**3GPP TSG RAN WG3 Meeting # 112-e R3-212699**

**e-meeting, 17-28th May 2021**

**Title: CB: # 80\_NTN\_FeederSwitch (1st round)**

**Source: Thales (moderator)**

**Type: discussion**

**Document for: Agreement**

**Agenda Item: 20.2.4**

**Work Item: NR\_NTN\_solutions: Solutions for NR to support non-terrestrial networks (NTN)\**

# Introduction

This document aims at discussing and agree on general assumptions to be considered during the Rel-17 WI NR\_NTN\_solutions.

Hereunder is recalled the description of the email discussion as defined by the RAN3 chair in its notes:

**CB: # 80\_NTN\_FeederSwitch**

**- (CT)**

**In case of centrally coordinated switch over, no new signaling is needed on Xn/NG to exchange configuration information.**

**The information related to switch over events schedule (e.g. start time and duration of switch over, etc.) provided by NTN control function to gNB should be defined.**

**NTN with de-centralized coordination of switch over has low priority in Rel-17.**

**- (Thales)**

**The gNB will be provided via OAM the following NTN control data:**

**- Actual Ephemeris of all the satellite/HAPS of the NTN system associated to the explicit epoch time when this actual ephemeris was computed. Format (Position Velocity and Time state vectors or Orbital parameters) is FFS; will be decided by RAN1**

**- Location of the NTN-Gateways associated to the gNB**

**A NTN-payload switch-over is the procedure where both service and feeder links are simultaneously changed from a source to a target NTN-payload while the NTN gateway remains unchanged.**

**Both hard and soft NTN-payload switch-over are applicable to NTN.**

**A NTN-payload switch may result in transferring established connection for the affected UEs between two cells.**

**For soft NTN-payload switch over, a NTN-Gateway may connect to more than one NTN-payload during a given period i.e. a temporary overlap can be ensured during the transition between the NTN-payloads.**

**For hard NTN-payload switch over, a NTN-Gateway only connect to one NTN-payload at any given time i.e. a radio link interruption may occur during the transition between the NTN-payloads.**

**In soft switch, the temporary overlap between the feeder links or between the NTN-payloads is expected to be sufficient for the hand-over of all affected UEs, e.g. at least [TBD] seconds.**

**In hard switch, a radio link interruption may occur during the transition between the feeder links or between the NTN-payloads is expected to be in the order of less than [TBD] ms to prevent excessive radio link failure.**

**The decision to perform a switch over (feeder link or satellite) is coordinated in a central way and assumed to be exactly predictable. It does not preclude dynamic correction of the pre-planned switch overs scheduling in a specific area due to feeder link or satellite impairments. In such case, these corrections could be provided via O&M to selected gNBs.**

**soft switch over are supported allowing gNB to configure UEs appropriately to execute the Handover during a time window; hard switch over FFS**

**The mapping between the cells and the NTN beams is pre planned by the NTN control functions and provided to the gNB through configuration.**

**NTN related parameters are provided by O&M to the gNB providing non-terrestrial NR access to support the mobility management procedures. The list of these parameters depends on the type of service links supported:**

**- Earth-fixed beams (e.g. GEO and HAPS): For each cell provided by a given satellite, it entails the Cell identifier (NG and Uu) and the Cell’s reference location (e.g. cell’s center).**

**- Quasi-Earth-fixed beams:**

**-- For each NG-cell, it entails its identifier, its reference location (e.g. cell’s center), the time window of the successive switch overs (feeder link, satellite), the time window and identifier of all serving satellites and NTN-Gateways, the time window and identifiers of the serving Uu-cell.**

**-- For each UU-cell, it entails the time-windows and identifiers of the active neighbor Uu-cells**

**- Earth-moving beams:**

**-- For each Uu cell provided by a given satellite, it entails its identifier, its elevation wrt satellite, its direction, the time window and identifier of all serving NTN-Gateway, the time window of the successive switch overs (feeder link, satellite), the identifiers of the neighbor cells (intra satellite as well as inter satellite/intra orbital plane), the time window and identifiers of the active neighbor cells (inter satellite/inter orbital plane)**

**- (CATT)**

**forget about the terminology “centralized coordination scenario” or “de-centralized coordination scenario”, to discuss the issues and solutions for the three phases of feeder link switch, i.e. “triggering”, “preparation” and “execution”.**

