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 ID  9.2.3.16 | Allocated at the M-NG-RAN node | YES | reject |
| S-NG-RAN node UE XnAP ID | M |  | NG-RAN node UE XnAP ID  9.2.3.16 | 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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 ID  9.2.3.16 | Allocated at the M-NG-RAN node | YES | reject |
| S-NG-RAN node UE XnAP ID | M |  | NG-RAN node UE XnAP ID  9.2.3.16 | 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 |
| CATT | Solution c is prefered, solution b with modification is acceptable | Solution c is prefered. RAN3 has already agreed to include a list of accepted PSCells and the corresponding CG-Config within the SN/SgNB Addition Request ACK, please refer RAN3 agreed CR R3-212968 and R3-212969 during RAN3#112 meeting. Take SN Addition Request ACK message as an example,  the S-NODE ADDITION REQUEST ACKNOWLEDGE message  >Candidate PSCell ID List 1  >>Candidate PSCell ID Item 1 .. <maxnoofPSCellCandidate>  >>>PSCell ID M Target Cell Global ID  >>>RRC Container M OCTET STRING  We think it is better to provide the candidate PSCells accepted by T-SN in parallel to the MN, which is clearer. The nested structure in solution a is not preferred.  Solution b can be accepted with modification. Considering the MN should make the association of the execution condition and the candidate PSCell configuration, we think it is better to indicate the accepted PSCell explicitly which should be added in parallel with the container CG-ConfigInfo. This is to avoid the MN to decode the CG-ConfigInfo to obtain the PSCell ID information.  e.g.  CG-CandidateList-IEs ::= SEQUENCE {  cg-CandidateList-r17 SEQUENCE (SIZE (1..FFS)) OF CG-CandidateInfo-r17 OPTIONAL,  nonCriticalExtension SEQUENCE {} OPTIONAL  }  CG-CandidateInfo-r17 ::= SEQUENCE {  ssbFrequency ARFCN-ValueNR,  physCellId PhysCellId,  candidateCG-Config OCTET STRING (CONTAINING CG-Config)  } |
| Qualcomm | Solution b) | Solution b) seems to be cleaner and simpler. |
| ZTE | Both solution a) and b) with modification | We also think it’s better to explicitly indicate the accepted PSCell to make the MN associate the execution condition and candidate PSCell configuration easier. And considering the current CG-Config-IEs have indicate pSCellFrequency, we think it’s simpler to just introduce an new IE for physCellId in CG-Config-IEs to avoid defining the redundant PSCell frequency information.  e.g.  CG-Config-v17xy-IEs ::= SEQUENCE {  physCellId PhysCellId,  OPTIONAL  nonCriticalExtension SEQUENCE {} OPTIONAL  }  With the modification above, we are fine to both solution a) and b). |
| NEC | Solution b with modification | Solution b with modification by adding the accepted candidate cell explicitly linked to corresponding PSCell config, as commented by CATT. |
| Lenovo, Motorola Mobility | Solution b | Solution b seems cleaner compared to solution a. What CATT proposed to include PSCell ID explicitly in parallel with the container CG-ConfigInfo is also fine to us. |
| Nokia | a) | We prefer a new CG-Config for Rel-17 which shall contain a list of CG-Configs. The exact IE names are to be discussed (not sure if the ‘‘Additional‘‘ in the name is required). It has to be also noted that MN may not be able to match each CG-Config with each target PSCell without decoding the RRC configuration provided for each cell. To avoid such complexity, an ordered list of cell identifiers should be sent outside of CG-Config. Alternatively, RAN2 can change its decision to use a single container for all configurations and support having separate, per each candidate target PSCell. |
| Futurewei | Either a) or b) with modification | We think either a) or b) is fine as long as cell IDs of the T-SN confirmed candidates are explicitly specified outside of the corresponding CG-config container as suggested by CATT. |
| Ericsson | a) | We are fine with both a) or b), but as there is impact to RAN3 specificaiton in solution b), we have a slight perference for solution a). We agree to have the explicit cell ID specified outside CG-Config as proposed by CATT. |
| Intel | Solution C | agree with CATT that, with Solution C, no need to do anything in RAN2 |
| Huawei, HiSilicon | b) with modification from CATT |  |
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Summary: Several companies are fine with both option a) and b) whereas some companies indicated a preference for either solution a) or solution b). Since there is a slightly higher preference for solution b) it is the rapporteur’s proposal to implement solution b). Since solution b) has impact on RAN3 signalling, it is also proposed to inform RAN3 of this agreement.

