**3GPP T****SG-RAN WG3 Meeting #117-e R3-225001**

**Online, 15th – 24th August 2022**

**Agenda Item: 9.2.8**

**Source: CMCC (Moderator)**

**Title: Summary of offline discussion on slice group**

**Document for: Discussion and Decision**

1. Introduction

**CB: # 14\_SliceGroup**

**- Whether and how to exchanging NSAG configuration between neighbour NG-RAN nodes over Xn with the same coding over NG and F1?**

**- Other corrections?**

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

(CMCC - moderator)

Summary of offline disc [R3-225001](https://ericsson-my.sharepoint.com/personal/angelo_centonza_ericsson_com/Documents/Local%20Documents/3GPP_ETSI/RAN3/RAN3-117e/EmailDiscussions/CB%20%23%2014_SliceGroup/Inbox/R3-225001.zip)

1. For the Chairman’s Notes

**The following proposals can be agreed:**

**TBD**

1. Discussion

RAN3#116-e meeting discussed the NSAG information transfer over Xn interface, but there was no consensus achieved, as captured in the Chairman notes as follows, but the discussion will be continued as corrections in R17.

**RAN node just reports its own slice group information to AMF, and the slice group info of neighboring cells should not be transferred to AMF.**

**Support of NSAG in Xn signaling or by OAM configuration.**

**To be continued in corrections in R17...**

This summary is to discuss the NSAG transfer over Xn interface and other corrections.

* 1. Whether and how to exchange NSAG configuration between neighbour NG-RAN nodes over Xn with the same coding over NG and F1?
     1. Support of NSAG over Xn interface

Large majority views of the reference papers [1,2,3,5] propose that the RAN node needs to know the NSAG information per TA supported by neighboring nodes over Xn interface, due to the following reasons (some of them already covered in email discussion of last meeting [8]).

* Follow the same principle for the slice information exchange between nodes. Starting from R15, the TAI Slice Support List is introduced to facilitate the connected mode mobility between neighbour NG-RAN nodes. Then for the NSAG information, it can be used for idle mode mobility (i.e. the cell reselection) as specified in TS 38.304.
* The self-configuration/self-optimization mechanism of the NSAG information could be enabled. Whenever the NSAG information is updated in a neighbour node, the serving RAN node can get automatically informed. Otherwise, each time a new S-NSSAI is enabled or an old one is released for a single NG-RAN node, the OAM may have to reconfigure the change towards many neighbour NG-RAN nodes, which is not only time-consuming, but also increases much burden for the OAM work.
* In SIB16, there is an allowed/excluded list in a cell granularity to indicate either the allow-list or the excluded-list neighbour cells for NSAG. It is much cumbersome and complicated work for the OAM to configure this cell list belonging to the neighbour NG-RAN nodes for the NG-RAN node. And considering the possible change of the configuration, it is even not possible work relying on the OAM.

In addition, the reference paper [3] clarifies the issue how the *nsag-CellReselectionPriority*/ *nsag-CellReselectionSubPriority* are decided. This NSAG Cell Reselection Priority should be decided by the OAM, which has the same handling for the non-NSAG related cell reselection priority.

* Starting from R15, the NR-RAN node can decide the cell reselection priority for serving frequency in SIB2, and the one for inter-frequency in SIB4. When the NG-RAN node is aware of the neighbour frequencies by the Xn setup/configuration message, the OAM can decide the corresponding the frequency priority accordingly. And in this case, the OAM can coordinate the NG-RAN nodes to have aligned cell reselection priority to avoid any ping-pong.
* Then in terms of the cell reselection priority for NSAG, the same handling can be followed. The OAM can decide the frequency priority for each NSAG (if needed) after the NG-RAN node is aware of supported NSAGs from its neighbour NG-RAN nodes, and can avoid any mis-alignment. Then there is not any need for neighbour NG-RAN nodes to exchange NSAG cell reselection priority over Xn interface.

