3GPP TSG-RAN WG3 #119bis-e R3-231884

Online, Apr 17th – Apr 26th, 2023

**Agenda item: 14.2**

**Source: Huawei (rapporteur)**

**Title: Summary of offline discussion for CB: # MobilityEnh2\_L1L2Mobility**

**Document for: Discussion**

# 1 Introduction

This document contains the summary of offline discussion for the following CB:

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| **CB: # MobilityEnh2\_L1L2Mobility****- Summary on pros and cons of candidate cell suggestion using one or multiple messages.****- Discuss on data transmission,** **i.e. introduce new message or reuse legacy message. how to define d new message, and identify which legacy message to be reused.****- How to avoid HO collision between the LTM and the L3 based inter-cell mobility.****- Discuss on subsequent LTM procedure, i.e. subsequent LTM with RACH or without RACH.****- Discuss on releasing of candidate cells, reference configuration, DDDS, releasing of candidate cells,** **TA Acquisition.****- E1 interface issue, i.e. intra-CU-UP LTM and inter-CU-UP LTM?****- Capture all the agreements for above issues and prepared for the draft CRs of TS 38.401(HW), TS 38.473(E///).** (moderator - HW)Summary of offline disc R3-231884 |

# 2 Proposals for chair notes.

Candidate cells configuration in one message or multiple message:

**Conclusion: no progress. To be continued.**

Data transmission:

Two options are discussed:

* Option 1: New F1 message , class 1 or class 2, like “LTM CELL CHANGE NOTIFICATION”.
* Option 2: Legacy message, i.e., “UE Context Modification Required message”

No consensus. questions needs to be clarified:

* What is the purpose of this message?
	+ Notify CU about the LTM initiation
	+ Modify to the UE context
	+ Negotiate other parameters with CU or target DU in inter-DU LTM?
	+ Any else?

**Conclusion: For intra-DU LTM, a new class 2 message is preferred. For inter-DU LTM, pending to the progress in RAN2 on how to support the RACH-less inter-DU LTM.**

**To be continued on above basis.**

**DDDS:**

propose to agree on the following proposals:

**Proposal 3.2-1: For intra-DU LTM, DDDS from gNB-DU to CU-UP is not needed for those DRBs RLC is not re-established.**

**Proposal 3.2-2: For intra-DU LTM, the gNB-DU sends a DDDS frame about unsuccessfully transmitted downlink data to the gNB-CU after LTM cell switch if RLC reestablishment is configured.**

**Proposal 3.2-3: For inter-DU LTM, the DDDS should be sent from source gNB-DU to CU-UP when the LTM cell switch command is sent. Then the CU-UP can start forwarding the unsuccessfully transmitted data to target gNB-DU.**

**Proposal 3.2-4: For both intra-DU and intra-CU inter-DU LTM, target gNB-DU sends initial DDDS using the new UL TEID to CU-UP after target gNB-DU detects the UE access.**

**Proposal 3.2-5: For intra-DU LTM, if RLC is not re-established, the gNB-DU shall continue sending UL PDCP PDUs to the gNB-CU using the previous UL GTP TEID until cell switch command, and after then start sending UL PDCP PDUs using the new UL GTP TEID.**

**Proposal 3.2-6: For intra-DU LTM, if PDCP data recovery is not configured, the gNB-CU shall continue sending DL PDCP PDUs to the gNB-DU using the previous DL GTP TEID until it receives the LTM signalling from DU, and after then start sending UL PDCP PDUs using the new DL GTP TEID.**

**Handover collision avoidance between LTM and L3 handover:**

The following options are discussed:

* Option 1: OAM configured priority.
* Option 2: Network decides the priority based on scenario (intra-gNB-CU or inter-gNB-CU) and some assistance information (the measurement results, candidate target cells).
* Option 3: Flexible priority. The handover triggered first take the high priority.

For option 3, The detailed description would be:

* Case 1, L3 handover triggered earlier than LTM (the gNB-DU receives the L3 handover command before LTM is triggered), L3 handover has high priority.
* Case 2, LTM triggered earlier than L3 (the gNB-CU receives the LTM notify message from gNB-DU before L3 handover is triggered), LTM has high priority,
* Case 3, LTM and L3 handover are triggered almost simultaneously (cross signallings on F1). The (source) gNB-DU fails the L3 handover by responding with UE Context Modification Failure message with proper cause meaning LTM has high priority. This is to avoid to cancel the LTM command already sent to the UE which seems complex from moderator point of view.

No consensus. **To be continued on above basis.**

**Candidate cell modify and release:**

**Proposal 3.4-1: The gNB-CU may modify or release L1/2 Triggered Mobility (LTM) candidate cells in the gNB-DU.**

**Proposal 3.4-2: The gNB-DU may cancel already configured L1/2 Triggered Mobility (LTM) candidate cells.**

**Proposal 3.4-3: The gNB-CU may use the UE Context Modification procedure to modify or release the prepared resources of candidate cells in the gNB-DU and use the UE Context Release procedure to release the UE context in the gNB-DU.**

**Proposal 3.4-3a: the gNB-DU may use the UE Context Modificaiton Required message to release the candidate cells, and the gNB-CU shall not reject .**

**Proposal 3.4-4: The gNB-DU may use the UE Context Modification Required procedure to request to cancel the prepared resources of a subset of candidate cells in that gNB-DU and use the UE Context Release Request procedure to request to release all candidate cells in that gNB-DU.**

**Subsequent LTM:**

**Proposal 3.5-1: Subsequent LTM is considered feasible for the candidate cells once they are configured to the UE in initial LTM configuration.**

E1 Aspects:

**Questions needs to be clarified online:**

1. For intra-DU LTM and intra-UP (i.e. no change of CU-UP), there will be no need to create new TEID, actually no signalling will be exchange with CU-UP?
2. whether can realize CU UP change without security key update? This case is very limited and we prefer to consider it later.
3. why the CU-UP would be changed, i.e., we wanted to understand the motivation for considering the inter-CU-UP LTM case in the first place, further considering that Rel-18 LTM is for intra-CU.

**The following proposals are for agreement if above questions are clarified:**

**Proposal 3.6-1: For intra-CU-UP case, propose to turn the following WF to an agreement:**

**In case of CP UP separation, once CUCP receives LTM cell switch signling from (source)DU , CU CP initiates E1 bearer context modification to the CU UP including DL tunnel ID per DRB for target cell, for data transmission.**

**Proposal 3.6-2: For inter-CU-UP LTM, once the CU-CP receives LTM cell switch signaling from (source) DU, the CU-CP initiates E1 bearer context modification to the target CU UP including DL tunnel ID per DRB for data transmission.**

**Proposal 3.6-3a: Revisit the following proposals after the basic procedure is stable.**

* **One option that can minimize the impact on CU-UP when performing LTM is that the steps 3 and 4 are executed together with steps 9 and 10.**
* **One more option that can minimize the impact on CU-UP when performing LTM is that the CU-UP provides only one UL TNL address which will only be used by the target cell after successful execution of LTM cell switch.**

**To be continued.**

**The following are agreeable, but may revisit in second round if needed.**

**Proposal 3.6-3: For inter-CU-UP LTM, the CU-CP initiates E1 bearer context modification to the source CU-UP for retrieving the latest PDCP status at the source CU-UP and exchanging the data forwarding information to target CU-UP.**

**Proposal 3.6-4: In case of gNB-CU-UP change, the gNB-CU triggers the source gNB-CU-UP to start data forwarding after receiving LTM cells switch signalling from DU.**

**Proposal 3.6-5: For inter-CU-UP LTM, Path switch procedure is performed towards the core network after detecting the UE has accessed to the target cell.**

Second round plan:

1. Finalize the inter-CU-UP overall LTM procedure
2. Proceed TPs to reflect first round agreements that not covered by 1)
3. Other issues, like reference configuration, etc.

# 3 Discussion

Here is the list of topics summarized by chair to be discussed in this CB:

* Summary on pros and cons of candidate cell suggestion using one or multiple messages.
* Discuss on data transmission, i.e. introduce new message or reuse legacy message. how to define d new message, and identify which legacy message to be reused.
* How to avoid HO collision between the LTM and the L3 based inter-cell mobility.
* Discuss on subsequent LTM procedure, i.e. subsequent LTM with RACH or without RACH.
* Discuss on releasing of candidate cells, reference configuration, DDDS, releasing of candidate cells, TA Acquisition.
* E1 interface issue, i.e. intra-CU-UP LTM and inter-CU-UP LTM?
* Capture all the agreements for above issues and prepared for the draft CRs of TS 38.401(HW), TS 38.473(E///).

