**3GPP TSG RAN WG2 Meeting #116bis-e R2-220xxxx**

Electronic meeting, 17th – 25th Jan 2022

Agenda Item: 8.4.3

Source: Intel Corporation (Rapporteur)

Title: Summary of discussion [AT116bis-e][051][eIAB] UE Caps (Intel)

Document for: Discussion and Decision

# Introduction

This document captures the following discussion:

* [AT116bis-e][051][eIAB] UE Caps (Intel)

Scope: Attempt offline agreements of proposals in R2-2201689, can also capture open issues and FFSes.

Intended outcome: Report, agreements, open issues.

Deadline: EOM (hopefully all offline).

The discussion consists of two phases, Phase 1 and Phase 2, and the deadline of each phase is given below:

Phase 1: to agree on easy agreement and attempt to discuss further details of open issues, Deadline: Friday Jan 21 0900UTC

Phase 2: to formulate agreeable proposals and capture open issues and FFSes for offline agreement, Deadline: EOM

## **Contact**

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates who provide input to provide their contact information in this table:

|  |  |
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|  |  |

# Discussion

### RAN1/RAN4 related UE Capabilities

For RAN1 and RAN4 eIAB related feature list and UE capabilities, based on RAN2-116e meeting agreement:

|  |
| --- |
| For Rel17 NR UE caps:   * Aim to Work on mega CRs (one mega CR for TS38.306 and one for TS38.331) to incorporate all RAN1/RAN4 feature groups. ​There could be exceptions, case by case. |

It is proposed to work on eIAB feature list and UE capabilities in mega CR in [7]. Rapporteur would like to point out that, RAN1 related eIAB UE capabilities in [8] is captured in the mega CR [9] and [10], which will be discussed in [AT116bis-e][017][NR17] UE caps main (Intel). Companies are welcome to review and discuss RAN1 feature list of eIAB in AI 8.0.2.

**Observation 1: R17 eIAB RAN1/RAN4 feature groups and UE capabilities are discussed together with mega CR in [AT116bis-e][017][NR17] UE caps main (Intel).**

### LCG Extension

Based on contribution [1][2][3][4][5], a UE capability for LCG extension is proposed as optional UE capability for IAB-MT in [7]. In RAN2 #116e meeting, it was agreed that LCG extensions is supported as an optional capability and captured in the running CR R2-2111604 [11] under parent IE *MAC-ParametersCommon*. It is proposed to confirm previous RAN2 agreement to define a new UE capability for LCG Extension in [7].

**Proposal 1 [already agreed]: Confirm to define a new UE capability for LCG Extension in *MAC-ParametersCommon* as optional UE capability for IAB-MT.**

#### **Q1. Do you agree with Proposal 1 on UE capability for LCG Extension?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| LGE | Y |  |
| Huawei, HiSilicon | Y |  |
| Samsung | Y |  |
| Ericsson | Y |  |
| Nokia | Y |  |
| Qualcomm | Y |  |
| vivo | Y |  |
| Lenovo | Y |  |
| Apple | Y |  |
| Futurewei | Y |  |
| ZTE | Y |  |
| NEC | Y |  |
| Intel | Y |  |

Additionally, it is also proposed in [1][3] also propose to define a new feature group for LCG extension. Rapporteur also notice that there’s no suitable feature group defined in Rel-16 IAB can be used for LCG extension. Hence, it is proposed to define a new feature group for LCG extension in TS38.822.

#### **Q2. Do you think a new feature group needs to be defined for LCG extension in TS38.822?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| LGE | Y |  |
| Huawei, HiSilicon | Y | The new FG is because this is R17 eIAB, which will captured in different section with R16 IAB. |
| Samsung | Need clarification | Is the question asking if we need a new FG, as opposed to just a component of another FG (or no related FG at all)? (This is our understanding of the question.)  Or is the question asking how to capture this new Rel-17 feature, assuming it is indeed a separate FG? (This seems to be Huawei’s understanding.) |
| Ericsson | - | How to handle this Technical Report has been discussed at plenary. We recall an agreement that only the rapporteur should update this specification. We can leave it to the rapporteur to decide if/when this should be captured. We do not think it is a critical issue to keep this Technical Report up-to-date. |
| Nokia | Y | We share the understanding there is no suitable feature group defined in **Rel-16 IAB** |
| vivo | Y |  |
| Lenovo | Y |  |
| Apple | Y |  |
| Futurewei | Y |  |
| ZTE | Y |  |
| NEC | Y |  |
| Intel | Y | New feature group (different FG defined in Rel-16 IAB) need to be defined. |

### Type-2 and Type-3 RLF Indication

It is proposed in [1][4][5] to define UE capabilities for BH RLF detection indication and BH RLF recovery indication. However, it is not clear whether to use single UE capability or separate UE capabilities for both RLF indications. [5] considers it as single UE capability, as it is unlikely that only one of type 2 and type 3 BH RLF indication is supported by IAB-MT. [1] and [4] considers it as two separate UE capabilities.

