

Agenda Item: 7.2.2
Source: Fujitsu
Title: Discussion on SRB via SeNB for dual connectivity
Document for: Discussion and Decision

1. Introduction

In the last RAN2 meeting, “RAN2 agrees to use Control Plane option C1 as baseline for dual connectivity” [1]. For the issue whether or not signalling can be transmitted via SeNB, even through some contributions have mentioned that [2, 3], it was not discussed separately and RAN2 only agreed that “L2 transport of these messages depends on the chosen UP architecture and the intended solution” [4]. So in this contribution, we will address this issue. Firstly, we will provide the usage scenarios for configuring SRB via SeNB. Secondly we check the candidate user plan architectures to find the feasibility of configuring SRB via SeNB. Then, we briefly review the impact of configuring SRB via SeNB on the current specification. Finally we propose RAN2 to discuss configuring SRB via SeNB for dual connectivity and study the issues listed.

2. Discussion

2.1 Usage Scenario

Small cell scenario 1

In small cell scenario 1, to assure the UE can receive RRC signalling timely, configuring SRB via SeNB is necessary. One example is shown in figure 1. In figure 1, small cell C2 is surrounded by macro cell C1. If one UE moves from left to right along the dashed line, after it arrives at point a, it enters into CRE area of small cell C2 and may be configured with TDM-based dual connectivity, then data and/or signalling could be transmitted by small cell. If the UE continues moving into the central area of small cell C2, for example between point b and c, and C2 doesn't apply ABS [5], the UE then has less possibility to receive the data or signalling from C1 correctly due to interference from C2. Especially if the UE is a low speed terminal, the time when the UE can't receive the RRC signalling from C1 will be long. In this case, transmission of RRC signalling by C2 is the only way to go.

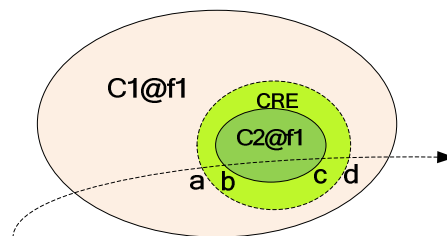


Fig. 1 One example of RRC signalling transmission via SeNB in small cell scenario 1

Small cell scenario 2

In small cell scenario 2, configuration SRB via SeNB is also required. For example, in figure 2, one small cell C2 is not completely covered by the overlaid macro cell C1. When the UE moves into area only covered by C2 (the right half of C2), if the eNB decides to reconfigure the UE, the RRC message can only be conveyed by small cell C2.

Another example is handover scenario in small cell scenario 2 as shown in figure 3, wherein small cell C3 is not completely covered by any overlaid macro cell and located in between two macro cells C1 and C2. If one UE moves from left to right along the dashed line, after it arrives at point “a”, it can be configured with dual connectivity. When the UE enters into the overlapped area covered by both C1 and C2, for example, between point b and c, because of the intra-frequency interference between C1 and C2, it is better the important RRC signalling, such as HO command and measurement report, is transmitted/received via C3 to/from the UE. In case too late HO happens, for example, HO command has not issued or received successfully when the UE has entered into the overlapped area covered by both C2 and C3, for example, between point c and d, then (the retransmitted)HO command can be transmitted to the UE via C3. In this way, HO failure can be avoided and mobility performance will be enhanced.

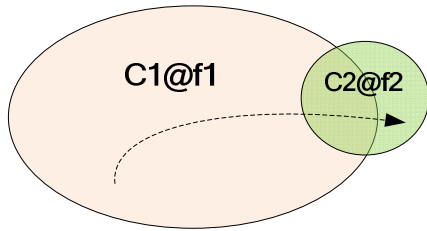


Fig. 2 One example of signalling transmission by SeNB in scenario 2 (small cell is uncovered)

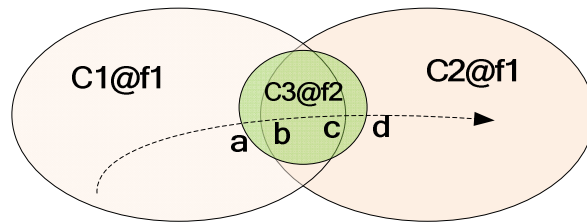


Fig. 3 Another example of signalling transmission by SeNB in scenario 2 (HO scenario)

In the above scenarios, allowing RRC signalling being transmitted by SeNB can assure that the UE can always receive the RRC signalling in the coverage of dual connectivity, especially when the MeNB coverage is not available. Considering SRB is the only bearer to convey RRC signalling, we have the following observation:

Observation 1: Configuring SRB via SeNB can assure the UE can always receive the RRC signalling in the coverage of dual connectivity, especially when the MeNB coverage is not available.

