3GPP TSG-RAN WG2 #116-e electronic R2-2110701

Electronic, 1 – 12 Nov 2021

Agenda Item: 8.8.3

Source: Ericsson

Title: [Post115-e][242][Slicing] Cell- vs. UE specific slice group signalling (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This contribution summarizes the following discussion:

* [Post115-e][242][Slicing] Cell- vs. UE specific slice group signalling (Ericsson)

 Scope: Aim to understand issues with NAS signaling (which is UE-specific) since slice information should be common to all UEs in the same cell. Discuss if there are issues and attempt to resolve them. Focus on RACH aspects. Can have draft LS to SA2/CT1 (if needed)

 Intended outcome: report + draft LS (if needed)

 Deadline: Long

Deadline: October 21th, 0900 UTC

Contact person(s) for each participating company:

|  |  |
| --- | --- |
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# 2 Discussion

## 2.1 Background

The part of chair’s notes relevant to this email discussion is copied below.

[R2-2108839](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108839.zip) Report for [Post114-e][252][Slicing] RACH partitioning details for slicing CMCC discussion Rel-17 NR\_slice

- LGE wants to discuss P1+2 together, P6, P8-10 in the general discussion.

- Xiaomi is fine with P3/5/7, but thinks P2 should be discussed with P1. May not need extra signalling for the mapping. For P6, we need to first discuss 2-step RA support and whether UE chooses 2-step and 4-step first.

- For P7, ZTE wonders will all slice-specific resources have the same TB size since 2-step RA has limited data size. CMCC thinks we can leave this to network implementation.

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Discussion (1+2)

- Apple wonders if P2 means UE-specific grouping. Thinks RAN-specific grouping should be common to all UEs. Thinks we need to tell SA2 about that. CMCC explains this was not discussed during email discussion. Apple thinks for cell reselection, everything should be cell-specific. QC thinks we can leave this to operator configuration.

- CATT thinks that gNB is not aware NAS signalling. OPPO agrees but thinks CN can indicate the information to gNB via network interface. Slice group would be common to all UEs. Thinks we should have common grouping for RACH and cell reselection.

- OPPO agrees with P1+2. QC also agrees.

- Ericsson thinks NAS signalling is problem for cell-specific signalling. thinks it's difficult to decide without resolving this. Apple thinks we can provide more information to SA2/CT1. QC thinks we could still wait for one meeting and discuss.

- CMCC thinks one slice can be mapped to one and only one group, which will avoid problems. Similar to broadcast NSSAI vs. S-NSSAI.

* 1 A new slice grouping mechanism is introduced for RACH configuration. One slice belongs to one and only one slice group. Slice groups are assumed to be only updated when UE does Registration Update.
* 2 Working assumption: The mapping between S-NSSAIs and slice groups should be configured to the UE through NAS signalling. Discuss problems for cell- vs. UE-specific signalling via post-meeting email discussion.
* [Post115-e][242][Slicing] Cell- vs. UE specific slice group signalling (Ericsson)

 Scope: Aim to understand issues with NAS signaling (which is UE-specific) since slice information should be common to all UEs in the same cell. Discuss if there are issues and attempt to resolve them. Focus on RACH aspects.Can have draft LS to SA2/CT1 (if needed)

 Intended outcome: report + draft LS (if needed)

 Deadline: Long

## 2.2 Cell- vs. UE specific slice group signalling

In the scope of this email discussion, the following is listed:

Aim to understand issues with NAS signaling (which is UE-specific) since slice information should be common to all UEs in the same cell. Discuss if there are issues and attempt to resolve them. Focus on RACH aspects. Can have draft LS to SA2/CT1 (if needed)

The rapporteur assumes the nw operator configures the following via OAM:

* mapping of slices to slice groups, sent from CN to UE in NAS signalling (OAM configures CN)
* broadcast of slice group and its slice specific RACH configuration in SIB, when applicable (OAM configures RAN)

Consequently, the nw operator ensures the information signalled to each UE in NAS signalling and in SIB in cell is consistent, like existing TA/RA configuration.

The rapporteur assumes there are no issues to be solved w.r.t. “Cell- vs. UE specific slice group signalling” in standards, and no reason to send LS to SA2/CT1 at this stage.

