3GPP TSG-RAN WG3 Meeting #107bis-e R3-202840

E-meeting, 20 – 30 April, 2020

**Agenda item: 10.2.2.1**

**Source: Nokia (moderator)**

**Title: Summary of discussions on Mobility Load Balancing - second phase**

**Document for: Approval**

# 1 Introduction

This paper provides summary of discussions at RAN#107bis-e for the second phase of CB: # 1005\_Email\_SON-MDT\_\_MLB. Agreements and other conclusions from the first phase can be found in section 2. Open points for further discussion at the present meeting are:

**- Active UEs**

**- Load reporting per node or cell level or slice**

**- Slice Capacity Value vs. Slice Available Capacity Value**

**- Attempt to agree at least on some of the issues (as listed above), once there is an agreement or at least clear majority view – proceed to discuss the TPs**

**- This email discussion is expected to produce agreements (to be captured in the meeting minutes) on the high level principles, stage-3 TP for 38.473, 38.463, 38.423, 36.423, and possibly stage-2 TP for 38.300 – in that order**

**- FFS, corrections (e.g. ASN.1, presence, etc), missing parts (e.g. procedural text where needed, etc) are to be discussed when the discussion progresses to the TP stage (high level agreements should come first)**

Companies responsible for MLB TPs are:

* X2AP: CATT
* F1AP: Huawei
* E1AP: Nokia
* XnAP: Ericsson
* TS 36.300: CATT
* TS 38.300: CMCC

# 2 For the Chairman’s Notes

**introduce the HW Capacity Indicator IE on F1, and remove it from X2/Xn**

:

**On X2 and Xn, TNL capacity indicator to be included per cell.**

**On F1, TNL capacity indicator to be included per node.**

No more discussions on SUL in this meeting

No more discussions on Network sharing in this meeting

Reporting of Number of Active UEs:

Main options are:

* Xn only (two companies)
* F1+Xn, based on TS 38.314 section 4.1.1.3 (per DRB level measurements)
* F1 + Xn, based on TS 38.314 section 4.1.1.3.5 Mean number of Active UEs per cell

Additional question on whether to also report on X2.

**To be continued...**

E1AP: FFS whether to provide measurements (TNL Available Capacity Indicator, HW Capacity Indicator) per slice.

No conclusion

Additional metric to be reported per slice

Several companies see benefits for enhancements, other companies believe this can be continued in Rel-17.

To be continued based on contribution.

X2/Xn: Both split and non-split architecture are specified for NG-RAN. Please provide your view on whether to include load TNL load information for both backhaul (S1-U/NG-U) and fronthaul links (F1-U) reported separately (X2, Xn).

No conclusion.

TPs:

X2AP (CATT): 1999 revised in 2744

F1AP (Huawei): 1743 revised in 2689

E1AP (Nokia): 1835 revised in 2746

XnAP (Ericsson): 2267 revised in xxxx

TS 36.300 (CATT): 1995

TS 38.300 (CMCC): 2440 revised in xxxx

# 3 Discussion

## 3.1 Supplementary Uplink (SUL)

See company input in R3-202466 [1].

## 3.2 Active UEs

Earlier company input can be found in R3-202466.

From the online session: To continue the discussion based on:

* Reporting on Xn only (metric determined based on existing E1 signalling)
* Reporting on F1 only, based on TS38.314, section 4.1.1.3.5 Mean number of Active UEs per cell (RLC/MAC)
* Reporting on F1 and Xn (same definition on both interfaces?)
* Reporting on F1, Xn and X2 (same definition on all interfaces?)

