3GPP TSG-RAN WG3 Meeting #125bis R3-245715

Hefei, China, 14th – 18rd October, 2024

Agenda Item: 9.2

Source: Google (moderator)

Title: Summary of offline for Mobility Enhancement Corrections

Document for: Approval

# Introduction

**CB: # 9\_MobilityEnh**

**- Check the critical corrections if any**

(moderator - Google)

Summary of offline disc

# For the Chairman’s Notes

**L2 reset configuration**

**Stage 2 - R3-245724 (revised from R3-245516) is agreed**

**Stage 3- R3-245341 is agreed**

**Early TA acquisition alignment**

**R3-245786 (revised from R3-245242) is agreed**

**SpCell ID replacement**

**R3-245749 (Rel-18, Cat. F, revised from R3-245350) is agreed**

**(new) R3-245750 (Rel-16, Cat. F) is agreed**

**(new) R3-245751 (Rel-17, Cat. A) is agreed**

**Correction on LTM procedures for Inter-DU case and CU-UP change**

**R3-245790 (revised from R3-245566 and merging agreeable changes from R3-245567) is agreed**

**TA information transfer during L3 HO with LTM configurations kept**

**R3-245161 is noted**

# Discussion

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| **Mobility Enh** |
| [R3-245516](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245516.zip) | Stage-2 support for LTM L2 reset (Ericsson, Samsung, LG Electronics, NEC, Nokia, Google, ZTE, Huawei, CATT) | CR0432r, TS 38.401 v18.3.0, Rel-18, Cat. FHW: The same change needed for inter-DU L2 reset configurationQC: Not convinced on inter-DU case |
| [R3-245341](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245341.zip) | L2 reset for intra-DU LTM (Samsung, LG Electronics, NEC, Nokia, Google, ZTE, Huawei, Ericsson, CATT) | CR1496r, TS 38.473 v18.3.0, Rel-18, Cat. F |
| [R3-245242](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245242.zip) | Alignment for misalignment of early sync procedure (CATT, China Telecom, CMCC) | CR0429r, TS 38.401 v18.3.0, Rel-18, Cat. FE///: The name alignment is fine, but the color in the figure is not correct |
| [R3-245350](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245350.zip) | Clarification on SpCell ID replacement (Google) | CR1456r1, TS 38.473 v18.3.0, Rel-18, Cat. F |
| [R3-245566](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245566.zip) | Rel-18 correction on LTM with gNB-CU-UP change (LG Electronics Inc.) | CR0423r1, TS 38.401 v18.3.0, Rel-18, Cat. F |
| [R3-245567](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245567.zip) | Rel-18 correction on Intra-CU LTM procedure (LG Electronics Inc.) | CR0434r, TS 38.401 v18.3.0, Rel-18, Cat. F |
| **CB: # 9\_MobilityEnh****- Check the critical corrections if any**(moderator - Google) |

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| [R3-245161](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_125-bis%5CDocs%5CR3-245161.zip) | Discussion on remaining issues on R18 LTM (Samsung) | DiscussionMove to 8.1 |

## L2 reset stage 2 (R3-245516)

Based on RAN2's agreements regarding support for L2 reset in intra-DU LTM, the descriptions in the signaling flows need to be updated to reflect this.

**Proposal: Update step 5 in the intra-DU LTM signaling flows to indicate that the gNB-DU receives the L2 reset information from the gNB-CU in order to perform RLC reestablishment.**

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| 5. The gNB-CU sends a UE CONTEXT MODIFICATION REQUEST message to the gNB-DU which may include the LTM configuration ID mapping listand/or the updated CSI resource configuration. The gNB-CU may inform the gNB-DU about intra-DU L2 reset configuration. |

**Comments online:**

HW: The same change needed for inter-DU L2 reset configuration

QC: Not convinced on inter-DU case

**Comments:**

Similar wording to be captured in 8.2.1.5 Inter-gNB-DU LTM around the step 5?

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| NOTE 1: The CU-initiated UE Context Modification procedure may be initiated for preparing candidate cells in the source gNB-DU as specified in step 3 and 4 in 8.2.1.4 Intra-gNB-DU LTM. 5. The gNB-CU sends a UE CONTEXT MODIFICATION REQUEST message to the source gNB-DU including the information related to early sync and the LTM configuration ID mapping list for the accepted target candidate cell(s). The gNB-CU may send the updated CSI resource configuration to the source gNB-DU |

E///: NEC asked whether to use step 3 as well?

QC: Should we use both step 3 and step 5? Or only one of them (i.e., the info should be sent in step 3 instead)

E///: Step 5 seems to be a better place to add

CATT: No harm to add it in step 3 as an alternative

LG: There could be intra-DU case in the candidate DU (i.e., more than one candidate cells at the candidate DU). So should we somehow mention it in the inter-DU scenario (e.g., at step 7-8).

