**3GPP T****SG-RAN WG2 Meeting #122 R2-2306952**

**Incheon, KR, 22nd - 26th May 2023**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.340** | **CR** | **draft** | **rev** | **-** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *For* ***[HELP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <http://www.3gpp.org/Change-Requests>.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | 37.340 running CR for introduction of NR further mobility enhancements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE Corporation, Sanechips | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_Mob\_enh2-Core | | | | |  | ***Date:*** | | | 2023-06-28 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This CR is to introduce Rel-18 subsequent CPAC and CHO with multiple candidate SCGs. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduction of Rel-18 subsequent CPAC and CHO with multiple candidate SCGs. Agreements up to RAN2#122 are reflected in the draft so far. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Rel-18 subsequent CPAC and CHO with multiple candidate SCGs are not supported in NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 10.1, 10.2.2, 10.3.2, 10.4.2, 10.5.2, 10.6, 10.19.2, 10.19.x, 10.X | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

START OF CHANGES

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 36.300 [2].

**Child node**: IAB-DU's or IAB-donor-DU's next hop neighbour IAB-node.

**Conditional PSCell Addition:** a PSCell addition procedure that is executed only when PSCell addition execution condition is met.

**Conditional PSCell Change:** a PSCell change procedure that is executed only when PSCell change execution condition is met.

**En-gNB:** node providing NR user plane and control plane protocol terminations towards the UE, and acting as Secondary Node in EN-DC.

**Fast MCG link recovery:** in MR-DC, an RRC procedure where the UE sends an MCG Failure Information message to the MN via the SCG upon the detection of a radio link failure on the MCG.

**IAB-donor:** gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-MT:** IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise.

**IAB-node:** RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes. The IAB-node does not support backhauling via E-UTRA.

**Master Cell Group**: in MR-DC, a group of serving cells associated with the Master Node, comprising of the SpCell (PCell) and optionally one or more SCells.

**Master node**: in MR-DC, the radio access node that provides the control plane connection to the core network. It may be a Master eNB (in EN-DC), a Master ng-eNB (in NGEN-DC) or a Master gNB (in NR-DC and NE-DC).

**MCG bearer**: in MR-DC, a radio bearer with an RLC bearer (or two RLC bearers, in case of CA packet duplication in an E-UTRAN cell group, or up to four RLC bearers in case of CA packet duplication in a NR cell group) only in the MCG.

**MN terminated bearer:** in MR-DC, a radio bearer for which PDCP is located in the MN.

**MCG SRB**: in MR-DC, a direct SRB between the MN and the UE.

**Multi-Radio Dual Connectivity:** Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes.

**Ng-eNB**: as defined in TS 38.300 [3].

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [18] and ProSe Communication (including ProSe UE-to-Network Relay and non-Relay communication) as defined in TS 23.304 [24], between two or more nearby UEs, using NR technology but not traversing any network node.

**NR sidelink discovery**: AS functionality enabling ProSe non-Relay Discovery and ProSe UE-to-Network Relay discovery for Proximity based Services as defined in TS 23.304 [24] between two or more nearby UEs, using NR technology but not traversing any network node.

**Parent node:** IAB-MT's next hop neighbour node; the parent node can be IAB-node or IAB-donor-DU.

**PCell**: SpCell of a master cell group.

**PSCell**: SpCell of a secondary cell group.

**RLC bearer:** RLC and MAC logical channel configuration of a radio bearer in one cell group.

**Secondary Cell Group**: in MR-DC, a group of serving cells associated with the Secondary Node, comprising of the SpCell (PSCell) and optionally one or more SCells.

**Secondary node**: in MR-DC, the radio access node, with no control plane connection to the core network, providing additional resources to the UE. It may be an en-gNB (in EN-DC), a Secondary ng-eNB (in NE-DC) or a Secondary gNB (in NR-DC and NGEN-DC).

**SCG bearer**: in MR-DC, a radio bearer with an RLC bearer (or two RLC bearers, in case of CA packet duplication in an E-UTRAN cell group, or up to four RLC bearers in case of CA packet duplication in a NR cell group) only in the SCG.

**SN terminated bearer:** in MR-DC, a radio bearer for which PDCP is located in the SN.

**SpCell**: primary cell of a master or secondary cell group.

**SRB3**: in EN-DC, NGEN-DC and NR-DC, a direct SRB between the SN and the UE.

**Split bearer:** in MR-DC, a radio bearer with RLC bearers both in MCG and SCG.

**Split PDU Session (or PDU Session split):** a PDU Session whose QoS Flows are served by more than one SDAP entities in the NG-RAN.

**Split SRB**: in MR-DC, a SRB between the MN and the UE with RLC bearers both in MCG and SCG.

**Subsequent Conditional PSCell Addition or Change (subsequent CPAC):** a conditional PSCell change procedure that is executed after a PSCell addition or PSCell change based on pre-configured CPA or CPC configuration of candidate PSCell(s) without reconfiguration and re-initiation of CPC/CPA.

Editor’s note: FFS whether to support subsequent CPA, e.g. maintaining candidate PSCell configurations for CPA after SCG release.

**User plane resource configuration:** in MR-DC with 5GC, encompasses radio network resources and radio access resources related to either one or more PDU sessions, one or more QoS flows, one or more DRBs, or any combination thereof.

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [19], between nearby UEs, using E-UTRA technology but not traversing any network node.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

BFD Beam Failure Detection

CHO Conditional Handover

CLI Cross Link Interference

CPA Conditional PSCell Addition

CPAC Conditional PSCell Addition or Change

CPC Conditional PSCell Change

DAPS Dual Active Protocol Stack

DC Intra-E-UTRA Dual Connectivity

DCP DCI with CRC scrambled by PS-RNTI

EN-DC E-UTRA-NR Dual Connectivity

IAB Integrated Access and Backhaul

MCG Master Cell Group

MN Master Node

MR-DC Multi-Radio Dual Connectivity

NE-DC NR-E-UTRA Dual Connectivity

NGEN-DC NG-RAN E-UTRA-NR Dual Connectivity

NR-DC NR-NR Dual Connectivity

RLM Radio Link Monitoring

SCG Secondary Cell Group

SMTC SS/PBCH block Measurement Timing Configuration

SN Secondary Node

V2X Vehicle-to-Everything

# 10 Multi-Connectivity operation related aspects

## 10.1 General

Similar procedures as defined under clause 10.1.2.8 (Dual Connectivity operation) in TS 36.300 [2] apply for MR-DC.

Similar CHO principles as defined in TS 36.300 [2] and TS 38.300 [3] apply for the Conditional PSCell Change and Conditional PSCell Addition in MR-DC.

Conditional PSCell Change and conditional PSCell addition are not supported for the MR-DC options NE-DC and NGEN-DC.

Subsequent CPAC is only supported for NR-DC.

Configuration of a deactivated SCG in a conditional configuration, configuration of CPC while the SCG is deactivated and SCG deactivation while CPC is configured are not supported.

In MR-DC, CHO is supported in Master Node to eNB/gNB Change procedure and Conditional Handover with Secondary Node procedure.

## 10.2 Secondary Node Addition

### 10.2.1 EN-DC

The Secondary Node Addition procedure is initiated by the MN and is used to establish a UE context at the SN to provide resources from the SN to the UE. For bearers requiring SCG radio resources, this procedure is used to add at least the first cell of the SCG. This procedure can also be used to configure an SN terminated MCG bearer (where no SCG configuration is needed). In case of CPA, the Conditional Secondary Node Addition procedure can be used for CPA configuration and CPA execution.

**Secondary Node Addition**

Figure 10.2.1-1 shows the Secondary Node Addition procedure.



Figure 10.2.1-1: Secondary Node Addition procedure

1. The MN decides to request the SN to allocate resources for a specific E-RAB, indicating E-RAB characteristics (E-RAB parameters, TNL address information corresponding to bearer type). In addition, for bearers requiring SCG radio resources, MN indicates the requested SCG configuration information, including the entire UE capabilities and the UE capability coordination result. In this case, the MN also provides the latest measurement results for SN to choose and configure the SCG cell(s). The MN may request the SN to allocate radio resources for split SRB operation. The MN always provides all the needed security information to the SN (even if no SN terminated bearers are setup) to enable SRB3 to be setup based on SN decision. In case of bearer options that require X2-U resources between the MN and the SN, the MN provides X2-U TNL address information for the respective E-RAB, X2-U DL TNL address information for SN terminated bearers, X2-U UL TNL address information for MN terminated bearers. In case of SN terminated split bearers the MN provides the maximum QoS level that it can support. The MN may request the SCG to be activated or deactivated. The SN may reject the addition request.

NOTE 1: For split bearers, MCG and SCG resources may be requested of such an amount, that the QoS for the respective E-RAB is guaranteed by the exact sum of resources provided by the MCG and the SCG together, or even more. For MN terminated split bearers, the MNs decision is reflected in step 1 by the E-RAB parameters signalled to the SN, which may differ from E-RAB parameters received over S1.

NOTE 2: For a specific E-RAB, the MN may request the direct establishment of an SCG or a split bearer, i.e., without first having to establish an MCG bearer. It is also allowed that all E-RABs can be configured as SN terminated bearers, i.e. there is no E-RAB established as an MN terminated bearer.

2. If the RRM entity in the SN is able to admit the resource request, it allocates respective radio resources and, dependent on the bearer option, respective transport network resources. For bearers requiring SCG radio resources, the SN triggers Random Access so that synchronisation of the SN radio resource configuration can be performed. The SN decides the PSCell and other SCG SCells and provides the new SCG radio resource configuration to the MN in a *NR RRC configuration* message contained in the *SgNB Addition Request Acknowledge* message. In case of bearer options that require X2-U resources between the MN and the SN, the SN provides X2-U TNL address information for the respective E-RAB, X2-U UL TNL address information for SN terminated bearers, X2-U DL TNL address information for MN terminated bearers. For SN terminated bearers, the SN provides the S1-U DL TNL address information for the respective E-RAB and security algorithm. If SCG radio resources have been requested, the SCG radio resource configuration is provided. If the MN requested the SCG to be deactivated, the SN may keep the SCG activated. If the MN requests the SCG to be activated, the SN shall keep the SCG activated.

NOTE 3: For the SN terminated split bearer option, the SN may either decide to request resources from the MN of such an amount, that the QoS for the respective E-RAB is guaranteed by the exact sum of resources provided by the MN and the SN together, or even more. The SNs decision is reflected in step 2 by the E-RAB parameters signalled to the MN, which may differ from E-RAB parameters received in step 1. The QoS level requested from the MN shall not exceed the level that the MN offered when setting up the split bearer in step 1.

NOTE 4: In case of MN terminated bearers, transmission of user plane data may take place after step 2.

NOTE 5: In case of SN terminated bearers, data forwarding and the SN Status Transfer may take place after step 2.

3. The MN sends to the UE the *RRCConnectionReconfiguration* message including the NR RRC configuration message, without modifying it. Within the MN *RRCConnectionReconfiguration* message, the MN can indicate the SCG is deactivated.

4. The UE applies the new configuration and replies to MN with *RRCConnectionReconfigurationComplete* message, including a NR RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

5. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SgNB ReconfigurationComplete* message, including the encoded NR RRC response message, if received from the UE.

6. If configured with bearers requiring SCG radio resources and the SCG is not deactivated, the UE performs synchronisation towards the PSCell of the SN. The order the UE sends the *RRCConnectionReconfigurationComplete* message and performs the Random Access procedure towards the SCG is not defined. The successful RA procedure towards the SCG is not required for a successful completion of the RRC Connection Reconfiguration procedure.

7. If PDCP termination point is changed to the SN for bearers using RLC AM, and when RRC full configuration is not used, the MN sends the *SN Status Transfer* message.

8. For SN terminated bearers moved from the MN, dependent on the bearer characteristics of the respective E-RAB, the MN may take actions to minimise service interruption due to activation of EN-DC (Data forwarding).

9-12. If applicable, the update of the UP path towards the EPC is performed.

**Conditional Secondary Node Addition**

Figure 10.2.1-2 shows the Conditional Secondary Node Addition procedure.



Figure 10.2.1-2: Conditional Secondary Node Addition procedure

1. The MN decides to configure CPA for the UE and requests the candidate SN(s) to allocate resources for a specific E-RAB, indicating E-RAB characteristics (E-RAB parameters, TNL address information corresponding to bearer type), indicating that the request is for CPAC and providing the upper limit for the number of PSCells that can be prepared by the candidate SN. In addition, for the bearers requiring SCG radio resources, the MN indicates the requested SCG configuration information, including the entire UE capabilities and the UE capability coordination result. In this case, the MN also provides the candidate cells recommended by MN via the latest measurement results for the candidate SN to choose from and configure the SCG cell(s). The MN may request the candidate SN to allocate radio resources for split SRB operation. The MN always provides all the needed security information to the candidate SN (even if no SN terminated bearers are setup) to enable SRB3 to be setup based on SN decision. In case of bearer options that require X2-U resources between the MN and the candidate SN, the MN provides X2-U TNL address information for the respective E-RAB, X2-U DL TNL address information for SN terminated bearers, X2-U UL TNL address information for MN terminated bearers. In case of SN terminated split bearers the MN provides the maximum QoS level that it can support. The candidate SN may reject the addition request.

NOTE 6: For split bearers, MCG and SCG resources may be requested of such an amount, that the QoS for the respective E-RAB is guaranteed by the exact sum of resources provided by the MCG and the SCG together, or even more. For MN terminated split bearers, the MN decision is reflected in step 1 by the E-RAB parameters signalled to the candidate SN, which may differ from E-RAB parameters received over S1.

NOTE 7: For a specific E-RAB, the MN may request the direct establishment of an SCG or a split bearer, i.e., without first having to establish an MCG bearer. It is also allowed that all E-RABs can be configured as SN terminated bearers, i.e. there is no E-RAB established as an MN terminated bearer.

2. If the RRM entity in the candidate SN is able to admit the resource request, it allocates respective radio resources and, dependent on the bearer option, respective transport network resources, and provides the prepared PSCell ID(s) to the MN. For bearers requiring SCG radio resources, the candidate SN configures Random Access so that synchronisation of the SN radio resource configuration can be performed at the CPA execution. From the list of cells indicated within the measurement results provided by the MN, the candidate SN decides the list of PSCell(s) to prepare (considering the maximum number indicated by the MN) and, for each prepared PSCell, the candidate SN decides SCG SCells and provides the corresponding SCG radio resource configuration to the MN in an NR *RRCReconfiguration\*\** message contained in the *SgNB Addition Request Acknowledge* message. The candidate SN can either accept or reject each of the candidate cells listed within the measurement results indicated by the MN, i.e. it cannot configure any alternative candidates. In case of bearer options that require X2-U resources between the MN and the candidate SN, the candidate SN provides X2-U TNL address information for the respective E-RAB, X2-U UL TNL address information for SN terminated bearers, X2-U DL TNL address information for MN terminated bearers. For SN terminated bearers, the candidate SN provides the S1-U DL TNL address information for the respective E-RAB and security algorithm. If SCG radio resources have been requested, the SCG radio resource configuration is provided.

NOTE 8: For the SN terminated split bearer option, the candidate SN may either decide to request resources from the MN of such an amount, that the QoS for the respective E-RAB is guaranteed by the exact sum of resources provided by the MN and the candidate SN together, or even more. The candidate SN decision is reflected in step 2 by the E-RAB parameters signalled to the MN, which may differ from E-RAB parameters received in step 1. The QoS level requested from the MN shall not exceed the level that the MN offered when setting up the split bearer in step 1.

NOTE 9: In case of SN terminated bearers, early data forwarding may take place after step 2. For the early data forwarding of SN terminated bearers, the MN forwards the PDCP SDU to the candidate SN and also sends the *Early Status Transfer* message. For the early transmission of MN terminated split/SCG bearers, the MN forwards the PDCP PDU to the candidate SN.

3. The MN sends to the UE an *RRCConnectionReconfiguration* message including the CPA configuration, i.e. a list of *RRCConnectionReconfiguration\** messagesand associated execution conditions. Each *RRCConnectionReconfiguration\** message contains the SCG configuration in the *RRCReconfiguration\*\** message received from the candidate SN in step 2 and possibly an MCG configuration. Besides, the *RRCConnectionReconfiguration* message can also include an updated MCG configuration, e.g., to configure the required conditional measurements.

4. The UE applies the *RRCConnectionReconfiguration* message received in step 3, stores the CPA configurationand replies to the MN with an *RRCConnectionReconfigurationComplete* message. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

4a. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies *RRCConnectionReconfiguration\** messagecorresponding to the selected candidate PSCell, and sends an *RRCConnectionReconfigurationComplete\** message, including an NR *RRCReconfigurationComplete\*\** message for the selected candidate PSCell, and information enabling the MN to identify the SN of the selected candidate PSCell.

5a-5c. The MN informs the SN of the selected candidate PSCell that the UE has completed the reconfiguration procedure successfully via *SgNB Reconfiguration Complete* message, including the *RRCReconfigurationComplete\*\** message. The MN sends the *SgNB Release Request* message(s) to cancel CPA in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

6. The UE performs synchronisation towards the PSCell indicated in the *RRCConnectionReconfiguration\** message applied in step 4a. The order the UE sends the *RRCConnectionReconfigurationComplete\** message and performs the Random Access procedure towards the SCG is not defined. The successful RA procedure towards the SCG is not required for a successful completion of the RRC Connection Reconfiguration procedure.

7. If PDCP termination point is changed to the SN for bearers using RLC AM, and when RRC full configuration is not used, the MN sends the *SN Status Transfer* message.

8. For SN terminated bearers moved from the MN, dependent on the bearer characteristics of the respective E-RAB, the MN may take actions to minimise service interruption due to activation of EN-DC (Data forwarding).

