3GPP TSG-RAN WG2 #109-e R2-2000740

Online, February 24th– March 6th 2020

Agenda Item: 6.1.1

Source: Ericsson

Title: Email discussion [108#46][IAB] Feature List

Document for: Discussion, Decision

# 1 Introduction

This document contains email discussion:

* [108#46][IAB] Feature List (Ericsson)

 **Intended outcome:**

 **Deadline**: 2020-01-30

The discussion is divided into three parts. The first part aims at identifying and agreeing on the IAB feature list as well as the feature groups for each feature and then the components for each feature group. The second part aims at discussing the mandatoriness of each of the agreed feature/feature groups/components. The last and third part of the email discussion focuses on Rel-15 features. Companies can provide comments about UE features that may or may not be mandatory for IAB nodes. This third part is, however, outside the scope of this email discussion and its only purpose is to faciliate the discussions which may come in RAN2#109.

For the first phase, the rapporteur suggests a deadline the **2020-01-21**. After this date, the rapporteur will compile the outcome and will trigger phase 2 and phase 3.

# 2 Discussion

## Phase 1: Identification of IAB feature list

The purpose of this phase is to identify the Rel-16 IAB feature capability list, feature groups, and components for a given feature group. For this purpose, the rapporteur has compiled a possible list of feature capabilities, feature groups, and components for Layer 1, Layer 2-3, and RF and RRM (see below).

Release 16 IAB-MT feature list

Layer-1 IAB features

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Field name in TS 38.331 [2]** | **Parent IE in TS 38.331 [2]** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Note** | **Mandatory/Optional** |
| 0. IAB initial access and mobility | 0-0 | Extension of RACH occasions and periodicities for backhaul RACH resources | 1) prach-ConfigurationPeriodScaling2) prach-ConfigurationFrameOffset3) prach-ConfigurationSOffset |  |  |  |  |  |  |  |
|  | 0.1 | Extensions of SSBs for inter-IAB-node discovery and measurements | 1) ssb-MTC |  |  |  |  |  |  |  |
| 1. IAB scheduling | 1.0 | Resource multiplexing | 1) slot format indication2) resource availability indication3) Guard symbol indication |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 2. IAB synchronization  | 2.0 | Mechanism to support the “case-1” OTA timing alignment | 1) T\_delta |  |  |  |  |  |  |  |

Layer-2 and Layer-3 features

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Field name in TS 38.331 [2]** | **Parent IE in TS 38.331 [2]** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Note** | **Mandatory/Optional** |
| 0. BAP Layer | 0.0 | Basic procedures | 1) Routing2) Bearer mapping3)… |  |  |  |  |  |  |  |
|  | 0.1 | HbH flow control |  |  |  |  |  |  |  |  |
|  | 0.2 | RLF handling |  |  |  |  |  |  |  |  |
| 1. PDCP | 1.0 | DRB handling |  |  |  |  |  |  |  |  |
| 2. RLC  | 2.0 |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 3. MAC | 3.0 | Scheduling | Pre-BSR |  |  |  |  |  |  |  |
|  | 3.1 | bearer mapping | LCID extension |  |  |  |  |  |  |  |

4.3 RF and RRM features

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Field name in TS 38.331 [2]** | **Parent IE in TS 38.331 [2]** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Note** | **Mandatory/Optional** |
| 0. | 0-0 |  |  |  |  |  |  |  |  |  |

### Layer 1 IAB features

**Question 1 – Are there any feature group/components missing or not need in feature “0. IAB initial access and mobility”?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
|  |  |  |
|  |  |  |
|  |  |  |

**Question 2 – Are there any feature group/components missing or not need in feature “1. IAB scheduling”?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
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|  |  |  |
|  |  |  |

**Question 3 – Are there any feature group/components missing or not need in feature “2. IAB synchronization”?**

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| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
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|  |  |  |
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**Question 4 – Are there any other missing feature?**

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| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
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**Rapporteur’s summary:**

Companies responded to this part of the email discussion without replying/filling in the suggested survey.

Thus, the conclusions are based on the informal responses companies provided via the email reflector.

Several companies suggested not to discuss L1 features/capabilities since RAN1 is discussing capabilities. Hence, there are no RAN2 conclusions in this part of the email discussion.