One company proposed to include the identity of the accepted target candidate PSCell (in terms of frequency and PCI) outside the corresponding CG-Config, which got support from most companies. It is therefore the rapporteur’s proposal to include this in the new inter-node message.

**Proposal 1: Introduce a new inter-node RRC message that includes the full list of CG-Config(s).**

**Proposal 2: Specify the accepted target PSCell identity (frequency and PCI) outside the corresponding CG-Config in the new inter-node message.**

**Proposal 3: Send an LS to RAN3 to inform about the new inter-node RRC message that includes a full list of CG-Config(s), and the corresponding impact to RAN3 specification.**

### 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:

Option a:

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

}

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Option b: Considering the execution condition doesn’t need to be transferred to the T-SN, add the explicit information “candidateCellList” to indicate the recommended cells by the S-SN in parallel with the candidateCellInfoListCPC-r17. This way the MN can directly transfer the list of the recommended cells by the S-SN to the T-SN, without decoding candidateCellInfoListCPC-r17 to generate a new list of candidate cells recommended by the S-SN. And the candidateCellInfoListCPC-r17 can be kept by the MN.

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

candidateCellInfoListCPC-r17 CandidateCellInfoListCPC-r17 OPTIONAL,

candidateCellList-r17 CandidateCellList-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 Candidate-r17 OPTIONAL

}

Candidate-r17::= SEQUENCE {

physCellId-r17 PhysCellId OPTIONAL,

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

}

CandidateCellList-r17::= SEQUENCE {

ssbFrequency-r17 ARFCN-ValueNR OPTIONAL,

physCellId-r17 PhysCellId OPTIONAL

}

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

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Option c: Similar with option b, but the candidate cells recommended by the S-SN (the candidateCellList in option b) and transferred to the T-SN is indicated by bit mapping like method, where each bit of the bit string represents the corresponding cell within the candidateCellInfoListSN. Value 1 means the corresponding cell is a candidate cell, otherwise it is not. Same as option b, another parallel field (candidateCellInfoListCPC) will be kept by the MN carrying the execution condition and the associated candidate PScell ID.

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

candidateCellInfoListCPC-r17 CandidateCellInfoListCPC-r17 OPTIONAL,

candidateCellList-r17 OCTET STRING (CONTAINING CandidateCellList-r17) OPTIONAL,

nonCriticalExtension SEQUENCY{} 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 Candidate-r17 OPTIONAL

}

Candidate-r17::= SEQUENCE {

physCellId-r17 PhysCellId OPTIONAL,

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

}

CandidateCellList-r17 ::= BIT STRING (SIZE (1..64))

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

Option d:based on option a, additionally define separate *candidateCPCCellInfoListSN* to indicate the candidate cells recommended by the S-SN. The *candidateCPCCellInfoListSN* reuses the IE MeasResultList2NR, only the measurement of the candidate PSCell recommended by the S-SN are included. The original candidateCellInfoListSN doesn’t include the measurement of the candidate PSCell recommended by the S-SN.

CG-Config-IEs ::= SEQUENCE {

[……]

candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

[……]

nonCriticalExtension CG-Config-v1540-IEs OPTIONAL

}

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

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

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

nonCriticalExtension CG-Config-v17xy-IEs OPTIONAL

}

CG-Config-v17xy-IEs ::= SEQUENCE {candidateCellInfoListCPC-r17 CandidateCellInfoListCPC-r17 OPTIONAL,

candidateCPCCellInfoListSN-r17 OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

nonCriticalExtension SEQUENCY{} 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 Candidate-r17 OPTIONAL

}

Candidate-r17::= SEQUENCE {

physCellId-r17 PhysCellId OPTIONAL,

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

}

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

Option e:based on option a, additionally add an indicator under the candidateCellInfoListSN (i.e. in MeasResultNR) to indicate whether the related cell is a CPC candidate cell or not.

