3GPP TSG-RAN WG2 #114-e Tdoc R2-21xxxxx

Electronic meeting, 19th - 27th May 2021

Agenda Item: 8.13.2.1

Source: Ericsson

Title: [Offline 801][SON/MDT] Handover related SON aspects (Ericsson)

Document for: Discussion, Decision

# Introduction

This contribution summarizes the following discussion.

* [AT114e][801][SON/MDT] Handover related SON aspects (Ericsson)

Collect companies’ views on the cat-a and cat-b proposals in R2-2106637 which not discussed online.

Try to figure out the WFs based on majority views.

Intended outcome: Email discussion report

Deadline:11:00 UTC, Tuesday May 25

Contact person for each participating company:

|  |  |  |
| --- | --- | --- |
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# Handover related SON aspects

## CHO related aspects

### Timers-related info

For convenience, it is copied below the table with the CHO timers from the email discussion [20]:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Timer** | **Start time (for time related measurements)** | **End time (for time related measurements)** | **Comments** |
| A | Timeline relationship between two consecutive RLF reports for cases of successful or unsuccessful CHO after unsuccessful CHO or handover failure | Time of declaring first RLF / HOF | Time of declaring second RLF/HOF |  |
| B | Time between the UE receiving the CHO command and RLF | Time of received CHO configuration | Time of declaring RLF in the source cell. |  |
| C | Time elapsed between the first CHO execution and the corresponding latest CHO configuration received for the selected target cell | Time of received CHO configuration | Time of CHO execution | [Rapporteur]: Agreed in RAN2#112 |
| D | Time elapsed between CHO execution until the first HOF/RLF | Time of executing the first CHO | Time of first HOF/RLF | [Rapporteur]: Agreed in RAN2#113 |
| E | CHO interruption time | Time of executing the first CHO | Time of HO completion or successful reestablishment |  |
| F | Time elapsed between CHO execution successful until RLF in target | Time of CHO execution successful | Time of RLF in target |  |
| .... |  |  |  |  |

Related to timer, the following agreements were reached during the online session in RAN2#114-e:

|  |
| --- |
| **From RAN2#114-e**  Agreements:  1 To represent Timer C, i.e. the “Time elapsed between the first CHO execution and the corresponding latest CHO configuration received for the selected target cell” introduce a new timer, e.g. timeSinceCHOReconfig.  => RAN2 to progress the following method to derive Timer D, i.e. the time elapsed between CHO execution until the first HOF/RLF: The TimeConnFailure is re-used with possible updates to indicate that it is started at CHO execution. Introduce a new timer is not excluded. |

Hence, given the above, Rapporteur considers Cat-a-Proposal 3 and Cat-a-Proposal 4 in the email discussion in [22] resolved for the moment.

Related to timer C, one company (i.e. QC) believe that a previous agreement should be revisited. Rapporteur proposes cat-b for it:

RAN2 to discuss the need to revisit a previous agreement on timer C:

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

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

* **Q1: Do see the need to revisit the definition of Timer C, as proposed in the above proposal?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes | The change in difinition is import if network can send legacy handover command prior to the execution of the conditional handover. However, if this scenario is deprioratized, we can revist the change in difinition later. |
| vivo | Tend to No | The secnario that both CHO and HO command are sent to a UE seems to be a rather rare case.  Further, if this is considered to be a common case that needs to be optimized, then DAPS HO command prior to the execution of the conditional handover seems also need to be taken into account? |
| Ericsson | No | We do not think we need to revisit the wording of this agreement. One concern is that if it is revised, then it will not be clear anymore for the network whether the timer C is the “Time difference between RRCReconfiguration (containing CHO configuration) reception and execution” **or** “the time difference between RRCReconfiguration (containing HO/CHO configuration) reception and RRCReconfiguration (containing CHO configuration) reception”. |
| OPPO | No | Agree with Ericsson |
| China Telecom | No | Agree with Ericsson that the change in definition makes timer C not clear.  Regarding the first part of definiton change “the time difference between RRCReconfiguration (containing HO configuration) reception and RRCReconfiguration (containing CHO configuration) reception”, we are ok because RRCReconfiguration (containing HO) reception means HO execution, similar to CHO execution.  Regarding the second part of definition change “the time difference between RRCReconfiguration (containing CHO configuration) reception and RRCReconfiguration (containing CHO configuration) reception”, we think two timer C will be recorded if the UE perform CHO execution, which makes confusion.  Besides, the definiton “the time difference between RRCReconfiguration (containing HO/CHO configuration) reception and RRCReconfiguration (containing CHO configuration) reception” should be limited to the two successive HO/CHO configurations are configured in the same source cell. |
| ZTE | Yes with clarification that timer C is no needed when rlf-type is RLF. | We think this discussion also relates to how we present the elapse time from CHO execution to connection failure. In our understanding,this information is very useful for NW to quickly diagnose the CHO MRO scenarios, so it is needed to be explicitly indicated. Based on previous contribution, there are two methods to present such information:   * Alt1:Update TimeConnFailure to elapse time from CHO execution to connection failure * Alt2: Use new IE to present elapse time from CHO execution to connection failure and keep timeConnFailure unchanged.   To us, timer C is only needed when alt1 is adopted, and for alt2, there is no need for timer C, since it can be derived based on new IE and legacy timeConnFailure.  Following we’ll give a simple analysis on the two alternatives based on the most controversial scenarios, i.e., when CHO configuration is received but not executed, which includes following two cases:   * Case 1: CHO configuration is received but not executed, and UE experience RLF; * Case 2: CHO configuration is received but not executed, UE receives HO command and fails   **If alt 1 is used:**   * For case 1: timeConnFailure represent elapse time from CHO reception to RLF, and this information is sufficient for NW to determine whether the CHO configuration received is too early or too late. It seems no need to includes the time between CHO reception to a HO execution before it since it has no relation with the RLF.Therefore timer C is no needed. * For case 2, timeConnFailure represent the elapse time from HO reception to HOF, and additionally UE will include timer C as the time difference between CHO reception to HO reception, therefore NW can derive the CHO reception time to HOF.   **If alt2 is used:**  For both case1/2, since no CHO execution, only timeConnFailure will be included.   * For case 1: timeConnFailure represent elapse time from CHO reception to RLF, and this information is sufficient for NW to determine whether the CHO configuration received is too early or too late. * For case 2: timeConnFailure represent the elapse time from HO reception to HOF, but NW cannot know there is a CHO configuration received and unused, which could be improper or too late CHO configuration. Additional time info for NW to derive the CHO reception to connection failure is still needed.   Based on above analysis, we believe the proper combination of timers is to   1. Update timeConnFailure as elapse time from CHO execution to connection failure in case CHO execution failure , otherwise elapse time from latest RRCConfiguration to connection failure; 2. Introduce timer C as proposed with condition, timer C is optional included when CHO configuration is included and RLF type is not RLF. |
| Lenovo | See comments | We agree with observation 6 in QC paper (R2-2106010). After the UE receives the RRCReconfiguration (containing CHO configuration, the UE receives the RRCReconfiguration (containing HO configuration. Then, the normal HO fails. It is helpful for the UE to report the time difference between RRCReconfiguration (containing CHO configuration and RRCReconfiguration (containing HO configuration) |
| Sharp | No | Maybe we should first conclude whether the normal HO command case should be considerred together with CHO case. then we can discuss whether to reuse or update this time C. |

Rapporteur´s summary: To be added later

Other timers are mentioned in submitted contributions. Since those timers were discussed in previous email discussions, but not agreed, Rapporteur proposes to further discuss them as cat-b proposals:

RAN2 to discuss the need of the following timers:

