**3GPP TSG-RAN WG3 #122R3-23xxx3**

**Chicago, USA, 13th – 17th November 2023**

**Agenda Item: 12.4**

**Source: Lenovo**

**Title: SoD of left issues for SCPAC**

**Document for: Discussion and Approval**

# 1 Introduction

**CB: # MobilityEnh\_S-CPAC**

**Xxx**

# 2 For Chair Notes

# 2 Discussion

## 2.1 Overall diagram (modified based on R3-237186 Nokia)



## 2.2 Easy to Agree

Q-a: Introduce new indicator in the SN MOD REQ message to indicate the request for SCPAC? To configure the S-SN as a candidate SN during preparation. Case 1. Together with other necessary information.

Easy to agree.

To continue discussing Case 2.

* **To configure the S-SN as a candidate SN during preparation, introduce new indicator in the SN MOD REQ message to indicate the request for SCPAC together with other necessary information.**

Q1: Enhance SN ADD REQ message to include:

* Option 1: list of SN keys
* Option 2: list of SN key and sk-counter pair

Easy to agree Option 2.

* **Enhance SN ADD REQ message for MN to inform SN about the list of SN key and sk-counter pairs for S-CPAC preparation.**

Q2: Enhance SN MOD REQ message to add new pairs of SN keys and SN Counters?

Easy to agree

* **Enhance SN ADD REQ message for MN to inform SN about the list of SN key and sk-counter pairs for S-CPAC preparation.**

Q6: Can the following be agreed?

* A: Re-use the existing mechanism devised for Rel-17 SN-initiated inter-SN CPC. Just need to update the semantic of SN MOD REQ > Conditional PSCell Change Information Update IE such that this additional MN-initiated SN modification procedure can also be used for Rel-18 S-CPAC with a candidate SN.
* B: Enhance SN ADD REQ > Conditional PSCell Addition Information Request IE to include a list of SN, so that OCTET STRING (containing either candidateCellInfoListMN or candidateCellListCPC) can be provided per other candidate SN.

Easy to agree A B

* **Re-use the existing mechanism devised for Rel-17 SN-initiated inter-SN CPC. Just need to update the semantic of SN MOD REQ > Conditional PSCell Change Information Update IE such that this additional MN-initiated SN modification procedure can also be used for Rel-18 S-CPAC with a candidate SN.**
* **Enhance SN ADD REQ > Conditional PSCell Addition Information Request IE to include a list of SN, so that OCTET STRING (containing either candidateCellInfoListMN or candidateCellListCPC) can be provided per other candidate SN.**

Q5: How to indicate if the candidate PSCell configuration is delta or complete configuration

Option 1: add RRC config indication IE (as defined in legacy) in SN ADD REQ ACK message

Option 2: add new IE per cell in SN ADD REQ ACK message

Option 3: no additional Xn IE needed

May be easy to agree Option 2?

Q7: Upon SCPAC execution, how does MN inform source SN about the execution and stop data transfer to UE?

* Option 1: Xn-U ADDRESS INDICATION message
* Option 2: SN MOD REQ message
* Option 3: new Class 2 message

May be Option 2?

## 2.3 Not easy to agree

Q8: How does MN inform each candidate SN about the data forwarding addresses of other candidate PSCells belonging to other SNs? upon SCPAC execution

* Option 1: multiple Xn-U ADDRESS INDICATION messages
* Option 2: SN RECONFIGURATION COMPLETE MESSAGE messages
* Option 3: one Xn-U ADDRESS INDICATION with enhancement

Q9: Whether MN retrieves data forwarding proposals from candidate SNs during SCPAC preparation phase, e.g., via enhance SN ADD REQ ACK > 9.2.1.6 PDU Session Resource Setup Response Info – SN terminated to include 9.2.1.17 Data Forwarding and Offloading Info from source NG-RAN node?

Q3: From NW perspective, if coordination between MN/SN is required anyway, do we really want to support SCPAC of SN format? Wouldn’t it be enough to support only MN format SCPAC configuration, if there is no clear benefit from UE perspective neither?

Q4: If Q3 is agreed, how does MN/SN coronation look like?

* Option 1: MN informs SN that SN format is allowed (e.g., in SN ADD REQ)
* Option 2: S-SN requests MN to configure intra-SN SCPAC with MN format (e.g., in SN CHANGE REQD or SN MOD REQD)

Q10: Can RAN3 confirm the following as raised in RAN2 LS?