**The triggering of the feeder link switch is decided by NTN control function or gNB/NTN-GW with some assistance info from NTN control function, which info to transfer and how to transfer between NTN control function and gNB/NTN-GW is out of RAN3 scope, no change to Xn/NG signaling is needed.**

**Introduce a new non-UE Xn procedure for feeder link switch, to exchange the necessary info between the gNBs, at least including satellite information and corresponding serving cell(s) information to be generated by the target gNB.**

**the order of the serving cell list should be kept same between the source and target gNBs to maintain the correct neighbor relationship.**

**CHO related discussion is pending RAN2, no further impact to network interfaces is foreseen for the execution of feeder link switch.**

**- (Nok)**

**No enhancement is needed for cell ID mapping during the handover for feeder link switch over.**

**do not discuss the de-centralized scenario in current WI.**

**Existing XnAP procedure can be reused to exchange the Served Cell information and neighbor cell information in NTN system.**

**To Support feeder link switch, current NG/Xn based HO procedure can be reused, and no need to introduce enhancement to XnAP specification and NGAP specification.**

**For F1 impact wait for RAN2 decision.**

**- (SS)**

**signaling exchange is needed on Xn/NG to support the unpredictable feeder link switchover, feeder link switch-over procedure captured in TR 38.821 could be used as baseline, and the details should be further discussed.**

**discuss the exchange of below information on Xn/NG:**

**- Cell mapping between source gNB and target Gnb to perform the correct handover during feeder link switchover**

**- Available RACH resources between source and target to support RACH attempts distribution**

**- UE list and handover policy between source and target to support RACH attempts distribution**

**- (ZTE)**

**The potential enhancement for soft switch-over should be de-prioritized.**

**The potential enhancement for hard switch-over should be pending RAN2.**

**The feeder link switch-over procedure captured in TR 38.821 could be regarded as the baseline of decentralized feeder link switch-over, and the details should be further discussed.**

**- (CMCC)**

**- Chair: seems consensus not to discuss “centralized”/”de-centralized”? Discuss how much “coordination” detail to specify (a number of details might seem within SA5 scope?); no st3 impacts agreeable in previous meetings – any new findings? St2 TP seems sufficient**

(Thales - moderator)

Summary of offline disc

# For the Chairman’s Notes

Propose the following:

Propose to capture the following:

# 1st round discussion

## NTN payload switch over

**Question 3.1.1: In addition to feeder link switch overs, “NTN-payload switch-over” need to be managed by NG-RAN**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson | Sure | but what is the difference to the functions we looked at already? |
| Qualcomm | Agree | Same question as Ericsson.  |
| ZTE | Agree |  |
| Eutelsat | Agree |  |
| CMCC | Agree |  |

**Question 3.1.2: In case of positive response to Q3.1.1, do you agree with the following proposals**

* **A NTN-payload switch-over is the procedure where both service and feeder links are simultaneously changed from a source to a target NTN-payload while the NTN gateway remains unchanged.**
* **A NTN-payload switch may result in transferring established connection for the affected UEs between two cells.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree with comments | Is it same as inter-satellite HO and both satellites connect with same GW? The text above describes “**the NTN gateway remains unchanged**”. What happens if the payloads connect with different GW? |
| China Telecom | Agree |  |
| Samsung |  | Same question as Nokia. Do we need two different terms to describe:Case 1: NTN-payload switch overCase 2: Inter-satellite HO with different GWOr slightly enhance NTN-payload switch over to cover case 2? |
| Ericsson |  | Agree with Nokia and Samsung, what is the delta w.r.t the protocol functions / architectural aspects we looked at so far? |
| Qualcomm | No | It is problematic to propose definitions which somehow determine procedures / functions. This is related to the definition of NTN payload. For example is NTN payload a per-UE concept? That is not what the current 38.300 definition seems to say. Need more clarification. |
| ZTE |  | The questions raised by companies should be clarified. |
| Eutelsat | Agree | Do we need definition of “simultaneously” here? Agree with Samsung question; it may be better to not to use the term “inter-satellite HO” for case 1 as handover is better reserved for change of fixed network entities, and the procedure is quite different |
| CMCC |  | Agree with Nokia, Samsung and Ericsson, we need to clearly define payloads switch over with different GW and payloads switch over with same GW. |