* 1. Timer A, i.e. to include the timeline relationship between two consecutive RLF reports for cases of successful or unsuccessful CHO after unsuccessful CHO or handover failure
  2. Timer B, i.e. time between the UE receiving the CHO command and RLF in source
  3. Timer F, i.e. time elapsed between successful CHO execution/recovery until RLF in target
  4. In case the UE is configured with both A3 and A5 event for CHO, the UE to report in the RLF report the time elapsed between the fulfilment of the two triggering conditions for the CHO cell
* **Q2: Which (if any) of the four timers (option-a, b, c, d) are acceptable (you can select more than one or none)?**

|  |  |  |
| --- | --- | --- |
| Company | Option-a, b,c,d, none | Comments |
| Qualcomm | none | For a, I agree with VIVO contribution that this timer is irrelevant for network optimization. For timer b, the legacy difinition of timeConnFailure should be sufficient, where timeConnFailure captures the time since reception of RRCReconfiguration until RLF or HoF. Time F is captured by timeUntilRecoonection. I believe that the last timer is irrelevant and I am wondering how this can be useful in network optimization. |
| vivo | none | Agree with QC. |
| Ericsson | B, D | A/F: we agree with QC  B: We have agreed that it will be captured the time difference between CHO configuration and CHO failure. Hence, it seems straightforward to assume that if RLF occurs before CHO execution, i.e. RLF in source cell, then this timer is stopped and logged in the RLF-Report  D: the gNB may configure a UE with an A3 and A5 event as CHO execution conditions. Knowing the time elapsing between these two events may be beneficial for the network to determine whether both events should be configured or only one of them. For example, if the time elapsed is too long, there might be the risk that the UE experiences an RLF before triggering the HO, on the other hand it the time elapsed is sufficiently short, two event conditions may make the HO more robust. |
| OPPO | B | B could be derived using timeConnFailure. |
| China telecom | none of option-a/b/c  And no strong view for option-d. | Timer A/B/F: agree with QC. |
| ZTE | None | As commented in previous question, we think time difference between two failure can provide more information.  Agree with QC on d.  In our understanding, two CHO event is used to improve the robustness of CHOs, where different parameter can be evaluated (e.g., RSTP/SINR). If only one event is used instead of two events simply because the time difference between satisfying two events is too long, then cell with poorer quality might be selected, then the CHO might in the end fails. How to use this information is still not clear to us. |
| Lenovo | None |  |
| Sharp | none | Agree with Qualcomm |

Rapporteur´s summary: To be added later

### Radio measurements-related info and candidate cells indication

Related to radio measurements, the following was agreed in RAN2#114-e:

|  |
| --- |
| **From RAN2#114-e**  Agreements:  2 To represent the measurement results of the candidate target cells:  Reuse the measResultNeighCells in the RLF-Report, and include an indication (depending RAN3 conclusion) on whether a measured neighbour cell was configured as a CHO candidate or not. |

Hence, given the above agreement, Cat-a-Proposal 5 and Cat-a-Proposal 6 in the email discussion [22] are considered resolved.

There are other possible measurement-related info proposed in various contributions. Rapporteur proposes the following:

RAN2 to discuss the need of the following information in the RLF report:

* 1. For successive CHO failure event, it is proposed to include the following information for the first failure case: csi-rsRLMConfigBitmap/ssbRLMConfigBitmap
  2. The first satisfied event or condition (A3 or A5)
  3. The measurements of the second condition when the first condition is fulfilled
* **Q3: Which (if any) of the three options (option-a, b, c) are acceptable (you can select more than one or none)?**

|  |  |  |
| --- | --- | --- |
| Company | Option-a, b,c, none | Comments |
| Qualcomm | none | A is already part of RLF report. B and C can be determined by the network from the measurement provided in the RLF report. |
| vivo | none | Agree with QC. |
| Ericsson | B (if D in Q2 is agreed) | B is needed in case the timer D is agreed, i.e. if the UE reports the time elapsed between A3(A5) and A5(A3), then it should log also which was the condition which was first met. |
| OPPO | none | Agree with Qualcomm |
| China telecom | No strong view |  |
| ZTE | a | In our understanding this is to confirm including legacy RLF content for CHO failure. |
| Lenovo | none | Agree with QC. |
| Sharp | none | Agree with Qualcomm |

Rapporteur´s summary: To be added later

One company (Nokia) believes that one agreement related to the “fulfilled CHO execution conditions” should be clarified:

RAN2 to discuss whether the following agreement should be clarified:

* 1. Include in the RLF-report for CHO the following: “Fulfilled CHO execution condition(s), i.e. whether A3 and/or A5 event was fullfilled, for the cell(s) in which CHO execution was triggered”
* **Q4: Do you see the need to revisit the above agreement? If yes, alternative wording should be given in the reply?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | No | Network can determine this from the measurement provided in the RLF report. |
| vivo | Subjecto RAN3 LS | In case the UE CONTEXT is maintained by NW (that A3/A5 execution conditions are known by NW), NW can be able to derive, for a specific cell, whether CHO execution conditions are fuifilled or not via the measurement recorded in RLF report. |
| Ericsson | Maybe | One thing that could be revised is to clarify that it is applicable only to the first cell in which CHO was executed. In fact, if reestblishment occurs in a second CHO cell, the UE may not evaluate A events, e.g.:  “Include in the RLF-report for CHO the following: “Fulfilled CHO execution condition(s), i.e. whether A3 and/or A5 event was fullfilled, for the first cell in which CHO execution was triggered |
| OPPO | Want for RAN3 LS |  |
| China Telecom | Subjecto RAN3 LS | Agree with vivo. |
| ZTE | No | We think the all fulfilled cells and the detailed configuration of each event configured, not just the selected one, since it is possible there could be multiple cells satisfying the triggering conditions. |
| Lenovo | Yes | This agreement was made based on the contributions (R2-2101102 and R2-2100711) in the post email discussion (R2-2103945). According to the discussion, this agreement is associated with CHO recovery case. After RLF or HOF, the UE performs cell selection. If the UE can select one cell meeting S-criteria, that means the selected cell does not meet the CHO execution condition. Therefore, the above two contributions proposed that the UE needs to report whether CHO execution condition is met or not in the CHO recovery case.  Therefore, we suggest to make the agreement clear as follow:  “CHO execution condition(s) is Fulfilled or not, i.e. whether A3 and/or A5 event was fullfilled, for the cell(s) in which CHO execution for recovery was triggered” |
| Sharp |  | We should wait for RAN3 LS on this. |

Rapporteur´s summary: To be added later

### Other info

Related to the IDs to use for the first and second reestablishment attempts, these were the agreements from RAN2#113bis-e:

The following information in the RLF report for CHO are needed:

b. CHOCellId, to indicate the selected CHO cell after the first connection failure and before the reestablishment

c. CellID to indicate the cell in which the UE attempted the second reestablishment after failure of the first reestablishment following an HOF/RLF.

How to provide these information is FFS.

Related the cellID in bullet C from the above agreements, many companies (Huawei, Ericsson, Lenovo, Nokia, ZTE) believe that the reestablishment cell ID can be used. Hence, Rapporteur proposes the following:

1. RAN2 to agree that the reestablishmentCellID is used to represent:
   1. CellID in which the UE attempted the second reestablishment after failure of the first reestablishment following an HOF/RLF

* **Q5: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes | I believe that UE behaviour should be simple. We can simply say that if UE apply CHO configuration after a failure, then the cellID is added on the CHOCellID (irrespective of successful or failed attempt), otherwise it will be included as the reestablishmentCellID. |
| vivo | Yes |  |
| Ericsson | Yes | Agree with QC |
| OPPO | Yes but | In current spec, reestablishmentCellID indicates the cell in which re-establishement was performed after connection failure. In CHO case, UE could perform up to two re-establishment, one towards candidate cell, and another towards non-candidate target cell. To differentiate these two cells, in the last meeting, we agree two cell IDs should be employed to indicate them respectively. Bearing this in mind, we should have a integrated plan: if reestablishementcellID is used to represent cellID, how about the CHOCellID? |
| China telecom | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Sharp | Yes | Agree with Qualcomm to make the statement clearer. |

Rapporteur´s summary: To be added later

One company (Ericsson) believe that the reestablishmentCellID can also be used to indicate the cellID of the first attempted reestablishment, if such cell is an ordinary cell, i.e. non-CHO candidate.

