**3GPP T****SG-RAN WG3 Meeting #111-e R3-210963**

**Electronic Meeting, Jan 25th – Feb 5th, 2021**

**Agenda item: 9.3.4.2**

**Source: Qualcomm Incorporated (moderator)**

**Title:** **Summary for CB: # 10\_DirectDataFwd\_DC-CAmobility**

**Document for: Discussion and Decision**

# 1 Introduction

This is to discuss CB #10:

|  |
| --- |
| **CB: # 10\_DirectDataFwd\_DC-CAmobility****CATT,CT,QC,CMCC****If no agreement possible, check with SA5 whether it is possible for all eNBs involved in EN-DC operation to be configured with information on whether direct data forwarding tunnel is available or not between two neighbor gNBs.****source MN uses the same procedure as SCG configuration retrieval towards SN to retrieve information on whether direct data forwarding is available or not.****introduce a new direct data forwarding availability query IE in SgNB Modification Request message and direct data forwarding availability result IE in SgNB Modification Response message.** **let source MN trigger S-NG-RAN node modification procedure to source S-NG-RAN node to retrieve information on whether direct data forwarding is available or not.****introduce a new direct data forwarding availability query IE in S-NG-RAN node Modification Request message and direct data forwarding availability result IE in S-NG-RAN node Modification Response message.****QC,CATT,CT****consider the various assumptions, based on possible OAM configurations, provided for direct data forwarding in inter-system handover scenarios, and to discuss on a way forward as to which assumptions are suitable.****Based on the assumptions, the proposed solutions for the signaling support to enable DL direct data forwarding all involve standards changes.****HW,SS****unified solutions for inter-system and intra-system involving MR-DC direct data forwarding;****Introduce the signalling based solution for direct data forwarding for handover involving MR-DC in Rel-16 (NGAP and XnAP impact)****- OAM vs. signaling support?****- If no agreement, consensus that OAM is always possible and close discussion**(QC - moderator)Summary of offline disc [R3-210963](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CInbox%5CR3-210963.zip) |

Phase 1 deadline: Friday 16:00 UTC, 8:00 Pacific time, 24:00 Beijing time

# 2 For the Chairman’s Notes

TBD

# 3 Phase 1 Discussion

The following discussion is regarding the observations and proposals from the following contribution papers: CATT, China Telecom, Qualcomm, CMCC [0247], CATT, China Telecom [0248, 0249], Qualcomm, CATT, China Telecom [0335], Huawei, Samsung [0586, 0786].

The goal in the above contributions is to extend the signaling support that currently exists for direct forwarding in inter-system handovers between two standalone network nodes to direct forwarding in MR-DC scenarios and to develop a unified framework for inter-system and intra-system handovers in MR-DC scenarios.

## 3.1 Supporting direct data forwarding for inter-system HO from EN-DC to NR SA or from NR-DC to NR SA

In contributions by various companies two types of solutions were considered for enabling direct data forwarding in the MR-DC scenarios of interest: standards-based solution and solution based on OAM configuration.

**Solution based on OAM configuration**

According to CATT, China Telecom, Qualcomm, CMCC [0247] and Huawei, Samsung [0586], OAM configuration for supporting direct data forwarding involves the following: for a network node, OAM needs to configure neighbor relationships between two neighbor nodes. For example, in EN-DC to NR SA HO, OAM needs to configure source MeNB with the information whether source SgNB has a direct path to the target NG-RAN node, besides configuring whether source MeNB itself has a direct path to the target NG-RAN.

It might be complex for OAM to configure this information. The contribution [0247] has the following observation.

**Observation 1: Based on current specification, whether direct data forwarding should be implemented between two nodes is per UE not per node. What’s more, it is not supported to configure the neighbor relationship between two neighbor nodes. Therefore, OAM based solution could not work.**

The contribution [0586] thinks that the complexity of configuration needs to be evaluated as it is needed to cover many scenarios and number of base stations and has the following observation.