Please provide your view on: Reporting on Xn only (metric determined based on existing E1 signalling)

|  |  |
| --- | --- |
| Company | Comment |
| Nokia | This metric, to be reported on Xn, is based on information already available in the CU-CP. It will represent the number of active UEs based on legacy E1 signalling (inactivity indication per UE), and therefore takes into account both UL and DL activity (including DL PDCP buffer). This measurement provides complementary information to CAC and Radio Resource Status (PRB) reporting already agreed, so may have some benefit on Xn. It can also be considered for X2, where scenario involving load status of a physical NR cell supporting both NSA (EN-DC) and NR SA may need clarification. |
| ZTE | For XN part, share the view with Nokia  For X2 part, since there is no active UE reported in current LTE MLB, more discussion needed for how to apply the parameter in eNB. |
| CMCC | We support Reporting on F1, Xn and X2 (same definition on all interfaces) and please find details below. |
| Deutsche Telekom | Same view as CMCC. |
| Ericsson | We support reporting on F1 and Xn based on TS38.314, section 4.1.1.3.5 Mean number of Active UEs per cell (RLC/MAC). We prefer not to impact LTE as there is no use to date of Active UEs in the MLB algorithms, while these algorithms have already been optimised to work with the information available. |
| Huawei | We prefer reporting on F1 and Xn (with same definition on both interfaces) |
| Samsung | Prefer Xn and not to impact LTE. |

Please provide your view on: Reporting on F1 only, based on TS38.314, section 4.1.1.3.5 Mean number of Active UEs per cell (RLC/MAC). Reporting on F1 and Xn (same definition on both interfaces?). Reporting on F1, Xn and X2 (same definition on all interfaces?).

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| --- | --- |
| Company | Comment |
| Nokia | We believe this RAN2 defined metric is not beneficial neither on the F1 interface nor on Xn/X2. It is claimed by proponents that the RAN2-defined metric can reflect U-plane load status linearly in case of many UEs. We believe this is not the case due to the broad variety of use cases supported in NR. |
| ZTE | As need from many Operators ,to our understanding, the parameter is an useful complementary information in XnAP to RRC Connections number ,CAC etc. And without support in F1AP, gNB-CU could not provide the information being request by neighbour.  We prefer report it on F1 and Xn (same definition on both interfaces based on TS38.314, section 4.1.1.3.5 ). |
| CMCC | We support Reporting on F1, Xn and X2 (same definition on all interfaces).  And we do think RAN2 defined metrics in TS38.314 are applicable for load reporting on F1, Xn and X2. The main point is whether the measurement on MAC and RLC is enough to reflect the number of active UEs with per second reporting. As a major argument, one company pointed out in the contribution: the sampling data N in clause *4.1.1.3.2 Max number of Active UEs in the DL per DRB per cell* is described to be measured at MAC RLC or PDCP, which may involve some coordination between CU and DU. As far as we know, there’s an ongoing email discussion in RAN2, and indicating ‘PDCP’ in the description is more likely to be a typo and all companies in RAN2 so far agree to delete this ‘PDCP’ thing to avoid confusion. Therefore, all measurements related to number of active UEs in 38.314 are performed at MAC and RLC, and there’ll be no extra coordination needded.  In addition, besides Mean number of Active UEs per cell as given in 4.1.1.3.5, we would like to introduce all the other measurements related to Number of active UEs as described in 38.314 section 4.1.1.3 as load metrics. We believe that supporting per DRB level measurements for Number of active UEs to be exchanged on interfaces will be helpful to differentiate the broad variety of use cases. The TPs on Xn/X2/F1 from NTT DoCoMo are suggested to be considered for load reporting. |
| Deutsche Telekom | Same view as CMCC. |
| Ericsson | We support reporting on F1 and Xn based on TS38.314, section 4.1.1.3.5 Mean number of Active UEs per cell (RLC/MAC). |
| Huawei | We prefer reporting on F1 and Xn (with same definition on both interfaces) |
| Samsung | Prefer Xn and not to impact LTE. |

**Summary:**

Main options are:

* Xn only (two companies)
* F1+Xn, based on TS 38.314 section 4.1.1.3 (per DRB level measurements)
* F1 + Xn, based on TS 38.314 section 4.1.1.3.5 Mean number of Active UEs per cell

Then additional question on whether to also report on X2.

## 3.3 Load reporting per node or cell level or slice

### 3.3.1 Attempt for high-level agreement

See company input in R3-202466.