The reestablishmentCellID can also be used to represent the cellID of the cell in which the UE attempted the (first) reestablishment if such cell is a non-CHO candidate cell

* **Q6: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes. | I believe that UE behaviour should be simple. We can simply say that if UE apply CHO configuration after a failure, then the cellID is added on the CHOCellID (irrespective of successful or failed attempt), otherwise it will be included as the reestablishmentCellID. |
| vivo | Yes |  |
| Ericsson | Yes | Agree with QC. This is the option that requires less specification changes. |
| OPPO | Yes |  |
| ZTE | Yes | Already part of RLF content. |
| Lenovo | Yes |  |
| Sharp | Yes | This aligns with legacy behavior. |
|  |  |  |

Rapporteur´s summary: To be added later

Related to bullet B in the above agreement from RAN2#113bis-e, i.e. CHOCellID, some companies have further provided proposals on it. Most of them believe that a new IE CHOCellID should be used. One company (ZTE) believe that the existing failedPCellID should be used. Since the need of this new IE was already discussed in RAN2#113bis-e, Rapporteur proposes to stick to that agreement:

1. RAN2 to confirm the agreement from RAN2#113bis-e, i.e.
   1. A new CHOCellID is introduced to represent the CHO candidate cell selected after the first connection failure and before the reestablishment

* **Q7: Is the proposal in (a) acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcom | Yes | I believe that UE behaviour should be simple. We can simply say that if UE apply CHO configuration after a failure, then the cellID is added on the CHOCellID (irrespective of successful or failed attempt), otherwise it will be included as the reestablishmentCellID. |
| vivo | Yes |  |
| Ericsson | Yes | Agree with QC |
| OPPO | Yes | Agreement on the proposal in Q5 should be coupled with the one in this question |
| ZTE | No | failedPCellID is a mandatory presented IE, to avoid duplication, it is prefer to reuse this IE. Based on information related to the failure type or fulfiled CHO conditions, whether the selected cell is a CHO cell shall be able to derived. |
| Lenovo | Yes | It is necessary to specify a separate cell ID for CHO recovery. |
| Sharp | Yes |  |
|  |  |  |

Rapporteur´s summary: To be added later

Some companies (ZTE, Huawei) focus on other possible parameters that could be included. Rapporteur proposes to discuss it:

RAN2 to include in the RLF report the following parameters:

* 1. failedPCellId is reused to indicate the cell where the first connection failure is detected in case of CHO
  2. previousPCellId to include the source cell identity if the first failure is a HOF or CHOF
  3. C-RNTI
  4. rlf-cause if the first failure is RLF
  5. noSuitableCellFound
* **Q8: Which of the proposals (a,b,c,d,e), if any, are acceptable (you can select more than one or none)?**

|  |  |  |
| --- | --- | --- |
| Company | a,b,c,d,e, none | Comments |
| Qualcomm | Okay | I believe this is about reusing the existing RLF contents for CHO. |
| vivo | All, but.. | We agree the intention of the proposal, but maybe the wording needs to be revised a little bit as now it seems to be a proposal solely about RLF report while actually this is about how to re-use the legacy parameters in RLF report to represent the CHO failure cases:  RAN2 to include in the RLF report the following parameters for CHO failure cases: |
| Ericsson | OK | Agree with QC, and with Vivo proposed rewording. We also believe that the intention of this proposal is to reuse the above existing parameters already present in the RLF report. |
| OPPO | OK |  |
| China telecom | Yes | Agree to reuse these information for CHO related RLF report. |
| ZTE | all |  |
| Lenovo | all | Agree to reuse these IE for CHO case. |
| Sharp | All | Agree all can be reused in CHO failure case. |

Rapporteur´s summary: To be added later

Related to the need of an explicit CHO flag, some companies (Nokia, ZTE, Lenovo) believe that this is needed:

RAN2 to discuss the need of an explicit CHO indication as HO type in the RLF-Report

* **Q9: Is the above explicit CHO indication needed?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualocmm | No | Considering fields considered, it should be clear from the report implicitly. |
| vivo | No |  |
| Ericsson | Maybe | Considering that the UE may execute an ordinary HO while configured with CHO, it might be needed to have such an indication because the ordinary HO may fail and still the UE may include in the RLF report CHO-related paramters (since it was configured with CHO). Hence, it will be unclear whether the ordinary HO or the CHO failed.  We can maybe discuss the need of this parameter, once we have a first structure of the signalling needed, i.e. during stage-3. |
| OPPO | No | As Ericsson said, we can review the need duing stage-3 phase. |
| ZTE | Yes | It is preferred to use explicit indication, so that NW can based on such indication to quickly categorize the MRO scenarios or pick out interested RLF reports. |
| Lenovo | Yes | It is better to discuss it now since we have already agreed that CHO related information will also be included in the ordinary HO failure case. |
| Sharp | Maybe | Agree with Ericsson, this can be discussed later. If there is any CHO-specific parameter included in RLF-report for all failure scenario, then this explicit indication is not needed. |
|  |  |  |

Rapporteur´s summary: To be added later

Rapporteurs proposes to further discuss these proposals:

For scenarios that two connection failures happened, it should be clarified that whether the connection failure means the first failure or the second failure.

* **Q10: For CHO scenarios in which a first failure occurs in a first CHO cell and then a second failure occurs in a second CHO cell, which event is considered as “connection failure”?** 
  1. **The first failure**
  2. **The second failure**

|  |  |  |
| --- | --- | --- |
| Company | Option (a,b) | Comments |
| Qualcomm | A |  |
| vivo | a |  |
| Ericsson | A |  |
| OPPO | A |  |
| China telecom | a |  |
| ZTE |  | In our understanding, the intention is to identify the order of each failures, which in our understanding can be differentiated based on the IE names if separate IEs is used for first and second connection failure respectively. |
| Lenovo | A with comments | We have separate IE to indicate two failures. |
| Sharp | A |  |

Rapporteur´s summary: To be added later

Introduce a single flag indicating whether all CHO conditions were met. Do not introduce a seperage flag indicating whether UE attempted recovery (given large overlap)

* **Q11: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | No | No need for a flag. It should be determined by the network from measurement in RLF report. |
| vivo | Subject to RAN3 LS | Similar reasons as commented in Q4. |
| Ericsson | No | We already have the agreement “Include in the RLF-report for CHO the following: “Fulfilled CHO execution condition(s), i.e. whether A3 and/or A5 event was fullfilled, for the cell(s) in which CHO execution was triggered”.  It is seems that the intention of this proposal is already covered. |
| OPPO | Wait for RAN3 LS |  |
| ZTE |  | The proposal is not clear to us. |
| Lenovo | No |  |
| Sharp | See comments | For flag indicating the CHO conditions, we can wait for RAN3 response LS.  Separate flag for whether UE attemped recovery is not needed if new IE CHOcellID is agreed to be included to represent CHO recovery cell. |
|  |  |  |

Rapporteur´s summary: To be added later

The network need to confirm whether attemptCondReconfig-r16 is configured or not to help deducing the optimization direction. Whether an explicit indication is needed in RLF report depends on RAN3’s response to LS R2-2102149.

* **Q12: As per the above proposal, do you see the need to include in the RLF-Report indication of whether “attemptCondReconfig” was configured to the UE?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | No | This should be handled by the network. |
| vivo | Subject to RAN3 LS | Similar reasons as commented in Q4. In case UE context is maintained by the NW, this information is not needed to be included in the RLF report at all. |
| Ericsson | No | This information can be beneficial, but maybe it can be alredy inferred from the reestablishment cell ID and from the information on measured CHO cells, i.e. if the reestablishment cell ID is a cell flagged as CHO cell in the measResultNeighCells, then the NW can figure out that attemptCondReconfig was not configured. |
| OPPO | No | Agree with Ericsson |
| China telecom | Subject to RAN3 LS | take scenario 1d as example, the UE experiences RLF in the source cell before CHO execution conditions fulfilled and subsequently (un)successful reestablishment in non-candidate CHO cell. It is not clear the reason for UE selecting a non-candidate CHO cell is none of the candidate CHO cells fulfill the CHO execution conditions or UE was NOT configured *attemptCondReconfig-r16*. The network would be not sure the optimization direction is adjust CHO execution conditions, candidate CHO cell list or just configure *attemptCondReconfig-r16* to allow CHO recovery. |
| ZTE |  | This information can be derived based on the CHO configuration and the cell measurements. |
| Lenovo | See comments | Do not agree Ericsson.  - Case#1: UE selects one non-CHO candidate cell in the case that CHO configuration is configured.  - Case#2: UE selects one non-CHO candidate cell in the case that CHO configuration is not configured.  Whether attemptCondReconfig-r16 is configured could be helpful to differentiate the above two cases. |
| Sharp | No | Share Ericsson’s view. |

Rapporteur´s summary: To be added later

### Signalling model

Related to the signalling model to adopt for the multiple failures the UE may experience during CHO, these are the options:

* + Use separate IEs within the existing RLF-report to represent the second failure, and the first failure can be represented by reusing as much as possible existing IEs (Lenovo, Huawei, Nokia, Ericsson, China Telecommunication, ZTE)
  + In case UE experiences multiple report triggers/ events, the UE stores multiple reports that network can retrieve (Samsung)

Given the above, Rapporteur proposes the following:

1. Use separate IEs within the existing RLF-report to represent the second failure, and the first failure can be represented by reusing as much as possible existing IEs.