**Observation 2: The OAM based solution is simple without RAN specification impact, but its configuration complexity needs to be evaluated.**

### **Question 1: (a) Do companies agree with Observations 1 and 2 [0247, 0586] that for an OAM-based solution, OAM needs to configure for each network node, neighbor relationships between two neighbor nodes? (b) If companies agree that it is too complex to configure this information, do companies agree that this means that the OAM-based solution cannot be made to work?**

###  **These questions are relevant for other scenarios discussed in the contributions: NR SA to EN-DC HO, and intra-system HOs and SN change, and additional specific comments for these scenarios can be provided here as well, if needed.**

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| **Company** | **Yes/No** | **Comments** |
| Huawei | Yes | As mentioned in the observation 2, the OAM based solution is simple but its configuration complexity needs to be evaluated. Note that for observation 1, we kind of think the configuration of direct data forwarding should be node level, not UE level.  |
| Samsung |  | We think O&M based solution could work. But it’s too complex to configure each node with the information whether two pair of neighbors has direct interface. Especailly considering there are many high frequency base stations in a macro coverage, such configuration will bring a lot of burden to operators.For observation 1, even though the direct forwarding path availability is transmited in UE associated signaling, direct forwarding path availability is per pair of nodes.Propose to reword the question e.g. whether signaling based solution is needed to reduce the effort of operator configuration. |
| Nokia | No | We definitely do not agree that direct data forwarding is UE-specific feature – direct routing is either available for all UEs, or not available at all. Regarding configuration complexity, it exists always: some part of the network must be configured anyway. Also, OAMs are often proprietary, so it may not be possible to “evaluate” the effort. |

If RAN3 cannot agree on Observation 1, [0247] proposes that RAN3 should check with SA5 on this issue.

**Proposal 1: If RAN3 could not reach agreement, it is proposed to check with SA5 on whether it is possible for all eNBs involved in EN-DC operations to be configured with information on whether direct data forwarding tunnel is available or not between two neighbor gNBs.**

### **Question 2: In case RAN3 cannot come to an agreement in Question 1, do companies agree with Proposal 1 [0247] that RAN3 should check with SA5 on the feasibility of OAM configuration?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei | Depends | Not very necessary if we can conclude with the signaling based solution, since SA5 normally do not configure or define everything in their specifications.  |
| Samsung |  | No stong view on the LS |
| Nokia | No | We agree with Huawei, that SA5 may not be able to answer. So, the LS may help nothing. |

Qualcomm, CATT, China Telecom [0335] consider EN-DC to NR SA HO and the case where OAM configuration is assumed feasible and found that even then there are standards changes required for supporting direct data forwarding. The following assumption is made regarding the OAM configuration.

**OAM configuration Assumption:** Source MeNB is configured with the information whether source SgNB has a direct path to the target NG-RAN.

With the above assumption, a solution involves the following. Upon initiating handover, source MeNB includes direct forwarding indicators (Direct Forwarding Path Availability IEs) in Handover Required message, one for source MeNB and another for source SgNB. The changes required in the standards correspond to the following proposals in the paper [0335]. Proposal 2 involves ASN.1 change.

**Proposal 2. Source MeNB includes a direct forwarding indicator (Direct Forwarding Path Availability IE) in Handover Required message for source SgNB.**

**Proposal 3. Upon receiving the data forwarding addresses in Handover Command message from the MME for SN terminated bearers during the HO procedure, source MeNB forwards the addresses to the source SgNB.**

