

RAN-R18-WS-eMBB-China_Unicom - Version 0.0.5
RAN

3GPP TSG RAN Rel-18 workshop

RWS-210518

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.1

Source: China Unicom

Title: Email discussion summary for [RAN-R18-WS-eMBB-China_Unicom]

Document for: Information

1 Introduction

This email discussion summary covers the following documents:

RWS-210384 Motivation of Mobility enhancement for FR1 and FR2 in R18

Questions and comments followed responses from China Unicom will be collected in this document as per the deadlines provided by the RAN chair. Feedback forms will be opened and closed according to those deadlines.

Round 1 Q&A: Questions: June 14 08:00 UTC – June 17 8:00 UTC; Answers: June 17 8:00 UTC – June 18 23:59 UTC.

Round 2 Q&A: Questions: June 21 08:00 UTC – June 23 8:00 UTC; Answers: June 23 8:00 UTC – June 24 18:00 UTC.

2 Discussion

2.1 General comments and questions

For general comments and questions, please use the feedback form below.

2.1.1 1st Round Comments/Questions

Feedback Form 1: General comments and questions for 1st Round

1 – China Mobile International Ltd

In general, we are fine to have mobility enhancement in Rel-18. From commercial usage point of view, except for inter-frequency scenario, we can also give focus on intra-frequency and the simple solution which does not rely on high UE capability

2.1.2 1st Round Answers

To CMCC's question:

Thanks for your constructive suggestion. We share the same view that both inter-frequency and intra-frequency scenarios can be supported in R18 mobility enhancement with less impact on UE capability.

2.1.3 2nd Round Comments/Questions

Feedback Form 2: 2nd Round Comments/Questions

2.1.4 2nd Round Answers

2.2 DAPS enhancement for NR-CA/MR-DC

For 5G new service, service continuity and quality should be guaranteed simultaneously in NR-CA/MR-DC scenarios. While DAPS HO in MR-DC/NR-CA is not supported in R16 and R17, DAPS HO can be enhanced in FR1&FR2 NR-CA/MR-DC network. Thus, it is proposed to study and specify solution(s) to support "0ms" handover interruption as well as guarantee service continuity and quality in FR1&FR2 NR-CA/MR-DC network.

2.2.1 1st Round Comments/Questions

Feedback Form 3: Comments and questions on DAPS enhancement for NR-CA/MR-DC

1 – Apple Hungary Kft.

[Apple] We also think DAPS is one of the ways to improve mobility further, while we do acknowledge that it comes with additional complexity for low cost UEs.. But this can be studied.

2 – ZTE Corporation

We want to clarify whether the DAPS enhancement for MR-DC imply the UE should maintain more than two active connections simultaneously (i.e. connections with source MN+SN and connections with target MN+SN)?

3 – Lenovo (Beijing) Ltd

We agree that DAPS supporting DC/CA should be supported in Rel-18 to achieve the higher performance. We have the similar proposal in RWS-210283. Considering the UE complexity, we can restrict the maximum number of the active serving cell in source and target node.

4 – Beijing Xiaomi Mobile Software

Throughput during DAPS need to be improved to support new services, e.g. XR. But in the meantime, UE complexity should be considered.

5 – China Mobile International Ltd

Similar question as ZTE, whether the DAPS enhancement for MR-DC imply the UE should maintain more than two active connections simultaneously

6 – CATT

We think this is a good direction for further discussions, especially for the cases when both high data rate and continuous user experience are required. There might be concern on UE complexity, but that may not be a show stopper for at least some ue types (high end UEs, or TV camera type of devices for example)...

7 – HuaWei Technologies Co.

Do you think DAPS with CA/DC would require even stronger UE capability, i.e. supporting 4 legs at the same time?

2.2.2 1st Round Answers

To Apple's question:

Thanks for your constructive suggestion. We share the same view, low cost UEs with DAPS can be further studied.

To ZTE, CMCC and Huawei's question:

Thanks for your constructive suggestion.