MeasResultListNR ::= SEQUENCE (SIZE (1..maxCellReport)) OF MeasResultNR

MeasResultNR ::= SEQUENCE {

physCellId PhysCellId OPTIONAL,

[…]

[[

cpcCandidate-r17 ENUMERATED {true} OPTIONAL,

]],

}

**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?**

|  |  |
| --- | --- |
| Company | Comments |
| CATT | Agree with a seperate list of proposed PSCell candidates in addition to the *candidateCellInfoListSN*, as well as the execution condition.  As for “optional execution conditions”, if it means the execution condition should be optional present even if the list of proposed PSCell candidates is present? If our understanding is right, then we think it depends on whether the solution 2 is agreed (now is a work assumption), and when to provide the execution condition even if solution 2 is agreed, i.e., step 1 or step 3. All of these are FFS at the moment.  As for the detailed signalling design, please see the added solution b/c/d. In general, we think that the information transefered from thew S-SN to thye MN can be divided into 2 parts:   * information required by the T-SN: One part that need to be transfered to the T-SN, including the candidate cells recommended by the S-SN * information required by the MN: information used by the MN, including the execution condition and the associated candidated PSCell ID   It is better to define the 2 fields seperately, so when the MN receives the information from the S-SN, the MN can keep the “information required by the MN” itself and transfer the “information required by the T-SN” to the T-SN without additional decoding and re-generation for signalling.  Like the option b,c, d the field of candidateCellInfoListCPC-r17 is the “information required by the MN“ which should be kept by the MN. The field of candidateCellList in option b,c and the field of “candidateCPCCellInfoListSN” in solution d are the “information required by the T-SN” which can be transfered to the T-SN by the MN directly. |
| Qualcomm | Agree. |
| ZTE | 1. We agree with that a separate list for the candidate PSCell and the corresponding execution condition (e.g. CandidateCellInfoListCPC-r17) is needed regardless of which solution is adopted. The main difference is in which step the list can be provided? E.g. the list must be provided in step 1 for solution 1, while it may be not provided in step 1 (i.e. only in step 3) for solution 2. 2. For the list of suggested candidate PSCell (no execution conditions) provided from the source SN to the MN and from the MN to the target SN, we think whether it’s needed depend on which solution is agreed. For solution 1, since the execution conditions should be provided in step 1, the suggested candidate PSCells are always involved. And the MN should forward the suggested candidate PSCells to the target SN for the PSCell selection. For solution 2, if the execution conditions are only provided in step 3, it seems no much gain to just provide a suggested candidate PSCell list to the target SN through the MN. Anyway, the target SN can select the candidate PSCell from the candidateCellInfoListSN as the legacy PSCell change procedure. And the source SN can provide the corresponding execution conditions after knowing the accepted candidate PSCells. 3. We share the same view with CATT that the detailed signalling design can be divided into two parts: information required by the MN and information required by the target SN. And considering it’s agreed that the MN performs the association between the execution conditions and candidate PSCell configuration, it seems no much need to transfer the execution conditions from the MN to the target SN, i.e. the suggested candidate PSCell list is enough in same cases. If the suggested candidate PSCell list to the target SN is required (e.g. in solution 1), we prefer to combine this with the candidateCellInfoListSN (anyway it shall be transferred to the target SN), to avoid providing redundant cell information. So the option c or option e like solutions can be considered. |
| NEC | Agree that a separate list of proposed PSCell candidates should be introduced.  Regarding the example structure, we think the „condExecutionCond“ should be added in OCTET STRING which can be transparent to the MN. Among the options so far, we prefer to take the option b as baseline. |
