**3GPP TSG-WG SA2 Meeting #143E e-meeting  *S2-210xxxx***

**Elbonia, Feb 24 – March 9, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.401** | **CR** | TODO | **rev** | **-** | **Current version:** | **16.9.0** |  |
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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 |  | Core Network | **X** |

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| ***Title:*** | Introduction of Leaving procedure | | | | | | | | | |
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| ***Source to WG:*** | Samsung ,(Nokia, Nokia Shanghai Bell, Lenovo, Motorola Mobility, Vivo, LG Electronics, Qualcomm, Xiaomi, Huawei, China Telcom, Charter, MediaTek, Oppo, Intel, Apple, Vodafone, Spreadtrum, Ericsson) ? | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | MUSIM | | | | |  | ***Date:*** | | | 2021-02-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | Intoduction of the new feature where a UE can request network to release the NAS signalling connection. Additionally UE can provide assistance information for Paging filtering. | | | | | | | | |
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| ***Summary of change:*** | | UE can provide an indication that its leaving the network; 2. UE can provide filtering information to the network; 3. Network restrict paging based on filtering information. | | | | | | | | |
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| ***Consequences if not approved:*** | | The new agreed feature from the FS\_MuSIM is not introduced. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.3.3.1, 5.3.4.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

\*\*\*\*\* NEXT CHANGE \*\*\*\*\*

#### 5.3.3.1 Tracking Area Update procedure with Serving GW change



Figure 5.3.3.1-1: Tracking Area Update procedure with Serving GW change

NOTE 1: For a PMIP-based S5/S8, procedure steps (A) and (B) are defined in TS 23.402 [2]. Steps 9 and 10 concern GTP based S5/S8.

NOTE 2: In case of Tracking Area Update without MME change the signalling in steps 4, 5, 7 and steps 12-17 are skipped.

1. One of the triggers described in clause 5.3.3.0 for starting the TAU procedure occurs.

2. The UE initiates the TAU procedure by sending, to the eNodeB, a TAU Request (UE Core Network Capability, MS Network Capability, Preferred Network behaviour, Support for restriction of use of Enhanced Coverage, old GUTI, Old GUTI type, last visited TAI, active flag, signalling active flag, EPS bearer status, P‑TMSI Signature, additional GUTI, eKSI, NAS sequence number, NAS-MAC, KSI, Voice domain preference and UE's usage setting, UE has UE Radio Capability ID assigned for the selected PLMN, request to release S1 connection, paging restriction information) message together with RRC parameters indicating the Selected Network and the old GUMMEI. An exception is that, if the TAU was triggered for load re-balancing purposes (see clause 4.3.7.3), the old GUMMEI is not included in the RRC parameters. The UE shall set the Old GUTI Type to indicate whether the Old GUTI is a native GUTI or is mapped from a P-TMSI and RAI.

If the UE's TIN indicates "GUTI" or "RAT‑related TMSI" and the UE holds a valid GUTI then the old GUTI indicates this valid GUTI. If the UE's TIN indicates "P‑TMSI" and the UE holds a valid P‑TMSI and related RAI then these two elements are indicated as the old GUTI. Mapping a P‑TMSI and RAI to a GUTI is specified in Annex H. When the UE is in connected mode (e.g. in URA\_PCH) when it reselects to E‑UTRAN, the UE shall set its TIN to "P‑TMSI".

If the UE holds a valid GUTI and the old GUTI indicates a GUTI mapped from a P-TMSI and RAI, then the UE indicates the GUTI as additional GUTI. If the old GUTI indicates a GUTI mapped from a P-TMSI and RAI, and the UE has a valid P-TMSI signature, the P-TMSI signature shall be included.

The additional GUTI in the Tracking Area Update Request message allows the new MME to find any already existing UE context stored in the new MME when the old GUTI indicates a value mapped from a P-TMSI and RAI.

Alternatively, when a UE only supports E-UTRAN, it identifies itself with the old GUTI and sets the Old GUTI Type to 'native'.

