3GPP TSG-RAN WG2 Meeting #116bis-e R2-22XXXX

Electronic Meeting, 17 – 25 January 2022

**Agenda item: 8.8.1**

**Source: CMCC**

**Title: Report for [AT116bis-e][240][Slicing] Remaining details for slice groups (CMCC)**

**WID/SID: FS\_NR\_slice**

**Document for: Discussion and Decision**

# Introduction

This document aims at address the remaining details for slice groups

* [AT116bis-e][240][Slicing] Remaining details for slice groups (CMCC)

 Scope: Discuss the slice group aspects: 1) discuss what should be the definition of slice group (based on latest RAN2 and SA2 agreements)? 2) how to resolve the TA boundary aspects? 3) does UE select different slice group if no cell supporting that slice group is available?

 Intended outcome: Discussion summary in R2-2201708.

 Deadline: Deadline 3

 Comment deadline: Thursday W1, 1600 UTC (for collecting views)

 Rapporteur proposals: Friday W1, 0900 UTC (proposed resolution of issues)

 Document deadline: Monday W2, 1200 UTC (report or agreed CRs)

**Contact List**

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# Discussion

***Open issue 1: Definition of slice grouping***

Previous agreements in RAN2#116-e:

* A network slice can be associated to none or only one slice group.

Since SA2 hasn’t reached agreement on the definition of slice grouping, RAN2 can try to define one based our understanding. A candidate definition is shown below:

**Slice group: A group which is associated with one or multiple slices. And a slice is associated to none or only one slice group.**

**Q1.1: Do you agree with the above definition for slice group? Other suggestions are also welcome.**

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| **Company** | **Comments** |
| Qualcomm | Agree.  |
| Lenovo | No. There’s no need to restrict that one slice can belong to only one slice group. This would create deployment configuration issues e.g., if a slice can’t belong to more than one group, network might be forced to keep only one slice in a group, taking away all the advantages associated to a slice group. The definition can be modified as:**A network slice can be associated to none or more slice groups.** |
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Regarding to the maximum number of slice groups, the contributions [19, 30, 47] suggested the maximum number of slice groups as at most 16 slice groups, or as less as possible (e.g. 3 slice groups representing for high/medium/low degree of importance). While, [5] suggested to postpone the decision on maximum number of slice grouping configured by Network after it is clear what dedicate configurations can be configured for one slice group.

**Q1.2: What is the maximum number of slice group?**

**Option 1: 16**

**Option 2: other numbers.**

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| Company | Which option do you prefer | Comments |
| Qualcomm  | See comments | We still see more than 1 companies are proposing to modify previous RAN2 WA on per-TA slice grouping to per-PLMN with some technique justifications. If it is per-PLMN, it is obviously up to 16 groups is not sufficient. That is why we think it seems still not a good time to determine the maximum number of slice group. We think RAN2 can agree max slice grouping number only after:* The definition of slice grouping is finalized (including its definition and granularity)
* What configuration (and its payload size) can be configured to one slice group
 |
| Lenovo | 2 | Assuming this question is from network’s perspective. **Max Slice Groups:** Very unclear now. Logically, number of slice groups must be less than possible slices itself (S-NSSAIs) but it is difficult to put a number now. Number of slices itself could be in thousands: S-NSSAI ::= CHOICE{ sst BIT STRING (SIZE (8)), sst-SD BIT STRING (SIZE (32))}Calculating just with sst, we can have upto 256 slices but it is clear that even sst-SD can be used for forming slice identifications. Assuming about 1000 slice signaling possibility to be supported by Broadcast signalling and assuming that around 8 slices can be clubbed together in a slice group, we might end up supporting signalling possibility for up to 128 slice groups (7bits).Since it is difficult to see the necessity of so many slice groups in Rel. 17/ 18 timeframe, we can go for a lower number now like 16/ 32/ 64 slice groups. |
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***Open Issue 2: TA boundary***

Previous agreements in RAN2#116-e

* 3: Working assumption: The granularities of the slice groups for cell reselection are per TA. FFS on the details (e.g. how to resolve TA boundaries).

A number of contributions [4, 16, 19, 25, 30, 49] see issues for TA boundary and suggested to resolve the issues, while the contributions [22, 48] thought that there is no issue and no spec impacts on TA boundary.

