3GPP TSG-RAN WG2 Meeting #109e draftR2-20xxxxx

Elbonia, Online, 24 February – 6 March 2020

**Agenda item: 6.9.3.6**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Report from [AT109e][213][MOB] CHO failure handling**

**WID/SID: NR\_Mob\_enh-Core - Release 16**

**Document for: Discussion and Decision**

# 1 Brief scope of the paper

This document aims at collecting companies’ views regarding the open issues for Conditional Handover Failure handling, as summarized in [8].

# 2 Discussion

## 2.1 Proposals from the summary in [8]

The following proposals have been provided in [8]:

**Proposal S2\_1: Do not introduce a new timer to control the** **conditional handover procedure after RLF or HOF/CHOF.**

**Proposal S4\_1: Ensure *DataInactivityTimer* is stopped when CHO execution is triggered. Check whether the existing RRC CR needs to be updated accordingly.**

**Proposal S5\_1: Do not consider in Rel-16 additional scenarios where failure recovery via CHO can be applied.**

Based on brief RAN2 discussion we had directly before the RAN2#109e meeting, we assume those may be agreeable to most (hopefully all). Thus, we would like to ask collectively:

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| **Question 1: Are you OK with the proposals listed above? Please answer YES or NO. If the answer is NO, please kindly inform which proposal is not OK and why.** | |
| **Company** | **Answer** |
| Xiaomi | Regarding Proposal S4\_1, I’m not convinced how gNB could ensure DataInactivityTimer is stopped when CHO execution is triggered, since gNB is not aware when UE executes CHO.  Regarding Proposal S5\_1, I think it’s not clear what are the use cases. Some companies e.g. email rapporteaur (Nokia), seems to think only RLF and intra-RAT HOF should be handled. But some companies e.g. WI rapporteur (Intel), seems to think RLF, intra-RAT HOF and inter-RAT HOF should be handled. We should make this clear, both inter-RAT and intra-RAT HOF should be handled. While at compliance failure with NR RRC connection reconfiguration, LTE UE could also trigger CHO failure recovery, which has little spec or implementation impact. |
| OPPO | YES to all proposals.  For proposal S4\_1, we think the intention is to capture UE’s behaviour. In the current RRC CR, upon CHO execution, UE will reset the MAC entity and*DataInactivityTimer* will be stopped. |
| Huawei, HiSilicon | Yes to all proposals. |
| MediaTek | YES to all proposals. |
| Intel | Yes to all proposals. |
| Apple | Yes to all proposals. |
| Futurewei | Yes to all proposals. |
| Samsung | For Proposal S4\_1, On receiving reconfiguration with sync, UE resets the MAC entity. As part of MAC reset, all running timers are stopped. There seems to be no case where T304 and DataInactivityTimer are running simultaneously on the UE. Hence, it seems there is nothing to be handled and the existingspecification suffice. |
| ZTE | Yes to all proposals.  For Proposal S4\_1, we share the same view with Samsung. |
| Sharp | Yesto all proposals. |
| ETRI | Yes to all proposals.  Regarding proposal S4\_1, we see the same problem in network side with Xiaomi. Some companies commented that the same network that provided the UE with CHO configurations will not release this UE based on DataInactivityTimer expiry. In our understanding, this is not the correct behavior. As commented by a company, the “Bye”message can be a solution. However, in our view, there will be no critical problem because in general, the *DataInactivityTimer* at the network side is longer than T304. |
| Lenovo&MM | Yes to all proposals. For S4\_1, gNB may not release the target CHO afterDataInactivityTimer expires in gNB side. |
| vivo | For proposal S2\_1, we still think the triggering condition for CHO is not used to determine the CHO execution after RLF/HO/CHO failure. Thus, the CHO may be executed when the triggering condition is not met. We prefer to use another time value for CHO based RLF/HO/CHO failure handling. If the majority companies think it is not needed. We are OK with this.  Yes to other proposals. |
| Nokia | Yes to all proposals.  Regarding S2\_1we would like to reiterate what we already stated in pre-meeting e-mail thread: the fact CHO execution condition is not checked when recovery via CHO is done is not a justification for using another timer than T304. We have already agreed to use cell selection criteria for that (and not CHO execution condition), regardless of whether this is a good approach or not😉 When the cell is selected and this is a CHO candidate, from now onwards the sequence of actions is exactly the same as in the normal HO or CHO. So this is why we think T304 should be used in such case.  Regarding S4\_1: we agree with Samsung, ZTE and others. The same was also commented by us in the pre-meeting e-mail discussion. When CHO is executed, the UE will discard source cell configuration, including MAC. So DataInactivityTimer will not be considered anyway. The standard describes only UE actions upon the expiry of such timer. It is true, gNB does not know exactly when the UE executes the CHO, but gNB knows which UEs have been prepared with CHO and it would be a strange behaviour if the NW releases such UEs. |
| Potevio | Yes to all proposals. |
| Ericsson | Proposal S2\_1: Do not introduce a new timer to control the conditional handover procedure after RLF or HOF/CHOF. [Ericsson] YES, agree.  Proposal S4\_1: Ensure DataInactivityTimer is stopped when CHO execution is triggered. Check whether the existing RRC CR needs to be updated accordingly. [Ericsson] NO. There is no need to discuss that i.e. we do not agree, but we do not disagree unless proponents clearly show the impact in RRC.  Proposal S5\_1: Do not consider in Rel-16 additional scenarios where failure recovery via CHO can be applied. [Ericsson] Don’t know what to say, it is not clear what the proposal really means. Are we just endorsing what we have in the running CR i.e. no more changes? If so, why would be nee to change? |
| CATT | Yes to all proposals  Regarding S4\_1, we agree with other company comments that the MAC is reset hence all associated timers will also be stopped anyway when CHO is executed. No need to discuss. |
| LG | Yes except Proposal S4\_1.  Under the reasonable network implementation, once CHO is configured, it is unlikely that the data Inactivity timer is expired prior to CHO execution, because setting a very short value *i.e. at least 1sec* of data inactivity timer does not make any sense when CHO is supposed to be triggered. Thus, we think we don’t need to specify any special handling of data inactivity timer for CHO. |