The RRC parameter "old GUMMEI" takes its value from the identifier that is signalled as the old GUTI according to the rules above. For a combined MME/SGSN the eNodeB is configured to route the MME‑code(s) of this combined node to the same combined node. This eNodeB is also configured to route MME‑code(s) of GUTIs that are generated by the UE's mapping of the P‑TMSIs allocated by the combined node. Such an eNodeB configuration may also be used for separate nodes to avoid changing nodes in the pool caused by inter RAT mobility.

The last visited TAI shall be included in order to help the MME produce a good list of TAIs for any subsequent TAU Accept message. Selected Network indicates the network that is selected. Active flag is a request by UE to activate the radio and S1 bearers for all the active EPS Bearers by the TAU procedure when the UE is in ECM-IDLE state. Signalling active flag is a request by UE using Control Plane CIoT EPS Optimisation to maintain the NAS signalling connection after Tracking Area Update Procedure is completed in order to transmit pending Data using the Data Transport in Control Plane CIoT EPS Optimisation or NAS signalling. The EPS bearer status indicates each EPS bearer that is active in the UE. The TAU Request message shall be integrity protected by the NAS-MAC as described in TS 33.401 [41]. eKSI, NAS sequence number and NAS-MAC are included if the UE has valid EPS security parameters. NAS sequence number indicates the sequential number of the NAS message. KSI is included if the UE indicates a GUTI mapped from a P‑TMSI in the information element "old GUTI".

In the RRC connection establishment signalling associated with the TAU Request, the UE indicates its support of the CIoT EPS Optimisations relevant for MME selection.

For UE using CIoT EPS Optimisation without any activated PDN connection, there is no active flag or EPS bearer status included in the TAU Request message. For a UE with a running Service Gap timer in the UE the UE shall not set the active flag and the signalling active flag in the TAU request message (see clause 4.3.17.9).

If the UE has any PDN connection of PDN Type "non-IP" or "Ethernet", the UE shall send the EPS bearer status in the TAU Request message.

The UE sets the voice domain preference and UE's usage setting according to its configuration, as described in clause 4.3.5.9.

The UE includes extended idle mode DRX parameters information element if it needs to enable extended idle mode DRX, even if extended idle mode DRX parameters were already negotiated before.

The UE may include UE paging probability information if it supports the assignment of WUS Assistance Information from the MME to assist the eNB's Wake-Up Signal (WUS) group decision (see TS 36.300 [5]).

If a UE includes a Preferred Network Behaviour, this defines the Network Behaviour the UE is expecting to be available in the network as defined in clause 4.3.5.10.

If the UE supports RACS as defined in clause 5.11.3a, and if the UE is provisioned with a UE Radio Capability ID for use in the selected PLMN (i.e. PLMN-assigned for the specific PLMN or manufacturer-assigned), the UE includes a flag that indicates it has an assigned UE Radio Capability ID for use in the selected PLMN but the actual UE Radio Capability ID is provided to MME after security context is established in step 6 (see below).

If the UE in MUSIM mode wants to enter ECM-IDLE state it shall request to release S1 connection and optionally provide paging restriction information.

Editor’s Note: It is FFS if UE can provide paging restriction information from IDLE mode.

3. The eNodeB derives the MME address from the RRC parameters carrying the old GUMMEI, the indicated Selected Network and the RAT (NB-IoT or WB-E-UTRAN). If that MME is not associated with that eNodeB or the GUMMEI is not available or the UE indicates that the TAU procedure was triggered by load re-balancing, the eNodeB selects an MME as described in clause 4.3.8.3 on "MME Selection Function".

The eNodeB forwards the TAU Request message together with the CSG access mode, CSG ID, TAI+ECGI of the cell from where it received the message and with the Selected Network to the new MME. CSG ID is provided by RAN if the UE sends the TAU Request message via a CSG cell or a hybrid cell. CSG access mode is provided if the UE sends the TAU Request message via a hybrid cell. If the CSG access mode is not provided but the CSG ID is provided, the MME shall consider the cell as a CSG cell. For SIPTO at the Local Network with stand-alone GW architecture the eNodeB includes the Local Home Network ID in the Initial UE Message and in Uplink NAS Transport message if the target cell is in a Local Home Network.