| Lenovo, Motorola Mobility | Agree a separate list of proposed PSCell candidateas should be introduced. We also agree with analysis by CATT and ZTE, whether the execution conditions are optional presented and in which step depends on whether option 1 or option 2 will be taken. |
| Nokia | Yes. We are fine with the optional list of execution conditions. The structure shown above looks correct to us. However, if signalling the conditions is optional in SN change required, then it shall be provided to the MN in the message sent from S-SN when it is informed which PSCells have been accepted. |
| Futurewei | Agree that a separate list of proposed PSCell candidates with corresponding execution conditions. We would prefer simple solution of non-optional sending execution conditions at step one (“solution 1” in R2-2108112 is preferred). Upon received the final candidates from the T-SN, the MN should be able to send the CPC command to the UE. There is no need to waiting for SN again before MN sending CPC configuration to the UE. The measurement configuration change can be done afterward depending on the decision of S-SN. |
| Ericsson | Agree. There is an agreement from RAN2#114 that the source SN may provide the execution conditions (and/or SN measurement configuration) to the MN upon obtaining the information which cells have been ultimately prepared by the target SN. That means that the execution conditions need to be optional in the message. |
| Intel | agree |
| Huawei, HiSilicon | Agree that a separate list of proposed PSCell candidates with corresponding execution conditions is included.  We agree with a) except that all fields should actually be mandatory, i.e. frequency, PCI and condition.  There was a working assumption to clarify the agreement that says:  • Upon SN initiated CPC configuration, S-SN indicates the CPC candidates to MN and for each an execution condition  So the execution conditions should not be optional. |
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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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| --- | --- |
| Company | Comments |
| CATT | Yes, since for SN initiated inter-SN CPC, the execution condition is generated by the S-SN, the MN just needs to include the received execution condition generated by the S-SN directly within the CG-Config, The MN does not need to comprehend the execution conditions. |
| Qualcomm | Agree. the OCTET STRING does not seem to be needed as there is no need to explicitly try to make the execution conditions not visible to the MN. |
| ZTE | Yes, since the MN is not required to comprehend the execution conditions and measurements set by the source SN, we prefer to add the execution conditions as an OCTET STRING. |
| NEC | Yes. we can simply go with the legacy way, although we can see the point raised by Rapporteur (but no need to take different way). |
| Lenovo, Motorola Mobility | Yes |
| Nokia | No need to define it using OCTET STRING, i.e. we agree with the rapporteur it can be done simpler, with measurement identifiers. |
| Futurewei | We agree with rapporteur’s point to keep things simple. No need to make extra efforts to block MN to decode it. Anyway, the MN is not going to use the execution condition. |
| Ericsson | Agree with the rapporteur, an OCTET STRING seems unnecessary in this case. |
| Intel | Not necessary. Ok to use SEQUENCE (SIZE (1..2)) OF MeasId directly instead. |
| Huawei, HiSilicon | We need to be careful that MeasId is 1 to 32 in 36.331 but it is 1 to 64 in 38.331 (although there is an extension of measId range defined in 36.331, it was not used for CPC in Rel-16).  In (NG)EN-DC, it will be the MN encoding the MN Uu message that contains CondReconfigurationAddMod-r16 and now it contains LTE measId.  In general, it should be the same like for the Uu message. We suggest keeping if FFS now. |
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Summary: All companies agree to define a separate list of proposed PSCell candidates. Some companies question whether the execution conditions should be optional or not and that it depends on the solution chosen. However, there is already an agreement made in RAN2#114 the source SN may provide the execution conditions (and/or SN measurement configuration) to the MN upon obtaining the information which cells have been ultimately prepared by the target SN. That means that the execution conditions need to be optional in the message.

