3GPP TSG-RAN WG2 #115-e draft R2-21xxxxx

Electronic meeting, Aug 16th – 27th 2021

Agenda Item: 8.13.2.3

Source: CATT

Title: [Post114-e][852][SON/MDT] Modelling aspects related to information required by SN/SCG (CATT)

Document for: Discussion

# 1 Introduction

This document captures the outcome of the following email discussion [1]:

* [Post114-e][852][SON/MDT] Modelling aspects related to information required by SN/SCG (CATT)

Scope:

How to transfer RA report to the SN

How to transfer SN related MHI information

How to transfer and what information to transfer in association to the SCG failure

Here also one can use the current Rel-16 version (after Jun Plenary) as baseline to start discussing the ASN.1 changes required for different options.

Intended outcome: Email discussion report

Deadline: Long

This document is organized as the following. The discussions are in section 2, and the summary and proposals are in section 3.

# 2 Discussions

Please the participating delegates provide their contact information in this table.

|  |  |
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## 2.1 RA Report to the SN

Some background is provided on previous discussions.

**Background of the topic**

RAN3 has sent LS [2] to RAN2, which indicates that there was no means for the SgNB to retrieve from UE in MR-DC any information on RACH access procedure at SgNB, and thus there was no input for SON algorithm to adjust the RA related parameters in SgNBs. RAN3 asks RAN2 to consider UE RACH report for SgNBs and provide feedback to RAN3.

**Options**

This topic was discussed in the previous RAN2 meetings. More specifically, two options were summarized for SgNB RACH report [3]:

* Option 1: UE reports the SN RACH report to the MN, and then MN sends the SN RACH report to the SN;
* Option 2: SN requests SgNB RACH report, and then UE reports the SN RACH report to the SN, directly via SRB3 or via SRB1;

**Analysis of the options**

In order for RACH configuration optimization, the RACH report may need to be forwarded by either the MN (in Option 1) or by the SN (in Option 2) that gets the report from UE, to the SN for which the RACH procedure actually occurred. One observation was made in [3] to reflect this.

Observation 2.3.1-1 The mechanism that the current MN or SN forward the SN RACH report to the SN for which the RACH procedure actually occurred is anyway needed, no matter whether Option 1 or 2 is used [3].

The specification impact of these options were also discussed [3], where vast majority of the companies agreed with the following analysis

Specification impact of Option 1:

* For NR-DC case, current *rapurpose* already supported SN related RACH report, so there is no specification impact;
* For EN-DC case, the LTE RACH Report may need to include a NR container about SgNB UE RACH Report content.

Specification impact of Option 2:

* Legacy *UEInformationRequest* message can be embedded in EUTRA/NR *DLInformationTransferMRDC* to enable the interaction between SN and UE;
* Enhancements on the support of SgNB RACH report are required, potential solutions include:

a) The UE transfers the SN-related RACH report to SN via *ULInformationTransferMRDC*.

b) A new message, e.g., *UEInformationReponseSCG*, is used to transfer the SN RACH report to SN via SRB1 or SRB3 (if configured).

**Views from previous discussions**

From [3], vast majority (10/12) support Option 1. But there was no agreement, as some concerns exist, i.e.,

1. All nodes (MN and SN) may not support fetching of the MHI, hence option 2 can give the possibility to directly fetch the SN report, in case the PCell does not support MHI fetching [3].
2. Specification impact has not been evaluated so far in the discussions we have had. For option1, one needs to make multiple changes to both NR and LTE RRC specification and include new octet string based report retrieval which is unnecessarily complex [4].

**Further Analysis by Rapporteur**

It does not seem necessary to repeat all the discussions and views in [3][4]. Therefore in the following Rapporteur tries to provide some understanding on those concerns, so the companies can further discuss to see if any progress is possible.

For concern 1:

* In NR, the RACH report introduces the field of RA-ReportList-r16 which could recode RA info of multiple nodes (at least 8 entries), the node receiving RA Report from UE needs to forward the RA info to the right node. Therefore for NR RACH Report, the NG-RAN node which received the MHI from UE should support the MHI fetching function.
* For option 2 where SN directly receives the RA report, it is possible that the SN is a lower version NG-RAN node or it is even a non-standalone node (NSA scenario), and the RA information cannot be transferred from the SN.

For concern 2:

* Option 1 only impacts EN-DC scenario and current 38.331 text and ASN.1 cover the NR-DC scenario, while option 2 impact both EN-DC and NR-DC scenarios.
* For option 2, if SgNB directly retrieves RACH information, the network needs to firstly determine whether the SgNB related RACH information exists, which may also require some work.
* As observed in [3], the mechanism that the current MN or SN forward the SN RACH report to the SN for which the RACH procedure actually occurred is anyway needed, no matter whether Option 1 or 2 is used.

While the intention is not to repeat the old discussions, companies may check the background and analysis above, to see if they have other further comments to these options.

