3GPP TSG-RAN WG3 Meeting #127-bis R3-252288

Wuhan, China, 7th – 11st April 2025

Agenda Item: 11.3

Source: NEC (moderator)

Title: Summary of Discussion on CB: # AIRAN2\_CCO

Document for: Discussions & Approval

# Introduction

**CB: # AIRAN2\_CCO**

**- Discuss the open issues above**

**- Capture agreements and open issues**

(moderator - NEC)

Summary of offline disc [R3-252288](file:///C%3A%5CUsers%5Chma%5COneDrive%20-%20NEC%20Europe%20Ltd%5CDocuments%5C3GPP%5CRAN3%5C127b%5Ctdoc%5CCB%5CCB%20%23%20AIRAN2_CCO%5CInbox%5CR3-252288.zip)

# For Chairman’s notes

**Agree the following TPs reflecting the agreements from the online session.**

* **TP for the XnAP BLCR in R3-252355**
* **TP for the F1AP BLCR in R3-252356**

**To be continued in the next meeting:**

**Whether/what additional UE performance measurement metrics is needed?**

**Timing information for predicted CCO issue is NOT needed to exchange over Xn? Whether the predicted CCO issue and /or future CCO state can be updated over Xn?**

**For the receiving side, whether gNB-CU can also provide to gNB-DU a recommended future CCO state as assistance information?**

**Option 1: no need**

**Opton 2: gNB-CU directly forward the received further CCO state of neighbor cells to gNB-DU.**

**Option 3: gNB-CU generates a recommend further CCO state and send to gNB-DU.**

# 3 Discussion

In the online discussion the following was captured in the Chair’s meeting minutes:

|  |
| --- |
| **The maximum value of the Time interval for predicted CCO issue and future CCO state is 60s.****Legacy UE performance measurement metrics can be reused for CCO.** **Evaluate the predicted CCO issue and/or the future CCO state, what’s the difference？****Other additional information needed?****Timing information for predicted CCO issue is NOT needed to exchange over Xn? Whether the predicted CCO issue and /or future CCO state can be updated over Xn?****gNB-CU can also provide to gNB-DU a recommended future CCO state as assistance information?** |

## 3.1 UE performance feedback for CCO

CCO is to optimize the network by adjusting cell coverage due to coverage and capacity problems. For AI/ML based CCO, the predicted CCO issue can be avoided or mitigated by advance CCO action, therefore UE performance should be not (much) impacted due to the future CCO issue or the advance CCO action.

In order to evaluate the AI/ML CCO model, UE performance feedback can be used for UE performance comparation before and after a CCO action that is triggered based on the inference output from AI/ML CCO model.

For reference, we agreed in SI the following feedback can be considered for AI/ML based CCO and captured in TR 38.743:

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4.2.2.4 Feedback of AI/ML based CCO

To optimize the performance of AI/ML-based CCO model, following feedback can be considered to be collected from gNBs:

- Measured radio resource status

- Legacy UE performance feedback for those UEs handed over from the source gNB

- SON Reports (e.g., RLF, CEF, RA)

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**FFS:**

**Evaluate the predicted CCO issue and/or the future CCO state, what’s the difference？**

1. Predicted CCO issue
2. Future CCO state
3. ?

**Other additional information needed?**

In addition to Legacy UE performance measurement metrics, the following other metrics were proposed to be considered:

1. UE location or geographical areas [5] [7]
2. UE radio measurements (cell level RSRP, RSRP, SINR) [15] [22]
3. Node level UE performance [9] [30]

**Conclusion: Suggest to focus on UE performance measurement metrics directly and update open issue to the following:**

**Whether/what additional UE performance measurement metrics is needed?**

## 3.2 Time information for predicted CCO issue over Xn

For AI/ML based CCO, the following two time information were introduced:

* Time for future coverage state
	+ The point in time when the future coverage state will be applied.
	+ A relative time from the time of receiving the gNB-DU Configuration Update message over F1 and NG-RAN node config Update message over Xn.
* Time for predicted CCO issue
	+ The point in time when the CCO issue is predicted to happen.
	+ A relative time from the time of receiving the gNB-CU Configuration Update message over F1.

We already agreed and caprtured in BLCR [1] that, in XnAP NG-RAN NODE CONFIGURATION UPDATE message, a *Time for Future Coverage State* IE can be included for each Future Coverage Modification Item. As explained in the semantics description, this time information *indicates the time when the Future Cell Coverage State(s) and/or the Future SSB Coverage State(s) will be applied by the NG-RAN node1 relative to the time of receiving this information*.