For NR-CA and MR-DC, there are 2 scenarios. For scenario1, when UE moves from different FR2 Scells/SNs, UE can keep the Pcell/MN and source Scells/SNs unchanged, and then connect to the target Scell/SN simultaneously. In scenario 1, UE need to connect to the gNB with 3 legs. For scenario2, when UE moves from different FR2 Scells/SNs, UE keep the Pcell/MN and source Scells/SNs unchanged, and then connect to the target Pcell/MN and Scell/SN simultaneously. In scenario 2, UE need to connect to the gNB with 4 legs.

To Lenovo and Xiaomi's question:

Thanks for your constructive suggestion. UE complexity should be taken into consideration in R18 mobility enhancement, and details for restriction of the maximum number of the active serving cell in source and target node can be further studied.

To CATT's question:

Thanks for your constructive suggestion. We agree with that DAPS can be enabled at least some UEs e.g. high end UEs, XR terminals or TV camera type of devices.

2.2.3 2nd Round Comments/Questions

Feedback Form 4: 2nd Round Comments/Questions

1 – CATT

Thanks for your response in the 1st round. Seems our thinking aligned here. Then we think at this stage it may be quite useful to first discuss and confirm with companies the gap/motivation for mobility enh. for the case that both high data rate and non interruption are required. This we think is one important technical direction in R18 mobility enh.

2 – ZTE Corporation

Thanks for the clarification. For the DAPS with MR-DC, it seems the intention is to support three or four active legs in the DAPS HO. Since only two active connections can be supported in current MR-DC, we want to clarify whether the MR-MC (e.g. Multi-connectivity with 2 or 3 active SCG) is some kind of prerequisite of this feature? We are open to discuss this but we think the complexity should be taken into account to ensure the feature can be implemented and deployed in the market.

2.2.4 2nd Round Answers

To CATT's question:

Thanks for your constructive suggestion. Generally, the technical enhancement solutions need to be discussed and clarified at this stage, and gap/motivation can be discussed and confirmed at the WI stage. We are open to discuss gap/motivation if most companies want to discuss

To ZTE's question:

Thanks for your constructive suggestion. We agree that for MR-MC case that 2 or 3 active SCGs are needed to support if DAPS combining with MR-DC. The complexity of UE implementation is one of the most important aspects need to be discussed in R18.

2.3 Signalling overhead optimization for NR dense deployment scenario

For NR dense deployment scenario, frequent handover and cell reselection will consume lots of signalling overhead. When the UE moves along within the area of multiple SNs, the delay and signalling overhead of SN Change also need to be optimized. In this scenario, some solutions can be studied and specified, such as Make-before-break, RACH-less HO, and CHO-like (e.g. preconfigure a target cell list) solution.

2.3.1 1st Round Comments/Questions

Feedback Form 5: Comments and questions on Signalling overhead optimization for NR dense deployment scenario

1 – Apple Hungary Kft.

[Apple] We acknowledge on the improvement of mobility further and support this direction.

2 – Lenovo (Beijing) Ltd

DAPS is MBB-like handover according to the discussion in Rel-16. DAPS also can be applied to the UE with only one RX, which can not achieve zero interruption. I am not sure what is the difference between MBB based HO and DAPS.

For CHO-like, my understanding is that CHO-like is applied to SN change. In legacy, CHO configuration is based on the source configuration (delta configuration). If UE receives the CHO-like configuration in SN1 and switches from SN1 to SN2, i wonder if the CHO-like configuration is still available since the source configuration is different.

3 – vivo Mobile Communication Co.

Thanks for the nice contribution, we are very supportive on this working area in Rel-18, with several questions:

1. It seems that the solution Make-Before-Break is not include in your proposal, we would like to check the intention or any problem?

4 – Beijing Xiaomi Mobile Software

CHO-like solution could improve the mobility performance in FR2.

5 – China Mobile International Ltd

We could like to clarify what's the meaning of CHO-like solution

6 – Intel Corporation (UK) Ltd

Proposal 5 continuous handover solution

- Does that mean the UE should maintain the CHO configuration after HO/CHO?•

2.3.2 1st Round Answers

To Lenovo and CMCC's questions:

Thanks for your constructive suggestion. For MBB solution, UE keeps the connection with source cell before UE sends preamble. For DAPS solution, UE can connect and transmit data with source and target cell simultaneously. That's the difference between two solutions. If only 1RX, it is up to UE implementation to achieve zero interruption with DAPS solution.

