**3GPP TSG-RAN WG2 Meeting #128 draftR2-2410928**

**Orlando, USA, Nov. 18th – 22nd, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **37.340** | **CR** | **-** | **rev** | **-** | **Current version:** | **18.3.0** |  |
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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:***  | Introduction of NR mobility enhancements Phase 4 in TS 37.340 |
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| ***Source to WG:*** | China Telecom |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_Mob\_Ph4-Core  |  | ***Date:*** | 2024-11-26 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-19 |
|  | *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 canbe 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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* *Rel-20 (Release 20)* |
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| ***Reason for change:*** | This CR is to introduce the support of NR mobility enhancements Phase 4, including inter-CU LTM in DC scenarios. Stage-2 related RAN2 agreements

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| **RAN2#127:*** Inter-CU SCG LTM:

10. Inter-CU SCG LTM preparation can be initiated by source SN.11. The inter-CU SCG LTM configuration, SN generates SCG part configuration, MN includes it into its MN RRC configuration message.12. For inter-CU SCG LTM, the LTM cell switch command MAC CE is sent by source SN.13. RAN2 understands for the security key update of inter-CU SCG LTM, SCPAC security key update mechanism is taken as baseline. We will send LS to SA3 to ask them to take it into account for their works.14. Only SN-initiated inter-SN LTM (including LTM configuration, early DL/UL synch and LTM execution) is supported in Rel-19.* Inter-CU MCG LTM:

15. SCG configuration can be changed in inter-CU MN and leave how to handle SCG part up to NW implementation (e.g. release or reconfiguration).16. Upon execution of inter-CU MN LTM with DC, the UE is required to perform refresh of security key, re-establishment of RLC and PDCP, and MAC reset at both MN and SN side (i.e. Rel-15 principle is applied).17. For the SN key update in inter-CU MN LTM with DC, the UE applies legacy R15 RRC reconfiguration with sync procedure.**RAN2#127bis:**3. The SCPAC-similar security update configuration is introduced for inter-CU SCG LTM, i.e. similar to IEs sk-CounterConfiguration, servingSecurityCellSetId and securityCellSetId. The names of the new IEs are to be discussed in stage3.4. Regarding the candidate and reference configuration generation and signaling design, the following SCPAC-similar principles can be applied for inter-CU SCG LTM as baseline: - The reference configuration for inter-CU SCG LTM at least include SCG part, FFS on MCG part. - FFS: Network ensures that when UE combines the reference and candidate configuration for inter-CU SCG LTM, the configuration generated by UE must contain both MCG and SCG part configurations. - The candidate configuration and reference configuration are modeled as an MN RRCReconfiguration message. - Upon inter-CU SCG LTM, the UE performs reconfiguration with sync towards SCG, but the reconfiguration with sync in MCG is not allowed. - The MN generates the MCG part of the reference configuration (if any), while the SN (source or candidate) generates the SCG part of the reference configuration. - The MN is responsible for the reference configuration generation for SN initiated inter-CU SCG LTM. It can be up to the NW implementation whether to include the MCG part. - The MN can request an SCG reference configuration from any of the involved SNs.5. For SN initiated inter-CU SCG LTM, the candidate SN provides the SCG part configuration of each candidate PSCell, and may also provide the L1 RS (e.g. a list of SSB or a list of CSI-RS) configuration for L1 measurement, early UL sync configuration or TCI-state configuration, to the MN.6. The source SN is responsible to generate the common CSI resource configuration for L1 measurement on candidate SCG cells.7. The MN sends the received L1 RS configuration, early UL sync configuration, or TCI-state configuration of candidate cells to the source SN. And the source SN responds with the common CSI resource configuration to the MN.8. In order to support subsequent inter-CU SCG LTM, the MN needs to transfer, during the LTM preparation phase, the common CSI resource configuration and the collected information of candidate cells to the candidate SN(s). Accordingly, the candidate SN(s) responds with the updated candidate SCG configuration to the MN.9. Upon execution of inter-SN SCG LTM, the UE sends an MN RRCReconfigurationComplete message to the MN, which includes an SN RRCReconfigurationComplete message.10. Re-use legacy LTM Cell Switch Command MAC CE for inter-SN LTM.11. RAN2 confirms to support coexistence of following cases, it is up to network implementation to ensure simultaneous execution for both MCG and SCG will not happen: - Inter-MN LTM and intra-SN LTM - Inter-SN LTM and intra-MN LTM**RAN2#128:**4. RAN2 confirms that inter-CU MCG LTM with SCG addition is supported assuming no much specification effort is required. If there are much specification efforts, we will not have it.5. RAN2 confirms that the inter-CU MCG LTM with intra-SN PSCell change is supported in Rel19.6. From RAN2 perspective, the following coexistence cases in NR-DC can be supported: - Case 1: Intra-CU MCG LTM + Inter-CU MCG LTM - Case 2: Intra-CU SCG LTM + Inter-CU SCG LTMIn coexistence cases of inter-CU MCG/SCG LTM and intra-CU MCG/SCG LTM, when inter-CU MCG or SCG LTM is executed, it’s up to the NW to ensure that maintained LTM candidate configurations are valid, e.g. reconfigure or release invalid intra-CU MCG/SCG LTM candidate configurations. UE does not autonomously release invalid intra-CU candidate configurations.8. RAN2 to support intra-CU SCG LTM in MN RRC message (i.e. MN RRCReconfiguration message), in addition to SN RRC message.9. RAN2 to support intra-CU MCG LTM with SCG configuration.10. It’s up to NW to ensure that the complete configuration includes the MCG part and SCG part configuration when UE combines the reference and candidate configuration for inter-CU SCG LTM.11. RAN2 assumes that how to indicate the list of candidate PSCells from source SN to MN is up to RAN3. From RAN2 perspective, in INM, source SN may send measurement results of candidate PSCells to the MN. The MN then forwards the measurement results to the candidate SN(s), and then the candidate SN(s) determines the LTM candidate cells based on the measurement results and the upper limit for the number of PSCells that can be prepared by each candidate SN. The existing IEs defined in INM can be reused as a baseline. |

