3GPP TSG-RAN WG3 #114bis-e R3-221451

17 – 26 Jan. 2022

Agenda Item: 9.3.1.2

Source: Samsung (moderator)

Title: Summary of Offline Discussion on Mobility Between DC and SA

Document for: Approval

# Introduction

**CB: #** **8\_DirectDataFwd\_DC**

**- Focus on the open issues from last meeting**

**- Solution down selection, try to close this topic, capture agreements and provide CRs if agreeable**

(Samsung - moderator)

Summary of offline disc [R3-221000](file:///C:\Users\lx.xu\AppData\Local\Temp\BNZ.61e416551736bd6e\Inbox\R3-221000.zip)

# For the Chairman’s Notes

**Propose to agree the following:**

**Agree the following change to TS38.423 in order to support direct data forwarding for NR SA to MR-DC connected to 5GC Handover or SN change.**

**- 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.**

**WA: Support direct data forwarding from the source NG-RAN node to the target SN in scenario 3. Continue to discuss the solutions. Whether the WA will be changed to the agreement is depending on the specification impact.**

**WA: Support direct data forwarding from the source SN to the target NG-RAN node in scenario 3. Continue to discuss the solutions. Whether the WA will be changed to the agreement is depending on the specification impact.**

**Proposal: For handover from EN-DC to NR SA HO, agree Option 2a and Option 3a as way forward.**

Propose the following CRs to be agreed (ongoing reviewed, may or may not be revised):

Option 3a:

**R3-220674, agreed (Huawei, Samsung, China Telecom, ZTE),** [R3-221401](Inbox/R3-221401.zip) is withdrawn.

**R3-220774, agreed (Samsung, Huawei, ZTE),** R3-221389 is withdrawn

**R3-220775, agreed (Samsung, Huawei, ZTE),** R3-221390 is withdrawn

Option 2a:

**R3-221410, revision of R3-220540, agreed (CATT,Qualcomm,CMCC)**

**R3-221398, revision of R3-220601, agreed (Qualcomm Incorporated, CATT, CMCC)**

**R3-221454, revision of R3-220880, agreed (CMCC. CATT, Qualcomm)**

To be continued on TNL address allocation for handover to EN-DC

# Discussion (2nd Round)

Considering the limited time for 2nd round, the moderator propose to focus on the issue in section 4.3. Regarding the solution evaluation for scenario 3, it can be discussed at next meeting.

For Direct data forwarding from EN-DC to NR SA HO, still two solutions are on the table:

Option 2a: The source SN decides direct forwarding path availability between the source SN and the target node.

The source MN queries the source SN to get this information. The source MN transmits the information to the SMF. The SMF further transmits the information to the target node.

Option 3a: The target node decides direct forwarding path availability between the source SN and the target node. The target node transmits the information to the source in target node to source node transparent container.

So far, there are similar support for the two options. Seems down selection is not easy. The issue has been discussed for several meetings. Let’s check whether it is possible to agree both.

**Q1: Do you agree to support both Option 2a and Option 3a?**

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| --- | --- |
| Company | Comment |
| Huawei | We agree to support both as optional feature as compromise.  In addition, it is better to clarify that the above is only applicable to **scenario 1 and scenario 2** (i.e. not applicable for scenario 3 yet).  For option 2a, this means that only when the source MN has direct data forwarding path with the target node, it can trigger the query procedure.  And about the two WAs, we are fine with that. This WAs to agreement may depend on what we commented below.   * No CN impact. * No need to support the forwarding of MN-terminated bearers from the source MN to the source SN, then finally to the target node in case of NSA to SA handover. |
| CATT | Yes. To make progress, we are OK with the compromise.  To Huawei: We agree with your comments on the two WAs. However, for scenario 3a,we think it is better for the MN to check the availability of direct data forwarding path in source SgNB to support the direct data forwarding between source SgNB and target node since we all agree to support scenario 3 best effort without signaling impact. |
| CMCC | Ok with the compromise |
| Radisys | Just wondering if both the solutions are available, then how will target node know which way to go for DF? |
| ZTE | We are fine with the compromise |
| Ericsson | No. Agreeing 2 solutions for the same use-case is an exception which is (very) rarely used in RAN3. Especially if this is “only” a correction. I don’t think the issue is so big that companies cannot compromise and find a common solution.  Also agree with Radisys’ comment. |
| Samsung | We could accept the compromise.  Reply to Radisys’ question:  Firstly I would like to clarify that the solution discussed is for scenario 1 and scenario 2.  Scenario 1: Both MN and SN has direct forwarding path with the target.  Scenario 2: MN has direct forwarding path with the target. SN has no.  If both Option 2a and Option 3a will be supported, it’s the source MN to decide whether queries the SN or includes “The Source SN” IE in the Handover Required message. In above two scenarios, the target will assign direct data forwarding tunnels.  If the target receives “The Source SN” IE, it will decide whether there is direct forwarding path between itself and this node. If there is, the target include “Direct Forwarding Path Availability” IE in the Handover Request Ack. Message. Without “the source SN ID IE received, the target node behavior is the same as the existing. So there is no ambiguity in the target node. |
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**Moderator Summary:**