9-12. If applicable, the update of the UP path towards the EPC is performed.

### 10.2.2 MR-DC with 5GC

The Secondary Node (SN) Addition procedure is initiated by the MN and is used to establish a UE context at the SN in order to provide resources from the SN to the UE. For bearers requiring SCG radio resources, this procedure is used to add at least the initial SCG serving cell of the SCG. This procedure can also be used to configure an SN terminated MCG bearer (where no SCG configuration is needed). In case of CPA or subsequent CPAC, the Conditional Secondary Node Addition procedure can be used for CPA or subsequent CPAC configuration and CPA or subsequent CPAC execution.

**Secondary Node Addition**

Figure 10.2.2-1 shows the SN Addition procedure.



Figure 10.2.2-1: SN Addition procedure

1. The MN decides to request the target SN to allocate resources for one or more specific PDU Sessions/QoS Flows, indicating QoS Flows characteristics (QoS Flow Level QoS parameters, PDU session level TNL address information, and PDU session level Network Slice info). In addition, for bearers requiring SCG radio resources, MN indicates the requested SCG configuration information, including the entire UE capabilities and the UE capability coordination result. In this case, the MN also provides the latest measurement results for SN to choose and configure the SCG cell(s). The MN may request the SN to allocate radio resources for split SRB operation. In NGEN-DC and NR-DC, the MN always provides all the needed security information to the SN (even if no SN terminated bearers are setup) to enable SRB3 to be setup based on SN decision. The MN may request the SCG to be activated or deactivated.

For MN terminated bearer options that require Xn-U resources between the MN and the SN, the MN provides Xn-U UL TNL address information. For SN terminated bearers, the MN provides a list of available DRB IDs. The S-NG-RAN node shall store this information and use it when establishing SN terminated bearers. The SN may reject the request.

For SN terminated bearer options that require Xn-U resources between the MN and the SN, the MN provides in step 1 a list of QoS flows per PDU Sessions for which SCG resources are requested to be setup upon which the SN decides how to map QoS flows to DRB.

NOTE 1: For split bearers, MCG and SCG resources may be requested of such an amount, that the QoS for the respective QoS Flow is guaranteed by the exact sum of resources provided by the MCG and the SCG together, or even more. For MN terminated split bearers, the MN decision is reflected in step 1 by the QoS Flow parameters signalled to the SN, which may differ from QoS Flow parameters received over NG.

NOTE 2: For a specific QoS flow, the MN may request the direct establishment of SCG and/or split bearers, i.e. without first having to establish MCG bearers. It is also allowed that all QoS flows can be mapped to SN terminated bearers, i.e. there is no QoS flow mapped to an MN terminated bearer.

2. If the RRM entity in the SN is able to admit the resource request, it allocates respective radio resources and, dependent on the bearer type options, respective transport network resources. For bearers requiring SCG radio resources the SN triggers UE Random Access so that synchronisation of the SN radio resource configuration can be performed. The SN decides for the PSCell and other SCG SCells and provides the new SCG radio resource configuration to the MN within an SN RRC configuration message contained in the *SN Addition Request Acknowledge* message. If the MN requested the SCG to be deactivated, the SN may keep the SCG activated. If the MN requests the SCG to be activated, the SN shall keep the SCG activated. In case of bearer options that require Xn-U resources between the MN and the SN, the SN provides Xn-U TNL address information for the respective DRB, Xn-U UL TNL address information for SN terminated bearers, Xn-U DL TNL address information for MN terminated bearers. For SN terminated bearers, the SN provides the NG-U DL TNL address information for the respective PDU Session and security algorithm. If SCG radio resources have been requested, the SCG radio resource configuration is provided.

NOTE 3: In case of MN terminated bearers, transmission of user plane data may take place after step 2.

NOTE 4: In case of SN terminated bearers, data forwarding and the SN Status Transfer may take place after step 2.

NOTE 5: For MN terminated bearers for which PDCP duplication with CA is configured in NR SCG side, the MN allocates up to 4 separate Xn-U bearers and the SN provides a logical channel ID for primary or split secondary path to the MN.

For SN terminated bearers for which PDCP duplication with CA is configured in NR MCG side, the SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the SN via an additional MN-initiated SN modification procedure.

2a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

3. The MN sends the MN RRC reconfiguration message to the UE including the SN RRC configuration message, without modifying it. Within the MN RRC reconfiguration message, the MN can indicate the SCG is deactivated.

4. The UE applies the new configuration and replies to MN with MN RRC reconfiguration complete message, including an SN RRC response message for SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

5. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SN Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

6. If configured with bearers requiring SCG radio resources and the SCG is not deactivated, the UE performs synchronisation towards the PSCell configured by the SN. The order the UE sends the MN RRC reconfiguration complete message and performs the Random Access procedure towards the SCG is not defined. The successful RA procedure towards the SCG is not required for a successful completion of the RRC Connection Reconfiguration procedure.

7. If PDCP termination point is changed to the SN for bearers using RLC AM, and when RRC full configuration is not used, the MN sends the *SN Status Transfer* message.

8. For SN terminated bearers or QoS flows moved from the MN, dependent on the characteristics of the respective bearer or QoS flow, the MN may take actions to minimise service interruption due to activation of MR-DC (Data forwarding).

9-12. If applicable, the update of the UP path towards the 5GC is performed via a PDU Session Path Update procedure*.*

**Conditional Secondary Node Addition**

Figure 10.2.2-2 shows the Conditional SN Addition procedure.



Figure 10.2.2-2: Conditional Secondary Node Addition procedure

Editor’s note: FFS whether to have a separate signaling flow for subsequent CPAC procedure, depending on further progress from RAN2 and RAN3.

1. The MN decides to configure CPA or subsequent CPAC for the UE. The MN requests the candidate SN(s) to allocate resources for one or more specific PDU Sessions/QoS Flows, indicating QoS Flows characteristics (QoS Flow Level QoS parameters, PDU session level TNL address information, and PDU session level Network Slice info), indicating that the request is for CPA and providing the upper limit for the number of PSCells that can be prepared by the candidate SN. In addition, for bearers requiring SCG radio resources, the MN indicates the requested SCG configuration information, including the entire UE capabilities and the UE capability coordination result. In this case, the MN also provides the candidate cells recommended by MN via the latest measurement results for the candidate SN to choose and configure the SCG cell(s). If subsequent CPAC is requested, the MN may also provide a reference SCG configuration for the candidate SN to generate the candidate PSCell configuration. The MN may request the candidate SN to allocate radio resources for split SRB operation. In NR-DC, the MN always provides all the needed security information to the candidate SN (even if no SN terminated bearers are setup) to enable SRB3 to be setup based on SN decision.

Editor’s note: FFS which node initially generates the reference configuration in subsequent CPAC.

Editor’s note: FFS whether the reference SCG configuration is optionally provided to the candidate SN(s).

For MN terminated bearer options that require Xn-U resources between the MN and the candidate SN, the MN provides Xn-U UL TNL address information. For SN terminated bearers, the MN provides a list of available DRB IDs. The candidate SN shall store this information and use it when establishing SN terminated bearers. The candidate SN may reject the addition request.

For SN terminated bearer options that require Xn-U resources between the MN and the candidate SN, the MN provides in step 1 a list of QoS flows per PDU Sessions for which SCG resources are requested to be setup upon which the candidate SN decides how to map QoS flows to DRB.

NOTE 6: For split bearers, MCG and SCG resources may be requested of such an amount, that the QoS for the respective QoS Flow is guaranteed by the exact sum of resources provided by the MCG and the SCG together, or even more. For MN terminated split bearers, the MN decision is reflected in step 1 by the QoS Flow parameters signalled to the candidate SN, which may differ from QoS Flow parameters received over NG.

NOTE 7: For a specific QoS flow, the MN may request the direct establishment of SCG and/or split bearers, i.e. without first having to establish MCG bearers. It is also allowed that all QoS flows can be mapped to SN terminated bearers, i.e. there is no QoS flow mapped to an MN terminated bearer.

2. If the RRM entity in the candidate SN is able to admit the resource request, it allocates respective radio resources and, dependent on the bearer type options, respective transport network resources, and provides the prepared PSCell ID(s) to the MN. For bearers requiring SCG radio resources the candidate SN configures Random Access so that synchronisation of the SN radio resource configuration can be performed at the CPA execution. From the list of cells indicated within the measurement results provided by the MN, the candidate SN decides the list of PSCell(s) to prepare (considering the maximum number indicated by the MN) and, for each prepared PSCell, the candidate SN decides other SCG SCells and provides the new corresponding SCG radio resource configuration to the MN in an NR *RRCReconfiguration\*\** message, contained in the *SN Addition Request Acknowledge* message. The candidate SN can either accept or reject each of the candidate cells listed within the measurement results indicated by the MN, i.e. it cannot configure any alternative candidates. In case of bearer options that require Xn-U resources between the MN and the candidate SN, the candidate SN provides Xn-U TNL address information for the respective DRB, Xn-U UL TNL address information for SN terminated bearers, Xn-U DL TNL address information for MN terminated bearers. For SN terminated bearers, the candidate SN provides the NG-U DL TNL address information for the respective PDU Session and security algorithm. If SCG radio resources have been requested, the SCG radio resource configuration is provided. If subsequent CPAC has been requested, the candidate SN may also include an indication of that the provided SCG radio resource configuration is a complete or delta RRC configuration with respect to the reference SCG configuration.

Editor’s note: FFS which node(s) and how to generate execution conditions for subsequent CPC. FFS if it shall be possible to do something like MN-initiated CPA/CPC where Candidate SN generate execution conditions for subsequent CPC.

NOTE 8: For MN terminated bearers for which PDCP duplication with CA is configured in NR SCG side, the MN allocates up to 4 separate Xn-U bearers and the candidate SN provides a logical channel ID for primary or split secondary path to the MN.

For SN terminated bearers for which PDCP duplication with CA is configured in NR MCG side, the candidate SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the candidate SN via an additional MN-initiated SN modification procedure.

NOTE 9: In case of SN terminated bearers, early data forwarding may take place after step 2. For the early data forwarding of SN terminated bearers, the MN forwards the PDCP SDU to the candidate SN. For the early transmission of MN terminated split/SCG bearers, the MN forwards the PDCP PDU to the candidate SN.

2a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message. In case of early data forwarding in CPA, the MN sends the *Early Status Transfer* message to the candidate SN.

3. The MN sends to the UE an *RRCReconfiguration* message including the CPA configuration or the subsequent CPAC configuration, i.e. a list of *RRCReconfiguration\** messagesand associated execution conditions. Each *RRCReconfiguration\** messagecontains the SCG configuration in the *RRCReconfiguration\*\** received from the candidate SN in step 2 and possibly an MCG configuration. Besides, the *RRCReconfiguration* messagecan also include an updated MCG configuration. e.g. to configure the required conditional measurements. In subsequent CPAC, the *RRCReconfiguration* message may also include a reference SCG configuration.

Editor’s note: FFS if the reference configuration is optional in subsequent CPAC. FFS whether MCG configuration is included in the reference configuration.

Editor’s note: FFS whether the MCG configuration associated with the SCG configuration of a candidate PSCell is included in subsequent CPAC configuration.

4. The UE applies the *RRCReconfiguration* message received in step 3, stores the CPA configuration or the subsequent CPAC configurationand replies to the MN with an *RRCReconfigurationComplete* message. In case the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message, it performs the reconfiguration failure procedure.

4a. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies *RRCReconfiguration\** message corresponding to the selected candidate PSCell, and sends an MN *RRCReconfigurationComplete\** message, including an *RRCReconfigurationComplete\*\** message for the selected candidate PSCell, and information enabling the MN to identify the SN of the selected candidate PSCell. In subsequent CPAC, the UE keeps configured candidate PSCell configurations and evaluates the execution conditions of other candidate PSCells for subsequent CPAC.

Editor’s note: FFS whether to support the coexistence of legacy CPA/CPC and subsequent CPAC, i.e. there are some candidates for subsequent CPAC but others for legacy CPA/CPC.

5a-5c. The MN informs the SN of the selected candidate PSCell that the UE has completed the reconfiguration procedure successfully via *SN Reconfiguration Complete* message, including the *RRCReconfigurationComplete\*\** message. The MN sends the *SN Release Request* message(s) to cancel CPA in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

Editor’s note: FFS. It’s up to RAN3 how to notify the source SN and the selected target SN in subsequent CPAC.

Editor’s note: FFS. It’s up to RAN3 whether/how to inform other candidate SN(s) in subsequent CPAC.

6. The UE performs synchronisation towards the PSCell indicated in the *RRCReconfiguration\** message applied in step 4a. The order the UE sends the MN *RRCReconfigurationComplete\** message and performs the Random Access procedure towards the SCG is not defined. The successful RA procedure towards the SCG is not required for a successful completion of the RRC Connection Reconfiguration procedure.

7. If PDCP termination point is changed to the SN for bearers using RLC AM, and when RRC full configuration is not used, the MN sends the *SN Status Transfer* message.

8. For SN terminated bearers or QoS flows moved from the MN, dependent on the characteristics of the respective bearer or QoS flow, the MN may take actions to minimise service interruption due to activation of MR-DC (Data forwarding).

9-12. If applicable, the update of the UP path towards the 5GC is performed via a PDU Session Path Update procedure*.*

NOTE X: In subsequent CPAC, if the execution condition of one candidate PSCell is satisfied, the UE executes steps 5-16 in Figure 10.5.2-3, e.g. based on the configuration provided in step 3 in Figure 10.2.2-2.

### 10.2.3 Conditional PSCell Addition

A Conditional PSCell Addition (CPA) is defined as a PSCell addition that is executed by the UE when execution condition(s) is met. The UE starts evaluating the execution condition(s) upon receiving the CPA configuration, and stops evaluating the execution condition(s) once PSCell addition or PCell change is triggered.

The following principles apply to CPA:

- The CPA configuration contains the configuration of CPA candidate PSCell(s), execution condition(s) and may contain the MCG configuration, to be applied when CPA execution is triggered.

- An execution condition may consist of one or two trigger condition(s) (see *CondEvent*, as defined in TS 38.331 [4] or TS 36.331 [10]). Only a single RS type and at most two different trigger quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be used for the evaluation of CPA execution condition of a single candidate PSCell.

- Before any CPA execution condition is satisfied, upon reception of PSCell addition command or PCell change command, the UE executes the PSCell addition procedure as described in clause 10.2.1 or 10.2.2, or the PCell change procedure as described in clause 9.2.3.2 in TS 38.300[3] or clause 10.1.2.1 in TS 36.300 [2], regardless of any previously received CPA configuration. Upon the successful completion of PSCell addition procedure or PCell change procedure, the UE releases the stored CPA configuration.

- While executing CPA, the UE is not required to continue evaluating the execution condition of other candidate PSCell(s) or PCell(s).

- Once the CPA procedure is executed successfully, the UE releases all stored conditional reconfigurations (i.e. for CPA and for CHO, as specified in TS 38.300 [3] or TS 36.300 [2]).

CPA configuration in HO command, in PSCell addition command, or within any conditional reconfiguration (i.e., CPA, CPC or CHO configuration) is not supported.

## 10.3 Secondary Node Modification (MN/SN initiated)

### 10.3.1 EN-DC

The Secondary Node Modification procedure may be initiated either by the MN or by the SN and be used to modify, establish or release bearer contexts, to transfer bearer contexts to and from the SN or to modify other properties of the UE context within the same SN. It may also be used to transfer an NR RRC message from the SN to the UE via the MN and the response from the UE via MN to the SN (e.g. when SRB3 is not used). In case of CPA or inter-SN CPC, this procedure is used to modify CPA or inter-SN CPC configuration within the same candidate SN. In case of CPA or inter-SN CPC, this procedure may also be triggered by the candidate SN to add some prepared PSCells from the suggested list or cancel part of the prepared PSCells. In case of intra-SN CPC, this procedure is used to configure, modify or release intra-SN CPC configuration. This procedure may be initiated by the MN or SN to request the SN or MN to deactivate or activate the SCG.

The Secondary Node modification procedure does not necessarily need to involve signalling towards the UE.

**MN initiated SN Modification**



Figure 10.3.1-1: SN Modification procedure - MN initiated

The MN uses the procedure to initiate configuration changes of the SCG within the same SN, e.g. the addition, modification or release of SCG bearer(s) and the SCG RLC bearer of split bearer(s), as well as configuration changes for SN terminated MCG bearers. Bearer termination point change is realized by adding the new bearer configuration and releasing the old bearer configuration within a single MN initiated SN Modification procedure for the respective E-RAB. The MN uses this procedure to perform handover within the same MN while keeping the SN. The MN also uses the procedure to query the current SCG configuration, e.g. when delta configuration is applied in an MN initiated SN change. The MN also uses the procedure to provide the S-RLF related information to the SN. The MN also uses this procedure to activate or deactivate the SCG. The MN may not use the procedure to initiate the addition, modification or release of SCG SCells. The SN may reject the request, except if it concerns the release of SN terminated bearer(s) or the SCG RLC bearer of MN terminated bearer(s), or if it is used to perform handover within the same MN while keeping the SN. Figure 10.3.1-1 shows an example signalling flow for an MN initiated SN Modification procedure.