**Q1. Companies are asked to provide their comments on the above rapporteur assumptions, and/or propose alternative solutions.**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm  | We agree with Rapporteur that it should be similar to existing TA/RA configuration. However, it seems Rapporteur think OAM configures both CN and RAN on TA list, and thereby no NGAP signaling exchange is required to be introduced to ensure consistent configuration between CN and RAN. Our understanding is a bit different: * We understand OAM only need to configure RAN on TA list, and RAN notifies AMF TAI list via NG SETUP REQUEST/ RAN CONFIGURATION UPDATE.
* In TS 38.413, NG SETUP REQUEST / RAN CONFIGURATION UPDATE message is copied below with key info highlighted. It looks straight forward to add slice grouping configuration in a same level of “*TAI Slice Support List*”

So, besides Rapporteur’s understanding, we think another alternative is: * RAN2 understand the existing TA/RA configuration procedure can be reused for slice grouping configuration.
* OAM configure RAN the mapping of slices to slice groups. And RAN broadcast of slice group identifiers and its slice specific RACH configuration in SIB, when applicable
* RAN notify AMF the mapping of slices to slice groups, so that mapping configuration in NAS signalling and in SIB in cell are consistent.

For these two alternatives, we don’t have strong opinion as long as no consistence between CN and RAN (slighly prefer OAM configures RAN and RAN notifies CN). However, it should be decided by RAN3 because it may have RAN3 impact. Thus, we suggest to send LS including the two alternatives to RAN3 for conclusion, and cc SA2 and CT1.  |
| Intel | Agree with the rapporteur’s assumption. Whether to depend on CN OAM or have RAN provide the slice grouping info to CN can be discussed between RAN3 and SA2 and it will be difficult for RAN2 to decide on what is exchanged between RAN and CN. We do not think RAN2 can task RAN3 to do such signalling.  Any LS should only be to inform RAN3 about RAN2 agreements and for that, we do not see it essential to send an LS.  |
| Samsung | Agree with the rapporteur’s assumption.Also agree with Intel’s comment that the issue on whether the OAM configures both CN and RAN with the mapping information (between S-NSSAIs and slice groups) or OAM configures RAN and RAN sends this information to CN, is up to SA2 and RAN3 to decide. |
| OPPO | We also agree with the rapporteur’s assumption.Regarding the issue of the slice group info on the CN side is provided by either OAM or RAN, we think either solution works. Also, we agree with Intel and Samsung to leave it to RAN3 and SA2 to decide. |
| Nokia | We agree with the understanding that UE’s Access Stratum receives the information by NAS signalling. Where the UE’s NAS originally receives it (whether CN receives the grouping info from OAM) does not impact RAN2 procedures.  |
| Huawei, HiSilicon | We agree with the rapporteur’s assumptions.In our opinion, CN should provide the mapping of slices and slice groups to UE by NAS signalling, and how RAN/CN can acquire this maping information can be left to RAN3 and SA2 to discuss. |
| CMCC | Here are 3 candidate solutions on the table:1. CN OAM configure AMF with group mapping. AMF sends it to RAN in NG SETUP RESPONSE or AMF CONFIGURATION UPDATE.
2. RAN OAM configure RAN with group mapping and RACH resources. RAN sends the mapping to CN in NG SETUP REQUEST or RAN CONFIGURATION UPDATE. (similar as TA list, as commented by QC)
3. CN OAM configure AMF with the mapping, and RAN OAM configure RAN with the mapping.