Considering the pre-configured solution, network side can maintain a target cell configurations list (e.g. SN1, SN2, SN3...) based on the source configuration (delta configuration) for some time when UE move. One possible solution is that when UE switch from different SNs, it can retrieve the delta configuration from the list based on the first source gNB (SN1) configuration.

To vivo's questions:

Thanks for your constructive suggestion. MBB is already taken into consideration.

To Xiaomi's questions:

Thanks for your constructive suggestion. We share the same view CHO-like solution for FR2 should be

supported in R18 mobility enhancement.

To Intel's questions:

Thanks for your constructive suggestion. Considering the source gNB is not changed, the CHO configuration after HO/CHO will remain the same configuration.

2.3.3 2nd Round Comments/Questions

Feedback Form 6: 2nd Round Comments/Questions

1 – CATT

Looking at companies discussions we tend to agree that this is one topic for further discussions. Also we would like to point out that this issue/requirement might also be alleviated by some other means, e.g., multiple connectivity. But we agree that in this stage we can first clarify the gap/requirements. And we could discuss on technical enhancements a bit later, so that the work is organized in an efficient manner.

2.3.4 2nd Round Answers

To CATT's question:

Thanks for your constructive suggestion. For the low-cost/RedCap UE, MBB and RACH-less enhancements are easier to implement. It's OK to clarify the gap/requirements at this stage, but technical enhancements can be discussed on how to decide the potential solutions.

2.4 Mobility enhancement for 5G RAN sharing scenario

When the RAN sharing UE moves out from cell edge area of 5G RAN sharing network, RAN sharing UE cannot fast reselect to the 4G/5G non-sharing network with the same PLMN. While UE fails to reselect to 4G/5G non-sharing network within the same frequency band, this issue will increase time delay for reselection and decrease user experience.

2.4.1 1st Round Comments/Questions

Feedback Form 7: Comments and questions on Mobility enhancement for 5G network sharing scenario

1 – Apple Hungary Kft.

[Apple] We see value in this for RAN sharing, but we are wondering on what improvements would be needed during HO, as this is completely under NW control. We are willing to see views from other companies.

2 – ZTE Corporation

We want to clarify whether the proposal is mainly for the RAN sharing enhancement in intra-frequency

cell re-selection?

For the HO case, considering NW has clear information for the PLMNs supported in every neighbour cell, it is not clear whether any additional information is needed.

3 – Intel Corporation (UK) Ltd

UE in RAN sharing network to quickly re-select to the same PLMN non-sharing network in edge of MR-DC/NR-CA network.

- what do you expect in terms of UE specification change for MR-DC?

4 – Samsung Electronics Co.

We are positive on further mobility enhancements. Please see our questions below:

Q1: Regarding FR1&FR2 NR-DC/CA, we wonder the scenarios and expected gain.

Q2: Make-before-break already introduced in LTE is so beneficial, especially for UEs with low capabilities, e.g. with single transceiver. We wonder what the expected spec impact is for NR, compared to LTE Make-before-break.

Q3: In Rel-16, RAN2 considered, but didn't introduce RACHless because the gain due to RACHless can be replaced by 2-step RA. However, we have assumed RACHless is still beneficial because 2-step RA would be initiated only with good link quality. Since LTE RACHless would be a baseline, in high-level, we wonder what we should improve RACHless for NR.

Q4: The combination of DAPS HO and CHO could mean two different intentions as follows:

Intention 1 - DAPS HO is triggered upon a certain condition is met, or

Intention 2 - DAPS HO can be commanded (unconditionally) to the UE with CHO configuration

Thus, we wonder the exact intention on DAPS HO + CHO, i.e. intention 1, intention 2 or both.

Q5: We wonder what expected gain is with DAPS HO + CHO.

5 – Nokia Corporation

We share your view that mobility and CA/DC enhancements are important area for Rel-18 enhancements. We also see enhancements needs on similar area as you.

Is the proposal that the UE retains the CHO and CPAC configuration after the handover/cell change is performed?

P6: Can you clarify a bit more the problem/use case as this proposal is not fully clear to us?

P11: In our view potential gains should be studied first.

