

**RAN94e-R18Prep-23\_Inter-gNB\_Coordination - Version 0.0.5**  
**RAN**

3GPP TSG RAN#94e RP-212683

Electronic Meeting, December 06 - 17, 2021

Agenda Item: 8A.1

Source: Ericsson

Title: Moderator's summary for discussion [RAN94e-R18Prep-23] Inter-gNB Coordination

Document for: Information & Discussion

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## 1 Introduction

This discussion covers the topic of “Inter-gNB Coordination” including the areas of

- Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs
- Inter-gNB/gNB-DU multi-TRP operation
- Enhancement for resiliency of gNB-CU

Guidance, deadlines, and further background can be found in [RP-212608] and [RP-212657].

The discussion so far carried out in the RWS concluded with stating that all the points in scope of a potential SI are controversial. Nevertheless there has been substantial support from operators on the topics (see [RP-211666]).

For these reasons the moderator would like to focus the goal of the discussion on the justification for the study in each of the areas mentioned in [RP-211666].

The discussion will be a continuation of the RWS discussion on Inter-gNB coordination and will take its final summary as the starting point [RP-211666].

Please avoid any input like “We support / we do not support” without giving additional justification and motivation as this is no “number counting” driven discussion. Instead justify your view with strong technical arguments and/or tangible commercial interests (near & longer terms).

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## 2 Initial Round

Please provide your comments of the initial round in the below feedback forms. The initial round takes place from Wed., Oct. 20, 08:00h UTC to Fri., Oct. 22, 23:59h UTC.

## 2.1 Justification for Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs

The RWS discussion in September concluded on the following [RP-211666]:

- Performance assumptions for the backhaul should be established.
- Support of legacy UEs and Uu impact should be considered.
- Possibility of using current RAN architecture should be considered.
- Performance analysis by RAN1 and gNB impact analysis by RAN3.

[RP-211666] also mentioned what was supported by companies in the RWS discussion in September as Justification for the work and as contentious points. These are reported below:

- Justifications: Deployment flexibility and Better UL coverage compared to DC, and the higher performance of CA compared to DC.
- Contentious points (observations): No consensus whether the expected gain would motivate the expected effort and complexity. High performance backhaul assumption would require a new direct DU-DU link, which would bring complexity that is unreasonable. No consensus whether performance evaluation to evaluate gain would be needed first (e.g. compare against DC).

Please provide your views on the potential justification for a study on Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs, taking the above points into account.

### **Feedback Form 1: Views on the justification of a Study on Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs**

#### **Feedback Form 1:**

##### **1 – TELECOM ITALIA S.p.A.**

It appears the current justification requires a lot of pre-evaluations and RAN1 involvement. I do not see the reason behind these statements, since most of the work should be the specification of an inter DU interface. Based on the performance of the inter DU interface, there should really not be differences vs normal CA operation.

Therefore, the scope should be (under RAN3) the specification of an inter DU interface, with the justification to ensure sufficient performance to allow CA between cells under different gNB-DUs.

The risk is that this activity will be specified outside 3GPP.

##### **2 – Samsung Electronics Nordic AB**

It could provide the benefit to support deployment flexibility for multiple connections. But it is on top of the strict network side requirement and the complexity for timely coordination between two gNBs/gNB-DUs. So RAN1 evaluation would be necessary in order to justify the benefit compared with the complexity.

##### **3 – Verizon UK Ltd**

Inter gNB/gNB-DU CA is a deployment requirement for many operators. Performance comparison of CA

vs DC is well known and there is no need to waste 3GPP time on this. Inter gNB/gNB-DU CA can increase UL coverage significantly and significantly increase deployment flexibility. Many networks have this feature running using proprietary implementations in non co-located scenarios, proving technical feasibility. A standardized interface to enable inter gNB/gNB-DU CA is best specified within 3GPP.

#### **4 – SoftBank Corp.**

Similar to other operators, we don't see the strong need to perform the simulation campaign for the well-known technology. We can directly go to specification work in RAN3.

#### **5 – DOCOMO Communications Lab.**

We expect that the feature significantly improves deployment flexibility. Better UL coverage is also very important to us.

For the scope, we agree with TIM that the scope should be the specification of the interface. As the expected benefit is the deployment flexibility and the coverage that comes from the number of uplink, we do not need RAN1 evaluations.

#### **6 – KDDI Corporation**

Justification:

We think it's enough with the first statement "Deployment flexibility and Better UL coverage compared to DC, and the higher performance of CA compared to DC." We feel that having a further consensus on the gain among operators and network vendors would be very challenging. From the operators' point of views, it gives possibilities to switch the vendor to another. But network vendors' point of views, it causes complexity obviously, but the gain is not clear. We are also wondering what we expect as an output of performance evaluation. I agree with Telecom Italia comments that Based on the performance of the inter DU interface, there should really not be differences vs normal CA operation.

Scope:

We share the view with Telecom Italia, the scope should be (under RAN3) the specification of an inter DU interface, with the justification to ensure sufficient performance to allow CA between cells under different gNB-DUs.

#### **7 – Telia Company AB**

Release 18 should include specifications for inter gNB/gNB-DU CA. Any study phase with simulations (if applicable) should be minimized and so to focus mostly on the work item outcome.

#### **8 – Deutsche Telekom AG**

The given justification explains very well the operators' demands on that topic; there is no need to add something. As Verizon pointed out there are already proprietary deployments of this kind, i.e., technical feasibility is given and performance aspects are known. The operators' wish is to have a standardized interface for inter-gNB/gNB-DU CA which should be the focus of that work under the responsibility of RAN3.

#### **9 – Huawei Tech.(UK) Co.. Ltd**

We are not keen on fundamental change in RAN architecture for 5G-Advanced, now it should be time where the system should reach maturity and not time for reshuffling the architecture principle. We also failed to understand the major performance benefit expected compare to existing optimized NR-DC feature. On

top of that a massive deployment, with standard interoperability context of inter-gNB/inter-DU CA is not obvious to us.

#### **10 – Ericsson LM**

Any functionality which involves direct coordination between gNB-DUs bypassing the respective gNB-CUs, regardless of the claimed benefit, requires a major redesign of the NG-RAN split architecture and hierarchy as specified since Rel-15. It is our firm belief that there is no scope for such an activity in 5G standardization. For Rel-18 we will only support discussing features which do not have any impact to the NG-RAN architecture.

The business & technological effects of such type of architectural change can be enormous as the whole industry is working under the current architectural assumptions. A decision in favor of such architectural change mid-term during an ongoing generation will be creating a moving ground that would not offer any stability base for the healthy development of the technology.

#### **11 – Nokia**

Introduction of a new DU-DU interface would require RAN1 involvement to (at least) evaluate information to be exchanged between DUs and the interface performance requirements. A new DU-DU interface would require alignment of MAC schedulers from different vendors which limits the potential for performance improvement, so it seems unrealistic to assume (as some proponents are) that performance would be the same as intra-gNB/gNB-DU CA.