2.2 UP Architecture Support

In the last RAN2 meeting, UP architecture options 1A, 2A, 2C, 3C and 3D were selected as the possible direction of UP architecture. With option 1A, S1-U is terminated in SeNB and data forwarding from MeNB to SeNB is not required. If SRBs for MeNB and SeNB also take this protocol architecture, that is: “RRC signalling forwarding” is not required, CP architecture option C1 can’t be realized. Therefore, if we prefer that UP and CP have the same L2 protocol architecture for the reason of simplicity, UP architecture option 1A can’t support configuring SRB via SeNB.

Meanwhile, in the other UP architecture options (2A, 2C, 3C and 3D), data forwarding from MeNB to SeNB is required via Xn interface. If we simply take the same protocol architecture as UP for CP, “RRC signalling” is forwarded from MeNB to SeNB, which is exactly required by option C1. So, UP options 2A, 2C, 3C and 3D can support to configure SRB via SeNB.

To setup SRB via SeNB, with UP option 2A, 2C, 3C and 3D, the network side can configure it by SRB in MeNB. For an example, in figure 4, when MeNB determines that it is necessary to setup SRB via SeNB according to the measurement report and/or the network deployment related information, it will send one Xn message to request SeNB to add SRB via it. After MeNB receives the Xn message including the confirmation on SRB setup from SeNB, it will send *RRConnectionReconfiguration* message via the SRB in MeNB to UE. Then after UE has finished configuration of SRB via SeNB, it will respond with *RRConnectionReconfigurationComplete* message to MeNB.

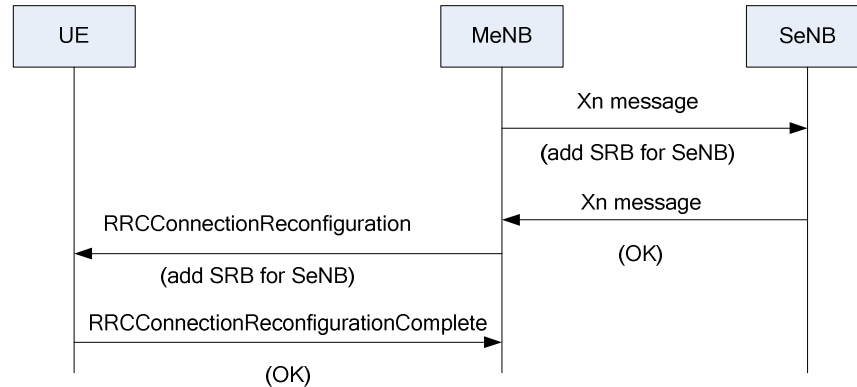


Fig. 4 The work flow for setup SRB via SeNB

Observation 2: If we take same L2 protocol architecture as UP for CP, with UP options 2A, 2C, 3C and 3D, SRB via SeNB can be configured.

Since in small cell scenario 1 and 2, configuring SRB via SeNB is necessary if one of the UP architecture options (2A, 2C, 3C and 3D) is selected as UP architecture baseline, we propose RAN2 to discuss configuring SRB via SeNB for dual connectivity.

Proposal 1: RAN2 is kindly asked to discuss to configure SRB via SeNB for dual connectivity if one of the UP architecture options (2A, 2C, 3C and 3D) is selected as UP architecture baseline.

2.3 Impaction

Introducing SRB via SeNB will impact current specification on several aspects. We need further study on the following issues:

SRB management: If configuration of SRB via SeNB is allowed, would it be setup when dual connectivity is configured or on demand? After having been setup, would SRB via SeNB be released when dual connectivity is released or on demand?

RLM & RLF: If SRB via SeNB is configured, whether or not the UE needs to perform RLM for the link of SeNB? Furthermore, if RLM is performed for SeNB link, how to handling RLF for UE?

Proposal 2: If configuration of SRB via SeNB is allowed, it is proposed that RAN2 further study its impaction on SRB management, RLM and RLF.

3. Conclusion

With the above discussion, we propose below:

Proposal 1: RAN2 is kindly asked to discuss to configure SRB via SeNB for dual connectivity if one of the UP architecture options (2A, 2C, 3C and 3D) is selected as UP architecture baseline.

Proposal 2: If configuration of SRB via SeNB is allowed, it is proposed that RAN2 further study its impaction on SRB management, RLM and RLF.

Reference

- [1] R2-13xxxx, Chairman report_RAN2_83
- [2] R2-132469, "Performance of Control Plane Diversity", MediaTek

- [3] R2-132858, "Dual Connectivity SRB options, for Signaling Load Reduction", Qualcomm
- [4] TR 36.842 v.0.3.0, "Study on Small Cell Enhancements for E-UTRA and E-UTRAN – Higher layer aspects"
- [5] R2-131856, "The challenges of dual connectivity for single RX/TX capable UEs", Fujitsu