6/7 companies are fine the compromise.

1/7 company is not ok.

**Proposal: For handover from EN-DC to NR SA HO, agree Option 2a and Option 3a as way forward.**

If the answer to Q1 is no, any other proposal for moving forward?

**Q2: Any other proposal for moving forward if the answer to Q1 is no?**

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| Company | Comment |
| CATT | Another compromise we could agree is to adopt option 2a for MR-DC to SA and option 3a for EN-DC to SA. The reason is that the decision of data forwarding proposal in EN-DC and MR-DC is different.  For handover from EN-DC to SA, the data forwarding proposal for SN terminated bear is decided by source MN node. However, for handover from MR-DC to SA, it is decided by source SN node. So, for handover from MR-DC to SA, anyway, the source MN would ask for data forwarding proposal towards source SN node before initiating HO preparation procedure, thus, it could check the direct data forwarding availability with the same message. With this, scenario 1, 2 and scenario 3a could be supported without any delay or extra specification impact in option 2a. So, at least, for MR-DC to SA, option 2a should be adopted. |
| Ericsson | Continue discussing next meeting |
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# Discussion (1st Round)

## TNL address allocation for handover to EN-DC

The operator may configure different IP address spaces for X2-U and Xn-U (e.g. IPv4 for X2-U and IPv6 for Xn-U, or X2-U is deployed on the legacy LTE transport network).

In the following two scenarios, the target eNB and en-gNB should assign corresponding TNL address for direct data forwarding from the source node. E.g. TNL address for X2-U in case A, TNL address for Xn-U in case B.

Case A: LTE to EN-DC

Case B: NR to EN-DC

In [1][2][3], two problems were identified for supporting direct data forwarding for handover in the above two scenarios:

* Problem 1: The target eNB does not know Direct Forwarding Path Availability between the source node and the target eNB. Only the source RAN node and the core network knows direct data forwarding or indirect data forwarding.
* Problem 2: The target SN is not aware of EPS to EPS handover or 5GS to EPS handover. Only the target M-eNB knows such information. The target M-eNB knows the handover is intra-system handover or inter-system based on the Handover Type IE.

To solve the two problems, the proposal is to include

* Direct Forwarding Path Availability IE in the source eNB to the target eNB transparent container.
* Handover Type IE in the X2AP SGNB ADDITION REQUEST message.

**Q1: Do you agree the proposal?**

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| --- | --- |
| Company | Comment |
| Samsung | Yes.  Otherwise, the target eNB and en-gNB cannot assign corresponding TNL address for direct data forwarding. |
| Nokia | Not sure about the indicator. But regarding the address type, this seems like more general problem and we would like to discuss it separately (perhaps it concerns also other types of a HO?). Here, let’s focus on the direct path availability. |
| Huawei | We acknowledge this issue: similar to what we agreed for the intra-5GS handover. But we think that the path availability IE in the container, may impact existing long-deployed LTE nodes, where the legacy target eNBs have already been able to provide proper TNL addresses. More thinking is needed from our side.  So we kind of agree with Nokia to focus on the handover involving MR-DC first at this meeting. Then this TNL topic can be to be continued. |
| Qualcomm | Agree with Huawei. Let’s focus on SN direct forwarding. |
| ZTE | Agree. Fine to postpone the discussion to address more important issues first. |
| Ericsson | Agree with Nokia et al. |
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Moderator Summary:

To be continued.