* **Q13: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes. |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| China telecom | Yes |  |
| ZTE | Yes | We believe using separate IEs can avoid duplicated information, which has less specs impact. It also allows NW to request complete RLF report for optimization. |
| Lenovo | Yes |  |
| Sharp | Yes |  |

Rapporteur´s summary: To be added later

### Scenarios

Related to the merging of scenarios 1b/1c, 3 companies (China Telecommunication, LG) believe that they should not be merged. One company (Huawei) believe that they should be merged. Given the above, Rapporteur suggests the following

1. No need to merge scenarios 1b/1c

* **Q14: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes |  |
| OPPO | Yes | Considering different IE should be captured in the scenario 1b/1c, no need to merge. |
| China telecom | Yes |  |
| ZTE | Yes with conditions | Yes if we don’t introduce additional information to indicate the outcome of reestablishment. I guess the difference between 1b/1c is the reestablishment outcome, which can be differentiated based on already existing IEs including reestablishmentCellId, NoSuitableCellFound or reconnectedCellID, and it shall be sufficient. |
| Lenovo | Yes |  |
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Rapporteur´s summary: To be added later

Related to the merging of scenarios 2a/2b, 2 companies (China Telecommunication, Oppo, LG) believe that they should not be merged. One company (Oppo) believe that they should be merged. Rapporteur believe that in can be discussed in stage-3 whether the same set of IEs or different should be used to represent the scenarios 2a/2b. Hence, given the above, Rapporteur suggests to agree on the following for the time being:

1. No need to merge scenarios 2a/2b

* **Q15: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | Yes |  |
| OPPO | Yes | Our originial opinion is to merge scenarios 2a/2b. But considering that CHOCellId is needed for 2b, we are ok to not merge these two scnearios |
| China telecom | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
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Rapporteur´s summary: To be added later

For the other proposals on this topic, Rapporteur suggests to further discuss it, since there are no sufficient views available in submitted contributions.

RAN2 to discuss the need to Deprioritize case 3c and 3f for MRO of mixed ordinary HO and CHO

* **Q16: As per the above proposal, do you see the need to Deprioritize case 3c and 3f for MRO of mixed ordinary HO and CHO?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | May be | Can be deprioratized or wait for RAN3 for this |
| Ericsson | No | It is a possible scenario, and considering that it can be covered with no major standardization efforts it can be kept on the table from the time being |
| China telecom | No strong view |  |
| ZTE | No | We want to understand the outcome if we deprioritize 3c and 3f, does it mean UE only store the latest failure information without including any information related to previous failure or what? Because in our understanding, 3c and 3f has been agreed in RAN3’s MRO, so we don’t think we shall deprioritize the discussion. Also when discussing the timer related topic, this scenarios have as l well been extensively discussed, if we don’t consider this scenario, we might need to revisit some of the timer related agreements. |
| Lenovo | No strong view |  |
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Rapporteur´s summary: To be added later

RAN2 to discuss the following “Case 2b is the CHO to wrong cell not too early CHO according to the definition in stage 2”

* **Q17: Do you see the need to move CHO scenario 2b from “To early CHO” to “CHO to wrong cell”?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | No strong view |  |
| OPPO | No for now | Noted that in this sceanrio, Source cell is the final re-established cell. The reason that moveing such sceanrio to CHO to wrong cell should be further clarifed |
| China telecom | No strong view |  |
| ZTE |  | RAN3 scope. |
| Lenovo | No strong view |  |
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Rapporteur´s summary: To be added later

RAN2 to discuss the need to use more exact wording in the description of MRO scenarios and actions in order to differentiate between CHO recovery and re-establishment procedure

* **Q18: Do you see the need to use more accurate wording to differentiate between CHO recovery and re-establishment procedure? If yes, please provide your definition.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | No | Don’t see the need. |
| Ericsson | No | Agree with QC. Do not think RAN2 should spend time on this. |
| OPPO | No |  |
| ZTE |  | It is more like a stage 3 issue. In our understanding CHO recovery is considered as the following: attemptCondReconfig is configured;, and an CHO candidate cell is selected while T311 is running. |
| Lenovo | See comments | If not to differentiate them, do we consider CHO recovery is a part of re-establishment? |
|  |  |  |
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Rapporteur´s summary: To be added later

## DAPS related aspects

### Timers-related info

Related to the use of timeConnFailure, these are the views:

* timeConnFailure is to indicate the time elapsed since the last HO initialization, including DAPS HO, until first connection failure (Huawei)
* timeConnFailure represents “The elapsed time between the execution of DAPS and HOF or RLF in target cell” (Ericsson, CATT, China Telecommunications)
* timeConnFailure represents “Time elapsed since reception of RRCReconfiguration containing DAPS HO until UE leaves CONNECTED state, i.e., UE doesn’t have an active cell connection.” (Qualcomm)

Further one company (Oppo) believe that a new IE timeConnFailureTarget might need to be introduced in the RLF report to indicate the time elapsed since the DAPS HO execution until RLF occurs in the target cell. Rapporteur proposes to discuss the following.

1. RAN2 to discuss what timeConnFailure should represent among the following options
   1. “The elapsed time between the execution of DAPS and HOF or RLF in target cell”
   2. “The time elapsed since the last HO initialization, including DAPS HO, until first connection failure”
   3. “Time elapsed since reception of RRCReconfiguration containing DAPS HO until UE leaves CONNECTED state, i.e., UE doesn’t have an active cell connection.”
   4. A new IE timeConnFailureTarget is introduced in the RLF report to indicate the time elapsed since the DAPS HO execution until RLF occurs in the target cell.

* **Q19: Which of the above proposals (a,b,c,d) are acceptable (you can select more than one)?**

|  |  |  |
| --- | --- | --- |
| Company | A,b,c,d,none | Comments |
| Qualcomm | Fine with B or C |  |
| vivo | B |  |
| Ericsson | A | The timeConnFailure is used in legacy to represent the time between HO initialization and HOF or RLF in target. Hence, A seems simpler and more aligned with the legacy intention of timeConnFailure.  B: If the first failure is the failure in source, then the timeConnFailure would be stopped. So it will remain unclear which timer to use in case the UE gets an HOF or an RLF in the target. We would need to introduce a new timer which somehow changes the legacy behaviour.  C: This modifies the legacy intention of timeConnFailure, so we should not pursue it  D: It seems strange to introduce a new timer for a functionality that can be already covered by a legacy timer. |
| OPPO | A or D | In DAPS, connection failure could be either RLF in the source cell or the HOF or RLF in the target cell. To exclude the possibility of stopping the timer running when connection failure is detected towards the source cell, we propose to define a new IE timeConnFailureTarget (considering the case that connection towards the source cell is failed, but UE finishes HO towards target cell and at last experiences RLF in target cell, the time elapsed since the HO initialization to the RLF in target cell is needed for network for further optimization). But we are also OK if to redefine the legecy timer timeConnFailure in the DAPS scenario. |
| China telecom | A | There is no difference about the timer timeConnFailure definition for ordinary HO and DAPS HO except the HO type. |
| ZTE | c | We think the definition of timeConnFailure related to the scenarios we considered and how we intend to present such information, especially for the case there are two consecutive failure occurs, for example:   * Case 1: RLF in source during DAPS HO, and HOFs. * Case 2: DAPS HO failure, UE fallback to source and shortly UE experience RLF in source. * For case 1, since UE shall store both failure information since it cannot fallback to source which lead to some interruption time, and it is not desirable. NW would like to know both failure information to know whether the DAPS decision is appropriate. In this case, timeConnFailure will be used to indicate the elapse time between the DAPS execution to UE leaves connected mode (i.e., HOF in target) and addition information is needed for NW to know the DAPS execution to the source RLF to know if the DAPS HO decision is too late. One possible solution is to introduce a new timer to indicate the time difference between two failure, then this information can be derived. * For case 2 since UE has successfully fallback to source, the DAPS could be too early or to wrong cell, which is similar to legacy MRO. It is shall be sufficient to store the latest RLF, and UE will includes the timeConnFailure as the time elapse from DAPS HO execution to UE leaves connected mode (e.g., RLF in source) and similarly a new timer is also introduced to present the time difference between the two failure, therefore NW can deduce the DAPS HO decision to the RLF in source to decide whether it is a too early HO or not.   Based on above our views is summarized as follows:   1. Definition c is used as definition of timeConnFailure in DAPS HOF. 2. New timer is introduced in DAPS HOF to present the time difference between first and second failure. 3. when RLF is detected in source during DAPS HO, and DAPS HO failures, UE stores both failure information in source and target in the rlf-report. ffs the detailed content and signalling format. |
| Lenovo | a | For B, if RLF happens on source after performing DAPS HO, it is not clear whether first connection failure is associated with source RLF. |
| Sharp | A | Agree with Ericsson |