To assist Location Services, the eNB indicates the UE's Coverage Level to the MME.

4. The new MME differentiates the type of the old node, i.e. MME or SGSN, as specified in clause 4.3.19, uses the GUTI received from the UE to derive the old MME/S4 SGSN address, and sends a Context Request (old GUTI, complete TAU Request message, P‑TMSI Signature, MME Address, UE validated, CIoT EPS Optimisation support inidication) message to the old MME/old S4 SGSN to retrieve user information. UE Validated indicates that the new MME has validated the integrity protection of the TAU message, e.g. based on native EPS security context for the UE. To validate the Context Request the old MME uses the complete TAU Request message and the old S4 SGSN uses the P‑TMSI Signature and responds with an appropriate error if integrity check fails in old MME/S4 SGSN. This shall initiate the security functions in the new MME. If the security functions authenticate the UE correctly, the new MME shall send a Context Request (IMSI, complete TAU Request message, MME Address, UE Validated) message to the old MME/S4 SGSN with the UE Validated set. If the new MME indicates that it has authenticated the UE or if the old MME/old S4 SGSN correctly validates the UE, then the old MME/old S4 SGSN starts a timer.

If the UE with emergency bearers is not authenticated in the old MME/old S4 SGSN (in a network supporting unauthenticated UEs) the old MME/old S4 SGSN continues the procedure with sending a Context Response and starting the timer also when it cannot validate the Context Request.

If a RLOS attached UE is not successfully authenticated in the old MME, the old MME continues the procedure with sending a Context Response and starting the existing timer also when it cannot validate the Context Request.

If the new MME supports CIoT EPS Optimisation, CIoT EPS Optimisation support indication is included in the Context Request indicating support for various CIoT EPS Optimisations (e.g. support for header compression for CP CIoT EPS Optimisation, etc.).

5. If the Context Request is sent to an old MME the old MME responds with a Context Response (IMSI, ME Identity (IMEISV), MM Context, EPS Bearer Context(s), Serving GW signalling Address and TEID(s), ISR Supported, MS Info Change Reporting Action (if available), CSG Information Reporting Action (if available), UE Time Zone, UE Core Network Capability, UE Specific DRX Parameters, Remaining Running Service Gap timer, LTE-M UE Indication) message. If the new MME supports CIoT EPS Optimisation and the use of header compression has been negotiated between the UE and the old MME, the Context Response also includes the Header Compression Configuration which includes the information necessary for the ROHC channel setup but not the RoHC context itself.

If the Context Request is sent to an old S4 SGSN the old S4 SGSN responds with a Context Response (MM Context, EPS Bearer Context(s), Serving GW signalling Address and TEID(s), ISR Supported, MS Info Change Reporting Action (if available), CSG Information Reporting Action (if available), UE Time Zone, UE Core Network Capability, UE Specific DRX Parameters). If the source MME has not yet reported a non-zero MO Exception Data Counter to the PDN GW, the Context Response also includes the MO Exception Data Counter as described in TS 29.274 [43].

The MM Context contains security related information as well as other parameters (including IMSI and ME Identity (if available)) as described in clause 5.7.2 (Information Storage for MME). The unused Authentication Quintets in the MM Context are also maintained in the SGSN. TS 33.401 [41] gives further details on the transfer of security related information.

If the MM Context received with the Context Response message did not include IMEISV and the MME does not already store the IMEISV of the UE, the MME shall retrieve the ME Identity (IMEISV) from the UE.

The PDN GW Address and TEID(s) (for GTP-based S5/S8) or GRE Keys (PMIP-based S5/S8 at the PDN GW(s) for uplink traffic) and the TI(s), is part of the EPS Bearer Context. If the UE is not known in the old MME/old S4 SGSN or if the integrity check for the TAU Request message fails, the old MME/old S4 SGSN responds with an appropriate error cause. ISR Supported is indicated if the old MME/old S4 SGSN and associated Serving GW are capable to activate ISR for the UE.