The first two solutions are easy to keep consistent. The last solution may miss consistency when the mapping is changed on one side. Generally, we think the NG signalling is needed. Regarding to per TA or per cell or per UE slice group signalling, we think the grouping can work in the same way as homogeneous deployment of slice in TA. We can indicate to RAN3 and SA2 that, from RAN2 point of view, slice grouping can be consistently configured per TA.Therefore, we see the value to send LS to RAN3, SA2 and CT1 to indicate the following preference from RAN2 side (if they are agreeable in RAN2):1. Mapping between slice and slice group should be consistent between serving gNB and UE, in order to avoid misunderstanding of system information.
2. Mapping between slice and slice group can be consistent within the same TA.
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| Futurewei | Given the analysis from CMCC, the scheme aligned with the existing TA/RA configuration (i.e., 2) in CMCC’s comments) looks more appleaing in maintaining both the consistency and flexibility between RAN and core deployments. |
| CATT | We agree with CMCC’s analysis. Both sol1 and sol2 are reasonable and feasible. Consdiering the mapping table valid area may be large within AMF or across AMF, the sol1 is better. The maintance effort can be reduced in the CN OAM configure solution. Also the mapping may be used by SMF/UDM. We should send LS to SA2 to check how to handle the mapping. |
| Spreadtrum | Agree with the rapporteur’s assumption and CMCC’s analysis. And we also agree with above companies that the consistence of slice group between RAN and CN could be left to SA2/RAN3. |
| Xiaomi | Agree with rapporteur’s assumption.And we agree above companies’ view that whether slice group info in CN is provided by RAN or OAM is up to RAN3 and SA2 and has no impacts on RAN2 procedure. |
| Apple | We feel the solution 2 in CMCC’s analysis is promising. It could be determined by RAN3 and SA2. And we think an LS is helpful to RAN3/SA2 to explain the intention agreed in RAN2. |
| LGE | We agree with Rapporteur’s assumption and have similar view with Qualcomm (OAM configures RAN and RAN notifies CN). .Anyway we should send an LS to RAN3/SA2 and this should be discussed in RAN3/SA2.  |
| Sharp | We agree with rapporteur’s assumption. Although our understanding is that slice groups will be also used for slice-aware cell reselection priorities in RRCRelease. |
| ZTE | We agree with the rapporteur’s assumption.Regarding the slice grouping, SA2 is going to send us reply LS with some questions for clarification and some further discussion is expected in the upcoming RAN2 meeting to address the questions from SA2. |
| vivo | Agree with rapporteur’s assumption. Also agree that UE’s Access Stratum receives the information by NAS signalling. |

**Rapporteur Summary:**

Companies agree with the rapporteur’s assumption that there are no issues to be solved w.r.t. “Cell- vs. UE specific slice group signalling” in standards.

How RAN andCN acquires the mapping information can be left to RAN3 and SA2 to discuss

From the discussion above, the rapporteur proposes the following

1. RAN2 agrees there are no issues to be solved w.r.t. “Cell- vs. UE specific slice group signalling” in standards,
2. The solution for how the nw operator configures the following (CN and/or RAN OAM) and potential NGAP impact is left for SA2/RAN3 to discuss:
- mapping of slices to slice groups, sent from CN to UE in NAS signalling
- broadcast of slice group and its slice specific RACH configuration in SIB (and dedicated from RAN to UE in RRCRelease).
3. RAN2 to discuss send LS to SA2/RAN3.

## 2.3 Slice group and slice-specific RACH configuration in SIB

The rapporteur propose we use this email discussion to also discuss this.

In LS to CT1/SA2 ([R2-2108928](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_115-e/Docs/R2-2108928.zip)) , RAN2 indicated the following:

Furthermore, RAN2 has been discussing a Slice Group concept, where a slice group consists of one or multiple slices, one slice belongs to one and only one slice group and each slice group is uniquely identified by a slice group identifier. This can avoid publishing slice identities (S-NSSAI) in System Information (security concern and SI size concern). RAN2 assumes the signalling of such slice grouping and slice group identity would be indicated in NAS signalling to the UE. The discussion and agreements reached in RAN2 apply equally to “slice” as well as to “slice group”, even if at many places only “slice” appears.

In the slice-specific discussions in RAN2, RAN2 e.g. has used the following wording (with terms slice-specific and common RACH) related to RACH type selection:

*For RACH type selection, UE first selects between slice-specific and common RACH, then selects between 2-step and 4-step.*

From the above, the rapporteur assumes that a possible solution to slice groups and slice-specific RACH configuration in SI could be as follows:

1. For slice-specific cell re-selection, one or multiple slice group identities are indicated in SIB of the serving cell.
2. The same slice groups as used for slice-specific cell re-selection are also used for slice-specific RACH configuration.
3. In a cell, there may be multiple slice-specific RACH configurations.
4. One or more of the slice groups are linked link to a slice-specific RACH configuration.
5. There may be slice groups that are not linked to a slice-specific RACH configuration (they use the common RACH configuration).
6. All slices of a slice group use the slice-specific RACH configuration of the slice group.