### **Question 3: In case of EN-DC to NR SA HO, do** **companies agree that standards changes as in Proposals 2 and 3 above [0335] are required even if OAM configuration is assumed as above?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei | No | If we assume this OAM configuration case is valid, the source MeNB just includes the **legacy direct forwarding indicator** as long as at least one of source nodes (either the source MeNB or the source SgNB, or both) has direct forwarding address with the target node. Then when the MeNB receives the Handover Command message carryin the data forwarding address(es), it can decide whether to forward the direct forwarding address to the source SgNB, or allocate the data forwarding address of itself and signal to the SgNB. Also the introduction of the new indicator would have impact on the MME, for which we should avoid.  |
| Samsung | No | If including Direct Forwarding Path Availability IE for source SgNB in Handover Required message, the CN should also know which part of bearer(s) is SN terminated. This is too complex.In order to avoid the impact on the CN, the Direct Forwarding Path Availability only indicates whether direct forwarding path is available between the MN and the target. |
| Nokia | No |  |

**Standards-based solution**

In case the answer to Question 1 is “Yes”, i.e., the OAM-based solution approach is not feasible, there are following two candidate solutions.

**Solution 1: source MN queries source SN for directly data forwarding availability**

In [0247], the following proposals discuss how the source MN obtains information from source SN regarding whether there is a direct forwarding path available from source SN to the target NG-RAN.

**Observation 3：Currently, for inter-MN handover, it is already supported to let source MN trigger SN modification procedure to retrieve the UE context in SN node before sending Handover Request message to target MN.**

**Proposal 4: It is proposed for the source MN to use the same procedure as SCG configuration retrieval towards SN to retrieve information on whether direct data forwarding is available or not.**

**Proposal 5: It is proposed to introduce a new direct data forwarding availability query IE in SgNB Modification Request message and direct data forwarding availability result IE in SgNB Modification Response message.**

**Proposal 6: It is proposed to let source MN trigger S-NG-RAN node modification procedure to source S-NG-RAN node to retrieve information on whether direct data forwarding is available or not.**

**Proposal 7: It is proposed to introduce a new direct data forwarding availability query IE in S-NG-RAN node Modification Request message and direct data forwarding availability result IE in S-NG-RAN node Modification Response message.**

### **Question 4: In case the answer to Question 1 is “Yes”, i.e., the OAM-based approach is not feasible, do companies agree with the standards-based solution proposed in Observation 3 and Proposals 4, 5, 6, 7 above [0247] whereby MN uses SN Modification to retrieve the direct path availability information?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei | Possibly No | Our concern is that this may result at the increased handover latency. Also note that for observation 3, this retrieval of the UE context does not often happen considering the LS back and forth with RAN2 during the discussion of delta configuration in case of handover involving EN-DC. |
| Samsung | No | Handover latency is an important KPI for the network. That’s why a lot of effort was spent for mobility enhancement. . |
| Nokia | No | Signalling is the solution if it can eliminate OAM completely. Shifting configuration effort from one node to another and then adding signalling to transfer the information back again does not help, while it complicates the solution. |

### **Question 5: Any comments on the CRs (R3-210248, R3-210249) corresponding to the Proposals 4, 5, 6, 7?**

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| **Company** | **Comments** |
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**Solution 2: Target MN tells source MN the availability of direct data forwarding with source SN**

Solution 2 was proposed in [0586, 0786] which also requires standards changes. The solution consists of the following (the documents [0586, 0786] provide the CRs to TS 38.423 and TS 38.413).

- The source MN provides the source SN ID to the target node in source to target transparent container;

- The target node provides the direct data forwarding availability indication to the source MN in target to source transparent container.

### **Question 6: In case the answer to Question 1 is “Yes”, do companies agree with the standards-based solution mentioned above and proposed in R3-210586, R3-210786 (the documents are also CRs to TS 38.423 and TS 38.413)?**

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| **Company** | **Comments** |
| Huawei | Agree. For the ENDC to SA, or NR-DC to SA, only the CR to TS 38.413 is needed. For SN change, the CR to TS 38.423 is needed.  |
| Samsung | AgreeThis solution will not introduce handover latency.This solution has no impact on CN.This solution use the same principle for all scenarios i.e. EN-DC to SA, SA to EN-DC, SN change. |
| Nokia | No, this does not help.As discussed above, this solution assumes that the target node is configured and then enables sending the configured info to the source node. It assumes that configuring target may somehow be easier than configuring the source – but there it may well be not true (why the target is assumed to have “common” OAM with the SgNB?). Equally well the source node may be configured. As written above, a signalling is the solution if it can eliminate or minimize OAM completely in all possible deployment.  |