If the UE receives emergency bearer services from the old MME/old S4 SGSN and the UE is UICCless, IMSI can not be included in the Context Response. For emergency attached UEs, if the IMSI cannot be authenticated, then the IMSI shall be marked as unauthenticated. Also, in this case, security parameters are included only if available.

For a RLOS attached UE, the old MME includes an RLOS indication to the new MME. If the RLOS attached UE in the old MME does not have a USIM, IMSI can not be included in the Context Response. If the RLOS attached UE has USIM but the IMSI cannot be successfully authenticated, then the IMSI shall be marked as unauthenticated. Also, in this case, security parameters are included only if available.

If SIPTO at the Local Network is active for a PDN connection in the architecture with stand-alone GW, the old MME/old S4 SGSN shall include the Local Home Network ID of the old cell in the EPS Bearer context corresponding to the SIPTO at the Local Network PDN connection.

For UE using CIoT EPS Optimisation without any activated PDN connection, there is no EPS Bearer Context(s) included in the Context Response message.

Based on the CIoT EPS Optimisation support indication, old MME only transfers the EPS Bearer Context(s) that the new MME supports. If the new MME does not support CIoT EPS Optimisation, EPS Bearer Context(s) of non-IP PDN connection are not transferred to the new MME. If the new MME does not support Ethernet PDN Type, EPS Bearer Context(s) of Ethernet PDN type are not transferred to the new MME. If the EPS Bearer Context(s) of a PDN connection has not been transferred, the old MME shall consider all bearers of that PDN connection as failed and release that PDN connection by triggering the MME requested PDN disconnection procedure specified in clause 5.10.3. The buffered data in the old MME is discarded after receipt of Context Acknowledgement.

If the EPS Bearer Context(s) are to be transferred to the new MME, the old MME also includes the Serving GW IP address and TEID for both S1-U and S11-U, if available.

If the Old MME is aware the UE is a LTE-M UE, it provides the LTE-M UE Indication to the new MME. During inter PLMN mobility, the new MME shall delete the UE Radio Capability ID received from the old MME, unless the operator policy indicates that all UE Radio Capability IDs used in the old PLMN are also valid in the new PLMN.

6. If the integrity check of TAU Request message (sent in step 2) failed, then authentication is mandatory. The authentication functions are defined in clause 5.3.10 on "Security Function". Ciphering procedures are described in clause 5.3.10 on "Security Function". If GUTI allocation is going to be done and the network supports ciphering, the NAS messages shall be ciphered.

If this TAU request is received for a UE which is already in ECM\_CONNECTED state and the PLMN-ID of the TAI sent by the eNodeB in Step 3 is different from that of the GUTI, included in the TAU Request message, the MME shall delay authenticating the UE until after Step 21 (TAU Complete message).

NOTE 3: The MME delays the authentication such that the UE first updates its registered PLMN-ID to the new PLMN-ID selected by the RAN during handover. The new PLMN-ID is provided by the MME to the UE as part of the GUTI in the TAU accept message in Step 20. Doing this ensures that the same PLMN-ID is used in the derivation of the Kasme key by both the network and the UE.

If the new MME is configured to allow emergency bearer services for unauthenticated UE the new MME behave as follows:

- where a UE has only emergency bearer services, the MME either skip the authentication and security procedure or accepts that the authentication may fail and continues the Tracking Area Update procedure; or

- where a UE has both emergency and non emergency bearer services and authentication fails, the MME continues the Tracking Area Update procedure and deactivates all the non-emergency PDN connections as specified in clause 5.10.3.

If the new MME is configured to allow Restricted Local Operator Services, the new MME, based on local regulation and operator policy, may skip the authentication and security procedure, or may perform authentication if security parameters are available, or obtainable from HSS, and continues the Tracking Area Update procedure regardless of the authentication result.