**Q2. Companies are asked to comment on rapporteur assumptions 1-6 above and/or provide alternative solution outline.**

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| **Company** | **Comments** |
| Qualcomm | We have same understanding as Rapporteur on assumption 1-6 |
| Intel | We are fine with the assumptions.  |
| Samsung | We are ok with the rapporteur’s assumptions. |
| OPPO | We are fine with the rapporteur’s assumptions. |
| Nokia | Ad.1. There is no agreement that the available (supported) slices of the cell are broadcast. The ongoing email discussion [Post#115e][244] addresses this point. We do not think that RACH should depend on this agreement of cell reselection, see also comment on point 2. Ad.2 If the point 2 is on NW configuration, it may be left to NW implementation whether the same group of slices is considered for cell reselection and further Access Control via RACH config. It should not be precluded that NW distinguishes different polices for cell reselection and RACH prioritization/isolation (e.g. if gNB broadcast cell reselection parameters it should be possible to release the gNB from applying RACH priorities among the slices in the group) Ad 5. It needs to be clarified whether the point is a requirement towards the UE or the NW. From the NW-side, if the NW distinguishes different slice groups but decide to not configure them – can be left to NW implementation, for the UE: if the UE belongs to a slice group but there is no configuration provided for the group – it is regular behaviour. Thus, in any case the standard statement as given by 5. may be not necessary.  |
| Huawei, HiSilicon | We agree with the rapporteur’s assumptions. |
| CMCC | We agree with rapporteur’s assumption 1~6. |
| Futurewei | We are fine with taking Rapporteur’s assumptions as baseline operation of slice grouping and slice-specific RACH configuration.  |
| CATT | We agree with the rapporteur’s assumptions. There may be minor error in item4, the *link* after *linked* shoule be deleted.1. One or more of the slice groups are linked ~~link~~ to a slice-specific RACH configuration.
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| Spreadtrum | Agree with the rapporteur’s assumption. |
| Xiaomi | We agree with rapporteur’s assumptions. |
| Apple | We agree with rapporteur’s assumptions. |
| LGE | We agree with rapporteur’s assumptions. |
| Sharp | We agree with rapporteur’s assumptions. |
| ZTE | On point 1, we would like to clarify our understanding that the slice id(s) broadcast in the serving cell’s SIB refers to the slice id supported by the serving frequency and inter- frequencies.On point 2, we understand the mapping between slice id and slice(s) would be the same for slice specific reselection configuration and slice specific RACH but the exact slice groups can be configured differently for reselection and RACH. For example, NW is allowed to broadcast slice specific reselection information for slice group #1 and #2 while the slice specific RACH configuration is for slice group#3 and #4. |
| vivo | We agree with rapporteur’s assumptions |

**Rapporteur Summary:**

There was support for the rapporteur’s proposal possible solution to slice groups and slice-specific RACH configuration. The followong is proposed (text adjusted based on company comment):

1. RAN2 will use the following assumptions on slice groups and slice-specific RACH configuration in the work on Stage 3 details:

For slice-specific cell re-selection, one or multiple slice group identities are indicated in SIB of the serving cell. They refer to the slices supported by the serving frequency.

The same slice groups as used for slice-specific cell re-selection are also used for slice-specific RACH configuration. Slice groups can be configured differently for reselection and RACH.

In a cell, there may be multiple slice-specific RACH configurations.

One or more of the slice groups are linked to a slice-specific RACH configuration.

There may be slice groups that are not linked to a slice-specific RACH configuration (they use the common RACH configuration).

All slices of a slice group use the slice-specific RACH configuration of the slice group.

# 3 Conclusion

As outcome of this email discussion, the following is proposed:

1. RAN2 agrees there are no issues to be solved w.r.t. “Cell- vs. UE specific slice group signalling” in standards,
2. The solution for how the nw operator configures the following (CN and/or RAN OAM) and potential NGAP impact is left for SA2/RAN3 to discuss:
- mapping of slices to slice groups, sent from CN to UE in NAS signalling
- broadcast of slice group and its slice specific RACH configuration in SIB (and dedicated from RAN to UE in RRCRelease).
3. RAN2 to discuss send LS to SA2/RAN3.
4. RAN2 will use the following assumptions on slice groups and slice-specific RACH configuration in the work on Stage 3 details:

For slice-specific cell re-selection, one or multiple slice group identities are indicated in SIB of the serving cell. They refer to the slices supported by the serving frequency.

The same slice groups as used for slice-specific cell re-selection are also used for slice-specific RACH configuration. Slice groups can be configured differently for reselection and RACH.

In a cell, there may be multiple slice-specific RACH configurations.

One or more of the slice groups are linked to a slice-specific RACH configuration.

There may be slice groups that are not linked to a slice-specific RACH configuration (they use the common RACH configuration).

All slices of a slice group use the slice-specific RACH configuration of the slice group.