3GPP TSG-RAN WG2 Meeting #113bis Electronic R2-21xxxxx

Online, 12 – 20 April 2021

**Agenda item:**

**Source: CATT**

**Title: TP Introduction of CPA and inter-SN CPC for 37.340**

**WID/SID: LTE\_NR\_DC\_enh2-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This is the TP to capture the agreements made for introduction of CPA and inter-SN CPC in TS 37.340. Note that the CPA and MN initiated inter-SN CPC agreements are captured in the TP. The agreements of SN initiated inter-SN CPC will be captured after reaching agreements based on the email discussion [Post113-e][234].

**Agreements**

**Set 1A: general/procedure**

1. Maintain Rel-15 principle that only one PScell is active at a time even with conditional PScell addition/change.
2. Usage of CPAC is decided by the network. The UE evaluates when the condition is valid.
3. The baseline operation for CPAC procedure assumes the RRC Reconfiguration message contains SCG addition/change triggering condition(s) and the RRC configuration(s) for candidate target PSCells. The UE accesses the prepared PSCell when the relevant condition is met.
4. CPAC execution condition and/or candidate PSCell configuration can be updated by modifying the existing CPAC configuration.
5. Support configuration of one or more candidate cells for CPAC.
6. UE is not required to continue evaluating the triggering condition of other candidate PSCell(s) during CPC/CPA execution.
7. For FR1 and FR2, leave it up to UE implementation to select the candidate PSCell if more than one candidate cell meets the triggering condition. UE may consider beam information in this.
8. No additional optimizations with multi-beam operation are introduced to improve RACH performance for CPAC completion with multi-beam operation.

**Set 1B: trigger/ condition related**

1. For conditional PSCell addition, the MN decides on the conditional PSCell addition execution condition. FFS for PSCell Change.
2. The execution condition for CPAC is defined by a measurement identity which identifies a measurement configuration.

11 For conditional PSCell change, A3/A5 execution condition should be supported while for conditional PSCell addition, A4/B1 like execution condition should be supported.

12 Allow having multiple triggering conditions (using “and”) for CPAC execution of a single candidate cell. Only single RS type per CPAC candidate is supported. At most two triggering quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be configured simultaneously.

13 Cell level quality is used as baseline for CPAC execution condition;

14 Only single RS type (SSB or CSI-RS) per candidate PSCell is supported for PSCell change.

15 TTT is supported for CPAC execution condition (as per legacy configuration)

**Set 1C: signalling related**

16 Reuse the RRCReconfiguration/RRCConnectionReconfiguration procedure to signal CPAC configuration to UE following Rel-16 signalling.

17 Multiple candidate PSCells can be sent in either one or multiple RRC messages.

18 As part of the CPAC configuration to be sent to the UE, the RRC container is used to carry candidate PSCell configuration, and the MN is not allowed to alter any content of the configuration from the PSCell. Moreover, in case of SN change, source SN is not allowed to alter any content of the configuration from the target SN. FFS on which RRC format is used (can be considered in stage-3)

19 For conditional PSCell addition, the MN transmits the final RRCReconfiguration/ RRCConnectionReconfiguration message to the UE. **FFS how the encapsulation is done exactly (can be considered in Stage-3).**

 Agreements

* In MN initiated inter-SN CPC and CPA, the MN is not required to indicate the execution condition(s) to other involved entities (e.g. target SN, source SN).
* For CPA and MN initiated Inter-SN CPC, the MN generates and transmits the conditional configuration message (i.e. RRCReconfiguration/RRCConnectionReconfiguration message) to the UE. The RRCReconfiguration provided by the candidate PSCell(s) is encapsulated in the final conditional reconfiguration message to the UE. The MN is not allowed to alter the RRCReconfiguration provided by the candidate PSCell(s).

**Agreements**

**1: Option 1 should be used for the generation of conditional reconfiguration for SN initiated inter-SN conditional PSCell change.**

**Option 1: The MN generates CPC. The source SN sets the execution condition and communicates it to the MN. The MN generates the conditional reconfiguration message including the execution condition(s) provided by the source SN and RRCReconfiguration provided by the candidate PSCell(s).**

Agreement for RAN2#113e

Agreements

1 In SN initiated CPC with MN involvement, the source SN transfers the execution condition(s) to the MN. FFS whether MN needs to comprehend the execution condition set by the source SN. FFS on stage-3 detail of coding of execution condition(s) in the final message.

