3GPP TSG-RAN WG1 Meeting #115 R2-21xxxxx

Electronic, August 9th – 27th, 2021

Agenda: 8.2.3

Source: Ericsson

Title: Report for Inter-node message design

Document for: Discussion, Decision

# 1 Introduction

This document contains the report for discussion on details of inter-node messages for CPAC, related to the following e-mail discussion:

* [Post115-e][216][R17 DCCA] Inter-node message design (Ericsson)

Scope: Discuss details of inter-node messages for CPAC and provide draft CR of the resulting option(s).

 Intended outcome: Draft CR

 Deadline: Long

# 2 Discussion

## 2.1 Inter-node messages for CPAC

The impact to the inter-node signalling for the Conditional PSCell Addition and Change (CPAC) procedures, such as how to transfer information related to more than one PSCell candidate in a single procedure, has been discussed at the latest RAN2 meetings. The following agreements have been reached:

RAN2#114-e

* 1: In order to exchange per-PSCell parameter by reusing existing inter-node RRC message for CPAC, a list of CG-Config associated to each candidate PSCell should be sent from candidate SN to MN.
* FFS if a list of CG-ConfigInfo from MN to candidate SN is needed. FFS if a list of CG-Config from source SN to MN is needed.
* Discuss in Stage-3 whether new message is useful or not (based on signalling details)

RAN2#115-e

* 6 The inter-node signalling from (at least) target SN to MN for CPAC procedures only includes a single container (FFS which IE), even if several PSCell candidates are provided.

This e-mail discussion assesses the details of the inter-node message for CPAC on the different impacted interfaces, i.e.:

* from target SN to MN;
* from MN to target SN;
* from source SN to MN; and
* from MN to source SN.

### 2.1.1 Target SN to MN inter-node signalling for CPAC

On the interface from the target SN to the MN, the inter-node message should include the per candidate PSCell configuration in the XnAP S-NODE ADDITION REQUEST ACKNOWLEDGE message. Today the S-NODE ADDITION REQUEST ACKNOWLEDGE message contains a single RRC container that includes the *CG-Config*:

9.1.2.2 S-NODE ADDITION REQUEST ACKNOWLEDGE

This message is sent by the S-NG-RAN node to confirm the M-NG-RAN node about the S-NG-RAN node addition preparation.

Direction: S-NG-RAN node → M-NG-RAN node.

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| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| Message Type | M |  | 9.2.3.1 |  | YES | reject |
| M-NG-RAN node UE XnAP ID | M |  | NG-RAN node UE XnAP ID9.2.3.16 | Allocated at the M-NG-RAN node | YES | reject |
| S-NG-RAN node UE XnAP ID | M |  | NG-RAN node UE XnAP ID9.2.3.16 | Allocated at the S-NG-RAN node | YES | reject |
| [...] |
| S-NG-RAN node to M-NG-RAN node Container | M |  | OCTET STRING | Includes the *CG-Config* message as defined in subclause 11.2.2 of TS 38.331 [10]. | YES | reject |
| [...] |

It has been agreed in RAN2 that “…*a list of CG-Config associated to each candidate PSCell should be sent from candidate SN to MN*” and that “*The inter-node signalling from (at least) target SN to MN for CPAC procedures only includes a single container (FFS which IE), even if several PSCell candidates are provided*”.

The S-NODE ADDITION REQUEST ACKNOWLEDGE message should thus include a list of *CG-Config* within a single S-NG-RAN node to M-NG-RAN node container. The following solutions have then been proposed in contributions R2-2108112 and R2-2105988 for this:

* a) To extend the existing *CG-Config* message to include the list of additional CG-Config(s)
* b) To introduce a new RRC message that includes the full list CG-Config(s)

In solution a) an optional list of additional CG-Config(s) is added to the CG-Config message, i.e. so that the existing message includes a first PSCell candidate and the list includes CG-Config(s) for the other PSCell candidate(s), if any. At the RAN2#115-e meeting it was commented that there should be no empty SEQUENCE in the middle of the message, which would be the case if there is a CG-Config (which has an empty CG-Config at the end) included directly within another message. This issue exists for both solution a) and b) and can be handled by including the additional CG-Config(s) as an OCTET STRING, similar to how e.g. the *condRRCReconfig* includes an additional *RRCReconfiguration* in legacy. The implementation of solution a) in 38.331 could look like this:

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*CG-Config* message

-- ASN1START

-- TAG-CG-CONFIG-START

CG-Config ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 cg-Config CG-Config-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