**Question 3.1.3: In case of positive response to Q3.1.1, do you agree with the following proposals**

* **Both hard and soft NTN-payload switch-over are applicable to NTN**
* **For soft NTN-payload switch over, a NTN-Gateway may connect to more than one NTN-payload during a given period i.e. a temporary overlap can be ensured during the transition between the NTN-payloads.**
* **For hard NTN-payload switch over, a NTN-Gateway only connect to one NTN-payload at any given time i.e. a radio link interruption may occur during the transition between the NTN-payloads.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree with comments | Can a GW connect with multiple NTN payload? |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | what is the delta to what we have discussed so far?we say in endorsed stage 2 CR for 38.300- A gNB may serve multiple NTN payloads;- An NTN payload may be served by multiple gNBs.these should be sufficient architectural/stage-2 statements to cover those cases. |
| Qualcomm |  | Similar comment to Ericsson. Also if we state “For hard NTN-payload switch over, a NTN-Gateway only connect to one NTN-payload at any given time”. Is this really true? Surely in general a GW can have multiple payloads. |
| ZTE | Agree |  |
| Eutelsat | OK | Need or may connect? |
| CMCC | Agree |  |

## Impact associated to soft versus hard switch over

**Question 3.2.1: Do you agree with the following proposals**

* **In soft switch, the temporary overlap between the feeder links or between the NTN-payloads is expected to be sufficient for the hand-over of all affected UEs, e.g. at least [TBD] seconds.**
* **In hard switch, a radio link interruption may occur during the transition between the feeder links or between the NTN-payloads is expected to be in the order of less than [TBD] ms to prevent excessive radio link failure.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree | For soft switch, the overlap may last for a few seconds, which should be sufficient for the switch-over, the duration of the overlap is up to the implementation.For hard switch, the interruption time between the two feeder links should be as short as possible. |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | soft or hard, as you prefer to be deal or be dealt with. what is the delta to the discussions so far? |
| Qualcomm | Agree | This agreement is generic and not restricted to the type of switchover discussed above.  |
| ZTE | Agree |  |
| Eutelsat | Agree with comment | **In hard switch, where “continuous coverage” is specified, a radio link…** |
| CMCC | Agree |  |

**Question 3.2.2: Do you agree with the following proposals**

* **soft switch over are supported allowing gNB to configure UEs appropriately to execute the Handover during a time window;**
* **hard switch-over: FFS**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | See comment | For the Uu interface, RAN2 is discussing the CHO now, which could be used for normal service link switch and also feeder link switch for the UE.For soft switch, CHO configuration could be done in or before the time window, all the UEs will complete the service link switch over towards the target cell in the time window.For hard switch, CHO configuration for all the related UEs should be finished before the feeder link switch, start time of the target cell may be provided to UE as the triggering of the CHO.Anyway, how to switch the UEs in the feeder link switch is pending to RAN2.  |
| Nokia | Agree with comments | This is in RAN2 scope. |
| China Telecom | Agree with above | How the gNB configure UEs to execute the handover is pending to RAN2. |
| Samsung | Agree | This is in RAN2 scope. |
| Ericsson |  | decision making on that aspects is smelling so intensely like RAN2 territory, that we should be afraid to enter. From RAN3 point of view, as pointed out by others, we should be able to use existing functions. |
| Qualcomm |  | Seems not a necessary agreement, quite generic and somewhat out of scope |
| ZTE |  | Agree to be in RAN2 scope. |
| Eutelsat | Partly Agree | Term “handover” should be avoided for service+feeder link switchover, if that is what is meant. |
| CMCC | Agree with Nokia | This is in RAN2 scope. |

## Centralized deployment option

**Question 3.3.1: Do you agree with the following proposals**

* **The decision to perform a switch over (feeder link or satellite) is coordinated in a central way and assumed to be exactly predictable. It does not preclude dynamic correction of the pre-planned switch overs scheduling in a specific area due to feeder link or satellite impairments. In such case, these corrections could be provided via O&M to selected gNBs.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung |  | For dynamic correction, it is better to provide the correction via signaling. Dynamic correction is not easy to do by the OAM pre-configuration. |
| Ericsson | Agree | and then we go back to the CB on cell relations and say the same, please. |
| Qualcomm | Agree | We think that O&M central control is the only possibility now for Release 17. |
| ZTE | Agree |  |
| Eutelsat | Agree with comment | Where are “in a central way”, and “exactly predictable**”** defined? |
| CMCC | Agree |  |