2 Only SRB1 can be used in CPA and Inter-SN CPC scenarios in Rel-17. The complete message upon CPAC execution for CPA and Inter-SN CPC in Rel-17 should be provided to the MN via SRB1.

3 For the transmission of CPAC configuration, upon reception of RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, the UE shall reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to the MN to inform that the message has been received. FFS if the message contains an embedded RRC complete message to the SN.

4 UE checks the validity of CPAC execution criteria configuration immediately on receiving the CPAC Reconfiguration message.

 Compliance check for embedded RRCReconfiguration may be delayed until execution (up to UE implementation).

5 At least the following two options should be discussed for the transmission of RRC complete message upon the CPAC execution.

Option 1: If SRB1 is used for the transmission, in CPA and Inter-SN CPC, upon execution of CPAC, the UE shall reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to the MN including an embedded RRC complete message to the SN, and then the MN informs the target SN. This assumes the scenario where the MCG configuration is/can be changed upon triggering the CPA and/or inter-SN CPC.

Option 2: If SRB1 is used for the transmission, in CPA and Inter-SN CPC, upon execution of CPAC, the ULInformationTransferMRDC should be used to transfer the complete message (as for intra-SN CPC). This assumes the scenario where the MCG configuration is not changed upon triggering the CPA and/or inter-SN CPC.

6 FFS if the configurations of all candidates PSCell configurations for CPA and Inter-SN PSCell change are released upon the successful completion of CPAC, conventional PSCell change or conventional PSCell addition.

7 FFS if SCGFailureInformation procedure can be taken as the baseline for CPAC failure handling in Rel-17 scenarios.

Agreements

5 For CPC initiated by MN, A4/B1 like execution condition should be supported.

6 FFS can be removed from the following agreement: " Compliance check for embedded RRCReconfiguration may be delayed until execution (up to UE ‎implementation). FFS if this introduces specification changes regarding compliance checking of ‎embedded Reconfiguration message containing configuration of conditional PSCell candidate.‎"

7 Non-conditional SCG RRC Reconfiguration can be sent in the same MN generated RRCRconfiguration message, which carries execution conditions and target candidate configurations. i.e. ‎the secondaryCellGroup can be sent in the same configuration message with the ‎conditionalReconfiguration for inter-SN CPC.

8a In case of CPA and MN initiated Inter-SN CPC, upon reception of ‎RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, UE responds with RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to the MN to inform ‎that the message has been received. The message does not include an embedded RRC complete message for source SN.

8b In case of SN initiated Inter-SN CPC, upon reception of ‎RRCReconfiguration/RRCConnectionReconfiguration message with CPAC configuration, UE responds with RRCReconfigurationComplete/RRCConnectionReconfigurationComplete message to MN. This message can include an embedded RRC complete message for source SN.

9 The message carrying ‎conditionalReconfiguration for CPA/CPC is in MN format (i.e. contains ‎both MCG and SCG re-configurations). For the following cases: a). MN-Initiated CPA b). MN-Initiated inter-SN CPC c). SN-initiated inter-SN CPC.

10 In CPA and Inter-SN CPC, upon execution of CPAC, ‎the UE ‎shall ‎reply the RRCReconfigurationComplete/RRCConnectionReconfigurationComplete ‎message to ‎the MN ‎including an embedded RRC complete message to the SN, and then the MN ‎informs the ‎target SN.

11 Working assumption: the configurations of all candidates PSCell configurations for CPA and Inter-SN PSCell change are ‎released upon the successful completion of CPAC, conventional PSCell change or conventional PSCell ‎addition.‎ This can be revisited if critical issues found in a later stage.

12 SCGFailureInformation procedure can be taken as the baseline for CPAC failure ‎handling in Rel-17 ‎scenarios.‎

FFS on the exact content of the message.