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| ***Summary of change:*** | In order to support the features of NR mobility enhancements Phase 4, following procedures and changes are introduced in the stage-2 specification. 1. Add introduction of inter-CU LTM in NR-DC case.
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| ***Consequences if not approved:*** | Rel-19 NR mobility enhancements Phase 4 (including inter-CU LTM in DC scenarios) are not supported by TS 37.340. |
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| ***Clauses affected:*** | 10.1, 10.5.2, 10.6,10.7.2 |
|  |  |
|  | **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 ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R2-2410112 |

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| START OF CHANGES |

# 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.

Similar LTM principles as defined in TS 38.300 [3] apply for MCG LTM and SCG LTM in NR-DC. MCG LTM with SCG release and MCG LTM without SCG change are supported. LTM for simultaneous PCell and PSCell change is not supported. Only SN-initiated SCG LTM is supported. Configuration of inter-MN MCG LTM and intra-SN SCG LTM, and configuration of inter-SN SCG LTM and intra-MN MCG are supported. It is up to network implementation to ensure simultaneous execution for both MCG and SCG LTM will not happen.

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

Subsequent CPAC is only supported for NR-DC. Coexistence of CPAC and subsequent CPAC for the same candidate SN is not supported.

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

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

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| NEXT CHANGE |

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

\*// skip unrelated part //\*

### 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.

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**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 the QMC configuration information managed by the SN, and to allow provision of data forwarding related information before step 1.

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

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

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

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

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

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

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

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

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

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

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

**SN initiated SN Change**

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

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**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. For supporting QMC continuity during mobility, the *SN Change Required* message may contain the information about the QMC configurations at the source SN.

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

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

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

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

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

8. The UE synchronizes to the target SN.

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

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

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

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

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

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

**MN initiated conditional SN Change**

The Conditional Secondary Node Change procedure is initiated by the MN for inter-SN CPC configuration and inter-SN 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 CPAC. The MN also provides the candidate cells recommended by MN via the latest measurement results for the candidate SN(s) to choose and configure the SCG cell(s), 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.