2.4.2 1st Round Answers

To Apple, ZTE, Intel, Nokia's questions:

Thanks for your constructive suggestion. In the IDLE/Inactive state, when the UE (operator 2 with PLMN ID 2) moves from operator 1 RAN sharing network (PLMN ID 1), it will first reselect to the non-sharing network of operator 1 according to PLMN priority (PLMN ID 1), and UE will be rejected to access the non-sharing network of operator 1. After that, UE will reselect to operator 2 network according to PLMN 2 (stored with secondary PLMN), this will cause extra delay for reselection. It is proposed to consider the RAN sharing information for UE to fast reselect to the right non-sharing cell. Details can be further discussed.

To Samsung’s question:

Thanks for your constructive suggestion.

For Q1: Both FR1 and FR2 are critical for commercial deployment, besides that, service continuity and reliability with high UE experience are expected to achieve in R18 mobility enhancement.

For Q2: Take LTE based MBB as baseline, further investigated enhancement for NR if needed.

For Q3: Take LTE RACH-less would be a baseline, RACH-less enhancement for NR can be supported in R18.

For Q4: Intention 2 is slightly preferred, and other solutions are not precluded. For intention 2, if UE is not triggered to handover to the target cell under CHO configuration, the gNB can send the DAPS HO command to the UE, which can reduce the HO delay and improve the HO success rate.

For Q5: That depends on the further discussion in working group.

To Nokia’s questions:

Thanks for your constructive suggestion. Considering the source gNB is not changed, the CHO configuration after HO/CHO will remain the same configuration.

2.4.3 2nd Round Comments/Questions

Feedback Form 8: 2nd Round Comments/Questions

<p>1 – Intel Corporation (UK) Ltd</p> <p>Q1: For RAN sharing scenario, Should not the UE will use equivalent PLMN for RAN sharing scenario instead of PLMN ID 1 directly if PLMN ID 1 only does not allow the UE access? And then the UE will not select the cell if only PLMN ID 1 is broadcasted.</p>
<p>2 – China Telecommunications</p> <p>Q□When an UE of PLMN#2 accesses to a sharing network (PLMN#1 and PLMN#2), does the UE get the information of equivalent PLMNs from plmn-IdentityList in SIB1? Or how an UE get the information of its equivalent PLMNs ?</p>

2.4.4 2nd Round Answers

To Intel’s question:

Thanks for your constructive suggestion. Some detail clarification are provided for this RAN sharing scenario. The RAN sharing network can broadcast a list of PLMN IDs containing at least two operators. If the UE can only camp on a PLMN from one operator, the equivalent PLMN is not necessary. In the NR specification, cell reselection in Idle/Inactive mode is according to frequency priority in the PLMN list. If there exists two non-sharing networks, the cell reselection priorities cannot be configured for different PLMN IDs. In this case, it will lead to consequence that UE is not able to quickly reselect to the operator’s non-sharing network of home PLMN ID (or reselection failure happened).

To CTC's question:

Thanks for your constructive suggestion.

If a UE of PLMN#2 accesses to sharing network, the UE can access successfully, since the PLMN#1 and PLMN#2 are both broadcast in SIB1. There is no need to configure equivalent PLMN IDs, and the equivalent PLMNs information are transferred in NAS message.

2.5 L1/L2 based mobility enhancement

When gNBs are co-located deployed and the timing is obviously synchronized, L1/L2 based mobility enhancement will reduce the latency compared with L3 controlled mobility solutions. With L1/L2 solution, the serving SN/Scell is expected to fast switch from source SN/Scell to target SN/Scell during the UE mobility. L2 solution is easier to implement to support both intra-frequency and inter-frequency scenario.