FFS if time allows on further ‎enhancements to CPAC failure handling‎

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START OF CHANGE

## 3.1 Definitions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [18], between two or more nearby UEs, using NR technology but not traversing any network node.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 3.2 Abbreviations

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

CHO Conditional Handover

CLI Cross Link Interference

CPA Conditional PSCell AdditionCPC Conditional PSCell Change

DC Intra-E-UTRA Dual Connectivity

DCP DCI with CRC scrambled by PS-RNTI

EN-DC E-UTRA-NR Dual Connectivity

IAB Integrated Access and Backhaul

MCG Master Cell Group

MN Master Node

MR-DC Multi-Radio Dual Connectivity

NE-DC NR-E-UTRA Dual Connectivity

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

NR-DC NR-NR Dual Connectivity

SCG Secondary Cell Group

SMTC SS/PBCH block Measurement Timing Configuration

SN Secondary Node

V2X Vehicle-to-Everything

NEXT OF CHANGE

## 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, and fast MCG link recovery is configured, the UE triggers fast MCG link recovery. Otherwise, the UE initiates the RRC connection re-establishment procedure. During the execution of CPC/CPA, 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 and reports the failure with *MCG Failure Information* message to the MN via the SCG, using the SCG leg of split SRB1 or SRB3.

The UE includes in the *MCG Failure Information* 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 *RRC reconfiguration* message, *MobilityFromNRCommand* message, *MobilityFromEUTRACommand* message or *RRC release* message within a certain time after fast MCG link recovery was initiated.

Upon reception of the MCG Failure Indication, the MN can send *RRC reconfiguration* message, *MobilityFromNRCommand* message, *MobilityFromEUTRACommand* message or *RRC release* message to the UE, using the SCG leg of split SRB1 or SRB3. Upon receiving an *RRC reconfiguration* message, *MobilityFromNRCommand* message or *MobilityFromEUTRACommand* message, the UE resumes MCG transmissions for all radio bearers. Upon receiving an *RRC release* 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;

- SN 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;

- CPC execution failure.

Upon SCG failure, if MCG transmissions of radio bearers are not suspended, the UE suspends SCG transmissions for all radio bearers and reports the SCG Failure Information 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 *SCG Failure Information* message the measurement results available according to current measurement configuration of both the MN and the SN. The MN handles the *SCG Failure Information* 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 CPC, upon transmission of the *SCG Failure Information* message to the MN, the UE stops evaluating the CPC execution condition. The UE is not required to continue measurements for candidate PSCell(s) for execution condition upon transmission of the SCG Failure Information message to the MN.

NEXT OF CHANGE

## 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, this procedure is used to configure CPA configuration. Figure 10.2.1-1 shows the Secondary Node Addition procedure.



Figure 10.2.1-1: Secondary Node Addition procedu`re

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 SN may reject the 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.

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. In case of CPA, the MN generates the conditional *RRCConnectionReconfiguration* message containing the candidate PSCell configuration received from the candidate SN and the MN configuration, and sets the execution condition for each candidate PSCell. The MN indicates the CPA configuration (including the conditional *RRCConnectionReconfiguration* message and the associated execution condition) to the UE in the *RRCConnectionReconfiguration* message which can also include the new configuration of MN.

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. In case of CPA, the UE applies the new configuration not including the CPA configuration and replies to MN with *RRCConnectionReconfigurationComplete* message, without NR RRC response message.

4a. In case of CPA, the UE starts evaluating the CPA execution conditions for candidate PSCell(s) after receiving CPA configuration. If at least one CPA candidate PSCell satisfies the corresponding CPA execution condition, the UE applies the stored corresponding configuration for the selected candidate PSCell and synchronises to that candidate PSCell. The UE completes the CPA execution procedure by sending an *RRCConnectionReconfigurationComplete* message, including a NR RRC *RRCReconfigurationComplete* message for the new PSCell, to the MN.

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, 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.

### 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, this procedure is used to configure CPA configuration. The CPA configuration cannot be used to configure NE-DC. Figure 10.2.2-1 shows the SN Addition procedure.