There is a split view on whether to include the execution conditions in an OCTET STRING or as integers. The agreement says that the MN doesn’t need to comprehend the execution conditions, but even if the MN can decode the field, it still doesn’t comprehend the meaning of the conditions as the SCG measConfig is not comprehended by the MN. The implementation could also be different depending on if the MN and SN belong to the same RAT or different RAT, i.e. integers in one case and OCTET STRING in the other case. It is proposed to discuss this in the next RAN2 meeting.

**Proposal 4: Define a separate list of proposed PSCell candidates in CG-Config, including optional execution conditions.**

**Proposal 5: Discuss whether to include the execution conditions in an OCTET STRING or as integers.**

### 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

}

Option b: similar with the option b/c in 2.1.2, define separate field by OCTET STRING to carry the information received from the S-SN, to indicate the candidate cells recommended by the S-SN. And define a separate field to indicate the candidate cells recommend by the MN

1. ***CG-ConfigInfo* message**

-- ASN1START

-- TAG-CG-CONFIG-INFO-START

CG-ConfigInfo ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

cg-ConfigInfo CG-ConfigInfo-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

CG-ConfigInfo-IEs ::= SEQUENCE {

[……]

candidateCellInfoListMN MeasResultList2NR OPTIONAL,

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 CG-ConfigInfo-v17xy-IEs OPTIONAL

}

Option b:

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

candidateCellListSN-r17 OCTET STRING (CONTAINING CandidateCellList-r17) OPTIONAL,

candidateCellListMN-r17 CandidateCellList-r17 OPTIONAL,

nonCriticalExtension SEQUENCY{}

}[……]

-- TAG-CG-CONFIG-INFO-STOP

-- ASN1STOP

Option c: similar with the option d in 2.1.2, define separate field reuse the structure of *candidateCellInfoListSN/candidateCellInfoListMN*, to indicate the candidate cells recommended by S-SN/MN..

-- ASN1START

-- TAG-CG-CONFIG-INFO-START

CG-ConfigInfo ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE{

cg-ConfigInfo CG-ConfigInfo-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

CG-ConfigInfo-IEs ::= SEQUENCE {

[……]

candidateCellInfoListMN MeasResultList2NR OPTIONAL,

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 CG-ConfigInfo-v17xy-IEs OPTIONAL

}

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

candidateCPACCellInfoListMN-r17 MeasResultList2NR OPTIONAL,

candidateCPCCellInfoListSN-r17 OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

nonCriticalExtension SEQUENCY{} 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*?**

|  |  |
| --- | --- |
| Company | Comments |
| CATT | As for the issue on whethe to indicate the execution condition to T-SN:   * For MN initiated inter-SN CPC, it is already an agreement that there is no need for the MN to indicate the execution condition to the T-SN. * For SN initiated inter-SN CPC, since we already agreed that it is the MN to make the association of the execution condition and the RRC Reconfigutation received from the T-SN, we think there is no need for the MN to indicate the execution condition to the T-SN.   As for the ASN.1 signalling of the list of the proposed PSCell candidates, candidate options b/c is added.  Considering for the CPC initiated by the SN, the candidate PSCell recommended by the S-SN is generated by the S-SN. Therefore, it is better to be OCTET STRING which means that the MN doesn’t need to decode and re-generate the candidate PSCell information.  As for the CPAC initated by the MN, the candidate PSCell is recommended by the MN, the infomration of the candidate PSCell is generated by the MN. Therefore, the information of the candidate PSCell should be IE.  Due to the 2 cases, we prefer to define 2 separte fields for SN initiated CPC and MN initated CPAC to carry the candidate PSCell information. |
| Qualcomm | Yes, the same list of proposed PSCell candidates should be in CG-ConfigInfo as in CG-Config.  The execution conditions should not be included in CG-ConfigInfo because it seems that the target SN does not need them for any purpose. |
| ZTE | 1. For the execution conditions, we think it’s not required to be transferred to the target SN in both MN initiated CPA/CPC and SN initiated CPC considering the MN performs the association between the execution conditions and the candidate PSCell configuration. 2. For the list of proposed PSCell candidates, as our comment in Q2, it can be depend on which solution is adopted. If solution 1 is agreed, this is always needed. And we think the MN can simply transfer this information provided by the source SN to the the target SN, e.g. reusing option c or option e in 2.1.2. 3. For MN initiated CPA/CPC, we have not directly discussed whether a separate list of proposed PSCell candidates (different from candidateCellInfoListMN) is required, or we can simply reuse candidateCellInfoListMN as the legacy PSCell selection. We are open for this discussion. |
| NEC | Regarding the list of PSCell candidates, we understand the MN needs to understand the candidate cell so that the MN can send a CPC request for a proper target SN, unlike execution condition. So, the MN can use the similar list as the one receiveyd from the S-MN but no need to include the same list (i.e. as it is).  Regarding the execution condtion, No, we do not think it is necessary. The MN associates the execution conditon to the configuration of the candidate cell. |
| Lenovo, Motorola Mobility | Agree that proposed PSCell candidates should be introduced in CG-ConfigInfo as in CG-Config, for both CPA, and MN/SN initiated CPC.  Since RAN2 didnt agree that target SN shall understand the execution condition, we dont think execution conditions could be included in CG-ConfigInfo. |
| Nokia | Yes, it is easiest to use the same list as sent from S-SN to MN. We agree to specify the optional possibility to include measurement execution conditions in the message sent from MN to T-SN. |
| Futurewei | We agree that the same list of proposed PSCell candidates should be introduced in CG-ConfigInfo and sent from MN to T-SN. We are fine that MN also sends the execution conditions to the T-SN allowing the T-SN to determine the final candidates based on complete information. |
| Ericsson | We agree to use the same list of proposed PSCell candidates as sent from S-SN to MN. We do not see the need for the MN to send the execution condition to the T-SN and therefore we think it is fine to define a separate list without the execution conditions. |
| Intel | Ok to use same list to make the specification concise.  The execution conditions could be contained in the same IE, but with condition, i.e. it is only contained by S-SN, and should be absent otherwise. |
| Huawei, HiSilicon | We think it is easier for MN to include the same list received in the message and forward to T-SN. Forwarding the execution condition does not mean MN needs to comprehand it. |
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Summary: Most companies think that the same list of proposed PSCell candidates can be sent from MN to T-SN as from S-SN to MN. A few companies think that the execution conditions should be optionally included in the signalling to T-SN, but a majority of the companies think it should be excluded.

