3GPP TSG-RAN WG3 #115-e R3-222421

**E-meeting, 21st February – 3rd March 2022**

Source: CATT (moderator)

Title: CB: # SONMDT5\_RACHOpt

Agenda Item: 10.2.1.7

Document for: Approval

# Introduction

**CB: # SONMDT5\_RACHOpt**

**- DU shall/or may store received PRACH configurations? Whether any enhancements are needed?**

**- Capture agreements, clean up and provide TPs if agreeable**

(CATT - moderator)

The deadline for the first phase is 00:00 UTC on 25nd February (Friday).

# For the Chairman’s Notes

TBD.

# Discussion (first phase)

## Whether the gNB-DU “shall” or “may” store

Two companies expressed two contradicting views on this topic:

One company said that the gNB-DU “shall” store the neighbour PRACH configuration [4].

Another company said that the gNB-DU may not store the neighbour PRACH configuration, and F1AP should be enhanced so that the gNB-DU can indicate whether it stores or not and the gNB-CU can determine whether to send a full neighbour list or a delta neighbour list upon the next time it sends neighbour PRACH configuration [3]:

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| In that case, we believe that a better solution would be that the gNB-DU can indicate to the gNB-CU whether the latest received PRACH neighbour information has been stored. In this way the gNB-CU would know which neighbour PRACH information to signal to the gNB-DU in the future. |

**Questions 1-1**: What is your preference between the two options?
- Specifying that the gNB-DU shall store;
- Allowing that the gNB-DU does not store and enhancing the F1AP so that the gNB-DU can indicate whether it stores or not.

| Company | Comment |
| --- | --- |
| CATT | No strong opinion. |
| Ericsson | We believe that the gNB-DU shall not be mandated to store neighbour cell PRACH configurations. As explained in [4] the gNB-DU may either use this information and then discard them, or it might not even use it. It is therefore unnecessary and not beneficial to mandate a node to store information that is not essential.We however understand that the issue of mandating storage is perhaps motivated by allowing an easier behaviour at the gNB-CU and minimising F1 signalling. For that purpose we propose a solution that may simplify the gNB-CU behaviour and save F1 signalling, which is to allow the gNB-DU to flag whether neighbour cells PRACH information is stored or not. This could be an alternative to the costly mandate to always store the information. |
| Nokia | We believe that DU shall store the received PRACH Configurations by the CU until a new PRACH Configuration replaces the earlier one. This could also solve a problem where PRACH Configurations of more than 32 neighbours need to be sent to a DU; The CU can update the rest of the information through a subsequent message to DU. Also, storing of neighbour PRACH Configurations at the DU is in line with the current F1AP requirements and no F1AP modifications are needed. Sending an indication from DU to CU about whether it has stored the latest PRACH Configuration can also create a lot of signaling over F1 since for every signaled PRACH Configuration a DU needs to indicate whether it has stored it or not.  |
| Qualcomm | The option where gNB “shall” store seems simpler than introducing an indication over F1AP whether gNB-DU stores or not. |
| Huawei | We see the benefits to force the DU to store the neighbour cells’ PRACH configurations. This may avoid any further query procedure towards CU in case PRACH issues is detected.The DU may do the optimisation and adjustment immediately. However, if also considering the concern of optimisation to DU storage , maybe “should”, instead of either “may” or “shall” is the best wording here?The indication of whether DU stores or not does not make sense to us. |
| Samsung | We think the most reasonable way forward is that “the gNB-DU may store”Even if the DU may not store the neighbour cells’ PRACH configurations e.g. after resolving the conflict, it doesn’t mean F1 enhancement is needed. |

## Requesting for more neighbour PRACH Info

One company proposed an enhancement on F1AP so that the gNB-DU could request for more neighbour PRACH configuration, in addition to the “PRACH configurations for the neighbour cells in closest proximity”. The motivation was as following [3]:

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| However, some of the unselected cells e.g., the one which is not in the closest proximity, may also cause PRACH conflicts. A good example is scenario of massive narrow beamforming from a far away cell, where the narrow beams can cause interference to far away cells. Therefore, there might still be unresolved PRACH configuration conflict in gNB-DU even after the gNB-CU has signalled neighbour PRACH configuration information to the gNB-DU. In addition, there might be scenarios where the selection of a new PRACH configuration by the gNB-DU may trigger a new conflict with a neighbour not signalled by the gNB-CU. |

On the other hand, one company expressed their opposing [4]:

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| Also, regarding the need by a gNB-DU to request more eighbor PRACH Configurations to resolve possible PRACH Conflicts it seems to us that having received PRACH Configurations from 32 neighbours is sufficient under most scenarios of interest. Therefore, we think that a trigger from gNB-DU to gNB-CU is not needed. |

**Questions 1-2**: What is your opinion on whether some enhancement are needed so that the gNB-DU can request for more neighbour PRACH Info?