**FFS:**

**Timing information for predicted CCO issue is NOT needed to exchange over Xn?**

Below is the summary of proposals to this meeting:

1. No [4] [5] [7] [9] [25] [27] [30]
2. Yes [6] [10] [15] [21] [22] [32]

**Whether the predicted CCO issue and /or future CCO state can be updated over Xn?**

**Conclusion: No time to disc, continue next meeting.**

## 3.3 Recommended future CCO state from CU to DU

Considering gNB-CU holds the AI/ML-based CCO model and it collects all input data for AI/ML model, it is more knowledgeable on the neighbour node status and UE performance status. Based on the received future CCO state and predicted CCO issue, also together with other information, e.g. current/predicted radio resource status, gNB-CU can take advantage of AI/ML tool and, meanwhile, coordinate all gNB-DUs connected to it to generate a more suitable future CCO state. Therefore, some companies acknowledge the benefits that gNB-CU can generate a recommended future CCO state and send it to gNB-DU as assistance information.

**FFS: gNB-CU can also provide to gNB-DU a recommended future CCO state as assistance information?**

Below is the summary of proposals to this meeting:

1. Yes [5] [7] [22] [27]

**Moderate proposes to continue the disc by email disc.**

**Proposal 1: For the receiving side, gNB-CU can provide to gNB-DU a future CCO state.**

**Question 1: Companies are invited to share their views on Proposal 1 above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Support Proposal 1?** | **Comments** |
| Qualcomm  | No | Don’t understand the need of sending Future CCO state from receiving CU to receiving DU. Receiving CU can interpret the future CCO state to a CCO issue and send it to the receiving DU as a simple solution. Proposal 1 is a cyclic and complex solution. A receiving CU can receive future CCO state from more than one sending CU. In this case how many future CCO state will receiving CU send to receiving DU? The receiving CU can also have its own AI/ML model. It can predict a CCO issue. How can the receiving CU inform the receiving DU that the predicted issue is of its own and the future CCO is from its neighbour. Looks like complicated solution. |
| Ofinno | Yes | We agree that gNB-CU has AI/ML model and inference data / feedback for generating a recommended future CCO state for gNB-DU. |
| ZTE | - | We prefer to discuss this topic separately. ^\_^So far, this topic is possible to be understand from the following ways:**#1: CU can send the recommended future CCO state to DU.****#2: CU2 can send the received future CCO state1(DU1 generated) to DU2.**For #1: * From capacity view:as agreed before, CU is the proper entity for model inference. And it is also feasible for CU to generate the recommended future CCO state and forward to DU.
* From benefit view:CU can predict CCO issues and utilize the trained AI/ML model to forecast potential CCO states based on predicted CCO issues and its current and past coverage states. While the potential CCO states generated by the CU may not be as accurate as those produced by the gNB-DU due to the latter having more measurement data, this information serves as valuable assistance from the DU's perspective to help improve CCO state generation.

For #2: No clear view on how the future CCO state1 helps DU2 to generate its future CCO state2. From simplicity, at current stage, we prefer to support consider the legacy CCO mechanism, which is, no transmit the future CCO state1 from CU2 to DU2. |
| Lenovo | See comment | Needs clarification as ZTE indicated. Our understanding is below.**#1: CU can send the recommended future CCO state to DU.*** **No, since the common assumption is that DU will generate the future CCO state by itself in response to the received predicted CCO issue**

