**3GPP T****SG-RAN WG2 Meeting #118-e R2-2206829**

**Online, May 9th – 20th, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **37.340** | **CR** | **0310** | **rev** | **3** | **Current version:** | **17.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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| ***Title:*** | Corrections on TS 37.340 for DCCA enhancement | | | | | | | | | |
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| ***Source to WG:*** | ZTE Corporation, Sanechips, CATT, Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_NR\_DC\_enh2-Core | | | | |  | ***Date:*** | | | 2022-05-27 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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)* | |
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| ***Reason for change:*** | | **For SCG activation and deactivation:**   1. Considering “MCG link recovery while the SCG is deactivated” and “UE-initiated SCG activation via SCG” are not supported in Rel-17, there is no motivation to configure dedicated RACH resource prior to SCG activation, so the Editor’s Note in section 6.1 can be removed. 2. SCG (de)activation is not applicable to NE-DC scenario, but this is not captured in current spec. 3. To capture PDCP duplication can be active when the SCG is not deactivated. 4. Merge some changes proposed in R2-2205245, R2-2205926, R2-2205259, R2-2205446.   **For CPAC:**   1. RAN2 agreed that “RAN2 will not optimize using CPC with deactivated SCG in Rel-17. UEs are not required to support the joint configuration in Rel-17 (i.e. UE behaviour is not specified).” this needs to be reflected in the spec. 2. Events A4/B1 for CPA and MN initiated CPC should be captured in the spec. 3. The Editor’s Note on data forwarding in section 10.5.2 should be removed. 4. The description of CPA/CPC should be updated to improve the readability. 5. Some editorial changes are needed in figures 10.2.1-2, 10.2.2-2, 10.5.1-3, 10.5.1-4, 10.5.2-3 and 10.5.2-4. 6. Various editorial corrections should be fixed. 7. Merge some changes proposed in R2-2204546, R2-2204957, R2-2204802, R2-2205446, R2-2205927, R2-2205527 and R2-2205426. | | | | | | | | |
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| ***Summary of change:*** | | **For SCG activation and deactivation:**   1. Remove the Editor’s Node in section 6.1. 2. Change “MR-DC” into “(NG)EN-DC or NR-DC” in section 7.13. 3. Add “The network ensures the SCG is activated while PDCP duplication is activated for SCG RLC entities associated with a PDCP entitiy” to section 7.13.   From R2-2205245:  1. UE assistance information regarding SCG deactivation preference added to section 7.10;  2. Changed wording in section 10.3.1 and 10.3.2 to ensure SCG activation status is indicated to MN.  From R2-2205367 with some revision:  1. Clarify in section 7.7 that if the SCG failure information initiated is not due to BF on the PSCell while the SCG is deactivated, the UE suspends SCG transmission for all radio bearers.  2. Add “UE transmits UE assistance information to MN when it has UL data to transmit over SCG bearer while the SCG is deactivated.” to section 7.10.  From R2-2205926 with some revision:  1. Clarify in section 6.1 that the PSCell is always activated when the SCG is not deactivated.  2. Clarify in section 6.1 that PHR is not specific to the PSCell, it is for the SCG.  3. Clarify in section 7.13 that when the SCG is deactivated, the UE does not receive from DL-SCH.  From R2-2205259 with some revision:  1. Add the following text to 7.13:  “Upon SCG deactivation and while the SCG is deactivated, the network ensures that there is no uplink control PDU transmission to the deactivated SCG (e.g. the network releases statusReportRequired from PDCP entities of SCG bearers if configured, the network does not perform QoS flow remapping from a DRB associated to the deactivated SCG to another DRB).”  From R2-2205446 with some revision:  1. In 6.1, delete the sentence “the UE does not perform random access when TA timer expires”, because this does not apply to activated SCG either.  **For CPAC:**   1. Add the restriction on non-coexistence of CPA/CPC and SCG deactivation in section 10.1. 2. Add CPA related execution events A4/B1 in section 10.2.3 and CPC related execution events A4/B1 in section 10.6. 3. Remove the Editor’s Note on data forwarding in section 10.5.2. 4. Update the description of CPA, MN initiated CPC and SN initiated CPC procedure, e.g. add some missing descriptions, align the description/terminology in all cases, etc. 5. Update figures 10.2.1-2, 10.2.2-2, 10.5.1-3, 10.5.1-4, 10.5.2-3 and 10.5.2-4 for CPA/CPC, e.g. add the step on release of other potential SNs, update the notation of RRC messages, and correct editorial issues. 6. Fix various editorial corrections.   From R2-2204957:   1. Add some clarification for CPAC modification procedure in section 10.3. 2. Add some clarification on SgNB/SN Change Confirm message for SN initiated conditional SN change procedure in section 10.5.   From R2-2204802 with some revision:   1. Add notes on the handling of full-config for inter-SN CPC in section 10.5.1.   From R2-2205446/R2-2205927/R2-2205527:   1. Add missing “CPA” in section 7.7.   From R2-2205446 with some revision:   1. Add general principles for Conditional PSCell Addition in section 10.2.3. 2. Remove the description that the first UE response message at CPA/CPC does not contain any complete message to the S-SN in section 10.2 and 10.5. 3. Correct that the UE response message does not contain the PSCell at CPA/CPC execution, but information for the MN to identify the target SN in section 10.2 and 10.5. 4. The notation of the RRC messages have been updated in section 10.2 and 10.5, so that the same notation is used for the same type of message in all use cases. No star and one star are used for MN messages, two star for T-SN messages and three star for S-SN messages. 5. Add the description that the UE stops evaluating execution conditions once PCell change is triggered in section 10.6.   From R2-2205927:   1. Clarify that the ULInformationTransferMRDC is only used in intra-SN CPC in section 10.10.   From R2-2205426:   1. Remove the restriction on non-coexistence of CHO and CPC and the Editor's note in section 10.1.   **Impact analysis**  Impacted 5G architecture options:  (NG)EN-DC, NR-DC  Impacted functionality:  SCG (de)activation, CPA, CPC  Inter-operability:  If the network implements the CR and the UE does not, there is no inter-operability issue.  If the UE implements the CR and the network does not, there is no inter-operability issue. | | | | | | | | |
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| ***Consequences if not approved:*** | | Some texts/figures related to SCG activation/deactivation and CPA/CPC are incorrect. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.1, 7.7, 7.10, 7.13, 10.1, 10.2, 10.3, 10.5, 10.6, 10.10 | | | | | | | | |
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|  | | **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:*** | |  | | | | | | | | |