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### **Summary**

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## 3.2 Supporting direct data forwarding for inter-system HO from NR SA to EN-DC

Qualcomm, CATT, China Telecom [0335] and Huawei, Samsung [0586, 0786] consider OAM configuration-based and standards-based solutions for NR SA to EN-DC HO.

**Solution based on OAM configuration**

In [0335], two possible OAM configurations are considered which also involve configuration of neighbor relationships between neighbor nodes.

**OAM configuration Assumption 1:** Target MeNB knows, for a target SgNB, whether target SgNB has a direct path available to the source NG-RAN.

Under the additional assumption that Source NG-RAN indicates in Handover Required (Direct Forwarding Path Availability IE) whether it has a direct path to the target MeNB, upon further investigation, it was found that changes to the standards are still required to support direct data forwarding from the source NG-RAN to the target SgNB. The proposed changes are given by the following proposal in [0335].

**Proposal 8. In the Handover Request Acknowledge message to the MME, if direct forwarding to SgNB applies, target MeNB includes the following for each admitted E-RAB that is set up as an SN terminated bearer:**

* **TEID/TNL addresses provided by target SgNB;**
* **SN Direct Forwarding indicator.**

**OAM configuration Assumption 2:** Source NG-RAN node is configured with the information whether it has a direct path to the target MeNB as well as to potential target SgNBs.

Under the above assumption, the standards change identified in [0335] is the addition of direct forwarding indicators for potential target SgNBs in Handover Required message. Source NG-RAN node can determine the potential target SgNBs using measurement results provided by the UE – the potential target SgNBs are the nodes whose cells are candidate PSCells as per UE measurement results. The proposal in [0335] is as follows.

**Proposal 9. Source NG-RAN node includes direct forwarding indicators (Direct Forwarding Path Availability IEs) in Handover Required message for potential target SgNBs.**

### **Question 7: Do companies agree with the possible OAM configurations discussed in [0335] and outlined above in Assumptions 1, 2? Please also comment on whether one of the configurations seems more suitable than the other for the scenario under discussion.**

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| **Company** | **Yes/No** | **Comments** |
| Huawei |  | Both OAM configuraiton assumtpions seem complicated to us. Also no matter whether we have this OAM configuration, the CN impact should be avoided.  |
| Samasung |  | OAM configuration Assumption 1 |

### **Question 8: Do companies agree that standards changes as in Proposals 8 and 9 above [0335] are required with the possible OAM configurations assumed as above?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei | No | See our answer to Q7.  |
| Samsung |  | For Proposal 8, the indicator should be in the container.Not ok for 9. The reason is explained in the answer for question 3. |

**Standards-based solution**

In case the OAM-based solution is not feasible, a standards-based solution can be considered. In [0335] and in the discussion paper [1] and CR [2] that were submitted in the previous RAN3 #110-e meeting, the following are proposed for the standards-based solution. Huawei, Samsung [0586, 0786] have a similar set of proposals.

**Proposal 10. In SgNB Addition Request message, the target MeNB includes the source NG-RAN node ID and requests the target SgNB to check if it has a direct path to the source NG-RAN node.**

**Proposal 11. If target SgNB has a direct path to the source NG-RAN node, it includes the following in SgNB Addition Request Acknowledge message for each admitted E-RAB (SN-terminated bearer set up by target SgNB) for which DL direct data forwarding from source NG-RAN to target SgNB is applicable:**

* **TEID/TNL addresses;**
* **SN Direct Forwarding indicator, which will be used by the target MeNB as an indication that the provided TEID/TNL addresses should be forwarded to the MME.**