**Question 3.3.2: Do you agree with the following proposals**

* **The mapping between the cells and the NTN beams is pre planned by the NTN control functions and provided to the gNB through configuration (OAM).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | mapping means: Cell relations/neighbor cell relations? which we agree. |
| Qualcomm | Agree |  |
| ZTE | Agree |  |
| Eutelsat | Agree |  |
| CMCC | Agree |  |

**Question 3.3.3: do you agreed that for this deployment option no new signaling is needed on Xn/NG to exchange configuration**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree | Possible, if the target CGI to be generated by the target gNB towards a satellite beams could also be provided to the source NG-RAN via OAM/NTN control function.  |
| Nokia |  | Not sure about the question. What configuration is to be considered in this question? the cell relation/configuration is handled in CB#79.  |
| China Telecom | Agree |  |
| Samsung |  | Signalling exchange is needed on Xn/NG to support the unpredictable feeder link switchover |
| Ericsson | Agree | I don’t care in which CB such decision is made, but I asked the same in the cell relation CB. |
| Qualcomm | Conditionally agree | We think this should be the objective but we should still be ready for any exception, if really needed.  More like WA. |
| ZTE |  | If the configuration is cell configuration, this could be discussed in CB79. |
| CMCC |  | We think some cell relation information exchanged on Xn is more directly. |

**Question 3.3.4: Do you agree that the switch-over can be executed through CHO procedure upon information provided to the gNB via OAM ?**

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| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree with comments | CHO is defined for service link only. Does this mean using CHO in the service links to handle feeder link switch? Then OK. |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | We agree that CHO can be applied for NTN NR access as well, though this should be first decided in RAN2, as feasibility for NTN access has to be confirmed first from UE point of view.I agree that *preparation* of CHO in that proposed scheme is performed by data provided by OAM. Network signalling & Uu signalling to actually *execute* CHO is of course not an OAM matter.  |
| Qualcomm |  | Agree with Ericsson. |
| CMCC | Agree |  |

## NTN control data (switch-over)

**Question 3.4.1: Do you agree that, NTN related parameters can be provided by O&M to the gNB providing non-terrestrial NR access.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | I agree on the feasibility, given the low interest in that option, I disagree on prioritize work on that. |
| Qualcomm | Agree |  |
| ZTE | Agree |  |
| Eutelsat | Agree |  |
| CMCC | Agree |  |

**Question 3.4.2: Do you agree that NTN control function has the full knowledge of the constellation and its radio resources and hence may be able to provide cell to beam mappings and to predict the occurrence of all switch-overs.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree with comments | The Uu radio resource is controlled by the gNB.  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | be careful: constellation and relation is ok to be an OAM matter, but knowledge (or even control) of radio resources is in the hands of the non-NTN functions of the gNB. |
| Qualcomm | Agree | With Nokia/Ericsson correct caveats |
| ZTE | Agree | At least, this is true for centrally coordinated switch-over. |
| Eutelsat | Agree with comment | “full knowledge” is perhaps unobtainable. Maybe “…**NTN control function should have sufficient knowledge of the constellation and its radio resources and to be able to provide cell to beam mappings and to predict the occurrence of all switch-overs.** |
| CMCC | FFS | We need to figure out what kind of radio resource is under the OAM control. |

**Question 3.4.3: Do you agree that these NTN related parameters provided by O&M to the gNB may depend on the type of service links supported (Earth fixed beams, quasi Earth fixed beams, Earth moving beams) ?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | there is for sure a difference, but details I do not know |
| Qualcomm | Agree |  |
| ZTE | Agree |  |
| Eutelsat | Agree |  |
| CMCC | Agree |  |

**Question 3.4.4: Do you agree that in case of Earth fixed beams (e.g. GEO and HAPS), these NTN related parameters provided by O&M to the gNB can be ?**

