3GPP TSG-RAN WG3 Meeting #115-e R3-222424

Online, 21 Feb – 3 Mar 2022

Agenda Item: 10.2.6

Source: Lenovo, Motorola Mobility (moderator)

Title: Summary of Offline Discussion on SON Enhancements for CHO

Document for: Approval

# Introduction

**CB: # SONMDT8\_MobilityEnh**

**- Down select network-based solutions, e.g. for the case that a RLF occurred in CHO target cell after completing handover:**

**Option a-1/a-2/b/c, or combination of at least one of them?**

**- Whether to introduce a new initiating condition for CHO recovery procedure in FAILURE INDICATION message?**

**- Whether the FAILURE INDICATION message may be initiated without RLF report for CHO, if yes, whether to include an explicit CHO recovery cell ID in FAILURE INDICATION message and whether to include an explicit CHO recovery Cell CGI in HANDOVER REPORT message, in case of without RLF Report?**

**- Capture agreements, and provide TPs if agreeable**

(Lenovo - moderator)

Summary of offline disc [R3-222424](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_115-e/Inbox/Drafts/CB%20%23%20SONMDT8_MobilityEnh)

Phase I：Please provide your inputs before UTC time 10:00 Thursday 24th Feb.

Phase II：TBD.

# For the Chairman’s Notes

The following proposals can be agreed:

Propose the following:

R3-20xxxa, R3-20xxxc merged

R3-20xxxc rev [in xxxg] – agreed

R3-20xxxd rev [in xxxh] – agreed

R3-20xxxe rev [in xxxi] – agreed

R3-20xxxf rev [in xxxj] – endorsed

Propose to capture the following:

**Agreement text…**

**Agreement text…**

**WA: carefully crafted text…**

**Issue 1: no consensus**

**Issue 2: issue is acknowledged; need to further check the impact on xxx. May be possible to address with a pure st2 change. To be continued…**

# Discussion

## CHO execution condition(s) and candidate cell list

RAN3#114bis-e meeting has agreed network-based solution is needed for the source node to get CHO execution condition(s) and candidate cell list e.g. for the case that a RLF occurred in CHO target cell after completing handover, and it is FFS which network-based solution is adopted. As summarized in [1], the on-table options are as below:

Option a: Derive candidate cell list and CHO execution condition(s) based on Mobility Information.

* Option a-1: Source node transmits the Mobility Information to the target node when CHO is completed, i.e. in the SN STATUS TRANSFER message, and the target node sends the Mobility Information back to the source node via HANDOVER REPORT message.
* Option a-2: Source node transmits the Mobility Information to each candidate target node in the HO request message, and the target node sends the Mobility Information back to the source node via HANDOVER REPORT message.
* Option a-3: Including the Mobility Information in the UE RLF-report. RAN3 asks RAN2 to consider feasibility of adding the Mobility Information to the CHO configuration.

Option b: Source node sends candidate cell list and CHO execution condition(s) to the target node after receiving Handover Success message, e.g. in SN Status Transfer message, and then the target transmits the info back to the source node in HANDOVER REPORT message.

Option c: Source node stores the CHO related configuration.

In [2], it is observed that Option a-2 and Option c are supported in legacy MRO functionality and they can be applied for CHO, [2] also proposes that Option a-1 should be optimized for CHO.

In [3], it is proposed that Option a-2 or Option a-1 combined with Option c can be supported.

In [4], it is proposed that Option c can be used for CHO since it does not create additional signaling and it is a straightforward implementation, to lower the time the source node keeps the UE context, [4] also proposes a new message from target candidate to source node indicating that RLF Report is on its way.

In [5], Option b is proposed, considering Option b provides precise information to the source node comparing with Option a-1, and it is easy for implementation since the source node does not need to think how to map Candidate Cell list and CHO Execution Conditions together with other mobility information (e.g. UE group, handover trigger) to an container.