**#2: CU2 can send the received future CCO state1(DU1 generated) to DU2.*** **Yes, this can be optionally supported. As we believe it could be beneficial for DU2 to plan a future CCO state taking into account the future CCO state of a neighbor DU1.**
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| CATT | No | If the question is option 1 mentioned by ZTE, we do not think it is needed since coverage status is only configured in gNB-DU.Furthermore,since coevergae status is dedided by gNB-DU.it is not clear how gNB-DU could use this recommend information when deciding the coverage status.If the question is option 2 mentioned by ZTE.we also think it iis not needed.We have already agreed that for AI/ML based CCO ,principle of legacy mechanism should be followed.In legacy CCO,in the receiving side,it is not necessary for the gNB-CU to forward the received CCO issue to the concerned gNB-DU.One possible implementation in gNB-CU is to analyze the possible CCO issue based on the updated coverage status together with the CCO issue provided by the neighbor node and send the CCO issue it identified to gNB-DU.So,similarly,it is not necessary to make restriction that gNB-CU forward the receveid predicted CCO issue and predicted coverage status to gNB-DU. |
| Ericsson | Yes for CU2 to signal to DU2 the Future CCO state received from gNB1 | This is in our understanding the only solution that allows alignment between the future CCO states derived by gNB1 and Future CCO states to be produced by gNB2. gNB-DU2 will receive the Future CCO states generated by gNB1 and it will derive CCO states that are aligned with them. Note that letting gNB-CU2 to infer a new CCO issueand signal it to gNB-DU2 does not ensure that gNB-DU2 generates Future CCO states matching with the Future CCO states generated by gNB1. Also note that gNB-DU2 cannot measure how the cells/beams of gNB-DU1 have changed until the Future CCO states generated by gNB1 are activated. Therefore, the only way for gNB-.DU2 to derive Future CCO states matching the ones from gNB1 before the Future CCo state activation is to receive gNB1´s Future CCO states.  |
| LGE | Yes if CU2 can send the received future CCO state to DU2 | Because the future CCO state that the CU2 receives is a new cell and/or beam configuration that has not yet been applied to the DU1, the DU2 cannot deduce this future CCO state until it is applied and cannot generate a matching CCO state. Therefore, the CU2 should transfer the future CCO state to the DU2.For that CU can send the recommended future CCO state to DU, the CU cannot suggest a future CCO state based on current and/or past CCO states because it is impossible to understand them, which are configured to DUs only that it hosts by OAM. Therefore, transferring the suggested future CCO status from the CU to the DU is unnecessary. |
| CMCC | See comment | Agree with option 2 mentioned by ZTE, As for AI/ML-enabled CCO, the future CCO state of source DU will not be applied when the target gNB-DU derives/generates the corresponding future CCO state, the target DU may not acknowledge what is the future CCO state of source DU, and may confuse about how to change the coverage for the predicted CCO issue. It’s beneficial that the target CU provide the future CCO state of source DU to target DU. |
| NEC | Yes | In legacy, gNB-DU can use received CCO issue toghther with its own measurement info to decide its own cell adjustment. But for further CCO state adaptation, gNB-DU cannot decide if it only has a predicted CCO issue, therefore we think, besides a predicted CCO issue, a further CCO state is also needed in gNB-DU.Regarding the further CCO state mentioned above, considering gNB-CU holds the AI/ML-based model, gNB-CU can take advantage of the AI/ML model, incl. all input data and also other prediction output, e.g. Predicted Radio Resource Status and coordinate all gNB-DUs connected to it to generate a more propitiate future CCO state. Therefore, we think gNB-CU can generate a recommended future CCO state for gNB-DU, instead directly forward the further CCO state of neighbor node, as assistance information. |

**Question 2: Whether the future CCO state in proposal 1 is a recommended future CCO state generated by the receving gNB-CU?**

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| --- | --- | --- |
| **Company** | **Support Proposal 1?** | **Comments** |
| Qualcomm  |  | See above |
| ZTE | Support if we can also confirm future CCO state in P1 is equal to recommended future CCO state. | Detail explanation can be checked in Q1. |
| CATT |  | See above |
| Ericsson | No | gNB-CU2 cannot generate Future CCO states ass it does not know which CCO states DU2 supports, nor it knows which CCO states DU2 can activate. To let gNB-DU2 to generate Future CCO states matching those of gNB1, the best solution is to forward to gNB-DU2 the Future CCO states of gNB1. |
| LGE | No | Similar view with E///. |
| NEC | Yes | See commnet above. |

**Conclusion:**

**For ease of discussion next meeting, I summaried the options for this FFS below:**

**For the receiving side, whether gNB-CU can also provide to gNB-DU a recommended future CCO state as assistance information?**

**Option 1: no need**

**Opton 2: gNB-CU directly forward the received further CCO state of neighbor cells to gNB-DU.**

**Option 3: gNB-CU generates a recommend further CCO state and send to gNB-DU.**

## 3.4 TP to BLCR

**Moderate proposes to agree the TP for the XnAP BLCR and F1AP BLCR respectively in the draft folder reflecting the following agreements.**

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| --- |
| **The maximum value of the Time interval for predicted CCO issue and future CCO state is 60s.** |