One company [7] has a difference view and thinks OAM should configure to the RAN NSAG information for all NSAGs used in a cell, including the NSAGs signalled in SIB16 by each cell in the system, the mapping between each NSAG and the associated frequency, the *CellReselectionPriority* associated to the NSAG, and the S-NSSAIs included in the NSAG. Therefore, XnAP signaling is not needed for the following reasons:

* The Rel17 WI on Enhancement of RAN Slicing has been successfully completed and closed in RAN2/RAN3. No more changes have been identified as needed in addition to the approved CR package for Rel17. Any change concerning Enhancement of RAN Slicing solutions should be considered either as essential corrections to Rel17, or as technical enhancements for Rel18
* Dynamic NSAG updates always involve OAM configuration. The “dynamicity” of such updates depends on how “fast” the OAM can reconfigure the RAN.
* The OAM can configure a RAN node with NSAGs of neighbour cells. The OAM can reuse the same procedure followed to configure NSAGs to be broadcast by a cell of a RAN node.
* An OAM solution guarantees neighbour NSAG configuration even in absence of Xn connectivity, because OAM is fully aware of the NSAGs configured in each cell of each RAN node. A solution based on neighbour NSAG configuration via Xn does not work when neighbour RAN nodes are not Xn connected.

Following the majority views, the moderator made the following proposals.

**Proposal 1: RAN node needs to know the NSAG information per TA supported by neighboring nodes via Xn interface, and the NSAG specific cell reselection priority is decided by OAM which has the same handling as legacy cell reselection priority.**

**Q1: Do you agree with Proposal 1? Any comments are welcome.**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | No | In R3-224574 it has been explained that a solution based on OAM configuration is sufficient and that indeed a solution based on Xn signalling would purely consist of a duplication. Here we give a summary of why.  The OAM is the system in charge of configuring NSAGs at the RAN. Namely, any change to the supported NSAGs per cell is the result of OAM configuration. The RAN is not able to autonomously change NSAGs. RAN3 has acknowledged that the OAM is in charge of assigning CellReselectionPriority per NSAG.  The OAM configures NSAGs at the RAN on a per cell basis, i.e. the OAM knows which NSAGs are supported by each cell.  With the above in mind, the following statement is incorrect:  “Whenever the NSAG information is updated in a neighbour node, the serving RAN node can get automatically informed. Otherwise, each time a new S-NSSAI is enabled or an old one is released for a single NG-RAN node, the OAM may have to reconfigure the change towards many neighbour NG-RAN nodes, which is not only time-consuming, but also increases much burden for the OAM work.”  This is because enabling, modifying or deactivating an NSAG is always the result of OAM configuration at the RAN.  Moreover, if a new NSAG is enabled and a neighbour node wants to broadcast it, the OAM will anyhow need to configure the neighbour node with the CellReselectionPriority for the neighbour NSAG.  Namely, there is always an OAM configuration involved with any NSAG change at source and neighbour cells. So why not taking advantage of such configuration and configure he RAN in full?  Given that the OAM needs to configure the NSAGs per cell, the OAM can easily configure the allowed/excluded cell list because the OAM knows which NSAGs are supported by each neighbour cell.  Note that in 38.304 section 5.2.4.11, it is described that the allowed/excluded cell list gives the cell’s support of the slices of the corresponding NSAG. What NSAG’s are used in the other cell is irrelevant. Therefore, if a RAN node broadcasts a certain NSAG X including, e.g. Slice 1 and Slice 2, the allowed/excluded NSAG list may be also deduced by the legacy Slice Support list signalled over Xn. So, an allowed cell list for NSAG X shall include neighbouring cells that support slice 1 and 2.  So in conclusion, the OAM shall configure the following:   * To configure new NSAGs and NSAG to S-NSSAI mapping per cell * To remove NSAGs and NSAG to S-NSSAI mapping per cell * To modify NSAGs and NSAG to S-NSSAI mapping per cell * To associate a CellReselectionPriority per NSAG of own cell * To associate a CellReselectionPriority per NSAG of neighbour cell   Given that the OAM shall always do the above, it is logical that the OAM can, without any extra effort, do the following:   * Any time an NSAG is added, modified, removed: configure the NSAG (and NSAG to S-NSSAI mapping) at neighbour cells together with the associated CellReselectionPriority (given that there is anyhow the need of a configuration loop for the CellReselectionPriority) * Configure the list of allowed/excluded NSAGs at neighbour cells or alternatively * Once the neighbour NSAGs and NSAG to S-NSSAI mapping is configured at the RAN, let the RAN deduce the list of allowed/excluded NSAGs from the Slice Support List received from neighbours   Also note that there are use cases where an Xn connection between neighbour nodes cannot be guaranteed, in which case the only solution is an OAM based solution.  From the above it can be seen that signalling of NSAGs over Xn is totally redundant and a duplication. An OAM based solution is always needed for the reasons above. To avoid duplication of features, development and standardization we suggest that an OAM centric solution is adopted for NSAG configuration. |
| Qualcomm | Yes | Can follow the legacy way. OAM option is always there by default. XN option allows flexibility and inter vendor operability. |
| CATT | Yes |  |
| Huawei | Yes | Agree with Qualcomm.  The OAM option is always the last resort. But indeed, we need self-configuration/self-optimization mechanism in place, and we have followed this principle to exchange information between neighbor NG-RAN node for many Work Items during last R15/16/17 releases. Then the same is true also for the NSAG. |
| Nokia | Yes | Agree with Qualcomm, CATT, Huawei. Xn option allows flexibility and inter vendor operability. |
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**Summary of Q1:**

