3GPP TSG-RAN WG2 #116-e DocNumber

Electronic meeting, 1th – 12th November 2021

Agenda Item: 8.13.2.1

Source: Ericsson

Title: [AT116-e][850][SONMDT] Handover related SON aspects again (Ericsson)

Document for: Discussion, Decision

#  Introduction

This contribution addresses the following offline discussion:

* CB on Thursday:
* **[AT115e][850][SON/MDT]** Handover related SON aspects again **(Ericsson)**

Scope: focus on proposals 5-14 in R2-2110889.

 Intended outcome: Report

 Deadline: 05:00 UTC, Wednesday November 10th

To aid better communication between the respective delegates handling this topic from different companies, it is requested to fill-in the contact information.

**Contact Information**

|  |  |  |
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#  Discussion

## CHO related

Proposal 5 RAN2 to further discuss the need to include in the RLF-Report an indicator indicating whether the last executed HO before the RLF in the target cell was a CHO HO.

There is one proposal on discussion related to including the HO type of the last executed HO. To help the discussions, the rapporteur has depicted the scenarios in the Figure 1. Scenario depicted in (a) shows a normal HO scenario and the scenario depicted in (b) shows a CHO scenario. In both scenarios, the content of the previousPCell and timeConnFailure is the same as shown in the figure

1. Normal HO scenario

(b) CHO scenario

RLF

RLF

CHO from cell-A to cell-B

Normal HO from cell-A to cell-B

previousPCell 🡪 CellA

timeConnFailure 🡪 2 seconds

previousPCell 🡪 CellA

timeConnFailure 🡪 2 seconds

Figure 1: Scenarios involving RLF followed by (a) normal HO (b) conditional HO

Based on the above, the proponents (in the #899 email discussion) of including the HO type indicator mentions that there is a need to differentiate whether the HO from cell-A to cell-B was a normal HO or a CHO so that the corresponding HO parameters can be tuned accordingly. The proponents mentioned that the CHO parameters are different from the normal HO parameters.

Thus, rapporteur would like to ask the following question.

Question-1: Do you agree to include an indicator in the RLF report indicating whether the last executed HO before the RLF in the target cell was a CHO HO?

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| **Qualcomm** | **Disagree** | We have agreed to include the flag in the neighboring cell measurement to indicate if the cell was configured as the target cell. This flag should be sufficient to indicate whether the last executed HO before the RLF in the target cell was a CHO HO. We don’t need an additional flag.  |
|  |  |  |
| Ericsson | Agree | The scenario as shown above is the case when the UE has successfully completed the HO and then declares RLF in the target cell. Once the HO is completed, the UE would not remember the CHO configuration i.e., there is no neighbor cell information included specific to CHO candidates. So, what Qualcomm mentions is not applicable in this scenario (their argument is applicable if the UE declares HOF while excuting the HO).The HO triggering settings used for CHO are different from that of a legacy HO triggering settings. Therefore, it is important to know which setting to tune.  |
| NEC | Agree | Considering the triggering conditions for CHO can be different from triggering conditions for other types of HO, we see some benefit of this. |
| **OPPO** | **Disagree** | Agree with Qualcomm. In addition, new introduced timer between reception of the CHO command and execution of the CHO is another indication. Regarding Ericsson’s comment, UE could decide the duration of remembering the CHO configuration in case of UE might suffer from RLF at target cell. |
| vivo | See comments. | In the case that UE successfully completes the HO and then declares RLF in the target cell, there seems to be no means to indicate the previous HO was a CHO, according to the current spec and agreements (since it will be considered as a radio link failure event instead of a HO failure event, the UE would not record the CHO candidate flag or the new timer which will be defined for HOF case in the procedural text).However, we are not sure about the motivation of having the parameter-tuning use case for CHO in the above scenario. We think the current SHR and RLF report mechanisms for CHO are sufficient for this purpose. By having various parameters in such reports but with less motivated purpose would not only be detrimental for UE’s storage/operation complexity, but also requires the NW to further filter out the unncessary information. Thus the use case should be carefully justified.We are ok to accept this indicator if the majority agrees the use case. |
| LG | Disagree | Agree with Qualcomm and OPPO. |
| Nokia | Agree |  |
| Samsung | Agree |  |
| Sharp | Agree |  |
| Huawei, HiSilicon | Disagree | For the case b, the CHO from cell A has been triggered. The UE will include timer C in the RLF report. This can implicitly indicate that the HO type from cell A to cell B was a CHO.  |
| CATT | Disagree | When RLF occurs in the target cell, if the network needs to optimize CHO parameters by received RLF report, we think the related CHO parameters should be included in RLF report, and then the CHO indicator will be indicated implicitly. |
| ZTE | Disagree | We tend to agree with vivo’s analysis that based on existing agreements, this is RLF after a successful CHO, which means UE will not stored the the related CHO information (e.g., timer C) in the RLF content. But we are open to discuss include such information in the RLF which would be more useful than a CHO cell type. |
| Lenovo | Disagree | CHO specific information is included in the RLF report, e.g. CHO execution condition(s) or time elapsed between the CHO execution and the corresponding received latest CHO configuration, thus the network can understand it is a RLF in CHO implicitly from the RLF report.Regarding the comment from Ericsson, CHO configuration can be deleted after HO succeeds. However, UE can still store some information related with MRO. |

**Rapporteur summary:**

13 companies participated in the discussion.

