3GPP TSG-RAN WG3 #119bis-e R3-231892

17th – 26th April 2023

Online

Agenda Item: 17.2

Source: Samsung (moderator)

**Title: Summary of Discussion on CB: # NTN1\_ServiceContinuity**

Document for: Discussion & Decision

# Introduction

This document is used for discussion and decision for the CB as follows,

**CB: # NTN1\_ServiceContinuity**

**- Cell ID exchanged via Xn Setup and Configuration Update messages?**

**- Multiple TACs over Xn?**

**- Details of time-based HO info over NG, e.g., time-related info, data forwarding enhancement?**

**- Any other issues?**

**- Capture agreements and provide TPs if agreeable**

(moderator - SS)

Summary of offline disc

This CB is planned to be carried out in two rounds:

Round 1: Till EOM of Friday, the first week. Collect comments for open issues.

Round 2: Prepare TPs according to the outcome of Round 1.

# For the Chairman’s Notes

**Agreements:**

**xxxx**

**Open issues:**

**xxxx**

# Discussion (Round 1)

## Cell ID and TAC(s)

The Cell ID exchanged by Xn Setup and Configuration Update has been discussed for several meetings.

Regarding this issue,

Samsung [1] proposes: **Proposal 1: It is suggested to use Uu cell ID associated with multiple TACs to be exchanged via Xn setup and Configuration Update procedures.**

Qualcomm, CATT, Nokia and NEC [2] proposes: **Proposal 1: Uu Cell ID is used in Xn procedures as per legacy behavior for NTN. Endorse the TP to TS 38.300**

China Telecom [11] proposes: **Proposal 1: Uu cell ID should be used over Xn Setup/Configuration Update procedure, if the Served Cell Information NR is exchanged between two NTN-gNBs.**

CATT [12] proposes:

**Proposal 1: Uu Cell ID should be used in Xn Setup and Configuration Update procedures. Proposal 3: The Xn procedures could follow legacy behaviours by using Uu Cell ID and no issue is identified to Uu Cell ID in Xn procedures.**

ZTE [13] proposes: **Proposal 1: Exchange the mapped cell ID with single TAC over Xn for non-UE associated Xn procedures.**

Huawei [15] proposes: **Proposal 1: There is no need to specify the cell ID usage for all the cases including the non-UE associated message like Xn setup request.**

In summary, there are three options on the table:

**Option 1**: Uu Cell ID

**Option 2**: Mapped Cell ID

**Option 3**: No need to specify the Cell ID usage

Compared to the last meeting,

The proponents of Option 1 additionally provide the following explanations [2],

**Observation 1: Since PCI is associated to Uu Cell ID, the mapped cell ID will have time varying PCI in EMC case. If mapped cell ID is used for Xn setup and config update messages, then PCI needs to be updated which increases the Xn signaling.**

**Observation 2: When Mapped Cell ID falls in the overlapping area of two or more Uu Cell IDs, then one Mapped Cell ID will have multiple PCIs.**

**Observation 5: TN neighbors sending Uu Cell ID over Xn and NTN neighbors sending Mapped Cell ID over Xn will cause confusion at the receiving node.**

The proponent of Option 3 additionally provide the following explanation [15],

*We are wondering is there really a need to specify clearly the cell ID usage for all the cases. The NR CGI is at least also used in cell activation and node configuration update in Xn; F1 setup request, GNB-DU/GNB-CU configuration update, Resource Status Report/Update, UE context setup, Access success, initial UL RRC Message and Paging in F1; and E1 setup request in E1. In our understanding, with the OAM effort, which is anyway needed, each node should know the mapping relationship of mapped cell ID and Uu cell ID at a certain time. Then we do not see the need to specify cell ID usage for all the cases, and RAN3 has never discussed the other cases.*

1. There are many other appearance of cell IDs in various interfaces, whose cell ID usage has never been discussed.

So we’d like to ask,

**Q1: Regarding the Cell ID exchanged via Xn Setup and Configuration Update procedure, which option would you prefer?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Ericsson | 3 | We agree with the analysis in [15] (but we also have some sympathy with the analysis in [12]: in general, NTN RAN is never going to be “plug and play”. In principle, all options could work, and they will all need varying levels of OAM intervention. For this reason, by the way, the 3 observations in favor of Opt. 1 mentioned above do not seem entirely correct. |
|  |  |  |
|  |  |  |

Another open issue which has also been extensively discussed is whether we exchange single TAC or multiple TACs over Xn.