## 2.2 Issues from [8] requiring further discussion

The authors of [6] and [7] have discussed on the UE actions in case recovery via CHO (specified in Rel-16 MobEnh WI) and fast MCG recovery (specified in Rel-16 DC/CA enhancements WI) are configured simultaneously, while the UE encounters PCell’s RLF. In [8] the following suggestion for a discussion was made:

**DISC S6\_1: Discuss further which solution shall be chosen in case of Pcell’s failure when both recovery via CHO and fast MCG recovery are configured.**

Thus, we would like to ask the RAN2 companies to answer the following question:

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| **Question 2: What shall be the UE’s behaviour in case of Pcell’s failure when both recovery via CHO and fast MCG recovery are configured? Please motivate your selection.** | |
| **Company** | **Answer** |
| Xiaomi | Fast MCG recovery has higher probability to recover connection to MCG, thereforeshould be prioritized.If fast MCG recovery fails, this is a new use case for CHO failure recovery, which is related to use case discussion in [8].I think UE could trigger CHO failure recovery in this new scenario. |
| OPPO | Fast MCG recovery should be chosen. Recovery via CHO is not always possible in case when the selected cell is not a CHO candidate, in which case, re-establishment will be performed and will introduce more data interruption. Fast MCG recovery is thus a better option. |
| Huawei, HiSilicon | Fast MCG recovery should be chosen. |
| MediaTek | Fast MCG recovery should be chosen. Recovery via CHO is only possible when there is another CHOcandidate, and should be considered as a “secondary” solution. |
| Intel | It depends whether CHO can be configured together with DC. If it is possible, we should avoid to have multiple recovery, e.g. MCG failure recovery first and then CHO, i.e. we should only select one solution, MCG failure or CHO. |
| Apple | MCG failure recovery should be prioritized, since UE is still in connected mode and data transmission is still ongoing via SCG. |
| Futurewei | Fast MCG recovery should have high priority over the CHO recovery. |
| Samsung | We don’t see a reason for the network to configure both MCG recovery and CHO failure handling to UE at the same time. Therefore, we suggest that a restriction is placed where the network can only configure one of these recovery mechanism to the UE at any given time. |
| ZTE | We think the UE should process MCG fast recovery procedure first considering the delay caused by MCG fast recovery is more predictable, and will be smaller in more cases. If MCG fast recovery fails, then the UE can try the failure recovery via CHO (i.e. the UE performs cell selection and if the selected cell is a CHO candidate, then the UE attempts CHO execution, otherwise re-establishment is performed).  Besides, if the NW wants to trigger failure recovery via CHO upon detection of PCell RLF, the NW can disable MCG fast recovery when configuring CHO for the UE. |
| Sharp | UE should go for fast MCG recovery first, as it is possible that the selected cell is not a CHO candidate cell for CHO recovery. Can discuss further if UE only tries fast MCG recovery in MCG RLF case, or UE tries fast MCG recovery first and then tries CHO recovery if a fast MCG recovery is failed. |
| ETRI | We think it can be left to UE implementation. In the case of normal PCell RLF, we share the same view as other companies. However, in other cases (e.g., RLF during handover or HOF), a recovery via CHO will outperform the fast MCG recovery in our view because the source PCell is not already good enough in those cases. |
| Lenovo&MM | In DCCA, it was agreed that if RLF happens and fast MCG link recovery is configured, UE will perform fast MCG link recovery. If guard timer for MCG link recovery expires, UE initiate re-establishment. Currently, CHO recovery is a part of re-establishment procedure. We donot need to change the order. Namely, fast MCG link recovery is performed first. |