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

3. The MN sends to the UE an *RRCReconfiguration* messageincluding the CPC configuration, 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, together with the Early Status Transfer procedure, starts early data forwarding. The PDCP SDU forwarding may take place during early data forwarding.

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

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

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

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 SN of the selected candidate PSCell via *SN Reconfiguration Complete* message, including the SN *RRCReconfigurationComplete\*\** message. The MN sends the *SN Release Request* message(s) to cancel CPC in the other candidate SN(s), if configured. The other candidate SN(s) acknowledges the release request.

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

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

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

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

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

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

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

**SN initiated conditional SN Change**

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

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

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

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**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 each candidate SN, and may also include the SCG measurement configurations for CPC (e.g. measurement ID(s) to be used for CPC).

2/3. The MN requests each candidate SN(s) to allocate resources for the UE by means of the SN Addition procedure(s), indicating the request is for CPAC, 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.

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

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

6. The MN sends to the UE an *RRCReconfiguration* message including the CPC configuration, 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 each candidate SN to the source SN in the *SN Change Confirm* message.

The MN sends the *SN Change Confirm* message towards the source SN to indicate that CPC 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 address(es), the source SN, if applicable, together with the Early Status Transfer procedure, starts early data forwarding. The PDCP SDU forwarding may take place during early data forwarding. In case multiple candidate SNs are prepared, the MN includes a list of Target SN ID and list of data forwarding addresses to the source SN.

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

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

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

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

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 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.

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

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.

**SN initiated inter-SN SCG LTM without MN changed**

The SN initiated inter-SN SCG LTM procedure is used to configure inter-SN SCG LTM without MN changed.



**Figure 10.5.2-5 SN initiated inter-SN SCG LTM without MN changed**

Figure 10.5.2-5 shows an example signalling flow for the inter-SN SCG LTM initiated by the SN without MN changed:

1. The source SN initiates the inter-SN SCG LTM procedure by sending the *SN Change Required* to the MN providing a list of candidate PSCell(s) for inter-SN SCG LTM preparation. The message also contains candidate node ID(s) and may include an SCG reference configuration. Source SN may send measurement results of candidate PSCells to the MN.

*Editor’s Note: RAN2 assumes that how to indicate the list of candidate PSCells from source SN to MN is up to RAN3.*

2. The MN requests each candidate SN to allocate resources for the UE by means of the SN Addition procedure. The MN also provides a list of KSN and associated sk-Counter values for each candidate SN, and forwards the measurement results to the candidate SN(s). The MN may select one of the candidate SN(s) and request providing the reference SCG configuration as part of the SN Addition procedure. Once obtained, the MN provides the reference configuration to other candidate SN(s).

NOTE X: The MN may trigger the MN-initiated SN Modification procedure (to the source SN) to request a reference configuration for the subsequent inter-SN SCG LTM before step 2, if not provided in step 1.

3. The candidate SN(s) determines the LTM candidate cells based on the measurement results and the upper limit for the number of PSCells that can be prepared by each candidate SN. The candidate SN provides the SCG part configuration of each candidate PSCell, and may also provide the L1 RS (e.g. a list of SSB or a list of CSI-RS) configuration for L1 measurement, early UL sync configuration or TCI-state configuration, by sending *SN Addition Request Acknowledge* message to the MN.

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

5. The MN sends the received L1 RS configuration, early UL sync configuration, or TCI-state configuration of candidate cells to the source SN *via SN Modification Request* message.

6. The source SN generates the common CSI resource configuration for L1 measurement on candidate PSCells. The source SN sends the generated common CSI resource configuration and the updated source SCG configuration to the MN via *SN modification request acknowledge* message.

7. In order to support subsequent inter-CU SCG LTM, the MN needs to transfer, during the LTM preparation phase, the common CSI resource configuration and the collected information of candidate cells to each candidate SN.

