**3GPP T****SG-RAN WG3 Meeting #110-e R3-210988**

**Online, 25th January – 5th February 2020**

Agenda Item: 31.2.1

Source: Ericsson

Title: Summary of Discussion for Local\_NG-RANnode\_ID

Document for: Discussion, Decision

# Introduction

A Summary of Offline Discussions has been assigned to the topic of Local\_NG-RANnode\_ID.

The discussion has been summarised as follows in the meeting minutes:

**CB: # 23\_Local\_NG-RANnode\_ID**

**HW**

**further clarify the possible solution for gNB ID resolution from I-RNTI, especially on the observations raised**

**any new solution shall support the following requirements:**

**1) Work well in multi-vendor scenario**

**2) Support Network Sharing**

**3) Avoid any collision or confusion**

**4) Solution should be backward compatible**

**ZTE**

**discuss whether a short gNB ID would be needed in I-RNTI.**

**three alternatives to address the ambiguity caused by different lengths of (short) NG-RAN Node IDs:**

**Alt1: length of the (short) NG-RAN Node ID part in I-RNTI is fixed in the specification, as that for Resume ID in LTE.**

**Alt2: length of (short) NG-RAN Node ID part in I-RNTI is explicitly sent to the new NG-RAN node with the I-RNTI.**

**Alt3: length of (short) NG-RAN Node ID part in I-RNTI is self-contained in the I-RNTI, e.g., to separate 3bits in I-RNTI for using as I-RNTI structure indication.**

**Nok**

**Specify sol2: the bits encoding the old gNB ID pointer are simply generated taking the modulo value of the true gNB ID (no XnAP impact)**

**E///,AT&T,Vz**

**agree on a standardized structure of the I-RNTI. Two options:**

**Opt1: the I-RNTI structure includes a Local gNB Identifier and a UE Context identifier. The length in bits of the Local gNB Identifier and the length in bit of the UE Context identifier are identical in the complete PLMN. More than one Local gNB Identifiers can be assigned per RAN node.**

**Opt2: the I-RNTI structure includes an I-RNTI profile of fixed length, a Local gNB Identifier and a UE Context Identifier. The length of the Local gNB Identifier and the length of the UE Context Identifier are encoded in the I-RNTI profile.**

**- To be considered in the discussion: are principles in 0448 agreeable as basis to further guide selection? Is it possible at all to avoid st3 impact? If st3 impact is unavoidable, which option is preferable?**

**- check details; merge/revise as needed**

(E/// - moderator)

# For the Chairman’s Notes

**Proposed agreements after first round of discussions:**

* **It is agreed that the description in the informative Annex C of TS38.300 is not sufficient and a standardized solution minimizing OAM configuration needs to be produced by RAN3**
* **It is agreed that the solution to be agreed by RAN3 shall support flexible assignment of the maximum number of Inactive UE contexts per NG-RAN node within some limits to be also standardized.**
* **This means that the maximum number of Inactive UE Contexts may be different between NG-RAN nodes within such limit and that such number may be changed after node deployment in a semi-static manner.**
* **Agree to work on the first step which is to define this limit.**
* **Solutions based on OAM configuration may be considered if they fulfil requirements of:**
	+ **flexibility in allocation of maximum number of Inactive UE contexts per NG-RAN node;**
	+ **Interoperability between vendors; support for RAN sharing;**
	+ **Minimized configuration effort;**

# Discussion

At RAN3-110e the following agreements were taken concerning the topic of Local NG-RAN Node ID for RRC Inactive:

**A standardized solution enabling an inter vendor interoperable way for an NG RAN node to deduce the identity of another NG RAN node from the received I-RNTI is needed**

**Agree on the benefits of a solution that allows at least some flexibility in the selection of the Local Node ID length; further details FFS**

**To be discussed as TEI17; we start only on this topic in RAN3 #111-e (Jan. 2021)**

**- The solution should be based on standardized multi-vendor interoperable signaling. The exact solution is FFS**

Based on past discussions, the following sections try to reach convergence on solution related aspects

## I-RNTI Formatting

In [2], [3], [4] solutions are proposed to fulfil the requirements agreed in RAN3-110e. On the other hand, in [1] there are no references to a specific solution apart to the one described in the informative Annex C of TS38.300.