6 Layer 2 related aspects

6.1 MAC Sublayer

In MR-DC, the UE is configured with two MAC entities: one MAC entity for the MCG and one MAC entity for the SCG. The serving cells of the MCG other than the PCell can only be activated/deactivated by the MAC Control Element received on MCG, and the serving cells of the SCG other than PSCell can only be activated/ deactivated by the MAC Control Element received on SCG. The MAC entity applies the bitmap for the associated cells of either MCG or SCG. When the SCG is not deactivated, the PSCell is always activated like the PCell (i.e. deactivation timer is not applied to PSCell). With the exception of PUCCH SCell, one deactivation timer is configured per SCell by RRC.

In MR-DC, semi-persistent scheduling (SPS) resources and configured grant (CG) resources can be configured on serving cells in both MCG and SCG.

In MR-DC, for 4-step RA type, contention based random access (CBRA) procedure is supported on both PCell and PSCell while contention free random access (CFRA) procedure is supported on all serving cells in both MCG and SCG. For 2-step RA type, CBRA can be supported on the PCell, if the MN is a gNB (i.e. for NE-DC and NR-DC) and on the PSCell, if the SN is a gNB (i.e, for EN-DC, NGEN-DC and NR-DC) while CFRA is only supported on the PCell, if the MN is a gNB (i.e. for NE-DC and NR-DC).

