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

**, Apr 12 – Apr 20, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **Current version:** | **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:*** |  | | | | | | | | | |
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| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_feMob-Core | | | | |  | ***Date:*** | | | 16 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | There are some restrictions on what other features that can be configured together with a DAPS handover. Only some of these restrictions are however captured in 36.300 whereas the restrictions that UDC or EHC cannot be configured during a DAPS handover are missing.  For the features that cannot be configured together with a DAPS handover (CA, DC, EHC, UDC and CHO) it is not clear from the specifications when the target node can configure the UE with them again. It was confirmed at RAN2#113bis-e that the target node can configure those features again in the RRC Reconfiguration message that includes *daps-SourceRelease*, i.e. the same message that completes the DAPS handover. This needs to be captured in the specifications. | | | | | | | | |
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| ***Summary of change:*** | | The restrictions that UDC and EHC features cannot be configured together with DAPS handover are captured in 10.1.2.1.1.  It is captured in 10.1.2.1.0 that the target eNB can configure the UE with additional serving cells (for CA and/or DC) again in the same message that releases the source PCell and completes the DAPS handover.  It is captured in 10.1.2.1.1 that the features that cannot be configured simultaneously with DAPS handover can be configured again in the same *RRCConnectionReconfiguration* message that releases the source cell.  **Impact Analysis**  Impacted functionality:  DAPS handover, Conditional Handover  Inter-operability:  1. If the network is implemented according to the CR and the UE is not, the UE may consider it an error if the other features are configured in the RRCConnectionReconfiguration message that includes *daps-SourceRelease*.  2. If the UE is implemented according to the CR and the network is not, the network may attempt to configure UDC or EHC simultaneously with the DAPS handover which will cause the UE to reject the handover. | | | | | | | | |
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| ***Consequences if not approved:*** | | It is not clear from the Stage-2 whether it is possible to configure UDC or EHC while DAPS handover is configured. It is not clear from the specifications whether it is possible for the target eNB to include configuration of CA, DC, EHC, UDC or CHO in the *RRCConnectionReconfiguration* message that includes *daps-SourceRelease*. | | | | | | | | |
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| ***Clauses affected:*** | | 10.1.2.1.0, 10.1.2.1.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

#### 10.1.2.1 Handover

##### 10.1.2.1.0 General

The intra E-UTRAN HO of a UE in RRC\_CONNECTED state is a UE-assisted network-controlled HO, with HO preparation signalling in E-UTRAN:

- Part of the HO command comes from the target eNB and is transparently forwarded to the UE by the source eNB;

- To prepare the HO, the source eNB passes all necessary information to the target eNB (e.g. E-RAB attributes and RRC context):

- When CA is configured and to enable SCell selection in the target eNB, the source eNB can provide in decreasing order of radio quality a list of the best cells and optionally measurement result of the cells.

- When DC is configured, the source MeNB provides the SCG configuration (in addition to the MCG configuration) to the target MeNB.

- Both the source eNB and UE keep some context (e.g. C-RNTI) to enable the return of the UE in case of HO failure;

- If RACH-less HO is not configured, the UE accesses the target cell via RACH following a contention-free procedure using a dedicated RACH preamble or following a contention-based procedure if dedicated RACH preambles are not available:

- the UE uses the dedicated preamble until the handover procedure is finished (successfully or unsuccessfully);

- If RACH-less HO is configured, the UE accesses the target cell via the uplink grant preallocated to the UE in the RRC message. If the UE does not receive the preallocated uplink grant in the RRC message from the source eNB, the UE monitors the PDCCH of the target cell;

- If DAPS handover is configured, the UE continues the downlink user data reception from the source eNB until releasing the source cell and continues the uplink user data transmission to the source eNB until successful random access procedure to the target eNB. Upon reception of the handover command, the UE:

- Creates a MAC entity for target cell;

- Establishes the RLC entity and an associated DTCH logical channel for target cell for each DRB configured with DAPS;

- For the DRB(s) configured with DAPS, reconfigures the PDCP entity to configure DAPS with separate security and ROHC functions for source and target and associates them with the RLC entities configured for source and target respectively;

- Retains rest of the source link configurations until release of the source.

- UE maintains only PCell connection with both source and target nodes and any other configured serving cells are released by the network before the handover command is sent to the UE. The target eNB can then configure the UE with additional serving cells (for CA and/or DC) in the same message that releases the source PCell and completes the DAPS handover.