Regarding this issue,

Samsung [1] proposes: **Proposal 1: It is suggested to use Uu cell ID associated with multiple TACs to be exchanged via Xn setup and Configuration Update procedures.**

Qualcomm [3] proposes:

**Proposal 4: Similar to TAI support list for slices, extended TAC list can be exchanged over XN Setup and Config Update messages.**

**Proposal 5: Endorse TP for TS 38.423 for addition of extended TAC to Served Cell Information**

China Telecom [11] proposes: **Proposal 2: It is beneficial to exchange multiple TACs via Xn setup and Configuration update messages, RAN3 needs to further discuss the impact on EMC case.**

CATT [12] proposes:

**Proposal 2: It’s un-necessary to exchange multiple TACs per PLMN for NTN cells in XN Setup procedure and Configuration Update procedure.**

ZTE [13] proposes: **Proposal 1: Exchange the mapped cell ID with single TAC over Xn for non-UE associated Xn procedures.**

Huawei [15] proposes: **Proposal 2: In the scenario of NTN, we do not exchange the TAC(s) and leave it to OAM**

In summary, there are three options on the table,

**Option 1**: Multiple TACs

**Option 2**: Single TAC

**Option 3**: Do not exchange TAC(s) over Xn for NTN

According to the contributions, whether to use single or multiple TACs is also associated with which Cell ID to be exchanged over Xn. And the proponents of Option 3 provides the additional explanations as follows,

CATT [12]:

*In the Xn Setup procedure, the List of Served Cells NR to be exchanged between the gNBs is optional,*

*…From implementation point of view, it’s possible to exchange the served cells and neighbour relations in case of earth fixed cells are deployed, like the way in TN. It may not need to exchange the served cells and neighbour relations in case of earth moving cells are deployed. The served cell information and its neighbour relations could be left to OAM.*

Huawei [15]:

**Observation 3: OAM effort and NRT is anyway needed to help nodes understand the neighbour relationship of peer nodes.**

So we’d like to ask,

**Q2: Regarding whether to exchange multiple TACs over Xn, which option would you prefer?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Ericsson | 3 | We agree with the analysis in [12] and [15]. The use of NRT/ANR in NTN RAN will not be the same as in terrestrial networks. |
|  |  |  |
|  |  |  |

**Brief summary: xxxx.**

## Time-based NG HO

The first question is whether we add Handover Window Start and Handover Window Duration in the Source to Target Transparent Container over NGAP. According to the contributions, it seems that no company opposes such approach. So the moderator would propose to confirm this approach, which is also proposed by the contribution [7] (co-sourced by a bunch of companies) and [13].

**Proposal X: Confirm to add the handover window start and duration IEs to the NGAP *Source NG-RAN Node to Target NG-RAN Node Transparent Container* IE.**

**Q3: Can we confirm the Proposal X above?** Please provide your comment, if any, in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | Yes |  |
|  |  |  |
|  |  |  |

The next open issue is whether to enhance data forwarding for NG HO. Multiple companies show great interest in enhancing the early data forwarding especially allowing the source node to indicate which data forwarded and stored at the target node can be discarded. For example, as observed by NEC [4],

**Observation 2: the problems of time-based trigger NG-HO are:**

1. **The Target gNB buffers a large amount of the data from Source gNB, which is challenging for Target gNB.**
2. **A long-time date forwarding takes many NGAP resources, and most of the data is useless;**
3. **UE will receive many data from Target gNB, which Source gNB already transmits; the handover interruption is equivalent to being extended.**

As a result, the proponents provides the following proposals,

NEC [4] proposes:

**Proposal 1: the options listed below are advised to discuss in RAN3:**

**Option 1: Do nothing and wait for NG-CHO to be supported in TN.**

**Option 2: *Early Status Transfer Transparent Container* IE is suggested to support CHO.**

**Option 3: Introducing a new IE to inform Target gNB to discard the buffered data when UE detaches from the Source gNB.**