Companies that agree: 5/12

Companies that disagree: 7/12

One company expressed that the use case is not very well motivated.

Firstly, there is no clear majority for this question.

The reasoning provided by the companies that agree with the proposal are:

1. The HO parameter settings used to trigger a normal handover is different from the HO parameter settings used to trigger a conditional handover.
2. The UE does not remember the CHO configuration after completing the CHO towards a target cell and thus would not report any CHO specific information in the existing menthods.

The reasoning provided by the companies that disagree with the proposal are:

1. The flag in the neighboring cell measurement to indicate if the cell was configured as the target cell. This flag should be sufficient to indicate whether the last executed HO before the RLF in the target cell was a CHO HO.
2. Newly introduced timer between reception of the CHO command and execution of the CHO is another indication.

In some of the companies’ comments (Qualcomm, Oppo, Huawei, CATT, Lenovo), indicate that that UE includes certain CHO specific information (timer-C, flag in the neighboring cell measurement) to indicate that the previously completed handover was a CHO. This is not the same understanding of all the companies in the comments (Ericsson, Vivo, ZTE). Therefore, before deciding on the outcome of this question, rapporteur believes that it is necessary to have the common understanding of whether the UE remembers the CHO configuration and/or associated timer-C related information after successfully completing the HO and at the time of declaring RLF in the target cell.

1. RAN2 to check which of the following is the common understanding of the previous RAN2 agreements:
	1. UE forgets the CHO configuration after completing the HO to the target cell and if the UE declares RLF in the target cell, then the UE does NOT include the CHO configuration specific information from the source cell (timer-C and/or whether a neighbor cell was a CHO candidate or not)
	2. UE remembers the CHO configuration after completing the HO to the target cell and if the UE declares RLF in the target cell, then the UE does includes the CHO configuration specific information from the source cell (timer-C and/or whether a neighbor cell was a CHO candidate or not)
2. Based on the outcome of Proposal-1, RAN2 to decide on one of the following option:
	1. An explicit indicator is added in the RLF report indicating whether the last executed HO before the RLF in the target cell was a CHO HO
	2. An implicit indicator is used to indicate whether the last executed HO before the RLF in the target cell was a CHO HO

## DAPS related

Proposal 6 RAN2 to further discuss the need to include in the RLF-Report an indicator indicating that the last executed HO before the RLF in the target cell was a DAPS HO.

The scenario is the same as depicted in Figure 1 but instead of CHO, the DAPS HO is used.

Thus, rapporteur would like to ask the following question.

Question-2: Do you agree to include an indicator in the RLF report indicating whether the last executed HO before the RLF in the target cell was a DAPS HO?

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| **Qualcomm** | **Disagree** | The presence of *timeConnSourceFailure* in the RLFreport is sufficient to represent this.  |
| Ericsson | Agree | Again, the scenario here is that the UE successfully completes the DAPS HO and then declares the RLF in the target cell. So, the UE wouldn’t inlcude timeConnSourceFailure as mentioned by Qualcomm.The HO parameters used for DAPS execution could be different from that of normal HO and therefore, it is valuable to know whether the previously completed HO is a DAPS HO or a normal HO.  |
| NEC | Agree | Considering the triggering conditions for DAPS HO can be different from triggering conditions for other types of HO, we see some benefit of this. |
| OPPO | Agree  | Agree with Ericsson |
| vivo | See comments in Q1. |  |
| LG | Disagree | We are still not clear why this indication is really necessary. The DAPS handover configuration is provided based on coordination between target cell and source cell, it is enough to the network to know the last handover type. |
| Nokia | Agree |  |
| Samsung | Agree |  |
| Sharp | Agree |  |
| Huawei, HiSilicon | Agree | In our understanding, if there wasn’t RLF in source cell A before the successful RACH with target cell B, the UE stops RLF detection in cell A after successful RACH with cell B. As showed in fig b, the UE didn’t detect RLF in cell A. It is possible that the UE will not report *timeConnSourceFailure*, we need the explicit indicator to indicate the DAPS HO type. |
| CATT | Disagree | We don‘t see the benefit of including the DAPS HO indicator. |
| ZTE | Disagree | Still not convinced whether there will be any difference on optimization if only latest executed HO type is provided? Also if we really want to do some optimization, to includes other information, e.g., HO interruption time or timeSourceFailure seems more useful than a single HO type indication. |
| Lenovo | Agree | timeConnSourceFailure will not be included in some case if RLF in the source is not detected. Therefore, DAPS can not be implicitly indicated. |

**Rapporteur summary:**

12 companies participated in the offline discussion.

Companies that agree: 8/12

Companies that disagree: 4/12

One company expressed that the use case is not very well motivated.