Rapporteur´s summary: To be added later

Related to the “The time elapsed since DAPS HO execution until RLF occurs in source cell before fallback”, some companies (Ericsson, CATT, China Telecommunication, Oppo) believe that a new IE should be used. One company (Huawei) believe that timeConnFailure can be reused

1. RAN2 to discuss how to represent the “The time elapsed since DAPS HO execution until RLF occurs in source cell before fallback”, among the following options
   1. A new timeConnSourceFailure IE is introduced
   2. timeConnFailure is reused

* **Q20: Which of the above proposals (a,b) are acceptable (you can select more than one)?**

|  |  |  |
| --- | --- | --- |
| Company | A,b | Comments |
| Qualcomm | B | timeConnFailure should be reused. |
| vivo | b | We should try to reuse the legacy timers as much as possible. |
| Ericsson | A | The failure in source while doing HO is a new scenario not existing in legacy. Hence, it makes sense for this new scenario to introduce a new timer. |
| OPPO | A |  |
| China telecom | A | Because the legacy RLF report only includes one timer timeConnFailure since RLF in the source cell and HOF in the target cell won’t happen together for ordinary HO. However, in case of DAPS HO, RLF in the source cell and HOF in the target cell can happen together. The legacy timeConnFailure would be used to record the time elapsed since DAPS HO execution until HOF in the target cell. Then a new timer need to be introduced to record the time elapsed since DAPS HO execution until RLF occurs in source cell.  Otherwise, there will be two timeConnFailure are recorded for RLF in source cell during DAPS HO, the network would be confused. |
| ZTE | Depends on the outcome of Q19 | As explained in our comments to Q19, if definition c is adopted, this information can be implicitly derived based on timeConnFailure and the new timer introduced to present the time between first and second failure. |
| Lenovo | A |  |
| Sharp | A | timeConnFailure is preferred to be reused for HOF, and we need a new timer for source RLF. |

Rapporteur´s summary: To be added later

Related to the “The time elapsed since DAPS HO execution until RLF occurs in source cell after fallback”, two companies (CATT, China Telecommunication) believe that a new IE should be introduced. One company (Ericsson) believe that the timeConnFailure can be reused together with a “DAPS fallback” indication. Hence, Rapporteur proposes to discuss the following:

1. RAN2 to discuss how to represent the “The time elapsed since DAPS HO execution until RLF occurs in source cell after fallback”, among the following options:
   1. A new timer IE is introduced
   2. timeConnFailure is reused and a “DAPS fallback” indication is introduced

* **Q21: Which of the above proposals (a,b) are acceptable (you can select more than one)?**

|  |  |  |
| --- | --- | --- |
| Company | A,b | Comments |
| Qualcomm | B |  |
| vivo | b |  |
| Ericsson | B | B seems simpler since it allows the UE and the network to reuse a legacy timer. |
| OPPO | B |  |
| China telecom | A | Similar to comments for Q20. |
| ZTE |  | Same comments as Q20 |
| Lenovo | B |  |
| Sharp | A | A single new timer can be used for source RLF in both before and after fallback case. the network can know whether the source RLF is “before fallback”or “after fallback” from other information, e.g. the time value of this timer and timeConnFailure. |

Rapporteur´s summary: To be added later

Further, two companies (Huawei, Qualcomm) proposes to introduce a timer to indicate the time elapsed betwen the first connection failure until the second one. Since this was discussed in the past in [20] but not agreed, Rapporteur proposes cat-b.

RAN2 to discuss the need to include in the RLF report the “The elapsed time between first failure in source (or target) and second failure in target (or source) while performing the DAPS HO”.

* **Q22: As per the above proposal, do you see the need to include in the RLF report the “The elapsed time between first failure in source (or target) and second failure in target (or source) while performing the DAPS HO”?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo | No |  |
| Ericsson | No | It does not seem to be essential to explicitly know the time elapsed between the two failures. |
| OPPO | No | The reason to do so is unclear |
| ZTE | Yes | Please refer to our comment in Q19. |
| Lenovo | No |  |
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Rapporteur´s summary: To be added later

One company (Huawei) further suggests introducing a new timer. Since that was not discussed in the past, Rapporteur proposes cat-b.

RAN2 to discuss the need to introduce the following timer:

* 1. new time IE, e.g., timeFailureDAPSHO, to indicate the time elapsed since the first connection failure until the successful RACH with the target DAPS HO cell
* **Q23: Do you see the need to introduce the timer in the above proposal?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | No | I believe timeUntilReconnection is the same as proposed timer. |
| vivo | No | Agree with QC that *timeUntilReconnection* can be reused, the definition of the legacy timer is given below:  This field is used to indicate the time that elapsed between the connection (radio link or handover) failure and the next time the UE comes to RRC CONNECTED in an NR or EUTRA cell. |
| Ericsson | No | Agree with QC/Vivo |
| OPPO | No |  |
| ZTE | No strong view | Since the DAPS is successful, we don’t know how this information can be used to optimize the configuration. More justification is needed. |
| Lenovo | No |  |
| Sharp | No |  |
|  |  |  |

Rapporteur´s summary: To be added later

One company (Huawei) suggests that the “timeSinceFailure” is defined to indicate the time elapsed since the last connection failure”. Since this was not discussed before, Rapporteur suggests discussing it. Rapporteur also would like to note that according to TS38.331 the timeSinceFailure in the RLF-Report is “the time that elapsed since the last radio link failure or handover failure”.

RAN2 to discuss what “timeSinceFailure” represents in case of DAPS HO, e.g.

* 1. The time elapsed since the connection failure in the target
  2. The time elapsed since the last connection failure (irrespective of whether that is in source or target)
* **Q24: Which of the above option (a,b) is acceptable for the definition of timeSinceFailure in DAPS HO scenarios?**

|  |  |  |
| --- | --- | --- |
| Company | A/B | Comments |
| Qualcomm | B |  |
| vivo | B | B seems to be more aligned with the legacy definition of *timeSinceFailure*. |
| Ericsson | B | Agree with QC/Vivo. B is more aligned to the legacy definition. |
| OPPO | B |  |
| ZTE | b | In our understanding, this information is to indicate the time period before UE comes back to connected, therefore b is more aligned with its original meaning. |
| Lenovo | B |  |
| Sharp | B |  |
|  |  |  |

Rapporteur´s summary: To be added later

### Other info

Different new indicators are proposed by various companies. Some of them were discussed in [20], but not agreed. Hence, Rapporteur proposes to further discuss the need of them:

RAN2 to discuss the need of:

* 1. DAPS handover type indication in RLF-report in case that DAPS HO is successfully performed but subsequent RLF occurs in target
  2. failure order indicator, e.g., consecutivetwofailuresoder, to indicate whether the failure between the UE and the source cell occurs before the one between the UE and the target cell
  3. Indicator to determine whether the HoF happened before or after the RLF at the source
  4. The state of source link after successful RACH should be included in the RLF-Report.
* **Q25: Which of the above options (a,b,c,d) is acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | A,B,C,D | Comments |
| Qualcomm | C |  |
| vivo | D, but… | We notice the D is beneficial to NW as this indicates that the DAPS HO is actually failed even though a successful RACH is performed at the target cell.  As the UE stops sending and receiving any RRC control plane signalling toward the source cell once it receives the DAPS handover message, the radio link failure detection mechanism for the source cell is suspended likewise. It is true that there is still a possbility the UE can be aware of the the source link quality via HARQ/ARQ retransmission and ROHC feedback transmissions to the source gNB, but it may not be always the case.  So the inclusion of D is not always feasible, we wonder how to ensure that the UE is able to find out the source connection problems every time? |
| Ericsson | C | C is needed for the case of “failure in source after fallback”. D seems to be more a SHR case |
| ZTE | a might be useful  c/b can be considered together with modification  d needs further discussion | For us, a is similar to legacy too early or to wrong HO, depends on the selected cell during reestablishment. The difference is that previous HO is a DAPS HO, and it introduce extra complexity and requires reserving more resource, in that sense, it might be beneficial to have such flag so that NW can see the occurrence of improper DAPS HO to investigate if there is a real need to configure DAPS.  The intention for b/c is similar, and we can simply have one indication(e.g., sourceRLFDuringHO) to indicate whether RLF is detected in source during DAPS HO, if it is set to true, then NW can know the source RLF is before DAPS HO. Then together with present of other timers, e.g., time difference between two failure, timeConnFailure, UE shall be able to deduce the difference situation:   * Case 1. source RLF before DAPS failure(i.e., source RLF during DAPS HO): sourceRLFDuringHO included, both timeConnFailure and time difference between two failures are included; * Case 2: source RLF after DAPS failure: sourceRLFDuringHO is not included, and both timeConnFailure and time difference between two failures are included; * Case 3: No source RLF after/before DAPS failure: sourceRLFDuringHO is not included, and only timeConnFailure is included;   For d, it shall be included in SHO Report, not RLF-report. Since there are companies share different views, and we are open to discuss..  Based on above, we propose following modification to address both c and b.  Indication to indicate whether source RLF is detected during DAPS HO is considered in rlf-report. ffs on d. |
| Lenovo | a |  |
| Sharp | A | Both B and C can be known by the network from timeConnFailure and new time defined in Q20/21. |
|  |  |  |
|  |  |  |