In (NG)EN-DC and NR-DC, when SCG is deactivated as described in clause 7.13, the TA timer associated with SCG continues running, the UE considers the TA is valid as long as TA timer is running. In case of SCG activation, the UE can be instructed by the network to perform random access towards PSCell even if the TA timer associated with PSCell is running and RLF and beam failure are not declared. Besides, the UE can be instructed by the network to perform SCG activation without performing random access, if the TA timer associated with PSCell is running and RLM and beam failure detection are configured but RLF or beam failure is not declared. In case of network-initiated SCG activation, both CBRA and CFRA on PSCell are supported. For CFRA, the dedicated RACH resources can be provided in the RRC message used to activate SCG.

In MR-DC, the BSR configuration, triggering and reporting are independently performed per cell group. For split bearers, the PDCP data is considered in BSR in the cell group(s) configured by RRC.

In MR-DC, separate DRX configurations are provided for MCG and SCG. A secondary DRX group can be configured in MR-DC for a cell group that includes cells in different Frequency Ranges as specified in TS 38.331 [4].

In MR-DC, PHR is independently configured per cell group. Events in one cell group can trigger power headroom reporting in both MCG and SCG. Power headroom information for one cell group is also included in a PHR transmitted in the other cell group. While the SCG is deactivated, PHR for SCG is not reported.

In MR-DC, consistent LBT failure recovery procedure as described in clause 5.6.1 in TS 38.300 [3] can be configured for both MAC entities of MCG and/or SCG when operating with shared spectrum channel access.

In MR-DC, for power saving purpose, the UE can be configured with DCP to be monitored on the PCell, if the MN is a gNB (i.e. for NE-DC and NR-DC) and/or with DCP to be monitored on the PSCell, if the SN is a gNB (i.e. for EN-DC, NGEN-DC and NR-DC).

In MR-DC, the UE may be configured with enhanced intra-UE overlapping resources prioritization on MN, if the MN is a gNB (i.e. for NE-DC and NR-DC) and on SN, if the SN is a gNB (i.e. for EN-DC, NGEN-DC and NR-DC).

# 7 RRC related aspects

\*\*\* skip non-related part \*\*\*

7.7 SCG/MCG failure handling

RLF is declared separately for the MCG and for the SCG.

If radio link failure is detected for MCG, fast MCG link recovery is configured and the SCG is not deactivated, the UE triggers fast MCG link recovery. Otherwise, the UE initiates the RRC connection re-establishment procedure. During the execution of PSCell addition or PSCell change, if radio link failure is detected for MCG, the UE initiates the RRC connection re-establishment procedure.

During fast MCG link recovery, the UE suspends MCG transmissions for all radio bearers, except SRB0, and reports the failure with *MCGFailureInformation* message to the MN via the SCG, using the SCG leg of split SRB1 or SRB3.

The UE includes in the *MCGFailureInformation* message the measurement results available according to current measurement configuration of both the MN and the SN. Once the fast MCG link recovery is triggered, the UE maintains the current measurement configurations from both the MN and the SN, and continues measurements based on configuration from the MN and the SN, if possible. The UE initiates the RRC connection re-establishment procedure if it does not receive an *RRCConnectionReconfiguration* message, *RRCReconfiguration* message, *MobilityFromNRCommand* message, *MobilityFromEUTRACommand* message, *RRCConnectionRelease* message or *RRCRelease* message within a certain time after fast MCG link recovery was initiated.

Upon reception of the *MCGFailureInformation* message, the MN can send *RRCConnectionReconfiguration* message, *RRCReconfiguration* message, *MobilityFromNRCommand* message, *MobilityFromEUTRACommand* message, *RRCConnectionRelease* message or *RRCRelease* message to the UE, using the SCG leg of split SRB1 or SRB3. Upon receiving an *RRCConnectionReconfiguration* message, *RRCReconfiguration* message, *MobilityFromNRCommand* message or *MobilityFromEUTRACommand* message, the UE resumes MCG transmissions for all radio bearers. Upon receiving an *RRCConnectionRelease* message or *RRCRelease* message, the UE releases all the radio bearers and configurations.