**Agree the following TPs reflecting the agreements from the online session.**

* **TP for the XnAP BLCR in R3-252355**
* **TP for the F1AP BLCR in R3-252356**

# 4 References

1. R3-250924 (BL CR to TS 38.423) Support of enhancements on AI/ML for NG-RAN
2. R3-250925 (BL CR to TS 38.473) Support of enhancements on AI/ML for NG-RAN
3. R3-251648 (TP for BLCR to TS 38.473) Further discussion on energy efficient AI/ML-based CCO issue prediction in split architecture Nokia, FiberCop, Jio Platforms (JPL)
4. R3-251649 (TP for BLCR to TS 38.473) Further discussion on signalling for AI/ML-based CCO Nokia
5. R3-251678 Open issues for AI/ML-based CCO NEC
6. R3-251787 Discussion on remaining issues in AI/ML enabled CCO Qualcomm Incorporated
7. R3-251794 Discussion on AI/ML enabled CCO Samsung
8. R3-251825 (TP on 38.473) Open issues on the CCO use case CATT
9. R3-251826 Open issues on the CCO use case CATT
10. R3-251869 Discussion on AI/ML based Coverage and Capacity Optimization China Telecom
11. R3-251870 (TP for BLCR to TS38.423) Support of AI/ML based Coverage and Capacity Optimization China Telecom
12. R3-251871 (TP for BLCR to TS38.473) Support of AI/ML based Coverage and Capacity Optimization China Telecom
13. R3-251911 AIML enabled CCO - Single predicted CCO issue resolution Ericsson, InterDigital, Jio Platforms, Deutsche Telekom
14. R3-251912 (TP to 38.473) - AIML enabled CCO - Single predicted CCO issue resolution Ericsson, InterDigital, Jio Platforms, Deutsche Telekom
15. R3-251913 AIML enabled CCO - Prediction validation and timing issues Ericsson, InterDigital, Jio Platforms, Deutsche Telekom, FiberCop
16. R3-251914 (TP to 38.473) - AIML enabled CCO - Prediction validation and timing issues Ericsson, InterDigital, Jio Platforms, Deutsche Telekom, FiberCop
17. R3-251915 (TP to 38.423) - AIML enabled CCO - Prediction validation and timing issues Ericsson, InterDigital, Jio Platforms, Deutsche Telekom, FiberCop
18. R3-251916 AIML enabled CCO - Multiple CCO issues Ericsson, InterDigital, Jio Platforms, Deutsche Telekom
19. R3-251917 (TP to 38.473) – AIML enabled CCO - Multiple CCO issues Ericsson, InterDigital, Jio Platforms, Deutsche Telekom
20. R3-251918 (TP to 38.423) - AIML enabled CCO – Multiple CCO issues Ericsson, InterDigital, Jio Platforms, Deutsche Telekom
21. R3-251936 Discussion on AIML based CCO Lenovo
22. R3-251994 Discussion on AI/ML-based Coverage and Capacity Optimization Huawei, Jio Platforms, Orange, Deutsche Telekom, FiberCop
23. R3-251995 (TP for AIML BLCR to TS 38.423) XnAP enhancements for AIML-based Coverage and Capacity Optimization Huawei, Jio Platforms, Deutsche Telekom, FiberCop
24. R3-251996 (TP for AIML BLCR to TS 38.473) F1AP enhancements for AIML-based Coverage and Capacity Optimization Huawei, Jio Platforms, Deutsche Telekom, FiberCop
25. R3-252090 Discussion on issues for AI/ML-based CCO LG Electronics Inc.
26. R3-252091 (TP for NR\_AIML\_NGRAN\_enh-Core for TS 38.473) Discussion on issues for AIML-based CCO LG Electronics Inc.
27. R3-252155 Discussion on AI/ML assisted Coverage and Capacity Optimization ZTE Corporation
28. R3-252156 [TP to 38.401] Support of AI/ML assisted CCO ZTE Corporation, Lenovo, China Unicom, China Telecom
29. R3-252157 [TP to 38.423 and 38.473] Support of AI/ML assisted Coverage and Capacity Optimization ZTE Corporation
30. R3-252174 Discussion on AI/ML-based CCO CMCC
31. R3-252204 Coexistence of multiple CCO issues Rakuten Mobile, Inc
32. R3-252205 Timing Information for AIML based CCO Rakuten Mobile, Inc
33. R3-252237 [TP to BLCR to TS 38.300] Support of AI/ML assisted CCO ZTE Corporation, Lenovo, China Unicom