Rapporteur´s summary: To be added later

One company (Huawei) seems to propose some different interpretations of failedPCell and reestablishmentCellID. Rapporteur is unsure on whether any change is needed compared with legacy.

1. In case of DAPS HO, the failedPCell and reestablishmentCellID in the RLF-report are reused as in legacy.

* **Q26: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| ZTE | Needs further discussion | For case1 we raised in Q19 (source RLF during DAPS HO, and then HO fails ), how to present the failure information needs further discussion. |
| Lenovo | Yes |  |
| Sharp | Yes |  |
|  |  |  |

Rapporteur´s summary: To be added later

### Signalling model

Related to the signalling model, two options are possible:

* DAPS handover failure information could be included in FailureInformation message for handover optimization (CATT, Sharp)
* The existing FailureInformation message associated to DAPS failure is not enhanced for SON purposes (Ericsson, ZTE, Lenovo, Vivo, Huawei, CMCC)

Rapporteur proposes the following:

1. The existing FailureInformation message associated to DAPS failure is not enhanced for SON purposes.

* **Q27: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | No | I believe that it needs to be enahced. In the case the fallback happens, early information to network can help network in providing the second reconfiguration to avoid RLF at source after failure. |
| vivo | Yes | The legacy FailureInformation already functions as a means to help NW in providing the second reconfiguration as it explicitly delivers the message that DAPS failure occurred. This is not the same to MCG/SCGFailureInformation which requires a timely notification, instead, the reconfiguration/optimization on DAPS parameters rely on the collective data reported from a significant number of UEs. |
| Ericsson | Yes | Agree with Vivo. Additionally, we should avoid adding overhead to the FailureInformation message that is likely sent by the UE when it is already in bad coverage. Since the SON information are not time critical, they should be reported using the classical RLF-report framework. |
| OPPO | No | Agree with Qualcomm |
| China telecom | Yes | Agree with vivo and Ericsson. |
| ZTE | Yes | As emphasized in our paper, failureInformation is designed to carry minimum information, and it is important to guarantee the successful delivery of such information so that NW can decide whether to initiate another HO or not. Additional information could endanger the successful delivery of FailureInformation, therefore shall be avoided. |
| Lenovo | Yes |  |
| Sharp | No | Agree with Qualcomm. |

Rapporteur´s summary: To be added later

### Scenarios

Related to the merging of scenarios 2b/2c, and 3b/3c in [20], these are the views:

* Merge scenarios 2b/2c and 3b/3c (China Telecommunication, Oppo, ZTE, Huawei)
* Not merge 2b/2c and 3b/3c (LG)

Given the above, Rapporteur proposes the following:

1. Scenarios 2b/2c and 3b/3c are merged

* **Q28: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | No strong view |  |
| OPPO | Yes | Both of 2b and 2c are categorized into the ‘too early HO’ case, the network should improve the HO triggering RSRP/RSRQ threshold of the target gNB. From this perspective, there is no difference between Scenario 2b and 2c. The difference between Scenario 3b and 3c is similar with the difference between Scenario 2b and 2c. Both of the Scenarios result in the same set of IEs included in the RLF report and gNB behaviour. No need to differentiate these two scenarios. |
| China telecom | Yes |  |
| ZTE | Yes | To us NW cannot perform optimization based on such information, therefore no need to differentiate the two scenario. |
| Lenovo | No strong view |  |
|  |  |  |
|  |  |  |
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Rapporteur´s summary: To be added later

One company (Huawei) has further proposals on scenarios that Rapporteur suggests to further discuss.

RAN2 to further discuss the following:

* 1. Move scenario 1b into the too early DAPS HO
  2. Introduce new scenario 3d and merge scenarios 3a and 3d
* **Q29: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Ericsson | No | We believe that at this stage of the WI, RAN2 should not spend time complicating scenarios’ discussion. |
| ZTE |  | RAN3 scope. We shall focus on RAN2 related topic. |
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Rapporteur´s summary: To be added later

## Successful Handover Report

### SHR triggering conditions

The following triggering conditions were agreed in RAN2#113bis-e:

At least the following triggering conditions are applied for generating an HO Success Report in the case that the HO succeeds:

a. The UE logs the HO success report if, while doing HO, T310 value exceeds a threshold

b. The UE logs the HO success report if, while doing HO, T312 value exceeds a threshold

c. The UE logs the HO success report if, while doing HO, T304 exceeds a threshold

d. In case of DAPS, if the UE gets an RLF in the source while doing DAPS.

One company (Huawei) provides proposals on how to configure the T310/T312/T304 thresholds for SHR reporting.

1. There are separate thresholds for T310/T312/T304 for SHR triggering conditions, and the values should be within the existing values.

* **Q30: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Seems okay. However, this is not whthin the scope of this meeting |  |
| vivo | Not sure | It not so clear to us that what’s the meaning of ‘the values should be within the exisiting values’.  Take T312 as an example:  T312-r16 ::= ENUMERATED { ms0, ms50, ms100, ms200, ms300, ms400, ms500, ms1000}  Assume NW configures T312 = 50ms to a UE, does the proposal mean that the threshold to generate the SHR can only be set to 0ms? If so, this seems not be desriable as it would always trigger the SHR… |
| Ericsson | To be postponed | We understand the intention of “separate thresholds”, but we also share Vivo´s concern.  We can discuss such details later on. |
| OPPO | To be postponed | Agree with VIVO |
| China telecom | To be postponed | Agree with vivo. |
| ZTE | Yes |  |
| Lenovo | Postpone |  |
| Sharp |  | Basically it is fine, but it is too detailed to be discussed now. |

Rapporteur´s summary: To be added later

1. The UE does not log SHR if not triggering conditions are configured.

* **Q31: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| China telecom | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Sharp | Yes |  |

Rapporteur´s summary: To be added later

Two companies (Nokia, Lenovo) believe that exceeding the thresholds for T310, T312, T304 should be used as SHR triggering conditions also for CHO. This seems to be in line with the above agreements.

1. RAN2 to confirm that the UE generates Successful HO report upon exceed thresholds on T310, T312 and T304 exceed also for CHO case (in addition to regular HO)

* **Q32: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| ZTE | Further discussed | We understand the intention is to save UE memory. But in another case, CHO is new feature included and it will require NW to reserved much more resource than normal HO, so it seems also useful to store CHO without any configuration on the timer threshold, or to log CHO related SHO report in some specific event? This can be further studied. |
| Lenovo | Yes |  |
|  |  |  |
|  |  |  |

Rapporteur´s summary: To be added later

A number of companies proposes additional triggering conditions on top of what already agreed in RAN2#113bis-e.