#### **12 – Qualcomm Technologies Int**

On the justification, it is understood that CA in general will have some advantages over DC, regardless of whether this is between inter-gNB or inter-gNB-DU. But we would also expect some overall trade-off between actual gains and realistic backhaul latency(ies) / topologies, and also a trade-off with the resulting impact on the RAN architecture if any. It should also be noted that a solution applicable to new UEs only might not help with deployment flexibility, i.e., the consequence of the justification seems to be that legacy UEs should be supported (as an objective).

#### **13 – VODAFONE Group Plc**

We agree with the views of Telecom Italia, Verizon and the many other operators.

#### **14 – Futurewei Technologies**

We are somewhat skeptical that potential gains, if any, would justify major architectural changes to RAN such as introduction of new DU-DU interface.

#### **15 – AT&T GNS Belgium SPRL**

A standards-compliant way of performing CA/multi-TRP operation across gNB-DUs from different vendors is currently missing in 3GPP specifications. We believe this mainly requires RAN3 work. Such a DU-DU interface can be defined intelligently to focus on information elements needed to enable inter-gNB CA/multi-TRP operation in a way that does not completely disrupt current RAN architecture principles. After all, if inter-gNB CA/multi-TRP operation can be currently supported in a proprietary manner within the same vendor's framework without a huge disruption in RAN architecture principles, surely 3GPP can find an intelligent way to define a DU-DU interface such that inter-gNB CA/multi-TRP operation can be supported in a standards-compliant manner.

**16 – Intel Technology India Pvt Ltd**

The aim of this topic is to lift up the current restriction of intra-DU operation, so that additional deployment flexibility and performance optimization can be made possible, which should be first evaluated with non-ideal backhaul and potential limitations of a logical standardized interface between DUs. The standardization works and impacts on the current NG-RAN architecture are expected to be big though.

**17 – Telstra Corporation Limited**

Strongly agree with Verizon's comments; the benefits of CA over DC are well known, inter gNB/gNB-DU CA can help better utilise expensive spectrum

## 2.2 Justification for Inter-gNB/gNB-DU multi-TRP operation

The RWS discussion in September concluded on the following [RP-211666]:

- Performance assumptions for the backhaul should be established.
- Possibility of using current RAN architecture should be considered.
- Performance analysis by RAN1 and gNB impact analysis by RAN3

[RP-211666] also mentioned what was supported by companies in the RWS discussion in September as Justification for the work and as contentious points. These are reported below:

- Justification: Deployment flexibility, and that the higher performance of multi-TRP can be applicable also at DU borders.
- Contentious points (observations): No consensus whether the expected gain would motivate the expected effort and complexity. High performance backhaul assumption would require a new direct DU-DU link, which would bring complexity that is unreasonable. No consensus whether performance evaluation to evaluate gain would be needed first (it is also not clear what to evaluate).

Please provide your views on the potential justification for a study on Inter-gNB/gNB-DU multi-TRP operation, taking the above points into account.

**Feedback Form 2: Views on the justification of a Study on Inter-gNB/gNB-DU multi-TRP operation****Feedback Form 2:****1 – TELECOM ITALIA S.p.A.**

same as in 2.1

It appears the current justification requires a lot of pre-evaluations and RAN1 involvement. I do not see the reason behind these statements, since most of the work should be the specification of an inter DU interface. Based on the performance of the inter DU interface, there should really not be differences vs normal CA operation.

Therefore, the scope should be (under RAN3) the specification of an inter DU interface, with the justification to ensure sufficient performance to allow CA between cells under different gNB-DUs.

The risk is that this activity will be specified outside 3GPP.

## **2 – Samsung Electronics Nordic AB**

Compared with CA case, inter-gNB/gNB-DU multi-TRP requires more strict network side requirement and complex operation/coordination. However, it not clear how much performance enhancement can be achieved and the benefit is not clear either. So, before studying the network side impact, RAN1 impact shall be clarified and the performance enhancement shall be verified by RAN1. Since we don't have clear view for the achieval benefit, we are wondering if it is desirable to spend a large amount of time to let RAN1 carry out this evaluation at this moment.

## **3 – Verizon UK Ltd**

Comments to 2.1 apply here as well.

The scope should be to specify necessary interface/signaling for inter-gNB/gNB-DU multi-TRP operation. Benefits of CA/multi-TRP are well known and there is no need for a RAN1 study to justify performance. Backhaul impact on multi-TRP performance could be studied to come up with any backhaul requirements.

## **4 – SoftBank Corp.**

same comment as in 2.1

## **5 – DOCOMO Communications Lab.**

same comment as in 2.1

## **6 – KDDI Corporation**

same comment as in 2.1

## **7 – Telia Company AB**

see our comment in 2.1.

## **8 – Deutsche Telekom AG**

Same comment as in 2.1

## **9 – Huawei Tech.(UK) Co.. Ltd**

Same view here, same arguments as above, and the TRP is today a function and not node, the proposal way will definitively break the current architecture by the introduction of new logical node, new interfaces ... this will have major impact on all existing procedures e.g. mobility, SON, etc..

## **10 – Ericsson LM**

Same comment as in 2.1.

Any functionality which involves direct coordination between gNB-DUs bypassing the respective gNB-CUs, regardless of the claimed benefit, requires a major redesign of the NG-RAN split architecture and hierarchy as specified since Rel-15. It is our firm belief that there is no scope for such an activity in 5G standardization. For Rel-18 we will only support discussing features which do not have any impact to the NG-RAN architecture.

The business & technological effects of such type of architectural change can be enormous as the whole industry is working under the current architectural assumptions. A decision in favor of such architectural

change mid-term during an ongoing generation will be creating a moving ground that would not offer any stability base for the healthy development of the technology.

**11 – Nokia**

Please see response in 2.1.

**12 – Qualcomm Technologies Int**

The justification depends on the “edge effects” of intra-DU multi-TRP operation, i.e. whether there is sufficient performance loss at the edge of a DU’s controlled coverage compared to other areas. This also depends on what a real typical mTRP deployment would look like. At this point, it is likely that different scenarios could be constructed with varying gains. It is not clear if the “typical gain” in a realistic scenario would be large enough to justify the effort or possible impacts.

**13 – Futurewei Technologies**

Our understanding is that current architecture does not exclude or limit deployment of multiple and distributed TRPs, as long as these TRPs are associated with the same DU. It seems reasonable that before agreeing to major changes to the existing architecture, some level of performance evaluation be carried out to compare expected performance with what can already be achieved.

**14 – AT&T GNS Belgium SPRL**

Please see comments in section 2.1.

**15 – Intel Technology India Pvt Ltd**

The same comment as in Section 2.1.

## 2.3 Justification for Enhancement for resiliency of gNB-CU (RAN3)

In the RWS discussion in September it was concluded that this topic is within the remit of RAN3. The discussion also concluded on the following [RP-211666]:

- Support mechanisms for DU connecting to multiple CUs (for the same PLMN).
- Support at least the case of no UE context transfer or sharing between CUs.
- Prioritize CU CP but CU UP not precluded.

[RP-211666] also mentioned what was supported by companies in the RWS discussion in September as Justification for the work and as contentious points. These are reported below:

- Justification: To have a standardized mechanism that could work also between vendors, and to ensure that there actually is a mechanism.
- Contentious points (observations): A significant number of operators show interest and think the justification is important. A couple of companies (mainly network vendors) express doubt, and one company refer to that using virtualization would be the easier way to achieve this. TS 38.401 states ”For resiliency, a gNB-DU and/or a gNB-CU-UP may be connected to multiple gNB-CU-CPs by appropriate implementation”.