If the UE indicated it has a UE Radio Capability ID assigned for use in the selected PLMN in step 2, the MME may request the UE to provide the UE Radio Capability ID in Security Mode Command, if the MME needs to get the UE Radio Capability ID from the UE e.g. at inter-PLMN mobility. If enquired by the MME the UE shall include the UE Radio Capability ID in Security Mode Command Accept for the supported UE radio capabilities.

7. The MME (if the MME has changed then it is the new MME) determines to relocate the Serving GW. The Serving GW is relocated when the old Serving GW cannot continue to serve the UE. The MME (if the MME has changed then it is the new MME) may also decide to relocate the Serving GW if a new Serving GW is expected to serve the UE longer and/or with a more optimal UE to PDN GW path, or if a new Serving GW can be co-located with the PDN GW. Selection of a new Serving GW is performed according to clause 4.3.8.2 on "Serving GW selection function".

If the MME has changed the new MME sends a Context Acknowledge (Serving GW change indication) message to the old MME/old S4 SGSN. Serving GW change indication indicates a new Serving GW has been selected. The old MME/old S4 SGSN marks in its UE context that the information in the GWs is invalid. And, if the old node is an MME, the old MME marks in its UE context that the information in the HSS is invalid. This ensures that the old MME/old S4 SGSN updates the GWs, and the old MME updates the HSS, if the UE initiates a TAU or RAU procedure back to the old MME/old S4 SGSN before completing the ongoing TAU procedure.

NOTE 4: Updating the GWs refers to deletion of session(s) on the Serving GW followed by re-creation of session(s) on the Serving GW. The re-creation of session(s) on the Serving GW will result in successful re-establishment of the S5/S8 tunnel between the selected Serving GW and the PDN GW.

If the security functions do not authenticate the UE correctly, then the TAU shall be rejected, and the new MME shall send a reject indication to the old MME/old S4 SGSN. The old MME/old S4 SGSN shall continue as if the Identification and Context Request was never received.

ISR is not indicated in the Context Acknowledge as ISR is not activated due to the S‑GW change.

For UE using CIoT EPS Optimisation without any activated PDN connection, the steps 8, 9, 10, 11, 18 and 19 are skipped.

8. If the MME has changed the new MME verifies the EPS bearer status received from the UE with the bearer contexts received from the old MME/old S4 SGSN. If the MME has not changed the MME verifies EPS bearer status from the UE with the bearer contexts available in the MM context. The MME releases any network resources related to EPS bearers that are not active in the UE. If there is no bearer context at all, the MME rejects the TAU Request.

If the MME selected a new Serving GW it sends a Create Session Request (IMSI, bearer contexts, MME Address and TEID, Type, the Protocol Type over S5/S8, RAT type, LTE-M RAT type reporting to PGW flag, Serving Network, UE Time Zone, MO Exception data counter) message per PDN connection to the selected new Serving GW. The PDN GW address and TFT (for PMIP-based S5/S8) are indicated in the bearer Contexts. Type indicates to the Serving GW to send the Modify Bearer Request to the PDN GW. The Protocol Type over S5/S8 is provided to Serving GW which protocol should be used over S5/S8 interface. RAT type indicates a change in radio access. If it is a mobility from a SGSN to a MME and if the MME supports location information change reporting, the MME shall include the User Location Information (according to the supported granularity) in the Create Session Request, regardless of whether location information change reporting had been requested in the previous RAT by the PDN GW. If it is an inter MME mobility and if the PDN GW requested location information change reporting, the MME includes the User Location Information IE in this message if it is different compared to the previously sent information. If the PDN GW requested User CSG information, the MME also includes the User CSG Information IE in this message. If Control Plane CIoT EPS Optimisation applies, the MME may also indicate S11-U tunnelling of NAS user data and send its own S11-U IP address and MME DL TEID for DL data forwarding by the SGW. The MME shall include the MO Exception data counter if it has received the counter for RRC cause "MO Exception data" in the Context Response message.

If only the Control Plane CIoT EPS Optimisation is used, the MME shall include a Control Plane Only PDN Connection Indicator in Create Session Request.