1. The MN sends the *SgNB Modification Request* message, which may contain bearer context related or other UE context related information, data forwarding address information (if applicable) and the requested SCG configuration information, including the UE capability coordination result to be used as basis for the reconfiguration by the SN. The MN may request the SCG to be activated or deactivated. In case a security key update in the SN is required, a new *SgNB Security Key* is included. In case of SCG RLC re-establishment for E-RABs configured with an MN terminated bearer with an SCG RLC bearer for which no bearer type change is performed, the MN provides a new UL GTP tunnel endpoint to the SN. The SN shall continue sending UL PDCP PDUs to the MN with the previous UL GTP tunnel endpoint until it re-establishes the RLC and use the new UL GTP tunnel endpoint after re-establishment. In case of PDCP re-establishment for E-RABs configured with an SN terminated bearer with an MCG RLC bearer for which no bearer type change is performed, the MN provides a new DL GTP tunnel endpoint to the SN. The SN shall continue sending DL PDCP PDUs to the MN with the previous DL GTP tunnel endpoint until it performs PDCP re-establishment and use the new DL GTP tunnel endpoint starting with the PDCP re-establishment.

2. The SN responds with the *SgNB Modification Request Acknowledge* message, which may contain SCG radio resource configuration information within a NR RRC configuration message and data forwarding address information (if applicable). If the MN requested the SCG to be activated or deactivated, the SN indicates whether the SCG is activated or deactivated. In case of a security key update (with or without PSCell change), for E-RABs configured with the MN terminated bearer option that require X2-U resources between the MN and the SN, for which no bearer type change is performed, the SN provides a new DL GTP tunnel endpoint to the MN. The MN shall continue sending DL PDCP PDUs to the SN with the previous DL GTP tunnel endpoint until it performs PDCP re-establishment or PDCP data recovery, and use the new DL GTP tunnel endpoint starting with the PDCP re-establishment or data recovery. In case of a security key update (with or without PSCell change), for E-RABs configured with the SN terminated bearer option that require X2-U resources between the MN and the SN, for which no bearer type change is performed, the SN provides a new UL GTP tunnel endpoint to the MN. The MN shall continue sending UL PDCP PDUs to the SN with the previous UL GTP tunnel endpoint until it re-establishes the RLC and use the new UL GTP tunnel endpoint after re-establishment.

NOTE 00: In case SN includes the indication of full RRC configuration in *SgNB Modification Request Acknowledge* message to MN e.g. comprehension failure upon intra-CU inter-DU change, MN performs release and add of the NR SCG part of the configuration but does not release SN terminated radio bearers towards the UE.

3-5. The MN initiates the RRC connection reconfiguration procedure, including the NR RRC configuration message. The UE applies the new configuration, synchronizes to the MN (if instructed, in case of intra-MN handover) and replies with *RRCConnectionReconfigurationComplete*, including a NR RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. Upon successful completion of the reconfiguration, the success of the procedure is indicated in the *SgNB Reconfiguration Complete* message.

7. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SgNB addition procedure. Otherwise, the UE may perform UL transmission after having applied the new configuration.

8. If PDCP termination point is changed for bearers using RLC AM, and when RRC full configuration is not used, the SN Status Transfer takes place between the MN and the SN (Figure 10.3.1-1 depicts the case where a bearer context is transferred from the MN to the SN).

NOTE 0: The SN may not be aware that a SN terminated bearer requested to be released is reconfigured to a MN terminated bearer. The SN Status for the released SN terminated bearers with RLC AM may also be transferred to the MN.

9. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.1-1 depicts the case where a bearer context is transferred from the MN to the SN).

10. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the E-RABs to be released and for the E-RABs for which the S1 UL GTP Tunnel endpoint was requested to be modified.

NOTE 1: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

11. If applicable, a path update is performed.

**SN initiated SN Modification with MN involvement**



Figure 10.3.1-2: SN Modification procedure - SN initiated with MN involvement

The SN uses the procedure to perform configuration changes of the SCG within the same SN, e.g. to trigger the release of SCG bearer(s) and the SCG RLC bearer of split bearer(s) (upon which the MN may release the bearer or maintain current bearer type or reconfigure it to an MCG bearer, either MN terminated or SN terminated), to trigger the release of SCG resources (e.g., release SCG lower layer resources but keep SN), and to trigger PSCell change (e.g. when a new security key is required or when the MN needs to perform PDCP data recovery). The MN cannot reject the release request of SCG bearer and the SCG RLC bearer of a split bearer and the release request of SCG resources. The SN also uses this procedure to activate or deactivate the SCG. The MN shall either accept modification of all of the requested SCG bearer(s) and the SCG RLC bearer of split bearer(s) and the request of activation or deactivation of the SCG, or fail the procedure. Figure 10.3.1-2 shows an example signalling flow for an SN initiated SgNB Modification procedure, with MN involvement.

1. The SN sends the *SgNB Modification Required* message including a NR RRC configuration message, which may contain bearer context related, other UE context related information and the new SCG radio resource configuration. The SN may request the SCG to be activated or deactivated. For bearer release or modification, a corresponding E-RAB list is included in the *SgNB Modification Required* message. In case of change of security key, the *PDCP Change* *Indication* indicates that a S-KgNB update is required. In case the MN needs to perform PDCP data recovery, the *PDCP Change* *Indication* indicates that PDCP data recovery is required. In case SN decides to trigger SCG release, the E-RABs to be modified list includes all the E-RABs of the UE with SCG resource indicated as not present for each E-RAB.

The SN can decide whether the change of security key is required.

NOTE 1a: In case SN includes the indication of full RRC configuration in *SgNB Modification Required* message to MN e.g. comprehension failure upon intra-CU inter-DU change, MN performs release and add of the NR SCG part of the configuration but does not release SN terminated radio bearers towards the UE.

NOTE 1b: In case that a MN initiated conditional reconfiguration (e.g. CHO or MN initiated inter-SN CPC) is prepared, and if any execution of a prepared SN initiated intra-SN CPC procedure or reconfiguration of the SCG, the SN notifies to the MN via the *SgNB Modification Required* message. In this case, the steps 2 and 3 are skipped.

NOTE 1c: In case of SN initiated inter-SN CPC and in case that a candidate SN triggered the SN Initiated SN Modification procedure to include some more prepared PSCells (within the candidate cells suggested by the source SN in SN initiated inter-SN CPC) or to remove some prepared PSCells, the MN may decide to trigger the step 2 towards the source SN.

2/3. The MN initiated SN Modification procedure may be triggered by the *SN Modification Required* message (e.g. to provide information such as data forwarding addresses, new SN security key, measurement gap, etc...)

NOTE 2: If only SN security key is provided in step 2, the MN does not need to wait for the reception of step 3 to initiate the RRC connection reconfiguration procedure.

4. The MN sends the *RRCConnectionReconfiguration* message including a NR RRC configuration messageto the UE including the new SCG radio resource configuration.

5. The UE applies the new configuration and sends the *RRCConnectionReconfigurationComplete* message, including an encoded NR RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. Upon successful completion of the reconfiguration, the success of the procedure is indicated in the *SgNB Modification Confirm* message containing the encoded NR RRC response message, if received from the UE.

7. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SN addition procedure. Otherwise, the UE may perform UL transmission after having applied the new configuration.

8. If PDCP termination point is changed for bearers using RLC AM, and when RRC full configuration is not used, the SN Status Transfer takes place between the MN and the SN (Figure 10.3.1-2 depicts the case where a bearer context is transferred from the SN to the MN).

NOTE 2a: The SN may not be aware that a SN terminated bearer requesting to release is reconfigured to a MN terminated bearer. The SN Status for the released SN terminated bearers with RLC AM may also be transferred to the MN.

9. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.1-2 depicts the case where a bearer context is transferred from the SN to the MN).

10. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the E-RABs to be released.

NOTE 3: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

11. If applicable, a path update is performed.

**SN initiated SN Modification without MN involvement**



Figure 10.3.1-3: SN modification - SN initiated without MN involvement

The SN initiated modification without MN involved procedure is used to modify the configuration within SN in case no coordination with MN is required, including the addition/modification/release of SCG SCell and PSCell change (e.g. when the security key does not need to be changed and the MN does not need to be involved in PDCP recovery). The SN may initiate the procedure to configure, modify or release intra-SN CPC configuration within the same SN. Figure 10.3.1-3 shows an example signalling flow for SN initiated SN modification procedure, without MN involvement. The SN can decide whether the Random Access procedure is required.

1. The SN sends the *RRCReconfiguration* message to the UE through SRB3. The UE applies the new configuration. In case the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message, it performs the reconfiguration failure procedure.

2. If instructed, the UE performs synchronisation towards the PSCell of the SN.

3. The UE replies with the *RRCReconfigurationComplete* message.

**SN initiated Conditional SN Modification without MN involvement (SRB3 is used)**



Figure 10.3.1-3a: SN Modification - SN-initiated without MN involvement and SRB3 is used to configure intra-SN CPC.

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is used to configure intra-SN CPC.

1. The SN sends the *RRCReconfiguration* message including CPC configuration to the UE through SRB3.

2. The UE applies the new configuration. In case the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message, it performs the reconfiguration failure procedure. The UE starts evaluating the CPC execution conditions for the candidate PSCell(s). The UE maintains connection with the source PSCell and replies with the *RRCReconfigurationComplete* message to the SN via SRB3.

3. If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE detaches from the source PSCell, applies the stored configuration corresponding to the selected candidate PSCell and synchronises to the candidate PSCell.

4. The UE completes the CPC execution procedure by sending an *RRCReconfigurationComplete* message to the new PSCell.

**Transfer of an NR RRC message to/from the UE (when SRB3 is not used)**



Figure 10.3.1-4: Transfer of an NR RRC message to/from the UE

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used.

1. The SN initiates the procedure by sending the *SgNB Modification Required* to the MN.

2. The MN forwards the NR RRC message to the UE in the *RRCConnectionReconfiguration* message.

3. The UE applies the new configuration and replies with the *RRCConnectionReconfigurationComplete* message. In case the UE is unable to comply with (part of) the configuration included in the NR RRC message, it performs the reconfiguration failure procedure.

4. The MN forwards the NR RRC response message, if received from the UE, to the SN in the *SgNB Modification Confirm* message.

5. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SgNB Addition procedure. Otherwise the UE may perform UL transmission after having applied the new configuration.

**SN initiated Conditional SN Modification without MN involvement (SRB3 is not used)**



Figure 10.3.1-5: SN Modification - SN-initiated without MN involvement and SRB3 is not used to configure intra-SN CPC

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used to configure intra-SN CPC.

1. The SN initiates the procedure by sending the *SgNB Modification Required* to the MN including the SN RRC reconfiguration message with CPC configuration.

2. The MN forwards the SN RRC reconfiguration message to the UE including it in the *RRCConnectionReconfiguration* message.

3. The UE replies with the *RRCConnectionReconfigurationComplete* message by including the SN RRC reconfiguration complete message. In case the UE is unable to comply with (part of) the configuration included in the SN RRC reconfiguration message, it performs the reconfiguration failure procedure. The UE maintains connection with source PSCell after receiving CPC configuration, and starts evaluating the CPC execution conditions for the candidate PSCell(s).

4. The MN forwards the SN RRC response message, if received from the UE, to the SN by including it in the *SgNB Modification Confirm* message.

5. If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE completes the CPC execution procedure by an *ULInformationTransferMRDC* message to the MN which includes an embedded *RRCReconfigurationComplete* message to the selected target PSCell.

6. The *RRCReconfigurationComplete* message is forwarded to the SN embedded in *RRC Transfer* message.

7. The UE detaches from the source PSCell, applies the stored corresponding configuration and synchronises to the selected candidate PSCell.

### 10.3.2 MR-DC with 5GC

The SN Modification procedure may be initiated either by the MN or by the SN and be used to modify the current user plane resource configuration (e.g. related to PDU session, QoS flow or DRB) or to modify other properties of the UE context within the same SN. It may also be used to transfer an RRC message from the SN to the UE via the MN and the response from the UE via MN to the SN (e.g. when SRB3 is not used). In NGEN-DC and NR-DC, the RRC message is an NR message (i.e., *RRCReconfiguration*) whereas in NE-DC it is an E-UTRA message (i.e., *RRCConnectionReconfiguration*). In case of CPA, inter-SN CPC or inter-SN subsequent CPAC, this procedure is used to modify CPA, inter-SN CPC or inter-SN subsequent CPAC configuration within the same candidate SN. In case of CPA, inter-SN CPC or inter-SN subsequent CPAC, this procedure may also be triggered by the candidate SN to add some prepared PSCells from the suggested list or cancel part of the prepared PSCells. In case of intra-SN CPC or intra-SN subsequent CPAC, this procedure is used to configure, modify or release intra-SN CPC or intra-SN subsequent CPAC configuration. This procedure may be initiated by the MN or SN to request the SN or MN to activate or deactivate the SCG.

Editor’s note: FFS. It’s up to RAN3 on the details how to update/modify/cancel the prepared candidate PSCells for subsequent CPAC.

The SN modification procedure does not necessarily need to involve signalling towards the UE.

**MN initiated SN Modification**



Figure 10.3.2-1: SN Modification procedure - MN initiated

The MN uses the procedure to initiate configuration changes of the SCG within the same SN, including addition, modification or release of the user plane resource configuration. The MN uses this procedure to perform handover within the same MN while keeping the SN, when the SN needs to be involved (i.e. in NGEN-DC). The MN also uses the procedure to query the current SCG configuration, e.g. when delta configuration is applied in an MN initiated SN change. The MN also uses the procedure to provide the S-RLF related information to the SN or to provide additional available DRB IDs to be used for SN terminated bearers. The MN also uses this procedure to activate or deactivate the SCG. The MN may not use the procedure to initiate the addition, modification or release of SCG SCells. The SN may reject the request, except if it concerns the release of the user plane resource configuration, or if it is used to perform handover within the same MN while keeping the SN. Figure 10.3.2-1 shows an example signalling flow for an MN initiated SN Modification procedure.

1. The MN sends the *SN Modification Request* message, which may contain user plane resource configuration related or other UE context related information, PDU session level Network Slice info and the requested SCG configuration information, including the UE capabilities coordination result to be used as basis for the reconfiguration by the SN. In case a security key update in the SN is required, a new *SN Security Key* is included. In case the PDCP data recovery in the SN is required, the *PDCP Change* *Indication* is included which indicates that PDCP data recovery is required in SN.

2. The SN responds with the *SN Modification Request Acknowledge* message, which may contain new SCG radio configuration information within an SN RRC reconfiguration message*,* and data forwarding address information (if applicable). If the MN requested the SCG to be activated or deactivated, the SN indicates whether the SCG is activated or deactivated.

NOTE 1: For MN terminated bearers to be setup for which PDCP duplication with CA is configured in NR SCG side, the MN allocates up to 4 separate Xn-U bearers and the SN provides a logical channel ID for primary or split secondary path to the MN.

For SN terminated bearers to be setup for which PDCP duplication with CA is configured in NR MCG side, the SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the SN via an additional MN-initiated SN modification procedure.

2a. When applicable, the MN provides data forwarding address information to the SN. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

3/4. The MN initiates the RRC reconfiguration procedure, including an SN RRC reconfiguration message. The UE applies the new configuration, synchronizes to the MN (if instructed, in case of intra-MN handover) and replies with MN RRC reconfiguration complete message,including an SN RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

5. Upon successful completion of the reconfiguration, the success of the procedure is indicated in the *SN Reconfiguration Complete* message.

6. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SN addition procedure. Otherwise, the UE may perform UL transmission after having applied the new configuration.

7. If PDCP termination point is changed for bearers using RLC AM, and when RRC full configuration is not used, the SN Status Transfer takes place between the MN and the SN (Figure 10.3.2-1 depicts the case where a bearer context is transferred from the MN to the SN).

8. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.2-1 depicts the case where a user plane resource configuration related context is transferred from the MN to the SN).

9. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 2: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related QoS flow is stopped.

10. If applicable, a PDU Session path update procedure is performed.

**SN initiated SN Modification with MN involvement**



Figure 10.3.2-2: SN Modification procedure - SN initiated with MN involvement

The SN uses the procedure to perform configuration changes of the SCG within the same SN, e.g. to trigger the modification/release of the user plane resource configuration, to trigger the release of SCG resources (e.g., release SCG lower layer resources but keep SN), and to trigger PSCell changes (e.g. when a new security key is required or when the MN needs to perform PDCP data recovery). The MN cannot reject the release request of PDU session/QoS flows and the release request of SCG resources. The SN also uses the procedure to request the MN to provide more DRB IDs to be used for SN terminated bearers or to return DRB IDs used for SN terminated bearers that are not needed any longer. The SN also uses this procedure to activate or deactivate the SCG. Figure 10.3.2-2 shows an example signalling flow for SN initiated SN Modification procedure.

1. The SN sends the *SN Modification Required* message including an SN RRC reconfiguration message, which may contain user plane resource configuration related context, other UE context related information and the new radio resource configuration of SCG. The SN may request the SCG to be activated or deactivated. In case of change of security key, the *PDCP Change* *Indication* indicates that an SN security key update is required. In case the MN needs to perform PDCP data recovery, the *PDCP Change* *Indication* indicates that PDCP data recovery is required.

The SN can decide whether the change of security key is required.

NOTE 3a: In case that a MN initiated conditional reconfiguration (e.g. CHO, MN initiated inter-SN CPC or MN initiated inter-SN subsequent CPAC) is prepared, and if any execution of a prepared SN initiated intra-SN CPC or SN initiated intra-SN subsequent CPAC procedure or reconfiguration of the SCG, the SN notifies to the MN via the *SN Modification Required* message. In this case, the steps 2 and 3 are skipped.

NOTE 3b: In case of SN initiated inter-SN CPC or SN initiated inter-SN subsequent CPAC and in case that a candidate SN triggered the SN Initiated SN Modification procedure to include some prepared PSCells (within the candidate cells suggested by the source SN in SN initiated inter-SN CPC or SN initiated inter-SN subsequent CPAC) or to remove some prepared PSCells, the MN may decide to trigger the step 2 towards the source SN.

2/3. The MN initiated SN Modification procedure may be triggered by *SN Modification Required* message, e.g. when an SN security key change needs to be applied.