Companies that have supported mentioned that this differentiator is needed to tune the DAPS specific handover settings compared to normal handover settings. Two companies who disagree mention that they do not see the need for this as the optimization of normal HO parameter and DAPS handover parameters would be the same. As there is majority support, rapporteur proposes the followinsg.

1. Include an indicator in the RLF report indicating whether the last executed HO before the RLF in the target cell was a DAPS HO

## SHR related

There are several open issues related to SHR.

One such open issue is related to whether the source cell or the target cell configures the T304 related threshold value.

Proposal 7 The value of the T304 threshold to be provided in the SHR configuration is configured by the target cell.

The following technical reasonings are mentioned in the respones of the #899 email discussion:

1. Agreeing companies
	1. Source cell doesn’t know the value of T304. It is arbitrary for the source cell to configure the threshold without knowing the value of T304.
	2. If the source cell is to decide on the T304 percentage value, it may choose a fixed value because it has no idea about T304 value.
	3. Target node can also use the SHR to optimize its HO related parameters like T304 value that it configures in the future.
2. Disagreeing companies
	1. T304 threshold for the SHR configuration is not necessarily related to the T304 absolute value set by the target cell.
	2. SHR is used by the source node to optimize the relevant parameters, such as the threshold to trigger HO.

Based on this, rapporteur would like to ask the following question.

Question-3: Do you agree that the value of the T304 threshold to be provided in the SHR configuration is configured by the target cell?

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Comments** |
| Qualcomm | Agree | In my understanding, the purpose of the SHR is to detect and report any lower layer issue during a successful handover, such that parameters can be optimized to alleviate lower layer issues during a handover.In my understanding, this if SHR generated with the indication of T304 issue, the target cell should do the analysis of the SHR. In the scenario, where SHR is generate due to the issue with T304, the target needs to optimize its handover parameters. Note that optimizing T304 is not the purpose of SHR. However, handover parameters needs to be optimizied by the target.  |
| Ericsson | Agree |  |
| NEC | Disagree | SHR is used by the source node to optimize the timing/triggering conditions of handover procedure. So we think it is up to the source to configure SHR parameters. |
| OPPO | Agree |  |
| vivo | Disagree | Views are expressed that if the SHR is used by the source node, it should be the source node to enable this mechanism (by setting the triggering conditions), and if used by the target node then it should be configured by target node instead.According to TR 37.816 (5.3.2.5 Successful HO Report), the Successful HO Report can be both utilized by the source and target gNB for further analysis. So we think both configuration options (either by target or source) can be justified.

|  |
| --- |
| **TR 37.816 (5.3.2.5 Successful HO Report)**Upon reception of a Successful HO Report, the receiving node is able to analyse whether its mobility configuration needs adjustment. Such adjustments may result in changes of mobility configurations, such as changes of RLM configurations or changes of mobility thresholds between the source and the target. In addition, target NG RAN node, in the performed handover, may further optimize the dedicated RACH-beam resources based on the beam measurements reported upon successful handovers. |

If the T304 configuration is set by the target node, the source node must be aware of the triggering value, so new signalling should be specified for the communication between source and target nodes.**If the T304 configuration is set by the source node,** the source source node can still properly select one of the percentages from the candidate values without knowing the exact value of T304, therefore **avoiding the unnecessary signalling overhead and the corresponding specification efforts.** So we prefer the option that T304 threshold to be provided in the SHR configuration is configured by the source node.  |
| LG | Agree | Since T304 is configured by target, it seems reasonable that the target cell configures the T304 threshold. |
| Nokia | Mostly agree | With the observations that if percentages are used as threshold values (agreed in RAN2#115e), the source node does necessarily need to know T304 value and that both source and target could use the information in SHR triggered by T304 for optimization purposes.   |
| Samsung | Agree |  |
| Sharp | Agree with comments.  | We are wondering whether the T304 threshold value is determined by only one node(source or target) or by both nodes. If it is determined by only one node, as we are not sure if the source node can configure a proper threshold value of T304 without knowing its value, even by using percentage, it may not be so precise. We prefer the target node to do the configuration.Otherwise, as the Successful HO Report can be both utilized by the source and target, then it is ok for us to have the possibility to allow both nodes to set the threshold. |
| Huawei, HiSilicon | Agree | We agree with the analyis from Qualcomm |
| CATT | Agree |  |
| ZTE |  | Although for simplicity we tend to think source configure the threshold without knowing the exact T304 values shall be sufficient, but if majority prefer to let target configure we can also accept it. However, since RAN3 signalling will be impacted, this agreement needs to be confirmed by RAN3.  |
| Lenovo | Agree | Since T304 is configured by the target node in the HO command, it is suitable for the target node to configure the T304 threshold for SHR trigger condition.T304 problem is associated with random access parameter configured by target cell. Therefore, the SHR triggered by T304 is used by the target gNB rather than source gNB. |

**Rapporteur summary:**

13 companies participated in this question.

Companies that agree: 10/13

Companies that disagree: 2/13

One company wants to check with RAN3.