NOTE: The handling on RLC and PDCP for DRBs not configured with DAPS is the same as in normal handover.

- If the access towards the target cell (using RACH or RACH-less procedure) is not successful within a certain time, the UE initiates radio link failure recovery using a suitable cell except in DAPS handover or CHO scenarios:

- When DAPS handover fails, the UE falls back to source cell configuration, resumes the connection with source cell, and reports the DAPS handover failure via the source without triggering RRC connection re-establishment if the source link is still available; Otherwise, RRC re-establishment is performed;

- When initial CHO execution attempt fails or Handover fails, if network configured the UE to try CHO after HO/CHO failure and the UE performs cell selection to a CHO candidate cell, the UE attempts CHO execution to that cell; Otherwise, RRC re-establishment is performed.

- No ROHC and EHC context is transferred at handover;

- No UDC context is transferred at handover;

- ROHC and EHC contexts can be kept at handover within the same eNB.

##### 10.1.2.1.1 C-plane handling

The preparation and execution phase of the HO procedure is performed without EPC involvement, i.e. preparation messages are directly exchanged between the eNBs. The release of the resources at the source side during the HO completion phase is triggered by the eNB. In case an RN is involved, its DeNB relays the appropriate S1 messages between the RN and the MME (S1-based handover) and X2 messages between the RN and target eNB (X2-based handover); the DeNB is explicitly aware of a UE attached to the RN due to the S1 proxy and X2 proxy functionality (see clause 4.7.6.6). The figure below depicts the basic handover scenario where neither MME nor Serving Gateway changes:



Figure 10.1.2.1.1-1: Intra-MME/Serving Gateway HO

Below is a more detailed description of the intra-MME/Serving Gateway HO procedure:

0 The UE context within the source eNB contains information regarding roaming and access restrictions which were provided either at connection establishment or at the last TA update.

1 The source eNB configures the UE measurement procedures according to the roaming and access restriction information and e.g. the available multiple frequency band information. Measurements provided by the source eNB may assist the function controlling the UE's connection mobility.

2 A MEASUREMENT REPORT is triggered and sent to the eNB.

3 The source eNB makes decision based on MEASUREMENT REPORT and RRM information to hand off the UE.

4 The source eNB issues a HANDOVER REQUEST message to the target eNB passing necessary information to prepare the HO at the target side (UE X2 signalling context reference at source eNB, UE S1 EPC signalling context reference, target cell ID, KeNB\*, RRC context including the C-RNTI of the UE in the source eNB, AS-configuration, E-RAB context and physical layer ID of the source cell + short MAC-I for possible RLF recovery). The source eNB may also request a DAPS Handover for one or more E-RABs. UE X2 / UE S1 signalling references enable the target eNB to address the source eNB and the EPC. The E-RAB context includes necessary RNL and TNL addressing information, and QoS profiles of the E-RABs.

5 Admission Control may be performed by the target eNB dependent on the received E-RAB QoS information to increase the likelihood of a successful HO, if the resources can be granted by target eNB. The target eNB configures the required resources according to the received E-RAB QoS information and reserves a C-RNTI and optionally a RACH preamble. The AS-configuration to be used in the target cell can either be specified independently (i.e. an "establishment") or as a delta compared to the AS-configuration used in the source cell (i.e. a "reconfiguration").

6 The target eNB prepares HO with L1/L2 and sends the HANDOVER REQUEST ACKNOWLEDGE to the source eNB. The HANDOVER REQUEST ACKNOWLEDGE message includes a transparent container to be sent to the UE as an RRC message to perform the handover. The container includes a new C-RNTI, target eNB security algorithm identifiers for the selected security algorithms, may include a dedicated RACH preamble, and possibly some other parameters i.e. access parameters, SIBs, etc. If RACH-less HO is configured, the container includes timing adjustment indication and optionally a preallocated uplink grant. The HANDOVER REQUEST ACKNOWLEDGE message may also include RNL/TNL information for the forwarding tunnels, if necessary. The target eNB also indicates if a DAPS Handover is accepted.

NOTE 1: As soon as the source eNB receives the HANDOVER REQUEST ACKNOWLEDGE, or as soon as the transmission of the handover command is initiated in the downlink, data forwarding may be initiated.

NOTE 1a: For E-RABs configured with DAPS, downlink PDCP SDUs are forwarded with SN assigned by the source eNB, until SN assignment is handed over to the target eNB in step 11b, for which the normal data forwarding follows as defined in 10.1.2.3.