Note that TA acquisition is related to the RAN1 LS, and it will be discussed in the other CB in this AI.

And reference configuration issue is more related to RAN2 and moderator proposes to wait for more RAN2 progress before discussing it in RAN3. Hope the authors of those proposals to understand.

#### 3.1 Issue 1: Candidate cells configuration in one message or multiple message

Below are the companies views on this issue at last meeting,

* **Option 1: One message: HW, E///, ZTE, LENOVO, CMCC, QC, LG, CT**
* **Option 2: multiple messages: INTEL, NOKIA, CATT, SAMSUNG, NEC, GOOGLE**

Papers in R3-231315, R3-231447, R3-231459, R3-231510, R3-231573, and R3-231848 express support to option 1. While paper in R3-231751, think that option 2 should be adopted to minimize the spec impact. R3-231807 thinks that either option is fine. R3-231747 proposes a compromised solution as following.

* **Option 3: Both options are supported. In case that a list of candidate cells is included, the DU responds to the CU with the accepted candidate cells which have the same admitted result for DRBs.**

After read all papers related to this issue, the moderator thinks that there are no any new arguments brought up which can be used to make a final decision. And it seems that companies still keep their positions no change as last meeting.

Keeping it in mind that much more F1AP signalling requirements will be needed for L1 measurement configuration and early TA acquisition according to the LS in R3-231107 (discussed in another CB), let’s check companies views once again to see if we can converge.

**Q 3.1-1: Which option do you prefer among option 1, 2 and 3?**

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any |
| Google | Option 2 is preferred | There is no actual problem to adopt Option 2 as it already works for R-17;As for skipping the reference configuration issue, there had been sufficient RAN2 progress in this topic (i.e., agreements and running CRs) and as RAN2 does not handle the F1 interface, we should have some discussion as well.  |
| NEC | Option 2 |  |
| E/// | Option 1 | The principle between R17 CHO for example is fundamentally different with R18 LTM. For Xn interface the UE-associated logical connection may not be maintained for all the time UE is in connected mode, so the parallel HO request procedures were introduced. However, for F1AP, CU can be always connected to DU, so there is no need to re-initiate the UE associated logical connection at certain time intervals. To avoid overhead signaling, Option 1 would be the best way for network implementation. |
| China Telecom | Option 1 or Option3 | We still prefer1 as it can reduce the signalling load over F1 interface. LTM is more suitable for FR2 scenario, which means there are more candidate cells, if we only allowed to configure the candidate cell in parallel way, the signalling load will be heavy. For option 2, it can also be supported if option 1 is adopted, by carrying only one candidate cell in each request message.As moderator proposed, we can also adopt option 3 as a compromise way.  |
| CATT  | Still prefer option 2 | Signalling load may not very critical in F1AP |
| NTT DOCOMO | Option 1, 2, and 3 | We are open for these options. However, option 3 seems good compromised solution. |
| Huawei | Option 1  | If option 2 is adopted, it means that there will be much more F1 signalling between source DU and CU, and between target DU and CU for support of L1 measurmemnt configuration and early TA acquisition. |
| Samsung | If we want to progress, Option 3 is a middle ground. | The key difference between two methods is how to deal with the case that different candidate cells have different admission results. To support this case, the single message method will result in large specification impact since different admission results should be reflected w.r.t. different candidate cells. This is what we want to avoid. Option 3 is a middle ground between Opt 1 and Opt 2. If multiple candidate cells can have the same admission results, the impact to the signal can be small. |
| Lenovo | Option 1 | The reason why parallel configuration is adopted for CHO is to align with the Xn interface design, where the target node can choose only one cell and send the respective RRC HandoverCommand message in the Handover Request Acknowledge message.For LTM, there is only impact on F1 interface. We don’t need to follow the CHO principle, and we propose to contain multiple candidate cells in one message to reduce the signalling overhead. |
| ZTE | Option 1 | Since we are stuck in this issue for several meetings, option 3 may be the way forward. |
| Charter Comm | Option 1 |  |
| Qualcomm | Option 1 | We think Option 1 is preferable from a latency point of view, and also taking into account the fact that subsequent configuration modifications may be needed after the initial preparation (using multiple messages results in delays in such modification procedures also). We can try and make Option 1 work even though there are changes required to the signalling messages. |
| Nokia | Option 2 | Single procedure incurs unnecessary complexity. Similarly, the signaling overhead over F1 is likely not overly critical. This given that we do not assume that LTM configurations would change too frequently over short periods of time. Hence, there is a benefit in terms of IE structure and F1AP spec reuse from utilizing multiple messages, each conveying configuration of each target candidate cell. |
| CMCC | Either option | In the online meeting, hope people in RAN could evaluate the complexity of spec design on candidate cell suggestion during this meeting. |
| Intel | Option 2 | As we discussed in our paper, there’s no issue for using option 2, as it follows the same approach that was previously established for CHO/CPAC |

**Moderator’s summary:**

Option 1: Ericsson, China Telecom, Huawei, NTT DOCOMO, Lenovo, ZTE, Charter Comm, QC, CMCC

Option 2: Google, NEC, CATT, Nokia, Samsung, NTT DOCOMO, CMCC, Intel

Option 3: Samsung, NTT DOCOMO, China Telecom

Companies views are still diverged. However, the moderator would like to encourage companies to think of the signalling requirements for support of L1 measurement configuration, early TA acquisition, and subsequent LTM. If one LTM configuration message only contains 1 single cell, the additional F1AP signalling for support of those functions will increase with the number of prepared candidae cells.

**Conclusion: no progress. To be continued.**

#### 3.2 Data transmission

In this section, we will discuss, i.e. introduce new message or reuse legacy message, how to defined new message, and identify which legacy message to be reused, probably also the DDDS handling as this relates to the data transmission.

RAN3 has agreed that the gNB-DU will notify the gNB-CU about the LTM initiation with a F1AP message. And it is still FFS on whether to use a new message or legacy message.

To summarize the proposals in papers in R3-231182, R3-231447, R3-231459, R3-231510, R3-231573, R3-231652, R3-231678, R3-231747, R3-231807, and R3-231848, the following options are on the table:

* **Option 1: New F1 message , class 1 or class 2, like “LTM CELL CHANGE NOTIFICATION”.**
* **Option 2: Legacy message, i.e., “UE Context Modification Required message”**

Note that as we have agreed to design common messages for both intra-DU LTM and inter-DU LTM. Therefore, above options covers the two use cases.

**Q 3.2-1: Which option do you prefer between option 1, and option 2?**

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any |
| Google | Option 2 is preferred |  |
| NEC | either is workable, however prefer option2 to extend existing message in order to avoid a single signalling message only for one purpose. |  |
| E/// | Option 2 |  |
| China Telecom | Option 1 | We think define a new message is more reasonable, since the legacy Modification procedure aims to modify the established UE Context. The new introduced message can be a class 2 message which doesn’t require feedback information from the receiving node, in this way, the F1 interface ssignalling load and latency can be reduced. |
| CATT | Slightly prefer option 1 | Just due to the usage of the discussed message is not match any legacy message |
| NTT DOCOMO | Open for both options |  |
|  |  |  |
| Huawei | Either way is fine | We think that either way is feasible. And it is pending to the progress in RAN2 on how to support the RACH-less inter-DU LTM. And it depends on the purpose of this message. If the only purpose of this procedure is to inform the CU about the initiation of LTM, then a new class 2 procedure may be sufficient. But if this procedure is used to negociate something with CU or target DU, then, a class 2 procedure is needed. Either new message or legacy is feasible. |
| Samsung | Option 1 | Since this is specific for LTM, a new F1 message may be cleaner. On top of this, class 1 procedure would be more suitable. The reason is that we may need this message to transmit other information. |
| Lenovo | Option 1 | As described in TS 38.473, the purpose of the UE Context Modification Required procedure is to modify the established UE Context, e.g., modifying and releasing radio bearer resources, or sidelink radio bearer resources or candidate cells in conditional handover or conditional PSCell addition or conditional PSCell change. However, when the DU is to inform that the cell switch has been triggered, it is not about changing the UE Context. |
| ZTE | Option 2 | We should avoid defining new messages for single usage. The usage of the UE context modification required message can be extended to be reused. |
| Charter Comm | Option 2 |  |
| LGE | Option 2 | Though this signalling has only one purpose for LTM, additional information would be transmitted to the gNB-CU using it. |
| Qualcomm | Option 2 | Agree with NEC |
| Nokia | Option 1 | Defining a NEW procedure is preferable, and reuse of gNB-DU initiated UE Context Modification procedure is not appropriate. When a gNB-DU informs that LTM has been triggered, it is NOT modifying the actual UE Context nor modifying its prior configuration via this signaling. Thus, even if there is to be some level of information updated later on (e.g., as in an inter-gNB-DU scenario), that would be a decision handled at gNB-CU itself as a result of LTM procedure being carried out and not due to a “request from the source gNB-DU”. Therefore, a new message should be introduced. |
| CMCC | Option 1 | It is found that there is no suitable procedure in F1AP to inform gNB-CU about the initiation of the L1/L2 triggered mobility. |
| Intel | Option 2 |  |