Companies’ views are still controversial. To down select, for Option a-1/Option a-2/Option b/Option c, companies are invited to provide their views on which option(s) are acceptable, and which are not. Moderator would like to go with the majority’s votes to make final decision on which network-based solution to be agreed.

**Q1: For Option a-1/Option a-2/Option b/Option c, companies are invited to provide their views on which is acceptable, and which is unacceptable. Multiple acceptable or unacceptable options can be provided, if any.**

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| --- | --- | --- | --- |
| **Company** | **Acceptable opt.** | **Unacceptable opt.** | **Comments** |
| Samsung | Option b  Option b + Option c | Option a-1  Option a-2  Option c only | Option c mandates the source node to store the CHO related configuration even after successful handover. Previously RAN3 has agreed that the source mode may release the UE context after successful handover when RAN3 sent reply LS to RAN2 in R3-212944, it was said:  *RAN3 has discussed the UE context handling and retention at the source node after HO, and concluded that it is not mandated that the source node stores the UE context.*  That’s why RAN2 start to define some RLF Reporting i.e. include Candidate cell list and CHO execution conditions for HOF failure.  For the same issue, we should have the same assumption.  Option c can be used in implementation. But we cannot mandate the source which is not in line with the standard.  Option a-2 has three drawbacks: 1) the source node has to send the Mobility Information to each candidate. 2) The information may be not up-to-date e.g. the source updated the UE after Handover Request. 3) The source has to consider how to map candidate cell list and CHO execution condition to an index.  Comparing Option a-1 and Option b, both needs to add new IE in SN Status Transfer message. The main difference between a-1 and b is whether to include Candidate Cell list and CHO Execution Conditions in an implementation dependent container or add explicit information in Xn message. When Mobility Information was introduced in LTE, it was defined as a container because it includes UE group related information which are highly dependent on implementation. Pls note that Mobility Information cannot represent the exact UE context. It is UE group related information. It is used by the source node to optimize handover trigger for different UE groups between two pair of cells. Candidate cell list and CHO execution conditions are different. They are standard parameters which are already transmitted over air interface. In this case, it is easy to include them explicitly in Xn messages. Option b provides precise information to the source node. The source node can use it to detect whether the failure reason is due to inappropriate candidate cell list or due to improper execution conditions. We doubt option a-1 can achieve this purpose and option a-1 bring complexity for implementation to map Candidate Cell list and CHO Execution Conditions together with other implementation based parameters (e.g. UE group) to a container. |
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## FAILURE INDICATION message and HANDOVER REPORT message

### initiating condition in FAILURE INDICATION message

[2] proposes to extend the existing initiating condition “RRC Setup” to be “RRC Setup or Reconfiguration” for CHO Recovery procedure, as [2] states that even CHO Recovery procedure is part of the Reestablishment procedure, *RRCReconfigurationComplete* message is sent instead of *RRCRestablishmentRequest* message, it cannot be considered as the RRC Reestablishment initiated reporting.

[6] proposes to enhance Failure Indication to include a new initiating condition for CHO recovery procedure, as they don’t support reusing original RRC Reestablishment initiating condition or reusing original RRC Setup initiating condition.

[3] [4] and [5] propose that introducing new initiating condition for CHO recovery procedure in FAILURE INDICATION message is not needed. [4] also proposes there is no need to change initiating conditions for CHO recovery.

In general, there are two camps, one camp supports changing the existing initiating condition or introducing a new initiating condition [2] [6], and the other supports totally reusing the existing initiating condition [3-5].

From moderator point of view, CHO recovery behavior is a part of RRC re-establishment procedure as captured in RAN2 specification even handover may be executed if the selected cell is a CHO candidate cell, network can distinguish CHO recovery from legacy RRC re-establishment based on received CHO specific information in the RLF report (e.g., when reusing “RRC Reestab Reporting with RLF Report” as the initiating condition for CHO). There is no problem to reuse the existing initiating condition, and the benefit of introducing a new initiating condition seems not significant.