RAN2 to discuss the need of the following additional SHR triggering conditions:

* 1. The UE logs the Successful HO report if the time between receiving the RRCReconfiguration command with sync and the CHO execution exceed a certain threshold
  2. In case of CHO, if the UE gets an RLF in the source while doing CHO/normal HO;
  3. For UE configured with CHO, when RLF does not happen in target cell but T310 in target cell is started within a period after successful handover
  4. For UE configured with CHO, when RLF does not happen in target cell but T312 in target cell is started within a period after successful handover
  5. For UE configured with CHO, when RLF does not happen in target cell but the number of consecutive "out-of-sync" indications from target cell is greater than one threshold
  6. The UE logs the HO success report if, while doing HO, the number of out-of-sync indications exceeds a threshold
  7. The UE logs the HO success report if the beam(s) configured with CFRA for the RACH to the target, are not the best beams at the time of HO
  8. the ratio of CFRA attempt among the total attempts is less than a configured threshold
  9. if T310 value for source cell exceeds a threshold at the time of RA completion in case of DAPS HO
  10. The UE to include in the HO Success Report for CHO and ordinary HO, the HO interruption time, i.e. time elapsed between last received packet in the DL (last transmitted packet in the UL) in source cell, and first received packet in the DL (transmitted packet in the UL) in the target cell
* **Q33: Which of the above options (a,b,c,d,e,f,g,h,i), if any, are acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | a,b,c,d,e,f,g,h,i, none | Comments |
| Qualcomm | None |  |
| vivo | None |  |
| Ericsson | E/F, G, J | E/F can be beneficial because even if T310 is not started, still the overall amount of out-of-sync indications can be high which may make the HO not very robust.  G: That is needed because the CFRA configuration at HO may be based on certain measurements that are not actually reflecting the “best” beams at HO for the UE.  J is needed because if the HO interruption time is high, then the network can for example use this information to enable a DAPS HO to minimize the interruption time. |
| OPPO | none |  |
| ZTE | E/F can be merged;  G; h; i with modification | A can not be optimized by NW;  For b, except for DAPS, UE won’t continue monitor source RLF in HO, this will require additional UE behavior;  For c/d, so long as there is on RLF it is fine. If RLF detected shortly then it could be too early or to wrong HO, then RLF report will be considered, no need to consider in SHR;  e/f indicate the similar scenarios and can be merged;  Both g and h is used to identify improper CFRA configuration, and we think both can be considered;  We think i can be modified as RLF in source is detected before RA completion in case pf DAPS HO, since it means if RA fails, UE cannot fallback to source, which could be endanger of the zero-interruption time HO.Based on that we can optimize the DAPS HO timing. |
| Lenovo | C,D,E,F | For C,D,E,  Besides T310 or T312 for radio link of the source cell, the UE may also monitor target link after the UE successfully handovers to the target cell but finally no RLF occurs in the target cell, e.g. the UE starts T310 or T312 for the target cell, or the UE detects the consecutive "out-of-sync" indications from target cell. |
| Sharp | I | If T310 is running before RA completion for DAPS, it implies that the source lin quality is not good enough and there may be data interruption. SHR in this case can be used for NW to optimize the data interruption in source. |
|  |  |  |

Rapporteur´s summary: To be added later

### Timers-related info

In RAN2#113bis-e the following FFS were left:

|  |
| --- |
| Proposal 6 RAN2 to further discuss the need of the following time-related measurements as part of the successful HO report:  a. Elapsed time for T310 timer for normal HO  b. Elapsed time for T310 timer for Conditional HO |

Given the above FFS and the submitted proposals on this topic, Rapporteur proposes to first discuss whether explicit values of RLM timers should be included or if instead it should be just included an indicator indicating which triggering conditions for SHR was fulfilled by the UE.

1. RAN2 to discuss how to represent time-related information in the SHR:
   1. The UE reports in SHR explicit values of RLM timers or other timers/indicators from the list proposed in Cat-b-Proposal 20
   2. The UE indicates which triggering conditions for generating the SHR were fulfilled, e.g. flag for T310, T304, T312 indications, or for other possible information agreed in Q33

* **Q34: Which of the above options (a,b) are acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | A,B | Comments |
| Qualcomm | B |  |
| vivo | B | Don’t see the need to indicate the value, as what really matters to SHR is the failure events occurred previously, instead of when it succeeds. |
| Ericsson | B | B sounds a good compromise between SHR information accuracy and overhead/complexity. |
| OPPO | B | Reduction of overhead is needed |
| ZTE | a,b |  |
| Lenovo | B |  |
| Sharp | A |  |
|  |  |  |

Rapporteur´s summary: To be added later

If Option A in the above question is agreed, RAN2 should discuss including the following explicit information proposed in various contributions.

RAN2 to discuss the need of the following timers to be included in the SHR:

* 1. Elapsed time for T310 timer for normal HO
  2. T304 elapsed time
  3. For UEs configured with CHO, T310 value in target cell
  4. For UEs configured with CHO, T312 value in target cell
  5. For UEs configured with CHO, The number of consecutive "out-of-sync" indications from target cell.
  6. For UEs performing DAPS HO, T310 value in target cell
  7. For UEs performing DAPS HO, T312 value in target cell
  8. For UEs performing DAPS HO, The number of consecutive "out-of-sync" indications from target cell
  9. In case the UE is configured with both A3 and A5 event for CHO, the UE to report in the HO Success Report the time elapsed between the fulfilment of the two triggering conditions for the CHO cell
  10. Include the RLM related timers and RLC retransmission counter in the Successful Handover Report.
  11. UE includes the time elapsed from the DAPS HO command reception to RLF in source cell in successful HO report for DAPS HO.
  12. The UE to include in the HO Success Report for CHO and ordinary HO, the HO interruption time, i.e. time elapsed between last received packet in the DL (last transmitted packet in the UL) in source cell, and first received packet in the DL (transmitted packet in the UL) in the target cell
  13. time between the RLF occurrence at the source cell and the success RACH to the target, in order to identify the service interruption during DAPS HO
* **Q35: Which of the above options (a,b,c,d,e,f,g,h,I,j,k,l,m) are acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | A,b,c,d,e,f,g,h,i,j,k,l,m | Comments |
| Qualcomm | None |  |
| Ericsson | None if B in Q34 is agreed |  |
| OPPO | None |  |
| ZTE | A,B,I,k,m | But perhaps we need to first clarify whether the agreed threshold is also applied to CHO/DAPS cases before agreeing on c~h.  DAPS is introduced to achieve zero-interruption time HO, but considering the complexity and the extra resource used, it is would be beneficial to know the interruption time to evaluate whether it is worth to configure DAPS. But it also depends on how to store SHR, if only the latest SHR is stored then this information can be derived from NW’s side, thus no need to report. |
| Lenovo | B,c,d,e,f,g,h |  |
| Sharp | A,J,K |  |
|  |  |  |
|  |  |  |

Rapporteur´s summary: To be added later

### Radio measurements-related info

In RAN2#113bis-e the following was left as FFS:

|  |
| --- |
| Proposal 4 RAN2 to further discuss the need of the following parameters as part of the successful HO report:  a. Latest radio link quality of neighbour cells before HO command was received for all HO types.  b. Configured CHO execution condition(s), e.g. A3 and/or A5 event configuration, of the candidate target cells. The inclusion of this parameter depends on the RAN3 reply to the RAN2 LS R2-2102149.  c. The radio quality of source cell when ConditionalReconfiguration is received before conditional handover execution condition is satisfied  d. Latest radio link quality of source cell before HO command was received in the case of DAPS. |

Given the above FFS and submitted proposals, Rapporteur proposes to continue the discussion on the need of any radio measurements in the SHR.

1. RAN2 to discuss the need of any of the following radio-related measurements to be included in the SHR
   1. Latest radio link quality of neighbour cells before HO command was received for all HO types
   2. Configured CHO execution condition(s), e.g. A3 and/or A5 event configuration, of the candidate target cells. The inclusion of this parameter depends on the RAN3 reply to the RAN2 LS R2-2102149
   3. The radio quality of source cell when ConditionalReconfiguration is received before conditional handover execution condition is satisfied
   4. Latest radio link quality of source cell before HO command was received in the case of DAPS
   5. Latest radio measurement results of source and target cells
   6. Fulfilled CHO execution condition(s), i.e. whether A3 and/or A5 event was fullfilled, for the cell in which CHO execution was triggered
   7. Indication that none of beams in *candidateBeamRSList* could meet the measurement requirement
   8. ID and measurements of beams whose measurement higher than the threshod *rsrp-ThresholdSSB* but not within the configured list *candidateBeamRSList*
   9. Measurements of reference signals that within the configured list *candidateBeamRSList*

* **Q36: Which of the above options (a,b,c,d,e,f,g,h,i) are acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | A,b,c,d,e,f,g,h,i | Comments |
| Qualcomm | A (with the modification for CHO prior to execution) |  |
| vivo | A |  |
| Ericsson | A,B,E,F | That is aligned with what agreed for the RLF-Report, so it can be included in the SHR as well. |
| OPPO | A |  |
| ZTE | A,B,C,D,E, |  |
| Lenovo | B,c |  |
| Sharp | A,E,F |  |
|  |  |  |

Rapporteur´s summary: To be added later

### Other info

For the above proposals, Rapporteur proposes to discuss them since in [20] only the location information were agreed as “other info”.