**Moderator’s summary:**

* **Option 1: New F1 message , class 1 or class 2, like “LTM CELL CHANGE NOTIFICATION”.**
* **Option 2: Legacy message, i.e., “UE Context Modification Required message”**

Option 1:China Telecom (classs 2), CATT, Samsung (class 1), Lenovo, Nokia, CMCC

Option 2: Google, NEC, Ericsson, ZTE ,Charter Comm ,LGE ,Qualcomm, Intel

Either option 1 or option 2: NTT DOCOMO, Huawei

Moderator’s summary:

Technically, either option 1 or option 2 is feasible. Here are the questions needs to be clarified:

* What is the purpose of this message?
	+ Notify CU about the LTM initiation
	+ Modify to the UE context
	+ Negotiate other parameters with CU or target DU in inter-DU LTM?

**Conclusion: For intra-DU LTM, a new class 2 message is preferred. For inter-DU LTM, pending to the progress in RAN2 on how to support the RACH-less inter-DU LTM.**

**To be continued.**

**DDDS:**

The following proposals are made by companies’ papers about DDDS:

**Proposal 3.2-1: For intra-DU LTM, DDDS from gNB-DU to CU-UP is not needed for those DRBs RLC is not re-established.**

**Proposal 3.2-2: For intra-DU LTM, the gNB-DU sends a DDDS frame about unsuccessfully transmitted downlink data to the gNB-CU after LTM cell switch if RLC reestablishment is configured.**

**Proposal 3.2-3: For inter-DU LTM, the DDDS should be sent from source gNB-DU to CU-UP when the LTM cell switch command is sent. Then the CU-UP can start forwarding the unsuccessfully transmitted data to target gNB-DU.**

**Proposal 3.2-4: For both intra-DU and intra-CU inter-DU LTM, target gNB-DU sends initial DDDS using the new UL TEID to CU-UP after target gNB-DU detects the UE access**

Q**3.2-2: Any comments on above proposals:**

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any |
| Google | OK with the proposals  |  |
| NEC | Agreeable to all proposals. |  |
| E/// | Fine |  |
| China Telecom | We are fine with the above proposals. |  |
| CATT | Ok with Proposal 3.2-1, 3.2-3, | For the proposal 3.3-2, the high level principle is ok, one concern is according to RAN2 discussion, in intra-DU case, there is no RLC re-established, so we why we need proposal 3.3-2? If we agree this proposal, may mislead other group that intra-DU case may have RLC re-establishe.[Moderator] As per RAN2 agreement, whether RLC is re-established or not is configurable by RRC.For 3.2-4, intra-DU, DDDS seems not needed.[Moderator] the DDDS is used on F1-U to inform the CU or CU-UP that the UE is reachable in the target cell. Same DU behaviour as legacy L3 HO. |
| NTT DOCOMO | OK with the proposals |  |
|  |  |  |
| Huawei | All above proposals are agreeable. |  |
| Samsung | Comments | We are not sure about the intention of the first three proposals. DDDS should be sent regardless of there is a handover or not. Even there is no RLC re-establishment, the DDDS is also needed since this is used by UP for flow control. For the fourth one, is it legacy behaviour?[Moderator] the intention of the proposals are to clarify the DU behaviour on F1-U during LTM. For the scenario of RLC is not re-established, DDDS is not prohibit but is not needed from standard pov. The fourth proposal is legacy behaviour. |
| Lenovo | Agree with the proposals. |  |
| ZTE | Agree |  |
| Charter Comm | OK with the proposals |  |
| Qualcomm | OK with the proposals. Please see comments for P3.2-4 | Since we already have the Access Success message, we were wondering what is the purpose of sending the initial DDDS message (we understand that the initial DDDS is a part of legacy handover execution, but wondering if it is needed here).  |
| Nokia | Agree with the proposals |  |
| CMCC | Agree with the proposals |  |

**Moderator’s summary:**

Majority companies agree to the proposals. Moderator’s clarifications are provided to CATT, Samsung and QC’s comments above inline.

The moderator therefore propose to agree on the following proposals:

**Proposal 3.2-1: For intra-DU LTM, DDDS from gNB-DU to CU-UP is not needed for those DRBs RLC is not re-established.**

**Proposal 3.2-2: For intra-DU LTM, the gNB-DU sends a DDDS frame about unsuccessfully transmitted downlink data to the gNB-CU after LTM cell switch if RLC reestablishment is configured.**

**Proposal 3.2-3: For inter-DU LTM, the DDDS should be sent from source gNB-DU to CU-UP when the LTM cell switch command is sent. Then the CU-UP can start forwarding the unsuccessfully transmitted data to target gNB-DU.**

**Proposal 3.2-4: For both intra-DU and intra-CU inter-DU LTM, target gNB-DU sends initial DDDS using the new UL TEID to CU-UP after target gNB-DU detects the UE access.**

**Agreements clarification:**

RAN3 made the following agreement on TEID assignment at RAN3#118 meeting which is same as the legacy.

|  |
| --- |
| **For intra-DU LTM, the gNB-CU assigns a new UL GTP TEID for each DRB and provides it to the gNB-DU via UE Context Modification Request message(s). The gNB-DU assigns the new DL GTP TEIDs per DRB per candidate cell (whether it should be per candidate cell needs to be further discussed) and provides them back to the gNB-CU in UE Context Modification Response message(s).****For inter-DU LTM, the gNB-CU assigns a new UL GTP TEID for each DRB and provides it to the target gNB-DU via UE Context Setup Request message(s). The target gNB-DU assigns the new DL GTP TEIDs per DRB per candidate cell (whether it should be per candidate cell needs to be further discussed) and provides them back to the gNB-CU in UE Context Setup Response message(s).** |

One thing which may be different from the legacy is that RAN2 agreed that the L2 can be continued without RLC re-establishment and PDCP recovery which is controlled by network as shown below.

|  |
| --- |
| * **R2 assumes that L2 is continued whenever possible (e.g. intra-DU), without Reset, with the target to avoid data loss, and the additional delay of data recovery.**
* **R2 assumes that at L1L2 cell switch: Whether the UE performs partial or full MAC reset (FFS what partial reset is, e.g. to avoid data loss), re-establish RLC, perform data recovery with PDCP is explicitly controlled by the network. R2 assumes that this can be configured by RRC. FFS if MAC CE indication(s) is/are needed.**
 |

For UL GTP-U tunnel switching, it is clear that if RLC is re-established, the gNB-DU shall continue sending UL PDCP PDUs to the gNB-CU using the previous UL GTP TEID until RLC is re-established which is the same as legacy. The new case needs to clarify is when to switch the UL GTP tunnel in case of RLF is not re-established.

Similar issue exits for the PDCP recovery case for DL. The proposal from company paper is that:

**Proposal 3.2-5: For intra-DU LTM, if RLC is not re-established, the gNB-DU shall continue sending UL PDCP PDUs to the gNB-CU using the previous UL GTP TEID until cell switch command, and after then start sending using the new UL GTP TEID.**

**Proposal 3.2-6: For intra-DU LTM, if PDCP data recovery is not configured, the gNB-CU shall continue sending DL PDCP PDUs to the gNB-DU using the previous DL GTP TEID until it receives the LTM signalling from DU, and after then start sending using the new DL GTP TEID.**

**Q3.2-3: Any comments on above proposals:**

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any |
| Google | OK with the proposals |  |
| NEC | For intra-DU LTM, if RLC is not re-established and PDCP data recovery is not configured, then will not need new UL/DL TEID. In intra-DU LTM, would this be not the normal case? | [Moderator]There seems no need that the UL/DL GTP tunnel setup is subject to L2 configuration. Decoupling them will make implementation easier. And may have a unified handling on F1 in subsequent handover if the L2 configuration is changed. |
| E/// | Same question as NEC |  |
| China Telecom | We are fine with the above proposals. |  |
| CATT | Same as NEC, why need new DL/UL TEID in intra-DU case |  |
| NTT DOCOMO | OK with the proposals |  |
| Huawei | Ok | we don't think that the UL/DL GTP tunnel setup is subject to L2 configuration. Decoupling them will make implementation easier. And may have a unified handling on F1 in subsequent handover if the L2 cofiguration is changed.Therefore, we support above proposals. |
| Samsung | Comments | In legacy case, the new TEID is used after RLC re-establish/PDCP recovery. Here, for RLC re-establishment/PDCP recovery is not carried out, is there any clear motivation to change the TEID?[Moderator] see clarification above. |
| Lenovo | Same view with NEC. |  |
| ZTE | Same view with NEC. |  |
| Charter Comm | Ok with the proposals |  |
| LGE | Same comment as NEC |  |
| Qualcomm | Agree with the proposals | Maybe we should add to the proposals “new DL GTP TEID corresponding to the candidate target cell”. |
| Nokia | Agree with the proposals |  |
| CMCC | Same view with NEC |  |
| Intel |  Ok with proposal |  |

**Moderator’s summary:**

Majority companies agree with the propsoals. Some companies questioned that if RLC is not established in intra-DU LTM, why change the UL GTP TEID? . Clarification from moderator is provided above inline.