Besides, all contributions propose to consider UE capability for BH RLF detection and recovery indication as optional UE capability for IAB-MT.

Based on above, here are two proposed options:

Option 1: Single UE capability for BH RLF detection and recovery indication.

Option 2: Two UE capabilities. One UE capability for BH RLF detection indication, another UE capability for BH RLF recovery indication

#### **Q3. Which option do you prefer to define an optional UE capability for Type-2 and Type-3 RLF indication?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/Option 2 | Comment |
| LGE | Option1 | They are not independent capabilities. It is strange to support type2 only or type3 only. |
| Huawei, HiSilicon | Option 1, but | We need to clarify why this capability is need. How can CU use this capability? To configure what based IAB-MT’s capability?  We understand that type2/3 indication is not configurable. |
| Samsung | Option 1 | Same as LGE, we think these are not two independent UE capabilities (in practice). |
| Ericsson | Option 1 | Even if it will be agreed that the NW cannot configure the type 2/3, this capability is useful for the NW to know that certain temporarily topology changes, due to local routing, may occur at the child, since this IAB-MT is supporting type2/3 transmission. |
| Nokia | Option 1, but | It might be too premature to decide, as RLF Type-2 and Type-3 principles are not finalized yet.  Though, we believe one capability bit (Option 1) can be assumed for now, as RLF Type-3 will be dependant on RLF Type-2. The RLF Type-3 functionality is complementary and follow-up for the RLF Type-2 indicator. The one capability bit could relate to a feature group that could have further split into components (e.g. RLF Type-2 and RLF Type-3). |
| Qualcomm | Option 1 | Same as LGE |
| vivo | Option 1 | Triggering, transmission and reception of Type 2 and Type3 indications are coupled capabilities. |
| Lenovo | Option 1 | Agree with LGE. |
| Apple | Option 1 | Agree with LGE. |
| Futurewi | Option 1 |  |
| ZTE | Option 1 | it is unlikely that only one of type 2 and type 3 BH RLF indication is supported by IAB-MT. If type 2 BH RLF indication is supported by the IAB-MT, type 3 BH RLF indication needs to be supported as well. And if type 3 BH RLF indication is supported by the IAB-MT, type 2 BH RLF indication needs to be supported as well. Therefore, we suggest that one capability needs to be defined for type 2/3 BH RLF indication and it’s optional for R17 IAB-MT. |
| NEC | Option 1 | Same view with LGE |
| Intel | Option 1 | Agree with Ericsson. Although network may not configure type-2/3 RLF indication, IAB-donor CU still need to configure re-routing path for local re-routing, which can be triggered by type-2 RLF indication. Also, such local rerouting behaviour needs to be visible to IAB-donor CU. |

[1][3] propose to define a new feature group for new RLF indication introduced in R17, i.e. RLF detection indication and RLF recovery indication. It was also proposed by ZTE during pre-meeting email discussion [Pre116bis][004] that it is possible to reuse feature group defined in Rel-16 for new UE capabilities, e.g. RLF handling.

Based on above, here are two proposed options for type-2/3 RLF indication feature group:

Option 1: Define a new feature group ‘BH RLF detection and recovery indication’.

Option 2: Reuse Rel-16 feature group ‘RLF handling’, where BH RLF detection indication and recovery indication are added as component to this feature group, together with type-4 RLF indication in Rel-16.