* A: coexistence of subsequent CPAC and legacy CPAC is supported in R18.
* B: ting signalling flow charts and procedural texts for Rel-17 CPA/CPC procedures can be reused for subsequent CPAC procedure with some modifications.

## 2.4 TPs

LS to RAN2: revision of R3-237623 (ZTE)?

Stage 2:

TP for TS 37.340: revision of R3-237622 (ZTE)?

TP for TS 38.401: revision of R3-237644 (SS)?

Stage 3:

TP for TS 38.423:

* Implementing RAN2 agreement: revision of R3-237648 (LGE)?
* …

TP for TS 37.483: revision of R3-237597 (CATT)?

# 3 Summary of issues

## 3.1 Preparation of S-CPAC

### S-CPAC request indication in SN MOD REQ

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| R3-237319: (Ericsson)Proposal 1 To support Case 1, introduce a new indicator named “Kept for S-CPAC Indicator” in the S-NODE MODIFICATION REQUEST message to inform the source SN that it is kept as a candidate SN.R3-237622: (ZTE)Proposal 7: Introduce a new indicator for subsequent CPAC in the SN modification request message to prepare the source SN as a candidate SN.R3-237644: (Samsung)Proposal 3: Introduce a new indicator in the S-NODE MODIFICATION REQUEST message to indicate that the request is for Subsequent CPAC. |

Q-a: Introduce new indicator in the SN MOD REQ message to indicate the request for SCPAC? To configure the S-SN as a candidate SN during preparation. Case 1. Together with other necessary information.

Easy to agree.

To continue discussing Case 2.

### Security

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| R3-237186: (Nokia)The SN ADDITION REQUEST:* List of proposed PSCells for all other SNs to be prepared;
* Reference configuration (if the existing container can’t be used);
* List of SN keys;
* Information if SN format is allowed;

The SN MODIFICATION REQUEST:* List of prepared PSCells for all other prepared SNs;
* Information if SN format is allowed;

Proposal 2-1: The Addition Preparation and the MN-initiated Modification procedures are updated as discussed in chapter 2.2.R3-237285 (NTT DOCOMO)Proposal 3: RAN3 should consider following spec impacts for each option:Option 1: MN should send the list of KSNs and corresponding sk counters to each target SN in S-CPC preparation phase via SN Addition/Modification Request message.Option 2-1: No RAN3 impact.Option 2-2: SN should send the request for new KSN derivation with the selected sk counter received from the UE.Option 3: MN should send the list of KSNs to each target SN in S-CPC preparation phase via SN Addition/Modification Request message.).R3-237288 (Qualcomm)Proposal 2. During Subsequent CPAC preparation, MN derives a list of (SN counter, SN key) pairs for a candidate SN and provides the list to the candidate SN in the SN Addition Request message. The candidate SN stores the list of (SN counter, SN key) pairs in its security context for the UE.Proposal 3. Upon subsequent CPAC execution, if the SN key is changed, upon receiving the RRC reconfiguration complete with the included SN counter, MN checks whether there is a key mismatch. If MN determines there is a key mismatch, MN forwards the SN counter received from the UE to the selected candidate SN in SN Reconfiguration Complete, and the selected candidate SN applies the corresponding SN key.R3-237319 (Ericsson)Proposal 6 Introduce a list of security keys and sk-counter values to the S-NODE ADDITION REQUEST and S-NODE MODIFICATION REQUEST messages. Final agreements are subject to SA3’s discussion.Proposal 7 Add in the semantics description for the existing S-NG-RAN Node Security Key in the S-NODE ADDITION REQUEST message that it shall be ignored if the new list is present.R3-237418 (Lenovo)Proposal 1 In SN ADD REQ message, introduce new IE (e.g., Additional S-NG-RAN node Security Key List) for MN to provide the list of SN security key to the candidate SN for SCPAC.Proposal 2 In SN MOD REQ message, introduce new IEs (e.g., S-NG-RAN node Security Key To Be Added List, S-NG-RAN node Security Key To Be Released List)) for MN to add or release SN security key to the candidate SN for SCPAC. |

**RAN3 is suggested to discuss the following:**

Q1: Enhance SN ADD REQ message to include:

* Option 1: list of SN keys
* Option 2: list of SN key and sk-counter pair

Easy to agree Option 2.

Q2: Enhance SN MOD REQ message to add new pairs of SN keys and SN Counters?