**Proposal 6: A list of proposed PSCell candidates is sent from MN to T-SN in the same way as from S-SN to MN. The execution conditions are not sent to T-SN and therefore a separate list is defined for proposed PSCell candidates.**

### 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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| --- | --- |
| Company | Comments |
| CATT | The information can be included in the SN CHANGE CONFIRM message is based on which solutin is used (sloution 1 or solution 2).  If solution 1 is adopted, we thnk RAN3’s agreements made in#113e meeting has already covered the question, i.e the information of the accpeted target candidate PSCells is added directly in the XnAP message,.  RAN3#113e  Signalling design of SN initiated inter-SN CPC  -       FFS: Introduce the RRC complete message for source SN in the SN Change Confirm message, in order to provide from MN to the source SN about the embedded RRC complete message for source SN, after confirmation of receiving CPAC configuration from the UE.  -        Introduce “List of Prepared PSCell IDs” in SN Change Confirm.  if solution 2 is adopted, another new message from the MN to the S-SN is still needed, beside the SN CHANGE CONFIRM message. Then we should first decide which step to use the SN CHANGE CONFIRM message, before we discuss the content of the SN CHANGE CONFIRM message. |
| Qualcomm | It seems in the last RAN3 meeting (RAN3 #113-e) this has already been agreed:  Introduce “List of Prepared PSCell IDs” in SN Change Confirm.  It is likely that RAN3 has agreed to have this information directly in the XnAP message, but this can be confirmed. |
| ZTE | Based on RAN3#113e agreements, it seems RAN3 has decided to add the information of the accepted target candidate PSCells directly in the XnAP message. Depend on the selected solution (i.e. 1 or 2), it can be up to RAN3 further discussion and decision which message can be used to contain this information. |
| NEC | The list of accepted target candidate cells has been discussed in RAN3 and their assumption is to include such list directly in XnAP message. We think this can be the same for the MN to the S-SN. If RAN3 sees some issues, then they will inform us. |
| Lenovo, Motorola Mobility | Similar view as CATT |
| Nokia | How to include those cells within inter-node messages can be up to RAN3 to decide. |
| Futurewei | Agree to follow RAN3 decision on how to deliver the T-SN confirmed final candidates from MN to S-SN. |
| Ericsson | Up to RAN3 to decide. |
| Intel | We could consult RAN3 and follow RAN3’s decision. |
| Huawei, HiSilicon | We share the similar views as above companies that accordind to RAN3’s ageement to include “List of Prepared PSCell IDs” in SN Change Confirm, it will be done by RAN3 in XnAP, thus no RAN2 inter-node message impact for now unless issues identified later. |
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Summary: Companies think that RAN3 is already discussing to include accepted target candidate cells in XnAP signalling and that RAN2 can wait for the RAN3 conclusion.

**Proposal 7: Wait for RAN3 conclusion on signalling of accepted target candidate cells.**

# Conclusion

Based on the above, the following is proposed:

# 4 References