| vivo | We think it is not a popular case that network configures both MCG recovery and CHO failure handling to the UE. |
| Nokia | We are fine with prioritizing fast MCG recovery, surely for the RLF case. In addition, we somewhat share preceding comments stating that such simultaneous configuration may not be an extremely popular case. |
| Potevio | Fast MCG recovery should be chosen in case of PCell’s failure, since it is not possible to always have a CHO candidate cell for CHO recovery. |
| Ericsson | We do not think the suggestion in [8] is wise. According to chairman we should avoid adding impact to the specs at the moment that are not really basic/necessary. This is a discussion on how to solve the co-existence of two optimizations, i.e., far from a high priority topic and should not be possible in Rel-16. Hence, if a UE is capable of both features, network needs to select which one to configure. If a not so smart network ends up configuring both, it remains unspecified what happens (as this would be a network mistake). |
| CATT | Agree with Lenovo&MM comments that the order of procedure is already that MCG fast recovery is performed first, if both CHO recovery and MCG fast recovery are configured.  However we think that network should not configure both MCG fast recovery and CHO recovery simultaneously to the UE. The network can control this situation by configuring only one recovery procedure. |
| LG | We think triggering CHO recovery is much cleaner, because this approach avoids triggering of successive failure recovery attempts.  To clarify the successive failure recovery attempts, let us assume that the UE triggers fast MCG recovery upon PCell failure. If the fast MCG recovery fails, the UE will then initiate re-establishment procedure. Note that, during the re-establishment, the UE will attempt CHO based failure recovery, instead of performing legacy re-establishment, since the UE still has CHO candidates available. Because this successive failure recovery attempt is a natural (but unintended) consequence of combining DCCA running CR and MOB running CR, we may need to have a special treatment to prevent the successive failure recovery attempt. |

# 3 Conclusions

17 companies responded to Q1. The distribution of opinions was as follows:

* 16 out of 17 were OK with Proposal S2\_1 (Do not introduce a new timer to control the conditional handover procedure after RLF or HOF/CHOF)
* 15 out of 17 companies were OK with Proposal S4\_1 (Ensure *DataInactivityTimer* is stopped when CHO execution is triggered. Check whether the existing RRC CR needs to be updated accordingly). A widespread view is that there is no problem as MAC is anyway reset when UE executes CHO, so the timer will not expire (and there is no risk UE will move to RRC\_IDLE). Companies were not concerned with the actions on NW’s side. Thus, specification changes are not required.
* 15 out of 17 companies were OK with Proposal S5\_1. One company had difficulty in understanding the purpose and the meaning of Proposal S5\_1. Nevertheless, the clear majority wants to limit the use of” recovery via CHO” in Rel-16 to intra-RAT RLF, HOF or CHOF. And that will be a resulting proposal.

17 companies responded to Q2. The following feedback was given:

* The majority of companies would like to prioritize fast MCG recovery over recovery via CHO
* Several companies (e.g. Samsung or Ericsson) believe these two features will never be configured simultaneously and there is no real problem to be addressed.
* Lenovo and CATT think the procedural text is already clear and the UE performs fast MCG recovery first before attempting re-establishment (which in turn, may comprise recovery via CHO). So, no changes to the specification are needed.