* **For each cell provided by a given satellite, it entails the Cell identifier (NG and Uu) and the Cell’s reference location (e.g. cell’s center).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | don’t quite understand the question, as far as RAN3 is concerned? |
| Qualcomm | Partial Agree  | For GEO and HAPS, other parameters besides cell ID and cell center are needed.  |
| ZTE | Agree |  |
| CMCC | Agree |  |
|  |  |  |

**Question 3.4.5: Do you agree that in case of quasi Earth fixed beams, these NTN related parameters provided by O&M to the gNB can be ?**

* **For each NG-cell, it entails its identifier, its reference location (e.g. cell’s center), the time window of the successive switch overs (feeder link, satellite), the time window and identifier of all serving satellites and NTN-Gateways, the time window and identifiers of the serving Uu-cell.**
* **For each UU-cell, it entails the time-windows and identifiers of the active neighbor Uu-cells.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree, but | Just try to clarify, for quasi earth fixed beams, all the quasi cells on the ground will switch simultaneously? Or each cell may have different lifetime? For the later case, maintenance of the neighbor relations will be a bit more complex. |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | I refuse to deal with that question in this CB |
| Qualcomm | Partial Agree  | These parameters seem needed but they would be others – e.g. cell and beam coverage areas. What is the prupose of this list? |
| CMCC | Agree |  |

**Question 3.4.6: Do you agree that in case of Earth moving beams, these NTN related parameters provided by O&M to the gNB can be ?**

* **For each Uu cell provided by a given satellite, it entails its identifier, its elevation wrt satellite, its direction, the time window and identifier of all serving NTN-Gateway, the time window of the successive switch overs (feeder link, satellite), the identifiers of the neighbor cells (intra satellite as well as inter satellite/intra orbital plane), the time window and identifiers of the active neighbor cells (inter satellite/inter orbital plane).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree |  |
| Nokia | Agree with comments | The neighbor cell information may be optional, e.g. it may be exchanged via Xn. Anyway, the cell info exchanging is handled in CB#79 |
| China Telecom | Agree |  |
| Samsung | Agree |  |
| Ericsson |  | I refuse to deal with that question in this CB |
| Qualcomm |  | Same answer as above |
| CMCC | Agree |  |

## NTN control data (UL synchronization)

**Question 3.5.1: Do you agree that for UL synchronization purposes, the following NTN related parameters should be provided by O&M to the gNB**

* **Actual Ephemeris of all the satellite/HAPS of the NTN system associated to the explicit epoch time when this actual ephemeris was computed. Format (Position Velocity and Time state vectors or Orbital parameters) is FFS; will be decided by RAN1**
* **Location of the NTN-Gateways associated to the gNB**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree |  |
| CATT | Agree | This is linked to RAN1 discussion on UL synchronization. |
| Nokia | Agree |  |
| China Telecom | Agree |  |
| Samsung  | Agree | Need further discussion with the conclusion from RAN1. |
| Ericsson |  | I refuse to deal with that question in this CB |
| Qualcomm | Agree |  |
| ZTE |  | RAN1 related issue, should be further clarified. |
| CMCC | Agree | Need align with RAN1. |

## NG/Xn information exchange (de-centralized deployment option)

**Question 3.6.1: Do you agree that to support the predictable switch-overs, existing Rel-16 defined NG/Xn based HO procedures may be used if needed (e.g. to exchange the Served Cell information and neighbor cell information in NTN system) ?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Agree | Not sure that they are needed if all gNBs are aware of when to active a cell via a new satellite/beam  |
| CATT | Depends | This is linked to the discussion in “cell relations”.For earth fixed cell, the existing Rel-16 defined NG/Xn based HO procedures could be reused to exchange the served cell info and related neighbor relations.For earth moving cell scenario, it seems not necessary to exchange the served cell info and neighbor relations. |
| Nokia | … | Not sure about the question, “… **NG/Xn based HO procedures … (e.g. to exchange the Served Cell information …)**”. HO procedure is not to exchange the cell info.If it is about reusing Xn/NG HO procedure, then it also applies to centralized deployment. So it should be in a general section. We think this section only contain questions on de-centralized. It may be better to start with the scenario (e.g. whether the scenario is agreeable, before discussing the solution)Anyway, no enhancement is needed for predictable switch-over.  |
| China Telecom |  | Possible for earth fixed cell scenario to exchange the Served Cell information and neighbor cell information between gNBs, while earth moving cell scenario may not. |
| Samsung |  | Served cell information is discussed in another CB. For HO procedure, agree Rel-16 HO procedure is the baseline.  |
| Ericsson |  | as said, I don’t care where this question is actually dealt with, but I think that the cell-relation CB is the better place |
| Qualcomm |  | Agree this should be considered in the cell relations CB |
| ZTE |  | Should be discussed in CB79. |
| CMCC |  | Take existing Rel-16 defined NG/Xn based HO procedures as baseline. Also, we think this question needs to discuss in cell relation CB. |