The rapporteur suggests the following way forward:

1. RAN2 does not discuss L1 a feature/capability support. RAN2 specific issues e.g. how capabilities are signalled, can be discussed after RAN1 concludes on the L1 features.

### Layer 2-3 IAB features

**Question 1 – Are there any feature group/components missing or not need in feature “0. BAP layer”?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
|  |  |  |
|  |  |  |
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**Question 2 – Are there any feature group/components missing or not need in feature “1. PDCP”?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
|  |  |  |
|  |  |  |
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**Question 3 – Are there any feature group/components missing or not need in feature “2. RLC”?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
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**Question 4 – Are there any feature group/components missing or not need in feature “3. MAC”?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
|  |  |  |
|  |  |  |
|  |  |  |

**Question 5 – Are there any other missing feature?**

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| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
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**Rapporteur’s summary:**

Companies responded to this part of the email without filling in the suggested survey.

So, the conclusions are based on the informal responses companies provided via the email reflector.

1) Companies showed concern on feature 1. PDCP, DRB handling. One company indicated that DRB handling for O&M is optional (RAN3 agreement) and, thus, it is up to the MT to support such type of configuration or not. Other companies were not aware of such an agreement or disagree that this is a capability for the MT.

2) Another company pointed out that “IP assignment over RRC” was missing from the feature list.

The rapporteur suggests the following way forward:

1. RAN2 to discuss whether the PDCP DRB handling is a feature/capability to support for the MT, or it is a feature that the MT must implement.
2. RAN2 to discuss whether “IP assignment over RRC” is to be introduced as a capability and if it can be part of the feature “0. BAP layer”.
3. Agree on the other features/feature groups/components.

Given the feedback, it seems that further discussion is needed, and hence the rapporteur suggests:

Proposal 2a: Discuss and agree if a “dummy” DRB is needed or if RRC needs to be updated to capture the case in which no DRB is set up for IAB. Note that this decision could affect RAN3.
Proposal 2b. if a “dummy” DRB is not needed, discuss and agree if PDCP must implement all related DRB functionality, or if it is optional.

**Proposal 3a: RAN2 to discuss whether “IP assignment over RRC” is to be introduced as a capability and if it can be part of the feature “0. BAP layer”.**

**Proposal 3b: Discuss whether “F1AP over LTE leg signaling for EN-DC IAB-MT” is a capability (if it is optional), and the feature/feature group in which it needs to be added.**

**Proposal 4:** **Discuss whether other features are missing and whether they should be placed in the feature list.**

It is encouraged to provide contributions to elaborate on the thinking and reasons.

### RF and RRM features

At the time of writing, the rapporteur has not identified any RF/RRM features for IABs. However, this may change as RAN4 progresses their work.

**Question 1 – Are there any missing features/feature/group/components?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer (Yes/No)** | **Comments**  |
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**Rapporteur’s summary:**

No response was received on this part of the email discussion.

## Phase 2: Discussion on mandatoriness of the IAB feature list

Feature 0. BAP Layer:

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| --- | --- | --- |
| Company | Feature group/component | Comments and justification |
| Nokia | 0.0 (Basic procedures) | Mandatory for IAB-MT as an IAB node cannot work without these features. |
| Samsung | Mandatory. |
| Ericsson | This feature group should be mandatory for a IAB node (conditional mandatoriness) and should be signalled. |
| Futurewei | Mandatory |
| CATT | Mandatory |
| ZTE | Mandatory |
| Huawei | Mandatory |

(copy+paste the figure above in case of adding comments on a different feature group/component)

**Summary:**

Companies did not express their position on the signalling. However, the rapporteur proposes that all features are signalled regardless of whether they are mandatory or not.

**Proposal 5: The BAP layer feature group is mandatory supported with capability signalling.**

Feature/feature group/component 0:

|  |  |  |
| --- | --- | --- |
| Company | Feature group/component | Comments and justification |
| Nokia | 0.1 (HbH flow control) | Optional for IAB-MT as it is an optimization and existing E2E flow control may be sufficient in some cases. |
| Samsung | Agree with Nokia that normally (in a single-vendor network) flow control and RLF notification can be optional. However a node should be able to interpret a flow control message from the node from another vendor, although it is not required to act on it.Another alternative is to rely on operating such a multi-vendor network according to the minimum supported set of features across all nodes. |
| Ericsson | For IAB node, this should be optional and shoud be signalled. |
| Futurewei | We agree with Samsung in that an IAB node (IAB-DU) is not required to act on flow control signals, and we have agreed that it is configurable (at least to the MT). In other words, if an operator does not want to use this feature, they can simply not enable it.So, we wonder if there is really any significant value to make this optional for the IAB-MT. The effort needed to support generating/sending flow control reports from the MT does not seem that significant.Having said that, we do not have a strong opinion on this. If there is a strong majority of companies that believe that this feature should be optional for the IAB-MT, that would also be acceptable to us. |
| CATT | Optional for IAB node. |
| ZTE | We also think this feature can be optional. |
| Huawei | Optional for IAB MT.We should have separate sub-features for flow control, i.e. option 1: BH RLC channel based, and option 2: routing ID based, according to the RAN2#108 meeting agreement. |

**Summary:**

**Proposal 6a: RAN2 discusses if the feature group is divided into two components:**

 **1) BH RLC channel based**

 **2) routing ID based**

**Proposal 6b: HbH flow control** **is optionally supported for IAB nodes with capability signalling.**

|  |  |  |
| --- | --- | --- |
| Company | Feature group/component | Comments and justification |
| Nokia | 0.2 (RLF handling) | Optional for IAB-MT, since it is just an optimization and there are other, existing, means to detect RLF or radio link issues. |
| Samsung | Same reasoning as for flow control. |
| Ericsson | Same reasoning as for flow control. |
| Futurewei | We are not very clear what was meant by the mandatoriness of “RLF handling” here? There is RLF handling at the node that detects the BH RLF (and generates the indication), and there is handling by the node that receives the indication from another node.Is the intent to ask if it is madatory for the BAP layer of an IAB node detecting a RLF to generate the BH RLF indication?Or if it is madatory for the BAP layer of the IAB node receiving a BH RLF indication to pass this indication to RRC?Of can the RRC of an IAB node receiving a BH RLF indication from the BAP layer, simply ignore (not act upon) the BH RLF indication?We think it is better to clarify the intent first so that everyone has a common understanding. |
| CATT | Optional for IAB node. |
| ZTE |  | We think it would be better to rephrase this feature as “RLF notification to child IAB node”. This RLF notification can be optional.  |
| Huawei | The RLF detection and handling as in R15 should be mandatory.The BH RLF **notification/indication** handling, introduced in IAB, should be optional. |

**Summary:**

RLF handling in BAP is only about the BAP indications and actions upon receiving such indications. It is not related to the legacy (RRC-specified) RLF.

**Proposal 7:** **RLF handling is optionally supported for IAB nodes with capability signalling.**

Feature/feature group/component 1:

|  |  |  |
| --- | --- | --- |
| Company | Feature group/component | Comments and justification |
| Ericsson | 1.0 | This feature group should be optional as it is optional to configure DRBs just for O&M. It should be signalled. |
| Futurewei | As indicated in our comment to Proposal 2, our understanding is that the IAB-MT anyway should support PDCP handling for SRBs. So we are not sure there is much value to make it optional specifically for DRBs. |
| ZTE | We agree with Futurewei in this respect. Anyway IAB-MT need to support PDCP handling. It is meaningless to stress whether the DRB PDCP is optional or not.  |
| Huawei | See our comments in Proposal 2. |

**Summary:**

This is related to Proposal 2.

Feature/feature group/component 3:

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| --- | --- | --- |
| Company | Feature group/component | Comments and justification |
| Nokia | 3.0 (Scheduling, pre-BSR) | Optional for IAB-MT, since it is possible to rely on existing BSR as well. |
| Samsung | Same reasoning as flow control/RLF notification – we see support for this as mandatory but its use can however be optional (configurable) of course. |
| Ericsson | Optional. |
| Futurewei | Similar view as for the flow control feature. We think the value of making pre-BSR optional for the IAB-MT seems a bit questionable, as long as it is configurable. However, if there is a strong majority view to make it optional, we can agree. |
| CATT | Optional for IAB-MT |
| ZTE | Optional |
| Huawei | Optional for IAB-MT |