NOTE 3: For SN terminated bearers to be setup for which PDCP duplication with CA is configured in NR MCG side, the SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the SN via the nested MN-initiated SN modification procedure.

4. The MN sends the MN RRC reconfiguration message to the UE including the SN RRC reconfiguration message with the new SCG radio resource configuration.

5. The UE applies the new configuration and sends the MN RRC reconfiguration complete message, including an SN RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

6. Upon successful completion of the reconfiguration, the success of the procedure is indicated in the *SN Modification Confirm* message including the SN RRC response message, if received from the UE.

7. If instructed, the UE performs synchronisation towards the PSCell configured by the SN as described in SN Addition procedure. Otherwise, the UE may perform UL transmission directly after having applied the new configuration.

8. If PDCP termination point is changed for bearers using RLC AM, and when RRC full configuration is not used, the SN Status Transfer takes place between the MN and the SN (Figure 10.3.2-2 depicts the case where a bearer context is transferred from the SN to the MN).

9. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.2-2 depicts the case where a user plane resource configuration related context is transferred from the SN to the MN).

10. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 4: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related QoS flow is stopped.

11. If applicable, a PDU Session path update procedure is performed.

**SN initiated SN Modification without MN involvement**

This procedure is not supported for NE-DC.



Figure 10.3.2-3: SN Modification – SN initiated without MN involvement

The SN initiated SN modification procedure without MN involvement is used to modify the configuration within SN in case no coordination with MN is required, including the addition/modification/release of SCG SCell and PSCell change (e.g. when the security key does not need to be changed and the MN does not need to be involved in PDCP recovery). The SN may initiate the procedure to configure, modify or release intra-SN CPC or intra-SN subsequent CPAC configuration within the same SN. Figure 10.3.2-3 shows an example signalling flow for SN initiated SN modification procedure without MN involvement. The SN can decide whether the Random Access procedure is required.

1. The SN sends the SN RRC reconfiguration message to the UE through SRB3.

2. The UE applies the new configuration and replies with the SN RRC reconfiguration complete message. In case the UE is unable to comply with (part of) the configuration included in the SN RRC reconfiguration message, it performs the reconfiguration failure procedure.

3. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SN Addition procedure. Otherwise the UE may perform UL transmission after having applied the new configuration.

**SN initiated Conditional SN Modification without MN involvement (SRB3 is used)**

This procedure is not supported for NE-DC and NGEN-DC.



Figure 10.3.2-3a: SN Modification – SN-initiated without MN involvement and SRB3 is used to configure intra-SN CPC or intra-SN subsequent CPAC.

Editor’s note: FFS whether to have a separate signaling flow for subsequent CPAC procedure, depending on further progress from RAN2 and RAN3.

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is used to configure intra-SN CPC or intra-SN subsequent CPAC.

1. The SN sends the SN RRC reconfiguration including CPC configuration or subsequent CPAC configuration to the UE through SRB3.

2. The UE applies the new configuration. In case the UE is unable to comply with (part of) the configuration included in the SN RRC reconfiguration message, it performs the reconfiguration failure procedure. The UE starts evaluating the execution conditions for the candidate PSCell(s). The UE maintains connection with the source PSCell and replies with the *RRCReconfigurationComplete* message to the SN via SRB3.

3. If at least one candidate PSCell satisfies the corresponding execution condition, the UE detaches from the source PSCell, applies the stored configuration corresponding to the selected candidate PSCell and synchronises to the candidate PSCell. In subsequent CPAC, the UE keeps configured candidate PSCell configurations and evaluates the execution conditions of other candidate PSCells for subsequent CPAC.

Editor’s note: FFS whether to support the coexistence of legacy CPA/CPC and subsequent CPAC.

4. The UE completes the CPC execution procedure by sending an *RRCReconfigurationComplete* message to the new PSCell.

NOTE X: In subsequent CPAC, if the execution condition of one candidate PSCell is satisfied, the UE executes steps 3-4, e.g. based on the configuration provided in step 1.

**Transfer of an NR RRC message to/from the UE (when SRB3 is not used)**

This procedure is supported for all the MR-DC options.



Figure 10.3.2-4: Transfer of an NR RRC message to/from the UE

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used.

1. The SN initiates the procedure by sending the *SN Modification Required* to the MN including the SN RRC reconfiguration message.

2. The MN forwards the SN RRC reconfiguration message to the UE including it in the RRC reconfigurationmessage.

3. The UE applies the new configuration and replies with the RRC reconfiguration complete message by including the SN RRC reconfiguration complete message. In case the UE is unable to comply with (part of) the configuration included in the SN RRC reconfiguration message, it performs the reconfiguration failure procedure.

4. The MN forwards the SN RRC response message, if received from the UE, to the SN by including it in the *SN Modification Confirm* message.

5. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SN Addition procedure. Otherwise the UE may perform UL transmission after having applied the new configuration.

**SN initiated Conditional SN Modification without MN involvement (SRB3 is not used)**

This procedure is not supported for NE-DC and NGEN-DC.



Figure 10.3.2-5: SN Modification – SN-initiated without MN involvement and SRB3 is not used to configure intra-SN CPC or intra-SN subsequent CPAC

Editor’s note: FFS whether to have a separate signaling flow for subsequent CPAC procedure, depending on further progress from RAN2 and RAN3.

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used to configure intra-SN CPC or intra-SN subsequent CPAC.

1. The SN initiates the procedure by sending the *SN Modification Required* to the MN including the SN RRC reconfiguration message with CPC configuration or subsequent CPAC configuration.

2. The MN forwards the SN RRC reconfiguration message to the UE including it in the *RRCReconfiguration* message.

3. The UE replies with the *RRCReconfigurationComplete* message by including the SN RRC reconfiguration complete message. In case the UE is unable to comply with (part of) the configuration included in the SN RRC reconfiguration message, it performs the reconfiguration failure procedure. The UE maintains connection with source PSCell after receiving CPC configuration or subsequent CPAC configuration, and starts evaluating the execution conditions for the candidate PSCell(s).

4. The MN forwards the SN RRC response message, if received from the UE, to the SN by including it in the *SN Modification Confirm* message.

5. If at least one candidate PSCell satisfies the corresponding execution condition, the UE completes the CPC execution procedure by an *ULInformationTransferMRDC* message to the MN which includes an embedded *RRCReconfigurationComplete* message to the selected target PSCell. In subsequent CPAC, the UE keeps configured candidate PSCell configurations and evaluates the execution conditions of other candidate PSCells for subsequent CPAC.

Editor’s note: FFS whether to support the coexistence of legacy CPA/CPC and subsequent CPAC.

6. The *RRCReconfigurationComplete* message is forwarded to the SN embedded in *RRC Transfer* message.

7. The UE detaches from the source PSCell, applies the stored corresponding configuration and synchronises to the selected candidate PSCell.

NOTE X: In subsequent CPAC, if the execution condition of one candidate PSCell is satisfied, the UE executes steps 5-7, e.g. based on the configuration provided in step 2.

## 10.4 Secondary Node Release (MN/SN initiated)

### 10.4.1 EN-DC

The Secondary Node Release procedure may be initiated either by the MN or by the SN and is used to initiate the release of the UE context at the SN. The recipient node of this request can reject it, e.g., if a SN change procedure is triggered by the SN.

In case of CPA or inter-SN CPC, this procedure may be initiated either by the MN or the candidate SN, and it is used to cancel all the prepared PSCells at the candidate SN and initiate the release of related UE context at the candidate SN.

It does not necessarily need to involve signalling towards the UE, e.g., in case of the RRC connection re-establishment due to Radio Link Failure in MN.

**MN initiated SN Release**



Figure 10.4.1-1: SN Release procedure – MN initiated

Figure 10.4.1-1 shows an example signalling flow for the MN initiated Secondary Node Release procedure when SN Release is confirmed by SN.

1. The MN initiates the procedure by sending the *SgNB Release Request* message. If applicable, the MN provides data forwarding addresses to the SN.

2. The SN confirms SN Release by sending the *SgNB Release Request Acknowledge* message. If appropriate, the SN may reject SN Release, e.g. if the SN change procedure is triggered by the SN.

NOTE 0: If CPA or inter-SN CPC is configured, upon reception of the *SgNB Release Request Acknowledge* message the MN cancels all CPAC with the target candidate SN(s).

3/4. If required, the MN indicates in the *RRCConnectionReconfiguration* message towards the UE that the UE shall release the entire SCG configuration. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

NOTE 1: If data forwarding is applied, timely coordination between steps 1 and 2 may minimize gaps in service provision, this is however regarded to be an implementation matter.

5. For bearers using RLC AM, the SN sends the *SN Status Transfer* message.

6. Data forwarding from the SN to the MN may start.

7. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 2: If data forwarding is applied, the order the SN sends the *Secondary RAT Data Usage Report* message and starts data forwarding with MN is not defined i.e., step 7 can take place before step 6. The SN does not need to wait for the end of data forwarding to send the *Secondary RAT Data Usage Report* message.

8. If applicable, the path update procedure is initiated.

9. Upon reception of the *UE Context Release* message, the SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**SN initiated SN Release**



Figure 10.4.1-2: SN Release procedure – SN initiated

Figure 10.4.1-2 shows an example signalling flow for the SN initiated Secondary Node Release procedure.

1. The SN initiates the procedure by sending the *SgNB Release Required* message which may contain inter-node message to support delta configuration.

2. If applicable, the MN provides data forwarding addresses to the SN in the *SgNB Release Confirm* message. The SN may start data forwarding and stop providing user data to the UE as early as it receives the *SgNB Release Confirm* message.

NOTE 2a: If CPA or inter-SN CPC is configured, upon reception of the *SgNB Release Required* message the MN cancels all CPAC with the target candidate SN(s).

3/4. If required, the MN indicates in the *RRCConnectionReconfiguration* message towards the UE that the UE shall release the entire SCG configuration. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

NOTE 3: If data forwarding is applied, timely coordination between steps 2 and 3 may minimize gaps in service provision. This is however regarded to be an implementation matter.

5. For bearers using RLC AM, the SN sends the *SN Status Transfer* message.

6. Data forwarding from the SN to the MN may start.

7. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 4: If data forwarding is applied, the order the SN sends the *Secondary RAT Data Usage Report* message and starts data forwarding with MN is not defined i.e., step 7 can take place before step 6. The SN does not need to wait for the end of data forwarding to send the *Secondary RAT Data Usage Report* message.

8. If applicable, the path update procedure is initiated.

9. Upon reception of the *UE Context Release* message, the SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

### 10.4.2 MR-DC with 5GC

The SN Release procedure may be initiated either by the MN or by the SN and is used to initiate the release of the UE context and relevant resources at the SN. The recipient node of this request can reject it, e.g., if an SN change procedure is triggered by the SN.

In case of CPA, inter-SN CPC or inter-SN subsequent CPAC, this procedure may be initiated either by the MN or the candidate SN, and it is used to cancel all the prepared PSCells at the candidate SN and initiate the release of related UE context at the candidate SN.

**MN initiated SN Release**



Figure 10.4.2-1: SN release procedure - MN initiated

Figure 10.4.2-1 shows an example signalling flow for the MN initiated SN Release procedure.

1. The MN initiates the procedure by sending the *SN Release Request* message.

2. The SN confirms SN Release by sending the *SN Release Request Acknowledge* message. If appropriate, the SN may reject SN Release, e.g., if the SN change procedure is triggered by the SN.

NOTE 00: If CPA, inter-SN CPC or inter-SN subsequent CPAC is configured, upon reception of the *SN Release Request Acknowledge* message the MN cancels all CPAC or subsequent CPAC with the target candidate SN(s).

2a. When applicable, the MN provides forwarding address information to the SN.

NOTE 0: The MN may send the *Xn-U Address Indication* message to provide forwarding address information before step 2.

3/4. If required, the MN indicates in the MN RRC reconfiguration message towards the UE that the UE shall release the entire SCG configuration. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

NOTE 1: If data forwarding is applied, timely coordination between steps 1 and 2 may minimize gaps in service provision, this is however regarded to be an implementation matter.

5. If PDCP termination point is changed to the MN for bearers using RLC AM, the SN sends the *SN Status Transfer* message.

6. Data forwarding from the SN to the MN may start.

7. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 1a: If data forwarding is applied, the order the SN sends the *Secondary RAT Data Usage Report* message and starts data forwarding with MN is not defined i.e., step 7 can take place before step 6. The SN does not need to wait for the end of data forwarding to send the *Secondary RAT Data Usage Report* message.

8. If applicable, the PDU Session path update procedure is initiated.

9. Upon reception of the *UE Context Release* message, the SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**SN initiated SN Release**



Figure 10.4.2-2: SN release procedure - SN initiated

Figure 10.4.2-2 shows an example signalling flow for the SN initiated SN Release procedure.

1. The SN initiates the procedure by sending the *SN Release Required* message which may contain inter-node message to support delta configuration.

2. If data forwarding is requested, the MN provides data forwarding addresses to the SN in the *SN Release Confirm* message. The SN may start data forwarding and stop providing user data to the UE as early as it receives the *SN Release Confirm* message.

NOTE 1b: If CPA, inter-SN CPC or inter-SN subsequent CPAC is configured, upon reception of the *SN Release Required* message the MN cancels all CPAC or subsequent CPAC with the target candidate SN(s).

3/4. If required, the MN indicates in the MN RRC reconfiguration message towards the UE that the UE shall release the entire SCG configuration. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

NOTE 2: If data forwarding is applied, timely coordination between steps 2 and 3 may minimize gaps in service provision. This is however regarded to be an implementation matter.

5. If PDCP termination point is changed to the MN for bearers using RLC AM, the SN sends the *SN Status Transfer* message.

6. Data forwarding from the SN to the MN may start.

7. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 3: If data forwarding is applied, the order the SN sends the *Secondary RAT Data Usage Report* message and starts data forwarding with MN is not defined i.e., step 7 can take place before step 6. The SN does not need to wait for the end of data forwarding to send the *Secondary RAT Data Usage Report* message.

8. If applicable, the PDU Session path update procedure is initiated.

9. Upon reception of the *UE Context Release* message, the SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

## 10.5 Secondary Node Change (MN/SN initiated)

### 10.5.1 EN-DC

The Secondary Node Change procedure is initiated either by MN or SN and used to transfer a UE context from a source SN to a target SN and to change the SCG configuration in UE from one SN to another. In case of inter-SN CPC, the Conditional Secondary Node Change procedure initiated either by the MN or SN is also used for inter-SN CPC configuration and inter-SN CPC execution.

NOTE 1: Inter-RAT SN change procedure with single RRC reconfiguration is not supported in this version of the protocol (i.e. no transition from EN-DC to DC).

The Secondary Node Change procedure always involves signalling over MCG SRB towards the UE.

**MN initiated SN Change**



Figure 10.5.1-1: SN Change – MN initiated

Figure 10.5.1-1 shows an example signalling flow for the MN initiated Secondary Node Change:

1/2. The MN initiates the SN change by requesting the target SN to allocate resources for the UE by means of the SgNB Addition procedure. The MN may include measurement results related to the target SN. If forwarding is needed, the target SN provides forwarding addresses to the MN. The target SN includes the indication of the full or delta RRC configuration.

NOTE 2: The MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration before step 1.

NOTE 2a: In case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.

3. If the allocation of target SN resources was successful, the MN initiates the release of the source SN resources including a Cause indicating SCG mobility. The Source SN may reject the release. If data forwarding is needed the MN provides data forwarding addresses to the source SN. If direct data forwarding is used for SN terminated bearers, the MN provides data forwarding addresses as received from the target SN to source SN. Reception of the *SgNB Release Request* message triggers the source SN to stop providing user data to the UE and, if applicable, to start data forwarding.

4/5. The MN triggers the UE to apply the new configuration. The MN indicates to the UE the new configuration in the *RRCConnectionReconfiguration* message including the NR RRC configuration message generated by the target SN. The UE applies the new configuration and sends the *RRCConnectionReconfigurationComplete* message, including the encoded NR RRC response message for the target SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. If the RRC connection reconfiguration procedure was successful, the MN informs the target SN via *SgNBReconfigurationComplete* message with the encoded NR RRC response message for the target SN, if received from the UE.

7. If configured with bearers requiring SCG radio resources, the UE synchronizes to the target SN.

8. For SN terminated bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends then to the target SN, if needed.

9. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the *SgNB Release Request* message from the MN.

10. The source SN sends the *Secondary RAT* *Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 3: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

11-15. If applicable, a path update is triggered by the MN.

16. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**SN initiated SN Change**



Figure 10.5.1-2: SN Change – SN initiated

Figure 10.5.1-2 shows an example signalling flow for the Secondary Node Change initiated by the SN:

1. The source SN initiates the SN change procedure by sending *SgNB Change Required* message which contains target SN ID information and may include the SCG configuration (to support delta configuration) and measurement results related to the target SN.

2/3. The MN requests the target SN to allocate resources for the UE by means of the SgNB Addition procedure, including the measurement results related to the target SN received from the source SN. If forwarding is needed, the target SN provides forwarding addresses to the MN. The target SN includes the indication of the full or delta RRC configuration.

NOTE 3a: In case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.

4/5. The MN triggers the UE to apply the new configuration. The MN indicates the new configuration to the UE in the *RRCConnectionReconfiguration* message including the NR RRC configuration message generated by the target SN. The UE applies the new configuration and sends the *RRCConnectionReconfigurationComplete* message, including the encoded NR RRC response message for the target SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. If the allocation of target SN resources was successful, the MN confirms the release of the source SN resources. If data forwarding is needed the MN provides data forwarding addresses to the source SN. If direct data forwarding is used for SN terminated bearers, the MN provides data forwarding addresses as received from the target SN to source SN. Reception of the *SgNB Change Confirm* message triggers the source SN to stop providing user data to the UE and, if applicable, to start data forwarding.

