3GPP TSG-RAN WG3 #113-e R3-214320

16-26 Aug 2021

Online

Agenda Item: 10.2.1.5

Source: CMCC

Title: Summary of offline discussion on load balancing enhancements

Document for: Discussion

# Introduction

This contribution provides the summary of the following email discussion,

**CB: # SONMDT4\_LoadBalance**

**- Topics to discuss:**

 **- Resolution to FFS of per slice PRB**

 **- Semantics description of NUL and SUL CAC**

 **- per-SSB SUL PRB**

 **- per-SSB and per-slice Mobility Setting Change**

 **- load metric for UEs in RRC Inactive**

 **- MLB for PSCell and resource aggregation**

 **- Mechanism of controlling load balancing**

**- Start with summary of offline, proceed to TPs if there are agreements**

(CMCC - moderator)

Summary of offline disc in [R3-214168](Inbox%5CR3-214168.zip) rev in [R3-214320](Inbox%5CR3-214320.zip)

# For the Chairman’s Notes

Propose to capture the following:

For proposals that could be agreed,

For proposals that could be captured as ‘to be continued’,

(To be added after the second round)

# Discussion (second round)

Last Friday online session captures the following content in the Chairman’s Notes:

The reference point for slice PRB usage is total PRBs available in the cell. And the semantics description for slice PRB usage should mention the selected reference point.

Separate reporting of dedicated/prioritized/shared slice PRB usage is not pursued in this release.

Remaining issues:

FFS on whether and how to introduce per-slice offset for Mobility Settings Change.

FFS on introducing load metric for UEs in RRC inactive.

FFS on whether and how to report load of potential PSCells.

FFS on whether and how to exchange information of cells for resource aggregation.

FFS on whether to introduce stop/pause/resume mechanism for load reporting.

Further carification on enabling per-SSB offset for Mobility Settings Change over Xn, and possibly F1.

FFS on introducing per SSB area SUL PRB usage over Xn and F1.

2nd round of discussion:

* Working on stage2 TP in [R3-214319](Inbox%5CR3-214319.zip)
* Further discussion on the left issues

Besides Stg2 TP, the second round will select some of the above open issues, which are expected to achieve further consensus or needs more clarifications for further discussion, including,

* Details on Semantics description of slice PRB usage
* Further clarification on enabling per-SSB offset for MSC over Xn, and possibly F1.

Other open issues are expected to be further discussed for the next meeting.

**Open issue 1: Further clarification on enabling per-SSB offset for MSC over Xn, and possibly F1.**

During the online session, one company shows concern that per-SSB offset for MSC over Xn may not work well if some beam-related information is not transmitted over F1 from DU to CU in cases of the disaggregated architecture. Other companies are fine to further discuss the scheme on F1, but more clarifications are needed.

Note that the proposing company has provided [6] to discuss the details on CU-DU impact for MSC procedure. And the following observations and proposals are given in [6],

**Proposal 1: RAN3 shall enable per-SSB Mobility Setting Change.**

**Observation 1: Setting and updating beam-dependent RRC parameters during mobility in a disaggregated architecture requires transfer of beam information and related configuration between CU and DU over F1.**

**Proposal 2: RAN3 shall add two new optional F1 IEs: the selected beam group ID to indicate the serving beam in F1: UE Context Setup Response, F1: UE Context Modification Response and F1: UE Context Modification Required messages from DU to enable CU to select the correct RRC parameter values corresponding to the UE’s serving beam at DU.**

**Proposal 3: The mobility parameters (e.g., CIO) are treated as a function of the serving beam/target beam by the DU.**

Please provide your comments in the following table on the above scheme for CU-DU case

|  |  |
| --- | --- |
| Company | Comment |
|  |  |
|  |  |
|  |  |

On the other hand, since the main concern raised above is focused on the disaggregated architecture, for non-disaggregated architecture, the concern may not apply. So we propose the following,

**Proposal 1: Enable per-SSB offset for Mobility Settings Change over Xn for non-disaggregated architecture. FFS on CU-DU case.**

Are companies OK with the above proposal?

|  |  |
| --- | --- |
| Company | Comment |
|  |  |
|  |  |
|  |  |

**Open issue 2: Details on Semantics description of slice PRB usage**

According to the latest version of BLCR for XnAp and F1AP, the semantics description for slice PRB usage is given as follows,

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| >>>>S-NSSAI DL GBR PRB usage | M |  | INTEGER (0..100) | Per cell DL GBR PRB usage for this slice. [FFS on the reference for the percentage calculation] | - |  |
| >>>>S-NSSAI UL GBR PRB usage | M |  | INTEGER (0..100) | Per cell UL GBR PRB usage for this slice. [FFS on the reference for the percentage calculation] | - |  |
| >>>>S-NSSAI DL non-GBR PRB usage | M |  | INTEGER (0..100) | Per cell DL non-GBR PRB usage for this slice. [FFS on the reference for the percentage calculation] | - |  |
| >>>>S-NSSAI UL non-GBR PRB usage | M |  | INTEGER (0..100) | Per cell UL non-GBR PRB usage for this slice. [FFS on the reference for the percentage calculation] | - |  |

During the online session, we achieved the following agreement,

The reference point for slice PRB usage is total PRBs available in the cell. And the semantics description for slice PRB usage should mention the selected reference point.