| Company | Comment |
| --- | --- |
| CATT | Not needed.The motivation provided in [3] is not justified.PRACH is an uplink channel. Ordinarily we don’t expect Ues to use massive narrow beamforming. Thus PRACH interference between far away cells is very unlikely.As the result, delivering only the closest neighbours is sufficient enough.Nevertheless, we are open to slightly widening the value “32”. |
| Ericsson | In reply to CATT, it is rather common to map RACH resources within the same beams serving an SSB. In this case massive narrow beamforming is a strong possibility, e.g. to cover motorways. If we admit that there may be cases where the neighbour information signalled by the gNB-CU do not include the neighbours causing RACH collisions, then how would the solution work? What can the gNB-DU do to flag this continued RACH conflict situation?  |
| Nokia | Not needed. We are not sure how this massive narrow beamforming can create problems from cells farther away, since massive narrow beamforming seems to be meant in the DL and not in the RACH UL. Regarding E///’s comment to CATT: “If we admit that there may be cases where the neighbour information signalled by the gNB-CU do not include the neighbours causing RACH collisions, then how would the solution work?”. We are wondering why the CU would not include the PRACH Configurations of those cells. In the agreement we took it says: “**It should be possible for the gNB-CU to provide the gNB-DU with information indicating the CGI of the cells potentially in conflict and the neighbouring relation between these cells and their neighbour cells, along with the PRACH configurations of those neighbour cells, so as to prevent the gNB-DU from reconfiguring one of its cells from conflicting with one neighbour toward conflicting with another neighbour. How/whether gNB-CU do the filter is up to implementation.”**So, CU should be able to avoid the scenario that some neighbours causing collisions are not included.  |
| Qualcomm | Considering RACH conflict itself is not a common occurrence, the RACH conflict due to massive narrow beamforming will be perhaps an even rarer scenario. In that case, signalling the 32 neighbor cells potentially in conflict is probably enough.  |
| Huawei | Similar view as the majority. |
| Samsung | Similar view as the majority. |

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## Indication of change on beam sweeping pattern

One company proposed an enhancement on F1AP so that the gNB-DU could indicate a change on beam sweeping pattern. The motivation was that the change on beam sweeping pattern will impact what beams used a given random access occasion (RO), thus turned the direction of the antenna for receiving PRACH preambles on that given RO away from the interference source.

On the other hand, one company expressed their opposing [4]:

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| Regarding the possible scenario that a gNB-DU changes its beam sweeping pattern so that a PRACH Configuration conflict is created, it seems to us that the probability of such event happening diminishes when beam forming is introduced. So this does not seem like a probable scenario. |

**Questions 1-2**: What is your opinion on whether some enhancement are needed so that the gNB-DU can indicate a change on beam sweeping pattern of its served cell?

| Company | Comment |
| --- | --- |
| CATT | Not needed.There is enough space to adjust the PRACH configuration directly (e.g. to change the root sequence index). No need to support such indirect approach. |
| Ericsson | A gNB-DU can anyhow change its sweeping pattern even today. What we propose is that the gNB-DU notifies the gNB-CU of such action because such changes could affect neighbour relations and mobility. |
| Nokia | Not needed. A RO can be shared with multiple or even all SSBs. The CU anyway will have to monitor the real RACH conflicts (it will also receive RACH Reports) so we don't see the need for such indicator. Besides, even though this approach seems simple with 2 gNBs in the figure, in a practical network with many gNBs such solution may be extremely complex, so that in practice PRACH conflicts will be resolved by e.g., using non-conflicting root sequence indexes.  |
| Qualcomm | Not needed (similar view as CATT and Nokia). |
| Huawei | Don't see the need to indicate the change on beam sweeping pattern |
| Samsung | Similar view as the majority. |

## IE name

One company observed that [1]:

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| Due to the limit of time, the finally agreed TP was as following: the outer list was named as “RACH Cell List”, whereas the inner list was named as “Neighbour NR Cells for SON List”.Although such naming does not affect the actual behaviour of RAN nodes, making the outer list covering a smaller scope while the inner list covering a larger scope is obviously no one’s intention. |

Thus it was proposed to align the list names. The original TP in [1] proposed aligning them toward “Cells for SON List”, but it was also claimed that other methods were acceptable to them.

NOTE: The text description in Section 8 was also proposed to be changed for consistence.

**Questions 1-4**: What is your opinion on the names of lists?

| Company | Comment |
| --- | --- |
| CATT | We are open on this topic.Nevertheless, we slightly prefer the option shown in [1]. |
| Ericsson | We are fine with the name “Cells for SON List” |
| Nokia | We think that “RACH Cell List” is a more intuitive name, but we are fine also with the “Cells for SON List” name. |
| Huawei | Either way is fine. |
| Samsung | Is it not better to have “RACH” in the name for both inner and outer list? |

## Stage 2 description of PRACH coordination for en-gNB cells

One company proposed a TP to capture the stage 2 description of PRACH coordination for en-gNB cells in [2].

**Questions 1-5**: Any comment on the TP in [2]?

| Company | Comment |
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| CATT | We agree with this TP. |
| Ericsson | The TP does not seem in line with the discussions so far. RAN3 discussed the problem of RACH conflict detection and resolution, while the TP seems to describe a pre-emptive method of signalling neighbour RACH configurations to en-gNBs. Therefore we think the TP is out of scope. |
| Nokia | We agree with the TP. |
| Qualcomm | Similar view as E///. Don’t think this scenario was ever discussed |
| Huawei | We are fine to capture something for this in stage2. |

# Conclusion, recommendations [if needed]

# Reference

[1] R3-222015; (TP on SON for 38.473) On naming issue for PRACH coordination; CATT.

[2] R3-222016; (TP on SON for 36.300) Description for RACH optimisation in EN-DC; CATT.

[3] R3-222070; (TP for SON BL CR for TS 38.473) RACH conflict resolution; Ericsson.

[4] R3-222119; (TP for TS 38.473) Addressing a few remaining aspects in RACH Optimization; Nokia, Nokia Shanghai Bell.