7. If the RRC connection reconfiguration procedure was successful, the MN informs the target SN via *SgNB Reconfiguration Complete* message with the encoded NR RRC response message for the target SN, if received from the UE.

8. The UE synchronizes to the target SN.

9. For SN terminated bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends then to the target SN, if needed.

10. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the *SgNB Change Confirm* message from the MN.

11. The source SN sends the *Secondary RAT* *Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 4: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SgNB may send the report when the transmission of the related bearer is stopped.

12-16. If applicable, a path update is triggered by the MN.

17. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**MN initiated conditional SN Change**

The MN initiated conditional inter-SN change procedure is used for inter-SN CPC configuration and inter-SN CPC execution.



Figure 10.5.1-3: Conditional SN Change – MN initiated

Figure 10.5.1-3 shows an example signalling flow for the MN initiated Conditional Secondary Node Change:

1/2. The MN initiates the conditional SN change by requesting the candidate SN(s) to allocate resources for the UE by means of the SgNB Addition procedure, indicating that the request is for CPAC. The MN also provides the candidate cells recommended by MN via the latest measurement results for the candidate SN(s) to choose and configure the SCG cell(s), and provides the upper limit for the number of PSCells that can be prepared by the candidate SN. From the measurement results indicated by the MN, the candidate SN decides the list of PSCell(s) to prepare (considering the maximum number indicated by the MN) and, for each prepared PSCell, the candidate SN decides other SCG SCells and provides the new corresponding SCG radio resource configuration to the MN in an NR *RRCReconfiguration\*\** message contained in the *SgNB Addition Request Acknowledge* message with the prepared PSCell ID(s). If forwarding is needed, the candidate SN provides forwarding addresses to the MN. The candidate SN includes the indication of the full or delta RRC configuration. The candidate SN can either accept or reject each of the candidate cells listed within the measurement results indicated by the MN, i.e. it cannot configure any alternative candidates.

NOTE 5: The MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration before step 1.

NOTE 5a: In case the candidate SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE in the conditional configuration.

3. The MN sends to the UE an *RRCConnectionReconfiguration* messageincluding the CPC configuration, i.e. a list of *RRCConnectionReconfiguration\** messagesand associated execution conditions, in which each *RRCConnectionReconfiguration\** message contains the SCG configuration in the *RRCReconfiguration\*\** messagereceived from the candidate SN in step 2 and possibly an MCG configuration. Besides, the *RRCConnectionReconfiguration* message can also include an updated MCG configuration, e.g., to configure the required conditional measurements.

4. The UE applies the *RRCConnectionReconfiguration* message received in step 3, stores the CPC configurationand replies to the MN with an *RRCConnectionReconfigurationComplete* message. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

4a. Upon receiving the *RRCConnectionReconfigurationComplete* message from the UE, the MN triggers the Data Forwarding Address Indication procedure to the source SN to inform that the CPC has been configured, the source SN, if applicable, together with the Early Status Transfer procedure, starts early data forwarding. The PDCP SDU forwarding may take place during early data forwarding.

NOTE 5b: Separate Data Forwarding Address Indication procedures may be invoked to provide different forwarding addresses of the prepared candidate target SNs. In this case, it is up to the MN and the source SN implementations to make sure that the EARLY STATUS TRANSFER message(s) from the source SN, if any, is forwarded to the right target destination. The Data Forwarding Address Indication procedure may further be invoked to indicate to the source SN to stop already initiated early data forwarding for some SN-terminated bearers if they are no longer subject to data forwarding due to the modification or cancellation of the prepared conditional SN change procedures.

NOTE 5c: For the early transmission of MN terminated split/SCG bearers, the MN forwards the PDCP PDU to the candidate SN(s).

5. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies *RRCConnectionReconfiguration\** messagecorresponding to the selected candidate PSCell, and sends an *RRCConnectionReconfigurationComplete\** message, including an NR *RRCReconfigurationComplete\*\** message for the selected candidate PSCell, and information enabling the MN to identify the SN of the selected candidate PSCell.

6a-6b. The MN triggers the MeNB initiated SgNB Release procedure to inform the source SN to stop providing user data to the UE, and, if applicable, the address of the SN of the selected candidate PSCell to start data forwarding.

7a-7c. If the RRC connection reconfiguration procedure was successful, the MN informs the SN of the selected candidate PSCell via *SgNB Reconfiguration Complete* message, including the SN *RRCReconfigurationComplete\*\** message. The MN sends the *SgNB Release Request* message(s) to cancel CPC in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

8. The UE synchronizes to the PSCell indicated in the *RRCConnectionReconfiguration\** message applied in step 5.

9a-9b. For SN terminated bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends to the SN of the selected candidate PSCell, if needed.

10. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the early data forwarding address in step 4a.

11. The source SN sends the *Secondary RAT* *Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 6: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

12-16. If applicable, a path update is triggered by the MN.

17. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**SN initiated conditional SN Change**

The SN initiated conditional SN change procedure is used for inter-SN CPC configuration and inter-SN CPC execution.

The SN initiated conditional SN change procedure may also be initiated by the source SN, to modify the existing SN initiated inter-SN CPC configuration, or to trigger the release of the candidate SN by cancellation of all the prepared PSCells at the candidate SN and releasing the CPC related UE context at the candidate SN.

NOTE 6a0: To modify or release an existing intra-SN CPC configuration, the source SN triggers an SN initiated Conditional SN Modification (with or without SRB3) without MN involvement, as specified in 10.3.



Figure 10.5.1-4: Conditional SN Change – SN initiated

Figure 10.5.1-4 shows an example signalling flow for the Conditional Secondary Node Change initiated by the SN:

1. The source SN initiates the conditional SN change procedure by sending *SgNB Change Required* message which contains a CPC initiation indication. The message also contains candidate SN ID(s) information and may include the SCG configuration (to support delta configuration), and contains the measurement results related to the candidate SN(s). The message also includes a list of proposed PSCell candidates recommended by the source SN, including execution conditions, the upper limit for the number of PSCells that can be prepared by each candidate SN, and may also include the SCG measurement configurations for CPC (e.g. measurement ID(s) to be used for CPC).

2/3. The MN requests each candidate SN to allocate resources for the UE by means of the SgNB Addition procedure(s) , indicating the request is for CPAC, and the measurements results related to the candidate SN and indicating a list of proposed PSCell candidates received from the source SN, but not including execution conditions. Within the list of PSCells suggested by the source SN, the candidate SN decides the list of PSCell(s) to prepare (considering the maximum number indicated by the MN) and, for each prepared PSCell, the candidate SN decides SCG SCells and provides the new corresponding SCG radio resource configuration to the MN in an NR *RRCReconfiguration\*\** message contained in the *SgNB Addition Request Acknowledge* message. If data forwarding is needed, the candidate SN provides data forwarding addresses to the MN. The candidate SN includes the indication of full or delta RRC configuration, and the list of prepared PSCell IDs to the MN. The candidate SN can either accept or reject each of the candidate cells suggested by the source SN, i.e. it cannot configure any alternative candidates.

NOTE 6a: In case the candidate SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE in the conditional configuration.

4/5. The MN may indicate the candidate PSCells accepted by each candidate SN to the source SN via *SgNB Modification Request* message before it configures the UE e.g., when not all candidate PSCells were accepted by the candidate SN(s). If the MN does not send such indication, step 4 and 5 are skipped. If requested,the source SN sends an *SgNB Modification Request Acknowledge* message and if needed, provides an updated measurement configurations and/or the execution conditions for CPC to the MN.

6. The MN sends to the UE an *RRCConnectionReconfiguration* messageincluding the CPC configuration, i.e. a list of *RRCConnectionReconfiguration\** messagesand associated execution conditions, in which each *RRCConnectionReconfiguration\** messagecontains the SCG configuration in the *RRCReconfiguration\*\** messagereceived from the candidate SN in step 3 and possibly an MCG configuration. Besides, the *RRCConnectionReconfiguration* message can also include an updated MCG configuration, as well as the NR *RRCReconfiguration\*\**\* message generated by the source SN, e.g., to configure the required conditional measurements.

7. The UE applies the *RRCConnectionReconfiguration* message received in step 6, stores the CPC configurationand replies to the MN with an *RRCConnectionReconfigurationComplete* message, which can include an NR *RRCReconfigurationComplete\*\**\* message. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

8. If an NR RRC response message is included, the MN informs the source SN with the NR *RRCReconfigurationComplete\*\**\* message via *SgNB Change Confirm* message. If step 4 and 5 are skipped, the MN will indicate the candidate PSCells accepted by each candidate SN to the source SN in the *SgNB Change Confirm* message.

The MN sends the *SgNB Change Confirm* message towards the source SN to indicate that CPC is prepared, and in such case the source SN continues providing user data to the UE. If early data forwarding is applied, the MN informs the source SN the data forwarding addresses as received from the candidate SN(s), the source SN, if applicable, together with the Early Status Transfer procedure, starts early data forwarding. The PDCP SDU forwarding may take place during early data forwarding. In case multiple candidate SNs are prepared, the MN includes a list of Target SgNB ID and list of data forwarding addresses to the source SN.

NOTE 6b: The Data Forwarding Address Indication procedure may further be invoked to indicate to the source SN to stop already initiated early data forwarding for some PDCP SDUs if they are no longer subject to data forwarding due to the modification or cancellation of the prepared conditional PSCell change.

NOTE 6c: For the early transmission of MN terminated split/SCG bearers, the MN forwards the PDCP PDU to the candidate SN(s).

9a-9d. The source SN may send the *SgNB Modification Required* message to trigger an update of CPC execution condition and/or corresponding SCG measurement configuration for CPC. In such case in step 9b, the MN reconfigures the UE and in step 9c the UE responds with *RRCConnectionReconfigurationComplete*, similarly as in steps 6 and 7.

10. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies the *RRCConnectionReconfiguration\** message corresponding to the selected candidate PSCell, and sends an *RRCConnectionReconfigurationComplete\** message, including the NR *RRCReconfigurationComplete\*\** message for the selected candidate PSCell, and information enabling the MN to identify the SN of the selected candidate PSCell.

11a-11b. The MN triggers the MeNB initiated SgNB Release procedure to inform source SN to stop providing user data to the UE, and provide the address of the SN of the selected candidate PSCell and if applicable, start late data forwarding.

12a-12c. If the RRC connection reconfiguration procedure was successful, the MN informs the SN of the selected candidate PSCell via *SgNB Reconfiguration Complete* message, including the SN *RRCReconfigurationComplete\*\** message. The MN sends the *SgNB Release Request* message(s) to cancel CPC in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

13. The UE synchronizes to the PSCell indicated in the *RRCConnectionReconfiguration\** message applied in step 10.

14a-14b. For SN terminated bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends then to the SN of the selected candidate PSCell, if needed.

15. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the early data forwarding message from the MN.

16. The source SN sends the *Secondary RAT* *Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 7: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SgNB may send the report when the transmission of the related bearer is stopped.

17-21. If applicable, a path update is triggered by the MN.

22. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

### 10.5.2 MR-DC with 5GC

**MN initiated SN Change**

The MN initiated SN change procedure is used to transfer a UE context from the source SN to a target SN and to change the SCG configuration in UE from one SN to another.

The Secondary Node Change procedure always involves signalling over MCG SRB towards the UE.



Figure 10.5.2-1: SN change procedure - MN initiated

Figure 10.5.2-1 shows an example signalling flow for the SN Change initiated by the MN:

1/2. The MN initiates the SN change by requesting the target SN to allocate resources for the UE by means of the SN Addition procedure. The MN may include measurement results related to the target SN. If data forwarding is needed, the target SN provides data forwarding addresses to the MN. The target SN includes the indication of the full or delta RRC configuration.

NOTE 1: The MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration and to allow provision of data forwarding related information before step 1.

2a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

3. If the allocation of target SN resources was successful, the MN initiates the release of the source SN resources including a Cause indicating SCG mobility. The Source SN may reject the release. If data forwarding is needed the MN provides data forwarding addresses to the source SN. If direct data forwarding is used for SN terminated bearers, the MN provides data forwarding addresses as received from the target SN to source SN. Reception of the *SN Release Request* message triggers the source SN to stop providing user data to the UE.

4/5. The MNtriggers the UE to apply the new configuration. The MN indicates the new configuration to the UE in the MN RRC reconfiguration message including the target SN RRC reconfiguration message. The UE applies the new configuration and sends the MN RRC reconfiguration complete message, including the SN RRC response message for the target SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

6. If the RRC connection reconfiguration procedure was successful, the MN informs the target SN via *SN Reconfiguration Complete* message with the included SN RRC response message for the target SN, if received from the UE.

7. If configured with bearers requiring SCG radio resources the UE synchronizes to the target SN.

8. If PDCP termination point is changed for bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends then to the target SN, if needed.

9. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the *SN Release Request* message from the MN.

10. The source SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 2: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related QoS flow is stopped.

11-15. If applicable, a PDU Session path update procedure is triggered by the MN.

16. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue

**SN initiated SN Change**

The SN initiated SN change procedure is used to transfer a UE context from the source SN to a target SN and to change the SCG configuration in UE from one SN to another.



Figure 10.5.2-2: SN change procedure - SN initiated

Figure 10.5.2-2 shows an example signalling flow for the SN Change initiated by the SN:

1. The source SN initiates the SN change procedure by sending the *SN Change Required* message, which contains a candidate target node ID and may include the SCG configuration (to support delta configuration) and measurement results related to the target SN.

2/3. The MN requests the target SN to allocate resources for the UE by means of the SN Addition procedure, including the measurement results related to the target SN received from the source SN. If data forwarding is needed, the target SN provides data forwarding addresses to the MN. The target SN includes the indication of the full or delta RRC configuration.

3a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

4/5. The MN triggers the UE to apply the new configuration. The MN indicates the new configuration to the UE in the MN RRC reconfiguration message including the SN RRC reconfiguration message generated by the target SN. The UE applies the new configuration and sends the MN RRC reconfiguration complete message, including the SN RRC response message for the target SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the MN RRC reconfiguration message, it performs the reconfiguration failure procedure.

6. If the allocation of target SN resources was successful, the MN confirms the change of the source SN. If data forwarding is needed the MN provides data forwarding addresses to the source SN. If direct data forwarding is used for SN terminated bearers, the MN provides data forwarding addresses as received from the target SN to source SN. Reception of the *SN Change Confirm* message triggers the source SN to stop providing user data to the UE and, if applicable, to start data forwarding.

7. If the RRC connection reconfiguration procedure was successful, the MN informs the target SN via *SN Reconfiguration Complete* message with the included SN RRC response message for the target SN, if received from the UE.

8. The UE synchronizes to the target SN.

9. If PDCP termination point is changed for bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends then to the target SN, if needed.

10. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the *SN Change Confirm* message from the MN.

11. The source SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 3: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SN may send the report when the transmission of the related QoS flow is stopped.

12-16. If applicable, a PDU Session path update procedure is triggered by the MN.

17. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**MN initiated conditional SN Change**

The Conditional Secondary Node Change procedure is initiated by the MN for inter-SN CPC or inter-SN subsequent CPAC configuration and inter-SN CPC or inter-SN subsequent CPAC execution.



Figure 10.5.2-3: Conditional SN change procedure - MN initiated

Editor’s note: FFS whether to have a separate signaling flow for subsequent CPAC procedure, depending on further progress from RAN2 and RAN3.

Figure 10.5.2-3 shows an example signalling flow for the conditional SN Change initiated by the MN:

1/2. The MN initiates the conditional SN change by requesting the candidate SN(s) to allocate resources for the UE by means of the SN Addition procedure, indicating that the request is for CPAC or subsequent CPAC [pending to RAN3]. The MN also provides the candidate cells recommended by MN via the latest measurement results for the candidate SN(s) to choose and configure the SCG cell(s), provides the upper limit for the number of PSCells that can be prepared by the candidate SN. If subsequent CPAC is requested, the MN may also provide a reference SCG configuration for the candidate SN to generate the candidate PSCell configuration. Within the list of cells as indicated within the measurement results indicated by the MN, the candidate SN decides the list of PSCell(s) to prepare (considering the maximum number indicated by the MN) and, for each prepared PSCell, the candidate SN decides other SCG SCells and provides the new corresponding SCG radio resource configuration to the MN in an NR *RRCReconfiguration*\*\* message contained in the *SN Addition Request Acknowledge* message with the prepared PSCell ID(s). If data forwarding is needed, the candidate SN provides data forwarding addresses to the MN. The candidate SN includes the indication of the full or delta RRC configuration. If subsequent CPAC has been requested, the candidate SN may include an indication of that the provided SCG radio resource configuration is a complete or delta RRC configuration with respect to the reference SCG configuration. The candidate SN can either accept or reject each of the candidate cells listed within the measurement results indicated by the MN, i.e. it cannot configure any alternative candidates.

Editor’s note: FFS which node initially generates the reference configuration in subsequent CPAC.

Editor’s note: FFS whether the reference SCG configuration is optionally provided to the candidate SN(s).

Editor’s note: FFS which node(s) and how/when to generate execution conditions for subsequent CPC, e.g. when the determination node decides the candidate PSCells for initial CPC, or after the determination node knows all candidate PSCells prepared by other candidate SNs. FFS if it shall be possible to do something like MN-initiated CPA/CPC where Candidate SN generate execution conditions for subsequent CPC.

NOTE 4: The MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration and to allow provision of data forwarding related information before step 1.

2a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message to the candidate SN(s).