NOTE 1: It is up to network implementation to guarantee that the RRC-related messages are delivered to the UE by the SN before the release of its control plane resources.

The following SCG failure cases are supported:

- SCG RLF;

- SCG beam failure while the SCG is deactivated;

- SN addition/change failure;

- For EN-DC, NGEN-DC and NR-DC, SCG configuration failure or CPC configuration failure (only for messages on SRB3);

- For EN-DC, NGEN-DC and NR-DC, SCG RRC integrity check failure (on SRB3);

- For EN-DC, NGEN-DC and NR-DC, consistent UL LBT failure on PSCell;

- For IAB-MT, reception of a BH RLF indication from SCG;

- CPA/CPC execution failure.

Upon SCG failure, if MCG transmissions of radio bearers are not suspended, the UE suspends SCG transmissions for all radio bearers if the SCG failure is not triggered by SCG beam failure and reports the *SCGFailureInformation* to the MN, instead of triggering re-establishment. If SCG failure is detected while MCG transmissions for all radio bearers are suspended, the UE initiates the RRC connection re-establishment procedure.

SCG/MCG failure handling by UE also applies to IAB MT.

In all SCG failure cases, the UE maintains the current measurement configurations from both the MN and the SN and the UE continues measurements based on configuration from the MN and the SN if possible. The SN measurements configured to be routed via the MN will continue to be reported after the SCG failure.

NOTE 2: UE may not continue measurements based on configuration from the SN after SCG failure in certain cases (e.g. UE cannot maintain the timing of PSCell).

The UE includes in the *SCGFailureInformation* message the measurement results available according to current measurement configuration of both the MN and the SN. The MN handles the *SCGFailureInformation* message and may decide to keep, change, or release the SN/SCG. In all the cases, the measurement results according to the SN configuration and the SCG failure type may be forwarded to the old SN and/or to the new SN.

In case of CPA/CPC, upon transmission of the *SCGFailureInformation* message to the MN, the UE stops evaluating the CPA/CPC execution condition. The UE is not required to continue measurements for candidate PSCell(s) for execution condition upon transmission of the *SCGFailureInformation* message to the MN.

7.10 UE assistance information

In MR-DC, the UE can be configured to report MCG specific UE assistance information if the MN is a gNB and/or SCG specific UE assistance information if the SN is a gNB, if it prefers an adjustment on the connected mode DRX parameters, the maximum aggregated bandwidth, the maximum number of secondary component carriers, the maximum number of MIMO layers, whether the UE perfers the SCG to be deactivated, and/or the minimum scheduling offset for cross-slot scheduling cycle length for power saving. In these cases, it is up to the network whether to accommodate the preference. SCG specific UE assistance information for power saving can be configured by the network via SRB1 or SRB3. SCG specific UE assistance information for power saving is directly transmitted to the SN via SRB3, if SRB3 is configured, otherwise UE transmits SCG specific UE assistance information for power saving in a transparent container to the MN. UE can implicitly indicate a preference for NR SCG release by indicating zero number of carriers and zero aggregated maximum bandwidth in both FR1 and FR2.

7.13 Activation and Deactivation of SCG

To enable reasonable UE battery consumption while having fast usage of SCG when (NG)EN-DC or NR-DC is configured, an activation/deactivation mechanism of SCG is supported. While the SCG is deactivated, there is no transmission via SCG RLC bearers. Only the NR SCG can be deactivated, and all SCG SCell(s) are in deactivated state while the SCG is deactivated.