**Summary:**

**Proposal 8:** **Pre-BSR is optionally supported for IAB nodes with capability signalling.**

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| --- | --- | --- |
| Company | Feature group/component | Comments and justification |
| Nokia | 3.1 (Bearer mapping, LCID extension) | Optional for IAB-MT as might not be needed in all deployments. |
| Samsung | Optional. |
| Ericsson | Optional. |
| Futurewei | Agree with Nokia, Samsung, and Ericsson that LCID extension can be optional. However, I’m not sure what is meant by “Bearer mapping” being optional here. My understanding is that bearer mapping occurs between BAP and BH RLC layers, so the relationship to MAC was not totally clear to me. Perhaps this could be clarified. |
| CATT | Optional for IAB-MT |
| ZTE | The feature of LCID extension should be optional. |
| Huawei | Optional for IAB-MT.But we are not sure the “bearer mapping” is a good wording, as it is also used in feature group 0-0. Maybe we just call it “backhaul logical channel” since here we only talk about the MAC layer. |

**Summary:** The rapporteur would like to clarify that “bearer mapping” (feature group) is related to the LCID extension (component). The rapporteur is open to change the name to avoid confusion.

**Proposal 9: LCID extension for BH logical channel is optionally supported for IAB nodes with capability signalling.**

## Phase 3: Discussion on Rel-15 UE mandatoriness for IAB-MT

In this phase, the rapporteur suggests to all companies to review the Release 15 features which were mandatory for a UE and comment on those which may/might not apply to IAB-MTs. The rapporteur will provide a summary and proposed ways forward when possible. In any case, a discussion can be taken during the RAN2 meeting.

The rapporteur suggests using one table for each feature/feature group/component so companies can share their views and thoughts with others.

Feature/feature group/component 0:

|  |  |  |
| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Ericsson | 0.0, 2) SCG DRB with NR PDCP | Though the DC concept applies to IAB, it is only for setting up MCG and SCG cell groups and not for the radio bearers (radio bearers still terminate at the UEs and IAB-donor CU). |
| Huawei | Generally, this is one optional capability with signalling for R15 UE. If IAB implementation does not support/apply this, IAB can just indicate “not support“. There is no need to discuss this and we can consider it is same as for Rel-15 UE. Besides, the DRB for OAM could use SCG DRB. |
|  |  |
|  |  |

Feature/feature group/component 0:

|  |  |  |
| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
|  | 0.31) Maximum number of DRBs2) Split DRB with one UL path 3) Split DRB with both UL MCG and SCG paths | Like the SCG DRB, split DRB is not needed for IAB as the IAB DC connectivity is not for the IAB (i.e., IAB-MT) own traffic but for forwarding UE bearers. Similarly, an IAB node may have a DRB for the OAM traffic if the network is using the PDU session for OAM, however, apart from this, there is no need to support more DRBs. |
| Futurewei | Our understanding is that support for split SRB and split DRB at the IAB-MT would anyway be captured as part of PDCP-ParametersMRDC.So is there something that Ericsson thinks needs to be done beyond the Rel. 15 UE Capabilities in this regards?  |
| CATT | Same as for Rel-15 UE. In principle, we think IAB-MT can follow all the Rel-15 UE features, which is simple way to implementation. |
| Huawei | Generally, 2) and 3) are optional capability with signalling for R15 UE. If IAB implementation does not support/apply this, IAB can just indicate “not support“. There is no need to discuss this and we can consider it is same as for Rel-15 UE. We also see no need to change the 1) compared to R15 UE. |
|  |  |

Feature/feature group/component 0:

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| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Ericsson | 0.5 IMS voice | Voice calls not applicable to IAB nodes. |
| Huawei | Generally, this is one optional capability with signalling for R15 UE. If IAB implementation does not support/apply this, IAB can just indicate “not support“. There is no need to discuss this and we can consider it is same as for Rel-15 UE.  |
|  |  |
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Feature/feature group/component 1:

|  |  |  |
| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Nokia | All1.0 Basic PDCP procedures | Same as for Rel-15 UE. |
| Samsung | Same as for Rel-15 UE. |
| Ericsson | PDCP procedures related to DRB should be optional (in the context of the suggested Rel-16 capability). A DRB may be used for OAM traffic, but that is only if the network decides to do so. There is another alternative to handle OAM traffic, i.e., via the IP connectivity that is established in step 2 of the IAB integration procedure. |
| Futurewei | Same as for Rel-15 UE  |
| CATT | Same as for Rel-15 UE. |
| Huawei |  | Same as for Rel-15 UE.The basic PDCP procedures should be mandatory for SRB case. |