Proponents have indicated that the T304 value is configured by target cell and thus it should have the possibility to configure the corresponding threshold for the generation of SHR. The proponets believe that such a SHR can be used by the target cell to optimize the T304 confioguration for future UEs. As most companies are fine with this, the following is proposed.

1. The value of the T304 threshold to be provided in the SHR configuration is configured by the target cell.

Another topic discussed in #899 email discussion is related to if and when the UE includes the RA-InformationCommon in the SHR.

Proposal 8 RAN2 to discuss when the RA-InformationCommon should be included in the SHR:

 a. Only in case the SHR is generated due to T304 above the threshold (8/16)

 b. It should never be included (8/16)

The following technical reasonings are mentioned in the respones of the #899 email discussion:

1. Companies supporting option-A
	1. RA-InformationCommon corresponding to SHR could be replaced or deleted from RA report.
	2. There is currently no way to link a specific RA report in the RA report list with the SHR
	3. There is no indicator or timestamp to associate the SHR to a specific entry in the RA-Report
2. Companies supporting option-B
	1. Already part of RA-report. No need to duplicate it..

Based on this, rapporteur would like to ask the following question.

Question-4: Which is the following option is preferred for the inclusion of RA-InformationCommon in the SHR?

Option-1: RA-InformationCommon is included in SHR when T304 is above the threshold

Option-2: RA-InformationCommon is not included in SHR

|  |  |  |
| --- | --- | --- |
| **Company** | **Option-1 / Option-2** | **Comments** |
| Qualcomm | Option 2 | Successful RACH information is already included in the RA report. The network can correlate them based on the cell ID information in both SHR and RA-report.  |
| Ericsson | Option-1 | As listed above, it is difficult to correlate the SHR contents with RA report contents as there is no timeStamp in any of these reports. |
| NEC | Option 2 | Network can obtain RA-information form RA-report based on the cell ID information, rapurpose and etc. So there is no need to have a duplicate report. |
| OPPO | Option-1 | Agree with Ericsson. As addresed in our paper R2-2110104, if UE has performed several times of RACH towards the same cell for the same purpose, i.e., handover, the network would not know which RACH entry in the RA report corresponds to the handover triggering SHR recording, which is illustrated in the following figure.To save the UE signalling overhead, we should identify under which sceanrio (e.g., T304 is above the threshold) it is necessary to include the RACH related information in the SHR. |
| vivo | Option-1 |  |
| LG | Option-2 | Agree with Qualcomm. RA-InformationCommon is already part of ra-Report. |
| Nokia | Option 2 | No need to include RA-InformationCommon in SHR. It is already part of ra-Report.  |
| Samsung | Option 1 |  |
| Sharp  | Option 2 | Agree with Qualcomm and Nokia. |
| Huawei, HiSilicon | Option 2 | We agree with Qualcomm. It is unnecessary for the UE to duplicately report the RA info for the same RACH procedure. This will bring useless signalling overhead. |
| CATT | Option 2 | We wonder to know the intention of including the RA related information in SHR report. In our view, if it is for RA parameters optimization, the network can use the RA report to complete the overall RA optimization.  |
| ZTE | Option 1 | NW might not always request both SHR and RA report immediately, and RA report can further includes RA information from other entries or be erased due to fail PLMN checking. Therefore, fetching RA information associated to the HO is not guaranteed. |
| Lenovo | Option1 |  |

**Rapporteur summary:**

13 companies participated in this question.

Companies that preferred option-1: 6/13

Companies that preferred option-2: 7/13

Proponets of option-2 indicate that the RA-Information is already provided in the RAReport whereas the proponents of option-1 indicate that correlating RAReport and SHR is not straightforward as there is no time stamp related information. It is not possible to conclude on this based on the outcome of this questionnaire.

1. RAN2 to further discuss whether RA-InformationCommon is included in SHR when T304 is above the threshold.

Another topic discussed in #899 email discussion is related to the impact of SHR and RLF report being generated for the same HO event.

Proposal 9 RAN2 believes that it is not a problem if both the SHR and RLF-Report are generated after the same HO, and it is not a problem if the network fetches them separately.

The following technical reasonings are mentioned in the respones of the #899 email discussion:

1. Companies who believes there is an issue
	1. Since the two reports were caused by a single event, it may be beneficial to correlate them for further parameters analysis
	2. The UE will report to the network both the SHR and the RLF-Report for the same HO event.
	3. It is not clear how the network implementation can fix this issue, given that there will not be any indicator or timestamp linking the RLF-Report to the SHR (and viceversa).
	4. In DAPS HO case, where UE experience RLF is source during HO failure and then UE successfully HO to target the UE generates both SHR and RLF report.
2. Companies who believe there is no issue
	1. The two reports have different optimization objectives
	2. This is related to network implementation issue
	3. The network needs to collect enough SON reports and then can do a full anaysis on the issues.

Based on this, rapporteur would like to ask the following question.