If the new MME receives the EPS bearer context with SCEF, then the new MME updates the SCEF as defined in TS 23.682 [74].

If the UE is using the LTE-M RAT type and the PDN GW expects the LTE-M RAT type reporting as specified in clause 5.11.5, the MME also includes the LTE-M RAT type reporting to PGW flag to indicate to the Serving GW to forward the LTE-M RAT type to the PDN GW.

9. The Serving GW informs the PDN GW(s) about the change of for example the RAT type that e.g. can be used for charging, by sending the message Modify Bearer Request (Serving GW Address and TEID, RAT type, Serving Network, PDN Charging Pause Support Indication) per PDN connection to the PDN GW(s) concerned. User Location Information IE and/or UE Time Zone IE and/or User CSG Information IE and/or MO Exception data counter are also included if they are present in step 8. The Serving GW and PDN GW indicate each use of the RRC establishment cause "MO Exception Data" by the related counter on its CDR.

If the Serving GW has received the Control Plane Only PDN Connection Indicator in step 8, the Serving GW indicates the use of CP only on its CDR.

If LTE-M RAT type and the LTE-M RAT type reporting to PGW flag were received at step 8, the Serving GW shall include the LTE-M RAT type in the Modify Bearer Request message to the PGW. Otherwise the Serving GW includes RAT type WB-E-UTRAN.

9a If dynamic PCC is deployed, and RAT type information needs to be conveyed from the PDN GW to the PCRF, then the PDN GW shall send RAT type information to the PCRF by means of an IP‑CAN Session Modification procedure as defined in TS 23.203 [6].

NOTE 5: The PDN GW does not need to wait for the PCRF response, but continues in the next step. If the PCRF response leads to an EPS bearer modification the PDN GW should initiate a bearer update procedure.

10. The PDN GW updates its bearer contexts and returns a Modify Bearer Response (MSISDN, Charging Id, PDN Charging Pause Enabled Indication (if PDN GW has chosen to enable the function)) message. The MSISDN is included if the PDN GW has it stored in its UE context. If there has been a RAT change towards E-UTRAN and location information change reporting is required and supported in the target MME, the PDN GW shall provide MS Info Change Reporting Action in the Modify Bearer Response.

If the Serving GW is relocated, the PDN GW shall send one or more "end marker" packets on the old path immediately after switching the path in order to assist the reordering function in the target eNodeB. If the Serving GW has no downlink user plane established, the Serving GW shall discard the "end marker" received from the PDN GW and shall not send Downlink Data Notification. Otherwise the Serving GW shall forward the "end marker" packets to the source eNodeB or source S4 SGSN.

11. The Serving GW updates its bearer context. This allows the Serving GW to route bearer PDUs to the PDN GW when received from eNodeB.

The Serving GW returns a Create Session Response (Serving GW address and TEID for user plane and control plane and PDN GW TEIDs (for GTP-based S5/S8) or GRE keys (for PMIP-based S5/S8) for uplink traffic and control plane, MS Info Change Reporting Action) message to the new MME.

If Control Plane CIoT EPS Optimisation applies and if the MME does not include Control Plane Only PDN Connection Indicator in the Create Session Request:

- If separation of S11-U from S1-U is required, the Serving GW shall include the Serving GW IP address and TEID for S11-U and additionally the Serving GW IP address and TEID for S1-U in the Create Session Response.

- Otherwise, if separation of S11-U from S1-U is not required, the Serving GW includes the Serving GW IP address and TEID for S11-U in Create Session Response.

When the MME receives the Create Session Response message, the MME checks if there is a "Availability after DDN Failure" monitoring event or a "UE Reachability" monitoring event configured for the UE in the MME and in such a case sends an event notification (see TS 23.682 [74] for further information).

12. The new MME verifies whether it holds subscription data for the UE identified by the GUTI, the additional GUTI or by the IMSI received with the context data from the old CN node.