Steps 7 to 16 provide means to avoid data loss during HO and are further detailed in 10.1.2.1.2 and 10.1.2.3.

7 The target eNB generates the RRC message to perform the handover, i.e. *RRCConnectionReconfiguration* message including the *mobilityControlInfo*, to be sent by the source eNB towards the UE. The source eNB performs the necessary integrity protection and ciphering of the message.  
  
The UE receives the *RRCConnectionReconfiguration* message with necessary parameters (i.e. new C-RNTI, target eNB security algorithm identifiers, and optionally dedicated RACH preamble, target eNB SIBs, etc.) and is commanded by the source eNB to perform the HO. If RACH-less HO is configured, the *RRCConnectionReconfiguration* includes timing adjustment indication and optionally preallocated uplink grant for accessing the target eNB. If preallocated uplink grant is not included, the UE should monitor PDCCH of the target eNB to receive an uplink grant. The UE does not need to delay the handover execution for delivering the HARQ/ARQ responses to source eNB.  
  
If Make-Before-Break HO is configured, the connection to the source cell is maintained after the reception of *RRCConnectionReconfiguration* message with *mobilityControlInfo* before the UE executes initial uplink transmission to the target cell.

NOTE 2: If Make-Before-Break HO is configured, the source eNB decides when to stop transmitting to the UE.

NOTE 3: The UE can be configured with Make-Before-Break HO and RACH-less HO simultaneously.

In case of DAPS Handover, the UE does not detach from the source cell upon receiving the *RRCConnectionReconfiguration* message. The UE releases the source SRB resources, security configuration of the source cell and stops DL/UL reception/transmission with the source upon receiving an explicit release from the target node.

NOTE 3a: The DAPS Handover is considered to only be completed after the UE has released the source cell as explicitly requested from the target node. Features that cannot be configured simultaneously with DAPS Handover (CA, DC, EHC, UDC and CHO) can be configured in the same *RRCConnectionReconfiguration* message that releases the source cell. RRC suspend, a subsequent handover or inter-RAT handover cannot be initiated until the source cell has been released.

NOTE 4: CA, DC, EHC, UDC, CHO or RACH-less HO cannot be configured simultaneously with DAPS Handover.

NOTE 5: For E-RABs configured with DAPS, the source eNB does not stop transmitting downlink packets until it receives the HANDOVER SUCCESS message from the target eNB in step 11a.

8a For E-RABs configured with DAPS, the source eNB sends the EARLY STATUS TRANSFER message. The DL COUNT value conveyed in the EARLY STATUS TRANSFER message indicates PDCP SN and HFN of the first PDCP SDU that the source eNB forwards to the target eNB. The source eNB does not stop assigning PDCP SNs to downlink packets until it sends the SN STATUS TRANSFER message to the target eNB in step 11b.

8 For E-RABs not configured with DAPS, the source eNB sends the SN STATUS TRANSFER message to the target eNB to convey the uplink PDCP SN receiver status and the downlink PDCP SN transmitter status of E-RABs for which PDCP status preservation applies (i.e. for RLC AM). The uplink PDCP SN receiver status includes at least the PDCP SN of the first missing UL SDU and may include a bit map of the receive status of the out of sequence UL SDUs that the UE needs to retransmit in the target cell, if there are any such SDUs. The downlink PDCP SN transmitter status indicates the next PDCP SN that the target eNB shall assign to new SDUs, not having a PDCP SN yet. The source eNB may omit sending this message if none of the E-RABs of the UE shall be treated with PDCP status preservation.

NOTE 6: In case of DAPS Handover, the uplink PDCP SN receiver status and the downlink PDCP SN transmitter status for an E-RAB with RLC-AM and not configured with DAPS may be transferred by the SN STATUS TRANSFER message in step 11b instead of step 8.

NOTE 7: For E-RABs configured with DAPS, the source eNB may additionally send the EARLY STATUS TRANSFER message(s) between step 8 and step 11b, to inform discarding of already forwarded PDCP SDUs. The target eNB does not transmit forwarded downlink PDCP SDUs to the UE whose COUNT is less than the conveyed DL COUNT value and discards them if transmission has not been attempted already.