Figure 10.2.2-1: SN Addition procedure

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

 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. 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. In case of CPA, the MN generates the conditional MN RRC reconfiguration message containing the candidate PSCell configuration received from the candidate SN and the MN configuration, and sets the execution condition for each candidate PSCell. The MN indicates the CPA configuration (including the conditional MN RRC reconfiguration message and the associated execution condition) to the UE in the MN RRC reconfiguration message which can also include the new configuration of MN.

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. In case of CPA, the UE applies the new configuration not including the CPA configuration and replies to MN with MN RRC reconfiguration complete message, without NR SN RRC response message.

4a. In case of CPA, the UE starts evaluating the CPA execution conditions for candidate PSCell(s) after receiving CPA configuration. If at least one CPA candidate PSCell satisfies the corresponding CPA execution condition, the UE applies the stored corresponding configuration for the selected candidate PSCell and synchronises to that candidate PSCell. The UE completes the CPA execution procedure by sending an MN RRC reconfiguration complete message, including a NR RRC *RRCReconfigurationComplete* message for the new PSCell, to the MN.

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, 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*.*

NEXT OF CHANGE

## 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 Secondary Node Change procedure initiated either by MN or SN is also used to configure CPC configuration.

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

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

**MN initiated SN Change**



Figure 10.5.1-1: SN Change – MN initiated

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

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

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

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 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. In case of CPC, the MN generates the conditional *RRCConnectionReconfiguration* containing the candidate PSCell configuration received from the candidate SN and the MN configuration, and sets the execution condition for each candidate PSCell. The MN indicates the CPC configuration (including the conditional *RRCConnectionReconfiguration* message and the associated execution condition) to the UE in the *RRCConnectionReconfiguration* message which can also include the new configuration of MN.

5. 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. In case of CPC, the UE applies the new configuration not including the CPC configuration and replies to MN with *RRCConnectionReconfigurationComplete* message, without NR RRC response message.

5a. In case of CPC, The UE maintains the connection with source SN after receiving the CPC configuration, and starts evaluating the CPC execution conditions for candidate PSCell(s). If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE detaches from the source SN and applies the corresponding stored configuration for the selected candidate PSCell and synchronises to that candidate PSCell. The UE completes the CPC execution procedure by sending an *RRCConnectionReconfigurationComplete* message, including a NR RRC *RRCReconfigurationComplete* message for the new PSCell, to MN.

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.

NEXT OF CHANGE

### 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. In case of CPC, the Secondary Node Change procedure initiated either by MN or SNis also used to configure CPC configuration

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.

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.

4The 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. In case of CPC, the MN generates the conditional MN RRC reconfiguration message containing the candidate PSCell configuration received from the candidate SN and the MN configuration, and sets the execution condition for each candidate PSCell. The MN indicates the CPC configuration (including the conditional MN RRC reconfiguration message and the associated execution condition) to the UE in the MN RRC reconfiguration message which can also include the new configuration of MN.

5. 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. In case of CPC, The UE applies the new configuration not including the CPC configuration and replies to MN with MN RRC reconfiguration complete message, without SN RRC response message.

5a. In case of CPC, the UE maintains the connection with source SN after receiving the CPC configuration, and starts evaluating the CPC execution conditions for candidate PSCell(s). If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE detaches from the source SN and applies the stored corresponding configuration for the selected candidate PSCell and synchronises to that candidate PSCell. The he UE completes the CPC execution procedure by sending an MN RRC reconfiguration complete message, including a NR RRC *RRCReconfigurationComplete* message for the new PSCell, to MN.

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

NEXT OF CHANGE

## 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 bearers using RLC AM mode PDCP data recovery applies, for bearers using RLC UM no action is performed in PDCP while for SRBs PDCP discards 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.

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 is triggered. Intra-SN CPC, 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 the MN configuration for CPA and inter-SN CPC.

- An execution condition may consist of one or two trigger condition(s) (CPC events A3/A5, as defined in [4]). Only single RS type is supported and at most two different trigger quantities (e.g. RSRP and RSRQ, RSRP and SINR, etc.) can be configured simultaneously for the evalution 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], 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 CPC configurations.

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

CPC configuration in HO command, PSCell change command or conditional configuration is not supported.

END OF CHANGE