

August 23-August 27, Madrid, Spain

Agenda Item: 7.1.1.4**Source:** MediaTek Inc.**Title:** Optimization on Intra-eNB Pcell Change Procedure**Document for:** Discussion and Decision

1 Introduction

In RAN2#69bis it is FFS on the need of an optimized approach for Pcell change in addition to the handover procedure. This paper analyses the changes in addition to ignoring RACH and K_{eNB} change, and provides analysis on the RRC message overhead between 1) Pcell change with handover procedure, and 2) a new Pcell change procedure which includes all possible optimizations.

2 Discussion

2.1 Scell reconfiguration Issue

The existing handover procedure requires the target eNB to reconfigure Scells for the UE after handover is done. Therefore, if Pcell change follows existing handover procedure, the original Scell configuration may need to be reset and reconfigured after Pcell change is done, which leads to unnecessary RRC message overhead.

However, existing handover procedure also allows the target eNB to pre-configure Scells for the UE during handover preparation. Therefore, it is sensible that in case of Pcell change, the original Scell configuration is considered as a pre-configuration of Scells for the UE, and hence the UE keeps its original Scell configuration unchanged after Pcell change, except for the old Pcell (now becomes a Scell) and new Pcell (was a Scell before).

Observation 1: Existing Scell configuration can be considered as a Scell pre-configuration when Pcell change is handled by normal handover procedure.

It has been agreed in RAN2#70bis that after handover all Scells are deactivated. This agreement implies that when applying handover procedure to Pcell change, all existing activated Scells should be deactivated after Pcell change is done. However, this leads to unnecessary signaling overhead, because most of time the existing Scells need not to be reconfigured, and hence existing service flows on the activated Scells should not be interrupted by the Pcell changed procedure.

Observation 2: In case of intra-eNB Pcell change, there is no need to deactivate those activated Scells, as the existing service flows on those activated Scells should not be interrupted by the Pcell change procedure.

2.2 MAC status of the old Pcell

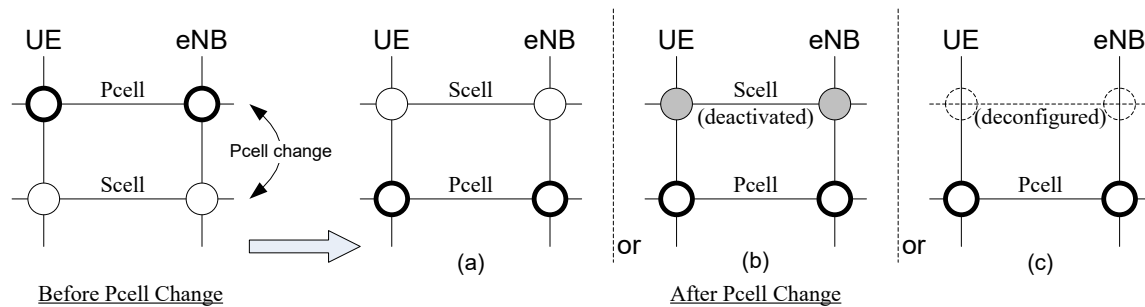


Figure 1 - Possible status of the old Pcell after Pcell change.

It is not clear that after Pcell change, the old Pcell should become an activated Scell or a deactivated Scell, or even be de-configured, as illustrated in Figure 1. We study this problem from the following perspectives:

1. The Pcell change is actually triggered by the bad link quality of the Pcell. In this case, the UE/eNB should de-configure the old Pcell after Pcell change.
2. The old Pcell remains acceptable quality for being a Scell after Pcell change. However, the traffic demand decreased after Pcell change and the eNB want to deactivate some Scells for power saving. In this case, the old Pcell should become a deactivated Scell after Pcell change, which aligns with the aforementioned agreement on the MAC status of the Scells after handover.
3. The old Pcell remains acceptable quality for being a Scell and the traffic demand by the UE is high after Pcell change. Therefore, the UE/eNB may want to keep it for data transmission or to continue existing service flows on this cell. In this case, the old Pcell should become an activated Scell after Pcell change. However, this violates the aforementioned agreement on the default MAC status of the Scells after handover. Therefore, a MAC CE should be transmitted in this case to activate this old Pcell after Pcell change is done.