**Conclusion:**

For inter-DU scenario, the CU may send the L2 reset configuration to the source DU in step 5 and may send the L2 reset configuration to the candidate DU in step 7.

## L2 reset stage 3 (R3-245341)

In RAN2#127 meeting, the following agreement were reached w.r.t L2 reset for intra-DU LTM.

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| * L2 reset (RLC reestablishment and PDCP data recovery) is also applicable for the intra-DU LTM case.
 |

Since the gNB-DU is the entity performing the RLC reestablishment, the gNB-DU should be aware whether there is need to perform the RLC reestablishment during an intra-DU LTM. To achieve this purpose, two options can be considered:

* Opt1: configure the ServingCellNoResetID and the noResetID of each candidate cell to the gNB-DU
* Opt2: after gNB-CU receives the DU-CU Cell Switch Notification message, the gNB-CU triggers UE Context Modification procedure to indicate whether RLC reestablishment is needed or not.

Compared with Opt1, Opt2 may delay the RLC re-establishment handling since it relies on the configuration from gNB-CU after triggering LTM. Moreover, the Opt1 is more aligned with RAN2’s design, and RAN3 determines to use the similar design for the UE based TA measurement. Thus, Opt 1 is a preferable solution.

**Proposal: Add the *LTM Reset Information* IE in UE CONTEXT MODIFICATION REQUEST message.**

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| If the *LTM Reset Information* IE is contained in the UE CONTEXT MODIFICATION REQUEST message, the gNB-DU shall, if supported, take them into account for L2 reset (i.e., RLC re-establishment) during an intra-DU LTM cell switch as specified in TS38.331 [8]. 9.3.1.xxx LTM Reset InformationThis IE contains the L2 reset configuration for the serving cell and LTM candidate cell(s).

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
| --- | --- | --- | --- | --- |
| Serving Cell L2 Reset Configuration | O |  | OCTET STRING | Includes the *ltm-ServingCellNoResetID* contained in the *LTM-Config* IE, as defined in TS38.331 [8], for the current serving cell. |
| **LTM L2 Reset Configuration List** |  | *0..1* |  |  |
|  **>LTM L2 Reset Configuration Item IEs** |  | *1.. <maxnoofLTMCells>* |  |  |
| >>Cell ID | M |  | NR CGI9.3.1.12 |  |
| >>LTM L2 Reset Configuration | M |  | OCTET STRING | Includes the *ltm-NoResetID* IE as defined in TS38.331[8], for the LTM candidate cell identified by the *Cell ID* IE. |

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**Comments online:**

**Comments:**

LG: shall we limit the name to only intra-DU usage?

E///: From RAN2 PoV the NoReset ID is applicable to different DUs as well. Maybe more future proof for the name?

SS: That could be by implementation.

HW: We only specify the receiving side behaviour.

**Conclusion:**

Propose to agree as it is (R3-245341). Check further details in offline if necessary.

## Early Sync procedure alignment stage 2 (R3-245242)

Figure and procedure text is misaligned in Figure 8.2.1.4-1 and Figure 8.2.1.5-1.

**Proposal: Change the step 11/step 13 in Figure 8.2.1.4-1/Figure 8.2.1.4-2 from Early TA acquisition to Early synchronization. Turn the one-way arrow into two-way arrow in Figure 8.2.1.4-2 step 13 for including both DL synchronization and UL synchronization.**





**Comments online:**

E///: The name alignment is fine, but the color in the figure is not correct

**Comments:**

Fix the arrow/line colours?

LG, Nokia: fix the description in the inter-DU section instead of the figure.

E///: Use box as in 38.300?

HW: no technical problem

**Conclusion:**

Fix the description (i.e., Early TA acquisition?) of the intra-DU and inter-DU sections. Check wording details in the offline.

## Clarification on SpCell ID replacement stage 3 (R3-245350)

The text in the UE Context Modification procedure includes:

“If the SpCell ID IE is included in the UE CONTEXT MODIFICATION REQUEST message, the gNB-DU shall replace any previously received value and regard it as a reconfiguration with sync as defined in TS 38.331 [8]”.

The gNB-DU stores a SpCell ID of the serving cell for the UE. In a LTM or conditional mobility preparation, the gNB-DU receives a SpCell ID of a (LTM) candidate cell in a UE CONTEXT MODIFICATION REQUEST. Based on the text above, the gNB-DU replaces the SpCell ID of the serving cell with the SpCell ID of the (LTM) candidate cell, which causes the gNB-DU to lose the SpCell ID of the serving cell.

The text above has been there since Release 15 and should only apply to non-LTM and non-conditional-mobility cases.

