**3GPP TSG-RAN WG2 Meeting #113-eR2-21xxxxx**

**Online, 25th Jan – 5th Feb 2021**

**Agenda item:** 8.13.2.1

**Source:** Qualcomm

**Title:** The report of[Offline-e][886][NRR17 SONMDT] How to address time information (Qualcomm)

**Document for:** Discussion and Agreement

# 1 Introduction

This is to report the result of the following email discussion at the RAN2#113-e meeting [1].

 [AT113-e][886][NR/R17 SON/MDT]  How to address time information (Qualcomm)

* Based on the agreements that “Include in the RLF report the “Time elapsed since CHO execution until connection failure”.
* Figure out how to convey this information.

      Intended outcome: Agreeable WF

      Deadline: Thursday 04/02/2021

According to the chair’s guidance, this report is used to collect companies’ views on the methodologies to capture the agreed time “*Time elapsed since CHO execution until connection failure*” [1], and to find an agreeable way forward. Companies are requested to provide their opinions before the deadline Thursday 04/02/2021, UTC 12:00.

# 2 Contact Information

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

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
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# 3 Discussion

During the RAN2#112-emeeting [2], offline-email discussion post RAN2#112-emeeting [3], and in the RAN2#113-emeeting online session, we discussed various aspects of timing information to be added in the RLF report for conditional HO (CHO). While we agreed to include the “*Time elapsed since CHO execution until connection failure*” based on the offline-email discussion post RAN2#112-emeeting [3] and RAN3 LS [4], this meeting is intended to discuss how the aforementioned timing information will be collected. Note that in RAN2#112-emeeting [2], we also agreed that we will only introduce the new fields in the RLF report if they cannot be obtained using the already existing IEs.

Therefore, our first objective is to determine that if there is an IE present in the rel-16 RLF report that can be used to indicate “*Time elapsed since CHO execution until connection failure*”. During the online discussion, *timeConnFailure* was discussed as the one potential solution for reporting the time “*Time elapsed since CHO execution until connection failure*”. In the TS 38.331, *timeConnFailure* is defined as “This field is used to indicate the time elapsed since the last HO initialization until connection failure.” While in legacy HO, UE executes RRCReconfiguration as soon as it receives from the UE, thus the HO initialization time is computed as the time at which UE receives the RRCReconfiguration message. However, in the CHO, UE does not execute the RRCReconfiguration upon reception but when the execution condition is met. Furthermore, RAN2 in the last meeting [2] agreed to introduce “Time difference of RRCReconfiguration execution and reception”. Timestamps of different events and possible choice for capturing the timing information “*Time elapsed since CHO execution until connection failure*” is presented below.

 RRCReconfiguration execution

 RRCReconfiguration reception Connection failure

*Time elapsed since CHO execution until connection failure*

Previously agreed time:

Time difference of RRCReconfiguration

execution and reception

From the two figure above, we have the following choices to define *timeConnFailure* as the following:

1. Define the *timeConnFailure* as“Time elapsed since CHO **execution** until connection failure”
2. Define the *timeConnFailure* as“Time elapsed since CHO **reception** until connection failure”

If we agree on option 1 for *timeConnFailure* as the“Time elapsed since CHO **execution** until connection failure”, then “Time elapsed since CHO execution until connection failure” is captured in *timeConnFailure.* However, see an issue with this in a scenario when the network sends the CHO configuration to the UE but the execution condition is never met. In such a scenario, “Time difference of RRCReconfiguration execution and reception” is NULL or Zero. Similarly, “Time elapsed since CHO execution until connection failure” is computed as NULL or Zero. In such a scenario, if we agree on option 1 above, then UE will lack the information regarding the RRCReconfiguration reception and connection failure.

On contrary, if we agree on option 2 for *timeConnFailure* as the“Time **elapsed** since CHO reception until connection failure”, then one of the agreements made in RAN2 becomes irrelevant, as “Time elapsed since CHO **execution** until connection failure” can be simply computed as the difference of “Time **elapsed** since CHO reception until connection failure” and “Time difference of RRCReconfiguration execution and reception”. In such a scenario, the explicit reporting of “Time elapsed since CHO **execution** until connection failure” may not be required and the network can compute “Time elapsed since CHO **execution** until connection failure” using other provided timing information. This avoids reporting unnecessary timing information while proving the network with the required timing information.