We believe that each of the above three scenarios is sensible and may happens interchangeably. Therefore, we think the Pcell change procedure can be further optimized to reduce some signaling overhead by explicitly indicating the status of the old Pcell (Act/Deact/de-configured) in the Pcell change message.

Observation 3: The Pcell change message can be used to explicit indicate the status (Activated or Deactivated) of the old Pcell after Pcell change, or to de-configure the old Pcell.

2.3 Analysis to the Pcell change procedure

2.3.1 Using existing handover procedure

Figure 2 illustrates the message sequences (both RRC messages and MAC CEs) when Pcell change is handled by normal handover procedure. As seen, in addition to the messages for handover operation, the eNB will need to perform RACH no matter whether the target Pcell has already been activated or not, and then send additional MAC CEs to activated Scells which were deactivated due to handover. Besides, the service flows on the Scells and previous Pcell need to be reestablished to apply the new K_{eNB} .

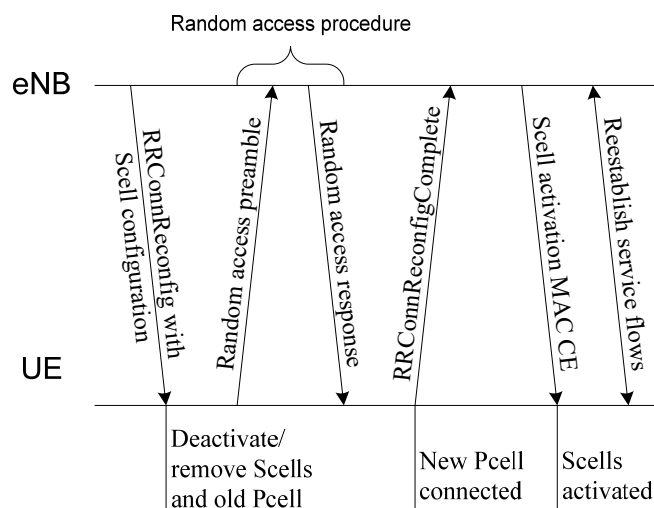


Figure 2 - Pcell change using existing handover procedure with Scell pre-configuration.

2.3.2 Optimized procedure for Pcell change

Figure 3 illustrates the message sequences of an optimized procedure for Pcell change. In this case, RACH and K_{eNB} change can be optionally ignored, and existing Scell configuration/status remain unchanged after Pcell change. Therefore, the eNB needs not send MAC CE to activate configured Scells after Pcell change, and existing service flows on the Scells (and even the old Pcell) can survive the Pcell change procedure without interruption.

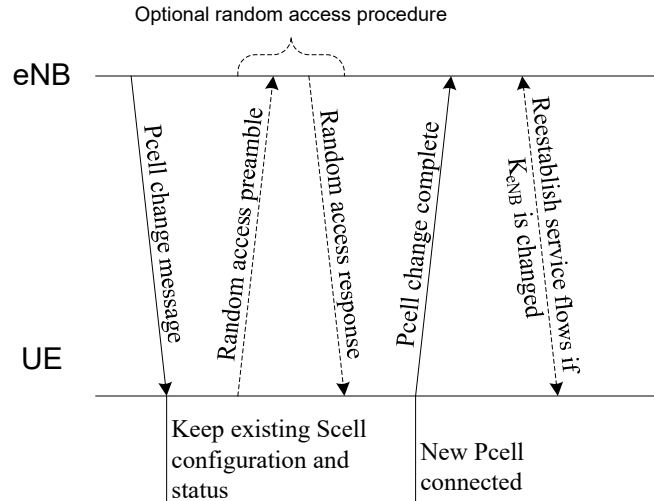


Figure 3 - Optimized procedure for Pcell change.

3 Conclusion

Based on the analysis in the previous section, the following list shows the necessary optimization to the Pcell change procedure:

Proposal: following optimization to the Pcell change procedure:

1. **Optionally ignore RACH;**
2. **Optionally ignore K_{eNB} change;**
3. **Keeping existing Scell configuration;**
4. **Keeping Activated/Deactivated status of existing configured Scells;**
5. **The Pcell change RRC message explicitly activate/deactivate/remove the old Pcell after Pcell change**