The first open issue is that, when UE is checking whether the highest ranked cell support the highest priority slice, how the UE is aware of the slice supported by the neighbouring cell belonging to other TA?

According to the contributions, there are several potential solutions for resolving the TA boundary issue.

**Q2.1: How UE can know the supported slice for neighbouring cell at TA boundary?**

**Option A: The gNBs exchange the supported slices (S-NSSAI/NSSAI) through Xn interface, then serving gNB can map the slices supported by neighbour cells to slice groups based on the slice group mapping relationship in current TA and broadcast it to the UEs. [19]**

**Option B: As assistance information, an optional PCI list is introduced to indicate the cells supporting one slice group in a new SIB. And if NW don’t provide such info on the best ranked cell, the UE may skip the checking on slice support in best ranked cell. [4]**

**Option C: Add the association of slice group IDs and their valid TACs in the slice-specific cell reselection info for inter-TA cell reselection. The UE can determine whether to camp on the highest ranked cell based on the TAC received in its SIB1.[30]**

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| Company | Which option do you prefer | comments |
| Qualcomm | Option B in RAN2 | We are proponent of Option B. It is also one solution to reduce signalling overhead of slice info in SIB. In this way, the UE behaviour is clearly specified, and no RAN3 and SA2 impacts are foreseen (i.e., it is up to source cell implementation how to provide the optional PCI list)For Option A and C, it obviously has at least RAN3 impacts. And we don’t see they are mutual exclusive to Option B. Because they are not RAN2 expertise, we suggest proponents to propose these solution in RAN3 and SA2 first.  |
| Lenovo | A | Our understanding is that the slice group should have the same meaning (i.e., the associated slices) for a UE in its registration area. Therefore, the TA-list received as part of the registration area should have consistent use of Slice group. On top of this, we think that the agreement from the last meeting applies:***A serving cell can provide slice support of neighbour cells.***In the (TA-list) boundary cases, the UE needs to perform RAU when reselecting to a cell of another RA (based on slice based or legacy reselection). The RAU procedure will reveal the applicable association of slice->slice group and therefore, optimizing for boundary cases is not necessary to eliminate cases when the meaning of slice group changes from one RA to another. |
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The contribution [19, 12] pointed out the case that the neighbour cell supports a slice which cannot be mapped into any current slice group and suggested to handle this issue. There are several potential solutions for this issue:

**Q2.2: How to handle the case if the gNB doesn’t support the slice group mapping for the slice of the neighbouring cell? Do we need to send LS to RAN3/SA2?**

**Option 1: The gNB can request CN to update the mapping to involve the new slice.[19]**

**Option 2: The gNB can request RAN OAM to update the mapping to involve the new slice.**

**Option 3: Restrict that one slice is mapped to only one slice group. [12]**

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| Company | Which option do you prefer | Send LS to RAN3/SA2? | comments |
| Qualcomm  | See comments | No | As we replied in Q2.1, Option 1 and Option 2 are RAN3 expertise. We suggest proponents to propose these solutions in RAN3 first. We don’t think any issue to resolve in RAN2, and also we don’t think RAN2 should trigger such discussion to RAN3.  |
| Lenovo | See comments | Not sure | Not supporting should not mean a gNB can’t advertise slice group mapping for the slice of the neighbouring cell. |
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***Open issue 3: Consider low priority slice or not***

The contribution [8, 19] have proposed that low priority slice is considered with iteration but needs to some enhancements, for example, reuse the immediate past measurements, or set the maximum number of iterations, or set a timer for iteration, etc. Another contribution [30] proposed that RAN can indicate the UE whether to perform Step 7 or the limit times of iterations.

On the other hand, the contribution [35, 37] proposed new algorithm on frequency priority handling, in which the low priority slice is considered without iteration.

Some contributions [4, 16, 11, 33, 41] suggested to only consider the highest priority slice.