Please provide your views on the potential justification for a study on Enhancement for resiliency of gNB-CU, taking the above points into account.

**Feedback Form 3: Views on the justification of a Study on Enhancement for resiliency of gNB-CU, taking the above points into account.**

**Feedback Form 3:**

**1 – TELECOM ITALIA S.p.A.**

justification and objectives are clear enough. And clearly the observation that the solution is appropriate implementation is not pertinent to 3GPP specification activity (you can always provide proprietary solutions, but this is not the scope of 3GPP).

The risk is that this activity will be specified outside 3GPP.

**2 – Samsung Electronics Nordic AB**

For this topic, we can see the potential benefit for the failure of CU/CU-CP. Such failure can be resolved with some implementation based methods; however, we can also see the motivation of defining some standardized method. So, we are open to perform evaluation on the solutions via a study item.

**3 – Verizon UK Ltd**

gNB-CU resiliency is a real issue for operators and justification is clear. It has to be dealt either in a standardized way or by proprietary solutions. We prefer a standardized solution specified by 3GPP.

**4 – ZTE Corporation**

Justification and objectives are clear.

**5 – DOCOMO Communications Lab.**

We are fine with the justification above. Though a private implementation can do anything, we expect a standardized solution that improves resiliency in multi-vendor deployments.

**6 – KDDI Corporation**

We are fine with the proposed justification and objectives. Even though some implementation based methods work for that, considering that backup AMF already specified in Core network, RAN3 can start the similar work also.

**7 – Telia Company AB**

Justification is clear.

**8 – Huawei Tech.(UK) Co.. Ltd**

We would like to clarify that resilience was part of the initial discussion of 5G, and the TS 38.401 is the result of RAN3 decision and part of the specification and implementation since day one of 5G. The resilience of RAN equipment was discussed for MCPTT in past and also concluded as implementation dependent. We would like also to clarify that the pooling of a CU in a gNB seems to us more a problem of integration than a problem of standard as the AMF pooling.

## **9 – Deutsche Telekom AG**

Resiliency becomes more and more an important topic for mobile networks driven by new 5G use cases (verticals, TSN, autonomous driving, etc.). Methods for network resiliency and elasticity have to work also in multi-vendor environments. Therefore, standardized approaches are needed, even if we expressed in initial Rel-15 specs that implementation-specific means are feasible. This is true only for the single-vendor case and was adequate at initial 5G deployment, but for 5G-Advanced more appropriate solutions are needed. Virtualization is also only partly useful and therefore doesn't allow to reach the high resiliency level required.

Based on that, the given justification describes the operators' demand in a clear way.

## **10 – Ericsson LM**

Considering the current specifications, there are provisions for gNB-CU resiliency in NG-RAN architecture (TS 38.401): For resiliency, a gNB-DU and/or a gNB-CU-UP may be connected to multiple gNB-CU-CPs by appropriate implementation. Therefore, since Rel-15 the standard supports and "embraces" a suitable implementation that is able to provide resiliency within the split gNB architecture. Furthermore (and more important), already by Rel-15, and even more so today, NG-RAN has been specified with virtualization in mind. This means that the concept of network node resiliency is not the same as in past releases. A logical node today (and especially the gNB-CU) is typically realized as a software instance in a server farm. Proper exploitation of virtualization techniques enables to minimize or even eliminate network disturbances due to the failure of a virtualized logical node.

During the Rel-18-preparation discussions, parallels have been drawn between resilience mechanisms defined in the 5GC and possible similar standardization work in NG-RAN. However, the fundamental difference is that AMF resiliency (as currently supported in the standard) is achieved by switching over to a back-up AMF, and not through simultaneous "live" connections to multiple nodes as has been proposed for the gNB-CU. AMFs handle UE contexts (only) so it is quite straightforward to change the AMF that is serving a UE (an operator once mentioned the requirement of being able to quickly move the CN entity handling a UE context from one part of the country to another at the touch of a button). A CU-CP cannot be subject to the same type of requirement because that is not the only function it provides: among other things, a CU-CP also handles DUs, playing a prominent role in mobility and RRM. These functions cannot be distributed in the same way as the processing of UE contexts.

## **11 – Nokia**

The justification seems clear.

## **12 – Qualcomm Technologies Int**

Although TS 38.401 opens the way for proprietary implementations that support resiliency since rel-15, it seems reasonable in rel-18 at least to revisit the topic and check if at least a common kernel between implementations can be defined. In that sense the justification seems reasonable.

## **13 – Futurewei Technologies**

We are not clear as to what is the additional functionality that can not already be supported per the current specification. As mentioned above, TS 38.401 already allows for a gNB-DU to be connected to multiple CU-CPs to achieve resiliency. The details are left to implementation.

## **14 – AT&T GNS Belgium SPRL**

The justification is reasonable.

#### **15 – Intel Technology India Pvt Ltd**

The similar response as above, the aim of this topic is to define a specified mechanism for DU resiliency that has been left to implementation, so that DU resiliency can be achieved across multi-vendor CUs. We could evaluate whether the back-up AMF type of resiliency that currently exists between RAN and CN could be applicable to CU-DU.

#### **16 – Telstra Corporation Limited**

Strongly agree with DT's comments; poor resiliency will destroy the business case for many use cases. We support the justification proposed.

## 2.4 Moderator summary of the Initial Round and recommendation for further discussion

### **Moderator Conclusion for Initial Round of discussions on "Justification for Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs"**

The group is split in near equal factions. A large group of operators promote that the work should be run solely in RAN3, as performance gains are obvious and do not need to be justified via a Study in RAN1. The latter is motivated by the statement that inter gNB-DU CA has been deployed as a proprietary intra vendor feature and for that there is no need to assess its gains e.g. in RAN1. Some operators see the need to run a study on performance evaluation in RAN1, with the focus of leading to a better description of normative work.

A substantial number of vendors state that the performance gain claimed for inter gNB-DU Ca is not guaranteed and that this should be studied in RAN1 first. Some vendors state that the fact the feature has been deployed proprietarily should not imply that there will be gains for a standardised solution. The reasoning is based on factors such as the long standing principle in 3GPP that RRM algorithms and scheduling have been considered implementation specific. Without a coordination of scheduling algorithms it is claimed that performance gains cannot be guaranteed. Another concern on performance relates to backhaul topologies, especially in cases of non-ideal backhails.

The involvement of RAN1 has been mentioned as needed also to identify the parameters that two gNB-DUs would need to exchange.

The other concern voiced by many vendors is the impact caused on the 5G RAN architecture. Many vendors believe that such changes would destabilise maturity of the 5G system and that, no matter the potential gains a solution may offer, 3GPP should not support such major reshuffles of architectural principles, which will destabilise product maturity.

The moderator opinion is that, so far, there seems to be no convergence between these two groups of companies on justification of work and on how to move forward to organise activities that could shed light on whether any normative work is needed. Companies are invited to foster identification of common grounds in the next round of discussions.