**Question 3.6.2: Do you agree that enhancement to XnAP specification and NGAP specification may be needed for un-predictable switch-overs ?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales |  | Can be considered for a next release |
| CATT | Agree | As been proposed in [3], exchange of target CGI to the source NN-RAN node seems beneficial. Normally, OAM only configures a NG-RAN node when to connect to the satellite, when the satellite leaves, and what radio resource to be generated towards the satellite. The target cell ID is one of the info OAM configured for the target gNB/NTN GW. To configure this info for the source RAN node requires linking the OAM configuration for the two NG-RAN nodes, which may introduce extra complexity for OAM/NTN control function. |
| Nokia | No | We do not see the need for the un-predictable switch over. The NTN control function monitor the payload in real-time. The scenario is unclear and not discussed in SI. Considering the limited time left for the WI phase, this may be considered in future release.  |
| China Telecom |  | We are willing to discuss un-predictable switch-over scenarios, but considering the extra complexity of this enhancement, it has low priority in Rel-17 and can be considered in future release. |
| Samsung | Agree | It is possible the feeder link switchover cannot be predicable if the feeder link is chosen according to the link condition which may be affected by weather or interferences. De-centralized coordinated switch over should not be precluded. Signalling exchange is needed on Xn/NG to support the unpredictable feeder link switchover |
| Ericsson |  | No, and I hope that the clockwork satellite prevents from such unpredictable occasions. |
| Qualcomm | Neither | Can be considered, though not clear that the case of switchover failure requires special handling in rel17 |
| ZTE |  | The signalling exchange may be needed over Xn for the unpredictable switch-over, but it should be further studied. |
| CMCC |  | We agree to consider the unpredictable situations, but this issue can be treated as low priority in this release.  |

**Question 3.6.3: Do you agree that each gNB should have the capability of selecting which beam/satellite be used for providing a given cell and therefore should be able to negotiate this with neighboring gNB ?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales | Don’t agree | It is not clear how gNBs can prevent contentious use of a given beam while taking care of inter beam interferences optimization (intra and inter satellite) |
| CATT | No |  |
| Nokia | No | The gNB does not have the capability to control the NTN payload.  |
| China Telecom | No |  |
| Samsung |  | From the question, I feel there is some misunderstanding. Pls allow me say more about this case. Assuming according to the ephemeris data, the satellite 1 is connected to gNB1, but due to bad feeder link for un-predicated reason, a new NTN GW (i.e. gNB2 on it) is chosen. OAM configure new cells in gNB2 to serve satellite 1. Since it is un-predictable case, the cells used by satellite 1 is not preconfigured in the gNB2 and in the surrounding gNBs. It is not saying the gNB2 will have the capability of selecting which beam/satellite used for providing a given cell. It is still configured by the OAM. But since un-predictable cells information has not been preconfigured in the neighboring gNBs, the gNB2 needs to notify the un- predictable cells to its neighboring, to build the neighboring cell relationship. |
| Ericsson |  | If the UE measurements tell, that the “visibility” of a certain beam is better then the one of another beam, the gNB should respect that and act accordingly. |
| Qualcomm | No |  |
| CMCC | No |  |

**Question 3.6.5: Do you agree that the following information should be exchanged between source and target gNBs via Xn/NG procedures**