To be summarized...

* + 1. Stage 3 details to support NSAG over Xn interface

RAN3#116-e meeting agreed the NSAG transfer over NG/F1 interface, and approved the CRs on NGAP/F1AP, namely R3-224051 [9] and R3-224052 [10], which captured the following agreements on stage 3 details:

**RAN provides the AMF the slice group and associated S-NSSAIs per TA using NG Setup and RAN Configuration Update procedures.**

**Introduce the NSAG information in the Served Cell Information IE of the F1 Setup and F1 Configuration Update messages.**

**Introduce a new Network Slice AS Groups (NSAGs) related IE, at the same level as TAI Slice Support List/Extended TAI Slice Support List.**

**The slice group for cell reselection and for RACH does not need to be differentiated and indicated in the network signaling.**

In this meeting, the reference papers [1,2,3,5] propose to introduce the same coding for NSAG configuration over Xn as used over NG and F1, i.e., introduction of the NSAGs (Network Slice AS Group) using the *TAI Support List IE* of the XnAP Setup and RAN Configuration Update messages.

Following the majority views, the moderator made the following proposals.

**Proposal 2: Introduction of the NSAGs (Network Slice AS Group) using the *TAI Support List IE* of the XnAP Setup and RAN Configuration Update messages. The same coding over NG/F1 is used for Xn interface.**

**Q2: Do you agree with Proposal 2? Any comments are welcome.**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | No | As explained above, introducing signalling over Xn is only a duplication of already needed OAM functions.  Proponents should explain why is Xn signalling needed given that we need for each NSAG change an OAM configuration to the RAN.  What is the benefit to have, in parallel, a configuration from OAM and Xn signalling to configure NSAGs at the same cell? |
| Qualcomm | Yes | Similar coding shall be followed |
| CATT | Yes |  |
| Huawei | Yes | See our comments to Q1. |
| Nokia | Yes | See our CR in [2]. |
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**Summary of Q2:**

To be summarized...

* 1. Whether stage 2 CR on the NSAG information is needed?

In the reference paper [6], the corrections on stage 2 text are proposed to support NSAG due to the following reasons:

1. In last RAN3#116-e meeting, RAN3 discussed the support of slice group (i.e. NSAG), and has agreed that RAN provides the AMF the slice group and associated S-NSSAIs per TA using NG Setup and RAN Configuration Update procedures. This means the RAN node can receive the supported NSAG(s) and associated S-NSSAIs from OAM in advance. But in current text in TS 38.300, OAM only configures supported S-NSSAI(s) for RAN node, the supported NSAG(s) is missed.
2. In addition, the above agreement on RAN behaviour is not captured in TS 38.300.
3. The latest TS 38.331 has specified that an optional slice-allowed neighbour cell list or slice-excluded neighbour cell list may be broadcasted in SIB16 for slice-based cell reselection. Thus, the awareness in the NG-RAN of the NSAG(s) supported in the cells of its neighbours may be needed.