**Q2-1: Companies are invited to provide their views on whether agree to reuse the existing initiating condition for CHO recovery procedure in FAILURE INDICATION message, i.e., neither extend the existing initiating condition nor introduce a new initiating condition.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | Reusing the existing initiating condition has no technical problem. |
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If companies do not agree to directly reuse the existing initiating condition, please provide your preference on how the FAILURE INDICATION message can be used for CHO recovery procedure, e.g., to extend the existing initiating condition “RRC Setup” to be “RRC Setup or Reconfiguration” as the TP provided in [2], or to introduce a new initiating condition as the TP provided in [6], or other solutions.

**Q2-2: If answer to Q2-1 is “No”, companies are invited to provide their views on how the FAILURE INDICATION message can be used for CHO recovery procedure (e.g. as TP in [2], or TP in [6], or other** **solutions).**

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| **Company** | **Comments** |
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### whether to support FAILURE INDICATION initiated without RLF report

[2] states that only in case that the reception node receives RLF report, it can trigger the FAILURE INDICATION message. Since for CHO recovery success without RLF Report, the reception node receiving RRCReconfigurationComplete message can’t differ the CHO recovery case from the CHO execution case, the reception node cannot trigger the FAILURE INDICATION message to the source node.

[3] proposes to support FAILURE INDICATION initiated with RLF report for MRO purpose for CHO, considering that FAILURE INDICATION initiated without RLF report can’t work well for some cases.

[5] states that FAILURE INDICATION initiated without RLF report for CHO is not useful. For example, for CHO recovery success without RLF Report, the RAN node receiving recovery cannot know which cell is the failure cell without RLF Report, the receiving RAN node can send FAILURE INDICATION to the source node but not to the last serving node, but the source node cannot detect the failure type without failure cell id.

However, [6] proposes FAILURE INDICATION shall be initiated without RLF report for CHO but network may not perform legacy MRO failure type analysis, since network is not aware whether CHO failure has occurred, whether it is CHO execution or CHO recovery when only RRC Reconfig complete message is received.

As most companies point out that FAILURE INDICATION initiated with RLF report works well for MRO for CHO, and without RLF report network may not perform MRO as legacy, we’d better to support that FAILURE INDICATION is initiated with RLF report. Companies are invited to provide their views on whether to support FAILURE INDICATION initiated with RLF report rather than without RLF report for MRO purpose for CHO.

**Q3: Companies are invited to provide their views on whether to support FAILURE INDICATION initiated with RLF report rather than without RLF report for MRO purpose for CHO.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | FAILURE INDICATION initiated without RLF report for CHO is not useful | For Reestablishment without RLF Report, the failure cell PCI, C-RNTI and shortMAI-C are included in RRCReestablishment Request message. The RAN node receiving RRCReestablishmentRequest can send FAILURE INDICATION message to the failure node (the last serving node) using those information in the RRCReestablishment Request message.  For CHO recovery success without RLF Report, the RAN node receiving recovery cannot know which cell is the failure cell without RLF Report. So the RAN node cannot send FAILURE INDICATION to the last serving node. The RAN node can send FAILURE INDICATION to the source node. But without failure cell id, the source node cannot detect the failure type.  Therefore FAILURE INDICATION initiated without RLF report for CHO is not useful. |
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### CHO recovery cell ID in FAILURE INDICATION message

This section is relevant to Q3.

[2] [3] [4] and [5] proposes that explicit CHO recovery cell ID is not needed in FAILURE INDICATION message since RLF report is included in the FAILURE INDICATION message for CHO.

However, [6] proposes to include an explicit CHO accessed cell ID in FAILURE INDICATION message if FAILURE INDICATION message is triggered by a RRC Reestablishment attempt without RLF Report.

In Q3, most companies support FAILURE INDICATION is initiated with RLF report, if it is agreed, an explicit CHO recovery cell ID is not needed in FAILURE INDICATION message.