Feature/feature group/component 2:

|  |  |  |
| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Nokia | All | Same as for Rel-15 UE. |
| CATT | Same as for Rel-15 UE. |
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Feature/feature group/component 3:

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| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Nokia | All3.3 DRX | Same as for Rel-15 UE. |
| Ericsson | Optional. An IAB node doesn’t have the power limitations of a UE (i.e. it will not be operating on a battery) and as it is also aggregating traffic of many UEs, expected to have traffic most of the time as compared to a UE that can have very intermittent traffic. |
| CATT | Same as for Rel-15 UE. |
|  |  |

Feature/feature group/component 4:

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| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Ericsson | 4.5 ANR | Optional. In general, an IAB node will not be mobile and thus will have limited use in helping the network build-up neighbor relation tables, which is the main purpose of ANR. |
| Futurewei | I’m not sure about this comment from Ericsson. I can envision that ANR may be a very useful feature to support on an IAB node, even if not mobile. Probably this warrants more discussion, and perhaps getting operational view from network operators. |
| Huawei | Generally, this is one optional capability with signalling for R15 UE. If IAB implementation does not support/apply this, IAB can just indicate “not support“. There is no need to discuss this and we can consider it is same as for Rel-15 UE.  |
|  |  |

Feature/feature group/component 5:

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| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Ericsson | SDAP | Not applicable. See comments about DRBs above (at most one DRB for OAM traffic, so no need for SDAP which is needed for mapping between QoS flows and DRBs). |
| Huawei | Even only with one DRB and one QoS flow, the procedure is needed anyway, |
|  |  |
|  |  |

Feature/feature group/component 6:

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| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
| Ericsson | Inactive | Not applicable. Similar to the comment on DRX, an IAB node is not battery operated and aggregating traffic from many UEs, so the inactive state is not relevant. |
| Huawei | Generally, this is one optional capability with signalling for R15 UE. If IAB implementation does not support/apply this, IAB can just indicate “not support“. There is no need to discuss this and we can consider it is same as for Rel-15 UE.  |
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(copy+paste the figure above in case of adding comments on a different feature group/component)

Feature/feature group/component X:

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| --- | --- | --- |
| Company | Feature/feature group/component | Comments and justification |
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(copy+paste the figure above in case of adding comments on a different feature group/component)

**Summary:**

The rapporteur understands that companies asked for more details and clarifications in some cases. Therefore, it is suggested that this discussion happens during the upcoming RAN2 meeting and recommends companies to submit contributions on this topic to explain and elaborate their viewpoint.

# 3 Summary

In this section, the rapporteur provides all the proposals. Individual summaries are given in the different subsections.

**Proposal 1: RAN2 does not discuss L1 a feature/capability support. RAN2 specific issues e.g. how capabilities are signalled, can be discussed after RAN1 concludes on the L1 features.**

**Proposal 2a: Discuss and agree if a “dummy” DRB is needed or if RRC needs to be updated to capture the case in which no DRB is set up for IAB. Note that this decision could affect RAN3.**

**Proposal 2b: if a “dummy” DRB is not needed, discuss and agree if PDCP must implement all related DRB functionality, or if it is optional.**

**Proposal 3a: RAN2 to discuss whether “IP assignment over RRC” is to be introduced as a capability and if it can be part of the feature “0. BAP layer”.**

**Proposal 3b: Discuss whether “F1AP over LTE leg signaling for EN-DC IAB-MT” is a capability (if it is optional), and the feature/feature group in which it needs to be added.**

**Proposal 4: Discuss whether other features are missing and whether they should be placed in the feature list.**

**Proposal 5: The BAP layer feature group is mandatory supported with capability signalling.**

**Proposal 6a: RAN2 discusses if the feature group is divided into two components:**

 **1) BH RLC channel based**

 **2) routing ID based**

**Proposal 6b: HbH flow control is optionally supported for IAB nodes with capability signalling.**

**Proposal 7: RLF handling is optionally supported for IAB nodes with capability signalling.**

**Proposal 8: Pre-BSR is optionally supported for IAB nodes with capability signalling.**

**Proposal 9: LCID extension for BH logical channel is optionally supported for IAB nodes with capability signalling.**