CG-Config-IEs ::= SEQUENCE {

 scg-CellGroupConfig OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,

 scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,

 configRestrictModReq ConfigRestrictModReqSCG OPTIONAL,

 drx-InfoSCG DRX-Info OPTIONAL,

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

 measConfigSN MeasConfigSN OPTIONAL,

 selectedBandCombination BandCombinationInfoSN OPTIONAL,

 fr-InfoListSCG FR-InfoList OPTIONAL,

 candidateServingFreqListNR CandidateServingFreqListNR OPTIONAL,

 nonCriticalExtension CG-Config-v1540-IEs OPTIONAL

}

*[…skipped parts…]*

CG-Config-v1640-IEs ::= SEQUENCE {

 servCellInfoListSCG-NR-r16 ServCellInfoListSCG-NR-r16 OPTIONAL,

 servCellInfoListSCG-EUTRA-r16 ServCellInfoListSCG-EUTRA-r16 OPTIONAL,

 nonCriticalExtension ~~SEQUENCE {}~~CG-Config-r17-IEs OPTIONAL

}

CG-Config-r17-IEs ::= SEQUENCE {

 additionalCG-ConfigList-r17 SEQUENCE (SIZE (1..FFS)) OF AdditionalCG-Config-r17 OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

AdditionalCG-Config-r17 ::= OCTET STRING (CONTAINING CG-Config)

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In solution b) a new inter-node RRC message, e.g. called “*CG-CandidateList*” is introduced to include the full list of CG-Config(s) for all the candidate PSCells. There is then however a need to update TS 38.423 to include that the RRC container in the S-NODE ADDITION REQUEST ACKNOWLEDGE message may include two different RRC messages (*CG-Config* or “*CG-CandidateList*”).

The implementation of solution b) in 38.331 and 38.423, respectively, could look like this:

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38.331:

*CG-CandidateList* message

-- ASN1START

-- TAG-CG-CANDIDATELIST-START

CG-CandidateList ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 cg-CandidateList CG-CandidateList-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

CG-CandidateList-IEs ::= SEQUENCE {

 cg-CandidateList-r17 SEQUENCE (SIZE (1..FFS)) OF OCTET STRING (CONTAINING CG-Config) OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-CG-CANDIDATELIST-STOP

-- ASN1STOP

38.423:

9.1.2.2 S-NODE ADDITION REQUEST ACKNOWLEDGE

This message is sent by the S-NG-RAN node to confirm the M-NG-RAN node about the S-NG-RAN node addition preparation.

Direction: S-NG-RAN node → M-NG-RAN node.

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| --- | --- | --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
| Message Type | M |  | 9.2.3.1 |  | YES | reject |
| M-NG-RAN node UE XnAP ID | M |  | NG-RAN node UE XnAP ID9.2.3.16 | Allocated at the M-NG-RAN node | YES | reject |
| S-NG-RAN node UE XnAP ID | M |  | NG-RAN node UE XnAP ID9.2.3.16 | Allocated at the S-NG-RAN node | YES | reject |
| [...] |
| S-NG-RAN node to M-NG-RAN node Container | M |  | OCTET STRING | Includes the *CG-Config* message or the CG-CandidateList message as defined in subclause 11.2.2 of TS 38.331 [10]. | YES | reject |
| [...] |

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**Question 1: Which solution do you think is most suitable for inclusion of multiple PSCell candidates in a single container from target SN to MN?**

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| Company | Solution (a or b) | Comments |
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### 2.1.2 Source SN to MN inter-node signalling for CPAC

At an SN initiated inter-SN CPC the S-SN sends information about the proposed PSCell candidate(s) and about execution conditions to the MN. The information can be sent in the S-NODE CHANGE REQUIRED message and/or the S-NODE MODIFICATION REQUIRED message, depending on solution chosen.

Both these messages include a container that consists of the *CG-Config* message. The *CG-Config* already includes the *candidateCellInfoListSN*, which contains information (such as measurement results) about cells that the S-SN suggests the target SN to consider. In the SN initiated inter-SN CPC case, the source SN needs to explicitly indicate what candidate PSCell(s) that the target SN is allowed to configure, but it should also be possible for the source SN to provide measurement information for other cells. One proposal in R2-2108112 has been to extend the *candidateCellInfoListSN* to include also execution conditions (for the candidate PSCells). However, since the *candidateCellInfoListSN* consists of *MeasResultList2NR*, which is used also in signalling by the UE, one should avoid introducing changes there due to inter-node signalling.

The list of proposed candidate PSCells as well as execution conditions could instead be introduced as a new list in *CG-Config*.

A text proposal for implementation of such a new list in 38.331 could look like this:

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CG-Config-IEs ::= SEQUENCE {

[…]

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

[…]

}

CG-Config-v1640-IEs ::= SEQUENCE {

 servCellInfoListSCG-NR-r16 ServCellInfoListSCG-NR-r16 OPTIONAL,

 servCellInfoListSCG-EUTRA-r16 ServCellInfoListSCG-EUTRA-r16 OPTIONAL,

 nonCriticalExtension ~~SEQUENCE {}~~CG-Config-v17xy-IEs OPTIONAL

}

CG-Config-v17xy-IEs ::= SEQUENCE {

 candidateCellInfoListCPC-r17 CandidateCellInfoListCPC-r17 OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

CandidateCellInfoListCPC-r17 ::= SEQUENCE (SIZE (1..FFS)) OF CandidateCellInfo-r17