Based on the above agreement, we believe the FFS in the tabular can be removed. And the selected reference point should be mentioned after ‘Per cell xxxx PRB usage for this slice.’ The update will be made at the next time we prepare our stg3 TP.

Are companies OK with the above way of handling semantics description for slice PRB usage?

|  |  |
| --- | --- |
| Company | Comment |
|  |  |
|  |  |
|  |  |

**Open issue 3: Stg2 TP**

The proposed stg2 TP in R3-214104 [17] mainly add slice PRB usage related metrics in load reporting section.

During online session, one company pointed out that the stg2 TP provided in [17] needs some revision, since we’ve not defined the Total PRB usage for slices. So a draft revised version is uploaded in the folder.

Some company also suggested not preparing stg2 TP until the end of Rel-17, so that all agreements can be captured as a package in stg2 TP once for all. But since we’ve spent several meetings discussing slice PRB usage, and finally achieved consensus on all open issues related to slice PRB usage, plus the condition that the stg3 TPs for slice PRB usage has been agreed and captured in BLCR during last meeting. To be consistent with XnAP and F1AP BLCR, the stg2 TP would be better to be updated accordingly sooner than later.

Is the stg2 TP provided in draft R3-214319 (in revision of R3-214104) agreeable?

|  |  |
| --- | --- |
| Company | Comment |
|  |  |
|  |  |
|  |  |

**Other open issues:**

As indicated above, other open issues are expected to be further discussed next meeting. Please provide comments below if companies find some open issues are better to be discussed during this meeting.

|  |  |
| --- | --- |
| Company | Comment |
|  |  |
|  |  |
|  |  |

# Discussion (first round)

## Resolution to FFS of per slice PRB

At the last meeting, PRB usage together with slice total PRB allocation has been introduced for load reporting, and stg3 TPs on XnAP and F1AP have been agreed. In the tabular of agreed TPs, there was an FFS left on the reference for the percentage calculation for S-NSSAI UL/DL GBR/non-GBR PRB usage.

According to the email discussion of last meeting, there are two interpretations on the table,

1) Slice PRB usage is calculated by the PRBs used compared to the total PRBs available in the cell

2) Slice PRB usage is calculated by the PRBs used compared to the Slice total PRB allocation for this slice in the cell.

Regarding two options on interpretations, the companies supporting Interpretation 1) are:

Huawei [10] **Proposal 1: Remove the FFS for per slice reporting of PRB**

Ericsson [13] **Proposal 3: The reference for calculating the percentage of Slice DL GBR/non-GBR UL/DL PRB usage is the number of resource blocks per cell as indicated in NR NRB IE over XnAP and F1AP.**

CMCC [16] **Proposal 1: It is suggested that Slice PRB usage is interpreted as the percentage used compared to the total cell capacity, and the semantic descriptions for XnAP and F1AP are updated accordingly if needed.**

While the companies supporting Interpretation 2) are:

NEC [1] **Proposal 1: Define DL PRB GBR/non-GBR usage as percentage of slice DL total PRB allocation. Define DL PRB GBR/non-GBR usage as percentage of slice DL total PRB allocation.**

Nokia [8] [9]

**Proposal 1: RAN3 shall discuss the benefits of either of the solutions. Reference to the resources available for the slice may be slightly better option to avoid errors.**

**Proposal 2: Considering that there are different possibilities for the reference, it may be clearer (and help avoid misunderstandings in future) if the selected reference is explicitly mentioned in the semantics.**