And also provide the clarification here:

There seems no need that the UL/DL GTP tunnel setup is subject to L2 configuration. Decoupling them will make implementation easier. And may have a unified handling on F1 in subsequent handover if the L2 configuration is changed.

It is proposed to agree on the following proposals:

**Proposal 3.2-5: For intra-DU LTM, if RLC is not re-established, the gNB-DU shall continue sending** **UL PDCP PDUs to the gNB-CU using the previous UL GTP TEID until cell switch command, and after then start sending UL PDCP PDUs using the new UL GTP TEID.**

**Proposal 3.2-6: For intra-DU LTM, if PDCP data recovery is not configured, the gNB-CU shall continue sending DL PDCP PDUs to the gNB-DU using the previous DL GTP TEID until it receives the LTM signalling from DU, and after then start sending UL PDCP PDUs using the new DL GTP TEID.**

#### 3.3 Handover collision avoidance between LTM and L3 handover

In R3-231182, it is observed that blindly prioritizing LTM over L3-mobility leads to handover to wrong cells or ping pongs. In R3-231573, R3-231745 and R3-231458, it thinks that the priority of mobility should not be fixed. R3-231573, and R3-231458 proposes to leave the coexistence issue up to network implementation. R3-231745 and R3-231381 provide a set of proposals to clarify the network nodes behaviours in three cases. And R3-231652 proposes to wait for RAN2 decision on the priority.

In summary, the following options for the LTM and L3 handover co-existence are on the table.

* **Option 1: OAM configured priority.**
* **Option 2: Network decides the priority based on scenario (intra-gNB-CU or inter-gNB-CU) and some assistance information (the measurement results, candidate target cells).**
* **Option 3: Flexible priority. The handover triggered first take the high priority.**

For option 3, The detailed description would be:

* **Case 1,** **L3 handover triggered earlier than LTM (the gNB-DU receives the L3 handover command before LTM is triggered), L3 handover has high priority.**
* **Case 2, LTM triggered earlier than L3 (the gNB-CU receives the LTM notify message from gNB-DU before L3 handover is triggered), LTM has high priority,**
* **Case 3, LTM and L3 handover are triggered almost simultaneously (cross signallings on F1). The (source) gNB-DU fails the L3 handover by responding with UE Context Modification Failure message with proper cause meaning LTM has high priority. This is to avoid to cancel the LTM command already sent to the UE which seems complex from moderator point of view.**

The moderator also thinks that OAM configured fixed priority is sub-optimal and should be excluded firstly. For option 2, the question needs to clarify is that the gNB-DU may not know the incoming L3 handover is for intra-CU or inter-CU based on the received UE Context Modification Request (with RRC L3 handover command).

With above understanding, the moderator would like to draw the following questions:

**Q3.3-1: Which option do you prefer (option 2 or option 3) for LTM and L3 handover co-existence?**

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Option 3 |  |
| NEC | Option 3. | L3 Handover signally message will always need preparation in target side and if any erroneous during the preparation including the execution phase in network (i.e. before sending HO Command to the UE), network is able to cancel the L3 handover. Therefore for case 3, it would be simple to take LTM as high priority as before sending L3 HO Command to UE, the L3 Handover can be cancelled. |
| E/// | None of above | It seems the option proposed by use is not explicitly listed above.Our preference is not fixing any priority and leave this for network implementation. The reason is that when we are talking about the triggering, LTM is based on L1 measurements that are periodic while L3 mobility is triggered based on L3 measurements that are event based. In that case LTM would be triggered faster in most cases thus the coexistence does not happen often. Standardizing the priority may lead to reduced flexibility in the network, potentially resulting in decreased performance. |
| China Telecom | None | Agree with Ericsson, we prefer to leave the coexistence issue up to network implementation. |
| CATT | Option 3 |  |
| NTT DOCOMO | Option 2 and 3 | As described in R3-231182 (from Nokia), in order to avoid handover to wrong cells or ping-pong, the priority between LTM and L3 mobility should depend on network decision. We think the pre-configured priority generated by CU can be included in "some assistance information" and sent from CU to serving DU. However, if the priority is configured as "the first received mobility has higher priority", option 2 includes option 3. Alternatively, option 3 may be supported if the priority or assistance information is not indicated. |
| Huawei | Option 3 | Our understanding is that option 3 actually is aligned to what Ericsson is saying above. Option 3 means no fixed priority beween LTM and L3 is specified.I think the intention of option 3 is not to standardize the priority, but to clarify the RAN nodes behaviour if collision happens. Such kind of handling needs to be specified somewhere either in stage 2 or the abnormal case in stage 3, otherwise, ambiguity exits in spec and IOT issues between vendors, and may also cause extra unnecessary signalings to the UE, for example to cancel an ongoing LTM in the UE. |
| Samsung | Comments | This is not about the priority between L3 HO and LTM. It is about which one comes to DU first:* If LTM is already sent to the UE when L3 HO CMD is received at gNB-DU, L3 HO CMD can be rejected by gNB-DU
* If L3 HO CMD arrives gNB-DU before sending LTM CMD, L3 HO is performed first.
 |
| Lenovo | See comments | We don’t need to preconfigure or define any priority to LTM or L3 HO. Especially, in non-split architecture, it is totally upon gNB implementation to trigger LTM or L3 HO based on received measurement report. The collision issue only applies to CU-DU split architecture. And we would prefer to discuss the handling case by case without having a priority mindset, e.g., modified from moderator’s description.* **Case 1, if the gNB-DU receives the L3 handover command while gNB-DU is about to trigger LTM switching the UE to a different target cell**
	+ gNB-DU may need to decide whether to a) send L3 HO command b) send LTM command and fail L3 HO
* **Case 2, the gNB-CU receives the LTM notify message from gNB-DU after gNB CU has start preparing (inter-CU) L3 HO but has not triggered L3 HO**
	+ gNB-CU may need to cancel the prepared HO over Xn interface, or
	+ gNB-CU coordinate with DU before L3 HO preparation to avoid such collision
* **Case 3, if the gNB-DU receives the L3 HO command while gNB-DU has already triggered the LTM**
	+ This implies UE may have already switch to another cell, and L3 HO is no longer applicable, gNB-DU may fail the L3 HO with necessary indication about the cause
 |
| ZTE | None | We still believe that this issue is RAN2 related. If RAN2 decides not to support the coexistence of L3 HO and LTM , the collision would not happen. If we really need to discuss this issue before getting RAN2 decision, we agree with E///’s view, this can be left to implementation. |

|  |  |  |
| --- | --- | --- |
| Charter Comm | Option 3 | In particular the proposal in R3-231458 |
| LGE | None | Unless the purpose is to let the UE simultaneously receive the LTM command and L3 HO command, as mentioned in Ericsson, leave this for network implementation. |
| Qualcomm | Option 3, though we think RAN3 should wait for RAN2’s decision on the priority. Please also see comments | Regarding Option 1, it can lead to sub-optimal performance.Regarding Option 2, since the focus in Rel-18 is on intra-CU mobility, inter-CU case should not be considered. It is not specified in detail in Option 2 as to how network decides the priority, so we cannot evaluate this option. Regarding Option 3, for Case 1, we think a separate indication is needed from the CU to the DU along with the L3 handover message, since the L3 handover command is transparent to the DU. The indication can indicate that the RRC container in the message is the L3 handover command.  |
| Nokia | Left to network implementation | It should be left up to network implementation whether to prioritize LTM or L3-mobility based on the scenario (intra-gNB-CU or inter-gNB-CU) and the measurement results. Similarly, fixing a priority for all cases may lead to suboptimal performance. Thus, RAN3 should explore further whether CU can provide some additional assistance information to improve mobility decisions at the DU. |
| CMCC | Option 2 and Option 3 | We think it is necessary to decide the priority between LTM and L3 mobility depending on network decision and some assistance information. |

**Moderator’s summary:**

No consensus. Some companies agree to option 2, and somes agree to option 3. And some think that it is up to implementation.