* **Available RACH resources to support RACH attempts distribution**
* **UE list and handover policy to support RACH attempts distribution**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales |  | This could be an optimization , for e.g. speed up the switchover, but in all cases, all handovers have to be completed at the end of the overlapping window during which the two feederlinks are available (given by the NTN control functions). Thus the RACH capacity of the target cell shall be sized so that to be able to handover the maximum number of UEs in the cell during this overlapping window.Not clear what is UE list and handover policy. |
| CATT | No | Similar view with Thales, this seems to be a kind of optimization. However, how to guarantee the RACH resources for feeder link switch is investigated in RAN1. Any impact or requirement for RAN3 is pending to the outcome of the other groups. |
| Nokia | No | The issue should be discussed and confirmed by RAN2, before RAN3 discuss the enhancements to Xn/NG. |
| China Telecom | No | Similar view with Thales, CATT. |
| Samsung | Yes | Could observe the conclusion made in RAN1 and RAN2. We can keep it open as the issue for group mobility is identified in our study stage.  |
| Ericsson | No, no | no |
| Qualcomm | Neither | Similar view to Nokia and others, a possible optimization, but should discuss in other groups |
| ZTE | No |  |
| CMCC | No | Similar view with Thales, need to wait for conclusion made by RAN1 and RAN2. |

**Question 3.6.6: Do you agree to consider as baseline, the feeder link switch-over procedure captured in TR 38.821 where the following information between source and target gNBs are exchanged (for example):**

**● A list of satellites to which the gNB connects;**

**● For each satellite in the list, an ID, a list of cell(s) from the gNB which is served through the satellite, and the ephemeris data for the satellite.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/not agree** | **Comment** |
| Thales |  | It is not clear how the source and target gNBs are able to determine the mapping between the available beams and cells ? |
| CATT |  | 1. No need to exchange a list of satellites the gNB connected, we assume only the satellite to be switched between two NTN GWs should be focused for feeder link switch.
2. Ephemeris data is not needed, as we could assume each gNB could get the latest ephemeris data from OAM/NTN control function.
3. The cell id, especially the target cell id to be generated by the target NG-RAN is the most essential info to be exchanged between NG-RANs.

3bis: Thales raised a good question how to determine the mapping between available beams and cells, this is also mentioned in our contribution [3]. To switch the UEs smoothly from the source cell to target cell, source gNB should be able to know the corresponding overlapped cells for each cell it served before switch. And it should know the target cell to be generated for the similar coverage of the cell it served before hard feeder link switch. We assume the mapping between beam ID and cell should be associated, or introduce some kind of “order” source and target gNB should obey. (e.g. cell list with the same order of beam id) |
| Nokia | No | The issue should be clarified and agreed before discussing the enhancement. What is the specific issue to be addressed here?As explained in our contribution (1897), the gNB does not have the capability to control the GW/Payload to setup the connection with the gNB. The NTN payload determines when setup a connection with a NTN GW. If a de-centralized function is desired, the related functions can only be located in the NTN payload and NTN GW, rather in the gNB.  |
| China Telecom |  | If the feeder link switch-over is controlled by NTN infrastructure, not sure whether it is necessary to exchange this information via Xn interface. |
| Samsung | No |  |
| Ericsson |  | don’t quite understand the scenario |
| Qualcomm | Neither | Does not seem needed but we do not have a strong view  |
| ZTE |  | This could be regarded as an enhancement, but it seems that this scenario has not been observed by companies. |
| CMCC |  | There is no need to exchange a list of satellites to which two gNB connect and also no need to exchange ephemeris information. The cell id information served by two gNBs need to be exchanged. The mapping between the available beams and cells provided by Thales needs FFS. |

## Any other topics to be discussed

|  |  |
| --- | --- |
| **Company** | **Suggested topics to be discussed** |
| Ericsson | no further topic, please!And we thought this topic is already closed pretty much. Quite astonished on this exorbitant (to use an extraterrestrial term) questionnaire ;-) |
|  |  |

# 2nd round discussion

# Reference

[1] R3-211720 “Further discussion on switch over for NTN” (China Telecommunication)

[2] R3-211787 “NTN control data” (THALES)

[3] R3-211816 “Further discussion on Feeder Link Switch” (CATT)

[4] R3-211897 “Discussion on Feeder Link Switchover” (Nokia, Nokia Shanghai Bell)

[5] R3-212419 “Discussion on enhancements for feeder link switch over” (Samsung)

[6] R3-212454 “Further Discussion on LEO Feeder Link Switch-Over” (ZTE)

[7] R3-212478 “Discussion on feeder link switch for NTN” (CMCC)

***END***