**Q2: If the answer to Q1 is yes, any comment on the CR in R3-220777 and R3-220778 [2][3]**

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| Company | Comment |
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## NR SA to MR-DC connected to 5GC Handover or SN change

The following agreements and the CR for TS36.423 in R3-216075 have been made at last RAN3#114e meeting for handover from NR SA to EN-DC:

**The target SN has information on direct forwarding path availability information between itself and neighboring source nodes.**

**In order to let the Target SN decides direct forwarding path availability between itself and the source NG-RAN, the following specification impact are needed:**

**- 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.**

In [4][5], it was observed that the agreed solution for handover from NR SA to EN-DC can also apply for handover from NR SA to MR-DC connected to 5GC and SN change in 5GS. The proposal is to agree the same change for TS38.423.

**Proposal: It is proposed to agree the following change to TS38.423 in order to support direct data forwarding for NR SA to MR-DC connected to 5GC Handover or SN change.**

**- 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.**

**Q3: Do you agree the proposal in order to support the NR SA to MR-DC connected to 5GC handover and SN change?**

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| --- | --- |
| Company | Comment |
| Samsung | Yes.  RAN3 had the following agreement at RAN3#113e.  The additional scenarios (i.e. intra-system SN change, and intra-system handover involving MR-DC) are considered, and it is expected to have a common design for all handover scenarios involving MR-DC.  The agreed mechanism for handover from NR SA to EN-DC can be applied to intra-system SN change and intra-system handover involving MR-DC. It’s reasonable to adopt the same changes to TS38.423. |
| CATT | Yes. |
| Nokia | All right…  BTW, I can’t see the title: |
| Huawei | Yes.  By this chance, I update the **Title** based on “v0” to help others to understand. |
| Qualcomm | Yes.  But, I also don’t understand the title 😊 |
| ZTE | Yes |
| Radisys | Yes |
| Ericsson | Ok |
| CMCC | Ok with the proposal |

Moderator Summary:

All companies agree the proposal.

**Agree the following change to TS38.423 in order to support direct data forwarding for NR SA to MR-DC connected to 5GC Handover or SN change.**

**- 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.**

## Direct data forwarding from EN-DC to NR SA HO

The following agreements have been made for handover from EN-DC to SA.

EN-DC to NR SA Handover:

direct data forwarding is possible between the source SN and the target NG-RAN node.

The source SN or the target NG-RAN node has information on the direct forwarding path between itself and neighboring nodes

The open question is whether the source SN or the target node decides direct forwarding path availability between the source SN and the target node for handover from EN-DC to SA. There are the following two options:

Option 2a: The source SN decides direct forwarding path availability between the source SN and the target node.

The source MN queries the source SN to get this information. The source MN transmits the information to the SMF. The SMF further transmits the information to the target node.

Option 3a: The target node decides direct forwarding path availability between the source SN and the target node. The target node transmits the information to the source in target node to source node transparent container.

The signaling flow for Option 2a:



Figure 1: The signaling flow for Option 2a:

The signaling flow for Option 3a:



Figure 2: The signaling flow for Option 3a:

**Q4: Is option 2a or option 3a your preferred solution for direct data forwarding from EN-DC to SA NR?**

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| --- | --- |
| Company | Comment |
| Samsung | Option 3a  The benefits of Option 3a is that the existing handover signaling flow is not impacted.  While for Option 2a, a new procedure is inserted between Handover Required and Handover Command message. New state machines have to be designed in implementation. Currently, the Source MeNB is waiting for Handover Command message after sending out Handover Required message.  The main argument for Option 3a is based on Scenario 3. Whether scenario 3 will be supported is not confirmed yet. To support scenario 3, both Option 2a nor Option 3a should be enhanced. The current solution as it is cannot work. There is no blocking point for supporting scenario 3 no matter Option 2a or Option 3a is concluded.  With above clarification, it could be observed that there is no drawback for the target NG-RAN node to decide i.e. Option 3a. |
| CATT | Option 2a  Normally, we first discuss scenarios that should be supported and then make decision on solutions for all supported scenarios. Here, we would like to adopt the similar procedure.  On the scenarios, we suggest to support scenario 3 if there is no big specification impact with the existing solutions on the table considering support of direct data forwarding between DC and SA in scenario 3 would bring much more benefit i.e. avoid the involvement of core network for data forwarding. To facilitate the discussion, scenario 3 is further divided into 2 sub-scenarios.  Scenario 3a: MN has no direct forwarding while SN has direct forwarding. At the same time, only flows/DRBs terminated in SN node needs to do data forwarding.  Scenario 3b: MN has no direct forwarding while SN has direct forwarding. At the same time, flows/DRBs terminated in both MN node and SN node needs to do data forwarding.  It is obvious that option 3a could support neither scenario 3a nor scenario 3b unless introduce extra impact to CN node. The impact to spec is significant. What’s more, with current option 3a, if there is no indirect data forwarding path available in core network, data forwarding between source SN and target node could not be supported in option 3a even there is direct path between source SN and target node.  Then for option 2a, obviously, in scenario 3a,it could support direct data forwarding between source SN and target node without any extra effort. In scenario 3b,if the source MN and source SN belong to the same vendor, it is still possible to support direct data forwarding between source MN and target node via implementation, i.e. MN could forwards the data to SN via implementation and then SN forward to the target node directly. However, if the source MN and source SN belong to different vendor, then further Xn impact on top of current option 2a is foreseen to support scenario 3b.It depends on the group whether further enhancement on option 2a is acceptable.  In summary, the current option 2a could support scenario 1,2,3a in all cases and also scenario 3b by implementation. On the other hand, current option 3a could only support scenario 1 and 2.  If RAN3 decides to support all scenarios completely, only XnAP impact is foreseen based on option 2a while significant impact on CN node is foreseen for option 3a. |
| Nokia | We do not have strong opinion, but 2a seems like having less impact, so may be preferred. |
| Huawei | Option 3a. It seems better to let the target node to decide. |
| Qualcomm | Agree with Nokia. Option 2a has less impact. |
| ZTE | Option 3a |
| Radisys | Option 3a |
| Ericsson | Option 3a |
| CMCC | Agree with Nokia, CATT and Qualcomm, option 2a |

**Moderator Summary:**

5/9 companies support Option 3a

3/9 companies support Option 2a. 1 company has no strong preference but may prefer Option 2a.

To be continued

## Scenario 3 (MN has no direct forwarding, SN has direct forwarding)

The scenario 3 is marked with FFS as follows. This is applicable both for EN-DC to NR SA handover, and NR SA to EN-DC handover.

***- Scenario 3 (FFS): MN has no direct forwarding, SN has direct forwarding***

### Inter-system handover from NR SA to EN-DC

In inter-system handover from NR SA to EN-DC case, the open point for scenario 3 is whether direct data forwarding should be performed from the source NG-RAN node to the target SN in the following scenario?

* Source NG-RAN node has no direct data forwarding path with the target eNB
* Source NG-RAN node has direct data forwarding path with the target en-gNB

**Q5: Do you think direct data forwarding for scenario 3 should be supported for inter-system HO from SA NR to EN-DC?**

|  |  |
| --- | --- |
| Company | Comment |
| Samsung | From technical point of view, it’s feasible to support direct data forwarding from NR SA to EN-DC in scenario 3.  We are fine to support direct data forwarding for scenario 3. |
| CATT | We prefer to support scenario 3 if there is no big specification impact with the solutions on table. In another word, we need to consider the pains and gains on support of this scenario. |
| Nokia | Yes, if no more changes are required on top of the information exchange concerning direct path availability.  BTW, I can’t see the title: |
| Huawei | Yes. In our view, this is already supported. It seems no specification impact is needed. |
| Qualcomm | Yes.  In current standard, indirect forwarding via core network is used for this scenario. This is quite inefficient.  It should be possible to support direct forwarding to SN and via SN with small standard enhancements. |
| ZTE | Yes |
| Radisys | Yes |
| Ericsson | Ok if no additional impact compared to current discussion |
| CMCC | Ok to support scenario 3 for SA to EN-DC HO |

**Moderator Summary**

5 companies are ok to support Scenario 3.

1 company said yes if there is no big specification impact with the solutions on table

1 company support scenario 3 if no more changes are required on top of the information exchange concerning direct path availability.

