**3GPP T****SG-RAN WG3 Meeting #110-e R3-211062**

**Online, 25th January – 5th February 2020**

Agenda Item: 9.3.8

Source: Ericsson

Title: Summary of Discussion for Insufficient UE Capabilities Indication

Document for: Discussion, Decision

# Introduction

A Summary of Offline Discussions has been assigned to the topic of Insufficient UE Capabilities Indication.

The discussion has been summarised as follows in the meeting minutes:

**CB: # 90\_MOACV**

**- confirmed that it’s for “don’t try again for this UE”**

**- seems no possibility for OAM-based solution?**

**- clarify usage**

(E/// - moderator)

# For the Chairman’s Notes

**[To be added]**

# Discussion

During RAN3-110e the topic of failure events due to insufficient UE capabilities has been discussed and the following has been minuted:

**Need a proper analysis on whether there is an issue that should be addressed in signaling (addressing this via cause value probably not the most appropriate way)**

At this meeting a more detailed description of failure cases due to UE insufficient capabilities has been presented in [1] and cosigned by a large number of operators.

## On the need for Insufficient UE Capabilities indication

The failure cases brought in [1] as examples can be summarized as follows:

EN-DC failure cases:

* An MeNB does not decode the NR UE Capabilities and for that it is not aware of whether the UE capabilities match the capabilities required by the SgNB.
For example, the MeNB does not know the UE capabilities in terms of supported DL BWP and DSS. If the SgNB requires support of a specific DL BWP size or it requires support of DSS, and if the UE does not have matching capabilities for the PSCells selected by the SgNB, the SgNB addition will fail.
* Failure case described in [2]: if an MeNB narrows down a list of band combination and transmits it to the SgNB, EN-DC configuration may fail due to no band combination available for SgNB. In detail, for instance, assume UE notifies eNB of UE capability of BC#1 and BC#2. Since eNB has no visibility over NR capabilities, it may narrow down a list of allowed band combination to BC#1 and transmit this available band combination to the SgNB. Assume SgNB only supports a fixed bandwidth operation for BC#1 (e.g. 100MHz), but the UE does not support such bandwidth operation. Then there is no band combination available for SgNB to select. Thus, the SgNB Addition procedure would fail.

MR-DC Failure Case:

* An MgNB does not know if potential PSCells at an SgNB use DSS with other nodes (other than the MgNB). If the SgNB requires support of DSS, and if the UE does not have matching capabilities for the PSCells selected by the SgNB, the SgNB addition will fail.

Handover Failure Case (valid for Xn and NG HOs):

* At handover the source is not able to determine the Initial BWP of the target cell. This is because UE neighbour cells measurements do not report this information (UE ANR measurements only report the CellAccessRelatedInfo IE from SIB1). Therefore, the target RAN node needs to perform a check of whether the UE capabilities support the carrier and bandwidth-part bandwidths of the target cell.
In case of bandwidth capability check at target, the target gNB can check the UE capabilities vs BWP and carrier bandwidth. If such check doesn’t have a positive outcome, the Handover Request will be rejected.

It was confirmed during the online discussion that the solutions proposed are aimed at preventing the repetition of the failure for the same UE.

If it is known at serving RAN node that a failure occurred because of insufficient UE capabilities, then:

* For DC scenarios, SN addition may be prevented if the same candidate PSCells (for which a failure occurred in the past) are reported by the UE as best cells for DC configuration
* For HO scenarios, HO towards a given HO target cell can be prevented if a failure due to insufficient capabilities was reported in the past for that target cell

Without a solution for this issue failures due to insufficient capabilities would neither be traceable, nor they would be preventable.