### 3.3.2 Attempt for detailed agreements

The following questions on load reporting per node / cell / slice level are marked FFS or raised in contributions to this meeting.

**X2AP: FFS whether NG TNL Capacity Indicator, Hardware Load/Capacity Indicator are reported per cell.**

Please provide your view on how to solve this FFS. For reporting of HW Load/Capacity Indicator see also discussion in section 3.6.

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | As explained in 3.3.1, it is neither possible nor useful to provide a value of the NG-U TNL capacity. That is because there are potentially multiple CU-UPs in a RAN node. It is not useful because we should rather try to express a TNL capacity available at a cell, independently of interfaces, hence per NG-U or per F1-U is not important, it is important a single TNL capacity value per cell. HW capacity is not needed over X2 |
| Deutsche Telekom | TNL capacities are usually shared between nodes or sites by multiplexing the data for different cells, so it does not make sense to break down the totally available TNL capacity on a cell level as there is no cell-based reservation in that sense. The only useful combination is to describe the offered TNL capacity for the node.  To break down the HW load on a cell level would require that a certain amount of totally available HW in a node is dedicated for a cell. That might be ok for some implementations, but the problem is the normalization procedure as e.g. in a virtualized environment additional resources can be added for cell-specific processing in case of high load. Therefore, a single cell HW load value does not provide a useful information without knowledge about current total load in the node caused also by other cells to recognize possible margins. Therefore, just a per-node HW load information makes sense. |
| CMCC | Same view as DT. |
| Huawei | We can report TNL per cell, mainly to be able to report different TNL per node in case of CU/DU |
| Samsung | Same view as DT. |
| Nokia | Report TNL per cell. |

**XnAP: FFS wether NG TNL Capacity Indicator is reported per cell**

Please provide your view on how to solve this FFS:

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Same as X2 |
| Deutsche Telekom | Same comment as for X2AP. |
| Huawei | We can report TNL per cell, mainly to be able to report different TNL per node in case of CU/DU |
| Samsung | Same as X2 |
| Nokia | Report TNL per cell. |

**F1AP: FFS whether NG TNL Capacity Indicator is reported per cell**

Please provide your view on how to solve this FFS:

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | TNL capacity is reported per node, i.e. it is the same for all cells of a DU. |
| Deutsche Telekom | Same comment as for X2/XnAP. |
| Huawei | TNL per node |
| Samsung | TNL per node |
| Nokia | Report TNL per cell. |

**Summary:**

* on X2 and Xn: companies seem split
* on F1: majority for reporting per node

**F1AP: New proposal: Enhance reporting per slice to include TNL Capacity Load Indicator and Slice Radio Resource Status (see R3-201832).**

Please provide your view:

|  |  |
| --- | --- |
| Company | Comment |
| Nokia | It is important to include this information on the F1 interface, where it would help the CU-CP to anticipate on access control outcome in the gNB-DU and help align access control functionality (and speed) between split and non-split architecture. |
| Huawei | We are OK to add per slice reporting for more metrics |
| ZTE | In current specification, Slicing is defined as implementation in RAN node. Therefore the “Slice Capacity” IE is able to cover new introduced IEs. |
| Samsung | Not necessary in Rel-16. |
| Ericsson | When we agreed to add per slice Available Capacity we also concluded that per slice PRB utilization is not feasible. So far there has been no explanation of how PRB utilization could be expressed per slice. Technically if we have already the per slice capacity we do not see the need of per slice resource utilization.  Per slice TNL capacity has not been discussed from a technical point of view. There are no means identified on how to split transport traffic on a per slice basis. We should not agree to parameters for which there is no technical understanding ofn their meaning. For that we see per slice TNL capacity as not feasible |
| Deutsche Telekom | Agree with the proposal to introduce the per-slice reporting of radio resource status.  Slice specific TNL information (related to F1-U) would make sense if there is also slice control on the TN, means that also upper limits may be set within the shared transport medium for dedicated slices. |
| ZTE | We notice there is no per slice PRB/TNL proposed for Slice Available Capacity in XnAP.  Then the solution for MLB of per slice PRB/TNL is incomplete.  To our understanding, NW slicing from Rel-15 is designed based on implementation. But as it is explained from Operator ,more per slice metrics is helpful . Indeed, during implementation, resource like PRB, TNL should be take into account as for slice based TNL. If the current “high level” matrix i.e. “Slice Capacity Value “ could not meet the requirement from Operator , it is necessary to consider add more matrix for slice in F1 and Xn. However the limitation is not crystal clear. For example, How to evaluate the Resource usage ratio especially in case of slices share resource need to be considered. Therefore detail of how to evaluate shared Slice resource is needed and we propose to discuss the issue at next meeting. |