8. The candidate SN(s) responds with the updated candidate SCG configuration to the MN.

9. The MN generates the reference configuration for SN initiated inter-CU SCG LTM, which may include the MCG part of the reference configuration generated by the MN (if any), together with the SCG part of the reference configuration generated by the source or candidate SN. The candidate configuration and reference configuration are modeled as an MN RRCReconfiguration message. The MN sends an *RRCReconfiguration* messageto the UE to configure SN-initiated inter-SN SCG LTM.

10. The UE applies the *RRCReconfiguration* message received in step 9, stores the SN-initiated inter-SN SCG LTM configurationand replies to the MN with an *RRCReconfigurationComplete* message, including an SN *RRCReconfigurationComplete* message to the source SN.

11. The MN informs the source SN with the SN *RRCReconfigurationComplete* message via SN Change Confirm message, to indicate that SCG LTM is prepared.

12. In case of SN terminated bearers, early data forwarding may take place. For the early data forwarding of SN terminated bearers, the MN forwards the PDCP SDU to the candidate SN(s). For the early transmission of MN terminated split/SCG bearers, the MN forwards the PDCP PDU to the candidate SN(s).

13. The UE may perform DL synchronization with LTM candidate cell(s) before receiving the cell switch command, as specified in clause 9.2.3.5.2 in TS 38.300 [3].

14a.The UE may perform UL synchronization with LTM candidate cell(s) before receiving the cell switch command, as specified in clause 9.2.3.5.2 in TS 38.300 [3].

14b. The candidate SN(s) transfers the calculated TA value of candidate cell(s) to the source SN via the MN.

*Editor’s Note: Details for TA information transfer procedure is up to RAN3 discussion.*

15. The UE performs L1 measurements on the configured LTM candidate cell(s) and transmits L1 measurement reports to the SN, if the L1 measurement configuration in *RRCReconfiguration* is received in step 9. The UE starts to perform L1 measurements once the L1 measurement configuration is applicable.

16. The source SN decides to execute cell switch to a target PSCell.

17. The source SN transmits an LTM cell switch command MAC CE triggering cell switch by including a target configuration ID and other related information for the target PSCell, as specified in clause 9.2.3.5.2 in TS 38.300 [3]. The UE switches to the target PSCell and applies the candidate configuration indicated by the target configuration ID.

18/19. The source SN sends a notification message to the target SN via the MN, to indicate the triggering of LTM to the UE.

*Editor’s Note: Details for Cell Switch Notification procedure is up to RAN3 discussion.*

20. The UE performs the random access procedure towards the target PSCell, if the UE does not have valid TA of the target PSCell.

21. The UE sends an MN *RRCReconfigurationComplete* message to the MN, which includes an SN *RRCReconfigurationComplete* message to the target SN.

22. The MN informs the target SN that the UE has completed the reconfiguration procedure successfully via *SN Reconfiguration Complete* message, including the SN *RRCReconfigurationComplete* message.

23~29. *Editor’s Note: Details for related procedures and descriptions are up to RAN3 discussion.*

NOTE X: The steps 13-29 can be performed multiple times for subsequent SCG LTM cell switch execution using the SCG LTM candidate configuration(s) provided in step 9.

*Editor’s Note: In the above descriptions and signalling flow for the overall procedure of SN-initiated inter-SN SCG LTM, the detail procedures and messages between MN, source or candidate SN(s) are up to RAN3 discussion.*

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10.6 PSCell change

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

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

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

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

The following principles apply to CPC:

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

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

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

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

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

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

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

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

An SCG LTM is defined as a PSCell cell switch procedure that the network triggers via MAC CE. Intra-SN SCG LTM without MN involvement and inter-SN SCG LTM initiated by SN without MN changed are supported. Inter-MN MCG LTM with intra-SN PSCell change is supported.

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10.7 Inter-Master Node handover with/without Secondary Node change

\*// skip unrelated part //\*

### 10.7.2 MR-DC with 5GC

Inter-MN handover with/without MN initiated SN change is used to transfer UE context data from a source MN to a target MN while the UE context at the SN is kept or moved to another SN. During an Inter-Master Node handover, the target MN decides whether to keep or change the SN (or release the SN, as described in clause 10.8). Only intra-RAT Inter-Master node handover with/without SN change is supported (e.g. no transition from NGEN-DC to NR-DC). Inter-MN MCG LTM with SCG release or without SN change, inter-MN MCG LTM with SCG addition are supported. In case of inter-MN MCG LTM without SN change, SCG configuration can be changed.



