in RRC during IP address allocation to the IAB node.**

In CB#44, there is feedback that some operator has expressed the source IP filtering will be deployed in their wireline network, so option 1 is not a good choice. Option 2-1 will becomes problematic in case the node has multiple IP addresses per donor-DU since the CU would not know which of those it should select for the UL mapping; Option 2-2 seems over designing since we only need to ensure the packet sends to right donor DU use suitable IP address; Option 2-3 is simple and good enough to avoid choosing unsuitable source IP address.

Therefore, we suggest the following two proposals:

**Proposal 1: Inter-donor DU re-routing is not support, the UL BAP address is donor DU specific.**

**Proposal 2: CU inserts mapping between IAB donor DU’s BAP address and IP addresses for IAB node in RRC during IP address allocation to the IAB node.**

We may need to prepare LS to RAN2 to inform them about Proposal 2 since there is RRC impact. This will be addressed after we have conclusion to agree P2.

***Companies are encouraged to share your view point on the above two Proposals.***

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| --- | --- | --- |
| **Company**  | **Agree/Disagree** | **Comments (if any)** |
| Huawei  | Agree P1 and P2 |  |
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Besides, since the discussion relates to the discussion

# Summary

To be added.

# Reference

1. R3-200760, Remaining issues for routing in IAB network. Huawei.
2. Chairman notes of 3GPP RAN WG2 #108 meeting.
3. R2-1916641, Running CR of TS 38.300 for IAB.
4. Report of the 3GPP RAN WG2 #106 meeting.