### **Moderator Conclusion for Initial Round of discussions on "Justification for Inter-gNB/gNB-DU multi-TRP operation"**

Companies positions are exactly the same as for the discussion on "Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs".

A large group of operators justifies activities on "Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs" on the bases of obvious benefits. A considerable group of vendors points at the need for assessing performance gains first and at the fact that the architecture impacts are too high to justify any work.

The differences with respect to the discussions on "Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs" lay in the actual feature, which appears to depend on "cell edge effects". Also, there are claims that this feature will likely introduce new logical nodes to the current architecture.

The moderator opinion is that, so far, there seems to be no convergence between these two groups of companies on justification of work and on how to move forward to organise activities that could shed light on whether more work is justified. Companies are invited to foster identification of common grounds in the next round of discussions.

### **Moderator Conclusion for Initial Round of discussions on "Enhancement for resiliency of gNB-CU"**

There is a majority of companies that believe a study in this area can be started.

Some companies state that the feature has been already allowed as an implementation option since Rel15 and that it is not clear what aspects of resiliency should be addressed.

The moderator suggests to discuss in more details the remit of a possible study in this area and to try to converge on the gaps the study should fill.

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## **3 Intermediate Round**

### **3.1 Justification for Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs**

Given the lack of convergence on this topic during the first round of discussions, the moderator suggests to expand on the following points in order to seek convergence and to identify consensus on any potential activity

- Should a study be needed to assess performance and to identify information to be exchanged between gNB-DUs ?
- If such study was deemed as needed, should it be led by RAN1 or any other WGs?
- Would the long standing principle that RRM algorithms, e.g. scheduling, are out of 3GPP scope constitute an obstacle to standardisation of the feature and achievement of performance gains?
- Can the consequences on architecture changes for 5G be accepted?

Companies are invited to provide their views on the points above.

**Feedback Form intermediate views on the issues concerning the justifications for activities on Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs, taking the above points into account.**

## Feedback Form 4:

### 1 – TELECOM ITALIA S.p.A.

Should a study be needed to assess performance and to identify information to be exchanged between gNB-DUs ? NO

Would the long standing principle that RRM algorithms, e.g. scheduling, are out of 3GPP scope constitute an obstacle to standardisation of the feature and achievement of performance gains? NO

Can the consequences on architecture changes for 5G be accepted? YES.

Just for the sake of technology discussion, there are already specified CU/DU interfaces. Having a DU/DU interface does not change the principle of CU/DU specification (in terms of RRM algorithms and back-hauling)

It is clear that opposing companies do not want to standardize this feature. The same issue happened in the past and Open RAN infrastructure has been specified OUTSIDE 3GPP.

We suggest to stop this discussion (since it is clear that companies are not going to agree) and go to RAN#94 for approval of the current Operators' proposal:

- The scope of this round of discussion is to prepare a proposal for discussion at RAN#94
- there is already a clear proposal

### 2 – DOCOMO Communications Lab.

> Q1: Should a study be needed to assess performance and to identify information to be exchanged between gNB-DUs ?

> Q2: If such study was deemed as needed, should it be led by RAN1 or any other WGs?

No evaluation study for performance. The information to be exchanged over the potential new interface should be studied, but it can be done in RAN3 - cf. LLS fronthaul study.

> Q3: Would the long standing principle that RRM algorithms, e.g. scheduling, are out of 3GPP scope constitute an obstacle to standardisation of the feature and achievement of performance gains?

No. We would like to standardize the interface and the information to be exchanged over it, not the RRM algorithms.

> Q4: Can the consequences on architecture changes for 5G be accepted?

Yes. As the operators stated in Phase 1, we expect a large benefit in terms of flexibility and coverage.

### 3 – Intel Technology India Pvt Ltd

The performance and feasibility evaluation seems necessary and we think it can be done by a study led by RAN3 while getting consultation from RAN1 whenever required. Whether the direct ideal DU-DU transport is necessary or can be worked out without architecture changes via CU can also be studied.

We think such evaluation should be done first before the study identifies what information should be exchanged between DUs to make it work and how.

### 4 – KDDI Corporation

Q1,Q2 : No, we are reluctant to have the study on performance. Since even if it concludes it causes some performance degradation, operators will claim to have the work for a new DU-DU interface after the study.

Q3 : We share the view with docomo, we will discuss the interface and the information to be exchanged over it, not the RRM algorithms.

Q4 : We are not sure what kind of “architecture changes” are expected, but we think that the benefit for flexibility and coverage compensates the drawback of “architecture changes”.

#### **5 – Deutsche Telekom AG**

We share the same view on feedback to questions and related technical aspects as TIM, DOCOMO and other operators.

#### **6 – Ericsson LM**

Any functionality which requires direct coordination between gNB-DUs bypassing the respective gNB-CUs, irrespective any possible benefit, requires a major redesign of the NG-RAN split architecture and hierarchy. It is our firm belief that architectural stability is a prerequisite for the creation of a healthy technical and business environment something that is proven by the 3gpp success in the evolution of the specified technology in steps of stable architectural choices.

Any activity concerning inter-gNB/gNB-DU coordination will require pre-evaluations activities with RAN1 involvement based on above principles and the mentioned long-standing 3gpp principles.

#### **7 – VODAFONE Group Plc**

same view as DT.

#### **8 – Huawei Tech.(UK) Co.. Ltd**

Our previous arguments still remain particularly on 5G Advanced architecture stability. Above the technical constraints already discussed e.g. quick and frequent CP message, tight synchronization, etc... the fact that the RRM policy will be then bind to other vendor is against the principle that the standard should specify the information exchange and not specify the node behavior ...

#### **9 – Samsung Electronics Nordic AB**

- Q1: We think a performance evaluation is needed with clear assumptions on, e.g., backhaul latency, information exchange. This evaluation can justify the benefit
- Q2: This work should be led by RAN3 since 1) network side performance determines the potential gain, and 2) network signaling design makes sure the inter-gNB/gNB-DU CA work
- Q3: RRM algorithm itself is out of 3GPP scope. However, to support it, the necessary signaling may need some standardization work.
- Q4: We understand that such new interface, the inter-gNB-DU interface, is mainly used for low layer information exchange, which is not originally seized by the gNB-CU. So, we can see some feasibility of this new interface, especially for intra-gNB-CU case. However, how the inter-gNB-DU interface impacts to the current architecture needs further study, on the basis of the performance gain.

In this sense, a study item for inter-gNB/gNB-DU CA can be considered to justify the benefit in terms of performance gain, backhaul requirement, signaling complexity, and network architecture impact, etc.

#### **10 – Nokia**

A new standardized DU-DU interface introduces a major re-design of the NG-RAN disaggregated architecture and will not achieve the same performance as intra gNB-DU CA, due to the need for coordination between schedulers of different vendors. It seems unrealistic that standardized gNB-DU CA would be deployed without knowing the achievable performance, so we believe that evaluation by RAN1 is needed

(and in general the needed effort by groups other than RAN3 is being significantly under-estimated in this discussion).

### **11 – ZTE Corporation**

–Should a study be needed to assess performance and to identify information to be exchanged between gNB-DUs ? –Yes

If such study was deemed as needed, should it be led by RAN1 or any other WGs?–Led by RAN1

Would the long standing principle that RRM algorithms, e.g. scheduling, are out of 3GPP scope constitute an obstacle to standardisation of the feature and achievement of performance gains?–Yes

Can the consequences on architecture changes for 5G be accepted?—Architecture changes should be take careful especially in the middle stage of NR.