**Q1: Do you agree with Rapporteur’s analysis above on Option 1 and 2? Please share your further comments on option 1 and 2 if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments if any** |
| Huawei, HiSilicon | Yes | We see that Option 1 is more straightforward and simpler than Option 2. |
| Samsung | No | On option 2, it’s not sure why new message UEInformationResponseSCG is required, i.e.  In SRB1, UEInformationRequest and UEInformationResponse would be carried over DLInformationTransferMRDC and ULInformationTransferMRDC.  And, if SRB3 has been configured, UEInformationRequest and UEInformationResponse would be carried over SRB3. |
| CATT | Yes | As we have listed all the concerns mentioned in previous and provided the analysis to them. |
| Sharp | Yes |  |
| vivo | Yes |  |
| ZTE | Yes for most of the analysis, | We agree most of the analysis except for the following:  For concern 1, since RA report is fetched in a reques-report procedure, lower version of NG-RAN node will not request UE to report the RA report, thus this won’t cause a problem.  For concern 2, Since RA procedure happens in PSCell, it is SgNB that is aware of the existence of RA report while MN of EN-DC might not be aware of the SN RA report existence, therefore some enhancements will be needed.  Although current NR specs allows inclusion of SgNB RA report, however whether UE shall store PSCell RA report have actually never been discussed in RAN2, therefore it would be nice to confirm companies’ understanding on this topic first. |
| Lenovo | Yes |  |
| OPPO | Yes | Option 1 brings less specification impact, which is preferred. |
| Qualcomm | Yes, for most | I am skeptical about the need for UEInformationResponseSCG in option 2. We have a similar view as Samsung.  Also, we prefer option 1. |
| Nokia | Yes | RA Report was designed to pass mainly MCG related information, thus SCG relevant part can be not immediately/easily given to SN. The most straightfoward approach is Option 1 |
| Ericsson | No | For the option-1, in Rel-16 we have not taken any decision that the UE shall store the SN related RA reports in the same UE variable as the MN related RA reports. Therefore, for NR-DC, we do not agree that Rel-16 RA report already supports SN RA reports. Thus we have a different understanding from the rapporteur (‘In NR, the RACH report introduces the field of RA-ReportList-r16 which could recode RA info of **multiple nodes** (at least 8 entries), + Option 1 only impacts EN-DC scenario and current 38.331 text and **ASN.1 cover the NR-DC scenario**’).  For option-1, the specification changes required are larger. We need to create octet string based fetching procedures in both LTE (for EN-DC) and NR (for NE-DC) specifications. Further, there might be an additional request-response procedure between the MN and SN wherein the SN needs to request the MN for the RA reports and then MN fetches the corresponding SN related RA report containers. Otherwise, we risk the situation wherein the MN fetches voluntarily and forwards it to the SN while the SN node in question has not implemented RA report processing. The UEInformationRequest might also need some changes as the MN might want to fetch only MN related RA reports and not both MN+SN related RA reports. Thus, we believe the amount of open issues related to option-1 are many.  For the option-2, there is no need to create a new message, UEInformationResponseSCG. The existing UEInformationResponse works fine. If the UE receives the UEInformationRequest with RA report request from the MN then the UE sends the MN related RA reports to MN and if the UE receives the UEInformationRequest with RA report request from the SN then the UE sends the MN related RA reports to SN.  Further, rapporteur’s summary has the following text –  ‘For option 2, if SgNB directly retrieves RACH information, the network needs to firstly determine whether the SgNB related RACH information exists, which may also require some work.’  This is always the case. If the UE is currently configured with DC, then the UE has performed atleast one RA towards the SN and thus the UE has RA reports. Just to further add, even towards the MN we do not have raReport available indication from the UE. This is purely based on the UE capabilities. **Therefore, we do not agree with the list of short comings listed for option-2.** |

Based on the above, Rapporteur thinks it possible to go with the majority’s preference i.e., option 1. This is checked by the following question.

**Q2: Is Option 1 acceptable to you? Please comment if any.**

*Option 1: UE reports the SN RACH report to the MN, and then MN sends the SN RACH report to the SN*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments if any** |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| ZTE | No.  Only latest SN RA report is reported to SN. | In previous discussion we supported UE to report the SN RACH report to MN, based on the understanding that MN can forward the RA report to corresponding node. However, after checking we notice this method might not work for following reasons.   1. In some case MN might not always aware the NCGI of PSCell (e.g., in intra-SN PSCell change), therefore MN might not always be able to forward the RA-report to intended node. 2. There is not availability bit for RA report because it is assumed that NW is aware of the RA completion, while MN is not aware for PSCell RA completion, therefore enhancements will be needed to inform MN there is a RA completed in SN to allow MN to request UE to report SN RA information.   Considering the SgNB RA report is expected to be only used for SN RA resource optimization, then it might be more straightforward for SN to independently request the RA report so that MN doesn’t need to decode the SN-related information.  Based on above analysis, we’d like to revert our previous opinion and let SN to independently request the SN RA report, and in order to minimize the specs impact, we prefer to only report the latest SN RA report so that it will not contain RA information from other SN node. |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Qualcomm | Yes |  |
| Nokia | Yes |  |
| Ericsson | NO | Copy pasting the reasons from the previous answer.  For option-1, the specification changes required are larger. We need to create octet string based fetching procedures in both LTE (for EN-DC) and NR (for NE-DC) specifications. Further, there might be an additional request-response procedure between the MN and SN wherein the SN needs to request the MN for the RA reports and then MN fetches the corresponding SN related RA report containers. Otherwise, we risk the situation wherein the MN fetches voluntarily and forwards it to the SN while the SN node in question has not implemented RA report processing. The UEInformationRequest might also need some changes as the MN might want to fetch only MN related RA reports and not both MN+SN related RA reports. Thus, we believe the amount of open issues related to option-1 are many. |

**Summary of SgNB RACH report**

On Q1, specification impact analysis for the options

Most companies (9/11) agree with most of the analysis by the Rapporteur (which is based on previous discussions). Some companies have raised additional concerns on the scenarios, about whether one UE variable could include both MN and SN RACH information, and think that the MN might not be aware of the SN RA report existence for option 1, and some other companies are not sure whether a new message is needed for option 2.

On Q2, choice of options

For the choice of options, 9 companies (9/11) think Option 1 is acceptable, while 2 companies do not think it is acceptable.

As there is clear majority’s support, and considering the need to progress at this stage of the WI, Rapporteur suggests to go with Option 1, which is reflected in the following.

**Proposal 1 UE reports the SN RACH report to the MN, and then MN sends the SN RACH report to the SN.**

**Proposal 2 RAN2 to discuss and reply LS to R2-2008723.**

## 2.2 SN Related MHI Information

PSCell MHI enhancement has been discussed [3][4], covering the following

* Issue 1: Structure of PSCell MHI
* Issue 2: Where to report PSCell related MHI
* Issue 3: Main content for PSCell MHI
* Issue 4: Message used to convey PSCell MHI
* Issue 5: Applicable scenarios

Some agreements were reached on the issue 3, i.e., the content.

In the following, we continue the discussions. It is noted that since the scenario (i.e., issue #5) can be discussed separately from the previous technical issues, and there were company proposals to postpone scenario discussions, Rapporteur suggests postpone as well, but focusing on other aspects that may progress.

### 2.2.1 Structure of PSCell MHI

This issue has been discussed in [3]. Some background is provided here to facilitate the discussions.