However, the agreements taken in RAN3-110e confirmed that the solution described in the informative text of Annex C of TS38.300 is not sufficient and that:

**A standardized solution enabling an inter vendor interoperable way for an NG RAN node to deduce the identity of another NG RAN node from the received I-RNTI is needed**

The agreement mentions that the identity of an NG-RAN node needs to be deduced from the received I-RNTI.

In [2], [3], [4], the solutions proposed imply the inclusion of a local (short) NG-RAN node ID as part of the I-RNTI, which would allow the identification of an NG-RAN node locally.

**Companies are invited to state whether they are favourable to the inclusion of a short Local NG-RAN Node ID as part of the I-RNTI, which can serve the purpose of locally identifying the NG-RAN node that assigned the I-RNTI.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | There are no standardized solutions on how to structure the I-RNTI and on how to deduce from it the identity of a neighbor NG-RAN node. This is at the source of the problem of interoperability and lack of flexibility for RRC Resume procedures. It is essential that a standardized solution is achieved, where a local identifier is included in the I-RNTI |
| Huawei | Yes | We are open to discuss any standard solution to reduce the OAM efforts of gNB ID configuration in I-RNTI.However the complexity of the standard solution should be acceptable, and should meet the following additional requirements as proposed in [1]:1) Work well in multi-vendor scenario2) Support of Network Sharing3) No collision or confusion possible4) Solution should be backward compatible5) Xn signaling load should be reasonable. |
| ZTE | Yes | A standard solution can increase the NW flexibility and reduce the OAM restriction. |
| Samsung | Yes |  |
| Vodafone | Yes |  |
| Verizon | Yes | Requirements in [1] should be met by the proposed solution. In addition, 1) Flexibility and 2) Aid automation should be considered as key requirements.  |
| Ericsson | Clarification | We acknowledge the requirements in [1] and support them. However, the requirement “No collision or confusion possible” seems to hint at a solution that is fully coordinated in a central way, which would exclude an Xn signalling based option. Maybe the requirement should be “Minimise collisions and ensure convergence if collision resolution is needed” |
| Nokia | Yes | Please notice that there is already a “Local NG-RAN Node ID” in the I-RNTI in annex C of TS 38.300 which is called “NG-RAN node index”. |

**First Round Discussion Conclusion:**

**It is agreed that the description in the informative Annex C of TS38.300 is not sufficient and a standardized solution minimizing OAM configuration needs to be produced by RAN3**

## Solution Flexibility

[2] and [4] present solutions that are based on the signaling of assistance information over the Xn interface between neighbor nodes, where such information help the NG-RAN nodes to derive the Local NG-RAN Node ID from an I-RNTI.

Solutions in [2] and [4] enable a flexible assignment of the maximum number of Inactive UE contexts per NG-RAN node by means of allowing each NG-RAN Node to adopt a different Local NG-RAN Node ID length and to signal it to neighbor nodes over Xn.

In [3] on the other end, a solution is proposed where the number of Inactive UE Contexts that an NG-RAN node can handle is fixed for all NG-RAN nodes. In this solution each node is configured with the length of the Local NG-RAN Node ID contained in the I-RNTI and each NG-RAN node knows that the Local NG-RAN Node ID is calculated as the “modulo(x)” operation (x is fixed) over the Global NG-RAN Node ID. Hence by fixing the Local NG-RAN Node ID length, the maximum number of RRC Inactive contexts per RAN node is also fixed.