**Question 1-1: Which interpretation do companies prefer? Please also provide reasons.**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Prefer Interpretation1.Some company may have concern that by Interpretation1, the value of slice PRB usage may be sometimes larger than the value of slice total PRB allocation, which is seen as an error; however, from our understanding, on the contrary, Interpretation1 is safer to avoid errors. As discussed in our contribution, for the value setting of slice total PRB allocation when slice total PRB allocation is modified due to OAM configuration within the measurement period for load reporting, it is reasonable to use the most updated total allocation per slice for load reporting, thus the receiving node is able to know that the slice total allocation has been changed for the specific cell in the sending node, without causing any confusion.In addition, Slice PRB usage is reported as an average value for sampling results during the time after slice total PRB allocation has been newly modified, rather than sampling results measured during the whole periodicity configured for load reporting. And such understanding will never lead to a condition that the value of slice PRB usage is larger than the value of slice total PRB allocation.Based on the above observations, Interpretation1 is on the contrary safer to be used since the receiving node will never know a logical error (such as filling in the wrong value to slice PRB usage/total PRB allocation) happens by using Interpretation2; while for Interpretation1, the receiving node can just disregard such load reporting information. |
| Nokia | As declared in our paper, either way will work. We have slight preference for option 2, to avoid possible miscalculations, but we will accept option 1, too. |
| Ericsson | Agree with CMCC.Interpretation 1 is also the simplest because it is based on the total PRBs available in the cell, which is a known and static parameter |
| Deutsche Telekom | Interpretation 1.W.r.t. reasons see CMCC’s and E///’s comments.  |
| ZTE | Similar view with Nokia, our intention is to select the Option 2). But we are not against the Option 1), if the majorities support it. |
| Huawei | Slight preference for interpretation 1. The interpretation of PRB is already quite difficult to understand so we prefer to align with the legacy as much as possible, i.e. to report per cell. |
| Orange | We prefer Interpretation 1 as it seems simpler and more efficient to avoid errors. |
| NEC | Similar to Nokia, in our paper we have preference for Interpretation 2, but we can accept Interpretation 1. But at least the reference should be clearly mentioned in the specifications to avoid different interpretations. |
| Samsung  | Prefer Interpretation1.Better to have same reference for PRB usages to avoid confusion.  |

**Question 1-2: Do companies agree that the selected reference should be explicitly mentioned in the semantics?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Slightly prefer to explicitly mention the selected reference to avoid confusion in the future. Also fine to just remove the FFS. |
| Nokia | Since there are two option, and we have already had interpretation issues, we think it will be beneficial to define it explicitly. Otherwise, we will have the same discussion again in a year or two. |
| Ericsson | Yes, it should be mentioned to avoid misinterpretation |
| Deutsche Telekom | Agree with statements from companies above. Explanation is needed to avoid implementations based on different interpretations. |
| ZTE | Agree to clarify the interpretation. |
| Huawei | This is already aligned in the semantics. All PRB usage is defined as " **Per cell xxxx PRB usage** ". The only deviating semantics is the last one for the total amount. So is the intention to clarify all? |
| Orange | We support the explicit reference in the semantics to avoid confusion |
| NEC | Yes. The reference shall be clearly mentioned in the specifications to avoid different interpretations. |
| Samsung | Ok for explicitly mention in the semantics |

Moderator’s summary:

Since the majority view (7 out of 9) prefers Interpretation 1 and all companies are fine to accept Interpretation 1, we can go for Interpretation 1 as a summary.

All companies agree that the selected reference should be explicitly mentioned in the semantics, and one company points out that the current semantics in BLCR has already indicated that the reference point is per cell. So we propose the following.

**Proposal 1: The reference point for slice PRB usage is total PRBs available in the cell. And the semantics description for slice PRB usage should mention the selected reference point.**

In addition, NEC [1] also proposes to consider more detailed slice related metrics for load reporting,

**Proposal 2: Consider to extend/update the current definitions of per slice PRB usage values and per slice available PRB values to have more specific reporting of dedicated/prioritized/shared resources per slice.**

**Question 1-3: Do companies think it beneficial to separately reporting dedicated/prioritized /shared slice PRB usage?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | We have long supported to introduce such separation, and have submitted contributions to discuss this topic for last several meetings. Our understanding is that such separation is absolutely beneficial under the condition that the RRMPolicy for slices configured by OAM is also exchanged between nodes. |
| Nokia | We preferred to have a simple approach in Rel.17. However, if time allows, we could start the discussion to see if there are any complications related to the split. |
| Ericsson | No. The agreement taken at the last meeting, which was the result of a compromise between different companies, is the following:**To enable reporting of utilised PRBs per slice, split to GBR/nGBR traffic, together with the total resource allocation per slice (exact definition FFS, e.g. “total resource allocation per slice is the overall amount of PRBs which could be available per slice if all the resources the slice could use were available”); RRM policies defined in SA5 should not be exposed**If we want to break such agreement by exposing the RRM policies, we should then revert it in full and remove support of utilised PRBs per slice. We could then discuss again the possibility of expressing available PRBs per slice, rather than utilised PRBs per slice. The latter solution does not need to express RRM policies. |
| Deutsche Telekom | We should respect the agreement from last meeting for the Rel-17 SON/MDT WI.Nevertheless, DT is supportive to discuss benefits of the more detailed approach proposed by NEC and CMCC as TEI17 or for Rel-18. From an operator’s perspective, we don’t see a problem to exchange slice-specific RRMPolicy between nodes at least in our own network. |
| ZTE | Agree with this optimization. |
| Huawei | In the last meeting we reached a compromise on how to report. We should not tear up this compromise. |
| Orange | We think that benefits of separately reporting dedicated/prioritized /shared slice PRB usage merit to be studied. Same opinion as DT regarding exchange of slice-specific RRM policies between nodes within our own networks.  |
| Samsung | The compromised way forward at last meeting is preferred. |

Moderator’s summary:

Four companies including 3 operators show interest of such enhancement. In addition, operators do not see any problem by exchanging slice related RRM policies between nodes in their own networks.