**Proposal: The gNB-DU replaces any previously received value if the SpCell ID IE is included in the UE CONTEXT MODIFICATION REQUEST message neither concerning LTM nor conditional mobility.**

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| If the *SpCell ID* IE is included in the UE CONTEXT MODIFICATION REQUEST message neither concerning LTM nor conditional mobility, the gNB-DU shall replace any previously received value and regard it as a reconfiguration with sync as defined in TS 38.331 [8]. |

**Comments online:**

E///, HW: The wording should be changed. Prefer listing the indicators

E///: For conditional mobility it affects also previous releases (Rel-16 and 17)

**Comments:**

Rewording attempt for Rel-18:

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| If the *SpCell ID* IE is included in the UE CONTEXT MODIFICATION REQUEST message and either the *LTM indicator* IE or the *Conditional Intra-DU Mobility Information* IE is not present, the gNB-DU shall replace any previously received value and regard it as a reconfiguration with sync as defined in TS 38.331 [8]. |

Rewording attempt for Rel-16, 17:

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| If the *SpCell ID* IE is included in the UE CONTEXT MODIFICATION REQUEST message and the *Conditional Intra-DU Mobility Information* IE is not present, the gNB-DU shall replace any previously received value and regard it as a reconfiguration with sync as defined in TS 38.331 [8]. |

E//: WI code needs to be updated to include WI for mobility enhancements for Rel-16, Rel-17 – same WI, CAT: A, Rel-18: Two WIs, mobility and LTM. CAT: F.

HW: Use top level IE (i.e., LTM Information Modify IE) for LTM

**Conclusion:**

Use the re-wording above and use top level IE for LTM. Fix WI issues for Rel-16, 17, and 18 CRs.

Check details offline.

## LTM with gNB-CU-UP change Stage 2 (R3-245566)

TS 38.401 Section 8.2.1.6 LTM with gNB-CU-UP change shows the procedure used for LTM with the change of gNB-CU-UP within a gNB.

The Steps 10-13 are used for CU-CP to initiate the change of CU-UP together with LTM cell switch command and notification procedures, **however, such change shall be executed only after the cell switch is successfully confirmed, i.e. after CU-CP receives ACCESS SUCCESS from the target DU**. The LTM execution attempt from the UE could fail and another LTM candidate cell under the source DU may be selected for access (called “failure-reattempt”), where the UE would remain served by the source CU-UP. The change of CU-UP before cell switch is successfully confirmed could result in additional unneccessary change of CU-UP back to the source CU-UP (and additional data forwarding if applicable).

Moreover, **the target DU, once the UE successfully accessed, informs the UE’s access to the target CU-UP via sending initial DDDS frame**. This was specified in Rel-15 to fastly inform CU-UP of the UE’s access during legacy mobility, and later extended for conditional mobility family (CHO, CPAC, subsequent CPAC) as a way to initiate DL data delivery from the target CU-UP. As LTM shares the same principle with conditional mobility family from CU-UP funtional point of view, this part was also missing in the figure.

Furthermore, the last agreed R3-243090 changed the Step 10-11 from mandatory to optional given that data forwarding is a optional feature. However, according to TS 38.401 Section 8.9.4 Steps 12c-d, during conditional mobility**, the Bearer Context Modification procedure toward the source CU-UP after the UE successfully accessed is always executed to indicate the source CU-UP to stop packet delivery to the UE** (and while doing so, may retrieve PDCP UL/DL status or exchange TNL address for data forwarding). Given that LTM shares the same principle with conditional mobility, those steps needs to be reverted back to mandatory with the correct descriptions.

Lastly, **early data forwarding** can be applied in LTM from the source CU-UP to the target CU-UP, which is currently missing.

**Proposals:**

**1. Revert the optional Step 10-11 back to mandatory with the correct description including indicating the source CU-UP to stop packet delivery.**

**2. Swap Step 10-13 and Step 15-16, for CU-CP to initiate Step 10-13 after receiving ACCESS SUCCES from the target DU.**

**3. Add the step of the target DU sending DDDS to the target CU-UP.**

**4. Add the optional steps (new step 7x) and the description for early data forwarding from the source CU-UP to the target CU-UP.**



**Comments:**

**Conclusion:**

Capture the parts related to DDDS and stop source CU-UP. Check offline.

12. The target gNB-DU sends an ACCESS SUCCESS message to inform the gNB-CU-CP of which cell the UE has successfully accessed. The target gNB-DU also sends a Downlink Data Delivery Status frame to inform the target gNB-CU-UP.

13. The gNB-CU-CP performs the Bearer Context Modification procedure to indicate the source gNB-CU-UP to stop packet delivery, which may also retrieve the PDCP UL/DL status and exchange the TNL address information for data forwarding for the bearers.