Easy to agree

### MN/SN format

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| R3-237186: (Nokia)Proposal 1-1: The MN-format for S-CPAC configuration shall be considered the default one. If the MN is configured not to use S-CPAC, the MN may indicate to the SN that the latter is free to use SN format, if it wants so.Proposal 1-2: In the Addition Preparation, the MN explicitly informs the SN if the latter may use SN format. The MN may change the decision using the SN Modification procedure, but only if there is no intra-SN S-CPAC operation configured.Proposal 1-3: RAN3 to review the existing signalling to verify how the change of the allowed configuration format may be avoided when there is active intra-SN S-CPAC configuration.R3-237288 (Qualcomm)Proposal 5. In the case of coexistence of inter-SN and intra-SN subsequent CPAC configurations, both the configurations should be provided in the MN format, for ease of handling at the UE. Proposal 6. Upon completion of preparation of an intra-SN subsequent CPC, the SN should provide the intra-SN subsequent CPC configuration to the MN using an SN Modification procedure so that the MN can include it in an MN RRC reconfiguration message to the UE.R3-237319 (Ericsson)Proposal 5 Introduce a list of PSCell IDs to the S-NODE CHANGE REQUIRED message to implicitly indicate that the S-SN triggers the intra-SN CPC in MN format.R3-237418 (Lenovo)Proposal 3 From RAN3 point of view, allowing intra-SN SCPAC to be configured with SN format while coordination between MN and SN is required to ensure only one SCPAC configuration format will introduce additional network signalling without clear benefit. It is suggested to only support MN format SCPAC for intra-SN SCPAC.Proposal 4 RAN3 replies RAN2 with LS drafted in the Annex.R3-237622 (ZTE)Proposal 3: It’s up to the source SN to decide which format is used to configure intra-SN subsequent CPAC.Proposal 4: The SN initiated SN modification with MN involvement procedure is used to configure subsequent CPAC in MN formatProposal 5: Add a new indicator in the SN modification required message to request the MN to generate the MN RRCReconfiguration message for intra-SN subsequent CPAC configuration. |

**RAN3 is suggested to discuss the following:**

Q3: From NW perspective, if coordination between MN/SN is required anyway, do we really want to support SCPAC of SN format? Wouldn’t it be enough to support only MN format SCPAC configuration, if there is no clear benefit from UE perspective neither?

Q4: If Q3 is agreed, how does MN/SN coronation look like?

* Option 1: MN informs SN that SN format is allowed (e.g., in SN ADD REQ)
* Option 2: S-SN requests MN to configure intra-SN SCPAC with MN format (e.g., in SN CHANGE REQD or SN MOD REQD)

### Delta/Complete Configuration

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| R3-237319 (Ericsson)Proposal 1 The candidate SN(s) sends an indicator related to complete configuration to the MN.Proposal 2 Introduce the S-CPAC Complete Configuration Indicator from the target SN(s) to the MN in the S-NODE ADDITION REQUEST ACKNOWELDGE and S-NODE MODIFICATION REQUEST ACKNOWLEDGE messages to indicate whether a complete configuration or a delta configuration on top of reference configuration is generated.R3-237566 (China Telecom)Proposal 2: Reuse existing RRC config indication IE contained in the S-NODE ADDITION REQUEST ACKNOWLEDGE message to indicate whether the associated SCG configuration is a delta with respect to the reference SCG configuration.R3-237622 (ZTE)Proposal 14: Add the RRC config indication IE as a sub IE of the Conditional PSCell Addition Information Acknowledge IE in the SN addition request acknowledge message to indicate whether the associated SCG configuration is a delta with respect to the reference SCG configuration.R3-237597 (CATT)Proposal 3: The indication for denoting whether the reference configuration is used can be within the CG-CandidateList IE in the S-NG-RAN node to M-NG-RAN node Container IE. |

**RAN3 is suggested to discuss the following:**

Q5: How to indicate if the candidate PSCell configuration is delta or complete configuration

Option 1: add RRC config indication IE (as defined in legacy) in SN ADD REQ ACK message

Option 2: add new IE per cell in SN ADD REQ ACK message

Option 3: no additional Xn IE needed

May be easy to agree Option 2?

### Other RAN3 impacts to reflect RAN2 agreements

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| R3-237648 (LGE)Proposal 13: A minor impact on RAN3 from P15/16 in RAN2 agreements [2]. Re-use the existing mechanism devised for Rel-17 SN-initiated inter-SN CPC. Just need to update the semantic of SN MOD REQ > Conditional PSCell Change Information Update IE such that this additional MN-initiated SN modification procedure can also be used for Rel-18 S-CPAC with a candidate SN. Proposal 14: To support P13 in RAN2 agreements [2], enhance SN ADD REQ > Conditional PSCell Addition Information Request IE to include a list of SN, so that OCTET STRING (containing either candidateCellInfoListMN or candidateCellListCPC) can be provided per other candidate SN. |

**RAN3 is suggested to discuss the following:**

Q6: Can the following be agreed?