Question-5: Do you agree that it is not a problem if both the SHR and RLF-Report are generated after the same HO, and it is not a problem if the network fetches them separately?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| Ericsson | No | We believe the network cannot resolve this issue as there is no time stamp in RLF report and/or SHR |
| NEC | Yes |  |
| OPPO | Yes but | We agree it is a problem, the network might be confused to what extent to tune the measurement reporting criteria for HO. But whether or not to have spec imapct on resolving this problem remains questionable.For the UE, one feasible way to solve the problem could be triggering a timer when the SHR is received by the UE. Before the expiration of the timer, if a RLF occurs, the UE needs to discard the SHR or stop the process of reporting it towards the network. Such operation has spec impact.For the network, suppose the source gNB receives both SHR and RLF report with similar location information included but without the timestamp information, the source gNB cannot know the SHR and RLF corresponds to the same HO, and could therefore not discard the SHR. However, the source gNB could simply always prioritize the information from RLF report over the SHR for tuning the measurement reporting threshold, and therefore no spec impact is foreseen. |
| vivo | See comments. | We agree that it is not feasible for NW to solve the issue, but the need to solve the issue seems to require further justification, as proposed by the opponents.. |
| LG | Yes | We think it can be handled by NW implementation. |
| Nokia | No | If both reports are generated and fetched (at different points in time) by the network, they need so somehow be correlated as they were triggered by the same event /chain of events.  |
| Samsung | Yes  |  |
| Sharp | Yes  |  |
| Huawei, HiSilicon | See comments | First, if both the SHR and RLF report related to the same HO procedure are reported seperately, we believe the network can realize that they are for the same HO procedure and can perform further analysis. Whether the analysis is based on SHR and/or RLF report is network implementation. However, there are also seperate SHR or RLF report for one HO procedure. The network doesn’t need to try to correlate each received SHR (or RLF report) with one RLF report (or SHR) which may be received later. Therefore, if the UE reports both SHR and RLF report for the same HO, we prefer to **introduce some information in SHR/RLF report to tell the network to perform the correlation**. Without the information, the network may try to correlate any RLF report or SHR with the future received report. This causes severe challenges on the NW implementation complexity. |
| CATT | No | Association of RLF report and SHR for the same HO is useful for network to accurate analysis the too early/too late handover, and better to optimize HO related parameters. The specific way can be discussed later. |
| ZTE | No | We agree it is not problem to generate SHR and RLF for the same HO event. However, to fetch the RLF and SHR associated to the same HO event (e.g., source RLF during DAPS HO) separately separately would have some issues since there are not additional information to indicate the two report is relevant, therefore NW might not always request the report simultaneously, it could lead to loss of report. Also we will need additional information to correlate the two reports. Considering this, it is preferred UE can include the previous RLF in the successful SHR for simplicity of NW’s implementation, and NW can fetch complete information with a single request. |
| Lenovo | See comments | Instead of NW handling, we think the issue to be discussed first is how the UE handles the case that the UE successfully completes an HO to a target cell and RLF is detected in the target after a short time. In this case, both SHR and rlf-report are triggered. We need to discuss whether one of them is reported or both are reported. |

**Rapporteur summary:**

13 companies participated in this question.

Companies that agree: 6/13

Companies that disagree: 4/13

Further, two companies (those that have not said yes/no explicitly) agree that the network cannot resolve this issue (correlating which SHR was associated to a HO that resulted in RLF in target shortly) via implementation. One company also bring up what the UE does if an RLF is detected shortly in the target cell after successful HO and if the UE has already generated a SHR for such a HO.

It is not possible to conclude on this issue based on the outcome of this questionnaire.

1. RAN2 to further discuss whether and how to handle the scenario of SHR and RLF-Report being generated for the same HO.

Another topic discussed in #899 email discussion is related to the scenario of including information related to the short-stay/ping-pong in the SHR.

Proposal 10 The SHR does not include information on whether the UE is handed-over to another cell early after the successful HO.

Almost all companies agreed with this proposal in the previous email discussion.

Based on this, rapporteur would like to ask the following question.

Question-6: Do you agree that the SHR does not include information on whether the UE is handed-over to another cell early after the successful HO?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| Ericsson | Yes |  |
| NEC | Yes |  |
| OPPO | Yes |  |
| vivo | Yes |  |
| LG | Yes |  |
| Nokia | Yes |  |
| Samsung | Yes  |  |
| Sharp  | Yes  |  |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |

**Rapporteur summary:**

13 companies participated in this question.

Companies that agree: 13/13

Companies that disagree: 0/13

All companies agree on this.

1. SHR does not include information on whether the UE is handed-over to another cell early after the successful HO.

Another topic discussed in #899 email discussion is related to UP measurements in the SHR.

Proposal 11 Related to the UP measurements to be included in the SHR, the UE should include at least the following:

a. User plane interruption at handover, as evaluated at PDPC layer without considering duplicates

Proposal 12 The user plane interruption at handover, as evaluated at PDPC layer without considering duplicates is defined as follows: “Time from the last packet received from the source and the first non-duplicate packet received from the target, measured at the time of reception of the first non-duplicate packet from the target cell.”