The corrections on TS 38.300 are as follows:

### ***16.3.1 General Principles and Requirements***

***<Unchanged Text Omitted>***

***Slice Availability***

*- Some slices may be available only in part of the network. The NG-RAN supported S-NSSAI(s) and NSAG(s) are configured by OAM. Awareness in the NG-RAN of the slices supported in the cells of its neighbours may be beneficial for inter-frequency mobility in connected mode.*

*- The NG-RAN and the 5GC are responsible to handle a service request for a slice that may or may not be available in a given area. Admission or rejection of access to a slice may depend by factors such as support for the slice, availability of resources, support of the requested service by NG-RAN.*

***<Unchanged Text Omitted>***

### *16.3.3a Slice aware cell reselection*

*Slice specific cell reselection information can be included in SIB16 and in RRCRelease messages. The slice specific cell reselection information may include reselection priorities per NSAG per frequency and corresponding list(s) of cells where the slices of the NSAG are supported or not supported. In the UE, NAS provides the NSAG(s) and their priorities to be considered during cell reselection. In order to support the NSAG, the NG-RAN provides the AMF with the NSAG information per TA in the appropriate NG interface management procedures, as specified in TS 23.501 [3]. The awareness in the NG-RAN of the NSAG(s) supported in the cells of its neighbours may be needed.*

*When a UE supports slice aware cell reselection, and when slice specific cell reselection information is provided to the UE, then the UE uses the slice specific cell reselection information. Valid cell reselection information provided in RRCRelease always has a priority over cell reselection information provided in SIB messages. When no slice specific reselection information is provided for any NSAG that UE AS received from NAS to be considered during cell reselection, then the UE uses the general cell reselection information, i.e., without considering the NSAG(s) and their priorities.*

**Q3: Do you think the corrections on TS 38.300 for NSAG are needed and agreeable?**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes, with modifications | The first change should be modified as follows:  *Some slices may be available only in part of the network. The NG-RAN supported S-NSSAI(s) and used NSAG(s) are configured by OAM. Awareness in the NG-RAN of the slices supported in the cells of its neighbours may be beneficial for inter-frequency mobility in connected mode.*  The second change should be modified as follows:  *In the UE, NAS provides the NSAG(s) and their priorities to be considered during cell reselection. In order to support the NSAG, the NG-RAN provides the AMF with the NSAG information per TA in the appropriate NG interface management procedures, as specified in TS 23.501 [3].*  This is because it was agreed that the RSAN only reports to AMF its own NSAGs, not the neighbor ones. |
| Qualcomm | OK | *Reword – The NG-RAN neighbours exchange NSAG(s) supported in the cells via XN interface to support cell reselection. ~~The awareness in the NG-RAN of the NSAG(s) supported in the cells of its neighbours may be needed.~~* |
| CATT | OK | QC version is more clear |
| Huawei | OK |  |
| Nokia | OK but | *Reword –*  *In order to support the NSAG, the NG-RAN provides the AMF with the NSAG configuration per TA in the appropriate NG interface management procedures, as specified in TS 23.501 [3] and may exchange NSAG configuration per cell with neighbor NG-RAN nodes.* |
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**Summary of Q3:**

To be summarized...

* 1. Whether TS 38.470 CR on the NSAG is needed?

In the reference paper [4], the corrections on TS 38.470 are proposed to support NSAG due to the following reasons:

* At previous RAN3#116 meeting, it was agreed that the *TAI NSAG Support List IE* is included in the F1 Setup Request message, and gNB-DU Configuration Update message, so that the gNB-CU can use it according to TS 23.501.
* While in the stage 2 specification, this part is missing. Note that it has already been specified in procedure texts that the S-NSSAI(s) supported by the gNB-DU can be informed by the F1 setup and gNB-DU Configuration Update functions.