### **12 – Futurewei Technologies**

Should a study be needed to assess performance and to identify information to be exchanged between gNB-DUs ?

- Yes, of course. How is it possible to contemplate defining a new interface between logical network node without first performing a study on performance impacts and information exchange.

If such study was deemed as needed, should it be led by RAN1 or any other WGs?

- Agree with Intel, this study can be RAN3 led. RAN1, or other working groups. may be consulted as needed.

Would the long standing principle that RRM algorithms, e.g. scheduling, are out of 3GPP scope constitute an obstacle to standardisation of the feature and achievement of performance gains?

- It is understood that the details of RRM algorithms are not within the scope of 3GPP. Therefore, defining or coordinating the implementation of such algorithms between vendors must be excluded from any study. The flexibility of vendor implementations must be maintained.

Can the consequences on architecture changes for 5G be accepted?

- Not clear at this point. That is why a study is vital in order to determine whether any performance benefits would warrant such a major change to RAN architecture.

### **13 – Verizon UK Ltd**

Q1) Should a study be needed to assess performance and to identify information to be exchanged between gNB-DUs ?

Q2) If such study was deemed as needed, should it be led by RAN1 or any other WGs?

No study on performance is needed. Information to be exchanged over the potential new interface should be studied and this can be in RAN3.

Q3) Would the long standing principle that RRM algorithms, e.g. scheduling, are out of 3GPP scope constitute an obstacle to standardisation of the feature and achievement of performance gains?

No. We would like to standardize the interface and the information to be exchanged over it to enable inter-gNB DU coordination use cases that are desired by multiple operators. Multiple scheduling/RRM algorithms could work within this framework and these should not be standardized to allow vendor innovation.

Q4) Can the consequences on architecture changes for 5G be accepted?

Yes. In fact, we expect a large benefit in terms of flexibility/coverage which would be very beneficial. The consequences if a feature that has much operator need/support is not standardized in 3GPP should also be considered. When companies used similar arguments to not standardize lower layer split (FH) in 3GPP, it was done in O-RAN which has now become a de-facto FH standard.

### 3.2 Justification for Inter-gNB/gNB-DU multi-TRP operation

The discussion in section 3.1 will be relevant towards the outcomes on "Inter-gNB/gNB-DU multi-TRP operation" as well. Additionally, the Moderator would like to bring up further following points.

- For the assessment of performance gain, is there any extra technical aspect to be considered for inter gNB-DU multi TRP coordination when compared to inter gNB-DU CA?
- Would inter gNB-DU multi TRP coordination need the introduction of new logical nodes?
- Is there any priority order between "Enhancements for inter gNB-DU CA" and "Enhancements for inter gNB-DU multi TRP", namely which of these two features is believed to deliver highest gains/benefits and should eventually be prioritised in 3GPP?

**Feedback Form intermediate views on the issues concerning the justifications for activities on Inter-gNB/gNB-DU multi-TRP operation, taking the above points into account.**

#### Feedback Form 5:

**1 – TELECOM ITALIA S.p.A.**

see answer to form 4

**2 – DOCOMO Communications Lab.**

We do not see any reason or mechanism that supports the claim that the introduction of multi-TRP by the inter-DU coordination requires a new logical node.

We would like to have both CA and mTRP in the Rel-18 package and we do not see no need to down-select one of them so far. However when we really have to prioritize one of CA and mTRP at the later stage, CA would be more fundamental from our perspective.

**3 – Intel Technology India Pvt Ltd**

We are not sure at this moment what extra technical aspect needs to be considered for the performance evaluation of inter-DU multi-TRP operation compared to inter-DU CA, but this can be studied further. Whether a new logical node is necessary or not can also be studied.

We think inter-DU multi-TRP could have priority as this is leftover from Rel-17 feMIMO WI of inter-cell multi-TRP operation.

**4 – KDDI Corporation**

We share the view with docomo.

**5 – Deutsche Telekom AG**

DT shares the same view as DOCOMO.

**6 – Ericsson LM**

Any functionality which requires direct coordination between gNB-DUs bypassing the respective gNB-CUs, irrespective any possible benefit, requires a major redesign of the NG-RAN split architecture and hierarchy. It is our firm belief that architectural stability is a prerequisite for the creation of a healthy technical and business environment something that is proven by the 3gpp success in the evolution of the specified technology in steps of stable architectural choices.

Any activity concerning inter-gNB/gNB-DU coordination will require pre-evaluations activities with RAN1 involvement based on above principles and the mentioned long-standing 3gpp principles.

**7 – Huawei Tech.(UK) Co.. Ltd**

The principal matter from previous response are also emphasize when we come to the TRP. It is true that the positioning feature specify the TRP as function, but the positioning feature only provide the configuration with minimum interaction between other cells and nodes... We would invite company to check TS 38.305 and TS 38.455 for the complexity of TRP configuration only. Please note that also the positioning current specifications allow a TRP for positioning only ( no data transfer) ... We enter with TRP in a new dimension of architecture where we have different types of TRP, different configurations and management which should interact with other DU or gNB TRPs. We fail to see how to manage this without new logical nodes, considering also some5G basic requirement like the separation of the UP and CP! There is here a lot of work, and the pain vs. gain is not clear ...

**8 – Samsung Electronics Nordic AB**

- Q1: we are concerning the additional gain compared to the inter-gNB CA. It can be foreseen that inter-gNB/gNB-DU multi-TRP has more strict requirement to the backhaul signaling. Before we get clear picture to the inter-gNB/gNB-DU CA, the additional work on multi-TRP may be questionable at this moment.
- Q2: we are unclear why a new logical node is needed.
- Q3: if this study is carried out during Rel-18, we think the inter-gNB/gNB-DU CA should be the starting point. Inter-gNB/gNB-DU multi-TRP can be postponed to future release if the benefit can be well proven.

**9 – Futurewei Technologies**

We are not sure what functionality "Inter-gNB/gNB-DU multi-TRP operation" would entail. However, it seems that this is not within the scope or current interfaces defined by RAN3. It is very possible that this could require the definition of a new logical network node as well as new interfaces. The details are not clear at this moment.

**10 – Verizon UK Ltd**

Refer to answer in Q4.

### 3.3 Justification for Enhancement for resiliency of gNB-CU

In light of the discussions in the first round, it is proposed to focus on the following points.

- Should the assumption be that the 5G split architecture is maintained for the RAN and for the CN, i.e. that solutions are derived "on top" of current architecture?
- What are the requirements a possible solution should fulfill? e.g.
  - o failure recovery should minimise signalling towards the UE, or towards neighbour nodes
  - o failure recovery should minimise UP interruptions

**Feedback Form intermediate views on the issues concerning the justifications for activities on Enhancement for resiliency of gNB-CU, taking the above points into account.**

**Feedback Form 6:**

**1 – Intel Technology India Pvt Ltd**

We agree with the moderator's assumption that the standardized solution for resiliency should be on top of the current architecture. Overall, we are also fine with two requirements but we think solutions should maintain a reasonable balance between complexity and performance (in terms of signaling and interruption) with consideration to the (low) likelihood of gNB-CU failure events.