**Proposal 2: We prefer Option 2 because it can solve the problems in Observation 2.**

Nokia [9] proposes: **Proposal 1-1: introduce a new *DL Discarding* IE needed to be introduced in NGAP, e.g. UPLINK RAN EARLY STATUS TRANSFER message and DOWNLINK RAN EARLY STATUS TRANSFER message.**

CATT [12] proposes: **Proposal 4:**  **To support time based CHO in Uu, there may be some benefits to enhance data forwarding for NG handover, and its proposed RAN3 to further discuss this issue in the future meetings.**

Since no company clearly opposes such enhance, so we’d like to ask,

**Q4: Can we confirm to enhance the early data forwarding with data discarding for NG HO?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | Yes but | Signaling time window parameters simplifies data forwarding handling at HO, because the involved gNBs know exactly when to start data forwarding (i.e. at the start of the time window or right before it) and how much data buffering will be needed (i.e. this is proportional to the time window duration). But we acknowledge that especially for very long time windows this may create problems to some implementations.  So, we do have some sympathy for the analyses in [9] and [4]. Notice that this is only between the source and target gNBs, so we would be OK with adding information to the source-to-target transparent container to avoid unnecessary impact to the AMF. |
|  |  |  |
|  |  |  |

The next open issue is whether the source node will send HO Request to multiple target cells for the same UE (just like the behavior for Xn CHO), which is also pointed out by [3].

Regarding this issue, Huawei [16] proposes:

**Proposal 2: RAN3 should discuss if any enhancement is needed for the time-based Handover.**

**Proposal 3: RAN3 to also consider use the time-related IEs for pre-configuration.**

So we’d like to check companies’ view on this open issue.

**Q5: Whether the source node can send multiple HO REQUEST messages to multiple target cells for the same UE during NG HO for NTN?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | Probably not | In general, inter-gNB mobility in NTN is much more predictable than in terrestrial networks due to the periodic satellite movement and NTN GW positions. So it’s extremely unlikely that a source gNB would prepare a HO to more than 1 (maybe 2) potential target gNBs. |
|  |  |  |
|  |  |  |

The next open issue is whether to introduce the new time-related info which is assumed to be applied to both time-based NG HO and time-based Xn CHO. Some companies point out that the propagation delay may impact the time-based HO mechanism to work properly with the following observations,

NEC [4] observes:

**Observation 3: The apparent propagation of NTN HO will bring two problems:**

1. **If the UE starts to access Target gNB from T1+T2–Δdelay to T1+T2, the access procedure is expected to fail;**
2. **The Target gNB cannot receive the preamble from UE between T1 to T1+delay.**

Ericsson and Thales [7] observe and propose:

**Observation 1: Since the exact time window is configured in both the UE and the target gNB, if the handover is triggered near the end of the time window the UE may end up accessing the target cell after the target gNB has already released the prepared resources.**

**Observation 2: This depends on propagation delays due to the long distance between UE and gNB and may also vary with cell size according to deployment.**

**Proposal 1: RAN3 should further discuss and acknowledge this issue.**

So we’d like to check,

**Q6: Do you acknowledge the propagation delay issue for time-based HO? If the issue is acknowledged, what spec impact do you foresee?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | ACK or not | Comment |
| Ericsson | ACK | Our analysis is very similar to the one in [4]. The only slight difference is in the proposed solution.  Given that this is about the risk of a “late” access to the target cell, it seems more appropriate to address it by adding a margin to the time window instead of shifting the whole window as proposed in [4]. The target cell “keeps waiting” for the UE during this additional margin. In our proposal, the margin is decided by the target gNB, but it could also be suggested by the source gNB. If agreed, this should be adopted in both XnAP and NGAP. |
|  |  |  |
|  |  |  |

As a consequence, companies also provide proposals on whether to send LS to SA2.

Qualcomm [3] thinks it is necessary to send LS to SA2.

Ericsson together with other 6 companies [5] think it is unnecessary to send LS to SA2 for Q3 because the window related IEs are added in the transparent container with no impact to SA2 spec.