9 If RACH-less HO is not configured, after receiving the *RRCConnectionReconfiguration* message including the *mobilityControlInfo*, UE performs synchronisation to target eNB and accesses the target cell via RACH, following a contention-free procedure if a dedicated RACH preamble was indicated in the *mobilityControlInfo*, or following a contention-based procedure if no dedicated preamble was indicated. UE derives target eNB specific keys and configures the selected security algorithms to be used in the target cell.   
  
If RACH-less HO is configured, UE performs synchronisation to target eNB. UE derives target eNB specific keys and configures the selected security algorithms to be used in the target cell.

10 If RACH-less HO is not configured, the target eNB responds with UL allocation and timing advance.

10a If RACH-less HO is configured and the UE did not get the periodic pre-allocated uplink grant in the *RRCConnectionReconfiguration* message including the *mobilityControlInfo*, the UE receives uplink grant via the PDCCH of the target cell. The UE uses the first available uplink grant after synchronization to the target cell.

11 When the RACH-less HO is not configured and the UE has successfully accessed the target cell, the UE sends the *RRCConnectionReconfigurationComplete* message (C-RNTI) to confirm the handover, along with an uplink Buffer Status Report, and/or UL data, whenever possible, to the target eNB, which indicates that the handover procedure is completed for the UE. The target eNB verifies the C-RNTI sent in the *RRCConnectionReconfigurationComplete* message. The target eNB can now begin sending data to the UE.

When the RACH-less HO is configured, after the UE has received uplink grant, the UE sends the *RRCConnectionReconfigurationComplete* message (C-RNTI) to confirm the handover, along with an uplink Buffer Status Report, and/or UL data, whenever possible, to the target eNB. The target eNB verifies the C-RNTI sent in the *RRCConnectionReconfigurationComplete* message. The target eNB can now begin sending data to the UE. The handover procedure is completed for the UE when the UE receives the UE contention resolution identity MAC control element from the target eNB.

11a/b In case of DAPS Handover, the target eNB sends the HANDOVER SUCCESS message to the source eNB to inform that the UE has successfully accessed the target cell. In return, the source eNB sends the SN STATUS TRANSFER message for E-RABs configured with DAPS for which the description in step 8 applies, and the normal data forwarding follows as defined in 10.1.2.3.

NOTE 8: For E-RABs configured with DAPS, the source eNB does not stop delivering uplink packets to the S-GW until it sends the SN STATUS TRANSFER message in step 11b. The target eNB does not forward the uplink PDCP SDUs successfully received in-sequence to the S-GW until it receives the SN STATUS TRANSFER message, in which UL HFN and the first missing SN in the uplink PDCP SN receiver status indicates the start of uplink PDCP SDUs to be delivered to the S-GW. The target eNB does not deliver any uplink packet which has an UL COUNT lower than the provided.

NOTE 9: Void.

12 The target eNB sends a PATH SWITCH REQUEST message to MME to inform that the UE has changed cell.

13 The MME sends a MODIFY BEARER REQUEST message to the Serving Gateway.

14 The Serving Gateway switches the downlink data path to the target side. The Serving gateway sends one or more "end marker" packets on the old path to the source eNB and then can release any U-plane/TNL resources towards the source eNB.

15 The Serving Gateway sends a MODIFY BEARER RESPONSE message to MME.

16 The MME confirms the PATH SWITCH REQUEST message with the PATH SWITCH REQUEST ACKNOWLEDGE message.

17 By sending the UE CONTEXT RELEASE message, the target eNB informs success of HO to source eNB and triggers the release of resources by the source eNB. The target eNB sends this message after the PATH SWITCH REQUEST ACKNOWLEDGE message is received from the MME.

18 Upon reception of the UE CONTEXT RELEASE message, the source eNB can release radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

When an X2 handover is used involving HeNBs and when the source HeNB is connected to a HeNB GW, a UE CONTEXT RELEASE REQUEST message including an explicit GW Context Release Indication is sent by the source HeNB, in order to indicate that the HeNB GW may release of all the resources related to the UE context.

For DAPS handover, upon receiving DAPS handover command message, the UE suspends source cell SRBs, stops sending and receiving any RRC control plane signalling towards the source cell and establishes SRBs for the target cell. The UE releases the source cell SRBs configuration upon receiving source cell release indication from the target cell after successful DAPS handover execution. When DAPS handover to the target cell fails and if the source cell link is available then the UE reverts back to the source cell configuration and activates source cell SRBs for control plane signalling. When DAPS handover is configured, PDCP duplication is not allowed.