#### **Q4. Which option do you prefer as feature group for Type-2 and Type-3 RLF indication?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/Option 2 | Comment |
| LGE | Option 2 | Both options are fine. No strong view. |
| Huawei, HiSilicon | Option 1 | The new FG is because this is R17 eIAB, which will captured in different section with R16 IAB in 38.822. |
| Samsung | Option 2 | Our understanding of ‘reuse Rel-16 FG’ is that the same approach will be adopted for the relevant Rel-17 FG (with additional components). So we are not really sure if these two options are any different from each other? |
| Ericsson | - | How to handle this Technical Report has been discussed at plenary. We recall an agreement that only the rapporteur should update this specification. We can leave it to the rapporteur to decide if/when this should be captured. We do not think it is a critical issue to keep this Technical Report up-to-date. |
| Nokia | - | This maybe matter of specification modelling. Currently, TS38.822 list Rel-16 features as separate sections. In case, the Option 2 is used, we wonder if the section is going to be Rel-17 specific? IN any case we uderstand Rel-17 features (groups) for NR\_IAB\_enh-Core have to be defined. Then bot options work: Option 1 and Option 2 |
| vivo | Option 2 | It seems Option2 gives better flexibilities. No strong view. |
| Lenovo |  | No strong view. |
| Apple | Option 1 | Same understanding as Huawei. |
| ZTE | Option 2 | To define new feature components in existing feature groups is enough. |
| NEC |  | No strong view |
| Intel |  | Both options could work. |

### F1-C transfer in NR-DC

In [1][2][3][4][5], it is proposed to define a new optional UE capability for CP/UP separation. As for the field name, following options are proposed in [1][4][5]

Option 1: *f1c-OverNonF1TerminationNode*

Option 2: *f1c-OverNRRRC*

Option 3: *f1c-OberNRAccessLink*

Rapporteur thinks all above options are ok. Hence, it is proposed in [7] to use Option 2, which is similar naming as EN-DC scenario.

#### **Q5. Do you agree to define an optional UE capability ‘*f1c-OverNRRRC*’ for IAB-MT CP/UP separation?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| LGE | Y |  |
| Huawei, HiSilicon | Y | => f1c-OverNR-RRC |
| Samsung | Y |  |
| Ericsson | Y |  |
| Nokia | Y |  |
| Qualcomm | Y | Prefer “OverNR-RRC”. Otherwise, it looks like a typo. |
| vivo | Y |  |
| Lenovo | Y |  |
| Apple | Y | Slightly prefer Option 1 as as a name to more intuitively identify the access link when there is NR-DC also considering that this will be defined under NR-DC parameters in 38.306. But option 2 is fine as well, no strong view (and it should be f1c-OverNR-RRC). |
| ZTE | Y | No strong view. |
| NEC | Y |  |
| Intel | Y |  |

As for the feature group, since there’s no suitable existing feature group for IAB defined in Rel-16, it is proposed in [7] to define a new feature group for CP/UP separation.

#### **Q6. Do you agree to define a new feature group for F1-C over NR RRC?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| LGE | Y |  |
| Huawei, HiSilicon | Y |  |
| Samsung | Y |  |
| Ericsson | - | How to handle this Technical Report has been discussed at plenary. We recall an agreement that only the rapporteur should update this specification. We can leave it to the rapporteur to decide if/when this should be captured. We do not think it is a critical issue to keep this Technical Report up-to-date. |
| Nokia | Y |  |
| vivo | Y |  |
| Lenovo | Y |  |
| Apple | Y |  |
| ZTE | Y |  |
| NEC | Y |  |
| Intel | Y |  |

As for the parent IE of CP/UP separation UE capability, two options are summarized based on contributions [1][2][4][5]:

* MR-DC parameter (included in *GeneralParametersMRDC*) [4]
* UE-NR-Capability [1][5]

Recalling F1-C transfer in CP/UP separation is defined for NR-DC scenario 1 and scenario 2, [1] further proposes to include this new UE capability as a separate capability in NR-DC, i.e. *NRDC-Parameters* as its parent IE.

Based on above summary, following options as the parent IE for this UE capability is proposed as below:

Option 1: *GeneralParametersMRDC* under *UE-MRDC-Capability*

Option 2: *NRDC-Parameters* under *UE-NR-Capability*

#### **Q7. Which option do you prefer as parent IE for UE capability ‘*f1c-OverNRRRC*’?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/Option 2 | Comment |
| LGE | Option2 |  |
| Huawei, HiSilicon | Either way. |  |
| Samsung | Option 2 |  |
| Ericsson | Option 2 |  |
| Nokia | Either way | As the CP/UP is considered for NR-DC it could be also Option 1 |
| Qualcomm | No strong view |  |
| vivo | Option2 |  |
| Apple | Option 2 |  |
| ZTE | No strong view |  |
| NEC | No strong view |  |
| Intel | Option 2 | As a NR-DC extended scenario, option 2 is more suitable to carry such UE capability. |

### BAP Header Rewriting and Rerouting

During [Pre116bis][004] email discussion, companies are wondering whether new UE capability for Rel-17 local rerouting is needed, as intra-donor DU local rerouting has been supported in R16, and the scenario of R17 local rerouting includes inter-donor DU and inter-donor CU rerouting. However, different from R16, new trigger conditions, e.g. type-2/3 RLF indication, congestion are agreed to trigger local rerouting, which might need new UE capability, so that IAB-donor CU can configure the alternative egress link and a configured threshold of available buffer size for the purpose of local rerouting.