**To be continued.**

#### 3.4 Candidate cell modify and release

Quite lots of papers (R3-231182, R3-231315, R3-231447, R3-231573, R3-231745, R3-231747, R3-231807, R3-231813, and R3-231848) address the candidate cells modification and release issue.

All the proposals seem similar. Therefore, the moderator summarizes all the proposals as following:

**Proposal 3.4-1: The gNB-CU may modify or release L1/2 Triggered Mobility (LTM) candidate cells in the gNB-DU.**

**Proposal 3.4-2: The gNB-DU may cancel already configured L1/2 Triggered Mobility (LTM) candidate cells.**

Note that although some proposals are made towards to the LTM completion phase, the moderator thinks that the above proposals should be applicable also to the LTM configuration phase.

**Q3.4-1: Are above proposals from moderator agreeable?**

Comments or wordings to above proposals, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | OK with the proposals |  |
| NEC | Agreeable. |  |
| E/// | Ok | For P3.4-2, when DU cancels the configured LTM candidate cell(s), it needs to tell CU. |
| China Telecom | We are fine with the above proposals. |  |
| CATT | Agree with both |  |
| NTT DOCOMO | OK with the proposals |  |
| Huawei | OK with the proposals | Agree with Ericsson. |
| Samsung | OK  |  |
| Lenovo | Agree with the proposals. | Agree with Ericsson. |
| ZTE | Agree |  |
| Charter Comm | OK with the proposals |  |
| Qualcomm | Agree with the proposals |  |
| Nokia  | Agree with the proposals |  |
| CMCC | Agree with the proposals |  |

**Moderator’s summary:**

**All companies agree to the propsoals with a minor comment.**

**Therefore, it is proposed:**

**Proposal 3.4-1: The gNB-CU may modify or release L1/2 Triggered Mobility (LTM) candidate cells in the gNB-DU.**

**Proposal 3.4-2: The gNB-DU may cancel already configured L1/2 Triggered Mobility (LTM) candidate cells.**

If the answer of Q3.4-1 is yes, the messages to be used for candidate cells modification and release should be decided. The moderator provides the following proposals based on the papers addressed this issue.

**Proposal 3.4-3: The gNB-CU may use the UE Context Modification procedure to modify or release the prepared resources of candidate cells in the gNB-DU and use the UE Context Release procedure to release the UE context in the gNB-DU.**

**Q3.4-2: Are above proposal from moderator agreeable?**

Comments or wordings to above proposal, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Yes |  |
| NEC | agreeable |  |
| E/// | Yes |  |
| China Telecom | Yes |  |
| CATT | agree |  |
| NTT DOCOMO | Yes |  |
| Huaweic | Yes |  |
| Samsung | Yes |  |
| Lenovo | Agree with the proposal. |  |
| ZTE | Yes |  |
| Charter Comm  | Yes |  |
| Qualcomm | Agree with the proposal |  |
| Nokia | Agree |  |
| CMCC | Yes |  |

**Moderator’s summary:**

**All companies agree to the propsoals with a minor comment.**

**Therefore, it is proposed:**

**Proposal 3.4-3: The gNB-CU may use the UE Context Modification procedure to modify or release the prepared resources of candidate cells in the gNB-DU and use the UE Context Release procedure to release the UE context in the gNB-DU.**

For the gNB-DU initiated candidate cells release (de-configuration), R3-231182 provides the following options and propose to adopt option 2b:

* Option 1a: Reuse of gNB-DU Initiated UE Context Modification procedure (i.e. UE CONTEXT MODIFICATION REQUIRED message).
* Option 1b: Similar to Option 1a, but with introduction of a new F1AP procedure requesting LTM target candidate cells DE-configuration.
* Option 2a. Have the gNB-DU directly DE-configure the LTM target candidate cells. That is, the gNB-DU signals the UE via an L1 message the target candidate cells to be DE-configured. Likewise, the gNB-DU removes the resources utilized for the LTM target candidate cells, and informs the gNB-CU the target candidate cells that have been DE-configured (likely via a new F1AP message).
* Option 2b: Similar to Option 2b, in that gNB-DU could DE-configure the target cells from itself. However, with difference that gNB-DU then signals the target cells that were de-configured to the gNB-CU, and it is kept a gNB-CU responsibility to build an appropriate RRC message and update the configuration to the UE.

Although, the majority view among the papers seems to prefer option 1a, the moderator would like to draw the following question:

**Q3.4-3: Which option do you prefer for the gNB-DU initiated candidate cells release?**

Comments or wordings to above proposal, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Option 1a  |  |
| NEC | Option 1a. | The simple way of course is to reuse the current signalling message, without creating new signalling message only for this small purpose as cancelling from source gNB-DU does not seems a normal case. |
| E/// | Option 1a |  |
| China Telecom | Option 1a |  |
| CATT | Option 1a with enhancement | First, we support that when the candidate DU decided to release some candidate cell, this request can not be rejected by CU. This is because such release is usually due to overload or DU’s own problems, the candidate cell cannot provide services any more.We think option1a is OK, but maybe we can do some enhancements to ensure CU will not refuse the candidate cell release require to make sure this procedure can execute success each time.For the option 2a and 2b, we are confused why the target can send L1 message to UE, especially in inter- DU case. In our understanding, UE is still connected with the serving DU and cannot receive the message from any candidate cells. |
| NTT DOCOMO | Option 1a | Option 1a/1b should be adopted if similar signaling design is adopted as much as possible in both inter-DU and intra-DU cases. In intra-DU, it is possible for DU to DE-configure some of the candidate cells from itself, but in inter-DU case, if the candidate DU releases the cells before informing the serving DU, cell switch failure may occur. |
| Huawei | Option 1a |  |
| Samsung | Option 1a |  |
| Lenovo | Option 1a. |  |
| ZTE | Option 1a. |  |
| Charter Comm | Option 1a |  |
| Qualcomm | Option 1a |  |
| Nokia | Option 1a or 2b | In our view, the important aspect is that the deconfiguration should always succeed. Hence, if RAN3 decides to go for Option 1a, we should consider enhancing the specification so that a deconfiguration request cannot be rejected by the CU. |
| CMCC | Option 1a |  |

Moderator’s summary:

All companies think that option 1a is agreeable. Two companies think that enchement may be needed to avoid the CU reject the DU initiated candidate cell release.

Therefore, it is proposed:

**Proposal 3.4-3a: the gNB-DU may use the UE Context Modificaiton Required message to release the candidate cells, and the gNB-CU shall not reject .**

If Q3.4-3’s answer is option 1a, the moderator would like to check companies view on below proposal:

**Proposal 3.4-4:** **The gNB-DU may use the UE Context Modification Required procedure to request to cancel the prepared resources of candidate cells in the gNB-DU and use the UE Context Release Request procedure to request to release the UE context in the gNB-DU.**

**Q3.4-4: Are above proposal from moderator agreeable?**

Comments or wordings to above proposal, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Yes |  |
| NEC | Agreeable. | With these procedures, it will be confirmed that basically the mobility is under gNB-CU control. |
| E/// | With comments | It needs to be clear that the first gNB-DU is the same as the second gNB-DU, which means the candidate DU. |
| China Telecom | Agree |  |
| CATT | Yes  | Same comment as above |
| NTT DOCOMO | Yes |  |
| Huawei | agree | Ericsson’s clarification is also correct. |
| Samsung | Comments | Depends on whether all candidate cells are requested to be released or not. * If a subset of candidate cells is requested to be released, UE context modification required message can be used.
* If all candidate cells are requested to be released, UE context release request message can be used.

To be clear, the proposal can be rephrased as:**The gNB-DU may use the UE Context Modification Required procedure to request to cancel the prepared resources of a subset of candidate cells in the gNB-DU and use the UE Context Release Request procedure to request to release all candidate cells ~~the UE context~~ in the gNB-DU.** |
| Lenovo | Agree with the proposal. |  |
| ZTE | Agree | Samsung’s proposal seems more clear |
| Charter Comm | Yes |  |
| Qualcomm | Agree with the proposal |  |
| Nokia | Agree with comments | As mentioned in the previous question, additional care is needed to avoid rejection by the CU of a LTM deconfiguration request. |
| CMCC | Agree |  |

**Moderator’s summary:**

All company agree to the proposal. And some companies provide some wording on the proposal.