**Companies are invited to express their view on whether the solution to be agreed by RAN3 shall allow for a flexible assignment of the maximum number of Inactive UE contexts per NG-RAN node or whether the maximum number of Inactive UE contexts per NG-RAN node should be fixed.**

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| --- | --- | --- |
| **Company** | **Flexible/Fixed** | **Comments** |
| Ericsson | Flexible | It is essential that the maximum number of Inactive UE Contexts per NG-RAN node is flexible. This is because different nodes will have different capacity and geographical coverage and for that they will serve different numbers of Inactive UEs |
| Huawei | Clarification on the requirement is needed | First of all, we need to clarify what does the flexible mean here.Does it mean that the no. of inactive UEs supported by each node is different and flexible? Or it means that the no. inactive UEs supported by a certain node can be dynamically changed after deployed?We think the flexibility is among different nodes due to the different capacities and coverages of each node.And furthermore, the more flexibility, the more complexity of the solution would have. We think there should be a limited number of node types in reality network with different capacity and coverage.c |
| ZTE | Flexible | Flexible number of UE context ID and local gNB ID can suit for different NW deployment scenarios(e.g. flexible balance between gNB capacities and gNB densities). |
| Samsung |  | We also think some clarification on the deployment requirement is needed, e.g. the required # of gNB identifications and the required # of UE identifications. The flexible solution can certainly support most of deployment scenarios, but some deployment scenarios may not be realistic and such kind of flexibility may not be needed to satisfy the deployment requirement and may cause unnecessary signaling overhead and complexity. |
| Ericsson Clarification |  | To answer to the questions on flexibility, from past discussions we understand that flexibility means that the maximum number of Inactive UE Contexts may be different between NG-RAN nodes and that such number may be changed after node deployment. Such changes after node deployment are not frequent and may be due to e.g. the increase in cell coverage of a given node. For this reason, one way to describe such “dynamic” flexibility could be that “the maximum number of inactive contexts per NG-RAN node may be changed after node deployment in a semi-static manner” |
| Vodafone | Flexible | Agree with Ericsson clarification above. |
| Verizon | Flexible | Agree with Ericsson view.  |
| Nokia | Flexible to some extent to be standardized | First, there seems to be a misunderstanding of solution [3] where it keeps saying that the length is fixed. This is not true. A gNB can generate a modulo which length is flexible, exactly at the solution in [4]. So there is no difference between solution [3] and [4] to this regards.Besides, one further useful clarification would be whether one should assume that the size length would be same in some “neighbourhood area” (or “zones”) or should we assume that any gNB could have neighbours of any length? Sais differently, to which extend should be consider this flexibility? How many different sizes of neighbours should a gNb expect? What is the maximum? These are the first questions to agree upon.  |

**First Round Discussion Conclusion:**

**It is agreed that the solution to be agreed by RAN3 shall support flexible assignment of the maximum number of Inactive UE contexts per NG-RAN node within some limits to be also standardized.**

**The first step is to define the requirement regarding this limit.**

**This means that the maximum number of Inactive UE Contexts may be different between NG-RAN nodes within such limit and that such number may be changed after node deployment in a semi-static manner.**

## Configuration Based vs Signalling Based solutions

Solutions proposed in [2] and [4] are based on Xn signaling. These solutions minimize the need for configuration at the RAN because an NG-RAN node learns how to derive the Local NG-RAN node ID of a neighbor node by means of information (e.g. the neighbor node’s Local ID) received from neighbor nodes over Xn.

These solutions may be subject to Local NG-RAN Node ID conflicts, where two neighbor nodes assign the same Local NG-RAN Node ID. Resolution of such conflicts may require a new assignment of the Local NG-RAN Node ID and a new round of signaling to neighbor nodes.

The solution described in [3] is not based on the exchange of the Local NG-RAN Node ID via Xn. Instead, the solution derives the Local NG-RAN Node ID as the “modulo(x)” operation over the Global NG-RAN Node ID. In this solution conflicts are also possible. When a conflict occurs in the solution in [3] it is assumed that the Global NG-RAN Node ID of the node in conflict would need to be re-selected and re-configured at the NG-RAN node.