**Summary:**

Several companies see benefits for enhancements, other companies believe this can be continued in Rel-17.

**E1AP: FFS whether to provide measurements (TNL Available Capacity Indicator, HW Capacity Indicator) per slice.**

Please provide your view on how to solve this FFS:

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | We d not se the need to this. Remove the parameters |
| Deutsche Telekom | Slice specific TNL information (related to NG-U) would make sense if there is also slice control on the TN, means that also upper limits may be set within the shared transport medium for dedicated slices.  No preference for slice-specific HW load indication. |
| Nokia | Reporting per slice is needed. |

No conclusion.

**X2/Xn: Both split and non-split architecture are specified for NG-RAN. Please provide your view on whether to include load TNL load information for both backhaul (S1-U/NG-U) and fronthaul links (F1-U) reported separately (X2, Xn).**

|  |  |
| --- | --- |
| Company | Comment |
| HW | We prefer not to have a separate signalling of fronthaul since this depends on the architecture of a neighbour node. Signaling two value brings no benefit. We prefer to send a single value including the limiting metric (backhaul or fronthaul) |
| ZTE | Since either backhaul or fronthaul bottleneck should be take into account in load balance, it seems necessary to reported TNL for backhaul and fronthaul separately. |
| CATT | Separating them can be useful. |
| Ericsson | In line with Huawei. As explained above we think we shoud report a single TNL Capacity value, independent of fronthaul or backhaul. An implementation can choose which capacity to express in such IE (i.e. the minimum of the maximum values on each interface that may serve a UE) |
| Deutsche Telekom | Same view as ZTE. |
| Samsung | Separating them seems benifical. |
| Nokia | Separating is beneficial. |

no conclusion (companies are split)

## 3.4 Network sharing

See company input in R3-202466.

## 3.5 Slice Capacity Value vs. Slice Available Capacity Value

F1AP: Which information is carried in the Slice Capacity Value IE? (There is a proposal to rename Slice Capacity Value into Slice Available Capacity Value in R3-201833 section 2.5).

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| --- | --- |
| Company | Comment |
| HW | Slight preference to keep the name, mainly since this is aligned with existing CAC. Do we need to also rename 9.3.1.x6 Capacity Value? Slice capacity value is part of the parent IE Slice Available Capacity. The proposal brings no benefit |
| Nokia | Prefer to use Slice Available Capacity Value in order to avoid misinterpretation in the future. |
| Samsung | OK for the renaming |
| LGE | Prefer the renaming |
| Ericsson | Slight preference to keep the name |
| Deutsche Telekom | Prefer renaming, as it describes the available, not the used capacity.  Question to definition in R3-201833:  “The Slice Available Capacity IE indicates the amount of resources per network slice that are available relative to the total gNB-DU resources. The Slice Capacity Value IE can be weighted according to the ratio of cell capacity class values, if available.”  What does a value of 100 mean? 100% of all gNB-DU resources (cell-based?) are used for that slice or only 100% of the resources assigned to that slice? Similar to NW sharing a slice may be limited by e.g. a maximum amount of total PRBs.  Same issue is with the information in the Slice Radio Resource Status IE. |
| CMCC | Slightly prefer to rename. |

**Summary:**

Renaming seems acceptable.

## 3.6 HW Capacity Indicator IE

See company input in R3-202466.