**Background**

Two options are raised in previous discussions

* Option 1: PSCell MHI nested within the PCell MHI.
* Option 2: PSCell MHI as a separate report from PCell MHI

For option 1, in each entry of PCell, multiple PSCells could be recorded. The correlation of the PCell and each PSCell is clear. From the information, the network can know the addition, release or change of the PSCell.

For option 2, the lists of PCell(s) and PSCell(s) are recorded separately, which may be more flexible. But on the other hand, the network may not know the association between the PScell and PCell based on the report.

From [4], some companies still have concern on Option 1. More specifically they are not convinced what the use case of such correlation is, and concerns the huge memory on UE side; some companies also think that a second list is more logical and can cover more cases.

**RAN3 progress**

In RAN3#112 meeting, work assumptions were made for the structure of CONNECTED mode SN UHI [5]:

|  |
| --- |
| **WA: SN is responsible for collecting the SN UHI;**  **WA: Correlation of MN UHI and SN UHI could be realized via two-dimensional structure for UHI (PSCells history information are listed within each PCell in the UHI); it may not be feasible on all interfaces.** |

Therefore the MN will maintain both the UHIs of MN and SN, PSCell UHI will be nested within the PCell UHI in MN. The SN is responsible for collecting the SN UHI and then sends the collected result to the MN.

**Further analysis from Rapporteur**

First of all, as shown in [3], Option 1 has support from a great majority.

Then as per RAN3 progress, it seems meaningful to have a clear association of the PCells and the PSCells, and the two-dimensional structure for MHI is reasonable choice.

At last, regarding the previous concerns on Option 1, the correlated information may be used together to deduce the UE path more accurate which could also has benefit for MN. Considering the UE memory, how many PSCells could be correlated to one PCell needs further discussion.

With these, Rapporteur understands that a potential WF is to go with majority’s view, and would like to check with companies on this.

**Q3: Is Option 1 acceptable to you? Please comment if any.**

*Option 1: PSCell MHI nested within the PCell MHI*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments if any** |
| Huawei, HiSilicon | Yes |  |
| Samsung | No with comments | As summarized by Rapporteur, we are concerned with (potential) huge memory on UE side i.e. the worst case will be 16\*16 big list.  Regarding the following WA,  **it may not be feasible on all interfaces**  our understanding is that according to RAN3 specification PCell ID is not always send to SN so SN has no way to link it. Similarly, there seems a case that MN doesn't know PSCell ID. Thus, even if we go for Option 1, the issue may still exist i.e. the network may not know the association between the PScell and PCell based on the report without updating RAN3 specification. It may be good to wait RAN3 progress. |
| CATT | Yes | The MN and SN will exchange the cell ID info in e.g. X2/Xn Setup. Therefore the association is clear to the PCell. The size of PSCells within one PCell entry could be further discussed after the option decided.  And for the question about whether the PSCell transition needs to be part of Mobility History Information from QC: “PSCell cannot be changed in the INACTIVE and IDLE state at the UE. Any transition of the PSCell is completely known at the serving gNB”. CATT has the view as below:  It is correct that for current RRC\_CONNECTED state UE, the PSCell info is completely known by the NW. But for the last connected state, the NW cannot maintain the PSCell info because the NW will remove all the UE context while UE leaving RRC\_CONNECTED state. Since the UE can record at most 16 entries of PCells, it is possible that the UE state transition will occur.  See the example below:  UE states: CONN 1  ->  IDLE  -> CONN 2  When UE in CONNECTED 2, the NW cannot know the PSCell info in previous CONNECTED 1. |
| Sharp | Yes |  |
| vivo | Yes |  |
| ZTE | Yes with clarification | It is preferred that PSCell is correlated with PCell, but we’d like to clarify our understanding on option 1. In our understanding, UE will create a new entry when either PCell or PSCell changes, therefore for each entry there will be at least one PCell and at most one PSCell (if UE is in DC) and a timeSpent. Although it might create some redundancy in case only PSCell is updated, but it can include the complete information and avoid discussion on whether to limit the number of PSCells can be included for each entry. Also, the behavior is more aligned with current UE behavior for MHI. |
| Lenovo | Yes | It is clear about the relationship between PCell and PSCell. |
| OPPO | No | Agree with Samsung that potentially huge UE memory size is needed for Option 1 |
| Qualcomm | NO (It may require a large UE memory),  we want to avoid wasting UE memory and we prefer to record only critical information that is not already available on the network | In our understanding, the PSCell transitions are recorded by the network, therefore, we should avoid wasting memory at the UE. However, if we want to record the PSCell transitions at the UE, then instead of recoding every PSCell transition, we should only record the PSCell transition when UE moves to IDLE/INACTIVE state from connected state and if the network has not instructed UE to release PSCell configuration. Otherwise, there is no need of recording the PSCell transitions. |
| Nokia | No | In our understanding RAN3 builds a network based solution that does not put any specific requirements towards RAN2/UE. We do not see the association exercise in the UE is requested by RAN3. Thus, RAN2 enhancements shouldn’t be based on deduced RAN3 needs.  In our view, there is no reason for the SN to know the MHI for MN. Having separate report helps not mixing the two. |
| Ericsson | Yes with some simplification | Firstly, we share the reasoning as explained by CATT as to why the UE should store and report PSCell MHI.    We prefer option-1 as there is an inbuilt linkage between MN and SN related MHI. Regarding the concern from some companies about the size growing too large i.e., 16\*16, we believe it is not yet agreed as whether we allow upto 16 PSCell history info per PCell. One could think of different ways to reduce this overhead. For example, the UE stores only upto latest 16 PSCell MHI but encodes them in a nested structure. |

**Summary of 2.2.1**

First of all, 1 company raised concern regarding whether the PSCell transition needs to be part of Mobility History Information. 2 companies have comments about this issue and think it is needed since the PSCell transition in previous RRC\_CONNECTED state will not be maintained by the network.

As most of the companies support it, for the sake of progress as this WI stage the Rapporteur suggests the following.

**Proposal 3 RAN2 to confirm that the PSCell transition is part of MHI.**

On Q3

Majoirty of the companies think option 1 is acceptable (7/11), while the other 4 companies can not accept it due to different reasons, e.g., the potential huge memory on UE side, the network may not know the association between the PScell and PCell, or SN may not need to know the MHI for MN. Among the first camp, some comapneis think there is room for simplification, which might alleviate the concern.