Almost all companies agreed with this proposal-11 and proposal-12 in the previous email discussion.

Based on this, rapporteur would like to ask the following questions.

Question-7: Do you agree that the UE should include UP interruption time at HO as evaluated at PDCP layer without considering duplicates in the SHR?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Agree with the UP measurement (but the measurement should be performed by the network) | In my understanding, the SON/MDT philosophy has been that UE does not need to report unnecessary measurements that can be computed by the network. Reporting of such information increases the size of reports and we should avoid reporting the measurements that the network can determine by itself. As this information is available at the network, our preference is that network can obtain such measurement by itself, instead of UE reporting these measurements.  |
| Ericsson | Agree | This has to be a UE based measurement as it is not possible to correlated time information collected by two nodes that are asynchronized. Thus, UE based reporting is needed.  |
| NEC | Yes | We are OK to report this for DL data interruption time in SHR. |
| OPPO | Agree with comments | Agree with Qualcomm |
| vivo | Agree | If the measurement can be performed by NW, UE-based reporting is not necessary |
| LG | Yes |  |
| Nokia | Yes |  |
| Samsung | Need to clarify | Just for clarification:There may be no UP packet in buffer before HO. For that case, we can regard it as UP interruption time at HO?Thus, the definition and motivation is unclear.Furthermore, it looks like a new L2 measurement. Hence, we would like to ask if a cross-confirmation is required with other WGs, e.g. SA5.  |
| Sharp  | Yes  | We understand this measurement is not available at network just as Ericsson commented. |
| Huawei, HiSilicon | Agree, but... | We prefer to clarify that the UP interruption reporting is only for the DAPS HO case: UE detects RLF @ SRC and completes the DAPS HO with target. And this is also aligned with the LS from RAN3:*RAN3 has concluded that the introduction of User Plane measurements in the Successful Handover Report, such as e.g. user plane interruption time at HO, will help the network evaluate the performance of successful DAPS HO.* |
| CATT | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |

**Rapporteur summary:**

13 companies participated in this question.

Companies that agree: 12/13

One company needs further clarification.

It seems like all companies agree on the need for UP interruption time information but in the comments companies indicated two different solutions. One is based on the UE reporting the experienced UP interruption time and the other based on the network collecting the UP interruption time. This aspect needs further discussion in RAN2.

One company wants to clarify how to define the UP interruption time if there is no packets to deliver to the UE at the time of HO.

1. UP interruption time at HO as evaluated at PDCP layer without considering duplicates in the SHR.
	1. FFS-1: whether this measurement is performed at the UE side or at the network side
	2. FFS-2: how to define the UP interruption time if there are no packets to deliver to the UE at the time of HO.

Question-8: Do you agree with the following definition for UP interruption time at HO as evaluated at PDCP layer without considering duplicates?

“Time from the last packet received from the source and the first non-duplicate packet received from the target, measured at the time of reception of the first non-duplicate packet from the target cell.”

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | We prefer measurement to be obtained at the network | Based on our preference, we want to modify: “Time from the last packet transmitted from the source and the first non-duplicate packet transmitted from the target, measured at the time of transmission of the first non-duplicate packet from the target cell.” |
| Ericsson | Yes | As exaplained to the previous question, UE based measurement is needed. |
| NEC | Yes |  |
| OPPO | We prefer measurement to be obtained at the network | Agree with Qualcomm |
| vivo | Yes |  |
| LG | Yes |  |
| Nokia | Yes |  |
| Samsung | Need to clarify | See our comment in Q7.And, we need to further clarify 1) if it is applicable for all HO typesIf so, during DAPS HO, the non-duplicate packet from the target may be received before the last packet from the source. How would the UP interruption time be then calculated?2) if it is per UE or per DRBThe current defnition is unclear if it is per UE or per DRB. |
| Sharp  | Yes  |  |
| Huawei, HiSilicon | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |

**Rapporteur summary:**

13 companies participated in this question.

Companies that agree: 12/13

One company needs further clarification.

Similar to previous question, though there is majority support some companies have indicated that this measurement needs further discussion regarding whether this can be performed at the network side or needs the UE to report this.

One company wants to clarify whether this measurement needs to be performed per DRB.

1. UP interruption time is defined as follows: Time from the last packet received/transmitted from the source and the first non-duplicate packet received/transmitted from the target, measured at the time of reception/transmission of the first non-duplicate packet from the target cell.
	1. FFS-1: reception (UE based) vs transmission (network based)
	2. Whether the measurement is performed per DRB

Another topic discussed in #899 email discussion is related to the additional scenarios for reporting SHR.

Proposal 13 RAN2 to discuss the following issues related to the SHR:

a. Support of inter-RAT SHR reporting

b. Including the time between the source RLF and DAPS HO completion

c. How to discard the stored SHR at T304 expiry

d. How to indicate SHR availability in case of RRCReconfigurationComplete message has already been generated

Rapporteur requests companies to be pragmatic here regarding what is essential to be included in Rel-17 considering the remaining time.