**2 – KDDI Corporation**

Assumption: We agree with the moderator's assumption

Requirements: In general, we are fine with the current statements, but in addition to failure recovery, we prefer to enhance the scope a little bit more, to study a mechanism to select an appropriate CU from multiple CU, if allowed.

**3 – DOCOMO Communications Lab.**

This work should realize solutions for CU resiliency that would work in a multi-vendor F1 deployments. Although virtualization might help in some cases in some setup, its effectiveness depends on many aspects like the type of failure, the method of virtualization, and the need for a virtualized infrastructure. We also think that the discussion should be open for enhancements of F1 interface, which would also be beneficial on top of CU-does-it-all solutions.

> Q1: Should the assumption be that the 5G split architecture is maintained for the RAN and for the CN, i.e. that solutions are derived "on top" of current architecture?

We could not have a clear understanding on the intention of the question. (For example, one may think of maintaining multiple F1 connections for backup. In addition, there is a related proposal of service-specific CUs which seems to assume that a cell is being served by multiple CUs. We suppose solutions like these can be said as being "on top" of the current architecture as the current specifications allow them by an appropriate implementation, but we are not sure whether this is the moderator's intention)

At least, the impact on the network nodes should be considered and we should find a good balance between performance and complexity in the study.

> Q2: What are the requirements a possible solution should fulfill?

The solutions should minimize the service downtime from the end-user perspective, which we think is expressed as UP interruptions in the question. We are open to consider other requirements, like signaling load as the moderator suggested.

#### **4 – Ericsson LM**

As argued in the previous round there are provisions for gNB-CU resiliency in NG-RAN architecture. The current specification does not provide the implementation details of the solution but does provide the architectural framework that a gNB-CU and its resilient implementation need to adhere to.

#### **5 – Deutsche Telekom AG**

Feedback to Q1 (assumption): We see the work as "on-top", i.e., current architecture should be seen as baseline where standardized resiliency measures can be added on top of existing procedures. If there are changes required in the baseline has to be evaluated during the study.

Feedback to Q2 (requirements): The increased resiliency should support both failure recovery schemes listed by the moderator, i.e., it should cover both CP and UP.

#### **6 – Huawei Tech.(UK) Co.. Ltd**

We would appreciate some feedback on moderator questions. Indeed now, it seems we do not have a common understanding of the "resiliency of gNB-CU", per basic definition we do understand the resilience as the ability of a gNB-CU to maintain service in the face of faults. It seems to us easier to use backup processing in the pool of the CU than transfer information of UE, handover (?) to other CU, from other vendor, which would be anyway a slow process .... All thoughts, per definition, both can apply but then there is definitively need on requirements ...

#### **7 – Qualcomm Technologies Int**

Assumptions / principles seem generally ok, we would like to add / clarify our understanding:

- Solutions are derived on top of the current architecture as a starting point. Deviations from this are not precluded but should be minimized. In particular we interpret this to mean that no new interfaces are expected (but new usage of existing interfaces may be considered)

- Main focus of rel-18 could be as already stated in the conclusions of the RAN#93 thread (topic set 3) , i.e.:

- *Support mechanisms for DU connecting to multiple CUs (for the same PLMN). Support at least the case of no UE context transfer or sharing between CUs.*
- *Prioritize CU CP but CU UP not precluded.*

In addition we agree that any failure recovery should aim for minimal (if any) signalling towards UE, and minimize UP interruptions.

[as a footnote, the above can be applied in other use cases including e.g. selection of suitable CP at access (cloud vs edge etc)]

#### **8 – Samsung Electronics Nordic AB**

- Q1: we understand that this study is on top of the current architecture without any changes to the architecture.

- Q2: we understanding that minimizing the signaling and interruption (both CP and UP) should be the main requirements for this study.

### **9 – Nokia**

The justification seems clear, and we are fine to study standardized solutions for improved gNB-CU resiliency. Regarding architecture assumptions, our view is that potential solutions must adhere to existing architecture agreements (e.g. interface cardinality). To make this clear, the objective could be re-worded as follows:

- Support mechanisms for DU connecting to multiple CUs (for same PLMN) assuming current F1 interface cardinality rules.

### **10 – ZTE Corporation**

In general agree with Moderator about the assumption and requirements.

### **11 – Futurewei Technologies**

Is the objective here that the network should be able to recover from any CU failure, with minimal UE service interruption? Or is it that a CU failure should have minimal impact in terms of service interruption to the served UEs? It seems reasonable that different CU implementations could be different in terms of resiliency to CU failures.

Also, if the feature is intended to operate in a multi-vendor environment, which network entity would be responsible for the detection of a CU failure, initiation of the recovery procedure, selection and instantiation of a new CU, etc.

### **12 – Verizon UK Ltd**

Q1 (Assumption): Yes, solutions are derived "on top" of current architecture which provides a framework but leaves resiliency measures to implementation. Standardized resiliency measures can be added on top of existing baseline procedures. Any architectural changes required in the baseline have to be evaluated during the study.

Q2 (Requirements): Agree with moderators's listing of requirements covering CP and UP i) failure recovery should minimise signalling towards the UE/neighbour nodes, ii) failure recovery should minimise UP interruptions. Also another objected should be added - iii) support for DU connecting to multiple CUs should be studied.

## **3.4 Moderator summary of the Intermediate Round and recommendation for further discussion**

### **Justification for Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs**

There is a pronounced lack of convergence on the topic.

To the question of whether a study is needed to assess the performance benefits of possible solutions, 7 companies replied in favour and 5 companies replied against.

The companies in favour of a study saw the involvement of RAN1, as well as other working groups, essential.

The companies in favour of the study sustained that the study would need to derive parameters to be exchanged by different gNB-DUs and that, given the proprietariness of RRM algorithms, such parameters are

not obvious. The same companies mentioned that impacts to current 5G architecture would be considerable and to be studied.

On the contrary, the companies against the SI, see proprietariness of RRM algorithms as of no importance to the definition of an interface between gNB-DUs. The same companies do not consider architecture impacts as a blocking point.

The only option where the moderator feels there could be some convergence is to propose to start a SI in Rel18, with the involvement at least of RAN1. This comes from the fact that a WI seems not agreeable. The only other alternative the moderator could think of would be to drop the work from Rel18's plans.

### **Justification for Inter-gNB/gNB-DU multi-TRP operation**

If consensus was poor for the previous topic, it is even poorer for this one.

What can be derived from the extra feedback gained in this discussion is that there is a majority of companies that see the inter gNB-DU coordination for CA as of higher priority with respect to multiTRP.

It is therefore proposed to down prioritise the work on Inter-gNB/gNB-DU multi-TRP operation and to focus on any possible progress on Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs

### **Justification for Enhancement for resiliency of gNB-CU**

A majority of companies support starting activities in Rel18 on Enhancement for resiliency of gNB-CU.

One fundamental principle supported by many companies is that the work should be based on the current architecture framework Namely, current interfaces, current logical nodes, current cardinality etc.