If there are no subscription data in the new MME for this UE, or for some network sharing scenario (e.g. GWCN) if the PLMN-ID of the TAI supplied by the eNodeB is different from that of the GUTI in the UE's context, then the new MME sends an Update Location Request (MME Identity, IMSI, ULR-Flags, MME Capabilities, Homogeneous Support of IMS Voice over PS Sessions, UE SRVCC capability, equivalent PLMN list, ME Identity (IMEISV)) message to the HSS. ULR-Flags indicates that update location is sent from an MME and the MME registration shall be updated in HSS. The HSS does not cancel any SGSN registration. The MME capabilities indicate the MME's support for regional access restrictions functionality. The inclusion of the equivalent PLMN list indicates that the MME supports the inter-PLMN handover to a CSG cell in an equivalent PLMN using the subscription information of the target PLMN. The "Homogenous Support of IMS Voice over PS Sessions" indication (see clause 4.3.5.8A) shall not be included unless the MME has completed its evaluation of the support of "IMS Voice over PS Session" as specified in clause 4.3.5.8. The ME Identity is included if step 5 caused the MME to retrieve the IMEISV from the UE.

NOTE 6: At this step, the MME may not have all the information needed to determine the setting of the IMS Voice over PS Session Supported indication for this UE (see clause 4.3.5.8). Hence the MME can send the "Homogenous Support of IMS Voice over PS Sessions" later on in this procedure.

If the UE initiates the TAU procedure in a VPLMN supporting Autonomous CSG Roaming and the HPLMN has enabled Autonomous CSG Roaming in the VPLMN (via Service Level Agreement) and the MME needs to retrieve the CSG subscription information of the UE from the CSS, the MME initiates the Update CSG Location Procedure with CSS as described in clause 5.3.12.

If the MME determines that only the UE SRVCC capability has changed, the MME sends a Notify Request to the HSS to inform about the changed UE SRVCC capability.

If all the EPS bearers of the UE have emergency ARP value, the new MME may skip the update location procedure or proceed even if the update location fails.

If the UE is RLOS attached, the new MME skips the Update Location procedure.

13. The HSS sends the message Cancel Location (IMSI, Cancellation Type) to the old MME with Cancellation Type set to Update Procedure.

14. If the timer started in step 4 is not running, the old MME removes the MM context. Otherwise, the contexts are removed when the timer expires. It also ensures that the MM context is kept in the old MME for the case the UE initiates another TAU procedure before completing the ongoing TAU procedure to the new MME. The old MME acknowledges with the message Cancel Location Ack (IMSI).

15. When old S4 SGSN receives the Context Acknowledge message and if the UE is in Iu Connected, the old S4 SGSN sends an Iu Release Command message to the RNC after the timer started in step 4 has expired.

16. The RNC responds with an Iu Release Complete message.

17. The HSS acknowledges the Update Location Request message by sending an Update Location Ack (IMSI, Subscription Data) message to the new MME. The Subscription Data may contain the CSG subscription data for the registered PLMN and for the equivalent PLMN list requested by MME in step 12.

The subscription data may contain Enhanced Coverage Restricted parameter. If received from the HSS, MME stores this Enhanced Coverage Restricted parameter in the MME MM context.

The subscription data may contain a Service Gap Time. If received from the HSS, the MME stores this Service Gap Time in the MME MM context for the UE and passes it to the UE in the Tracking Area Update Accept message.

The subscription data may contain Subscribed Paging Time Window parameter that applies to the UEs on a specific RAT, e.g. NB-IoT. If received from the HSS, MME stores this Subscribed Paging Time Window parameter in the MME MM context.

If the Update Location is rejected by the HSS, the new MME rejects the TAU Request from the UE with an appropriate cause. In such cases, the new MME releases any local MME EPS Bearer contexts for this particular UE, and additionally deletes the EPS bearer resources in the new Serving GW by sending the Delete Session Request (Cause, Operation Indication) messages to the new Serving GW. The Operation Indication flag shall not be set. Therefore, the new Serving GW receiving this request shall not initiate a delete procedure towards the PDN GW.