**Q4: Companies are invited to provide their views on whether to agree that an explicit CHO recovery cell ID is not needed in FAILURE INDICATION message.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | Since FAILURE INDICATION initiated without RLF report for CHO is not useful, FAILURE INDICATION will include RLF Report.  CHO recovery cell ID is included in RLF report. So **the last serving node** can get it from RLF report. |
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### CHO recovery cell CGI in HANDOVER REPORT message

This section is relevant to Q3.

[2] [3] and [5] proposes that explicit CHO recovery cell CGI is not needed in HANDOVER REPORT message since RLF report is included in the HANDOVER REPORT message for CHO.

However, [6] proposes to include an explicit CHO accessed cell ID in HANDOVER REPORT message if FAILURE INDICATION message is triggered by a RRC Reestablishment attempt without RLF Report.

In Q3, most companies support FAILURE INDICATION is initiated with RLF report, if it is agreed, an explicit CHO recovery cell CGI is not needed in HANDOVER REPORT message.

**Q5: Companies are invited to provide their views on whether to agree that an explicit CHO recovery cell CGI is not needed in HANDOVER REPORT message.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | Since FAILURE INDICATION initiated without RLF report for CHO is not useful, FAILURE INDICATION will include RLF Report.  CHO recovery cell ID is included in RLF report. So **the source node** can get it from RLF report. |
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## MRO detection mechanism in Stage 2

[5] proposes to add description in stage 2 that the source node needs to differentiate inappropriate candidate cell configuration from improper CHO Execution Condition configuration, and the changes are as below [5]:

*In case of Too Early Handover or Handover to Wrong Cell, the NG-RAN node receiving the failure indication may inform the NG-RAN node controlling the cell where the mobility configuration caused the failure by means of the Handover Report procedure over Xn or the Uplink RAN Configuration Transfer procedure over NG. This may include the RLF report. In case of Handover to Wrong Cell for CHO, the NG-RAN node receiving HANDOVER REPORT message further differentiates whether the failure is brought by inappropriate candidate cell configuration or improper CHO execution condition. If the first re-establishment attempt cell/the cell UE attempts to re-connect is not in the candidate cell list configured to the UE, the root cause of the failure is inappropriate candidate cell configuration. Otherwise, the failure is due to improper CHO execution condition.*

**Q6-1: Companies are invited to provide their views on whether to add above description in stage 2 to capture that the source node needs to differentiate inappropriate candidate cell configuration from improper CHO Execution Condition configuration.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | The detection mechanism has been captured in stage 2. It should cover all scenarios for completeness. These two cases are specific for CHO. Stage 2 text are needed. |
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[5] also thinks it is not clear whether “CHO triggering” in current stage 2 description means the UE receiving RRCReconfiguration message for CHO or CHO execution, so it proposes to change “CHO Triggering” to “CHO execution”. The changes are as below [5]:

*The "UE reported timer" above indicates the time elapsed since the last handover initialisation until connection failure or the time elapsed since the CHO execution until connection failure.*

**Q6-2: Companies are invited to provide their views on whether to** **change “CHO Triggering” to “CHO execution” in stage 2.**

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| **Company** | **Yes/No** | **Comments** |
| Samsung | Yes | For legacy handover, handover initialization or handover triggering means the UE receiving RRCReconfiguration message for handover. For CHO, it is not clear whether “CHO triggering” means the same or it means CHO execution. Better to make this point clear. |
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# References

1. R3-221294, Summary of Offline Discussion on SON Enhancements for CHO, Lenovo, Motorola Mobility
2. R3-221834, (TP for SON BLCR for 38.423) Mobility enhancements, Huawei
3. R3-221977, SON Enhancements for CHO, Lenovo, Motorola Mobility, ZTE
4. R3-222073, MRO for CHO and DAPS, Ericsson
5. R3-222301, TP for TS 38.300: SON enhancements for CHO, Samsung, Verizon Wireless
6. R3-222009, (TP on SON for 38.423) Discussion on MRO for mobility Enhancement, CATT