Question-9: Which of the following topics needs to be addressed in Rel-17?

a. Support of inter-RAT SHR reporting

b. Including the time between the source RLF and DAPS HO completion

c. How to discard the stored SHR at T304 expiry

d. How to indicate SHR availability in case of RRCReconfigurationComplete message has already been generated

e. None

|  |  |  |
| --- | --- | --- |
| **Company** | **a, b, c, d, e** | **Comments** |
| **Qualcomm** | **C** | A should be of low priority. B is not an identifier of the performance. This is not needed or can be referred to from question 8.D needs further discussion whether we want to consider this. In my view, the situation under discussion is UE performs successful DAPS HO and UE sends RRCReconfigurationComplete message, thereafter we have RLF at the UE. This scenario was never discussed in the SHR perspective. Furthermore, in our view there is no optimization objective here because UE cannot fallback to source anyways after the successful complition of DAPS HO. Therefore, after successful DAPS HO, optimization of source and UE link have very less significance.  |
| Ericsson | C | (C) is the minimal thing we need to do in Rel17. |
| NEC | C, D | A, this can be treated with low priority.B, we are not sure if we need this considering we already have UP interruption time.C, in case of T304 expiry, the UE should report RLF-report, and the stored SHR of this HO should be deleted.D, to clariy the scenarios of this issue, it can happen for the following two kinds of situations:1. T304 threshold condition of SHR is fulfilled after the generation of RRCReconfigurationComeplete message
2. SHR scenario 3b, i.e. “Successful HO completion, but RLF in source during DAPS HO”, i.e. the HO is successful, but source RLF happens after the generation of RRCReonfigurationComplete messsage.

If without any enhancement, there would be long delay of reporting and the stored SHR may be discared or replaced. |
| OPPO | C |  |
| vivo | C |  |
| LG | c |  |
| Nokia | B, C | A is too early/complex for considerations |
| Samsung | A and B  | On the comment from QC, we have assumed not to replace B by the UP measurement of UP interruption time above.We define B as interruption time from the source RLF to the success RACH during DAPS HOi.e. B is a physical interruption time during DAPS HO. On the other hand, the UP measurement cannot really reflect the interruption since this is related to the packet arrival at the gNB side, e.g. if there is no packet arrival during DAPS HO, the UE may report large UP interruption time |
| Sharp  | C |  |
| Huawei, HiSilicon | B | A should be de-prioritized.B is OK.C seems a sub-case of Q5, OK to solve it.D After the UE generates the SHR, the UE detects HOF/RLF and then generates the RLF report. It is better to define the same UE behaviour for this kind of scenario, e.g., to report both reports or delete the first one but only report the later one. |
| CATT | C,D | A is too early for considerations.B seems that it can be roughly deduced by UP interruption time.C is important case and need to be discussed in Rel-17.For D, we think the scenario need to be clarified.  |
| ZTE | B,C | B is ok to considerC is a subcategory of Q5 and can further discussed.  |
| Lenovo | B |  |

**Rapporteur summary:**

13 companies participated in this question.

|  |  |
| --- | --- |
| Support - a | 1/13 |
| Support – b | 4/13 |
| Support – c | 10/13 |
| Support – d | 2/13 |
| Support – e | - |

Based on the above, it is clear that option-c needs to be progressed in Rel-17 and the rest are not pursued in Rel-17.

1. RAN2 to work on how to discard the stored SHR at T304 expiry

In the #899 email discussion, some companies indicated additional SHR triggering conditions.

Proposal 14 RAN2 to discuss the need for the following SHR triggering conditions:

a. T310/T312 in target cell is started after a short time of successful HO

b. The number of preamble attempt in target cell is greater than one threshold

c. If the UP interruption time is above a certain threshold

d. Configured CFRA RACH resource not used and the UE is forced to use the CBRA for HO.

Rapporteur requests companies to be pragmatic here regarding what is essential to be included in Rel-17 considering the remaining time.

Question-10: Which of the following triggering condition for SHR do you support?

a. T310/T312 in target cell is started after a short time of successful HO

b. The number of preamble attempt in target cell is greater than one threshold

c. If the UP interruption time is above a certain threshold

d. Configured CFRA RACH resource not used and the UE is forced to use the CBRA for HO.

e. None

|  |  |  |
| --- | --- | --- |
| **Company** | **a, b, c, d, e** | **Comments** |
| **Qualcomm** | **e** | 1. SHR purpose is to determine lower layer issues during the handover. Once the handover is completed UE should release the SHR configuration. Note that SHR reporting purpose is not MRO.
2. RACH information included in the RA-report should be sufficient. We should remember that there are dedicated SON reports for different optimization objectives. This is the optimization of the RACH procedure, it should not be considered under the SHR, otherwise, we will keep making every single SON report unnecessarily huge.
3. It should be an IE instead of a trigger condition for reporting.
4. Same understanding on this as in b.
 |
| Ericsson | e  | To save time in Rel-17, we can postpone such triggers to Rel-18 |
| NEC | e | Any other triggering conditions can be discussed in furture release.  |
| oppo | d | As our comments in Question-4, if UE has performed several times of RACH towards the same cell for the same purpose, i.e., handover, the network would not know which RACH entry in the RA report corresponds to the handover triggering SHR recording |
| vivo | e | Ok to postpone the discussion to Rel-18. |
| LG | e |  |
| Nokia | B,c,d | Not for a) because SHR content is stable once the UE completed HO. If RLF happens after this point, RLF report will be generated.  |
| Samsung | e |  |
| Sharp  | e |  |
| Huawei, HiSilicon | B, C | 1. agree with Qualcomm
2. This is introduced as one triggering condition and doesn’t imply that the UE shoud inlcude the RA info in the SHR.
3. From the network perspective, if the interruption time is too small, it makes no sense to collect the info. Therefore, to reduce the reporting of unnecessary SHR, c should be considered.