3. The MN sends to the UE an *RRCReconfiguration* messageincluding the CPC configuration or the subsequent CPAC configuration, i.e. a list of *RRCReconfiguration\** messagesand associated execution conditions, in which each *RRCReconfiguration\** messagecontains the SCG configuration in the *RRCReconfiguration\*\** messagereceived from the candidate SN in step 2 and possibly an MCG configuration. Besides, the *RRCReconfiguration* message can also include an updated MCG configuration, e.g., to configure the required conditional measurements. In subsequent CPAC, the *RRCReconfiguration* message mayalso include a reference SCG configuration.

Editor’s note: FFS if the reference configuration is optional in subsequent CPAC. FFS whether MCG configuration is included in the reference configuration.

Editor’s note: FFS whether the MCG configuration associated with the SCG configuration of a candidate PSCell is included in subsequent CPAC configuration.

4. The UE applies the *RRCReconfiguration* message received in step 3, stores the CPC configuration or the subsequent CPAC configurationand replies to the MN with an *RRCReconfigurationComplete* message. In case the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message, it performs the reconfiguration failure procedure.

4a. Upon receiving the MN *RRCReconfigurationComplete* message from the UE, the MN informs the source SN that the CPC or the subsequent CPAC has been configured via Xn-U Address Indication procedure, the source SN, if applicable, together with the Early Status Transfer procedure, starts early data forwarding. The PDCP SDU forwarding may take place during early data forwarding.

NOTE 4a: Separate Xn-U Address Indication procedures may be invoked to provide different forwarding addresses of the prepared candidate target SNs. In this case, it is up to the MN and the source SN implementations to make sure that the EARLY STATUS TRANSFER message(s) from the source SN, if any, is forwarded to the right target destination. The Xn-U Address Indication procedure may further be invoked to indicate to the source SN to stop already initiated early data forwarding for some SN-terminated bearers if they are no longer subject to data forwarding due to the modification or cancellation of the prepared conditional SN change procedures.

NOTE 4b: For the early transmission of MN terminated split/SCG bearers, the MN forwads the PDCP PDU to the candidate SN(s).

5. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies *RRCReconfiguration\** message corresponding to the selected candidate PSCell, and sends an MN *RRCReconfigurationComplete\** message, including an NR *RRCReconfigurationComplete*\*\* message for the selected candidate PSCell, and information enabling the MN to identify the SN of the selected candidate PSCell. In subsequent CPAC, the UE keeps configured candidate PSCell configurations and evaluates the execution conditions of other candidate PSCells for subsequent CPAC.

Editor’s note: FFS whether to support the coexistence of legacy CPA/CPC and subsequent CPAC, i.e. there are some candidates for subsequent CPAC but others for legacy CPA/CPC.

6a-6c. The MN triggers the MN initiated SN Release procedure to inform the source SN to stop providing user data to the UE, and if applicable, triggers the Xn-U Address Indication procedure to inform the source SN the address of the SN of the selected candidate PSCell, to start late data forwarding.

Editor’s note: FFS. It’s up to RAN3 how to notify or release the source SN in subsequent CPAC, e.g. when the source SN is (not) configured as a candidate SN for subsequent CPAC.

7a-7c. If the RRC connection reconfiguration procedure was successful, the MN informs the SN of the selected candidate PSCell via *SN Reconfiguration Complete* message, including the SN *RRCReconfigurationComplete\*\** message. The MN sends the *SN Release Request* message(s) to cancel CPC in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

Editor’s note: FFS. It’s up to RAN3 how to notify the selected target SN in subsequent CPAC.

Editor’s note: FFS. It’s up to RAN3 whether/how to inform other candidate SN(s) in subsequent CPAC.

8. The UE synchronizes to the PSCell indicated in the *RRCReconfiguration\** message applied in step 5.

9a-9b. If PDCP termination point is changed for bearers using RLC AM, the source SN sends the message, which the MN sends then to the SN of the selected candidate PSCell, if needed.

10. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the early data forwarding address in step 4a.

11. The source SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 5: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related QoS flow is stopped.

12-16. If applicable, a PDU Session path update procedure is triggered by the MN.

17. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

NOTE X: In subsequent CPAC, if the execution condition of one candidate PSCell is satisfied, the UE executes steps 5-16, e.g. based on the configuration provided in step 3.

**SN initiated conditional SN Change**

The SN initiated conditional SN change procedure is used for inter-SN CPC or inter-SN subsequent CPAC configuration and inter-SN CPC or inter-SN subsequent CPAC execution.

The SN initiated conditional SN change procedure may also be initiated by the source SN, to modify the existing SN initiated inter-SN CPC or inter-SN subsequent CPAC configuration, or to trigger the release of the candidate SN by cancellation of all the prepared PSCells at the candidate SN and releasing the CPC or subsequent CPAC related UE context at the candidate SN.

NOTE 5a0: To modify or release an existing intra-SN CPC or intra-SN subsequent CPAC configuration, the source SN triggers an SN initiated Conditional SN Modification (with or without SRB3) without MN involvement, as specified in 10.3.



Figure 10.5.2-4: Conditional SN change procedure - SN initiated

Editor’s note: FFS whether to have a separate signaling flow for subsequent CPAC procedure, depending on further progress from RAN2 and RAN3.

Figure 10.5.2-4 shows an example signalling flow for the conditional SN Change initiated by the SN:

1. The source SN initiates the conditional SN change procedure by sending the *SN Change Required* message, which contains a CPC initiation indication or a subsequent CPAC initiation indication [pending to RAN3]. The message also contains candidate node ID(s) and may include the SCG configuration (to support delta configuration), and contains the measurements results which may include cells that are not CPC candidates. The message also includes a list of proposed PSCell candidates recommended by the source SN, including execution conditions, the upper limit for the number of PSCells that can be prepared by each candidate SN, and may also include the SCG measurement configurations for CPC (e.g. measurement ID(s) to be used for CPC).

2/3. The MN requests each candidate SN(s) to allocate resources for the UE by means of the SN Addition procedure(s), indicating the request is for CPAC or subsequent CPAC [pending to RAN3], and the measurements results which may include cells that are not CPC candidates received from the source SN to the candidate SN, and indicating a list of proposed PSCell candidates received from the source SN, but not including execution conditions. If subsequent CPAC is requested, the MN may provide a reference SCG configuration for the candidate SN to generate the candidate PSCell configuration. Within the list of PSCells suggested by the source SN, the candidate SN decides the list of PSCell(s) to prepare (considering the maximum number indicated by the MN) and, for each prepared PSCell, the candidate SN decides SCG SCells and provides the new corresponding SCG radio resource configuration to the MN in an NR *RRCReconfiguration\*\** message contained in the *SgNB Addition Request Acknowledge* message. If data forwarding is needed, the candidate SN provides data forwarding addresses to the MN. The candidate SN includes the indication of full or delta RRC configuration, and the list of prepared PSCell IDs to the MN. The candidate SN can either accept or reject each of the candidate cells suggested by the source SN, i.e., it cannot configure any alternative candidates. If subsequent CPAC has been requested, the candidate SN may include an indication of that the SCG radio resource configuration is a complete or delta RRC configuration with respect to the reference SCG configuration. Besides, the candidate SN generates execution conditions for subsequent CPC.

Editor’s note: FFS which node initially generates the reference configuration in subsequent CPAC.

Editor’s note: FFS how/when to generate execution conditions for subsequent CPC, e.g. when the candidate SN decides the candidate PSCells for initial CPC, or after the candidate SN knows all candidate PSCells prepared by other candidate SNs.

3a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message to the candidate SN(s).

4/5. The MN may indicate the candidate PSCells accepted by each candidate SN to the source SN via *SN Modification Request* message before it configures the UE, e.g., when not all candidate PSCells were accepted by the candidate SN(s). If the MN does not send such indication, step 4 and 5 are skipped. If requested, the source SN sends an *SN Modification Request Acknowledge* message and if needed, provides an updated measurement configurations and/or the execution conditions to the MN.

6. The MN sends to the UE an *RRCReconfiguration* message including the CPC configuration or the subsequent CPAC configuration, i.e. a list of *RRCReconfiguration\** messagesand associated execution conditions, in which each *RRCReconfiguration\** messagecontains the SCG configuration in the *RRCReconfiguration\*\** message received from the candidate SN in step 3 and possibly an MCG configuration. Besides, the *RRCReconfiguration* messagecan also include an updated MCG configuration, as well as the NR *RRCReconfiguration\*\**\* message generated by the source SN, e.g., to configure the required conditional measurements. In subsequent CPAC, the *RRCReconfiguration* message may also include a reference SCG configuration.

Editor’s note: FFS if the reference configuration is optional in subsequent CPAC. FFS whether MCG configuration is included in the reference configuration.

Editor’s note: FFS whether the MCG configuration associated with the SCG configuration of a candidate PSCell is included in subsequent CPAC configuration.

7. The UE applies the *RRCReconfiguration* message received in step 6, stores the CPC configuration or the subsequent CPAC configurationand replies to the MN with an *RRCReconfigurationComplete* message, which can include an NR *RRCReconfigurationComplete\*\*\** message. In case the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message, it performs the reconfiguration failure procedure.

8. If an SN RRC response message is included, the MN informs the source SN with the SN *RRCReconfigurationComplete\*\*\** message via *SN Change Confirm* message. If step 4 and 5 are skipped, the MN will indicate the candidate PSCells accepted by each candidate SN to the source SN in the *SN Change Confirm* message.

The MN sends the *SN Change Confirm* message towards the source SN to indicate that CPC or subsequent CPAC is prepared, and in such case the source SN continues providing user data to the UE. If early data forwarding is applied, the MN informs the source SN the data forwarding addresses as received from the candidate SN(s), the source SN, if applicable, together with the Early Status Transfer procedure, starts early data forwarding. The PDCP SDU forwarding may take place during early data forwarding. In case multiple candidate SNs are prepared, the MN includes a list of Target SN ID and list of data forwarding addresses to the source SN.

NOTE 5a: The Xn-U Address Indication procedure may further be invoked to indicate to the source SN to stop already initiated early data forwarding for some PDCP SDUs if they are no longer subject to data forwarding due to the modification or cancellation of the prepared conditional PSCell change.

NOTE 5b: For the early transmission of MN terminated split/SCG bearers, the MN forwads the PDCP PDU to the candidate SN(s).

9a-9d. The source SN may send the *SN Modification Required* message to trigger an update of CPC execution condition and/or corresponding SCG measurement configuration for CPC. In such case in step 9b, the MN reconfigures the UE and in step 9c the UE responds with *RRCReconfigurationComplete*, similarly as in steps 6 and 7.

10. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies *RRCReconfiguration\** message corresponding to the selected candidate PSCell, and sends an *RRCReconfigurationComplete\** message, including an *RRCReconfigurationComplete\*\** message for the selected candidate PSCell, and information enabling the MN to identify the SN of the selected candidate PSCell. In subsequent CPAC, the UE keeps configured candidate PSCell configurations and evaluates the execution conditions of other candidate PSCells for subsequent CPAC.

Editor’s note: FFS whether to support the coexistence of legacy CPA/CPC and subsequent CPAC, i.e. there are some candidates for subsequent CPAC but others for legacy CPA/CPC.

11a-11c. The MN triggers the MN initiated SN Release procedure to inform the source SN to stop providing user data to the UE, and triggers the Xn-U Address Indication procedure to inform the source SN the address of the SN of the selected candidate PSCell and if applicable, starts late data forwarding.

Editor’s note: FFS. It’s up to RAN3 how to notify or release the source SN in subsequent CPAC, e.g. when the source SN is (not) configured as a candidate SN for subsequent CPAC.

12a-12c. If the RRC connection reconfiguration procedure was successful, the MN informs the SN of the selected candidate PSCell via *SN Reconfiguration Complete* message, including the SN *RRCReconfigurationComplete\*\** message. The MN sends the *SN Release Request* message(s) to cancel CPC in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

Editor’s note: FFS. It’s up to RAN3 how to notify the selected target SN in subsequent CPAC.

Editor’s note: FFS. It’s up to RAN3 whether/how to inform other candidate SN(s) in subsequent CPAC.

13. The UE synchronizes to the PSCell indicated in the *RRCReconfiguration\** message applied in step 10.

14. If PDCP termination point is changed for bearers using RLC AM, the source SN sends the *SN Status Transfer* message, which the MN sends then to the SN of the selected candidate PSCell, if needed.

15. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the data forwarding address related information from the MN.

16. The source SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE as described in clause 10.11.2.

NOTE 6: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SN may send the report when the transmission of the related QoS flow is stopped.

17-21. If applicable, a PDU Session path update procedure is triggered by the MN.

22. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

NOTE X: In subsequent CPAC, if the execution condition of one candidate PSCell is satisfied, the UE executes steps 10-21, e.g. based on the configuration provided in step 6.

## 10.6 PSCell change

In MR-DC, a PSCell change does not always require a security key change.

If a security key change is required, this is performed through a synchronous SCG reconfiguration procedure towards the UE involving random access on PSCell and a security key change, during which the MAC entity configured for SCG is reset and RLC configured for SCG is re-established regardless of the bearer type(s) established on SCG. For SN terminated bearers, PDCP is re-established. In all MR-DC options, to perform this procedure within the same SN, the SN Modification procedure as described in clause 10.3 is used, setting the *PDCP Change Indication* to indicate that a S-KgNB (for EN-DC, NGEN-DC and NR-DC) or S-KeNB (for NE-DC) update is required when the procedure is initiated by the SN or including the *SgNB Security Key* / *SN Security Key* when the procedure is initiated by the MN. In all MR-DC options, to perform a PSCell change between different SN nodes, the SN Change procedure as described in clause 10.5 is used.

If a security key change is not required (only possible in EN-DC, NGEN-DC and NR-DC), this is performed through a synchronous SCG reconfiguration procedure without security key change towards the UE involving random access on PSCell, during which the MAC entity configured for SCG is reset and RLC configured for SCG is re-established regardless of the bearer type(s) established on SCG. For DRBs using RLC AM mode PDCP data recovery applies, and for DRBs using RLC UM no action is performed in PDCP. For SRB3 PDCP may discard all stored SDUs and PDUs. Unless MN terminated SCG or split bearers are configured, this does not require MN involvement. In this case, if location information was requested for the UE, the SN informs the MN about the PSCell change (as part of location information) using the SN initiated SN modification procedure independently from the reconfiguration of the UE. In case of MN terminated SCG or split bearers, the SN initiated SN Modification procedure as described in clause 10.3 is used, setting the *PDCP Change Indication* to indicate that a PDCP data recovery is required. If the MN subscribes to PSCell changes to retrieve the SCG UE history information, the SN informs the MN about the SCG UE history information using the SN initiated SN modification procedure when the SCG UE history information changes.

A Conditional PSCell Change (CPC) is defined as a PSCell change that is executed by the UE when execution condition(s) is met. The UE starts evaluating the execution condition(s) upon receiving the CPC configuration, and stops evaluating the execution condition(s) once PSCell change or PCell change is triggered. Intra-SN CPC without MN involvement, inter-SN CPC initiated either by MN or SN are supported.

The following principles apply to CPC:

- The CPC configuration contains the configuration of CPC candidate PSCell(s) and execution condition(s) and may contain the MCG configuration for inter-SN CPC, to be applied when CPC execution is triggered.

- An execution condition may consist of one or two trigger condition(s) (see *CondEvent*, as defined in TS 38.331 [4] or TS 36.331 [10]). Only single RS type and at most two different trigger quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be used for the evaluation of CPC execution condition of a single candidate PSCell.

- Before any CPC execution condition is satisfied, upon reception of PSCell change command or PCell change command, the UE executes the PSCell change procedure as described in clause 10.3 and 10.5 or the PCell change procedure as described in clause 9.2.3.2 in TS 38.300[3] or clause 10.1.2.1 in TS 36.300 [2], regardless of any previously received CPC configuration. Upon the successful completion of PSCell change procedure or PCell change procedure, the UE releases all stored CPC configurations.

- While executing CPC, the UE is not required to continue evaluating the execution condition of other candidate PSCell(s) or PCell(s).

- Once the CPC procedure is executed successfully, the UE releases all stored conditional reconfigurations (i.e. for CPC and for CHO, as specified in TS 38.300 [3] or TS 36.300 [2]).

- Upon the release of SCG, the UE releases the stored CPC configurations.

- MN can inform SN of the maximum number of conditional reconfigurations the SN is allowed to configure for SN initiated CPC including both intra-SN and inter-SN CPC.

CPC configuration in HO command, in PSCell addition/change command or within any conditional reconfiguration (i.e CPA, CPC or CHO configuration) is not supported.

10.19 Conditional Handover with Secondary Node

### 10.19.1 EN-DC

The Conditional Handover with Secondary Node procedure is used for configuration and execution of CHO with SN. This procedure includes the cases where the SN is kept, changed or added. If the SN is kept, the UE context at the SN is kept. If the SN is changed, the UE context at the source SN is moved to the target SN.



Figure 10.19.1-1: Conditional Handover with Secondary Node procedure

Figure 10.19.1-1 shows an example signaling flow for Conditional Handover with Secondary Node.

NOTE 1: For a CHO without SN change, the source SN and the target SN shown in Figure 10.19.1-1 are the same node.

NOTE 2: For a CHO with SN addition, the source SN and steps involving the source SN in Figure 10.19.1-1 are ignored.

1. The source MN starts the conditional handover procedure by initiating the X2 Handover Preparation procedure including MCG configuration and, if the UE is configured with an SCG, SCG configuration. The source MN may include the (source) SN UE X2AP ID, SN ID, the UE context in the (source) SN and the Conditional Handover Information Request IE in the *Handover Request* message.

NOTE 3: In case of the CHO with/without SN change, the source MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration, if configured, before step 1.