1 company said yes this is already supported.

1 companies said yes if no additional impact compared to current discussion

Based on above feedback, the moderator propose to agree the WA to support scenario 3. Then we continue to discuss the solutions for Scenario 3.

WA: Support direct data forwarding from the source NG-RAN node to the target SN in scenario 3. Continue to discuss the solutions. Whether the WA will be changed to the agreement is depending on the specification impact.

### Inter-system handover from EN-DC to SA

In inter-system handover from EN-DC to NR SA case, the open point for scenario 3 is whether direct data forwarding should be performed from the source SN to the target NG-RAN node in the following scenario?

* Source eNB has no direct data forwarding path with the target NG-RAN node
* Source en-gNB has direct data forwarding path with the target NG-RAN node

**Q6: Do you think direct data forwarding for scenario 3 should be supported for inter-system HO from EN-DC to SA?**

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| --- | --- |
| Company | Comment |
| Samsung | We are fine to support direct data forwarding for scenario 3. |
| CATT | We prefer to support scenario 3 if there is no big specification impact with the solutions on table. In another word, we need to consider the pains and gains on support of this scenario. |
| Nokia | Yes, if no more changes are required on top of the information exchange concerning direct path availability.  BTW, I can’t see the title: |
| Huawei | Depends.  This can be studied, but it depends whether or what the specification impact is. Our thinking is that:   * No CN impact. * No need to support the forwarding of MN-terminated bearers from the source MN to the source SN, then finally to the target node. |
| Qualcomm | Yes |
| ZTE | Yes |
| Radisys | Yes |
| Ericsson | Ok if no additional impact compared to current discussion |
| CMCC | Ok to support scenario 3 |

**Moderator Summary**

5 companies are ok to support Scenario 3.

1 company said yes if there is no big specification impact with the solutions on table

1 company support scenario 3 if no more changes are required on top of the information exchange concerning direct path availability.

1 companies said yes if no additional impact compared to current discussion

1 company think “Depends”. It’s ok if No CN impact and No need to support the forwarding of MN-terminated bearers from the source MN to the source SN, then finally to the target node.

Based on above feedback, the moderator propose to agree the WA to support scenario 3. Then we continue to discuss the solutions for Scenario 3.

WA: Support direct data forwarding from the source SN to the target NG-RAN node in scenario 3. Continue to discuss the solutions. Whether the WA will be changed to the agreement is depending on the specification impact.

# Conclusion, Recommendations [if needed]

If needed

# References

[1] R3-220776, Direct Data forwarding address allocation for handover to EN-DC (Samsung, Verizon Wireless, ZTE)

[2] R3-220777, Direct forwarding address allocation for handover to EN-DC (Samsung, Verizon Wireless, ZTE)

[3] R3-220778, Direct forwarding address allocation for handover to EN-DC (Samsung, Verizon Wireless, ZTE)

[4] R3-220957, Discussion on direct data forwarding for mobility between DC and SA (Samsung, Huawei, ZTE)

[5] R3-220674, Direct data forwarding for mobility between DC and SA (Huawei, Samsung, China Telecom, ZTE)

[6] R3-220774, Direct data forwarding for mobility between DC and SA (Samsung, Huawei, ZTE)

[7] R3-220775, Direct data forwarding for mobility between DC and SA (Samsung, Huawei, ZTE)

[8] R3-220260, SN direct data forwarding in inter-system handover (Qualcomm Incorporated)

[9] R3-220539, Discussion on direct data forwarding for mobility between DC and SA (CATT,Qualcomm,CMCC)

[10] R3-220540, Support of direct data forwarding for mobility from MR-DC to SA (CATT,Qualcomm,CMCC)

[11] R3-220548, Direct data forwarding in EN-DC to NR SA handover (CR to 36.413) (Qualcomm Incorporated, CATT, CMCC)

[12] R3-220601, Direct data forwarding in EN-DC to NR SA handover (CR to 36.423) (Qualcomm Incorporated, CATT, CMCC)

[13] R3-220879, CR on data forwarding from MR-DC to SA\_NGAP (CMCC. CATT, Qualcomm)

[14] R3-220880, CR on data forwarding between EN-DC MR-DC and SA handover (CMCC. CATT, Qualcomm)