Give the situation, the Rapporteur suggests that this is discussed further during the meeting, but focus could be on the concerns rasied by the companies, so that more progress is possible. This is reflected by the following.

**Proposal 4 RAN2 to discuss on Option 1 and potential simplification, taking into the following aspects**

* **the UE memory for PSCell MHI issue and whether/how to reduce it;**
* **Whether the network can know the association between the PScell and PCell based on the report without updating RAN3 specification;**
* **Whether there is need for the SN to know the MHI for MN.**

### 2.2.2 Where to Report PSCell Related MHI

**Background**

Two options were listed according to company proposals [3][4]:

* Option 1: PSCell MHI is reported to both PCell and PSCell MHI.
* Option 2: PSCell MHI is reported only to PCell

Based Option 1, the UE is allowed to send *mobilityHistoryAvail* indicator the SN node, and the SN node is also allowed to request for MHI result from UE.

For option 2, the UE reports all the MHI to the MN node. After receiving the MHI, the MN node could make use of the MHI itself to improve its corresponding configuration, and it may also forward the information to the SN.

**Main concern from companies**

In the first round discussion in [3], 10 companies (10/13) support option 2 that PSCell MHI is reported only to PCell, and the left companies (3/13) support option 1. The main motivations for option 2 seem to include:

* PSCell MHI report is not time sensitive, so there is no need to directly report it to PSCell and enhance signaling methods and overhead for that;
* Establishing SRB3 only for transmitting MHI report may not be needed;
* it is possible for MN to forward the SN related information to SN if needed, which can be easily supported with RAN3’s signalling.

But there were also concerns on option 2 [4]:

* Option 2 cannot support the independence of MHI report fetching for SN, and limit the flexibility of choice to NW implementation (i.e., NW can decide whether SN shall directly request the report or not).
* If the PCell does not support PSCell MHI retrieving, then all the SN MHI reports are lost even if the PSCell supports that.
* Specification impact is much larger compared with a solution in which the MHI goes also directly to the SN.

The group were not able to conclude on this due to lack of time in previous meetings.

Now that companies have more time to check the pros and cons, they are invited to share their preference by taking all these previous discussions into account.

**Q4: Which option do you prefer regarding where to report the PSCell related MHI? And please provide your further comment if any.**

*Option 1: PSCell MHI is reported to both PCell and PSCell*

*Option 2: PSCell MHI is reported only to PCell*

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Comments if any** |
| Huawei, HiSilicon | Option 2 |  |
| Samsung | Option 2 |  |
| CATT | Option 2 |  |
| Sharp | Option 2 |  |
| vivo | Option 2 |  |
| ZTE | Option 2 |  |
| Lenovo | Option2 |  |
| OPPO | Option 2 |  |
| Qualcomm | Option 2 |  |
| Nokia | Option 2 | As the network collects the information for MN and SN, it makes sense to collect MHI of UE only once, when the UE performs RRC connection |
| Ericsson | Not clear question in relation to Q3. | The answer to this question is dependent on the outcome of Q3 i.e., if the PScell MHI is nested with the PCell MHI, then we do not want the UE to create a new PSCell MHI list and report it to the PCell or PSCell.  As we support the nested structure of PSCell MHI within PSCell MHI, we would prefer that either the MN or the SN can fetch this nested list from the UE independently. From the UE perspective, it maintains only one list. |

**Summary of 2.2.2**

Most of the companies (10/11) support option 2.

1 company thinks that it is depend on the outcome of PSCell MHI structure, and if nested structure is adopted, either the MN or the SN can fetch this nested list from the UE independently.

With these and for the sake of progress, the Rapporteur suggests the following WF.

**Proposal 5 PSCell MHI is reported only to PCell.**

### 2.2.3 Message Used to Convey PSCell MHI

Furthermore, which message could carry the PSCell MHI was also discussed [3][4]. It seems clear that this issue may depend on the conclusion of the previous issues.

According to the companies’ feedback, majority support to use *UEInformationResponse* message to convey the PSCell MHI to the MN, but since there are some companies support to also transfer PSCell MHI to the SN directly, DL/ULInformationTrasnferMRDC (e.g. with SRB1 or SRB3) is a simple way.

Besides, some companies pointed out that the wording “enhanced” of the proposal in [4] could be misleading, as it may imply procedure change to UE Information reporting. This in the following some fine tuning of wording is done.

Companies are invited to share their view on whether the *UEInformationResponse* message is used to convey the PSCell MHI to the MN.

**Q5: Whether the *UEInformationResponse* message is used to convey the PSCell MHI to the MN?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments if any** |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Qualcomm | Yes |  |
| Nokia | Yes |  |
| Ericsson | Not clear question in relation to Q3. | Again, we believe that this is about nested PSCell MHI and not an independent PSCell MHI. Assuming this is the nested PSCell MHI within the PCell MHI, we agree with the proposal. |

And whether the messages of DL/ULInformationTrasnferMRDC are used to convey the PSCell MHI directly to the SN could also be decided, once there is a conclusion for the issue in section 2.2.2. A conditional question is as the following.

**Q6: If PSCell MHI is reported to both PCell and PSCell MHI, whether the *DL/ULInformationTrasnferMRDC* messages are used to convey the PSCell MHI to the SN?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments if any** |
| Samsung | Yes |  |
| Sharp | Yes |  |
| Ericsson | Yes | Again, we believe that this is about nested PSCell MHI and not an independent PSCell MHI. Assuming this is the nested PSCell MHI within the PCell MHI, we agree with the proposal. |
|  |  |  |
|  |  |  |

**Summary of 2.2.3**

The following can be observed regarding message to convey PSCell MHI

* For conveying PSCell MHI to the MN, most of the companies (10/11) support the UEInformationResponse message, while 1 company thinks that it depends on the outcome of PSCell MHI structure.
* For conveying PSCell MHI to the SN, 3 companies provide their views and all support that DL/ULInformationTrasnferMRDC messages can be used to convey the PSCell MHI.

As there is clear majority’s view the following is suggested as WF.