The proposal from Samsung are used for agreement:

**Proposal 3.4-4: The gNB-DU may use the UE Context Modification Required procedure to request to cancel the prepared resources of a subset of candidate cells in that gNB-DU and use the UE Context Release Request procedure to request to release all candidate cells in that gNB-DU.**

#### 3.5 Subsequent LTM

Regarding to subsequent LTM, below is the previous agreement that RAN3 made:

RAN3 works on the same signaling procedure for both initial cell switch and subsequent cell switch for intra-DU L1/L2 handover.

And among the papers in R3-231315. R3-231510, R3-231678, R3-231745, R3-231807, and R3-231813 in this meeting, the following issues and proposals are raised:

**Q3.5-1: When subsequent LTM is configured?**

* **Option 1:** **Subsequent LTM is configured together with initial LTM.**
* **Option 2: Subsequent LTM is configured after each LTM completion. E.g., when the gNB-CU receives the Access Success message from (target) gNB-DU,**

The point of option 1 is that RAN2 has agreed that there is no further RRC reconfigurations for subsequent LTM after initial LTM. Therefore, the configurations required for subsequent LTM should be prepared together with initial LTM. The configuration for initial LTM and subsequent LTM is sent to UE in the same RRC reconfiguration message for the first LTM preparation.

Then subsequent LTM can be executed multiple times referring to the execution part of the stage 2 procedure as captured in BLCR (i.e. step 9 ~ step 13, including L1 measurement reporting, LTM cell switch notify and ACCESS SUCCESS message).

While option 2 thinks that after each LTM, the CU may transmit a UE Context Modification Request to indicate to the DU to keep resources associated with a subset of the candidate cells for subsequent LTM. And it is pending to RAN2 discussion as there is UE impact.

Comments and answers to above question, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Option 1 | As answered in section 3.4, the candidate cells may be modified or released by the CU or DU and the left candidate cells can be used for subsequent LTM |
| NEC | Option 1 will be one shot of signalling which seems simpler. |  |
| E/// | Wrong assumption | The question is inadequately described. The network does not configure subsequent LTM. The UE is configured only for one time for one candidate cell. DU should keep the resources for the UE until it releases the LTM cell.Thus it is incorrect to say whether subsequent LTM is configured together with initial LTM or not. Subsequent LTM is feasible once the UE is configured. |
| China Telecom | Option 1 |  |
| CATT | Option 1 |  |
| NTT DOCOMO | Option 1 | Option 1 should be considered as a Subsequent LTM, while Option 2 may require re-configuration of the UE at each cell switch, which is considered a kind of re-initiation. The only difference between initial LTM and subsequent LTM with Option 2 is whether or not the candidate DUs have already prepared resources for the LTM. |
| Huawei | Option 1 | We have the same view as Ericsson. |
| Samsung | Comments | When to configure the subsequent LTM seems to be gNB-CU’s implementation issue. Specifically, as long as subsequent LTM candidates are decided, gNB-CU can inform it to gNB-DU. Even this issue needs discussion, it should be discussed in RAN2 first since subsequent LTM is introduced by RAN2 first. |
| Lenovo | Option 1 with comments | It is unclear what is the subsequent LTM configuration. In our understanding, the subsequent LTM is feasible when the candidate DU with the new source cell is aware of the candidate cell(s) configuration the UE has stored. |
| ZTE |  | Share same view as E/// and HW |
| Qualcomm | Option 1 |  |
| Nokia | Option 1 with comments | Similar view as Ericsson. “Subsequent LTM” is not something that is configured. Instead, the basis is that a cell either has LTM configured or not. The configuration remains valid regardless of whether a single or multiple LTM operations occur utilizing the same configuration.  |
| CMCC |  | Share same view as E/// and HW |

Moderator’s summary:

Most companies agree with option 1. And few companies think that subsequent LTM is not sth that can be configured.

The moderator would like to propose to combine option 1 and the major commemnts:

**Proposal 3.5-1: Subsequent LTM is considered feasible once the UE is configured in initial LTM configuration.**

**Q3.5-2: Which node decides the candidate cells to support subsequent LTM?**

There is only 1 proposal to propose the gNB-CU to decide.

**Proposal 3.5-2: the gNB-CU decides whether or which candidate cells need support subsequent LTM.**

**Proposal 3.5-3: Candidate gNB-DU can accept/reject the request for support subsequent cell switch from the gNB-CU.**

**Proposal 3.5-4: Introduce sequential cell switch supported indicator in the UE context setup/modification request message, whether it is per cell or pre node is still FFS.**

Comments on above question and proposals, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | OK with the proposals 3.5-2 and 3.5-3. | Not sure if proposal 3.5-4 is needed |
| NEC | Agreeable with the proposals. |  |
| E/// | ? | As explained in Q3.5-1, subsequent LTM is available once the UE is configured for LTM. There is no special handling for CU compared with “initial” LTM. Therefore, we don’t see the need to discuss this proposal. |
| China Telecom | We are fine with the proposals. |  |
| CATT | yes |  |
| NTT DOCOMO | OK with the proposals | Regarding proposal 3.5-4, candidate cells for subsequent LTM should be explicitly indicated in the UE context setup/modification request in order to ensure that the candidate cells are maintained in candidate DUs after initial LTM without explicit signaling and can be selected as target cells in subsequent LTM. |
| Huawei | None of them | We have the same understaning as Ericcsion. Subsequent LTM needs no additional decision and configuration. It will be supported once LTM is configured to the UE. |
| Samsung | Comments | In our understanding, it should be gNB-CU’s decision on the subsequent LTM candidates. However, the final decision should be made by RAN2 first. |
| Lenovo |  | See comments in Q3.5-1. |
| ZTE |  | Share same view as E/// and HW |
| Qualcomm | Agree with P3.5-2 and P3.5-3  | We would like to better understand P3.5-4 |
| Nokia | None | Similar view with Ericsson and Huawei. No additional indicators are needed either. |
| CMCC |  | Share same view as E/// and HW |

Moderator’s summary:

Some companies agree with the proposals. And companies think that no any addition indication is needed for subsequent LTM.

Therefore, the moderator would like to conclude that:

**The proposals are noted.**

The third question that the moderator thinks needs to clarify is about the option 1 in Q3.5-1:

**Q3.5-3: How to indicate LTM to the UE and the gNB-DU for option 1 in Q3.5-1 ?**

* **Option 1: all candidate cells/UE contexts configured are maintained for subsequent LTM by default after LTM initial configuration and release of them should be done by explicit signalling.**
* **Option 2; the candidate cells that should be maintained for subsequent LTM are explicitly indicated and the others without indications are released after LTM.**

Comments on above question and options, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Option 2 is slightly preferred |  |
| NEC | Another option 3: all candidate cells that should be maintained for subsequent LTM are explicitly indicated and the other will be released by explicit signalling.  |  |
| E/// | Option 1? | Some clarification is needed. Does the explicit signaling mean the cancellation of candidate cell, in the same way as “initial” LTM? If so, then the answer is yes. If new signaling is introduced, then the answer is no. |
| China Telecom | Option 2 |   |
| CATT | Option 2 |  |
| NTT DOCOMO | Option 2 |  |
| Huawei | Option 1 | As clarified in above questions, no explicit subsequent LTM config is needed. Normal LTM configuration means subsequent is supported by defaut. And normal candidate cells cancellation means no need subsequent LTM to those cells. |
| Samsung | Comments | Before making choice between opt1 and opt2, the most important thing for RAN3 is to discuss whether F1 signalling should be enhanced to inform subsequent LTM candidate cells to gNB-DU. In our understanding, this enhancement is needed. So, we propose to agree:**The subsequent LTM candidate cells should be configured to the gNB-DU.** The above options are different on whether subsequent LTM candidate cells are all LTM candidate cells or a subset of LTM candidate cells. This seems to be RAN2 issue. |
| Lenovo | See comments. | The indications to the UE and DU are different.For the UE, all candidate cells which should be maintained for subsequent LTM are explicitly indicated.For the DU, since the candidate cells will be from different candidate DUs, the candidate DU with the new source cell should be aware of the candidate cell(s) configuration the UE has stored. |
| ZTE | Option 1 | Share same view as E/// and HW |
| Qualcomm | Prefer Option 1, though both options work |  |
| Nokia | Option 1 with comments | As mentioned in previous questions, the LTM configuration should remain valid regardless of single or multiple LTM operations. Similarly, additional indicators are not needed. |
| CMCC | Option 1 |  |

Moderator’s summary:

Companies views are quite different. More clarification and discussion is needed.