Upon SCG deactivation and while the SCG is deactivated, the network ensures that there is no uplink control PDU transmission to the deactivated SCG (e.g. the network releases statusReportRequired from PDCP entities of SCG bearers if configured, the network does not perform QoS flow remapping from a DRB associated to the deactivated SCG to another DRB). The network ensures the SCG is activated while PDCP duplication is activated for SCG RLC entities associated with a PDCP entitiy.

NOTE: Upon SCG (de)activation, it is up to the network to ensure there is no pending SDUs or PDUs in SCG RLC entity (e.g. instructs the UE to perform PDCP data recovery and RLC re-establishment/release, if needed).

While the SCG is deactivated, the UE will not transmit PUSCH, SRS and CSI report on SCG, and the UE is not required to neither monitor PDCCH nor receive DL-SCH on SCG. If configured by the network, the UE performs radio link monitoring on the SCG and beam failure detection on the SCG while SCG is deactivated. In case of SCG activation without performing random access, the network can indicate TCI states to UE for PDCCH/PDSCH reception on PSCell, if not provided, the UE uses the previously activated TCI states.

The MN can configure the SCG as activated or deactivated upon e.g. PSCell addition, PSCell change, RRC Resume or handover. In case the SCG is configured as deactivated, the UE does not perform random access towards the PSCell. The network can trigger SCG RRC reconfiguration (e.g. PSCell change, configuration update) when deactivating the SCG and while the SCG is in deactivated state.

SCG activation can be requested by the MN, by the SN and by the UE. SCG deactivation can be requested by the MN and by the SN. For UL data arrival on SCG bearer(s) while the SCG is deactivated, the UE indicates to the MN that it has UL data to transmit over SCG bearer. During handover procedure, the target MN can indicate the SCG state in the RRC reconfiguration message sent to the UE by the source MN.

Network can configure whether the UE is allowed to indicate a preference for SCG deactivation to the MN.

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.

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 only supported in Master Node to eNB/gNB Change procedure in this release.

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.

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**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.

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.

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**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 CPA and provideing 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. 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 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 and MN terminated split/SCG 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 data forwarding of MN terminated split/SCG bearers, the MN forwards the PDCP PDU to the candidate SN. The MN sends the *Early Status Transfer* message 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, in which 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* messagecan 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, the Conditional Secondary Node Addition procedure can be used for CPA configuration and CPA execution.

**Secondary Node Addition**

Figure 10.2.2-1 shows the SN Addition procedure.

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**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.

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.

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**Figure 10.2.2-2: Conditional Secondary Node Addition procedure**

1. The MN decides to configure CPA 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). 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.

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. 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. 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.

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 and MN terminated split/SCG 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 data forwarding 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, i.e. a list of *RRCReconfiguration\** messagesand associated execution conditions, in which 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.

4. The UE applies the *RRCReconfiguration* message received in step 3, stores the CPA 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.

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.

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*.*

### 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) (CondEvents, 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).

- 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 in conditional configuration (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 CPC, this procedure is used to configure or modify CPA or CPC configuration within the same candidate SN. In case of CPA or 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. 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**

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**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**

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**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.

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**

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**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 or modify 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 (CPC) without MN involvement (SRB3 is used)**

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

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

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

2. The UE applies the new configuration. 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)**

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**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.

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 (CPC) without MN involvement (SRB3 is not used)**

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**Figure 10.3.1-5: SN Modification - SN-initiated without MN involvement and SRB3 is not used to configure 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 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. 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* is forwarded to the SN embedded in RRC Transfer.

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 or CPC, this procedure is used to configure or modify CPA or CPC configuration within the same candidate SN. In case of CPA or 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. This procedure may be initiated by the MN or SN to request the SN or MN to activate or deactivate the SCG.

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

**MN initiated SN Modification**

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**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**

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**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.

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.

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**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 or modify CPC 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 (CPC) without MN involvement (SRB3 is used)**

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

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

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

1. The SN sends the *SN RRC reconfiguration* including CPC configuration to the UE through SRB3.

2. The UE applies the new configuration. 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)**

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

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**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 reconfiguration* message.