**Proposal 6 *UEInformationResponse* message is used to convey the PSCell MHI to the MN.**

**Proposal 7 If PSCell MHI is convey to the SN, *DL/ULInformationTrasnferMRDC* message can be used.**

### 2.2.4 Main Content for PSCell MHI

In RAN2#113bis meeting only one agreement is achieved for issue 3:

Agreements:

Mobility history information enhancements

1 If PSCell MHI is introduced, at least include PSCell ID (may include CGI or frequency+PCI) and the time UE stayed in each PSCell into PSCell MHI.

Some other content of PSCell MHI was also discussed in company contributions, where the information below is supported at least by 3 companies [6][7][8]:

* The time without PSCell in the PSCell MHI report

Companies are invited to share their view on further information to support, if any.

**Q7: Whether ‘the time without PSCell in the PSCell MHI report’ needs to be support? Or please comment if you see any other necessary content(s).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Other comments/preference if any** |
| Huawei, HiSilicon | Yes | In our paper R2-2103733 for RAN2#113b-e, we propose to consider the scenario where the SN is released, because the continuous info for PSCell mobility can help the network to better estimate the UE mobility state. |
| Samsung | No | It is a clean approach to define seperate IE (e.g. visitedCellInfoListSCG). |
| CATT | Yes | From such information, the network could clearly know in which time the UE is connecting to a PSCell while connecting to the PCell, and in which time not. |
| Sharp | Yes | We agree with the intention to record MHI continuously. |
| vivo | Yes |  |
| ZTE | Can be implicitly derived | Based on our understanding on option 1, we believe this information can be implicitly derived based on the timeSpent stored in each entry. |
| Lenovo | No | Network can deduce the time without PSCell based on the reported time UE stayed in each PSCell. |
| Qualcomm | No | We should reduce the number of entries and associated information to be recorded. We are not in favor of recording every PSCell transitions but the critical ones. |
| Nokia | No | This information can be derived |
| Ericsson | Yes | Firstly, we do not believe that this information can be implicitly derived i.e., there are two aspects when the UE does not have PSCell.   1. When the UE is in single connectivity 2. When the UE is in idle mode/inactive state   Therefore, we need an explicit indication about time without PSCell‘ so that the network can differentiate the above two scenarios in the nested structure.  Therefore, the ‚time without PScell‘ indicator is required even for option-1. |

**Summary of 2.2.4**

There is no clear majority based on the feedback received. Therefore this could be further discussed.

**Proposal 8 RAN2 to discuss and decide whether ‘the time without PSCell in the PSCell MHI report’ is reported.**

## 2.3 Report and Content of SCG Failure Information

### 2.3.1 Contents related to SCG failure ~~Content of SCG Failure Information~~

In the previous discussions [4], majority of the companies seem to prefer the RAN3 LS [10] as a baseline for the SCG failure recording for the purpose of PSCell failure analysis. Some information from the LS is copied below.

|  |
| --- |
| RAN3 discussed the solution for the optimization of PScell change failure for MRO in case of MR-DC. RAN3 agreed it is beneficial for the NG-RAN node to receive the list of information as shown below for the purpose of PSCell failure analysis:   1. CGI of the Source PSCell: the source PSCell of the last SN change. The source PSCell could be E-UTRA cell or NR cell. 2. CGI of the Failed PSCell: the PSCell in which SCG failure is detected or the target PSCell of the failed PScell change. The Failed PSCell could be E-UTRA cell or NR cell. 3. timeSCGFailure: the time elapsed since the last PSCell change initialization until SCG failure. 4. connectionFailureType: radio link failure or SN change failure. 5. random-access related information set by the PSCell |

But no conclusion was made due to lack of time [11].

In the following we first try to confirm the content based on majority’s view from the previous discussions.

**Q8: Whether all content suggested by RAN3 LS R3-211332 should be reported by UE?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments if any** |
| Huawei, HiSilicon | Only 1, 2 and 3 | As commented in 2.3.4, only NR-DC and NE-DC are considered, so 4) is not required as there is failureType in SCGFailureInformation and SCGFailureInformationEUTRA messages.  For 5), we are open and we think it is related to SN RACH report. At RAN2#113b-e, it is FFS on SgNB RACH report, and RAN2 may discuss it in future meetings. If SgNB RACH report is to include SCG failure scenario, there may be no need to discuss it here.  *SgNB RACH report*  *FFS: Proposal 11: UE reports the SN RACH report to the MN, and then MN sends the SN RACH report to the SN.* |
| Samsung | Yes |  |
| CATT | Yes for all | Since all the content is requested by RAN3, it is reasonable to support them all.  And for which content has already been covered by current message(s) could be discussed in detailed in below section 2.3.3. |
| Sharp | Yes |  |
| vivo | Yes for 1/2/3 | Agree with HW that 4) is not needed, additionally, the type of SN change failure (too late/early PSCell change, PScell change to wrong PSCell) can be derived via the reported CGI (source/failed PSCell) and the re-established cell.  For 5), not sure whether we need to report the SgNB related RACH report in this scenario again if we support the feature of SN RACH report. Besides, in case of too late PSCell change, there is no random-access related information that can be recorded (since RLF happens earlier before the change of PSCell). |
| ZTE | Yes | I think all above information can be reported, but whether to use existing fields or new field, whether it is implicitly or explicitly indicated needs further discussion, which also depends on which message to convey this information.  Regarding to (4), we also agree this information shall be able to deduce from existing fields. However, according to current specs, UE will set FailureType to RandoAccessProblem once RA problem is detected in PSCells regardless if T304 is running or not, which means a SCG failure with failureType set to RandomAccessProblem could be a reconfigurationWithSyncFailure while NW might consider it as a Radio link Failure. Therefore NW cannot know the complete SN failure information for optimization. There could be two methods to fix this problem:   * Alt1: restrict UE to set failureType to RandomAccessProblem to only when T304 is stopped; * Alt2: Add one indication to indicate whether T304 is running or not   Alt2 doesn’t required UE behavior change which is backward compatible, and the specs impact is less therefore it is preferred.  For (5), we think it would be nice to have. And in our understanding it is different from SN RA report. RA information in SCG failure messages is related to failure RA event while SN RA report only includes successful RA information. |
| Lenovo | Yes |  |
| OPPO | Yes for 1/2/3 | Agree with Huawei and vivo |
| Qualcomm | Yes for 2, 3,  Maybe not for 1 and 4,  May be for 5 | I think source PSCell information is available at the MN at least until MN receives SCGFailureInformation from the UE. Therefore, this source PSCell information is not needed. Failed PSCell information may be needed if SN change is performed without MN involvement. 3 may be needed for optimizations.  For 4, as pointed out Huawei, maybe implicitly derived by the network from failureType. If failureType is set the network should assume SN RLF otherwise it should assume SN change or addition failure.  For (5), we think it may be okay to include if the RLF or SN change or addition fails due to RACH issues. |
| Nokia | Partly yes | (1), (2), (3), (4) should be reported. Not (5).  Random-access related information for PSCell can be retrieved via RACH report for PSCell (i.e. section 2.1). Thus, (5) is not needed additionally in the SCG failure information. |
| Ericsson | Yes to all | We believe the contents listed are similar to the ones in RLF report and these fields are introduced in the RLF report to aid in the identification of the cause of the failure. The same reasoning holds true for SCG failure as well.  Further, we would like to clarify that RA information collected in RA report is only for the successful RA procedures and not for failed RA procedures and thus we need RA info in this failure information if the reason for failure is RA or BFR. |