## 3.7 Other issues

### 3.7.1 Handover actions due to MLB (TS 38.300)

Please provide your view on CMCC's proposal below.

|  |  |
| --- | --- |
| Company | Comment |
| CMCC | In our contribution, we capture [the following] remaining issue that we believe can easily be agreed in principle:   1. According to the BL CR of TS38.300, three basic functionalities has been adopted to support NR MLB, which are listed as follows,  * *Load reporting* * *Handover actions due to MLB* * *Parameter adapting*   The text is still missing for ‘Handover actions due to MLB’, and we believe the LTE mechanism can be reused in NR, namely, the target cell should be able to distinguish the load balancing handovers from other handovers, in order to apply appropriate admission control. And a TP to 38300 is provided in [2]. |
| Deutsche Telekom | Support of CMCC’s proposal. Parameters (load information) in sub-section on load reporting should be adapted to last agreements in this meeting. |
| Ericsson | In general, ok with the TP. However, we do not use shall statements in stage2, hence the text needs to be modified accordingly. |
| Samsung | Agree the principle. |
| Nokia | Agree the principle |

**Summary:**

CMCC to provide TP for TS 38.300.

### 3.7.2 Cause value for Parameter adapting (TS 38.300)

Please provide your view on CMCC's proposal below.

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| --- | --- |
| Company | Comment |
| CMCC | In our contribution, we capture [the following] remaining issues that we believe can easily be agreed in principle:   1. We check the Cause value in the latest version as well as the BLCR of 38423, and find that the Cause value for Parameter adapting is still missing. Thus, we propose to add related Cause value for Parameter adapting in 38423, reuse LTE as baseline. A TP to 38423 is provided in [3]. |
|  |  |
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### 3.7.3 Max bit-rate for the DL/UL TNL Offered Capacity

Please provide your view on DT's proposal below.

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| --- | --- |
| Company | Comment |
| Deutsche Telekom | Currently, a maximum value of 16 Gbit/s is stated in proposals for the DL/UL TNL Offered Capacity. Typically, operators have steps of 1, 10, 25, 40, 100, … Gbit/s in the transport according to Gigabit Ethernet capacities, so we would prefer to use a value of at least 25 Gbit/s in the corresponding IE description.  Note: Minor issue, i.e., it is sufficient to discuss the topic at next meeting (if TNL capacity indication is agreed as metric at this meeting). |
| Nokia | Relative to the proposal from DT: Max bit rate on NG is 4 Tbit/s (TS 38.413 section 9.3.1.4), which we believe is aligned with core network interface specifications. It may need checking before next meeting whether to align with this value, or some lower value (above 16 Gbit/s). |
|  |  |
|  |  |

# 4 TP stage discussion

If any discussion is needed on the following bullet, please use this section (except FFSs handled in section 3.3.2).

**- FFS, corrections (e.g. ASN.1, presence, etc), missing parts (e.g. procedural text where needed, etc) are to be discussed when the discussion progresses to the TP stage (high level agreements should come first)**

## 4.1 Stage 3 issues concerning more than one interface

if needed

## 4.2 Issues concerning X2AP only

if needed

## 4.3 Issues concerning NGAP only

if needed

## 4.4 Issues concerning XnAP only

if needed

## 4.5 Issues concerning E1AP only

if needed

## 4.6 Issues concerning X2AP only

if needed

## 4.7 Issues concerning stage 2

if needed

# 5 Conclusion, Recommendations [if needed]

If needed

# 6 References

[1] R3-202466, Summary of discussions on Mobility Load Balancing, outcome from first phase of discussions at RAN3#107bis-e.

[2] [R3-202440](file:///C:\Users\ssirotki\AppData\Local\Temp\Temp1_RAN3_107bis-e_agenda_with_Tdocs_20200414_1724.zip\Docs\R3-202440.zip), TP to SON BLCR 38.300 on support of MLB (CMCC)

[3] R3-202441, TP to SON BLCR 38.423 on support of MLB (CMCC)