Nokia [9] thinks it is necessary to send LS to SA2 because TS 23.502 may be impacted by considering Q4.

So we’d like to ask,

**Q7: By keeping the answers to Q3-Q6 in mind, do you think it is necessary to send LS to SA2?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | ACK or not | Comment |
| Ericsson | No | What is on the table is only between the source and target gNBs. Even when considering Q4, if the stage 3 impact is kept within the containers, there is no impact to the core network. If such a solution is agreed, we can liaise SA2 afterwards, so that they can update their specifications if needed. |
|  |  |  |
|  |  |  |

**Brief summary: xxxx.**

## Others

Some companies propose to exchange Serving Cell Coverage Stop time as follows,

Qualcomm [3] proposes: **Proposal 6: Serving Cell Coverage Stop Time shall be exchanged via XN Setup procedure and Config Update procedure between the neighbouring gNBs for NTN cells to assist time-based CHO configuration. Endorse TP to TS 38.423.**

China Telecom [11] proposes: **Proposal 3: It is suggest to exchange NTN Cell Coverage Stop Time via Xn setup and Configuration update messages.**

And the moderator notice the following agreements we’ve achieved,

*The exchange of NTN Cell Coverage Stop Time between gNBs may be further discussed in future RAN3 meetings.*

*There is no need to exchange the cell coverage stop time in the signaling of time-based CHO parameters.*

So we’d like to ask,

**Q8: Is there any need to discuss the exchanging of serving cell coverage stop time over Xn given the agreement above?** Please provide your comment in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Ericsson | No | This issue was already discussed several times, as early as the Rel-16 SI. Unless there is new evidence not discussed before, we see no need to revisit the current agreements. The serving cell stop time derives from the ephemeris, which is always configured in the RAN; the source and target will take that into account when setting the time parameters. |
|  |  |  |
|  |  |  |

**Brief summary: xxxx.**

# References

|  |  |
| --- | --- |
| [1] [R3-231215](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231215.zip) | Remaining open issues on service continuity enhancement for NTN (Samsung) |
| [2] [R3-231255](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231255.zip) | Cell ID over Xn for NTN (Qualcomm Incorporated, CATT, Nokia, Nokia Shanghai Bell, NEC) |
| [3] [R3-231258](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231258.zip) | Discussion on NTN Service Continuity Enhancements (Qualcomm Incorporated) |
| [4] [R3-231387](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231387.zip) | Discussion on Mobility and Service Continuity Enhancements for NTN (NEC) |
| [5] [R3-231417](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231417.zip) | NGAP Support for Time-Based HO in NTN (Ericsson, Thales, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA) |
| [6] [R3-231418](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231418.zip) | Time-Based HO for NTN - NGAP Impacts (Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, CATT, ESA) |
| [7] [R3-231419](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231419.zip) | Time Margin for CHO in NR NTN (Ericsson, Thales) |
| [8] [R3-231420](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231420.zip) | Time Margin for CHO in NR NTN - XnAP Impact (Ericsson LM) |
| [9] [R3-231476](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231476.zip) | Discussion on the time-based trigger condition in NR NTN (Nokia, Nokia Shanghai Bell) |
| [10] [R3-231477](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231477.zip) | Support time-based trigger condition in NG-HO (Nokia, Nokia Shanghai Bell) |
| [11] [R3-231509](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231509.zip) | Remaining issues on NTN mobility enhancement (China Telecommunication) |
| [12] [R3-231669](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231669.zip) | Discussion Mobility and Service Continuity Enhancements for NTN (CATT) |
| [13] [R3-231691](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231691.zip) | Further discussion on mobility issue for NR NTN (ZTE) |
| [14] [R3-231697](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231697.zip) | (TP for NTN BL CR 38.300) Cell ID for non-UE associated Xn procedures (ZTE) |
| [15] [R3-231756](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231756.zip) | Further discussion on cell ID usage and TAC (Huawei) |
| [16] [R3-231757](file:///D:\会议硬盘\TSGR3_119bis-e\Docs\R3-231757.zip) | Further discussion on NG HO (Huawei) |