Then there may be proposals for additional contents, and that could be discussed in the following.

**Q9: Which additional content than those mentioned by RAN3 LS R3-211332 are needed? Please comment if any.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred additional content if any** | **Comments if any** |
| ZTE | One indication to indicate whether T304 is running or not | Please refer to our comments in Q8 |
| Lenovo | One indication to indicate whether T310 is running or not upon the reception of PSCell change command. |  |
| Nokia | No additional information is needed |  |
|  |  |  |
|  |  |  |

**Summary of issue 2.3.1**

On Q8, content requested by RAN3 LS

According to the feedback provided, for the 5 information requested by RAN3:

* CGI of the Source PSCell: 10 companies (10/11) support to report this information, and1 company (1/11) thinks source PSCell information is available at the MN at least until MN receives SCGFailureInformation from the UE and this source PSCell information is not needed;
* CGI of the Failed PSCell: All 11 companies support to report this information;
* timeSCGFailure: All 11 companies support to report this information;
* connectionFailureType: 7 companies (7/11) support to report this information, and 4 companies (4/11) think this connectionFailureType is not needed since it can be implicitly derived by the network from failureType;
* random-access related information set by the PSCell: 7 companies (7/11) support to report this information, and 4 companies (4/11) think it is open or not needed, and we should first decide if SgNB RACH report could include SCG failure scenario which can cover the RA failure case.

It seems a bit more clarification on the intention of Q8 is necessary. The original intention of these two questions was basically to check whether all the contents listed by the RAN3 LS are considered necessary from by RAN2, but that whether a particular content could reuse existing fields, or require new fields, or could be somehow derived implicitly was not the focus of the question. Those can be discussed in the following section 2.3.3.

With the above clarification, and based on the observation that no companies suggest any of the information listed by RAN3 LS was not even needed from RAN2 point of view, the Rapporteur suggests the following.

Proposal 9 RAN2 confirms that the 5 information requested by RAN3 LS ‎ R3-211332 ‎ are needed, and how to report them to the network could be further discussed.

On Q9, addiontial information

There were suggestions to consider additnoal contents, but no majoirty’s view is observed. So no proposal is made regarding this aspect.

### 2.3.2 Which Message(s) to Use

Here, possible alternatives are listed in terms of the message to carry the SCG failure related information to the network [12]:

Option 1: Reuse existing SCG failure messages;

* SCG failure messages have been already specified to carry the information regarding NR/E-UTRA SCG failures. And since it’s one-shot information unlike MDT operation periodically logged, the increased burden would be limited. [13]
* Some information requested by RAN3 LS is already present in the SCG Failure Information; [6] [14]

Option 2: Use other message(s);

* Adding the information requested by RAN3 LS in the SCG failure information messages may significantly increase the size of this report substantially which is not desired, especially because the SCGFailureInformation report should be delivered quickly reliably in order to minimize the service interruptions. Such concern should not be neglected, especially e.g. for URLLC type of scenarios. [7]

Companies are invited to provide their preference on these options.

**Q10: Which option do you prefer to transfer the SCG failure information to the network for PSCell failure analysis? And please provide your further comments if any.**

*Option 1: Reuse existing SCG failure messages*

*Option 2: Use other message(s)*

**And please specify which message(s) is used if you prefer Option 2.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Comments if any (e.g., which msg if you prefer O2)** |
| Huawei, HiSilicon | Option 1 | In section 2.3.1, based on our comments, the added information are CGI info of source PSCell and failed PSCell, and timeSCGfailure.  We prefer option 1. The existing SCG failure message is to inform E-UTRAN/NR MN about an SCG failure, so it is straightforward to extend the message for including above new info. In addition, regarding the increased size of the report, we think it exists in both options. |
| Samsung | Option 1 | We would like to minimize spec impact, i.e. it is not reasonable to introduce new RRC message for each specific purpose.  Since MCG link is mostly stable, we have not assumed that there would be remarkable service interruption. |
| CATT | Option 2 | Since *SCGFailureInformation* is used to recover the SCG link as quickly as possible, we are also concern about the increased size if add all the content in such message.  The optimization about SN parameters for SCG RLF or SN change failure is not so urgent and can be transmit to the network using other message than SCG failure messages, e.g. Reuse existing UE information request/response messages, since the RLF/HOF of MN is already reported by *UEInformationResponse* message and the solution could be reused to report the failure about SN. |
| Sharp | Option 1 |  |
| vivo | Option 1 |  |
| ZTE | Option 1 | Some of the parameters can reuse existing filed SCG failure messages. Compared to the cell measurements included in the SCG Failure messages , the additional information required is not so large.  A new message will have much more specs impact since we will need to further discuss details other than message content, e.g., the trigger, configuration, how to fetch and etc. |
| Lenovo | Option 1 |  |
| OPPO | Option1 | Minimization of the spec effort is preferred |
| Qualcomm | Option 1 |  |
| Nokia | Option 1 | Connection failure type and relevant measurements are already there in existing SCG failure information message.  Moreover, RAN3 decided to use the existing SCG failure information and enhance it with some new IEs for Rel-17 UEs for MRO. The legacy UEs will still use the existing SCG failure information. Consistency should be kept between Rel-17 and pre-Rel-17 UEs.  Thus, existing SCG failure information should be the baseline. |
| Ericsson | Option-2 | SCGFailureInformation is a MANDATORY message that is transmitted by the UE upon declaring SCG failure.  Until now, the SON optimization related contents are never transmitted in a mandatory message. Therefore, we do not want to start a new trend of including SON related fields from the UE in mandatory messages. This would severely restrict the information that can be put for the SON purposes. For example, if the UE has declared SCG failure due to the RA issues in the SN (BFR or any other RA procedure) then the inclusion of ra-InformationCommon in a mandatory message would cause very large overhead. This is not acceptable to us.  Therefore we prefer option-2. |