**Proposals are noted.**

#### 3.6 E1 Aspects

The discussions in papers R3-231182, R3-231315, R3-231573, and R3-231746 begin with the WF which was agreed at last meeting.

**In case of CP UP separation, once CUCP receives LTM cell switch signling from (source)DU , CU CP initiates E1 bearer context modification including DL tunnel ID per DRB for target cell, and security keys corresponding to target cell (if updated) for data transmission.**

Some companies observed that RAN2 agreed that no security update support in Rel-18 with L1/L2 based mobility. Based on that, the following proposal is made:

**Proposal 3.6-1: For intra-CU-UP case, propose to turn the following WF to an agreement:**

**In case of CP UP separation, once CUCP receives LTM cell switch signling from (source)DU , CU CP initiates E1 bearer context modification to the CU UP including DL tunnel ID per DRB for target cell, for data transmission.**

Furthermore, the proposal for inter-CU-UP would look like:

**Proposal 3.6-2: For inter-CU-UP LTM, once the CU-CP receives LTM cell switch signaling from (source) DU, the CU-CP initiates E1 bearer context modification to the target CU UP including DL tunnel ID per DRB for data transmission.**

Comments on above proposals, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above proposals | Comments if any. |
| Google | OK with the proposals |  |
| NEC | For inter-DU LTM, agree with the proposal.For intra-DU LTM and intra-UP (i.e. no change of CU-UP), there will be no need to create new TEID, actually no signalling will be exchange with CU-UP? |  |
| E/// | Yes |  |
| China Telecom | We are fine with the proposals. |  |
| CATT | ok | One concern is whether can realize CU UP change without security key update? This case is very limited and we prefer to consider it later. |
| NTT DOCOMO | OK with the proposals |  |
| Huawei | yes | Regarding the question from NEC,Our understanding is that the UL TEID may be kept no change in such case. But he DL TEID may be reallocated by the DU? |
| Samsung | OK |  |
| Lenovo | Agree with the proposal. |  |
| ZTE | Yes |  |
| LGE | OK |  |
| Qualcomm | Agree with the proposals. Please see comments | For P3.6-2, we were wondering why the CU-UP would be changed, i.e., we wanted to understand the motivation for considering the inter-CU-UP LTM case in the first place, further considering that Rel-18 LTM is for intra-CU.  |
| Nokia | OK |  |
| CMCC | OK |  |

**Most of companies agree with the proposals.**

**Questions needs to be clarified online:**

1. For intra-DU LTM and intra-UP (i.e. no change of CU-UP), there will be no need to create new TEID, actually no signalling will be exchange with CU-UP?
2. whether can realize CU UP change without security key update? This case is very limited and we prefer to consider it later.
3. why the CU-UP would be changed, i.e., we wanted to understand the motivation for considering the inter-CU-UP LTM case in the first place, further considering that Rel-18 LTM is for intra-CU.

**The following proposals are for agreememnt if above questions are clarified:**

**Proposal 3.6-1: For intra-CU-UP case, propose to turn the following WF to an agreement:**

**In case of CP UP separation, once CUCP receives LTM cell switch signling from (source)DU , CU CP initiates E1 bearer context modification to the CU UP including DL tunnel ID per DRB for target cell, for data transmission.**

**Proposal 3.6-2: For inter-CU-UP LTM, once the CU-CP receives LTM cell switch signaling from (source) DU, the CU-CP initiates E1 bearer context modification to the target CU UP including DL tunnel ID per DRB for data transmission.**

For intra-CU-UP LTM, one paper proposed the following signaling optimization:

**Proposal 3.6-3: One option that can minimize the impact on CU-UP when performing LTM is that the steps 3 and 4 are executed together with steps 9 and 10.**

**Proposal 3.6-4: One more option that can minimize the impact on CU-UP when performing LTM is that the CU-UP provides only one UL TNL address which will only be used by the target cell after successful execution of LTM cell switch.**



Comments on above proposals, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above proposals | Comments if any. |
| Google |  | Not sure if signalling optimization is needed |
| NEC | If intra-DU LTM, probably no need to have new TEID since security update will not be needed for LTM, as agreed by RAN2. |  |
| E/// | Yes | To clarify, it is not optimization, but to simplify the signalings design at the beginning of LTM feature. |
| China Telecom | Seems agreeable. |  |
| CATT | Agree with NEC |  |
| NTT DOCOMO | Open | We do not have strong view for those proposals. |
| Huawei |  | The issue is that if steps 3 and 4 are executed together with steps 9 and 10, what happens if step 9 and 10 are failed, for example due to CUUP overload? There is no time for the CU to find out another suitable target UP. But if not optimise the signalling, during LTM preparation in UP, if step 3 and 4 fails due to lack of resources in UP, the CU still can choose other Ups. |
| Samsung | Comments | Can we start the baseline procedure first? The optimization can be considered after the baseline is settle down. |
| Lenovo | See comments | Prefer to design the basic message flow first to have a whole picture. After that, we can discuss whether optimization is needed. |
| ZTE |  | Prefer to focus on the baseline procedure first and then consider the potential enhancements |
| LGE | Similar view to Samsung and Lenovo. |  |
| Qualcomm |  | Prefer to comment after seeing more details on the proposals. |
| Nokia | No | Disagree with the proposals. These proposals also break the basic framework we have for establishing UE/Bearer contexts in disaggregated architecture. |
| CMCC |  | Prefer to focus on baseline procedure first. |

**Moderator’s summary:**

**2 companies agree with the proposal. 1 company disagree.**

**Most of companies would like to see the basic message flow first and discuss the potential optimisation after.**

**Therefore, it is proposed:**

**Proposal 3.6-3a: Revisit the following proposals after the basic procedure is stable.**

* **One option that can minimize the impact on CU-UP when performing LTM is that the steps 3 and 4 are executed together with steps 9 and 10.**
* **One more option that can minimize the impact on CU-UP when performing LTM is that the CU-UP provides only one UL TNL address which will only be used by the target cell after successful execution of LTM cell switch.**

**To be continued.**

Furthermore, in case of inter CU-UP LTM, before cell switch there are some unsuccessfully transmitted DL data and new DL data already buffered at source CU-UP. For avoiding data loss, some papers propose that E1 bearer context modification shall be also used for getting the PDCP status at source CU-UP and exchanging the data forwarding information for data forwarding from source CU-UP to the target CU-UP. The target CU-UP can then (re)transmit the data to UE via the target cell after UE has accessed the target cell.

Then, the following is proposed by the moderator:

**Proposal 3.6-3: For inter-CU-UP LTM, the CU-CP initiates E1 bearer context modification to the source CU-UP for retrieving the latest PDCP status at the source CU-UP and exchanging the data forwarding information to target CU-UP.**

**Proposal 3.6-4: In case of gNB-CU-UP change, the gNB-CU triggers the source gNB-CU-UP to start data forwarding after receiving LTM cells switch signalling from DU.**

Comments on above proposals, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | OK with the proposals |  |
| NEC | Need time to check in detail after discussion. |  |
| E/// | Not for first round |  |
| China Telecom | Seems agreeable. |  |
| CATT | Agree |  |
| NTT DOCOMO | OK with the proposals |  |
| Huawei | OK |  |
| Samsung | OK |  |
| Lenovo | Agree with the proposals. |  |
| ZTE | Yes |  |
| Qualcomm | Overall agree with the proposals | As mentioned earlier, we were wondering whether CU-UP change case should be considered at all. |
| Nokia | OK |  |
| CMCC | OK |  |

**Moderator’s summary:**

**Most of companies agree to the proposals. 1 company would like to further check in second round.**

**Therefore, the following proposals are proposed for agreement and can be revisited in second round:**

**Proposal 3.6-3: For inter-CU-UP LTM, the CU-CP initiates E1 bearer context modification to the source CU-UP for retrieving the latest PDCP status at the source CU-UP and exchanging the data forwarding information to target CU-UP.**

**Proposal 3.6-4: In case of gNB-CU-UP change, the gNB-CU triggers the source gNB-CU-UP to start data forwarding after receiving LTM cells switch signalling from DU.**

In addition, thanking to the Access Success message from the target gNB-DU, the CU-CP may know that the UE has successfully accessed to the target cell, it then initiates the path switch procedure towards the CN for switching transmission of the subsequent DL data to the target CU-UP, e.g. via the new path.