A majority of companies also agrees that the following should be the main objectives:

- Solutions for failure recovery should minimise signalling towards the UE, or towards neighbour nodes
- Solutions for failure recovery should minimise UP interruptions, namely they should minimize the service downtime from the end-user perspective. Minimisation of CP interruptions should also be targeted.

The moderator proposes to check companies' positions on a possible Rel18 study tackling enhancements for resiliency of the gNB-CU, with the following main targets:

- Solutions for failure recovery should minimise signalling towards the UE, or towards neighbour nodes
- Solutions for failure recovery should minimise UP interruptions, namely they should minimize the service downtime from the end-user perspective. Minimisation of CP interruptions should also be targeted

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## 4 Final Round

### 4.1 Justification for Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs

The moderator proposes that the following is put up for discussion:

- Discuss the possibility of starting a Rel18 SI to assess performance and to identify information to be exchanged between gNB-DUs, with the involvement of (at least) RAN1
- If consensus on a Rel18 SI cannot be achieved, it should be discussed whether the work should be excluded from Rel18

Please provide your views on the points above.

**Feedback Form Final views on the issues concerning the justifications for activities on Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs, taking the above points into account.**

#### Feedback Form 7:

<p><b>1 – KT Corp.</b></p> <p>No. KT would like to have this work started in Release-18 as a new RAN3-led Work Item.</p>
<p><b>2 – DOCOMO Communications Lab.</b></p> <p>We would like to stress that the gain is flexibility and coverage, which is clear. The scope of the study should include the information that should be exchanged, which can be done in RAN3, and RAN1 study e.g. on the gain is optional.</p>
<p><b>3 – Deutsche Telekom AG</b></p> <p>As mentioned in earlier rounds we don't see the need for a performance study in RAN1. The focus of the work should be on needed interface characteristics and information to be exchanged.</p>
<p><b>4 – Verizon UK Ltd</b></p> <p>We do not see need for RAN1 performance study on this topic. The gains of flexibility and coverage are very clear. The focus should be on the inter gNB-DU interface and information needed to be exchanged. Backhaul requirements for such exchange could also be considered. All this can be done in RAN3 scope.</p>
<p><b>5 – KDDI Corporation</b></p> <p>In general, we also share the view with other operators. But we also understand that the discussion is reaching a deadlock. If there is no way to progress the discussion, we can accept to have some study involving RAN1 in addition to RAN3 work as a compromise.</p>
<p><b>6 – VODAFONE Group Plc</b></p> <p>We share the (above) views of the other operators.</p>

**7 – NEC Corporation**

We are ok to start a Rel-18 SI, as RAN3 needs to assume first the RAN architecture aspect, then can involve RAN1 by e.g. by LS exchanging.

**8 – TELECOM ITALIA S.p.A.**

No. This is the usual vendors' tactic to involve RAN1 and kill the activity.

As a compromise we can accept DOCOMO's proposal

**9 – Ericsson LM**

We can only accept a study if current architectural framework is respected.

**10 – Huawei Tech.(UK) Co.. Ltd**

We confirm our strong preference for a stable 5G-Advanced Architecture.

With regards to the justification, we confirm from our understanding that the information exchanged over a DU-DU interface will bind and hurt the RRM of target DU product by as example forcing some change. Starting in RAN1 might be a solution to justify the performance, but anyway the output of RAN1 should be mitigated due to the network impact, not only in term of backhaul efficiency, but also UP impact.

**11 – Telstra Corporation Limited**

Same view as DT & Verizon

**12 – Nokia**

Introduction of a new DU-DU interface would require RAN1 and RAN2 involvement to (at least) evaluate interface performance requirements and the information to be exchanged between DUs / schedulers. We also believe that performance evaluation is needed.

**13 – Futurewei Technologies**

We agree with the comment from Nokia. The evaluation of the performance requirements for such a new interface would require involvement from both RAN1 & RAN2. In addition, of course RAN3 would have to decide on functionality, architecture, etc.

**14 – Qualcomm Technologies Int**

As previously stated, a performance study could be a useful way to take the topic forward. However we would like to make the following additional considerations:

1. The previous email discussion concluded with the statement that "Support of legacy UEs and Uu impact should be considered". This aspect should not be lost in any draft. Additionally, this type of requirement is out of RAN3 domain, and seems quite important when defining the scope.
2. The previous email discussion also concluded with the statement "Possibility of using current RAN architecture should be considered." This seems reasonable and should not be precluded.

**15 – Samsung Electronics Nordic AB**

The previous discussions indicate that the key concern for this topic is the benefit on top of the standardization efforts. Operators believe the potential benefit, while vendors have concerns on it compared to the spec. impact. Considering the current situation, we think a Rel18 SI can be considered for progress to solve the concerns in both camps.

**4.2 Justification for Inter-gNB/gNB-DU multi-TRP operation**

In light of the discussions during the Intermediate phase, the moderator proposes the following:

- It is proposed to down prioritise the work on Inter-gNB/gNB-DU multi-TRP operation and to focus on any possible progress on Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs

Please provide your input on the point above.

**Feedback Form Final views on the issues concerning the Justification for Inter-gNB/gNB-DU multi-TRP operation, taking the above points into account.**

**Feedback Form 8:**

**1 – DOCOMO Communications Lab.**

Though from our perspective CA is more fundamental, we are happy to continue seeking for the common ground, as the main point of contention is the same as CA.

**2 – Deutsche Telekom AG**

We share the same view as DOCOMO.

**3 – Intel Technology India Pvt Ltd**

We are fine with the moderator’s proposal.

**4 – Verizon UK Ltd**

From our perspective, inter gNB-DU CA is top priority. That being said we share view with. DoCoMo that the contention is the same for multi-TRP as well. Also many of the information exchanged might be common for the use cases . We are ok to prioritize inter gNB-DU CA as a starting point before going to the other topics.

**5 – KDDI Corporation**

We are fine with the moderator’s proposal.

**6 – NEC Corporation**

The moderator’s proposed way forward is fine for us.

<p><b>7 – TELECOM ITALIA S.p.A.</b> support DOCOMO</p>
<p><b>8 – Ericsson LM</b> We can only accept a study if current architectural framework is respected. We share the opinion that Inter-gNB/gNB-DU multi-TRP should have much lower priority.</p>
<p><b>9 – Huawei Tech.(UK) Co.. Ltd</b> We agree on down prioritize select Inter-gNB/gNB-DU multi-TRP operation</p>
<p><b>10 – Telstra Corporation Limited</b> Ok with the proposed way forward</p>
<p><b>11 – Nokia</b> Moderator’s proposal is acceptable.</p>
<p><b>12 – Futurewei Technologies</b> We agree that inter-gNB/gNB-DU multi-TRP operation can be down prioritized.</p>
<p><b>13 – Samsung Electronics Nordic AB</b> We are fine to de-prioritize this topic since this requires more challenging requirements compared to CA case.</p>

### 4.3 Justification for Enhancement for resiliency of gNB-CU

In light of the discussions during the Intermediate phase, the modeerator proposes to check companies positions on a possible Rel18 study tackling enhancements for resiliency of the gNB-CU, with the following main targets:

- Solutions for failure recovery should minimise signalling towards the UE, or towards neighbour nodes
- Solutions for failure recovery should minimise UP interruptions, namely they should minimize the service downtime from the end-user perspective. Minimisation of CP interruptions should also be targeted

Please provide your input on the points above.