* A: Re-use the existing mechanism devised for Rel-17 SN-initiated inter-SN CPC. Just need to update the semantic of SN MOD REQ > Conditional PSCell Change Information Update IE such that this additional MN-initiated SN modification procedure can also be used for Rel-18 S-CPAC with a candidate SN.
* B: Enhance SN ADD REQ > Conditional PSCell Addition Information Request IE to include a list of SN, so that OCTET STRING (containing either candidateCellInfoListMN or candidateCellListCPC) can be provided per other candidate SN.

Easy to agree A B

## 3.2 Upon Execution, informing source SN about SCPAC execution

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| R3-237214 (Huawei)Proposal 2: Reuse legacy Xn-U Address Indication procedure in case of source SN configured as candidat SN to inform the old source SN (the current SN) the execution of CPC and to stop providing user date to UE.Proposal 3: The source SN recieves the Xn-U address indication message without receiving any SN release Reuqest messgae in order to stay as a candidate SN.R3-237237 (NEC)Proposal 1: For inter-SN S-CPAC, if MN decide to keep the old source SN after the CPC execution, the MN initiated SN Modification Preparation procedure is used to inform the old source SN to keep the SCG configuration, with an indicator (to add a Subsequent CPAC Request IE).R3-237288 (Qualcomm)Proposal 1. Assuming UE is initially in NR-DC operation, upon execution of the initial CPC, the source SN can be retained as a candidate SN for a subsequent CPC in inter-SN Subsequent CPAC. Upon execution of the initial CPC, MN may use the Xn-U Address Indication procedure to indicate to the source SN to keep the UE context if the source SN is to be prepared as a candidate SN for a subsequent CPC in inter-SN Subsequent CPAC.R3-237418 (Lenovo)Proposal 6 RAN3 uses a new Class 2 XnAP message (e.g., CONDITIONAL PSCELL CHANGE EXECUTION) for MN to inform the source SN about the execution of CPC, which could be due to SPAC or legacy CPAC.R3-237622 (ZTE)Proposal 1: If the source SN is configured as a candidate SN for subsequent CPAC after CPC execution, the MN should use the MN initiated SN modification preparation procedure to inform the source SN of the CPC execution and stop providing user data to the UE.Proposal 2: Add a new indicator in the SN modification request message to notify the source SN of the CPC execution and stop providing user data to the UE. |

**RAN3 is suggested to discuss the following:**

Q7: Upon SCPAC execution, how does MN inform source SN about the execution and stop data transfer to UE?

* Option 1: Xn-U ADDRESS INDICATION message
* Option 2: SN MOD REQ message
* Option 3: new Class 2 message

May be Option 2?

## 3.3 Informing candidate SN about early data forwarding address of other SNs

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| R3-237214 (Huawei)Proposal 1: Enhance SN RRC RECONFIGURATION COMPLETE message to carry the data forwarding addresses of all the other candidate SNs, to be triggered by the MN towards the new source SN after each time of subsequent CPAC execution.R3-237237 (NEC)Proposal 2: For the SN Terminated bearer the subsequent early data forwarding purpose, the SN Reconfiguration Complete procedure is used to inform to the new selected SN the data forwarding addresses of all the other candidate SN(s)R3-237418 (Lenovo)Proposal 7 RAN3 uses XN-U ADDRESS INDICATION message for MN to inform the candidate SN about early data forwarding addresses of other candidate SNs during the inter-SN subsequent CPAC procedure. It could happen during the SCPAC preparation or upon the execution of UE switching to another SN.R3-237566 (China Telecom)Proposal 1: To support early data forwarding, multiple Xn-U Address Indication procedures should be used to provide different forwarding addresses to the prepared candidate target SNs.R3-237622 (ZTE)Proposal 15: Use multiple Xn-U address indication procedures to transfer the data forwarding addresses of all other candidate SNs to the selected SN to start early data forwarding when it needs.R3-237644 (Samsung)Proposal 1: Enhancement on the SN Reconfiguration Complete message is needed for MN to inform the new source SN about the data forwarding address of all the other candidate SNs.R3-237648 (LGE)Proposal 8: Retrieve data forwarding proposals from the candidate SNs during S-CPAC preparation phase. During SN addition, each candidate SN generates data forwarding proposals for PDU sessions or DRBs admitted for its candidate PSCell(s) and provide to MN, to be used later when its candidate PSCell is selected for access later. For this, enhance SN ADD REQ ACK > 9.2.1.6 PDU Session Resource Setup Response Info – SN terminated to include 9.2.1.17 Data Forwarding and Offloading Info from source NG-RAN node.Proposal 9: MN stores the data forwarding TNLs assigned by each candidate SN as well as data forwarding proposals from each candidate SN to be used later. Once S-CPAC is executed, MN provisions the right forwarding TNLs of other candidate SNs to the selected SN, based on the stored data forwarding proposal from the selected SN, via SN RECONFIGURATION COMPLETE. Proposal 10: Based on the stored data forwarding proposals at MN, MN should be able to retrieve new forwarding TNLs from other candidate SNs, before provisioning forwarding TNLs to the selected SN via SN RECONFIGURATION COMPLETE. For this, re-use the existing mechanism via MN-initiated SN modification procedure. |