3. The UE applies the new configuration and replies with the *RRC reconfiguration complete* message by including the SN RRC reconfiguration complete message.

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 (CPC) without MN involvement (SRB3 is not used)**

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

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**Figure 10.3.2-5: SN Modification – SN-initiated without MN involvement and SRB3 is not used to configure 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 CPC.

1. The SN initiates the procedure by sending the *SN 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 *RRCReconfiguration* message.

3. The UE replies with the *RRCReconfigurationComplete* message by including the SN RRC reconfiguration complete message. 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 *SN 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* is forwarded to the SN embedded in RRC Transfer.

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

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 CPC, the Conditional Secondary Node Change procedure initiated either by the MN or SN is also used for CPC configuration and 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**

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**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, 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**

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**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, 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 CPC configuration and CPC execution.

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**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 CPC. 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* messagecan 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 triggered, the source SN, if applicable, starts early data forwarding. The PDCP PDU and/or PDCP SDU forwarding may take place during early data forwarding.

5. The UE starts evaluating the execution conditions. If the execution conditionof one candidate PSCell is satisfied, the UE applies *RRCConnectionReconfiguration\** message corresponding 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. If configured with bearers requiring SCG radio resources, the UE synchronizes to the PSCell indicated in the *RRCConnectionReconfiguration\** message applied in step 5.

9. 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 CPC configuration and CPC execution.

The SN initiated conditional SN change procedure may also be initiated by the source SN, to modify the existing SN-initiated 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.



**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 the candidate SN(s), 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) including a CPC initiation indication, 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 the candidate SN(s) 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. 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 or/and 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* 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.

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 RRC *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 the candidate SN(s) 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, the source SN, if applicable, starts early data forwarding. The PDCP PDU and/or 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.

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

14. 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, 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, 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 CPC configuration and CPC execution.

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

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 CPC. 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 . 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. 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 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.

3. The MN sends to the UE an *RRCReconfiguration* message including the CPC 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.

4. The UE applies the *RRCReconfiguration* message received in step 3, stores the CPC 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 has been configured via Xn-U Address Indication procedure, the source SN, if applicable, starts early data forwarding. The PDCP PDU and/or PDCP SDU forwarding may take place during early data forwarding.

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.

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.

7a-7c. If the RRC connection reconfiguration procedure was successful, the MN informs the target candidate SN 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.

8. If configured with bearers requiring SCG radio resources the UE synchronizes to the PSCell indicated in the *RRCReconfiguration\** message applied in step 5.

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 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.

**SN initiated conditional SN Change**

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

The SN initiated conditional SN change procedure may also be initiated by the candidate SN, to modify the existing 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.



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

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. 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 the candidate SN(s), 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), including a CPC initiation indication, 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. 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.

4/5. The MN may indicate the candidate PSCells accepted by the 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. 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 or/and the execution conditions to the MN.

6. The MN sends to the UE an *RRCReconfiguration* message including the CPC 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.

7. The UE applies the *RRCReconfiguration* message received in step 6, stores the CPC 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 the candidate SN(s) 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 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, the source SN, if applicable, starts early data forwarding. The PDCP PDU and/or 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.

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

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.

12a-12c. If the RRC connection reconfiguration procedure was successful, the MN informs the SN of the selected PSCell candidate 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.

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.

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.

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) (CondEvents, 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).

- 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.

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

## 10.10 RRC Transfer

### 10.10.1 EN-DC

The RRC Transfer procedure is used to deliver an RRC message, encapsulated in a PDCP PDU between the MN and the SN (and vice versa) so that it may be forwarded to/from the UE using split SRB. The RRC transfer procedure is also used for:

- providing an NR measurement report, NR failure information, NR UE assistance information or intra-SN CPC execution completion from the UE to the SN via the MN. If UE is IAB-MT, providing NR IAB other information from the IAB-MT to the SN via the MN;

- providing MCG failure information from the UE to the MN via the SN and an RRC reconfiguration, or release, or an inter-RAT handover command from the MN to the UE via the SN.