But as pointed out by many companies, it is also the truth that we achieved an agreement stating that ‘RRM policies defined in SA5 should not be exposed’ during last meeting. In order to follow the spirit of compromise, the moderator would like to propose the following,

**Proposal 2: Separate reporting of dedicated/prioritized/shared slice PRB usage is not pursued in this release.**

## Semantics description of NUL and SUL CAC

As proposed by NEC in [2] and [3], the semantics description on UL CAC is suggested to only reflecting NUL CAC in both XnAP and F1AP, which is modified as follows,

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** |
| Composite Available Capacity Downlink | M |  | Composite Available Capacity 9.2.2.52 | For the Downlink  |
| Composite Available Capacity Uplink | M |  | Composite Available Capacity 9.2.2.52 | For the Uplink NUL, not including SUL (if available) |
| Composite Available Capacity Supplementary Uplink | O |  | Composite Available Capacity 9.2.2.52 | For the SUL (if available) |

**Question 2: Do companies think it necessary to modify semantics description on UL/SUL CAC?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Temporarily no. Recall that we achieved an agreement during RAN3#111-e stating that ‘The currently reported UL information convers “both normal UL and SUL”’, but we are open to discuss and more clarification from supporting company may be needed. |
| Nokia | Prefer not to change it.This seems like changing the agreement regarding the interpretation of the eisting IEs we had at the beginning of the discussion. The agreement concerned existing implementations, so this change shall be carefully reviewed if it is functionally backward-compatible. |
| Ericsson | NO. the change would not be backwards compatible because in Rel16 the ony possible interpretation of the *Composite Available Capacity Uplink* IE is that it refers to all UL resources, i.e. NUL+SUL. |
| CATT | Not needed. Ordinarily the value would not differ much before and after this modification.And RAN3 has agreed that UL load metrics cover both the NUL and the SUL. |
| Deutsche Telekom | We prefer to keep current text. Any NBC change should be definitely avoided. |
| ZTE | Agree with this modification, if not, the IE *Composite Available Capacity Supplementary Uplink* seems to be unnecessary and can be removed. |
| Huawei  | We added SUL because some UEs (far from target) is likely to only being able to use SUL (and not NUL) so it makes sense to report SUL only. Having the combined SUL+NUL applies to UEs being able to be placed in either SUL or NUL. Reporting NUL only may be motivated (needs discussion) if there are many UEs only able to use NUL. Also, the SUL+NUL could probably be used for this considering that SUL typically has less resources? But if this NUL only is needed it would be better to add a new IE for NUL only instead of changing the existing. |

Moderator’s summary:

Many companies point out that the TPs proposed is NBC that should be avoided, and the majority view prefers to keep the current text. So these two TPs are not pursued.

## Per-SSB SUL PRB

As proposed by NEC in [4] and [5], per-SSB SUL PRB usage is suggested to be additionally introduced on top of current agreed per-SSB UL/DL PRB usage in both XnAP and F1AP, which is given as follows,

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** | **Criticality** | **Assigned Criticality** |
| **SSB Area Radio Resource Status List** |  | *1* |  |  | - |  |
| **>SSB Area Radio Resource Status Item** |  | *1..<maxnoofSSBAreas>* |  |  | - |  |
| >>SSB Index | M |  | INTEGER (0..63) |  | - |  |
| >>SSB Area DL GBR PRB usage | M |  | INTEGER (0..100) | Per SSB area DL GBR PRB usage | - |  |
| >>SSB Area UL GBR PRB usage | M |  | INTEGER (0..100) | Per SSB area UL GBR PRB usage | - |  |
| >>SSB Area DL non-GBR PRB usage | M |  | INTEGER (0..100) | Per SSB area DL non-GBR PRB usage | - |  |
| >>SSB Area UL non-GBR PRB usage | M |  | INTEGER (0..100) | Per SSB area UL non-GBR PRB usage | - |  |
| >>SSB Area DL Total PRB usage | M |  | INTEGER (0..100) | Per SSB area DL Total PRB usage | - |  |
| >>SSB Area UL Total PRB usage | M |  | INTEGER (0..100) | Per SSB area UL Total PRB usage | - |  |
| >>SSB Area SUL GBR PRB usage | O |  | INTEGER (0..100) | Per SSB area SUL GBR PRB usage | YES | ignore |
| >>SSB Area SUL non-GBR PRB usage | O |  | INTEGER (0..100) | Per SSB area SUL non-GBR PRB usage | YES | ignore |
| >>SSB Area SUL Total PRB usage | O |  | INTEGER (0..100) | Per SSB area SUL Total PRB usage | YES | ignore |
| >>DL scheduling PDCCH CCE usage | O |  | INTEGER (0..100) |  | - |  |
| >>UL scheduling PDCCH CCE usage | O |  | INTEGER (0..100) |  | - |  |