Based on the discussion above, we have the following choices:

Option 1: UE reports the previously agreed “Time difference of RRCReconfiguration execution and reception” and “Time elapsed since CHO execution until connection failure” as *timeConnFailure.*

Option 2: UE reports the previously agreed “Time difference of RRCReconfiguration execution and reception” and “Time elapsed since CHO reception until connection failure” as *timeConnFailure.* It is up to the network to compute the “Time elapsed since CHO execution until connection failure” as the difference of “Time **elapsed** since CHO reception until connection failure” and “Time difference of RRCReconfiguration execution and reception”.

Option 3: Introduce new IE to capture “Time elapsed since CHO execution until connection failure”

Option 4: Introduce new IE to capture “Time elapsed since CHO execution until connection failure” as agreed by RAN3, and “Time elapsed since CHO reception until connection failure” is reported as *timeConnFailure.* Previously agreed “Time difference of RRCReconfiguration execution and reception” is no longer needed.

Nonetheless, based on the arguments above, companies are requested to provide their opinion regarding the reporting/computing of Time elapsed since CHO execution until connection failure.

**For computing of “Time elapsed since CHO execution until connection failure”, we have the following options:**

**Option 1: UE reports the previously agreed “Time difference of RRCReconfiguration execution and reception” and “Time elapsed since CHO execution until connection failure” as *timeConnFailure.***

**Option 2: UE reports the previously agreed “Time difference of RRCReconfiguration execution and reception” and “Time elapsed since CHO reception until connection failure” as *timeConnFailure.* It is up to the network to compute the “Time elapsed since CHO execution until connection failure” as the difference of “Time elapsed since CHO reception until connection failure” and “Time difference of RRCReconfiguration execution and reception”.**