2.5.1 1st Round Comments/Questions

Feedback Form 9: Comments and questions on L1/L2 based mobility enhancement

<p>1 – Apple Hungary Kft.</p> <p>[Apple] We agree on rel-18 as a good candidate for further enhancements to L1/L2 mobility building on top of Rel-17 framework.</p>
<p>2 – ZTE Corporation</p> <p>We want to clarify the definition of L1/L2 based mobility. Does it refer to the L1/L2 centric mobility without RRC involved (i.e. similar to the L1/L2 centric mobility discussed in Rel-17 FeMIMO for scenario 1, for which the RRC will only be used to provide some kind of pre-configurations, but will not be involved during the mobility procedure) or it refers to the L1/L2 triggered L3 mobility (i.e. RRC procedure will be performed once the mobility is triggered by L1/L2 command)?</p>
<p>3 – Lenovo (Beijing) Ltd</p> <p>Similar discussion happened in L1/L2 centric mobility of Rel-17 FeMIMO, which is restricted to the intra-DU and intra-frequency. Do you aim to extend the L1/L2 centric mobility of Rel-17 FeMIMO?</p>
<p>4 – Beijing Xiaomi Mobile Software</p> <p>Similar question as other companies, does this L1/L2 mobility result in L3 handover?</p>
<p>5 – China Mobile International Ltd</p> <p>Does it propose to introduce the L1/L2 mobility that is under discussion at RAN#92e to inter-SN change?</p>
<p>6 – LG Electronics France</p> <p>Q1) For L1/L2-based mobility enhancement, could explain more about the expected mechanism from protocol perspective? Can CHO-like pre-configuration be applied with L1/L2 mobility mechanism?</p>

7 – HuaWei Technologies Co.

We share similar views that dynamic switch via L1/L2 signaling to support inter-cell mobility can improve the performance as in RWS-210449. We understand this does not involve L3 HO, right?

8 – Nokia Corporation

In our view potential gains should be studied first.

2.5.2 1st Round Answers

To Apple’s questions:

Thanks for your constructive suggestion. We share the same view with you L1/L2 mobility can be enhanced in R18.

To ZTE, Xiaomi, LG, Huawei’s question:

Thanks for your constructive suggestion. L1/L2 centric mobility solution can be supported in R18, and other potential enhancement solutions are not precluded.

To Lenovo and CMCC’s question:

Thanks for your constructive suggestion. We prefer to extend L1/L2 centric mobility scenarios with inter-DU and inter-cell into consideration.

To Nokia’s question:

Thanks for your constructive suggestion. Details on the L1/L2 solution can be further discussed, and potential gains can be studied.

2.5.3 2nd Round Comments/Questions

Feedback Form 10: 2nd Round Comments/Questions

2.5.4 2nd Round Answers

2.6 Other enhancement features

Some features can be further studied for enhancement, i.e. CHO with NG interface or/and inter-RAT CHO, CHO combination with CPAC, CHO combination with CPAC and inter-RAT PScell change.

2.6.1 1st Round Answers

Feedback Form 11: Comments and questions on other enhancement features

1 – Apple Hungary Kft.

[Apple] We agree with CHO improvements that can be added as part of Rel-18. Inter-RAT CHO is a viable improvement.

2 – ZTE Corporation

For the inter-RAT CHO, we want to clarify whether it only refers to the CHO between eLTE and NR (e.g. inter-system CHO is not in the scope)?

3 – Lenovo (Beijing) Ltd

We agree the combination of CHO and CPAC (and DAPS) can be supported.

4 – vivo Mobile Communication Co.

2. In the CHO-like solution, what is the enhancement? We think keep the current configuration without releasing will highly reduce the efficiency for reserved system resource.

5 – Guangdong OPPO Mobile Telecom.

Thanks for the sharing the comprehensive consideration on mobility enhancement. Two questions for clarification:

Q1: Mobility issue seems severer for FR2 than FR1. Is it better to focus on FR2 scenario?

Q2: The current scope seems quite large. Do you have any prioritized objectives in mind? If yes, which ones?

6 – Beijing Xiaomi Mobile Software

CHO+DAPS may be used to achieve 0 interruption and high robustness at the same time for some stringent service.

7 – CATT

We also think the combination of existing features could be considered, and it seems low hanging fruit but not considered due to lack of time in previous release.

8 – Ericsson LM

Questions for proposals in RWS-210384:

Proposal 3: Are you here referring to the Rel-14 LTE make-before-break solution? Or an enhanced version of it?

Proposal 4: Is handover the main use case for RACH-less in your view?

Proposal 10: Would it not be more interesting to speed up EN-DC to NR-DC and vice versa?