We don’t see the benefit. |
| CATT | e | Not considered in R17, can be discussed in later release. |
| ZTE | b,d | SHR in case suboptimal RACH configuration is identified in SI phase, and it would be fine to consider the scenario in this release. |
| Lenovo | A,b |  |

**Rapporteur summary:**

13 companies participated in this question.

|  |  |
| --- | --- |
| Support - a | 1/13 |
| Support – b | 4/13 |
| Support – c | 2/13 |
| Support – d | 3/13 |
| Support – e | 8/13 |

It seems like none of these scenarios have strong need to be agreed in Rel-17 and thus none of them are pursed in Rel-17.

1. The following triggering conditions for SHR are not pursued in rel-17:
	1. T310/T312 in target cell is started after a short time of successful HO
	2. The number of preamble attempt in target cell is greater than one threshold
	3. If the UP interruption time is above a certain threshold
	4. Configured CFRA RACH resource not used and the UE is forced to use the CBRA for HO

#  Conclusion

Following proposals are included in section-2.

[**Proposal 1 RAN2 to check which of the following is the common understanding of the previous RAN2 agreements:**](#_Toc87434516)

[**a. UE forgets the CHO configuration after completing the HO to the target cell and if the UE declares RLF in the target cell, then the UE does NOT include the CHO configuration specific information from the source cell (timer-C and/or whether a neighbor cell was a CHO candidate or not)**](#_Toc87434517)

[**b. UE remembers the CHO configuration after completing the HO to the target cell and if the UE declares RLF in the target cell, then the UE does includes the CHO configuration specific information from the source cell (timer-C and/or whether a neighbor cell was a CHO candidate or not)**](#_Toc87434518)

[**Proposal 2 Based on the outcome of Proposal-1, RAN2 to decide on one of the following option:**](#_Toc87434519)

[**a. An explicit indicator is added in the RLF report indicating whether the last executed HO before the RLF in the target cell was a CHO HO**](#_Toc87434520)

[**b. An implicit indicator is used to indicate whether the last executed HO before the RLF in the target cell was a CHO HO**](#_Toc87434521)

[**Proposal 3 Include an indicator in the RLF report indicating whether the last executed HO before the RLF in the target cell was a DAPS HO**](#_Toc87434522)

[**Proposal 4 The value of the T304 threshold to be provided in the SHR configuration is configured by the target cell.**](#_Toc87434523)

[**Proposal 5 RAN2 to further discuss whether RA-InformationCommon is included in SHR when T304 is above the threshold.**](#_Toc87434524)

[**Proposal 6 RAN2 to further discuss whether and how to handle the scenario of SHR and RLF-Report being generated for the same HO.**](#_Toc87434525)

[**Proposal 7 SHR does not include information on whether the UE is handed-over to another cell early after the successful HO.**](#_Toc87434526)

[**Proposal 8 UP interruption time at HO as evaluated at PDCP layer without considering duplicates in the SHR.**](#_Toc87434527)

[**a. FFS-1: whether this measurement is performed at the UE side or at the network side**](#_Toc87434528)

[**b. FFS-2: how to define the UP interruption time if there are no packets to deliver to the UE at the time of HO.**](#_Toc87434529)

[**Proposal 9 UP interruption time is defined as follows: Time from the last packet received/transmitted from the source and the first non-duplicate packet received/transmitted from the target, measured at the time of reception/transmission of the first non-duplicate packet from the target cell.**](#_Toc87434530)

[**a. FFS-1: reception (UE based) vs transmission (network based)**](#_Toc87434531)

[**b. Whether the measurement is performed per DRB**](#_Toc87434532)

[**Proposal 10 RAN2 to work on how to discard the stored SHR at T304 expiry**](#_Toc87434533)

[**Proposal 11 The following triggering conditions for SHR are not pursued in rel-17:**](#_Toc87434534)

[**a. T310/T312 in target cell is started after a short time of successful HO**](#_Toc87434535)

[**b. The number of preamble attempt in target cell is greater than one threshold**](#_Toc87434536)

[**c. If the UP interruption time is above a certain threshold**](#_Toc87434537)

[**d. Configured CFRA RACH resource not used and the UE is forced to use the CBRA for HO**](#_Toc87434538)