**RAN3 is suggested to discuss the following:**

Q8: How does MN inform each candidate SN about the data forwarding addresses of other candidate PSCells belonging to other SNs? upon SCPAC execution

* Option 1: multiple Xn-U ADDRESS INDICATION messages
* Option 2: SN RECONFIGURATION COMPLETE MESSAGE messages
* Option 3: one Xn-U ADDRESS INDICATION with enhancement

Q9: Whether MN retrieves data forwarding proposals from candidate SNs during SCPAC preparation phase, e.g., via enhance SN ADD REQ ACK > 9.2.1.6 PDU Session Resource Setup Response Info – SN terminated to include 9.2.1.17 Data Forwarding and Offloading Info from source NG-RAN node?

## 3.4 Coexistence of legacy CPAC and SCPAC

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| R3-237648 (LGE)Proposal 4: Allow co-existence of the legacy CPAC and S-CPAC, but per each candidate T-SN granularity (i.e. the same candidate T-SN shall not be requested by MN to prepare both at the same time – i.e. requested for either Rel-17 CPAC or Rel-18 S-CPAC).Proposal 5: Do not consider any enhancement to support co-existence or mix-up of Rel-17 CPAC and Rel-18 S-CPAC in the same CPA procedure to a candidate T-SN. A candidate T-SN should prepare as requested by MN, i.e. either to prepare Rel-18 S-CPAC (if requested so by MN) or to prepare Rel-17 CPAC (if requested so by MN), not to mix up both at the same time.Proposal 6: Confirm that the existing signalling flow charts and procedural texts for Rel-17 CPA/CPC procedures can be reused for subsequent CPAC procedure with some modifications.R3-237597 (CATT)Proposal 7: RAN3 confirm that the coexistence of subsequent CPAC and legacy CPAC is supported and send response LS to RAN2Proposal 8: MN releases all legacy CPAC SN and keeps all the subsequent CPAC SN after the UE access the SN which is either legacy CPAC SN or subsequent CPAC SN if the coexistence of subsequent CPAC and legacy CPAC is supportedProposal 9: RAN3 confirm that the existing signalling flow charts and procedural texts for Rel-17 CPA/CPC procedures can be reused for subsequent CPAC procedure with some modifications. R3-237665 (CMCC)Proposal 2: RAN3 confirms that the coexistence of subsequent CPAC and legacy CPAC is not supported in R18.Proposal 3: RAN3 confirm that the existing signaling flow charts and procedural texts for Rel-17 CPA/CPC procedures can be reused for subsequent CPAC procedure with some modifications.R3-237623 (ZTE) RAN3 agrees to support the coexistence of subsequent CPAC and legacy CPAC. RAN3 agrees to reuse the existing R17 CPAC signalling flow charts and procedural texts with some modifications for subsequent CPAC.R3-237319 (Ericsson)Observation 1 There is no issue supporting both legacy CPAC and subsequent CPAC from network signaling perspective. |

**RAN3 is suggested to discuss the following:**

Q10: Can RAN3 confirm the following as raised in RAN2 LS?

* A: coexistence of subsequent CPAC and legacy CPAC is supported in R18.
* B: ting signalling flow charts and procedural texts for Rel-17 CPA/CPC procedures can be reused for subsequent CPAC procedure with some modifications.

## 3.5 E1 BLCR

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| R3-237597 (CATT)Proposal 10: Add the description in E1AP related message to support subsequent CPAC as Annex |

**RAN3 is suggested to agree the BLCR for E1AP interface.**