CandidateCellInfo-r17 ::= SEQUENCE {

 ssbFrequency-r17 ARFCN-ValueNR OPTIONAL,

 candidateList-r17 SEQUENCE (SIZE (1..FFS)) OF CandidateList-r17 OPTIONAL

}

CandidateList-r17::= SEQUENCE {

 physCellId-r17 PhysCellId OPTIONAL,

 condExecutionCond-r17 SEQUENCE (SIZE (1..2)) OF MeasId OPTIONAL

}

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**Question 2: Do you agree that a separate list of proposed PSCell candidates, including optional execution conditions, should be introduced in *CG-Config* according to the text proposal above?**

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RAN2 made the agreement:

* The MN does not need to comprehend the execution condition set by the source SN. The MN can associate the execution condition configuration to an RRCReconfiguration message provided by the target –SN without comprehending the execution condition set by the source SN.

The agreement says that the MN does not need to comprehend the execution conditions, but it does not forbid the MN to comprehend the execution conditions either. It can be seen that it causes extra overhead to make the execution conditions non-visible to the MN. Such an implementation could look like:

CandidateList-r17::= SEQUENCE {

 physCellId-r17 PhysCellId OPTIONAL,

 condExecutionCond-r17 OCTET STRING (CONTAINING CondReconfigExecCond-r17) OPTIONAL

}

CondReconfigExecCond-r17 ::= SEQUENCE (SIZE (1..2)) OF MeasId

The RRC rapporteur questions the use of OCTET STRING in this case, as the conditions are just a list of integers. Normally OCTET STRING is used for messages or configuration of subsections/groups in order to get future extensions included, but here it is just a matter of integers. The reason for using OCTET STRING seems unclear here.

**Question 3: Do you think the execution conditions should be added within an OCTET STRING in the inter-node message?**

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### 2.1.3 MN to target SN inter-node signalling for CPAC

The list of target candidate PSCell(s) that the MN received from S-SN should be sent from MN to T-SN. The easiest option is to reuse the same list in the *CG*-*ConfigInfo* container to T-SN as was used from S-SN to MN in *CG*-*Config* as discussed in 2.1.2. This is similar to how *CG*-*ConfigInfo* and *CG-Config* both include the *candidateCellInfoListSN*, which contains information (such as measurement results) about cells that the S-SN suggests the target SN to consider. A corresponding TP for including a list of proposed target candidate PSCells in *CG-ConfigInfo* is shown below.

A question is whether the MN is allowed to include the execution conditions also in *CG*-*ConfigInfo*. It may be easier for the MN to include the same list as was received from S-SN, but it also means some extra information in the signalling. The execution conditions could be optionally included by the MN.

CG-ConfigInfo ::= SEQUENCE {

[…]

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

[…]

CG-ConfigInfo-v1640-IEs ::= SEQUENCE {

 servCellInfoListMCG-NR-r16 ServCellInfoListMCG-NR-r16 OPTIONAL,

 servCellInfoListMCG-EUTRA-r16 ServCellInfoListMCG-EUTRA-r16 OPTIONAL,

 nonCriticalExtension ~~SEQUENCE {}~~CG-ConfigInfo-r17-IEs OPTIONAL

}

CG-ConfigInfo-v17xy-IEs ::= SEQUENCE {

 candidateCellInfoListCPC-r17 CandidateCellInfoListCPC-r17 OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

CandidateCellInfoListCPC-r17 ::= SEQUENCE (SIZE (1..FFS)) OF CandidateCellInfo-r17

CandidateCellInfo-r17 ::= SEQUENCE {

 ssbFrequency-r17 ARFCN-ValueNR OPTIONAL,

 candidateList-r17 SEQUENCE (SIZE (1..FFS)) OF CandidateList-r17 OPTIONAL

}

CandidateList-r17::= SEQUENCE {

 physCellId-r17 PhysCellId OPTIONAL,

 condExecutionCond-r17 SEQUENCE (SIZE (1..2)) OF MeasId OPTIONAL

}

**Question 4: Do you agree that the same list of proposed PSCell candidates should be introduced in *CG-ConfigInfo* as in *CG*-*Config*? Do you think the execution conditions could be included in *CG*-*ConfigInfo*?**

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### 2.1.4 MN to source SN inter-node signalling for CPAC

At an SN initiated inter-SN CPC the MN needs to send information to the S-SN about the accepted PSCell candidate(s), independent on if solution 1 and solution 2 is implemented. In both cases the S-SN needs the information in order to decide if a reconfiguration of e.g. the SCG *measConfig* is needed. The message that is sent to S-SN in legacy is S-NODE CHANGE CONFIRM. In this message there is currently no RRC container included and no information about selected target PSCell either. For SN initiated inter-SN CPC, either an RRC container could be added or a list of the selected target candidate PSCell(s) could be added directly in the XnAP message. Both options have RAN3 impact and should be consulted with RAN3.

**Question 5: Do you have any comments on whether to add information about accepted target candidate PSCell(s) in an RRC container or directly in the XnAP message? Or whether just to consult RAN3 on this question?**

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# Conclusion

Based on the above, the following is proposed:

# 4 References