The corrections on TS 38.470 are as follows:

## *3.2 Abbreviations*

*For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].*

*BH Backhaul*

*DRB Data Radio Bearers*

*eDRX extended Discontinuous Reception*

*F1-U F1 User plane interface*

*F1-C F1 Control plane interface*

*F1AP F1 Application Protocol*

*GTP-U GPRS Tunnelling Protocol*

*IAB Integrated Access and Backhaul*

*IP Internet Protocol*

*L2 Layer-2*

*MBS Multicast/Broadcast Service*

*NR-MIB NR-Master Information Block*

*NSAG Network Slice AS Group*

*O&M Operation and Maintenance*

***<Unchanged Text Omitted>***

### *5.2.1 F1 interface management function*

*The error indication function is used by the gNB-DU or gNB-CU to indicate to the gNB-CU or gNB-DU that an error has occurred.*

*The reset function is used to initialize the peer entity after node setup and after a failure event occurred. This procedure can be used by both the gNB-DU and the gNB-CU.*

*The F1 setup function allows to exchange application level data needed for the gNB-DU and gNB-CU to interoperate correctly on the F1 interface, and exchange the intended TDD DL-UL configuration originating from the gNB-DU or destined to the gNB-DU. The F1 setup is initiated by the gNB-DU.*

*The gNB-CU Configuration Update and gNB-DU Configuration Update functions allow to update application level configuration data needed between gNB-CU and gNB-DU to interoperate correctly over the F1 interface, and may activate or deactivate cells. For cross-link interference mitigation, the gNB-CU may coordinate the exchange of intended TDD DL-UL configuration by merging, forwarding and selective forwarding of intended TDD DL-UL configuration(s) between its gNB-DUs, or between its gNB-DUs and other gNBs, gNB-CUs. With the gNB-CU Configuration Update function, energy saving with cell activation/deactivation can be supported as defined in TS 38.300 [8].*

*The F1 setup and gNB-DU Configuration Update functions allow to inform the S-NSSAI(s),* ***NSAG(s),*** *CAG ID(s) and NID(s) supported by the gNB-DU.*

*The F1 setup and gNB-DU Configuration Update functions allow to provide information on RedCap access configuration at the gNB-DU.*

*The F1 setup and gNB-CU Configuration Update functions allow to inform the NID(s) available at the gNB-CU.*

***<Unchanged Text Omitted>***

**Q4: Do you think the corrections on TS 38.470 for NSAG are needed and agreeable?**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| Qualcomm | Yes |  |
| CATT | Yes |  |
| Huawei | Yes |  |
| Nokia | Yes but | update to “NSAG configuration(s)” since not only supported NSAGs are sent but also the configuration (which slices comprise the NSAG). |
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**Summary of Q4:**

To be summarized...

1. Conclusion, Recommendations
2. Reference
3. R3-224455 Correction of Slice Group Configuration over Xn (Nokia, Nokia Shanghai Bell, CATT, NEC, LG Electronics) discussion
4. R3-224456 Correction of Slice Group Configuration over Xn (Nokia, Nokia Shanghai Bell, CATT, NEC, LG Electronics) CR0866r, TS 38.423 v17.1.0, Rel-17, Cat. F
5. R3-224725 Supporting network slice AS group (Huawei, CMCC, ZTE) discussion
6. R3-224726 Supporting network slice AS group (Huawei, CMCC, ZTE) CR0105r, TS 38.470 v17.1.0, Rel-17, Cat. F
7. R3-224275 Correction of Slice Group Configuration (ZTE, Huawei, CMCC) CR0833r2, TS 38.423 v17.1.0, Rel-17, Cat. F
8. R3-224918 38.300 CR Correction on slice group configuration (CMCC,Huawei,ZTE) draftCR
9. R3-224574 How to achieve NSAG configuration at NG-RAN (Ericsson) discussion
10. R3-223792 Summary of offline discussion on slicing grouping and priority (CMCC)
11. R3-224051 Correction of Slice Group Configuration (Nokia, Nokia Shanghai Bell, LG Electronics, Huawei, Ericsson) CR0785r, TS 38.413 v17.0.0, Rel-17, Cat. F
12. R3-224052 Supporting network slice AS group (Huawei, LG Electronics, CATT, CMCC, ZTE, Ericsson, Nokia, Nokia Shanghai Bell) CR0927r, TS 38.473 v17.0.0, Rel-17, Cat. F