2. If the candidate MN decides to keep the UE context in the SN, the candidate MN sends the *SgNB Addition Request* message to the SN including the SN UE X2AP ID as a reference to the UE context in the SN that was established by the source MN. If the candidate MN decides to change the SN allowing delta configuration, the candidate MN sends the *SgNB Addition Request* message to the candidate SN including the UE context in the source SN that was established by the source MN. Otherwise, the candidate MN may send the *SgNB Addition Request* message to the candidate SN including neither the SN UE X2AP ID nor the UE context in the source SN that was established by the source MN. Within the *SgNB Addition Request* message, the candidate MN also includes the CHO related information, i.e., the source MN ID and the MN UE X2AP ID in the source MN, in order to indicate that the SgNB Addition Preparation procedure is triggered in relation to a CHO and to enable the SN to identify requests related to the same UE.

NOTE 3a: The target MN and other potential target MNs may trigger the SgNB Addition Preparation procedure to the same (target) SN.

NOTE 3b: The source MN may initiate additional X2 Handover Preparation procedures towards the same or other target MNs. Based on each X2 Handover Preparation procedure, each target MN may decide to trigger SgNB Addition Preparation procedure.

3. The (candidate) SN replies with the *SgNB Addition Request Acknowledge* message. The (candidate) SN may include the indication of full or delta RRC configuration.

NOTE 4: In CHO with SCG configuration, it is up to the candidate MN implementation to make sure that the CG-Config provided from the (candidate) SN can be used in all CHO preparations.

4. The candidate MN includes within the *Handover Request Acknowledge* message a transparent container to be sent to the UE as an RRC message to perform the conditional handover, and may also provide forwarding addresses to the source MN. The candidate MN indicates to the source MN that the UE context in the SN is kept if the candidate MN and the SN decided to keep the UE context in the SN in step 2 and step 3.

4a. The source MN sends the *Data Forwarding Address Indication* message to the (source) SN. This *Data Forwarding Address Indication* message notifies conditional handover to the (source) SN, which may decide to perform, if applicable, early data forwarding for SN-terminated bearers, together with the sending of an *Early Status Transfer* message to the source MN.

NOTE 4a: Separate Data Forwarding Address Indication procedures may be initiated to provide different forwarding addresses of the prepared conditional handovers. In this case, it is up to the source MN and SN implementations to make sure that the *Early Status Transfer* message(s) from the source SN, if any, is forwarded to the right target MN. The Data Forwarding Address Indication procedure may further be initiated to indicate to the (source) SN to stop already initiated early data forwarding for some SN-terminated bearers, if they are no longer subject to data forwarding due to the modification or cancellation of the prepared conditional handovers.

5. The source MN sends an *RRCConnectionReconfiguration* message to the UE, including the CHO configuration, i.e. a list of *RRCConnectionReconfiguration\** messagesand associated execution conditions, in which each *RRCConnectionReconfiguration\** message contains an MCG configuration and possibly an SCG configuration in the *RRCReconfiguration\*\** messagereceived from the candidate SN in step 3.

6. The UE applies the *RRCConnectionReconfiguration* message received in step 5, stores the CHO configuration and replies to the MN with an *RRCConnectionReconfigurationComplete* message.

7/8. The UE maintains connection with the source MN and, if the UE is configured with a PSCell, with the source PSCell, after receiving CHO configuration, and starts evaluating the CHO execution condition for the candidate cell(s). If at least one CHO candidate cell satisfies the corresponding CHO execution condition, the UE detaches from the source MN, applies the stored corresponding configuration for that selected candidate cell, synchronises to that candidate cell and completes the RRC handover procedure by sending *RRCConnectionReconfigurationComplete\** message to the target MN. If the stored configuration for the selected candidate cell includes an SCG configuration, the UE includes an embedded SN *RRCReconfigurationComplete*\*\* message for the target SN. The UE releases stored CHO configurations after successful completion of RRC handover procedure.

NOTE 5: In case the target SN includes the indication of full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.

9. If configured with bearers requiring SCG radio resources, the UE synchronizes to the (target) SN.

NOTE 6: The order the UE performs Random Access towards the MN (step 7) and performs the Random Access procedure towards the (target) SN (step 9) is not defined.

10. If the RRC connection reconfiguration procedure was successful, the target MN informs the (target) SN via *SgNB Reconfiguration Complete* message.

11. The target MN sends the *Handover Success* message to the source MN to inform that the UE has successfully accessed the target cell.

12a/b. The source MN sends *SgNB Release Request* message to the (source) SN including a Cause indicating MCG mobility and, if applicable, data forwarding information. The source MN indicates to the (source) SN that the UE context in SN is kept, if it receives the indication from the target MN. The (source) SN acknowledges the release request.

12c. The source MN sends the *Handover Cancel* message toward the other signalling connections or other candidate MNs, if any, to cancel CHO for the UE.

12d/e. If the target MN is configured with other candidate PCell(s) associated with other candidate SN(s) than the target SN, the target MN sends the *SgNB Release Request* message(s) to the corresponding candidate SN(s). Other candidate MN(s) send(s) the *SgNB Release Request* message(s) to other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

13a. The (source) SN sends the *Secondary RAT* *Data Usage Report* message to the source MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 7: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SgNB may send the report when the transmission of the related bearer is stopped.

13b. The source MN sends the *Secondary RAT Data Usage Report* message to MME to provide information on the used NR resource.

14. For bearers using RLC AM, the source MN sends the *SN Status Transfer* message, including, if needed, SN Status received from the source SN to the target MN. The target MN forwards the SN Status to the target SN, if needed.

15. If applicable, data forwarding takes place from the source side (i.e. source MN or source SN). If the SN is kept, data forwarding may be omitted for SN-terminated bearers kept in the SN.

16-19. The target MN initiates the S1 Path Switch procedure.

NOTE 8: If new UL TEIDs of the S-GW are included, the target MN performs the MN initiated SN Modification procedure to provide them to the SN.

20. The target MN initiates the UE Context Release procedure towards the source MN.

21. Upon reception of the *UE Context Release* message, the (source) SN releases C-plane related resources associated to the UE context towards the source MN. Any ongoing data forwarding may continue. The SN shall not release the UE context associated with the target MN if the UE context kept indication was included in the *SgNB* *Release Request* message in step 12a.

### 10.19.2 MR-DC with 5GC

The Conditional Handover with Secondary Node procedure is used for configuration and execution of CHO with SN or CHO with candidate SCG(s). This procedure includes the cases where the SN is kept, changed or added. If the SN is kept, the UE context at the SN is kept. If the SN is changed, the UE context at the source SN is moved to the target SN.

CHO with candidate SCG(s) is not supported for NE-DC and NGEN-DC.



Figure 10.19.2-1: Conditional Handover with Secondary Node procedure

Figure 10.19.2-1 shows an example signaling flow for Conditional Handover with Secondary Node.

NOTE 1: For a CHO without SN change, the source SN and the target SN shown in Figure 10.19.2-1 are the same node.

NOTE 2: For a CHO with SN addition, the source SN and steps involving the source SN in Figure 10.19.2-1 are ignored.

1. The source MN starts the conditional handover procedure by initiating the Xn Handover Preparation procedure including MCG configuration and, if the UE is configured with an SCG, SCG configuration. The source MN includes the (source) SN UE XnAP ID, SN ID, the UE context in the (source) SN and the Conditional Handover Information Request IE in the *Handover Request* message.

Editor’s note: FFS. It’s up to RAN3 if/how to indicate the procedure to request CHO with candidate SCG(s).

NOTE 3: In case of the CHO with/without SN change, the source MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration, if configured, before step 1.

2. If the candidate MN decides to keep the UE context in the SN, the candidate MN sends the *SN Addition Request* message to the SN including the SN UE XnAP ID as a reference to the UE context in the SN that was established by the source MN. If the candidate MN decides to change the SN allowing delta configuration, the candidate MN sends the *SN Addition Request* message to the candidate SN including the UE context in the source SN that was established by the source MN. Otherwise, the candidate MN may send the *SN Addition Request* message to the candidate SN including neither the SN UE XnAP ID nor the UE context in the source SN that was established by the source MN. Within the *SN Addition Request* message, the candidate MN also includes the CHO related information, i.e., the source MN ID and the MN UE XnAP ID in the source MN, in order to indicate that the SN Addition Preparation procedure is triggered in relation to a CHO and to enable the SN to identify requests related to the same UE.

NOTE 3a: The target MN and other potential target MNs may trigger the SN Addition Preparation procedure to the same (target) SN.

NOTE 3b: The source MN may initiate additional Xn Handover Preparation procedures towards the same or other target MNs. Based on each Xn Handover Preparation procedure, each target MN may decide to trigger SN Addition Preparation procedure.

3. The (candidate) SN replies with the *SN Addition Request Acknowledge* message. The (candidate) SN may include the indication of the full or delta RRC configuration.

NOTE 4: In CHO with SCG configuration, it is up to the candidate MN implementation to make sure that the CG-Config provided from the (candidate) SN can be used in all CHO preparations.

3a. For the SN terminated bearers using MCG resources, the candidate MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

4. The candidate MN includes within the *Handover Request Acknowledge* message the MN RRC reconfiguration message to be sent to the UE in order to perform the conditional handover, and may also provide forwarding addresses to the source MN. If PDU session split is performed in the target side during handover procedure, more than one data forwarding addresses corresponding to each node are included in the *Handover Request Acknowledge* message. The candidate MN indicates to the source MN that the UE context in the SN is kept if the candidate MN and the SN decided to keep the UE context in the SN in step 2 and step 3. In case of CHO with candidate SCG(s), the candidate PSCell configuration is embedded in the MN RRC reconfiguration message. Besides, the candidate MN also indicates to the source MN the parameters of the execution condition of the candidate PSCell.

Editor’s note: FFS if/how to support event A3/A5 as the execution condition of the candidate PSCell, e.g. if source MN or source SN is allowed to generate the execution condition of the candidate PSCell based on event A3/A5.

4a. The source MN sends the *Xn-U Address Indication* message to the (source) SN. This *Xn-U Address Indication* message notifies conditional handover to the (source) SN, which may decide to perform, if applicable, early data forwarding for SN-terminated bearers, together with the sending of an *Early Status Transfer* message to the source MN.

NOTE 4a: Separate Xn-U Address Indication procedures may be initiated to provide different forwarding addresses of the prepared conditional handovers. In this case, it is up to the source MN and SN implementations to make sure that the *Early Status Transfer* message(s) from the source SN, if any, is forwarded to the right target MN. The Xn-U Address Indication procedure may further be initiated to indicate to the (source) SN to stop already initiated early data forwarding for some SN-terminated bearers, if they are no longer subject to data forwarding due to the modification or cancellation of the prepared conditional handovers.

5. The source MN sends an RRC reconfiguration message to the UE, including the CHO configuration, i.e. a list of RRC reconfiguration\* messagesand associated execution conditions, in which each RRC reconfiguration\* message contains an MCG configuration and possibly an SCG configuration in the RRC reconfiguration\*\* message received from the candidate SN in step 3. For each configuration of CHO with candidate SCG(s), the source MN provides an execution condition for the candidate PCell and an execution condition for the candidate PSCell. Besides, each RRC reconfiguration\* message contains an MCG configuration and an SCG configuration in the RRC reconfiguration\*\* message received from the candidate SN in step 3.

NOTE X: In case of CHO with candidate SCG(s), the source MN can provide multiple CHO configurations for the same candidate PCell (i.e. without SCG configuration or with a SCG configuration of different candidate PSCell).

6. The UE applies the RRC reconfiguration message received in step 5, stores the CHO configuration and replies to the MN with an RRC reconfiguration complete message.

7/8. The UE maintains connection with the source MN and, if the UE is configured with a PSCell, with the source PSCell, after receiving CHO configuration, and starts evaluating the execution condition for the candidate PCell(s) and if any, the execution condition for the candidate PSCell(s).

* If at least one candidate PCell satisfies the corresponding execution condition and the associated candidate PSCell satisfies the corresponding execution condition, the UE detaches from the source MN, applies the stored corresponding configuration for that selected candidate PCell and associated candidate PSCell, synchronises to that candidate PCell, and completes the RRC handover procedure by sending RRC reconfiguration complete\* message to the target MN. The UE includes an embedded SN *RRCReconfigurationComplete*\*\* message for the target SN.
* If at least one candidate PCell satisfies the corresponding execution condition for the candidate PCell and there is no execution condition for an PSCell, the UE detaches from the source MN, applies the stored corresponding configuration for that selected candidate PCell and, if included, associated PSCell, synchronises to that candidate PCell and completes the RRC handover procedure by sending RRC reconfiguration complete\* message to the target MN. If the stored configuration for the selected candidate cell includes an SCG configuration, the UE includes an embedded SN *RRCReconfigurationComplete*\*\* message for the target SN.
* The UE releases stored CHO configurations after successful completion of RRC handover procedure.

NOTE 5: In case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.

9. If configured with bearers requiring SCG radio resources, the UE synchronizes to the (target) SN.

NOTE 6: The order the UE performs Random Access towards the MN (step 7) and performs the Random Access procedure towards the (target) SN (step 9) is not defined.

10. If the RRC connection reconfiguration procedure was successful, the target MN informs the (target) SN via *SN Reconfiguration Complete* message.

Editor’s note: FFS how can the target MN be aware of the target SN selected by the UE.

11. The target MN sends the *Handover Success* message to the source MN to inform that the UE has successfully accessed the target cell.

12a/b. The source MN sends *SN Release Request* message to the (source) SN including a Cause indicating MCG mobility. The source MN indicates to the (source) SN that the UE context in SN is kept, if it receives the indication from the target MN. The (source) SN acknowledges the release request.

12c. The source MN sends *XN-U Address Indication* message to the (source) SN to transfer data forwarding information. More than one data forwarding addresses may be provided if the PDU session is split in the target side.

12d. The source MN sends the *Handover Cancel* message toward the other signalling connections or other candidate MNs, if any, to cancel CHO for the UE.

12e/f. If the target MN is configured with other candidate PCell(s) associated with other candidate SN(s) than the target SN, the target MN sends the *SN Release Request* message(s) to the corresponding candidate SN(s). Other candidate MN(s) send(s) the *SN Release Request* message(s) to other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

13a. The (source) SN sends the *Secondary RAT* *Data Usage Report* message to the source MN and includes the data volumes delivered to and received from the UE over the NR/E-UTRA radio as described in clause 10.11.2.

NOTE 7: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SN may send the report when the transmission of the related QoS is stopped.

13b. The source MN sends the *Secondary RAT Data Usage Report* message to AMF to provide information on the used NR/E-UTRA resource.

14. For bearers using RLC AM, the source MN sends the *SN Status Transfer* message to the target MN, including, if needed, SN Status received from the source SN. The target MN forwards the SN Status to the target SN, if needed.

15. If applicable, data forwarding takes place from the source side (i.e. source MN or source SN). If the SN is kept, data forwarding may be omitted for the SN terminated bearers or QoS flows kept in the SN.

16-19. The target MN initiates the Path Switch procedure*.* If the target MN includes multiple DL TEIDs for one PDU session in the *Path Switch Request* message, multiple UL TEID of the UPF for the PDU session should be included in the *Path Switch Ack* message in case there is TEID update in UPF.

NOTE 8: If new UL TEIDs of the UPF for SN are included, the target MN performs MN initiated SN Modification procedure to provide them to the SN.

20. The target MN initiates the UE Context Release procedure towards the source MN.

21. Upon reception of the *UE Context Release* message from source MN, the (source) SN releases C-plane related resources associated to the UE context towards the source MN. Any ongoing data forwarding may continue. The SN shall not release the UE context associated with the target MN if the UE contest kept indication was included in the *SN Release Request* message in step 12a.

### 10.19.x CHO with candidate SCG(s)

A CHO with candidate SCG(s) is defined as a PCell change with PSCell addition/change that is executed by the UE when the execution conditions for both PCell and the associated PSCell are met. The UE starts evaluating the execution conditions for candidate PCell(s) and candidate PSCell(s) simultaneously upon receiving the CHO with candidate SCG(s) configuration, and stops evaluating the execution conditions once PCell change is triggered. The UE does not execute CHO with candidate SCG(s) until the execution conditions for both PCell and the associated PSCell are met.

Editor’s note: FFS if to stop evaluating the execution conditions once PSCell change is triggered.

## 10.X Subsequent Conditional PSCell Addition or Change

A Subsequent Conditional PSCell Addition or Change (subsequent CPAC) is defined as a conditional PSCell change procedure that is executed after a PSCell addition or PSCell change based on pre-configured CPA or CPC configuration of candidate PSCells without reconfiguration and re-initiation of CPC/CPA. The UE keeps configured candidate PSCell configurations and evaluates the execution conditions of candidate PSCells after a PSCell addition or a PSCell change is triggered. SN initiated intra-SN subsequent CPAC, inter-SN subsequent CPAC initiated either by MN or SN are supported.

Editor’s note: FFS whether to support subsequent CPA, e.g. maintaining candidate PSCell configurations for subsequent CPA after SCG release.

Editor’s note: FFS how many subsequent conditional PSCell changes are targeted, and potential impacts.

The following principles apply to subsequent CPAC:

- The subsequent CPAC configuration may contain a reference SCG configuration, the SCG configuration(s) of candidate PSCell(s) and execution condition(s).

Editor’s note: FFS if the reference configuration is optional in subsequent CPAC. FFS whether MCG configuration is included in the reference configuration. FFS RRC model for the reference configuration.

Editor’s note: FFS whether the MCG configuration associated with the SCG configuration of a candidate PSCell is included in subsequent CPAC.

- Each candidate PSCell configuration can be provided as delta configuration on top of a reference configuration, which is used to form a complete candidate cell configuration. The reference configuration can be managed separately, and the UE stores the reference configuration as a separate configuration. Only one reference configuration is supported.