Then, the following is proposed by the moderator:

**Proposal 3.6-5: For inter-CU-UP LTM, Path switch procedure is performed towards the core network after detecting the UE has accessed to the target cell.**

Comments on above proposals, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | OK with the proposal |  |
| NEC | Agreeable. |  |
| E/// | Not for first round |  |
| China Telecom | Seems agreeable. |  |
| CATT | Agree |  |
| NTT DOCOMO | OK with the proposal |  |
| Huawei | OK. |  |
| Samsung | Comments | Is this the legacy procedure? |
| Lenovo | Agree with the proposal. |  |
| ZTE | Yes |  |
| Charter Comm | Yes |  |
| Qualcomm | Agree with the proposal |  |
| Nokia | OK |  |
| CMCC | Yes |  |

**Moderator’s summary:**

**Most of companies agree to the proposal. And clarification from moderator is that the proposal is the same as the legacy procedure.**

**The following proposal is for agreement:**

**Proposal 3.6-5: For inter-CU-UP LTM, Path switch procedure is performed towards the core network after detecting the UE has accessed to the target cell.**

If above proposals are agreeable, the following shows the tentative overall message flow for inter-CU-UP LTM. For intra-CU-UP LTM message flow, the moderator thinks that it is simple and could be treated part of the inter-CU-UP case. The only difference is in step 2 and 3, in which Bearer Context Modification will be used in case of intra-CU-UP LTM.

**Figure : Inter-DU LTM with gNB-CU-UP change**

0. The source gNB-DU forwards the Measurement Report to the gNB-CU-CP.

1. The gNB-CU-CP decides to initiate LTM configuration.

2. The gNB-CU-CP sends a BEARER CONTEXT SETUP REQUEST message containing UL TNL address information for NG-U to setup the bearer context in the gNB-CU-UP.

3. The gNB-CU-UP responds with a BEARER CONTEXT SETUP RESPONSE message containing the UL TNL address information for F1-U, and DL TNL address information for NG-U.

4 - 5. F1 UE context setup procedure is performed to setup one or more bearers in the gNB-DU.

6. The gNB-CU-CP notifies the source gNB-DU and sends the RRC Reconfiguration message to the UE.

7. The source gNB-DU make the LTM decision.

8. The source gNB-DU sends the LTM cell switch notify message to the gNB-CU-CP with the selected target cell ID.

9-10. The gNB-CU-CP performs the Bearer Context Modification procedure to retrieve the PDCP UL/DL status and to exchange data forwarding information for the bearer.

11-12. The gNB-CU-CP performs the Bearer Context Modification procedure to send the DL TNL address information for F1-U and data forwarding between source gNB-CU-UP and target gNB-CU-UP, and PDCP status..

13. The target gNB-DU detects the UE in the target cell.

14. The target gNB-DU sends an Access Success message to the gNB-CU-CP.

15. Data Forwarding may be performed from the source gNB-CU-UP to the target gNB-CU-UP.

16 - 18. Path Switch procedure is performed to update the DL TNL address information for the NG-U towards the core network.

19-20. Bearer Context Release procedure may be performed to release the UE context in the source gNB-DU. This step may be skipped in case that subsequent LTM is supported.

**Q3.6-6: Any comments on above tentative message flow for inter-CU-UP LTM?**

Comments on the tentative inter-CU-UP LTM message flow, please provide here.

|  |  |  |
| --- | --- | --- |
| Companies | Your company view on above question | Comments if any. |
| Google | Generally ok  | Should it be Q3.6-6? |
| NEC | Need time to check later after the discussion. |  |
| E/// | Not for first round |  |
| China Telecom | We prefer to check the message details in the second round. |  |
| CATT | Generally ok, need time for further check  |  |
| Huawei | Further check at second round. |  |
| Samsung | Can take it as baseline for further check |  |
| Lenovo | No need for the first round. |  |
| ZTE | Further check at second round. |  |
| Qualcomm | Overall ok. Would like to have another look at it after a set of proposals have been agreed.  |  |
| Nokia | Further check at second round | Likewise, the data forwarding is marked unnecessarily late in the diagram (after ACCESS SUCCESS). This can occur at an earlier stage. |
| CMCC | Further check at second round. |  |

**Moderator’s summary:**

**Check details in second round.**

# 4 Conclusion

# 5 Reference

|  |  |  |
| --- | --- | --- |
| [R3-231182](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231182.zip) | TP (BL CR TS 38.401) L1/2 Triggered Mobility (LTM) Procedures (Nokia, Nokia Shanghai Bell) | other |
| [R3-231183](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231183.zip) | Discussion on TA Acquisition for LTM (Nokia, Nokia Shanghai Bell) | discussion |
| [R3-231239](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231239.zip) | gNB-DU initiated target cell re-configuration for L1/L2 triggered mobility (Rakuten Symphony) | discussion |
| [R3-231315](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231315.zip) | Signalling Support for LTM (Qualcomm Incorporated) | discussion |
| [R3-231381](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231381.zip) | co-existence between LTM and L3 mobility (NEC) | discussion |
| [R3-231382](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231382.zip) | (TP to TS 38.473 on LTM) co-existence between LTM and L3 mobility (NEC) | other |
| [R3-231388](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231388.zip) | (TP for L1L2Mob BLCR for TS 38.401) Discussion on reference configuration in LTM (Google Inc.) | other |
| [R3-231447](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231447.zip) | Discussion on L1L2 based inter-cell mobility (Lenovo) | discussion |
| [R3-231448](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231448.zip) | (TP to TS 38.401 & TS 38.470) Support of L1L2 based inter-cell mobility (Lenovo) | other |
| [R3-231458](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231458.zip) | Collision between L1/L2-triggered mobility and L3 mobility (vivo) | discussion |
| [R3-231459](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231459.zip) | Discussion on L1/L2-triggered Mobility (vivo) | discussion |
| [R3-231510](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231510.zip) | Discussion on remaining issues for LTM procedure (China Telecommunication) | discussion |
| [R3-231511](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231511.zip) | (TP to TS 38.473 BL CR) On support of LTM procedure (China Telecommunication) | other |
| [R3-231573](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231573.zip) | (TP for LTM BL CR to TS 38.401) Solutions for LTM (Ericsson) | other |
| [R3-231574](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231574.zip) | (TP for LTM BL CR to TS 38.473) F1AP impacts for LTM (Ericsson) | other |
| [R3-231652](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231652.zip) | Discussion on LTM related issues (LG Electronics Inc.) | discussion |
| [R3-231653](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231653.zip) | (TP for NR\_Mob\_enh2 BL CR for TS 38.401) Discussion on LTM related issues (LG Electronics Inc.) | other |
| [R3-231654](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231654.zip) | (TP for NR\_Mob\_enh2 BL CR for TS 38.473) Discussion on LTM related issues (LG Electronics Inc.) | other |
| [R3-231678](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231678.zip) | Discussion on left issues for L1/L2 mobility (CATT) | discussion |
| [R3-231679](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231679.zip) | (TP for L1L2 Mob BLCR for TS 38.401) Support of L1L2 based inter-cell mobility (CATT) | other |
| [R3-231745](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231745.zip) | (TP for L1L2Mob BLCR for TS 38.401): L1/L2 Mobility procedure on F1 (Huawei) | other |
| [R3-231746](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231746.zip) | (TP for L1L2Mob BLCR for TS 38.401): L1/L2 Mobility procedure on E1 (Huawei) | other |
| [R3-231747](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231747.zip) | (TP to Mob\_enh2 BL CR TS38.401) Discussion on L1/L2 based Inter-cell Mobility (Samsung Electronics France SA) | discussion |
| [R3-231751](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231751.zip) | Considerations on parallel vs single (including TPs for TS 38.473) (Intel Corporation) | discussion |
| [R3-231807](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231807.zip) | Discussion on L1L2 based Inter-Cell Mobility (CMCC) | discussion |
| [R3-231808](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231808.zip) | (TP to TS 38.401) L1L2 based Inter-Cell Mobility (CMCC) | other |
| [R3-231813](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231813.zip) | Further discussion on LTM (NTT DOCOMO INC.) | discussion |
| [R3-231848](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231848.zip) | (TP for LTM BL CR to TS 38.473) Discussion on L1/L2 triggered mobility (ZTE) | other |
| [R3-231849](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_119bis-e%5CDocs%5CR3-231849.zip) | TP for LTM BL CR to TS 38.401 (ZTE) | other |