**Option 3: Introduce new IE to capture “Time elapsed since CHO execution until connection failure”**

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| --- | --- | --- |
| Company | Option 1/ option 2/ option3 | Detailed Comments |
| Qualcomm | Option 2  | Option 2 is our preferred choice as discussed above. Option 2 avoid reporting optimized the RLF report content while providing required timing information.  |
| Huawei, HiSilicon | Option 4  | The real question is whether to define *timeConnFailure* as“Time elapsed since CHO **execution** until connection failure” or as“Time elapsed since CHO **reception** until connection failure”. Then we can decide whether we should report the RAN2 agreed timer (option 1) or the RAN3 agreed timer (option 4) which to us are the only 2 options which make sense. In legacy, *tim*eConnFailure is defined as as “Time elapsed since CHO **reception** until connection failure” – however clearly the HO reception and execution are at the same time so really we just need to decide which way to define this for R17. For the case that CHO is executed: If we define *timeConnFailure* as “Time elapsed since CHO **execution** until connection failure” then it makes sense to use the previously agreed RAN2 timer in conjunction with this. If we define *timeConnFailure* as “Time elapsed since CHO **reception** until connection failure” then it makes sense to disregard the previous RAN2 agreement and introduce the new timer as requested by RAN3. Both ways work fine, but we have a preference to define as “Time elapsed since CHO **reception** until connection failure” which is closer to the legacy definition (i.e. we don’t need to change the definition much, if at all), and actually the most important new information for the NW is the time between execution and failure so it is better to explicitly report this time.Option 1 has a technical problem: In case CHO is not executed (too late HO) then no timer will be reported for timeConnFailure, and NW cannot know the time from CHO configuration to failure. Option 3 is not necessary – we assume this means to introduce 2 new timers (i.e. the RAN2 agreed one and the RAN3 one). We don’t need both, one is sufficient and the other can be derived.Option 2 is not preferable. Since the RAN2 agreed timer is defined as the time between reception of the **corresponding** HO configuration and the execution, things become more complicated when we have multiple CHO configurations and we end up having to derive the most important piece of information from 2 less important timers. In case we have e.g. CHO configuration 1, then configuration 2, in case the failure is associated with configuration 1 then the time needs to be calculated based on a previous CHO configuration, not the latest one – i.e. UE needs to maintain not only the time between configuration and execution but also the time difference between CHO configurations in order to report the relevant time. |
| oppo | Option 1 | Based on the decription of of rapporteur, it seems that the advantage of option 2 is that the time difference between RRCReconfiguration reception and the connection failure could be derived no matter if or not the CHO is executed. However, in our opinion, we doubt the usefulness of such information. What the network really care should be the CHO execution related information. Indeed, the UE could receive the RRCReconfiguration (including CHO execution condition) either later or sooner, but for optimization of the CHO performance, to know UE reception of the RRCReconfiguration timing information seems not usuful. Please correct us if we are wrong.Option 4 is not preferred since in the last RAN2 meeting the corresponding agreement has been achieved and confirmed. Such action should be avoided, since allowing reviewing such formal agreements will consume a lot of unnecessary time and efforts.  |
| vivo | Option 2 or Option 4 | By adopting Option 2, the legacy description for the field *timeConnFailure* could be consistently re-used for CHO, and the NW could be able to derive the RAN3-requested timing information.As long as we know 2 of the three timing variables, we can deduce the remaining one, so Option 4 proposed by HW also works.  |
| Apple | Option 1 | So far 3GPP only concluded that the time between CHO execution and connection failure should be reported. It's straightforward to reuse the legacy *timeConnFailure* for this purpose.For the time between CHO reception and connection failure, we don’t see how it helps the NW. RAN2 should first discuss if companies have the consensus to report this time then we can decide which option to use. |
| CATT | Option 2 or Option 4 | We slight prefer option 2 as it has little impact on the existing mechanism and does not need to change the confirmed agreement. |
| NTTDOCOMO | Option2  | Prefer option2 which has little impact on the current mechanism. |
| ZTE | Option 1 | Option 1 is preferred based on following reasoning:1. The time between CHO execution to failure can be directly indicated as requested by RAN3. timeConnFailure is used in RAN3 to for MRO functionality, for CHO cases, it makes more sense to modify the start point to CHO execution instead of the time CHO resource is reserved.
2. Comparing to option2, timer length in option 1 are shorter, which saves signalling overhead.
3. No need to revert previous agreement.
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| NEC | Option 1 | We don’t see the need of reporting time between CHO reception and connection failure. The RAN3 and RAN2 agreed time between CHO execution and connection failure can just reuse the existing *timeConnFailure* IE, which have aligned filed description as the HO initialization is equal to CHO execution in CHO case. We understand the intention of option 2 is to save efforts on the modification of the procedure part. However, the procedure part description “elapsed time since reception of the last RRCReconfiguration message including the *reconfigurationWithSync*” is not correct for CHO, as the RRC message of the triggered CHO event may not be the last RRCReconfiguration message including the reconfigurationWithSync. As anyway we need modification on the procedure part, the benefit of Option 2 is not valid. |
| Sharp | Option 1 | We understand that the intention of timeConnFailure in R16 is to record the time between a handover execution to failure which is used for MRO. So it is straightford that this IE is re-used in CHO case for the time between a CHO execution to failure if we follow this intention. And this is actually aligned with RAN3 LS.With regard to the time between CHO reception and CHO execution, we would like to respect this RAN2 agreement. a new IE can be introduced for “Time difference of CHO execution and the **corresponding** CHO configuration reception” |
| Lenovo&MM | Option 1 | Option 1 is simple. timeConnFailure is reused to describe “Time elapsed since CHO execution until connection failure” as. One additional IE is added for “Time difference of RRCReconfiguration execution and reception”. I don’t understand the analysis for option 1 from rapporteur. According to the RAN2 agreement, the time information is only associated with the candidate cell to be executed. The following case will not happen. “Time difference of RRCReconfiguration execution and reception” is NULL or Zero.In option2, two new IE should be introduced. |
| CMCC | Option 1 | Option 1 is simple and straightforward.  |
| Ericsson | Option 3 | We are concerned that Option 1 may affect legacy. In fact, the timeConnFailure is used to capture too-early HO scenarios, i.e. the time elapsed since the last HO initialization in the previous cell until connection failure.Let´s consider now the scenario in which the UE performs an handover from cell A to cell B, it gets a CHO configuration in cell B, and right after it gets an RLF. In this case what the timeConnFailure will represent? The time elapsed between the HO from cell A to cell B and RLF? Or the time elapsed between CHO configuration got in cell B and RLF ? And how can we ensure that both scenarios are considered?This solution will create ambiguity and also extra complexity in how to specify the procedural text, since we will need to add new clauses for the existing timeConnFailure.We also believe that at this stage we should avoid agreeing on whether/how existing parameters can be reused. We should rather focus on general timer functionalities and related scenarios. Any possible optimization on whether/how existing timers can be reused should be left to stage-3. |
| Samsung | Option 2 & option 3 | We has assumed the option 2 is the legacy definition, and we would like to keep the definition of the existing timeConnFailure even for CHO failure, in order to avoid any confusion. And, according to RAN3 input, we prefer to have a new timer corresponding to option 3.  |
| Nokia, Nokia Shanghai Bell | Option 2 | RRC reconfiguration and failure are two events that happen for sure in this scenario and the UE could easily log the ***time difference of failure and RRCReconfiguration reception***  (regardless of whether CHO is executed or not).  In case CHO is executed (i.e. the CHO execution condition is fulfilled) all options are ok. If however the CHO condition may not be fulfilled by the time failure happens,  then both previously agreed timer (***Time difference of RRCReconfiguration execution and reception***) and new timer (***Time elapsed since CHO execution until connection failure***) will be zero or NULL and the network will have no further concrete timing information relating to this failure.  That is why we think it is more beneficial to log the agreed timer (***Time difference of RRCReconfiguration execution and reception***) and the overall timer (***time difference of failure and RRCReconfiguration reception***)  and the network can compute the new timer (***Time elapsed since CHO execution until connection failure***) as a difference of the other two. As for variable names, one of the two timers, either ***time difference of failure and RRCReconfiguration reception*** or  ***Time elapsed since CHO execution until connection failure*** should be stored in *timeConnFailure* and the other in a new variable.  |