**Question 3: Do companies think it beneficial to introduce SUL PRB usage for load reporting?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Yes. We have per SSB and per slice PRB usage and CAC in parallel, and we have SUL CAC, so SUL PRB usage can also be introduced by following the similar reason. |
| Nokia | Not sure, but can SSB have a dedicated share in SUL?... This is quite implementation-specific, I think, so I would prefer not to make that detailed split. |
| Ericsson | We have no strong opinion but the change could be acceptable, although its benefits would be limited because SUL is normally non beamed |
| ZTE | Maybe not needed, we think the CAC is enough for the SUL. |
| Huawei | We are OK with this proposal |
| NEC | We believe this would be beneficial. |

Moderator’s summary:

Three companies support these TPs, one company can accept with no strong opinion, and two companies think it may not be needed. Since companies do not show strong concerns on not introducing such metrics, we propose the following (though might be controversial which could be discussed online):

**Proposal 3: Agree to introduce per SSB area SUL PRB usage over Xn and F1.**

## Per-SSB and per-slice Mobility Settings Change

Last several meetings have discussed whether to introduce per-SSB and/or per-slice handover trigger offset for Mobility Settings Change procedure. And at this meeting more arguments are provided by supporting companies to propose making such enhancements.

The companies supporting per-SSB Mobility Settings Change are,

Nokia [6] [7]

**Proposal 1: RAN3 shall enable per-SSB Mobility Setting Change.**

**Proposal 2: RAN3 shall add two new optional F1 IEs: the selected beam group ID to indicate the serving beam in F1: UE Context Setup Response, F1: UE Context Modification Response and F1: UE Context Modification Required messages from DU to enable CU to select the correct RRC parameter values corresponding to the UE’s serving beam at DU.**

**Proposal 3: The mobility parameters (e.g., CIO) are treated as a function of the serving beam/target beam by the DU.**

Ericsson [13] **Proposal 1: Enable optional per-SSB offset in the Mobility Setting Change procedure.**

While the companies supporting per-slice Mobility Settings Change are,

Huawei [10] **Proposal 2: Include Slice specific offset in MSC exchange.**

**Question 4-1: Do companies think it beneficial to introduce per-SSB offset for Mobility Settings Change?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | We see benefits of introducing such offset, which enables more granular and precise manipulation on handover trigger. |
| Nokia | Obviously, we support the discussion on the per-SSB MSC.  |
| Ericsson | We support a per SSB granularity for the MSC procedure. However, we do not think there is the need to impact the F1 nor the UE configuration due to such enhancement. The improvement is limited to the gNB-CU-CP and it implies that a mobility offset is applied to mobility towards a specific SSB area. We could discuss additions on top of this enhancement, to understand better why they would be needed. |
| Deutsche Telekom | We see also benefits to introduce the per-SSB offsite for MSC. |
| Huawei | We still do not see the big benefit of this. We understand the purpose would be to add additional requirements on the received UE reports before triggering mobility. Applying a large delta in target node would end up with the source having unnecessary UE reporting. UE mobility has always have this problem of uneven coverage. We design the system with overlap to work in most cases. If this is a real problem we would think that using CCO is a better way to resolve the scenario. |
| Orange | We think per-SSB offset for MSC can bring some benefits. |
| Qualcomm | Agree to include per-SSB offset. |

Moderator’s summary:

6 out of 7 companies support to introduce per-SSB offset over Xn; while further enhancement on F1 is still unclear to most companies. By following the majority view, we propose the following:

**Proposal 4: Enable per-SSB offset for Mobility Settings Change over Xn. FFS on further enhancement over F1.**

**Question 4-2: Do companies think it beneficial to introduce per-slice offset for Mobility Settings Change?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | We see benefits of introducing such offset, which negotiate the handover trigger from another dimension besides the consideration on coverage and load. |
| Nokia | We’re neutral (though benefits seem less obvious than in case of per-SSB MSC). |
| Ericsson | We do not support this change because the mobility setting change is a procedure that affects the HO trigger point towards a target cell in a service agnostic way. The proposal, on the contrary, is based on the concept of “per slice” mobility rules, which has not been discussed. A slice can support many different services. Some services may “survive” e.g. early mobility at the expenses of poorer radio signals, while some other services may not be suitable for such decisions. Introducing a per slice MSC procedure would modify mobility events for all UEs using a given slice and it could cause service deteriorations for those slice services that would not withstand such modified mobility decisions. There would also be the question of how to handle Ues that are using multiple slices, where each slice could have a different MSC configuration.  |
| Deutsche Telekom | We are also neutral. The per-slice offset will certainly increase the complexity of a solution that has to be justified by related benefits. As already noted by E///, HO performance improvements may rely on the slice set-up, i.e., which services with which characteristics and requirements are included and how many slices are used by UEs in parallel. Therefore, we are somehow sceptical w.r.t. that approach.  |
| Huawei | We support this and we have presented one way to do the mapping. The solution we outlined gives the possibility to apply this to certain slices. We think this is a reasonable trade-off to keep the signalling simple.The foreseen usage would be to protect certain slices a bit more by e.g. keeping the optimum HO trigger. Therefore solution itself could be made quite simple. It is true that slices could contain many different services and different mobility requirement so the real benefit of this is probably limited to slices with a uniform mobility requirement. |
| Samsung | Normally, a UE will have multiple ongoing PDU sessions. The PDU sessions may use different slices. Per slice MSC seems difficult to be used in reality. |

Moderator’s summary:

2 companies support, 2 companies are neutral, and 2 companies still has concern. It seems that more detailed discussions are needed, so we propose the following:

**Proposal 5: FFS on whether and how to introduce per-slice offset for Mobility Settings Change.**

## Load metric for UEs in RRC Inactive

Last meeting discussed whether to introduce number of Ues in RRC Inactive as a metric for load reporting. And at this meeting more contributions discuss this open issue.

The companies supporting to introduce such metric are,

Ericsson [13] **Proposal 4: Introduce a load metric for RRC inactive Ues per cell. Preference is to use the definition in TS 38.314 for mean number of stored inactive UE context.**

CMCC [16] **Proposal 2: It is suggested to introduce a metric to reflect the control plane capability on the maximum number of inactive UE context a specific cell supports to store, as well as the control plane status on the current number of stored inactive UE contexts.**

The companies suggesting to further clarify are,

ZTE [15] **Proposal: The benefit of introducing the number of inactive UE as the load metric should be clarified.**

**Question 5: Do companies think it beneficial to introduce load metric for Ues in RRC Inactive? If so, are definitions on number of stored inactive UE context given in TS 38.314 can be reused as a baseline?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Yes. And the definition in TS 38.314 can be reused. |
| Nokia | Not really. This metric relates to the hardware usage and potential load. Both can be addressed better with the existing metrics (e.g. the reporting node can reserve some resources for Ues that statistically are likely to return to active and report CAC appropriately; the receiving node does not have that good statistical reference). |
| Ericsson | Yes, this enhancement is beneficial because eit allows to represent the capacity of a RAN node in terms of number of inactive Ues that it can host. This is useful to decide the best mobility target for a UE that is likely to be mover to RRC inactive. An example could be a vehicular UE that connects periodically to transmit statistics e.g. about the vehicle performance. Such UE is likely to be mover to Inactive after signalling its statistics. Hence it would be useful to know which target cell has enough RRC\_Inactive UE capacity to host such type of Ues.We agree to reuse the definition in TS 38.314 for mean number of stored inactive UE context, in support of this enhancement |
| Deutsche Telekom | We see it beneficial to introduce that metric based on TS 38.314. |
| ZTE | To our understanding, the mean number of stored inactive UE context is related to the storage capability of the hardware, while the other metrics such as CAC or PRB usage are related to the processing capability of the hardware. In addition, the inactive UE context could be released by 5GC after a time period. So, we do not get the benefit of this load metric. |
| Huawei | We do not see the benefit. We agree with Nokia |

Moderator’s summary:

3 companies support and 3 companies still have concerns. So we propose the following:

**Proposal 6: FFS on introducing load metric for UEs in RRC inactive.**

## MLB for PSCell and resource aggregation

Such topics have been discussed for last several meetings.

CATT [11] [12] proposes to report CAC load for NR cells as potential PSCell in EN-DC scenario between eNBs over X2, and the following observations and proposal are captured,

**Observation 1: There are cases that one E-UTRA cell / NR Cell is filled with legacy LTE UEs, in which state the E-UTRA’s load is high and the NR’s load is low, thus ideal to accept EN-DC Ues but not ideal for legacy LTE Ues.**

**Observation 2: One load metric is not enough to represent both the dimention of whether an E-UTRA cell is a suitable target for MLB-oriented handover of legacy LTE Ues and the dimention of whether it is a suitable target for MLB-oriented handover of EN-DC capable Ues.**

**Proposal: One eNB working in EN-DC should also be possible to get aware of the load information of potential target PSCell from other eNBs.**