In [1] on the other hand, there are hints to a solution where conflicts shall not occur. This solution is only possible by means of centralized configuration of the Local NG-RAN Node ID at each NG-RAN node. Such centralized configuration shall happen across different RAN vendors’ and across different sharing operators’ domains. The advantage would be that there would not be Local NG-RAN Node ID conflicts. The disadvantage would be that a centralized configuration mechanism would need to be in place across sharing operators and, in order to achieve intervendor interoperability, across different RAN vendors. The latter would require standardization of the solution in SA5.

**Companies are invited to express their view on what type of solution shall RAN3 select in order to achieve flexible assignment of the Local NG-RAN Node ID length, inter vendor interoperability and interworking in RAN sharing scenarios.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Signalling Based/OAM Configuration Based**  | **Comments** |
| Ericsson | Signalling Based | A solution based on Xn signalling is natively inter-vendor interoperable. Any updates to the signaled information happens automatically between RAN nodes, without the need of centralized configuration and therefore without the need for inter vendor/inter operator coordination. A solution based on OAM configuration needs detailed specification in SA5 to achieve inter vendor interoperability. However, it would not work in inter operator cases (RAN sharing) because inter operators OAM communication is not specified, hence it cannot be interoperable. Besides, in an OAM configuration based solution, any changes to the Local NG-RAN Node ID would need central coordination, which is usually time and resource consuming. |
| Huawei | Signaling based or OAM based | At this stage, I don’t think we can rule out any solution without detailed analysis and comparison.Which solution is adopted depends on the outputs of the study.OAM solution is also feasible in inter-operator scenario. The configuration will be done in the OAM system of the primary operator who builds and owns the network.And could someone clarify how the signaling based solution would work in network sharing scenario? |
| ZTE | Signalling Based | Once the local gNB identity length in the I-RNTI is specified(e.g. two or three bits in I-RNTI are specified to indicate the local gNB identity length), the target gNB can exactly know the local gNB ID and UE context ID from the I-RNTI, based on which, OAM will not be necessary any more to determine the local gNB identity in the inter vendor interoperability case, the NW deployment will be more flexible. |
| Samsung |  | We think a signaling based solution may be needed depending on the analysis of the requirement. Whether and which information is additionally needed to support the deploy requirement should be verified. |
| Ericsson Clarification |  | To answer Huawei’s comments: a signallnig based solution for network sharing will work because the formatting of the I-RNTI will be standardized. For example, taking the solutions in [2] and [4] and assuming that the first 2 MSB of the I-RNTI point at a standardized structure, any NG-RAN node from any operator can deduce the Local NG-RAN Node ID and by that identify a peer node.  |
| Vodafone | Signalling based |  |
| Verizon | Signaling based | Signaling based solution is best for multi-vendor interoperability and automation. OAM solution would need some tedious coordination across multiple OAM systems and is a burden for operators. Automation is also difficult to achieve when such tedious OAM coordination is required.  |
| Nokia | Signaling and/or O&M based | First we note that again solution in [3] is erroneously presented when it says that the Global gNB ID would be re-selected. This has never been proposed in tdoc [3].Then we think like Samsung that the needed signaling would depend on exact requirement. For example, we should define to which extent the size can vary in neighbourhood.To that respect, a mix of solutions [2] and [3] should be investigated. Or we could consider an evolution of annex C integrating the ZTE solution [2]. |

**First Round Discussion Conclusion:**

**Solutions based on OAM configuration may be considered if they fulfil requirements of:**

* **flexibility in allocation of maximum number of Inactive UE contexts per NG-RAN node;**
* **Interoperability between vendors; support for RAN sharing;**
* **Minimized configuration effort;**

# Conclusion, Recommendations

# References

[1] R3-210448, Discussion on NG-RAN node ID resolution from I-RNTI (Huawei)

[2] R3-210195, Discussion on I-RNTI partitioning (ZTE)

[3] R3-210422, Local NG-RAN node identifier (Nokia, Nokia Shanghai Bell)

[4] R3-210734, Node Identifier for RRC Inactive (Ericsson, AT&T, Verizon Wireless)