Summary of the discussion:

Companies supporting option 1: 7/15 (OPPO, Apple, ZTE, NEC, Sharp, Lenevo, CMCC)

Companies supporting option 2: 6/15 (Qualcomm, VIVO, CATT, NTTDOCOMO, Samsung)

Companies supporting option 3: 2/15 (Ericsson, Samsung)

Companies supporting option 4: 3/15 (Huawei, Vivo, CATT)

In my understanding option 3 is should not be a candidate solution. However, let us first consider scenario raised by Ericsson

“Let´s consider now the scenario in which the UE performs an handover from cell A to cell B, it gets a CHO configuration in cell B, and right after it gets an RLF. In this case what the timeConnFailure will represent?”

However, there is nothing new for this scenario in CHO. The same scenario can exists in the legacy HO too, i.e. UE handover to cell B from cell A, thereafter it receives the new RRCReconfiguration in cell B. In my understanding, the UE behaviour and reporting of the time should be the same as in the case of legacy handover.

For option 1, there is an inherent issue with the option 1 in the scenario below:



Therefore, I want to raise the following question?

In the too late handover scenario, where RRCReconfiguration (containing CHO configuration) is received at the UE but RLF happens at the source cell as no CHO configuration for the non of the configured target cell is met then UE reports, the *timeConnFailure* as:

Option 1: UE reports nothing or arbitarary high value

Option 2: UE reports the time elapse sicne the RRCReconfiguration (containing CHO configurations) reception until connection failure

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| Company | Option 1/ option 2 | Detailed Comments |
| Qualcomm | Option 2  | As discussed in the email, I believe that in this situation UE can obtain *timeConnFailure* correctly. Thus, option 2.  |
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For handling the scenario, in the below figure, do we want want to make amendment to our previously agreed RAN2 time

From:

“Time difference between RRCReconfiguration (containing CHO configuration) reception and execution”

To

“Time difference between RRCReconfiguration (containing CHO configuration) execution and reception or time difference between RRCReconfiguration (containing HO configuration) reception and RRCReconfiguration (containing CHO configuration) reception”



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| Company | Yes/No | Detailed Comments |
| Qualcomm | Yes | Should be modified to consider the scenario in above figure  |
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**Conclusion:**

# 4 Conclusion

**TBD**

# 5 References

1. R2-113-e SONMDT HuNan 2021-01-29-0630 UTC
2. RAN2-112-emeeting report
3. R2-2100047, “LS on Mobility Enhancement Optimization”
4. R2-2101451, “[Post112-e][853][NR R17 SON/MDT] R17 Information needed in UE report for CHO cases (Ericsson)”