Additional details of the RRC transfer procedure are defined in TS 36.423 [9].

**Split SRB:**



Figure 10.10.1-1: RRC Transfer procedure for the split SRB (DL operation)

Figure 10.10.1-1 shows an example signaling flow for the DL RRC Transfer in case of the split SRB:

1. The MN, when it decides to use the split SRBs, starts the procedure by initiating the RRC Transfer procedure. The MN encapsulates the RRC message in a PDCP-C PDU and ciphers with own keys.

NOTE: The usage of the split SRBs shall be indicated in the Secondary Node Addition procedure or Modification procedure.

2. The SN forwards the RRC message to the UE.

3. The SN may send PDCP delivery acknowledgement of the RRC message forwarded in step 2.



Figure 10.10.1-2: RRC Transfer procedure for the split SRB (UL operation)

Figure 10.10.1-2 shows an example signaling flow for the UL RRC Transfer in case of the split SRB:

1. When the UE provides response to the RRC message, it sends it to the SN.

2. The SN initiates the RRC Transfer procedure, in which it transfers the received PDCP-C PDU with encapsulated RRC message.

**NR measurement report, NR failure information, NR UE assistance information, NR IAB other information or intra-SN CPC execution completion:**



Figure 10.10.1-3: RRC Transfer procedure for NR measurement report, NR failure information, NR UE assistance information, NR IAB other information or intra-SN CPC execution completion

Figure 10.10.1-3 shows an example signaling flow for RRC Transfer in case of the forwarding of the NR measurement report, NR failure information, NR IAB other information from the UE, NR UE assistance information or intra-SN CPC execution completion:

1. When the UE sends a measurement report, NR failure information, NR UE assistance information, NR IAB other information or intra-SN CPC execution completion, it sends it to the MN in a container within *ULInformationTransferMRDC* as specified in TS 36.331 [10].

2. The MN initiates the RRC Transfer procedure, in which it transfers the received NR measurement report, NR failure information, NR UE assistance information, NR IAB other information or intra-SN CPC execution completion as an octet string.

**MCG failure information and RRC Reconfiguration / RRC Release / inter-RAT handover command over SRB3:**



Figure 10.10.1-4: RRC Transfer procedure for MCG failure information

Figure 10.10.1-4 shows an example signaling flow for RRC Transfer in case of the forwarding of the MCG failure information from the UE:

1. When the UE sendsEUTRA *MCGFailureInformation* over SRB3, it sends it to the SN in a container within *ULInformationTransferMRDC* as specified in TS 38.331 [4].

2. The SN initiates the RRC Transfer procedure, in which it transfers the received EUTRA *MCGFailureInformation* as an octet string.

3. The MN initiates the RRC Transfer procedure, in which it transfers the EUTRA *RRCConnectionReconfiguration*, or EUTRA *RRCConnectionRelease*, or *MobilityFromEUTRACommand* as an octet string.

4. The SN sends the received EUTRA RRC message to the UE over SRB3 in a container within *DLInformationTransferMRDC*, as specified in TS 38.331 [4].

### 10.10.2 MR-DC with 5GC

The RRC Transfer procedure is used to deliver an RRC message, encapsulated in a PDCP PDU between the MN and the SN (and vice versa) so that it may be forwarded to/from the UE using split SRB. The RRC transfer procedure is also used for:

- providing a SN measurement report, failure information report, SN UE assistance information or intra-SN CPC execution completion from the UE to the SN;

- providing MCG failure information from the UE to the MN via the SN and an RRC reconfiguration, or release, or an inter-RAT handover command from the MN to the UE via the SN;

- providing F1-C traffic from an IAB-node to the MN via the SN, or F1-C traffic from the MN to an IAB-node via the SN.

Additional details of the RRC transfer procedure are defined in TS 38.423 [5].