#### **Feedback Form Final views on Justification for Enhancement for resiliency of gNB-CU**

##### **Feedback Form 9:**

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**1 – DOCOMO Communications Lab.**

We support the study that would help wide-coverage CU deployments and more extreme use cases with the aid of standardized coordination mechanism. It would also pave the way for a resilient system that includes CU and DU from different vendors.

Considering the outcome of RAN 93-e and this discussion, the essence of justification and objective seems stable, and we assume the draft SID (or the "by-product") for the resiliency can be prepared now.

Our understanding is that "current cardinality" includes what is now allowed for implementation (e.g. for multiple PLMN).

**2 – Deutsche Telekom AG**

We share the same view as DOCOMO.

**3 – Intel Technology India Pvt Ltd**

We are fine with the moderator's proposal.

**4 – ZTE Corporation**

We are fine with the moderator's proposal.

**5 – Verizon UK Ltd**

We share the same view as DoCoMo and DT.

**6 – KDDI Corporation**

We are fine with the moderator's proposal.

**7 – VODAFONE Group Plc**

We are fine with the moderator's proposal.

**8 – NEC Corporation**

The moderator's proposed main targets (or "requirements" instead of "targets"?) are fine for us. Just one thing, would the requirement of the "minimise signaling ... towards neighbour nodes" be better to say "minimise signaling load over network?"

**9 – TELECOM ITALIA S.p.A.**

Support DOCOMO

**10 – Ericsson LM**

We would be fine with supporting studying standardized solutions that enable gNB-CU resiliency to support minimizing service interruption in accordance with the current architectural framework.

<p><b>11 – Huawei Tech.(UK) Co.. Ltd</b></p> <p>Thank you for the moderator and companies to further clarify the resilience concept in the standard. We do understand now, we are focusing on how to recover from failure more efficiently, e.g. UP interruption, mobility in other node (CU), etc... As already stated several time, we have strong preference on stable 5G-Advanced architecture. Then the main question is does the existing “recovery” or “handover” could be improved?</p>
<p><b>12 – Telstra Corporation Limited</b></p> <p>Ok with the moderators proposal</p>
<p><b>13 – Nokia</b></p> <p>A Study Item focusing on the solutions for failure recovery of a gNB-CU can be beneficial to potentially improve the system robustness.</p>
<p><b>14 – Qualcomm Technologies Int</b></p> <p>Generally ok although the text, as already mentioned above, is more like a note or requirement, the general objective of the study should be to identify and assess solutions to improve resiliency and fault recovery in the RAN, and then the existing text goes under.</p>
<p><b>15 – Futurewei Technologies</b></p> <p>We are fine with the moderator’s proposal.</p>
<p><b>16 – Samsung Electronics Nordic AB</b></p> <p>In general, we are fine for the above two targets. One comment is for “... towards the UE, or towards neighbor nodes”, we are wondering why “or” is used here. In general, we think this recovery procedure should reduce the impact to both UE and neighbor nodes. So, we suggest to use “and” here.</p>

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## 5 Final Summary

Thanks to all the companies that contributed to this discussion. The topic is clearly controversial but the discussions helped understanding all parties’ positions and hopefully will serve as a base for future discussions.

Below the moderator added the final conclusions on a per topic basis.

### 5.1 Final Conclusions on Justification for Enhancements to Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs

The moderator proposed a discussion on the following points:

1. Discuss the possibility of starting a Rel18 SI to assess performance and to identify information to be exchanged between gNB-DUs, with the involvement of (at least) RAN1

2. If consensus on a Rel18 SI cannot be achieved, it should be discussed whether the work should be excluded from Rel18

The outcomes of the discussions focusses on principle 1 above:

- 1 company is against a SI for Rel18 and instead wants to see normative work led by RAN3 in Rel18
- 6 companies support a SI for Rel18 purely focussing on impact on interfaces and architecture, with an optional involvement from RAN1
- 8 companies support the start of an SI as per Principle 1
  - of these, 3 companies require that the current (Rel17) architecture is maintained
  - 3 companies mention that RAN1 and RAN2 would have to be involved.
- It was commented to maintain from the intermediate round of discussions the following point:  
*Support of legacy UEs and Uu impact should be considered*

Based on the above outcome, the following is concluded:

- **The scope of the discussion for Rel18 work on "Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs" should focus on the possible start of a SI. the study should follow the principles below:**
  - **Involvement in the study of at least RAN1 and RAN3. If is FFS whether other WGs need to be involved, e.g. RAN2.**
  - **The study scope should aim to maintain the current (Rel17) architecture, namely solutions should be based on current architecture, if possible.**
  - **The study should maintain as an objective that of minimising impacts on the Uu interface and on legacy UEs**
  - **The study should focus on the analysis of performance, interface impact and architecture impact of a solution on "Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs". If is FFS whether the scope of the SI can be further restricted or extended.**

## 5.2 Final Conclusions on Justification for Inter-gNB/gNB-DU multi-TRP operation

The moderator proposed a discussion on the following points:

1. It is proposed to down prioritise the work on Inter-gNB/gNB-DU multi-TRP operation and to focus on any possible progress on Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs

The outcomes of the discussions is described below:

- It is the moderator understanding that all companies agree on the fact that the CA use case is the one with highest priority
- 4 companies would like to maintain the Multi TRP use case in scope, as solutions might be reused across the two use cases (CA and Multi TRP)
- 9 companies agree with the principle 1 above and would like to down prioritise this use case

Based on the above outcome, the following is concluded:

- **A possible Rel18 study should focus on "Inter-gNB/gNB-DU coordination to enable CA between cells under different gNB-DUs". Work on "Inter-gNB/gNB-DU multi-TRP operation" is down prioritised and it might be tackled if sufficient progress on the CA use case is achieved.**

### 5.3 Final Conclusions on Justification for Enhancement for resiliency of gNB-CU

The moderator proposed a discussion on a possible Rel18 study tackling enhancements for resiliency of the gNB-CU, with the following main objectives:

1. Solutions for failure recovery should minimise signalling towards the UE, or towards neighbour nodes
2. Solutions for failure recovery should minimise UP interruptions, namely they should minimize the service downtime from the end-user perspective. Minimisation of CP interruptions should also be targeted

The outcomes of the discussions is described below:

- 13 companies support the objectives above
- 1 company commented that minimisation of signalling should be towards UEs *\*and\** towards neighbour nodes
- 1 company proposed to change “minimise signaling ... towards neighbour nodes” to “minimise signaling load over network”
- 1 company mentioned that the main objective of the study should be “to identify and assess solutions to improve resiliency and fault recovery in the RAN” and that the objectives above should follow.

Based on the above outcome, the following is concluded:

- The objective of a possible Rel18 SI is as follows:
  - To identify and assess solutions to improve resiliency and fault recovery in the RAN:**
    - **Solutions for failure recovery should minimise signalling towards the UE and signalling load towards the network**
    - **Solutions for failure recovery should minimise UP interruptions, namely they should minimize the service downtime from the end-user perspective. Minimisation of CP interruptions should also be targeted**