RAN2 to discuss the following information to be included in the SHR

* 1. The state of source link can be reported in the successful handover report.
  2. in case successful HO is stored when RA configuration is sub-optimal, UE includes the the same amount of RA information as in ra-InformationCommon of RA report in successful HO report
  3. For location config/reports for SHR, location info for RLF report can be reused
  4. UE includes the source RLF cause or the T310 value of source cell at RA completion in successful HO report for DAPS HO
* **Q37: Which of the above options (a,b,c,d) are acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | A,b,c,d | Comments |
| Qualcomm | B and C | A can be determined from the report. We are gerenrating the SHR report based on T310 timer condition. UE don’t need to include the T310 timer. UE can include the RLF cause if we envision there can be more than one RLF cause. |
| vivo | C |  |
| Ericsson | B,C | Agree with QC. RA information can be included as for the RLF report. The same holds for the location information. |
| OPPO | B C | We agree with Qualcomm that T310 time is not needed |
| ZTE | A,B,D, | A is only needed for DAPS case. |
| Lenovo | A, D |  |
| Sharp | A,C,D |  |
|  |  |  |

Rapporteur´s summary: To be added later

### Configuration aspects

Two companies (ZTE, NEC, Samsung) propose to configure the UE for the logging of SHR. Rapporteur proposes to discuss it.

UE logs successful HO report in case prior configuration is received for successful HO report (interested trigger and corresponding configuration), otherwise UE doesn’t store successful HO report

* **Q38: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes |  |
| vivo | Yes, but… | This seems to overlap with the questions in 2.3.1, should we have redundant proposals for the same issue? |
| Ericsson | Yes | As baseline, we can assume that the UE reports the SHR if it is configured to do so. |
| OPPO | Yes |  |
| China telecom | Yes |  |
| ZTE | Yes | Since we agree that UE can be configured to store SHR when T312/T310 exceeds a threshold, prior configuration is needed at least for the thresholds. And it is needed to further discuss the default behavior, if there is no prior configuration. For us, SHR is a new behavior, and only used for optimization, so there is not urgent need to report such information to NW, therefore by default it can be configured as not activated. |
| Lenovo | Yes |  |
| Sharp | Yes |  |

Rapporteur´s summary: To be added later

### Signalling and procedures

Related proposals on signalling and procedure, Rapporteur suggests to first agree on the following principles which should be in line with the current RLF report:

1. The *varSuccHOReport* is introduced to store the parameters for successful HO report.

* **Q39: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes | A UE variable would be needed to store the information. |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| China telecom | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Sharp | Yes |  |

Rapporteur´s summary: To be added later

1. The UE includes the availability of successful HO report to NW in each completed message send in RRC procedure, i.e., RRCReconfigurationComplete, RRCReestablishmentComplete, RRCSetupComplete, RRCResumeComplete message if it has available successful HO report to be reported.

* **Q40: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes (but we are fine with any two options here) | I believe that there can be two options:   1. Similar behavious as RLF report: UE indicates the availability in RRCReconfigurationComplete,RRCReestablishmentComplete,RRCSetupComplete, RRCResumeComplete messages and network can extract the report desired. In this case, UE can keep the report for maximum 48 hours. 2. UE reports the availability in RRCReconfigurationComplete only, if not requested by the network immediately, UE clears the SHO report |
| vivo | Yes |  |
| Ericsson | Yes | That is aligned to RLF-Report. We can discuss such details also later on during stage-3 discussion. |
| OPPO | Yes |  |
| China telecom | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Sharp | Yes |  |

Rapporteur´s summary: To be added later

1. UEInformationRequest/UEInformationResponse message is used for successful HO report request and report.

* **Q41: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes |  |
| vivo | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| China telecom | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Sharp | Yes |  |

Rapporteur´s summary: To be added later

Related to how many entries related to SHR shall be stored by the UE, one company (Huawei) believes that only one entry should be stored, while another company (ZTE) proposes have multiple SHR entries. Hence, Rapporteur proposes to discuss the following:

1. RAN2 to discuss the following:
   1. The UE only stores the latest SHR entry
   2. The UE may store multiple SHR entries

* **Q42: Which of the above option(a,b) are acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | A,B | Comments |
| Qualcomm | A | Similar behavious as RLF report |
| vivo | A | The latest SHR may be enough, we don’t want to burden UE in terms of such NW optimization. It is our understanding that SHR is not as significant as the other reports, for example, RLF/CEF/RACH report, since in this case the UE anyway succeeds in the end. |
| Ericsson | A | A can be assumed as baseline for the time being, since that is like for RLF-report. |
| OPPO | A | Agree with vivo, taking RLF report as the model is enough. |
| ZTE | B | For failure case, we normally store the latest failure information (e.g., RLF/CEF) to allow NW to respond as early as possible to recover the coverage, and it is easy to diagnose the failure cause from the failure content stored.  While for successful cases, optimization results is proportional to input data, and that’s why we have multiple RA entries for RA report. So for similar reason, we prefer to allow UE to include multiple SHR entries to improve NW’s optimization. |
| Lenovo | A |  |
| Sharp | A | This is similar to RLF-report. |
|  |  |  |

Rapporteur´s summary: To be added later

### Scenarios

Related to scenarios 2c and 3b, these are the views:

* Scenario 2c should be considered as part of RLF-report (Oppo, Ericsson)
* Scenario 2c should be considered as part of SHR (ZTE)
* Scenario 3b should be considered as part of SHR (Oppo, Ericsson, ZTE)
* Scenario 3b should be considered as part of RLF-report (Huawei: covered by 1a)

Hence Rapporteur proposes the following:

1. RAN2 to discuss if scenario 3b i.e. “Successful HO completion, but RLF in source during DAPS HO” is part of:
   1. RLF-Report
   2. SHR

* **Q43: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | a/b | Comments |
| Qualcomm | B | As HoF has not happended this should be considered in SHR. |
| vivo | B | At last meeting，we already agreed that the one of the triggering conditions for SHR is:  **In case of DAPS, if the UE gets an RLF in the source while doing DAPS.**  So I guess this scenario should be considered in SHR. |
| Ericsson | B | Agree with QC and Vivo. In this scenario, the UE completed successfully HO, so it would be weird to capture this case as RLF. |
| OPPO | A | Our position in the paper is A. The DAPS handover aims at providing a smooth 0ms user plane interruption handover experience to the UE. Given the fact that the RLF has occurred between UE and the source gNB, such 0ms user plane interruption experience is destroyed. Also, if this scenario is considered as successful handover, the RLF related information towards the source cell is needed to be transferred to SHR related variable. |
| ZTE | b | The outcome of DAPS HO is successful therefore shall be considered in the SHR.And to assist optimize the DAPS HO, failure information of source RLF can be considered included in SHR as well. |
| Lenovo | b |  |
|  |  |  |

Rapporteur´s summary: To be added later

1. RAN2 to discuss if scenario 2c, i.e. “Successful CHO recovery while initial failure” is part of:
   1. RLF-Report
   2. SHR

* **Q44: Is the above proposal acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | a/b | Comments |
| Qualcomm | B | In our understanding, during the recovery pocedure, the trigger condition can meet for the SHR, therefore, the scenario should be consider in the SHR and information regrading first failure should be reported in SHR report. |
| vivo | B |  |
| Ericsson | A | The fact that the UE successfully reestablished its connection in a CHO cell after the CHO failure is not a wanted outcome from the network perspective. The HO failed, and this means that the CHO configuration was not good, no matter if reestablishment in CHO cell succeeded.  Hence this case should be treated as RLF. |
| OPPO | A | Agree with Ericsson |
| ZTE | b | For 2c, we’d like to further clarified that the scenario refers to the case UE fails first HO/CHO attempt, and when T311 is running UE selects a CHO candidate cell to perform RRCReconfiguration, and successfully recovers. In our understanding, CHO recovery is different from normal reestablishment, since UE will go directly to reconfiguration, and we think it shall be considered in successful HO. Only when the CHO recovery fails it shall be considered in RLF report.  And to help NW to optimize the CHO configuration, the previous CHOF failure information shall be included in the SHR to provide complete information. |
| Lenovo | A |  |
|  |  |  |
|  |  |  |

Rapporteur´s summary: To be added later

# Conclusion

To be added later.

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