- The network explicitly configures a conditional reconfiguration for the current serving PSCell if the network wants to use that PSCell as a candidate PSCell for subsequent CPAC.

- The network explicitly releases all conditional reconfigurations for candidate PSCells after a PCell change (at least for inter-MN).

Editor’s note: FFS if and how to release the conditional reconfigurations in other cases, e.g. at intra-MN PCell change, SCG release, etc.

- A candidate PSCell configuration for CPA can be used for subsequent CPC, but with different execution conditions of the candidate PSCell.

Editor’s note: FFS how to handle the security issue in the subsequent CPC, i.e. the same sk-counter/ S-KgNB is used while connected to SN #1 before and after being connected to SN #2 [pending to SA3].

# Annex A - agreement note

## RAN2 agreements

Green highlight – agreement captured in stage-2 specifications

Blue highlight – agreement captured as editor’s notes

No highlight – agreement with no direct impact on specifications

### RAN2#119-e

NR-DC with selective activation of cell groups

* The selective activation of cell groups should correspond to support of subsequent conditional changes (CPC) after a cell group change (normal or conditional). CPA FFS.
* Initial focus on SCG
* There is interest to support delta configuration, to reduce the signalling overhead (FFS if some other objective should be achieved)
* FFS how many subsequent conditional changes are targeted (and what is the impact of such assumption).
* FFS whether there is a security issue: e.g. to determine vertical or horizontal key derivation, e.g. security parameters re-used as part of subsequent CG switch (for the case when UE goes back to a previous cell, maybe in another SN), and FFS on the procedure/method with which the UE derives the SN security, e.g. based on a prior MN config (without RRC CPC config at the time of SN switch).

CHO with one or multiple candidate SCGs

* Observation: Current RAN2 Stage-3 specifications can support CHO including target MCG and target SCG in Rel-17.
* CHO configuration referring to or including CPC/CPA configuration (intended to be applicable together) can be supported.
* FFS: When triggering CHO, UE perform CPC/CPA configuration to start CPC/CPA evaluation, FFS if CHO evaluation and CPC/CPA evaluation is concurrent or sequential.

### RAN2#119bis-e

NR-DC with selective activation of cell groups

* Baseline procedure to support subsequent secondary cell group change (FFS if UE keeps all configurations or if those are indicated by the network, FFS support of nested configs):

a. Step 1: when the execution condition of a CPC candidate PScell is met, a UE performs the execution of CPC towards this candidate PScell.

b. Step 2: After finishing the PSCell addition or change, the UE doesn’t release conditional configuration of other candidate PSCells for subsequent CPC, the UE continues evaluating the execution conditions of other candidate PScells.

c. Step 3: When the execution condition of a candidate PScell is met, the UE performs the execution of CPC towards this candidate PSCell.

* Confirm that “CPA” selective activation of cell groups will be supported for this WI objective
* Confirm that we aim to support delta configuration, i.e. that there need to be a known reference.
* RAN2 aim to support selective activation of cell groups without RRC reconfiguration with respect to security (FFS, need to consult with SA3 at some point in time).

### RAN2#120

NR-DC with selective activation of cell groups

**Delta configuration**

* **A UE stores the reference configuration as a separate configuration.**
* **The reference configuration is managed separately**

CHO with one or multiple candidate SCGs

* **Execution order: the UE doesn’t execute CPC/CPA unless CHO condition is fulfilled (regardless parallel or sequential evaluation)**

### RAN2#121

NR-DC with selective activation of cell groups

* Assume to support the following scenarios of SCG selective activation:
  + - SN initiated intra-SN SCG selective activation
    - MN initiated inter-SN SCG selective activation
    - SN initiated inter-SN SCG selective activation
* It is assumed that if the UE need to be able to return to a current SCG by conditional procedure, then the network could explicitly configure a candidate configuration for that cell.
* In SCG selective activation, the CPC/CPA configurations of the UE should be released after Pcell change, at least for inter MN (by explicit indication from network, FFS other case).
* R2 assumes that a CPA conditional configuration can be used for CPC (but with different triggering conditions)
* For inter-SN CPC, MN should provide the reference configuration to all candidate T-SNs (in order to generate the T-SN candidate configuration).
* R2 understands that A target SN may include an indication in SN Addition Request Ack for each candidate target PSCell, denoting whether the associated SCG configuration is a delta with respect to the reference SCG configuration.

CHO with one or multiple candidate SCGs

* RAN2 agrees to support the simultaneous evaluation of CHO and CPC in Rel-18
* The UE should not need to unpack any of the nested conditionalconfiguration containers in order to measure, acc to agreement above

### RAN2#121bis-e

NR-DC with selective activation of cell groups

* For the reference configuration for SCG Selective Activation, aim at following similar design as LTM.
* For inter-SN SCG Selective Activation, the RRC reconfiguration message containing the Rel-18 CPC configurations provided to the UE is in MN format.
* For MN initiated inter-SN SCG selective activation, source MN generates the execution conditions for the initial CPAC.

FFS on the following options for subsequent CPC:

Option 1: Source MN generates the execution conditions for all subsequent CPC.

Option 2: Candidate SN may generate execution conditions for subsequent CPC.

* For SN initiated inter-SN SCG selective activation, source SN generates the execution conditions for the initial CPC.   
  FFS if Candidate SN may generate/modify execution conditions for subsequent CPC
* Assume for now that there is only one reference configuration.
* The following may be included in the initial RRC reconfiguration message containing the Rel-18 CPC configurations:

1. Reference SCG configuration (Optionality FFS). Assume as for LTM Reference configuration may be empty.

FFS whether MCG configuration is included.

FFS RRC model for the reference configuration.

1. Initial List of candidate target PSCells (this list can be updated by the network, e.g., cells may be added or removed) with associated target SCG configurations. FFS whether the MCG configurations associated with the target SCG configurations are included.

3. The execution conditions associated with each candidate target PSCell.

a. For MN initiated procedure, execution conditions based on event A4 are supported. FFS whether A3/A5 are supported.

b. For SN initiated procedure, execution conditions based on events A3/A5 are supported.

* UE will keep R18 CPC configurations after CPC execution. It should be possible to release a CPC candidate explicitly by RRC reconfiguration procedure.

CHO with one or multiple candidate SCGs

For the CHO+CPC case:

* When both CHO and CPC conditions are met, both CHO and CPC cell change is executed.
* Baseline: The UE waits until both CHO and CPC conditions are met (always). (furthermore, it is assumed that if needed the network can provide a complementary CHO-only configuration, to avoid failures in deployments where failure would otherwise be likely to happen).
* Alternative: FFS if When CHO condition is met, but CPC condition is not met, CHO execution is triggered (and somehow source SCG can be released). IF allowed in the new configuration the UE may continue evaluation of CPC/CPA conditions.

### RAN2#122

NR-DC with selective activation of cell groups

* For SN-initiated SCG selective activation, candidate SN generates execution conditions for subsequent CPC.
* FFS if it shall be possible to do something like MN-initiated CPA/CPC where Candidate SN generate execution conditions for subsequent CPC
* The UE shall skip the condition evaluation for a candidate which is a current PScell.
* The reference configuration is provided to all candidates involved in preparation, FFS which node initially generates it. Assume it can be provided in MN initiated and in SN initiated procedures.
* Will not spend specific efforts for supporting nested configurations for candidate cell configuration.
* Terminology is “Subsequent CPAC”

CHO with one or multiple candidate SCGs

* P3: The CHO execution conditions (for candidate PCells) and CPA/CPC execution conditions (for candidate PSCells) are provided based on the source MeasConfig.
* P4: For CHO execution conditions, the source MN determines the execution conditions on candidate PCells, based on the source MCG MeasConfig.
* P5: For CPA/CPC execution conditions, the candidate MN determines the parameters of the execution conditions for candidate PSCells (e.g. event A4 threshold).
* P6: The candidate MN informs the source MN about the prepared candidate PSCells and parameters of the associated execution conditions (e.g. event A4 threshold). According to the received information from the candidate MN, the source MN generates the corresponding execution conditions based on the source MCG MeasConfig to the UE.
* FFS how, if to support event A3/A5.
* P8: For CHO with candidate SCGs for CPA/CPC, the RRCReconfigurtaion message in one CHO container includes one MCG configuration and one SCG configuration (i.e. similar to Rel-17 CHO with SCG configuration).
* P9: The execution conditions associated with one CHO container includes both CHO execution condition(s) and CPA/CPC execution condition(s), i.e. triggering conditions on both candidate PCell and candidate PSCell.
* P10: If there are multiple candidate PSCells associated with one candidate PCell, the NW can provide multiple CHO configurations for the same candidate PCell, i.e. each one contains one MCG configuration (for the same candidate PCell) and one SCG configuration (for different candidate PSCell).
* P12: When the CPA/CPC execution condition is met but no CHO execution condition is met, the UE continues to evaluate both CHO and CPA/CPC execution conditions.
* For CHO+CPC we only consider execution when BOTH conditions are met.

(When the CHO execution condition is met but no CPC execution condition is met, if there is an available CHO-only or Rel-17 CHO with SCG configuration for which the CHO condition is met, the UE performs the CHO-only or Rel-17 CHO with SCG execution, and THUS the network can handle such situation by providing proper configurations).

## RAN3 agreements

Green highlight – agreement captured in stage-2 specifications

Blue highlight – agreement captured as editor’s notes

No highlight – agreement with no direct impact on specifications

### RAN3#117-e

Selective activation of cell groups

* RAN3 considers SCG selective activation is prioritized in the Rel-18 work. It can be revisited based on RAN2 progress.
* WA: RAN3 considers the Inter-CU and Intra-CU cases with equal priority, and studies both the F1 and Xn signaling aspects. It can be revisited based on RAN2 progress.
* From RAN3 point of view, Rel-16/Rel-17 CPAC procedures are considered as start point for the Rel-18 work.
* The following scenarios are depending on RAN2 progress.
  + SCG failure handling enhancements to enable PSCell addition and PSCell change after SCG failure.
  + Signaling support for inclusion of CPC configuration within a CPC or CPA configuration, in case CPC/CPA configuration is supported within CHO configuration.
* WA: A primary focus of the objective is to enable subsequent cell changes by keeping conditional reconfigurations after a cell change. RAN3 to pursue study of the Xn/F1 signaling changes required to support this objective.

Support CHO in NR-DC

* In Rel.18, RAN3 will continue the work on the CHO with SCG at the target. The scope will be limited to the data forwarding optimizations.
* Regarding CHO with multiple SCGs at the target, RAN3 will wait for the progress in RAN2 before starting signalling design. At the next meeting, RAN3 will open discussion on the data forwarding aspects.
* WA: RAN3 agrees to create a separate chapter in TS 37.340 related to CHO with DC, and to do it as part of the work on the Rel.18 Mobility Enhancements.

### RAN3#117bis-e

Selective activation of cell groups

* RAN3 considers the Inter-CU and Intra-CU cases with equal priority, and studies both the F1 and Xn signaling aspects. It can be revisited based on RAN2 progress. [last meeting’s WA turned into agreement]
* WA: RAN3 will work to enable both indirect and direct early data forwarding in Selective Activation. At this moment, RAN3 does not foresee any scenarios where direct forwarding is not feasible/desired.
* WA (up to RAN2’s discussion): RAN3 assumes the last serving (source) PSCell may remain prepared within the prepared cells for Selective Activation.
* WA: Enhance signalling for Selective Activation.

Support CHO in NR-DC

* There is a need to discuss the avoidance of unnecessary signaling between MN and target SN for CHO + MR-DC.
* Early Data Forwarding optimizations with involvement of the target SCG(s) in Rel-18 will be supported.
* Focus on optimizing duplicated data forwarding scenario.
* There is no issue to identify the same target candidate SN by the source in case direct data forwarding is used on all the forwarding paths/target MNs.
* WA: both direct and indirect data forwarding will be supported.

### RAN3#118

Support CHO in NR-DC

* Direct data forwarding is supported by current specification, FFS on further signalling enhancement.
* Optimization on indirect data forwarding is by network implementation.
* RAN3 acknowledges unnecessary signaling exchange between MN and the target SN would cause inefficiency and extra latency for CHO + NR-DC, the solution is FFS.
* The issue on new problem of CHO with multiple SCGs at the target side is FFS.
* WA: In CHO with (multiple) SCG configuration, the (candidate) SN can acknowledge whether it has direct data forwarding path with source SN. If existed, it can assign the same data forwarding address for multiple data forwarding paths, otherwise, it is up to the candidate SN implementation.

### RAN3#119

Selective activation of cell groups

* Enhance XnAP and F1AP signaling to support NR Selective Activation.
* Introduce a new indicator to the S-NODE ADDITION REQUEST message over Xn to indicate that the request is for Selective Activation.

Support CHO in NR-DC

* Confirm the early data forwarding for CHO with multiple SCGs is a new problem.

### RAN3#119bis-e

Selective activation of cell groups

* R3-232063 (TP to TS 38.423) Support of SCG selective activation was agreed
* RAN3 assumes that a UE can be configured to keep a conditional configuration for CPA after CPA execution. The kept CPA conditional configuration is used for subsequent CPC (but with different triggering conditions). This can be revisited based on RAN2 progress.
* RAN3 should further analyze the impacts if RAN2 decides to support activation/deactivation of candidate PSCell evaluation after the first time SCG selective activation configuration.
* WA: Add a new indication as a sub IE of the Conditional PSCell Addition Information Request IE in the S-NODE ADDITION REQUEST message to indicate that the request is for SCG Selective Activation.
* For inter-SN SCG selective activation, after CPC execution, the MN needs to notify the source SN and the selected SN of the cell change.
* Reuse the following messages to update/modify/cancel the prepared candidate PSCells for SCG Selective Activation:
* SN Modification Request/ SN Modification Request Acknowledge
* SN Modification Required/ SN Modification Confirm
* Conditional PSCell Change Cancel
* SN Change Required/ SN Change Confirm
* SN Release Request / SN Release Request Acknowledge
* RAN3 eliminates the option for UPF-based data forwarding thus assuming that the number of PSCell prepared for Selective Activation will be limited and the serving PSCell will not change too often.
* Reuse the Xn-U Address Indication message and the Early Status Transfer message to support early data forwarding for SCG Selective Activation.

Support CHO in NR-DC

* R3-232172 TP for CHO with NR-DC to TS 37.340 was agreed.
* Working on including a note in TS 37.340 regarding direct data forwarding for CHO with SCG(s).
* Data forwarding optimizations should not impact legacy HO mechanism as the fundamental basis.
* Data forwarding optimizations focus on how to avoid multiple data forwarding paths.
* RAN3 focuses on the following aspects for CHO with multiple SCGs.
  + T-MN provides the PDU session admission results of different T-SN(s) in the HO procedure considering the pair of candidate T-MN and T-SN(s).
  + A set of data forwarding addresses are provided from candidate T-MN to the source node.

### RAN3#120

Selective activation of cell groups

* R3-233524 (TP to TS 38.423) Support of SCG selective activation was agreed.
* Add a new IE as a sub IE of the *Conditional PSCell Change Information Required* IE in the S-NODE CHANGE REQUIRED message to indicate that the request is for SCG Selective Activation.
* Add a new IE as a sub IE of the *Conditional PSCell Addition Information Request* IE in the S-NODE ADDITION REQUEST message to indicate that the request is for SCG Selective Activation.

Support CHO in NR-DC

* Regarding avoiding duplication of the data forwarding:
  + RAN3 confirms the problem that is to be solved is avoiding that the single T-SN receives the same data from multiple T-MNs prepared for CHO (assuming there are multiple T-MNs prepared with the same T-SN).
  + RAN3 agrees to enable the T-SN to let the T-MN know if it has direct path available to S-MN (or to both, S-SN and S-MN).
* Regarding avoiding unnecessary CHO cancellation: RAN3 agrees to enable the T-MN to inform the S-MN if the CHO is prepared with full or delta configuration.

# Annex B – open issue list

## Subsequent CPAC

### RAN2

* FFS how many subsequent conditional changes are targeted, and potential impacts.
* On reference configuration: FFS if the reference configuration is optional. FFS whether MCG configuration is included in the reference configuration. FFS RRC model for the reference configuration.
* FFS whether the MCG configuration associated with the SCG configuration of a candidate PSCell is included.
* FFS if and how to release the conditional reconfigurations in other cases, e.g. at intra-MN PCell change, SCG release, etc.
* FFS how to handle the security issue in the subsequent CPC, i.e. the same sk-counter/ S-KgNB is used while connected to SN #1 before and after being connected to SN #2 [pending to SA3].
* For MN initiated inter-SN SCG selective activation, FFS how to generate execution conditions for subsequent CPC. FFS if it shall be possible to do something like MN-initiated CPA/CPC where Candidate SN generate execution conditions for subsequent CPC.
* For SN initiated inter-SN SCG selective activation, FFS how/when to generate execution conditions for subsequent CPC, e.g. when the candidate SN decides the candidate PSCells for initial CPC, or after the candidate SN knows all candidate PSCells prepared by other candidate SNs.
* FFS whether to support the coexistence of legacy CPA/CPC and subsequent CPAC.

### RAN3

* FFS how to notify the source SN and the selected target SN after CPC execution.
* FFS whether/how to inform other candidate SN(s) in subsequent CPAC.

## CHO with multiple candidate SCGs

### RAN2

* FFS if/how to support event A3/A5 as execution conditions of the candidate PSCell, e.g. if source MN or source SN is allowed to generate execution condition of the candidate PSCell based on event A3/A5.
* FFS if to stop evaluating the execution conditions once PSCell change is triggered.

### RAN3

* FFS if/how to indicate the handover request procedure to request multiple candidate SCGs.
* Data forwarding optimizations