#### **Q8. Do you think new UE capability for Rel-17 intra-donor DU local rerouting is needed?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| LGE | Yes |  |
| Huawei, HiSilicon | No? |  |
| Samsung | Yes |  |
| Ericsson | Yes, but | If BAP header rewriting is supported that should be supported in all cases. But it is of interest for the NW to know whether the local routing can be triggered for any conditions or only for some of them |
| Nokia | Yes |  |
| Qualcomm | No | In Rel-16, we have in 38.306:  *Layer-2 and Layer-3 mandatory features for IAB-MT*   1. *Routing using BAP protocol, as specified in TS 38.340 [23]*   38.340 includes re-routing.  The same approach should apply to inter-donor-DU re-routing within the same topology in Rel-17. This implies that header-rewriting for inter-donor-DU rerouting in the same topology is a mandatory feature.  In Rel-16, topology adaptation was optional (except ENDC), but it was handled by RAN3 and therefore not included in capabilities since RAN3 does not support capabilities for inter-RAN-node signaling.  The same approach will apply to Rel-17 topology adaptation. We therefore do not have to consider capabilities for inter-donor-DU re-routing. |
| Vivo | No. | Intra-donor DU local rerouting is already doable according R16. Not necessary to define specific capability bit. |
| Lenovo | Yes | Intra-donor DU local rerouting has new trigger conditions than R16. |
| Apple | Yes |  |
| Futurewei | No |  |
| ZTE | No | We think intra-donor DU re-routing can be covered by R16. |
| NEC | No | We think intra-donor local rerouting is R16 rerouting. It not a new UE capability. |
| Intel | Yes | Different from Rel-16, Rel-17 agreed to support type-2 RLF indication and congestion based local rerouting. For congestion based local re-routing, IAB-donor CU also needs to configure a threshold which is used to determine the congestion for the purpose of local re-routing based on RAN2 agreement.   * A configured threshold of available buffer size based on flow control feedback is used to determine the congestion, for the purpose of local re-routing.   Additionally, it would be beneficial for IAB-donor CU to know whether the local re-routing is triggered by Rel-16 conditions or Rel-17 conditions, so that it could update the routing strategy accordingly. |

For inter-donor CU routing and inter-donor DU re-routing, [4] proposes two separate UE capabilities, one for header rewriting based inter-topology routing, another for header rewriting based local-rerouting. In [5], it is proposed IAB-MT indicates only whether the IAB-MT supports BAP header rewriting, regardless inter- or intra-topology. In [6], IAB-MT is proposed to indicate BAP-header rewriting UE capability for inter-donor CU routing, while a UL local rerouting UE capability for all local rerouting scenarios.

Based on above proposal, following options for inter-donor CU routing/inter-donor DU re-routing/Rel-17 intra-donor DU local re-routing is proposed:

**If Yes to Q8:**

**Option 1: Three UE capabilities**

* UE capability 1: BAP header rewriting based inter-donor CU routing
* UE capability 2: BAP header rewriting based inter-donor DU local re-routing
* UE capability 3: Rel-17 intra-donor DU local re-routing triggered by type-2/3 RLF indication, flow control feedback, etc.

**Option 2: Two UE capabilities**

* UE capability 1: BAP header rewriting for inter-donor CU routing and inter-donor DU local re-routing
* UE capability 2: Rel-17 intra-donor DU local re-routing triggered by type-2/3 RLF indication, flow control feedback, etc.

**Option 3: Two UE capabilities**

* UE capability 1: BAP header rewriting for inter-donor CU routing
* UE capability 2: UL local re-routing for inter-donor DU re-routing (with BAP header rewriting) and Rel-17 intra-donor DU local re-routing, triggered by type-2/3 RLF indication, flow control feedback, etc.