Ericsson [13] [14] proposes to exchange information on cells which are potentially used for resource aggregation, and the following proposal is captured,

**Proposal 2: Extend X2AP and XnAP signaling for serving cell configuration and serving cell configuration updates with a per-cell list of cell identifiers of cells that can be used for resource aggregation. Extend Resource Status Update with per-cell reporting of a list of cell identifiers of cells that can be used for resource aggregation.**

**Question 6-1: Do companies think it beneficial to report load of potential PSCells?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Our understanding is that two proposed schemes by CATT and Ericsson are similar (both exchanging a list of potential cells over X2/Xn, and uses CAC as a starting point for load metrics), and we may find a unified way to achieve both schemes if possible. |
| Nokia | No, this is not needed. There can be many possible PSCells and reporting all of them will make frequent load reporting very heavy. |
| Ericsson | We support proposal 2 because this proposal makes it clearer that there are “potential” cells that could be used for resource aggregation. Such information may be also useful in other features such as coverage and capacity optimisation, where it would be useful to know on what other cells´coverage and capacity a serving cell could rely. By knowing the information proposed in Proposal 2, a RAN node is able to trigger a request for resources towards the neighbour cells potentially used for resource aggregation at the target cell.We would like to avoid adding neighbour cell resource information in the Resource Status Update message, to avoid large messages with information that may not be needed.  |
| CATT | Yes |
| Deutsche Telekom | We see it generally beneficial to provide such information, but the resulting solution should avoid creating heavy load on X2/Xn. |
| ZTE | Maybe too complicated for the NG-RAN node. |
| Huawei | We do not see the benefit. It is difficult to know whether resource aggregation will be used for a UE. This is quite signaling intensive. |
| Samsung | MLB is used for handover decision to offload some traffic to neighbour cells. Target SN is decided by target MN. Source node cannot decide it. So we failed to see the usefulness to inform source node of the loads of potential target PSCells |

Moderator’s summary:

We believe that companies that actually answer to Question 6-1 is 6. 1 company clearly supports, 2 operators show interests, and 3 companies show concerns. Since the majority concern is focused on the extra signalling load and the logic that target SN is decided by target MN, we propose the following:

**Proposal 7: FFS on whether and how to report load of potential PSCells.**

**Question 6-2: Do companies think it beneficial to exchange information of cells for resource aggregation?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | See the answer in 6-1. |
| Nokia | The way it is proposed is quite slim. However, it assumes static mapping, which is a questionable assumption in our opinion (actual aggregation possibilities depend e.g. on UE’s capabilities). |
| Ericsson | See answer in 6-1 |
| CATT | We think CAC is much better than a Boolean value of “whether the load is under X%”. |
| Deutsche Telekom | We are in general positive with it, but there is the need for further discussion w.r.t. the argument raised by Nokia on dependency on UE capabilities. |
| ZTE | Need further discussion. |
| Huawei | We do not see the benefit. It is difficult to know whether resource aggregation will be used for a UE. |
| Samsung  | See the answer in 6-1 |

Moderator’s summary:

1 company clearly supports, 2 operators show interests, 5 companies show concerns regarding the dependency on UE capabilities and the effectiveness. So we propose the following:

**Proposal 8: FFS on whether and how to exchange information of cells for resource aggregation.**

## Mechanism of controlling load balancing

Ericsson [13] proposes to introduce some controlling mechanism for load reporting in NR, and reuse ‘stop request’ mechanism in LTE as a baseline. The following proposals are captured,

**Proposal 5: Introduce indications of measurements stop, pause and resume in Resource Status Update for NR.**

**Proposal 6: Introduce a Cause Value in Resource Status Update for NR to indicate the reason for measurements stop or pause.**

**Question 7: Do companies think it beneficial to introduce such mechanism for load reporting?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | We are open to have further discussion on this. |
| Nokia | Stopping is already supported, isn’t it? If so, the existing start/stop seems all that is needed. |
| Ericsson | We are in favour. We are adding many parameters in the Resource Status Update message and we think we need to introduce a mechanism that allows the sender to be “protected” against possible overloads, i.e. situations where resource information cannot be signalled either temporarily or for a long time span. For this we propose the introduction of the “measurement stop”, which is a request to stop the Resource Status Reporting procedure, as well as the introduction of Measurement Pause, by which the sender can declare that measurements cannot be provided temporarily, i.e. until a Resume message is received. The Pause and Resume additions allow for a clearer behaviour at the node receiving the measurements. Without these indications the receiving node would not understand why measurements are not received and whether the functions that are using such measurements should be turned off or temporarily suspended or kept active.These enhancements could be important also for AI based functions, given that with AI the request for resource information would be considerably higher and given that a sending node may incur in overloads with higher likelihood.  |
| CATT | Yes, this seems reasonable. |
| Deutsche Telekom | Makes sense. Ok to discuss details. |
| ZTE | Maybe not, this mechanism is not necessary. |
| Huawei | We think this can be discussed a bit more.In rel16 we selected to not introduce the stop. One reason was probably that the measurements (at least initially) were less complex than for LTE. If we want to introduce this in NR, there are some aspects we think needs to be considered:- what is the benefit of adding a pause/resume? Why not just omit these measurement results for certain cells?- how can a reporting and requesting node reach consensus about the difference between stop/pause? What is the benefit of having both?- why do we only indicate this in the cell domain? Was it because a strict HW relationship? Is the same still true? In some cases it may be the measurement type that is problematic? Or do we make a general stop indication?- any solution should probably allow requesting node to make the priority of what measurements to use. The proposed text says: " to remove all the items of the Cell Measurement Result Item IE " which gives the reporting node the power to select cells. Is this really what we want?- the requesting node will anyway see what the reporting node reports. Why not just let the requesting node re-prioritize (reconfigure) if he discovers that the reporting node is unable to fulfil the requested measurements. |

