**3GPP T****SG-RAN WG3 Meeting #110-e R3-211122**

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

Agenda Item: 9.3.8

Source: Ericsson

Title: Summary of Discussion for PCI reconfiguration signaling

Document for: Discussion, Decision

# Introduction

A Summary of Offline Discussions has been assigned to the topic of Normal Release Cause Value.

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

**CB: # 106\_****PCIrecnonfig**

**- clarify usage**

**- CU should be in charge of when to reconfigure? Whether to capture this is spec?**

**- whether (and how, if at all) DU should reply?**

**(E/// - moderator)**

**Summary of offline disc [R3-211122](file:///C:\\Users\\eangcen\\Documents\\3GPP_ETSI\\RAN3\\RAN3-111\\MyEmailDiscussions\\Inbox\\R3-211122.zip)**

# For the Chairman’s Notes

**[To be added]**

# Discussion

In [1] the cosourcing companies have exposed the issue of PCI reconfiguration and its timing.

[1] highlights the following text in TS38.473:

For gNB-CU Configuration Update

“*If Cells to be Activated List Item IE is contained in the GNB-CU CONFIGURATION UPDATE message, the gNB-DU shall activate the cell indicated by NR CGI IE and reconfigure the physical cell identity for which the NR PCI IE is included.*

*[…]*

If *Cells to be Activated List Item* IE is contained in the GNB-CU CONFIGURATION UPDATE message and the indicated cells are already activated, the gNB-DU shall update the cell information received in *Cells to be Activated List Item* IE.”

For the gNB-DU configuration Update

“*If Cells to be Activated List Item IE is contained in the GNB-DU CONFIGURATION UPDATE ACKNOWLEDGE message, the gNB-DU shall activate the cell indicated by NR CGI IE and reconfigure the physical cell identity for cells for which the NR PCI IE is included.*

*If Cells to be Activated List Item IE is contained in the GNB-DU CONFIGURATION UPDATE ACKNOWLEDGE message and the indicated cells are already activated, the gNB-DU shall update the cell information received in Cells to be Activated List Item IE.*”

From the highlighted text above it can be deduced that the gNB-DU shall reconfigure the PCI received from the gNB-CU, for the cell subject to such reconfiguration, as soon as the message from the gNB-CU is received.

As explained in [1] this approach is subject to performance impacts. In fact, changing the PCI of a cell while UEs are connected to and served by it can cause service disruptions for various reasons. For example, a UE may not be able to decode specific messages received from the serving RAN node if the PCI of the cell serving the UE is all of a sudden changed (as messages may be scrambled with the cell’s PCI). Similarly, the UE might lose synchronization if the PCI is changed while the UE is connected.

For these reasons, [1] proposes that the gNB-DU does not change the PCI immediately when received, but that the gNB-DU waits for the best opportunity to change the PCI. For example, the gNB-DU may monitor UE traffic load and number of connected UEs and decide to apply the change when minimum traffic load and/or number of connected UEs are recorded. Alternatively, the gNB-DU may pause scheduling of traffic to the UEs and only then update the PCI (so to give time to UEs to detect the new PCI before new messages are received).

During online discussion the main feedback presented by companies regarding the proposals in [1] was that the gNB-CU can already derive when the best time to apply a PCI change is, because the gNB-CU has knowledge of UE traffic.

The latter stand is incorrect for the following reasons:

* The gNB-CU-CP does not have knowledge of UE traffic at UP level. That knowledge resides at the gNB-CU-UP and at the gNB-DU.
* The gNB-CU-CP does not have knowledge of scheduling, namely it does not know when UE traffic is paused because the UE is not scheduled. That knowledge resides at the gNB-DU

Between the two nodes involved in the procedure of PCI reconfigurations, the only node that is aware of the dynamics of UP UE traffic is the gNB-DU.

Therefore, the gNB-DU knows when it is the best moment for applying the PCI reconfiguration so to minimize disruption of user services and to minimize failures.

With the above in mind, **companies are invited to provide their view on how the gNB-CU-CP determines when it is the best time to apply a PCI reconfiguration, given that the gNB-CU-CP is not aware about UP traffic dynamics.**

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| **Company** | **Comments** |
| Ericsson | As explained above, the gNB-CU-CP is not able to determine the dynamics of UP traffic transmission to the gNB-DU. For that the gNB-CU cannot determine when it is the best time to reconfigure the PCI of a cell served by a gNB-DU |
| Nokia | The gNB-CU-CP has some information relative to traffic dynamics based on the admitted QoS flows and inactivity information reported by the CU-UP. However traffic dynamics is not the only factor that needs to be considered, it is also important to take into account e.g. the issues being caused by the wrong PCI setting, e.g. frequency of delayed or failed handovers, and the CU-CP is in a better position to evaluate this. |
| Ericsson | From Nokia’s comments it seems clear that an immediate change in PCI performed by the gNB-DU may cause a service interruption at the UE because the UE may be scheduled with traffic and it may, .g. loose synchronization or miss scrambled messages.  Regarding the possibility of optimizing mobility in function of PCI change time, our proposal goes exactly in this direction, i.e. gNB-DU would notify gNB-CU of a modified PCI event, after which incoming mobility can be handled properly (outgoing mobility should not be a problem) |
| Huawei | Agree with Nokia. The CUCP has the inactivity notification from CUUP.  Offloading active UEs to neighboring cells is needed to minimize the impact on the user experience before changing the PCI of a cell. When and where to handover the UEs is decided by the CU.  So, it is the CU to determine the most proper time to change the PCI in a cell.  When you change the PCI of a NR cell, the security keys in the UE should be updated, not sure without CU involvement, how the DU can guarantee the UE’s service continuity. |
| ZTE | Agree with Nokia and Huawei, the CU has the overall view on the DUs, it should be up to CU to decide when to reconfigure the PCI. |

**In light of the above, companies are invited to provide their view on the procedure text introduced in [2]**

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| **Company** | **Comments** |
| Ericsson | We agree to the introduction of the text in [2]. We are also open to reformulations of the text, so long as we address the issue of how to enable the system to apply the PCI reconfiguration at the best possible time, minimizing service disruptions and errors. |
| Nokia | The CR doesn't seem needed. |
| Huawei | At least for now, we don’t need the CR. |
| ZTE | This CR seems to be not needed. |

# Conclusion, Recommendations

# References

[1] R3-210331, Discussion and solution on PCI Reconfiguration (Ericsson, Verizon Wireless)

[2] R3-211090, Corrections on PCI Reconfiguration (Ericsson, Verizon Wireless)