**Split SRB:**



Figure 10.10.2-1: RRC Transfer procedure for split SRB (DL operation)

Figure 10.10.2-1 shows an example signaling flow for DL RRC Transfer in case of the split SRB:

1. The MN, when it decides to use the split SRBs, starts the procedure by initiating the RRC Transfer procedure. The MN encapsulates the RRC message in a PDCP PDU and ciphers with own keys.

NOTE: The usage of the split SRBs shall be indicated in the Secondary Node Addition procedure or Modification procedure.

2. The SN forwards the RRC message to the UE.

3. The SN may send PDCP delivery acknowledgement of the RRC message forwarded in step 2.



Figure 10.10.2-2: RRC Transfer procedure for split SRB (UL operation)

Figure 10.10.2-2 shows an example signaling flow for UL RRC Transfer in case of the split SRB:

1. When the UE provides response to the RRC message, it sends it to the SN.

2. The SN initiates the RRC Transfer procedure, in which it transfers the received PDCP PDU with encapsulated RRC message.

**SN measurement report, failure information report, SN UE assistance information or intra-SN CPC execution completion:**



Figure 10.10.2-3: RRC Transfer procedure for SN measurement report, failure information report, SN UE assistance information or intra-SN CPC execution completion

Figure 10.10.2-3 shows an example signaling flow for RRC Transfer in case of the forwarding of the SN measurement report, failure information report, SN UE assistance information or intra-SN CPC execution completion from the UE:

1. When the UE sends an SN measurement report, failure information report, SN UE assistance information, or intra-SN CPC execution completion it sends it to the MN in a container called *ULInformationTransferMRDC* as specified in TS 38.331 [4].

2. The MN initiates the RRC Transfer procedure, in which it transfers the received SN measurement report, failure information, SN UE assistance information or intra-SN CPC execution completion as an octet string.

**MCG failure information and RRC Reconfiguration / RRC Release / inter-RAT handover command over SRB3:**



Figure 10.10.2-4: RRC Transfer procedure for MCG failure information

Figure 10.10.2-4 shows an example signaling flow for RRC Transfer in case of the forwarding of the MCG failure information from the UE:

1. When the UE sends *MCGFailureInformation* over SRB3, it sends it to the SN in a container called *ULInformationTransferMRDC* as specified in TS 38.331 [4].

2. The SN initiates the RRC Transfer procedure, in which it transfers the received *MCGFailureInformation* as an octet string.

3. The MN initiates the RRC Transfer procedure, in which it transfers the *RRCConnectionReconfiguration*, or *RRCReconfiguration*, or *RRCConnectionRelease*, or *RRCRelease*, or *MobilityFromNRCommand*, or *MobilityFromEUTRACommand* as an octet string.

4. The SN sends the received RRC message to the UE in a container called *DLInformationTransferMRDC*, as specified in TS 38.331 [4].

**F1-C traffic transfer:**



Figure 10.10.2-5: Scenario 2: F1-C is transported between IAB-MT and MN (F1-termination node) in NR-DC

1. The IAB-MT sends a F1-AP message encapsulated in SCTP/IP or F1-C related (SCTP/)IP packet to the SN (non-F1-termination node) via split SRB2 in a container within *ULInformationTransfer* encapsulated in a PDCP PDU as specified in TS 38.331 [4].

2. The SN initiates the RRC Transfer procedure, in which it transfers the received PDCP PDU (*ULInformationTransfer* message) including F1-AP message.

3. When the MN (F1-termination node) sends a F1-AP message encapsulated in SCTP/IP or F1-C related (SCTP/)IP packet, it starts the procedure by initiating the RRC Transfer procedure, if split SRB2 is determined to be used and usage of SCG path is determined. The MN sends the F1-AP message to the SN in a container within *DLInformationTransfer* encapsulated in a PDCP PDU specified in TS 38.331 [4].

4. The SN forwards the encapsulated *DLInformationTransfer* in a PDCP PDU as specified in TS 38.331 [4] to IAB-MT.