**Summary of issue 2.3.2**

Most companies (9/11) support to reuse existing SCG failure ‎messages to transfer the SCG failure information for PSCell failure analysis, while 2 companies (2/11) ‎prefer other message(s) such as UEInformationResponse.‎

For the sake of progress, the Rapporteur suggest the following.

**Proposal 10 Reuse existing SCG failure messages to transfer the SCG failure information for PSCell ‎failure analysis requested by RAN3.‎**

### 2.3.3 Further Details on Message Design

Companies may have different views regarding whether current messages already include the requested content, e.g., in [6][14] some detailed analysis was provided regarding which content was already covered, and which content should be added, if existing SCG failure messages is reused.

Again, the following lists are from RAN3 LS:

1. CGI of the Source PSCell: the source PSCell of the last SN change. The source PSCell could be E-UTRA cell or NR cell.
2. CGI of the Failed PSCell: the PSCell in which SCG failure is detected or the target PSCell of the failed PScell change. The Failed PSCell could be E-UTRA cell or NR cell.
3. timeSCGFailure: the time elapsed since the last PSCell change initialization until SCG failure.
4. connectionFailureType: radio link failure or SN change failure.
5. random-access related information set by the PSCell

In the following companies’ views are collected regarding which content (if agreed) would require new fields or not, depending on the exact message to use.

**Q11: Which content suggested by RAN3 LS R3-211332 require new fields in the message, if existing SCG failure messages are enhanced to support SCG MRO?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which content?** | **Comments if any** |
| Huawei, HiSilicon | 1) and 2) can re-use existing IEs  3) needs a new IE | Our technical analysis are as below:  1) CGI of the Source PSCell: the source PSCell of the last SN change. The source PSCell could be E-UTRA cell or NR cell.  **Comment: For an NR cell, the existing IE *CGI-InfoNR* can be re-used. For a E-UTRA cell, the existing IE *CGI-InfoEUTRA* can be re-used.**  2) CGI of the Failed PSCell: the PSCell in which SCG failure is detected or the target PSCell of the failed PScell change. The Failed PSCell could be E-UTRA cell or NR cell.  **Comment: For an NR cell, the existing IE *CGI-InfoNR* can be re-used. For a E-UTRA cell, the existing IE *CGI-InfoEUTRA* can be re-used.**  3) timeSCGFailure: the time elapsed since the last PSCell change initialization until SCG failure.  **Comment: It should be a new IE as no existing IEs provide this.** |
| Samsung | 1), 2), 3), 5) | There is the existing field, failureType to indicate the failure cause in the current SCGFailureInformation. Thus, 4) seems to be already covered.  Considering RA failure case, 5) is required, i.e. the current RA Report has covered success case only |
| CATT | 1), 2), 3), 5) | 1) and 2) needs new fields to specify which cell is the the Source PSCell and which cell is the Failed PSCell, the cell info in the measResultList which includes a lot of cells cannot be used for this purpose.  For 4), the existing *failureType* can be reused, and 3) and 5) also needs a new field. |
| Sharp | 1), 2), 3), 5) | 4) can reuse the existing field *failureType* |
| vivo | 1/2/3 | For 3), in case of too late PSCell change, this field should be set to absent or ‘infinity’. |
| ZTE | We think all IEs can reuse similar design of existing fields in either SCG failure messages or other messages (e.g., rlf-Report) | 1,2 can reuse the IEs defined in rlf-Report for identifying failed cells;  3 is similar to timeConnFailure in RLF report;  For 4 FailureType has already been included in SCG failure information;  For 5, the IEs for RA reporting can be reused, e.g., perRAInfoList. |
| Lenovo | 1,2,3,5 | 4 can covered by failuretype. |
| OPPO | 1/2/3 | For 3) it could be set as a optional field, and therefore could be set absently in too late PSCell change case. |
| Qualcomm | 2,3 | Depending upon the agreement Q8. IEs from RLF report can be reused. For 4, we believe that implicit indication should be sufficient. |
| Nokia | 1, 2, 3 | (4) is already there as failureType in existing SCG failure information. (5) is not needed in the message, since RA report for SN include this information. |

**Q12: Which content suggested by RAN3 LS R3-211332 require new fields in the message, if a separate message other than existing SCG failure messages is enhanced to support SCG MRO?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which content?** | **Comments if any** |
| CATT | All | As we prefer to report the SCG failure / SN change failure information in *UEInformationResponse* message, the information about RLF/HOF of MN could be directly copied for SN. |
| Ericsson | All | As we support the introduction of a new message to deliver the SCG failure related stored SON information, we prefer to include all of them and include all of them in a similar way as in RLF report. |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary of issue 2.3.3**

According to the feedback provided and remind companies comments in section 2.3.1, some companies may have mixed up the concepts of “IE” and the “field”.

In this question, the Rapporteur intends to collect companies’ views regarding which **fields** could be directly reused to cover the information requested by RAN3 (not which existing IE structure could be used), if the existing SCG failure messages are reused/extended.