Figure 10.7.2-1: Inter-MN handover with/without MN initiated SN change procedure

Figure 10.7.2-1 shows an example signalling flow for inter-MN handover with or without MN initiated SN change:

NOTE 1: For an Inter-Master Node handover without Secondary Node change, the source SN and the target SN shown in Figure 10.7.2-1 are the same node.

1. The source MN starts the handover procedure by initiating the Xn Handover Preparation procedure including both MCG and SCG configuration. The source MN includes the source SN UE XnAP ID, SN ID and the UE context in the source SN in the *Handover Request* message.

NOTE 2: The source MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration and the QMC configuration information managed by the SN and to allow provision of data forwarding related information before step 1.

2. If the target MN decides to keep the UE context in source SN, the target MN sends *SN Addition Request* to the SN including the SN UE XnAP ID as a reference to the UE context in the SN that was established by the source MN. If the target MN decides to change the SN allowing delta configuration, the target MN sends the *SN Addition Request* to the target SN including the UE context in the source SN that was established by the source MN. Otherwise, the target MN may send the *SN Addition Request* to the target SN including neither the SN UE XnAP ID nor the UE context in the source SN that was established by the source MN.

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

NOTE 2a0: Void.

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

4. The target MN includes within the *Handover Request Acknowledge* message the MN RRC reconfiguration message to be sent to the UE in order to perform the handover, and may also provide forwarding addresses to the source MN. If PDU session split is performed in the target side during handover procedure, more than one data forwarding addresses corresponding to each node are included in the *Handover Request Acknowledge* message. The target MN indicates to the source MN that the UE context in the SN is kept if the target MN and the SN decided to keep the UE context in the SN in step 2 and step 3.

5a/5b. The source MN sends *SN Release Request* message to the (source) SN including a Cause indicating MCG mobility. The (source) SN acknowledges the release request. The source MN indicates to the (source) SN that the UE context in SN is kept, if it receives the indication from the target MN. If the indication as the UE context kept in SN is included, the SN keeps the UE context.

5c. The source MN sends XN-U Address Indication message to the (source) SN to transfer data forwarding information. More than one data forwarding addresses may be provided if the PDU session is split in the target side.

6. The source MN triggers the UE to perform handover and apply the new configuration.

7/8. The UE synchronizes to the target MN and replies with MN RRC reconfiguration *complete* message.

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

NOTE 2a1: The order the UE performs Random Access towards the MN (step 7) and performs the Random Access procedure towards the SN (step 9) is not defined.

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

11a. The source SN sends the *Secondary RAT* *Data Usage Report* message to the source MN and includes the data volumes delivered to and received from the UE over the NR/E-UTRA radio as described in clause 10.11.2.

NOTE 2a2: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SN may send the report when the transmission of the related QoS is stopped.

11b. The source MN sends the *Secondary RAT Report* message to AMF to provide information on the used NR/E-UTRA resource.

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

13. If applicable, data forwarding takes place from the source side. If the SN is kept, data forwarding may be omitted for SN terminated bearers or QoS flows kept in the SN.

14-17. The target MN initiates the Path Switch procedure*.* If the target MN includes multiple DL TEIDs for one PDU session in the *Path Switch Request* message, multiple UL TEID of the UPF for the PDU session should be included in the *Path Switch Ack* message in case there is TEID update in UPF.

NOTE 3: If new UL TEIDs of the UPF for SN are included, the target MN performs MN initiated SN Modification procedure to provide them to the SN.

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

19. Upon reception of the *UE Context Release* message from source MN, the (source) SN releases C-plane related resources associated to the UE context towards the source MN. Any ongoing data forwarding may continue. The SN shall not release the UE context associated with the target MN if the UE contest kept indication was included in the *SN Release Request* message in step 5.

**Inter-MN MCG LTM with SCG release or without SN change or SN addition**

*Editor’s Note: Details are FFS.*

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