**Proposal 12. In the Handover Request Acknowledge message to the MME, the target MeNB includes the following for each E-RAB for which SN Direct Forwarding indicator is present in SgNB Addition Request Acknowledge: TEID/TNL addresses provided by target SgNB.**

### **Question 9: In case the answer to Question 1 is “Yes”, i.e., the OAM-based approach is not feasible, do companies agree with the standards-based solution as described in Proposals 10, 11, 12 above [0335, 0586, 0786]?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei |  | We think that signaling based solution should have no impact on the CN. So 0586 can be considered.  |
| Samsung | In principle ok | The indication should be in the target to source transparent container. |

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### **Summary**

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## 3.3 Supporting direct data forwarding for intra-system HO and SN change scenarios

Huawei, Samsung [0586, 0786] consider the following intra-system scenarios.

* Intra-system handover between EN-DC and LTE connected with EPC, or between the MR-DC and SA connected with 5GC.
* Intra-system SN change for EN-DC and MR-DC connected with 5GC, as depicted in section 10.5 in TS 37.340.

**Standards-based solution**

In [0586, 0786], the following solutions are proposed for the intra-system scenarios described above. The solution proposed is similar for the two scenarios. In [0586, 0786], the CRs are also provided.

**For SA to MR-DC handover:**

- The target MN provides the source RAN node ID to the target SN;

- The target SN notifies the direct data forwarding availability indication to the target MN.

**For SN change:**

- The MN provides the source SN ID to the target SN;

- The target SN notifies the direct data forwarding availability indication to the MN.

### **Question 10: Do companies agree with the standards-based solution as described above for the intra-system scenarios involving HO and SN change [0586, 0786]?**

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| **Company** | **Yes/No** | **Comments** |
| Huawei | Yes |  |
| Samsung | Yes | The same principle could be used for intra-system and inter-system.If the solution is agreed for intra-system, the same IE could be reused for EN-DC to SA and SA to EN-DC. |

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### **Summary**

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# 4 Conclusion

TBD

# 5 Reference

[1] R3-206182, SN direct data forwarding, RAN3 #110-e contribution.

[2] R3-206183, CR to TS 36.423, SN direct data forwarding, RAN3 #110-e contribution.

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| [R3-210247](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210247.zip) | Discussion on inter-system handover from EN-DC to SA (CATT, China Telecom,Qualcomm, CMCC) | discussion |
| [R3-210248](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210248.zip) | Support of direct data forwarding for S-NG-RAN node change or NR-NR DC to SA handover (China Telecom,CATT) | CR0538r, TS 38.423 v16.4.0, Rel-16, Cat. F |
| [R3-210249](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210249.zip) | CR for 36.423 Support of direct data forwarding for EN-DC to SA (CATT, China Telecom) | CR1575r, TS 36.423 v16.4.0, Rel-16, Cat. F |
| [R3-210335](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210335.zip) | SN direct data forwarding (Qualcomm Incorporated, CATT, China Telecom) | discussion |
| [R3-210586](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210586.zip) | Direct data forwarding for mobility between DC and SA (Huawei, Samsung) | CR0553r, TS 38.423 v16.4.0, Rel-16, Cat. F |
| [R3-210786](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210786.zip) | Direct data forwarding for handover without O&M configuraiton (Samsung, Huawei) | CR0562r, TS 38.413 v16.4.0, Rel-16, Cat. F |
| [R3-210336](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210336.zip) | SN direct data forwarding (Qualcomm Incorporated, CATT) | CR1576r, TS 36.423 v16.4.0, Rel-16, Cat. B |
| [R3-210337](file:///C%3A%5CUsers%5Cxipengz%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CD7HPEA7J%5CDocs%5CR3-210337.zip) | SN direct data forwarding (Qualcomm Incorporated, CATT) | CR0542r, TS 38.423 v16.4.0, Rel-16, Cat. B |
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