From the views expressed, the following can be observed

* If existing SCG failure messages are enhanced to support SCG MRO,
  + CGI of the Source PSCell: 7 companies support to add new field for this information;
  + CGI of the Failed PSCell: 8 companies support to add new field for this information;
  + timeSCGFailure: 9 companies support to add new field for this information;
  + connectionFailureType: 1 company support to add new field for this information;
  + random-access related information set by the PSCell: 4 companies support to add new field for this information, and this may depend on whether SgNB RACH report could include SCG failure scenario which can cover the RA failure case. If the SgNB RACH report could cover it , no new information is needed in the existing SCG failure messages.
* If a separate message other than existing SCG failure messages is enhanced to support SCG MRO, 2 companies support to include all contents suggested by RAN3 LS.

Therefore the Rapporteur suggests the following WF.

**Proposal 11 If reuse existing SCG failure messages, add new fields for the first 3 information (i.e., ‎CGI of the Source PSCell, CGI of the Failed PSCell, and timeSCGFailure) requested in RAN3 LS R3-211332.**

**Proposal 12 If reuse existing SCG failure messages, reuse existing field of failureType for the 4th *information (i.e*., ‎connectionFailureType‎) requested in RAN3 LS R3-211332 ‎.**

**Proposal 13 If reuse existing SCG failure messages, RAN2 to discuss whether to introduce a new field for the 5th information (i.e., random-access related information set by the PSCell) requested in RAN3 LS R3-211332. It is noted that this may depend on whether SgNB RACH report could include SCG failure scenario, i.e., if the information is included in SgNB RACH report then it is not needed in SCG failure messages.**

**Proposal 14 If a separate message other than existing SCG failure messages is used, new fields are needed for all the 5 information suggested by RAN3 LS R3-211332‎.**

### 2.3.4 Applicable Scenarios

RAN3 discussed the solution for the optimization of PScell change failure for MRO in case of MR-DC. RAN3 agreed it is beneficial for the NG-RAN node to receive the list of information. And the recorded and reported source/ target PSCell could be E-UTRA cell or NR cell:

|  |
| --- |
| 1. CGI of the Source PSCell: the source PSCell of the last SN change. The source PSCell could be E-UTRA cell or NR cell. 2. CGI of the Failed PSCell: the PSCell in which SCG failure is detected or the target PSCell of the failed PScell change. The Failed PSCell could be E-UTRA cell or NR cell. |

So from the LS we deduce the optimized node is NG-RAN node and the optimized scenarios should include:

* NG-EN-DC
* NR-DC
* NE-DC

But the EN-DC which only connected to EPC is not an NG-RAN node seems not in the consideration, even if EN-DC is still under RAN3’s discussion. Rapporteur thinks it is better to confirm this understanding before we discuss the detailed content adding. Whatever EN-DC connected to EPS is included, the impact specifications are:

* TS 38.331 (for NR-DC and NE-DC)
* TS 36.331 (for NG-EN-DC, and for EN-DC if any)

**Q13: Do you think EN-DC should also be the supported and the specification impact involves both TS38.331 and TS 36.331?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Whether to support EN-DC** | **Does it require changes to both TS38.331/36.331** | **Comments if any** |
| Huawei, HiSilicon | No | Only 38.331 | Firstly, we agree with the above comment that EN-DC is not in the consideration.  Secondly, we would like to avoid impact to 36.331 so NG-EN-DC case is not preferred.  In general, we think only NR-DC and NE-DC are applicable scenarios, and thus only impact to TS 38.331 is expected.  It may be good to check with RAN3 on applicable scenarios if needed. |
| Samsung | Yes | Yes | Need to check RAN3 opinion if needed |
| CATT | Yes | Yes | Since EN-DC is under RAN3’s discussion indeed, we also suggest checking with RAN3 about the scenarios first. And at least the NG-EN-DC case which will have 36.331 changes should be considered. |
| vivo |  |  | Should confirm the understanding with RAN3 |
| Lenovo |  |  | Can be decided by RAN3. |
| Qualcomm | No | Only 38.331 | Similar view as Huawei |
| Nokia | Yes | Yes | Based on RAN3 agreement, NR-DC is prioritized. EN-DC wasn’t excluded. |
| Ericsson |  |  | We propose to first clarify this with RAN3 i.e., whether it was their intention to exclude EN-DC or not. |

**Summary of issue 2.3.4**

3 companies (3/8) consider that EN-DC could be supported and both TS38.331/36.331 should be changed, 2 companies (2/8) do not want to support it and think only TS38.331 need to be changed. Anyhow it seems all companies agree to check this issue with RAN3 first.

**Proposal 15 Check with RAN3 first about whether EN-DC and NG-EN-DC scenarios are in the consideration of RAN3 LS R3-211332 for the SCG failure recording for the purpose of PSCell failure analysis.**

# 3 Conclusion

TBD

# 4 References

1. Draft\_R2-114-e\_Meeting\_Report\_v1, see https://www.3gpp.org/ftp/tsg\_ran/WG2\_RL2/TSGR2\_114-e/Report
2. R3-205662 LS to RAN2 on RACH report for SgNB, RAN3
3. R2-2103093 [Post113-e][852][NR R17 SON/MDT] 2 step RA and other SON changes (CATT)
4. R2-2104536 Report of  [AT113b-e][802][NR/R17 SON/MDT] 2 step RA and other SON enhancements (CATT)
5. RAN3\_112-e\_agenda\_with\_Tdocs20210527\_EOM2, see https://www.3gpp.org/ftp/tsg\_ran/WG3\_Iu/TSGR3\_112-e/Inbox/Drafts/Chairmans\_Notes
6. R2-2103733 Discussion on other SON aspects, Huawei, HiSilicon
7. R2-2103943 Other WID related SON features, Ericsson
8. R2-2103096 Further Consideration on PSCell MHI, CATT
9. R3-210002 Report of 3GPP TSG RAN WG3 meeting #110-e
10. R3-211332 LS on information needed for MRO in SCG Failure Report, RAN3
11. R2-2104701 Report of 3GPP TSG RAN WG2 meeting #113bis-e, Online
12. R2-2104296 Summary of AI 8.13.2.3 Other WID related SON features, vivo
13. R2-2104058 Other SON Enhancements, Samsung
14. R2-2103552 Discussion on other SON aspects, Nokia, Nokia Shanghai Bell