**If No to Q8:**

**Option 1a: Two UE capabilities**

* UE capability 1: BAP header rewriting based inter-donor CU routing
* UE capability 2: BAP header rewriting based inter-donor DU local re-routing

**Option 2a: One UE capability**

* UE capability 1: BAP header rewriting for inter-donor CU routing and inter-donor DU local re-routing

#### **Q10. Which option do you prefer to be used as UE capability for inter-donor CU routing, inter-donor DU re-routing and intra-donor DU local rerouting?**

|  |  |  |
| --- | --- | --- |
| Company | Option X | Comment |
| LGE | Option 2 or 3 |  |
| Huawei, HiSilicon | Option 1a | 1st:Inter-donor-DU re-routing and inter-donor CU re-routing has nothing new compared with the R16 local re-routing, except for the header rewriting. So, the new capability is actually “header rewriting based re-routing”.  2nd: CU does not need to know whether IAB-MT supports the new triggers for local re-routing. If IAB-MT supports, it directly perform the rerouting. There is no CU configuration related to the new trigger based re-routing. |
| Samsung | Option 1 |  |
| Ericsson | Option 3 | The first capability is used to indicate if the UE supports BAP header rewriting, the second is to know under which condition(s) the IAB-MT can trigger it. |
| Nokia | Option 2 or 3 | As a starting point RAN2 could assume one capability for BAP Header rewriting, another for local re-routing. Details remain to be specified once we have more stable agreements |
| Qualcomm | None of them | See reply to Q8 |
| vivo | Option 1a | Agree with Huawei that the actual new function for both inter-CU routing and inter-donor DU rerouting is header rewriting. After header rewriting the BAP routing is performed according R16 BAP routing. As inter-CU routing and inter-donor DU rerouting are quite different from the perspective of both application scenarios and the signaling procedure, separate capability bits are preferred. |
| Lenovo | Option 2 |  |
| Apple | Option 1a | Agree with Huawei and vivo. |
| Futurewei | Option 1a |  |
| ZTE | Option 1a |  |
| NEC | Option 1a | Agree with huawei. |
| Intel | Option 2 or 3 |  |

Moreover, it is proposed in [6] to define different UE capabilities for local re-routing based on different trigger conditions, e.g. type-2/type-3 RLF indication, type-4 RLF indication or congestion. If it is agreeable, following UE capabilities listed in the above options will be extended to multiple UE capabilities for different trigger conditions, including:

* UE capability 2 and 3 in Option 1
* UE capability 2 in Option 2
* UE capability 2 in Option 3
* UE capability 2 in Option 1a

#### **Q11. For Rel-17 UL local rerouting, i.e. inter-donor DU re-routing and intra-donor DU local rerouting (if yes to Q8), do you prefer single UE capability or separate UE capabilities for different trigger condition?**

|  |  |  |
| --- | --- | --- |
| Company | Option X | Comment |
| LGE | single |  |
| Huawei, HiSilicon | single | See our comments above |
| Samsung | single |  |
| Ericsson | No strong view (preferred for separate for different triggering conditions). | If separate UE capabilities for different trigger conditions are not supported, then it is assumed that the UE is supporting routing under any triggering conditions. |
| Nokia | No strong preference |  |
| vivo | single | Local rerouting upon type-2/type-3 RLF indication, type-4 RLF indication or congestion are similar functions, there is no need to define separate capability bits. |
| Lenovo | single |  |
| Apple | single |  |
| ZTE | Single |  |
| NEC | No strong view |  |
| Intel | Single |  |

For feature group of BAP header rewriting and re-routing, it is proposed to be FFS based on the outcome of Q8/9/10.

### Others

#### **Q12. Is there any other UE capability and related open issues need to be discussed? If yes, please add your comments below.**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | Another issue is whether we need to differentiate the capability between “inter-CU partial migration” and “BAP header rewriting based inter-donor CU routing”. |
|  |  |
|  |  |

# Conclusion

# References

[1] R2-2200354 UE capabilities for Rel-17 eIAB Intel Corporation

[2] R2-2200355 UE capabilities for Rel-17 eIAB Intel Corporation

[3] R2-2201055 IAB UE feature list Nokia

[4] R2-2201300 UE capability issues for eIAB HW

[5] R2-2201352 Discussion on R17 IAB-MT capabilities ZTE

[6] R2-2201609 On eIAB capabilities Ericsson

[7] R2-2201689 Summary of 8.4.3 UE caps Intel Corporation

[8] R1-2112902 Updated RAN1 UE features list for Rel-17 NR after RAN1 #107-e AT&T, NTT Docomo

[9] R2-2201653 Release-17 UE capabilities based on R1 and R4 feature lists (TS38.306) Intel Corporation

[10] R2-2201654 Release-17 UE capabilities based on R1 and R4 feature lists (TS38.331) Intel Corporation

[11] R2-2111604 Running CR to 38.331 eIAB Ericsson