9 – ITRI

Thanks for the proposals. We see the necessity of studying solution(s) to support CHO aligned with CPAC in Rel-18. When supporting CHO aligned with CPAC, we would like to know is it possible that the CHO and CPAC are executed at the same time.

2.6.2 1st Round Answers

To Apple's question:

Thanks for your constructive suggestion. We have the same view that inter-RAT CHO is a viable improvement.

To ZTE's question:

Thanks for your constructive suggestion. Our preference is inter-RAT inter-system CHO in a high priority.

To Lenovo, Xiaomi's question:

Thanks for your constructive suggestion. We share the same view that CHO and CPAC (and DAPS) can be supported.

To vivo's solution:

Thanks for your constructive suggestion. In our pre-configured solution, the network can keep a target cell configurations list (e.g. SN1, SN2, SN3...) based on the source configuration (delta configuration) for some time when UE move. One possible solution is that when UE switch from different SNs, it can retrieve the delta configuration from the list based on the first source gNB (SN1) configuration. It need to further investigate the efficiency of resource utilization.

To OPPO, CATT's question:

Thanks for your constructive suggestion.

For Q1: Further to discuss the scope on FR1 and FR2. FR2 scenario is considered in the scope of mobility enhancement. From operator side, it is very hard to deploy 5G network only in FR2 band.

For Q2: The following features should be considered in high priority, i.e. DAPS enhancement in NR-CA/MR-DC, MBB, RACH-less, CHO-like solution, L1/L2 mobility solutions, RAN sharing mobility solution, and inter-RAT CHO, DAPS+CPAC/CHO, CHO+CPAC, etc.

To Ericsson's question:

Thanks for your constructive suggestion.

For Q1: Take LTE based MBB as baseline, further investigated enhancement for NR if needed.

For Q2: In our opinion, RACH-less can also be applied for SN changes.

For Q3: Yes, EN-DC to NR-DC scenario with inter-RAT PScell change is very close to commercial deployment, we would like to support for this scenario in R18 mobility enhancement.

To ITRI's question:

Thanks for your constructive suggestion. From our view, it is possible that CHO and CPAC are executed at the same time, but details can be further discussed.

2.6.3 2nd Round Comments/Questions

Feedback Form 12: 2nd Round Comments/Questions

1 – ZTE Corporation

Thanks for the clarification. For the inter-RAT inter-system CHO, we also see some benefits and support this feature. In addition, considering some changes may be required in SA2, we think SA2 should be involved as well to confirm the feasibility.

2.6.4 2nd Round Answers

To ZTE's question:

Thanks for your constructive suggestion.

We share the same view with you, the discussion with SA2 may be needed to confirm the feasibility of inter-RAT inter-system CHO.

3 Summary

There are 16 companies have been participated in two rounds discussion on mobility enhancement for both FR1&FR2 bands and thanks for their valueable comments. The following aspects were discussed and clarified:

1. Both inter-frequency and intra-frequency scenarios need to be supported in R18 mobility enhancement.
2. UE implementation complexity, i.e. 3 legs or 4 legs, should be taken into account when discussing on DAPS solutions for mobility enhancement.
3. MBB solution, RACH-less solution may be supported in R18 mobility enhancement and if supported, the LTE solutions can be taken as baseline, and further discussions on whether to support MBB and RACH-less solutions are needed.
4. Mobility issue in 5G RAN sharing scenario is discussed, and it is clarified that this issue is related with UE in IDLE/IACTIVE state.
5. L1/L2 based solutions for mobility enhancement have been discussed, i.e. L1/L2 centric solution, L1/L2 triggered solution,etc. One company propose to study potential gain of L1/L2 solutions.
6. Other mobility enhancement solution ,i.e. inter-RAT inter-system CHO, CHO+CPAC, (CHO and/or CPAC) +DAPS, need further discussion whether to support in R18 mobility enhancement topic.

In summary, 16 companies participate into discussion on L1/L2 based mobility solutions, DAPS enhancement,

CHO+CPAC, (CHO and/or CPAC) +DAPS, MBB, RACH-less and other potential. Therefore, it is quite clear that the mobility enhancement shall be supported in Rel-18, and the service continuity, high quality of user experience should be guaranteed.

4 Reference

[1] RWS-210384 Motivation of Mobility enhancement for FR1 and FR2 in R18