To summarize, we propose the following:

**Proposal 1: Conditional handover procedure after RLF or HOF/CHOF relies on the legacy T304. No need to introduce a new timer.**

**Proposal 2: Failure recovery via CHO in Rel-16 is applicable only to RLF, Intra-RAT Handover Failure or Intra-RAT Conditional Handover Failure.**

[Ericsson] In our view, limiting the cases in our view would be reasonable in case we can simplify the RRC spec for CHO. Hence, we would like to confirm that such a proposal would not lead to changes in the running CR.

Otherwise, if changes are required, we would like to first see a possible TP that is simple to implement, unless there is a clear benefit in changing current running CR to accommodate the proposal.

[Intel] The changes would be to add the condition in 5.3.7.3, similar as below

#### 5.3.7.3 Actions following cell selection while T311 is running

Upon selecting a suitable NR cell, the UE shall:

1> ensure having valid and up to date essential system information as specified in clause 5.2.2.2;

1> stop timer T311;

1> if T390 is running:

2> stop timer T390 for all access categories;

2> perform the actions as specified in 5.3.14.4;

1> If the cell selection is triggered by detecting radio link failure of the MCG, re-configuration with sync failure of the MCG or mobility from NR failure, and

1> if *attemptCHO* is configured; and

1> if the selected cell is one of the candidate cells in *VarCHO-Config*:

2> apply the stored *cho-RRCReconfig* associated to the selected cell and perform actions as as specified in 5.3.5.3;

[LG] We agree with Intel’s intension. However, the suggested text is somewhat not clear to me because re-configuration with sync failure is also able to happen by failure of message reception in the fast MCG failure recovery. This is because the network provides reconfiguration with sync for recovering MCG upon reception of the fast MCG recovery information according to eDC running CR. Thus, I want to suggest like below:

1> If the cell selection is not triggered by upon T316 expiry i.e. failure of the fast MCG link recovery, and

1> if *attemptCHO* is configured; and

1> if the selected cell is one of the candidate cells in *VarCHO-Config*:

2> apply the stored *cho-RRCReconfig* associated to the selected cell and perform actions as as specified in 5.3.5.3;

[Lenovo] we agree with E///. It is better not to change the running CR.

**Proposal 3: Fast MCG recovery is prioritized over recovery via CHO if both are configured. No specification change is required as the standard already reflects that.**

[Ericsson] It seems there are some potential ambiguities if both are configured, so I think one should have first asked the question whether both are possible to be configured by the network at the same time. In our view, considering that we would like to finalize CHO, that some aspects of MCG failure report are still under discussions, that that this is a rule to which optimization to select in case two optimisations are configured, it seems reasonable to simply restrict the usage of both at the same time in Rel-16, and perhaps FFS in further releases whether there are any impacts of ambiguities on it.

[Intel] Look at the potential changes for P2. If MCG recovery is prioritized, then CHO will not be performed unless we add condition on MCG recovery failure. So does the proposal means, we always use fast MCG failure recovery if they are both configured, and then we do not need to change specificatin. If it is true, that is fine to us.

[Lenovo] Whether one or both of ‘fast MCG recovery’ and ‘CHO’ is configured at the same time is network implementation. If we follow the way forward of ‘only one is allowed to be configured’, specification effort is needed because the current running CR has not such restriction.

# 4 List of referenced documents

[1] [R2-2000331](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000331.zip), “*CHO and re-establishment procedure*”, Ericsson

[2] [R2-2000376](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000376.zip), “*Discussion on the CHO during failure handling*”, vivo

[3] [R2-2001003](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001003.zip), “*On T312 in Conditional PSCell change or handover*”, Nokia, Nokia Shanghai Bell

[4] [R2-2001105](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001105.zip), “*Avoid consecutive CHO failure*”, Beijing Xiaomi Software Tech

[5] [R2-2001](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001106.zip)106, “*Discussion on the use case of CHO failure recovery*”, Beijing Xiaomi Software Tech

[6] [R2-2001](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001260.zip)260, “*Discussion on fast RLF recovery when applying CHO and fast MCG recovery*”, ZTE

[7] [R2-2000918](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000918.zip), “*Discussion on CHO for DC scenarios*”, CMCC

[8] [R2-2002016](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2002016.zip), “*Summary of 6.9.3.2 Conditional Handover Failure Handling*”, Nokia, Nokia Shanghai Bell