## Intra-CU LTM procedure Stage 2 (R3-245567)

In Section 8.2.1.4 Intra-DU LTM,

* NOTE 2 description that is written to “transfer” the common CSI resource configuration “for each candidate cell” is misleading. Rel-18 LTM is based on common CSI resource configuration and cell-specific CSI report configuration, and the purpose of per-cell procedure is to retrieve cell-specific CSI report configuration individually from DU for each candidate cell.

In Section 8.2.1.5 Inter-DU LTM,

* Steps 7-8 that happens with the candidate DU(s) for subsequent LTM should be invoked per candidate cell, but it is currently written as if invoked per DU.
* NOTE 2 description is incomplete because the Steps 7-8 that happnes after the initial LTM preparation/configuration results in additional RRC reconfiguration with the UE.

**Proposals:**

1. **In 8.2.1.4, fixed the NOTE 2 to describe that the per-cell procedure is to retrieve the updated CSI report configuration from each candidate cell.**

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| 6. The gNB-DU responds with a UE CONTEXT MODIFICATION RESPONSE message which includes an updated lower layer configuration, e.g., containing the updated CSI report configuration of the source cell.NOTE 2: In case of subsequent LTM, the CU-initiated UE Context Modification procedure may be invoked per each candidate cell to retreive from the gNB-DU the updated CSI report configuration from each candidate cell. |

1. **In 8.2.1.5, fixed the Step 7-8 descriptions as invoked per candidate cell.**
2. **In 8.2.1.5, clarified the NOTE 2 that an additional RRC reconfiguration with the UE occurs.**

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| 6. The source gNB-DU responds with a UE CONTEXT MODIFICATION RESPONSE message which includes an updated lower layer configuration, e.g., containing the updated CSI report configuration of the source cell.7. The gNB-CU may send a UE CONTEXT MODIFICATION REQUEST message for each candidate cell accepted in the candidate gNB-DU(s), containing the information for subsequent LTM or for updating the configurations of candidate cells. The gNB-CU may also provide the lower layer part of the reference configuration to the candidate gNB-DU(s). 8. The candidate gNB-DU responds with a UE CONTEXT MODIFICATION RESPONSE message including the updated lower layer configuration, e.g., containing the updated CSI report configuration of the requested candidate cell.NOTE 2: Step 7 may also be triggered after step 19, or after step 22 by implementation for subsequent LTM. In this case, additional RRC reconfiguration with the UE occurs. |

**Comments:**

E///: merge some changes for per cell

**Conclusion:**

Check offline for detail wording for step 7 and 8.

## Remaining Issues on R18 LTM (R3-245161)

### TA information transfer during L3 HO with LTM configurations kept

In TS38.300, the following text is given for the LTM configuration during any L3 handover (except DAPS):

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| 9.2.3.5 L1/L2 Triggered Mobility9.2.3.5.1 General<…>While the UE has stored LTM candidate configurations the UE can also execute any L3 handover except for DAPS handover. In the RRC message which the UE applies for any L3 handover (except DAPS), LTM candidate configurations can be added/modified/released by the target cell. |

In addition, taking into account that early TA CFRA resource of each LTM candidate cell is pre-allocated for each LTM gNB-DU during LTM preparation phase, PDCCH order procedure cannot be triggered in L3 HO target gNB-DU for early TA acquisition when the target cell for L3 HO is located in a new gNB-DU which has never had an LTM candidate cells, since no early TA CFRA resource of LTM candidate cell is pre-allocated for this gNB-DU. Unless, gNB-CU should trigger a new round procedure to request each LTM gNB-DU respectively (per-candidate cell) for early TA CFRA resource allocation for this L3 HO target DU, and then send collected early TA CFRA resource of each LTM candidate cell to L3 HO target gNB-DU.

**Proposal 2-1: RAN3 agrees to transfer valid TA information of LTM candidate cells to target gNB-DU of L3 HO for LTM execution use if gNB-CU decides to keep LTM configuration when L3 HO is performed.**



**Figure.1 Message flows of intra-CU inter-DU L3 HO procedure with LTM configuration**

**Proposal 2-2: To transfer related TA information to target gNB-DU during L3 HO with LTM configuration kept, the UE Context Modification Request message can be enhanced to include an indication to request for TA information while gNB-CU decides to keep LTM configuration during L3 HO. Furthermore, source gNB-DU uses the UE Context Modification Response message to transfer related TA information to gNB-CU.**

**Proposal 2-3: Propose to reuse the UE Context Modification Request message to transfer related TA information** **from gNB-CU to target gNB-DU of L3 HO.**

**Proposal 2-4: RAN3 to agree the corresponding drafted TP for TS38.473 in Annex.**

**Comments:**

LG, QC: try to understand the scenario.

HW, E///, Gg, Nokia, CATT: seems like optimization

LG: The early TA acquisition at the target DU can be avoided.

**Conclusion:**

No consensus. Contribution driven to this topic.

# Conclusion, Recommendations [if needed]

If needed

# References

As listed in the table in the section 3.