**Q3: Does UE select different slice if no cell supporting that slice is available, which option do the companies prefer?**

**Option A1: Low priority slice is considered with iteration. [8, 19, 44, 45]**

**Option A2: Low priority slice is considered, but without iteration. [35, 37]**

**Option B: Only highest priority slice considered. [4, 16, 11, 33, 41]**

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| Company | Which option do you prefer | Comments |
| Qualcomm | Option B with comments | We support a clearer Option B:**Option B-1: Only highest priority slice considered, then legacy priorities considered. [4, 16, 11, 33, 41]** For Option A1 and A2:* We do not support them as we commented before that it will increase UE’s latency and power consumptions during cell reselection, especially if number of slice group is large. It is conflicted with the intention to introduce slice specific cell reselection.
* At such late stage of Rel-17, we have to emphasize that RAN2 need to focus on how to close open issues in the remaining two meetings. In our understanding, there is even not a converged baseline solution on how to consider the low priority slice (e.g., how to converge Option A1 and Option A2?). And more and more enhancements are being proposed as Rapporteur mentioned (e.g., set the maximum number of iterations, or set a timer for iteration), which we are not sure whether they are on top of Option A1 or Option A2? We don’t think how RAN2 can make progress for these on-fly proposals in the remaining 2 meetings.

In all, although we understand Option B-1 has some performance restriction, we think it is a reasonable way forward to finalize Rel-17 RAN slicing enhancement, given the current situation.  |
| Lenovo | A1 | **In case of Option A2** [35, 37]: UE after an unsuccessfully try to reselect a cell for the highest priority slice, will:*…the UE shall use the CellReselectionPriority as reselection priority for this frequency until the highest ranked cell changes on the frequency, or new slice priorities are received from NAS.*This approach has the following issues:Then this will/ can lead to a situation where the UE must start with measurement of other frequencies afresh.It is possible that the highest ranked cell supports the next highest prioritized slice, but since the UE is not going to consider this frequency again until the highest ranked cell changes, the second highest ranked slice can’t be attained.The condition “until the highest ranked cell changes” can lead to UE continuously monitoring the highest RC – leading to battery loss.**In case of B**, the importance of this work item is reduced to a bare minimum and is therefore un-acceptable; if e.g., there’s no frequency supporting UE’s highest priority slice, the UE falls back immediately to legacy cell reselection procedure. |
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# Summary

# References

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2. R2-2200044 Running 38.304 CR for RAN slicing Ericsson
3. R2-2200055 List of open issues for RAN slicing WI CMCC
4. R2-2200179 Remaining issues on slice specific cell reselection Qualcomm Incorporated
5. R2-2200180 Remaining issues on slice specific RACH Qualcomm Incorporated
6. R2-2200181 Further discussion on UE capability related to RAN slicing enhancement Qualcomm Incorporated
7. R2-2200406 Optimizations for signalling Slice Information Lenovo, Motorola Mobility
8. R2-2200407 RAN Slicing CR to 38.304 Lenovo, Motorola Mobility
9. R2-2200408 Triggers for initiating RAN slicing based cell reselections Lenovo, Motorola Mobility
10. R2-2200409 Principles of Slice based reselection Lenovo, Motorola Mobility
11. R2-2200416 Discussion on Slice based Cell Reselection CATT
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21. R2-2200847 Discussion on UE capability for RAN slicing enhancement CMCC
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30. R2-2200974 Discussion on slice based cell reselection under network control Huawei, HiSilicon
31. R2-2200975 Discussion on slice based RACH configuration Huawei, HiSilicon
32. R2-2200976 Discussion on UE capabilities for RAN slicing Huawei, HiSilicon
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34. R2-2201050 Detailed RRC signalling for RACH prioritization configuration Nokia, Nokia Shanghai Bell
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38. R2-2201170 RACH for RAN slicing enhancement Ericsson
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41. R2-2201192 Slice-based cell re-selection TP for solution 4C NEC Telecom MODUS Ltd.
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43. R2-2201208 Discussion on signalling slice information LG Electronics UK
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47. R2-2201409 Considerations on remaining issues for slice based RACH Beijing Xiaomi Software Tech
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51. R2-2201422 On selection of Solution 4 Option A, B and C Samsung R&D Institute UK
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53. R2-2201475 Remaining issues on slice based RACH prioritization LG Electronics Inc.
54. R2-2201536 38.321 running CR for RAN Slicing OPPO