Companies are therefore invited to provide their view on whether introducing an indication of failure due to Insufficient UE Capabilities in the SN addition and HO failure procedures is needed

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| **Company** | **Comments** |
| Ericsson | Yes, such indication is needed. Without this indication the only solution is to reuse existing cause values that neither have the same “barring” effect nor can convey the real reason for the failure, which is useful for network visibility and optimization planning  |
| Nokia | First of all, when reading the example scenarios, it does not seem like a critical error, so probably Rel.15 should not be touched.For EN-DC, the example scenario calls for a solution that we propose in another discussion: load per initial BWP (after all, the initial BWP should be compatible with any UE, shouldn’t it?). Nonetheless, we acknowledge the problem with UEs that may need to be rejected, while the MeNB does not have means to understand the scenario.For other Xn-based MR-DC options, the scenario is less clear: the MN should be able to read the capabilities, while the SgNB does not have to configure features which are not compatible with the UE (isn’t DSS configured per UE, I’m not sure?). All in all, it seems to me like the problem is related to very specific features and then the cause should also be specific. However, if this is not acceptable, we could accept also the general cause in Rel.16. However, in this case, we would like to make the description of the new cause more specific, i.e. to list there examples of what capability exactly may be insufficient.  |
| Deutsche Telekom | Same view as Ericsson. |
| Huawei | Indeed we understand the issue described in [1], the main point here is, the proposed solution doesn’t bring additional meaning against the current cause value, e.g. Target Not Allowed, since anyway MeNB doesn’t know what the exact the capability mismatch is, but will implement penalty measures on this UE, which should be the similar consequence if a “Target Not Allowed” is received, since MeNB will also implement penalty measures, i.e. MN will not try again for this UE, please note that if SgNB rejects due to resource or other configuration mismatch, we have specific ones for those cases. |
| Verizon | Yes, from an operator perspective, such an indication (insufficient UE capabilities) is needed as there is a gap in what the existing cause values can convey. Same view as Ericsson.  |

## On the type of Insufficient UE Capabilities Indication

In [1] two solutions are proposed for Insufficient UE Capabilities indication.

Solution 1: To specify a new cause value over the X2, Xn, F1, NG interfaces for Insufficient UE capabilities. This solution maintains standardization impacts to a minimum

Solution 2: To specify a new cause value over the X2, Xn, F1, NG interfaces for Insufficient UE capabilities and to enhance the X2: SgNB ADDITION REQUEST REJECT message and the Xn: S-NODE ADDITION REQUEST REJECT with a list of PSCells for which the rejection occurred, namely a list of the PSCells that were tried, but where the procedure failed.

**Companies are invited to provide their view on which of the two solutions above is preferred.**

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| **Company** | **Comments** |
| Ericsson | We prefer Solution 2, which is a more complete solution and allows to have more knowledge about the PSCells for which the failure occurred  |
| Nokia | Providing back the list of PSCells is very strange proposal: the MN does not select the PSCell, so it would have absolutely no benefit in knowing which cells are “incompatible” with the UE. Also, we expect that if there is at least one PSCell where the UE could be admitted, the SN would not reject it. Hence, rejection means none of the possible PSCells (if the MN even analyses the NR measurements!) could be used for the UE.So, option 1 is the only needed solution for the problem, as presented. |
| Deutsche Telekom | Initial preference for Solution 2, but we agree with Nokia’s argumentation that the SN may have different options to admit the UE in case of different PSCells. From that perspective, Solution 1 may be sufficient. |
| Huawei | See comments for the first issue. On top of that, we failed to see the motivation of including rejected Scells, the reason is simple, firstly, MN actually doesn’t care which scells are used or not but just provide candidate list for SN to select; secondly, we are discussing insufficient capability of UEs, what’s the point of letting MN knows the scells who rejected, will MN try to remember/record those scells for that UE, and exclude these cell from candidate list for next time? But how does it come that some cells under the same gNB have different capability when acting as scells for the same UE? |
| Verizon  | Solution 1 can be taken as baseline. Solution 2 adds something on top of Solution 1. This can be further considered later if use case merits providing such additional info (tries PSCells list). Initial thinking is Nokia’s reasoning seems good and adding tried PSCells list would need further justification.  |

# Conclusion, Recommendations

# References

[1] R3-211064, Cause value on X2, Xn and F1 for insufficient UE capabilities (Ericsson, Verizon Wireless, Deutsche Telekom, CMCC, BT, AT&T, China Unicom, Telecom Italia, Vodafone, NTT DoCoMo Inc.)

[2] R2-2100772, Clarification on band combination selection over inter-node message (NTT DoCoMo Inc.)