Moderator’s summary:

Majority view goes for needing further discussion and particularly one company list a couple of questions to further discuss. So we propose the following:

**Proposal 9: FFS on whether to introduce stop/pause/resume mechanism for load reporting.**

## Other(s)

CMCC [17] provides a TP to SON BLCR 38.300, which mainly updates load information of slice PRB usage in the text, according to agreed TPs on XnAp and F1AP last meeting.

**Question 7: Do companies think the proposed TP is agreeable?**

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | Yes. And the TP can also be updated according to the progress of this meeting. |
| Nokia | Yes. |
| Ericsson | The TP is in principle ok, but we would like to close the discussion on per slice PRB first before agreeing to a stage 2 TP |
| ZTE | OK with this TP. |
| Huawei | Yes |

Moderator’s summary:

All companies are OK to agree the TP. And it can be foreseen that the slice PRB usage discussion is drawing near. So we propose the following:

**Proposal 10: Agree Stg2 TP in R3-214104.**

# Conclusion, Recommendations [if needed]

If needed

# References

|  |  |  |
| --- | --- | --- |
| [1] | [R3-213286](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213286.zip) | PRB per slice reporting: proposed resolution to FFS (NEC) |
| [2] | [R3-213287](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213287.zip) | (TP for SON BLCR for 38.423) Load Balancing Enhancements: SUL reporting in Composite Available Capacity message (NEC) |
| [3] | [R3-213288](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213288.zip) | (TP for SON BLCR for 38.473) Load Balancing Enhancements: SUL reporting in Composite Available Capacity message (NEC) |
| [4] | [R3-213289](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213289.zip) | (TP for SON BLCR for 38.423) Load Balancing Enhancements: SUL reporting in Radio Resource Status message (NEC) |
| [5] | [R3-213290](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213290.zip) | (TP for SON BLCR for 38.473) Load Balancing Enhancements: SUL reporting in Radio Resource Status message (NEC) |
| [6] | [R3-213388](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213388.zip) | Consideration on the CU-DU impacts of the per-beam mobility setting change (Nokia, Nokia Shanghai Bell) |
| [7] | [R3-213389](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213389.zip) | (TP to SON BL CR to 38.473, NR\_ENDC\_SON\_MDT\_enh-Core) Enabling CU-DU information exchange to support per-beam mobility setting change (Nokia, Nokia Shanghai Bell) |
| [8] | [R3-213390](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213390.zip) | Completion of the solution for per-slice PRB reporting (Nokia, Nokia Shanghai Bell) |
| [9] | [R3-213391](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213391.zip) | (TP to SON BL CR to 38.423, NR\_ENDC\_SON\_MDT\_enh-Core) Removal of the FFS related to the per-slice PRB reporting (Nokia, Nokia Shanghai Bell) |
| [10] | [R3-213407](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213407.zip) | (TP for SON BLCR for 38.423) Load Balancing Enhancements (Huawei) |
| [11] | [R3-213510](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213510.zip) | Discussion on PSCell MLB (CATT) |
| [12] | [R3-213511](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213511.zip) | (TP on SON for 36.423) TP on PSCell MLB (CATT) |
| [13] | [R3-213815](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213815.zip) | (TP for SON BL CR for TS 38.423) MLB enhancements (Ericsson) |
| [14] | [R3-213816](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-213816.zip) | (TP for SON BL CR for TS 36.423) MLB enhancements (Ericsson) |
| [15] | [R3-214092](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-214092.zip) | Discussion on Number of Inactive UE (ZTE) |
| [16] | [R3-214103](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-214103.zip) | Further discussions on load metric (CMCC) |
| [17] | [R3-214104](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_113-e%5CDocs%5CR3-214104.zip) | TP to SON BLCR 38.300 on MLB (CMCC) |