If the UE initiates the TAU procedure at a CSG cell, the new MME shall check whether the CSG ID and associated PLMN is contained in the CSG subscription and is not expired. If the CSG ID and associated PLMN is not present or expired, the MME shall send a Tracking Area Update reject message to the UE with an appropriate cause value. The UE shall remove the CSG ID and associated PLMN from its Allowed CSG list if present. If the UE has ongoing emergency bearer services no CSG access control shall be performed.

If all checks are successful then the new MME constructs a context for the UE.

18. If the MME has changed, when the timer started in step 4 expires the old MME/old S4 SGSN releases any local MME or SGSN bearer resources and additionally the old MME/old S4 SGSN deletes the EPS bearer resources by sending the Delete Session Request (Cause, Operation Indication) messagesto the old Serving GW if it received the Serving GW change indication in the Context Acknowledge message in step 7. When the Operation Indication flag is not set, that indicates to the old Serving GW that the old Serving GW shall not initiate a delete procedure towards the PDN GW. If ISR is activated the Cause indicates to the old S‑GW that the old S‑GW shall delete the bearer resources on the other old CN node by sending Delete Bearer Request message(s) to that CN node.

If the MME has not changed, step 11 triggers the release of the EPS bearer resources at the old Serving GW.

19. The Serving GW acknowledges with Delete Session Response (Cause) messages. The Serving GW discards any packets buffered for the UE.

20. If due to regional subscription restrictions or access restrictions (e.g. CSG restrictions) (received in update location procedure in step 17) the UE is not allowed to access the TA:

- The MME rejects the Tracking Area Update Request with an appropriate cause to the UE.

- For UEs with emergency EPS bearers, i.e. at least one EPS bearer has an ARP value reserved for emergency services, the new MME accepts the Tracking Area Update Request and deactivates all non-emergency PDN connections as specified in clause 5.10.3. If the Tracking Area Update procedure is initiated in ECM-IDLE state, all non-emergency EPS bearers are deactivated by the Tracking Area Update procedure without bearer deactivation signalling between the UE and the MME.

If the TAU request message includes paging restriction information, the MME stores it for this UE, then enforces it in the network triggered service request procedure as described in clause 5.3.4.3. If the TAU Request message does not include any paging restriction information, the MME shall delete any stored paging restriction information for this UE and stop restricting paging accordingly.

If the TAU Request message includes a request to release S1 connection, then the MME shall not activate the user plane setup procedure in the subsequent steps and triggers the S1 release procedure as described in clause 5.3.5 after the completion of TAU procedure.

The MME sends a TAU Accept (GUTI, TAI list, EPS bearer status, NAS sequence number, NAS-MAC, IMS Voice over PS session supported, Emergency Service Support indicator, LCS Support Indication, Supported Network Behaviour, Service Gap Time, Enhanced Coverage Restricted, Indication of support of 15 EPS bearers per UE, PLMN-assigned UE Radio Capability ID, indication for PLMN-assigned UE Radio Capability ID deletion) message to the UE. If the active flag is set the MME may provide the eNodeB with Handover Restriction List. GUTI is included if the MME allocates a new GUTI. If the active flag is set in the TAU Request message the user plane setup procedure can be activated in conjunction with the TAU Accept message. If the DL Data Buffer Expiration Time for the UE in the MME has not expired, the user plane setup procedure is activated even if the MME did not receive the active flag in the TAU Request message If the new MME receives the Downlink Data Notification message or any downlink signalling message while the UE is still connected, the user plane setup procedure may be activated even if the new MME did not receive the active flag in the TAU Request message. The procedure is described in detail in TS 36.300 [5]. The message sequence should be the same as for the UE triggered Service Request procedure specified in clause 5.3.4.1 from the step when MME establishes the bearer(s). The MME indicates the EPS bearer status IE to the UE. The UE removes any internal resources related to bearers that are not marked active in the received EPS bearer status. If the EPS bearer status information was in the TAU Request, the MME shall indicate the EPS bearer status to the UE. Handover Restriction List is described in clause 4.3.5.7 "Mobility Restrictions". The MME sets the IMS Voice over PS session supported as described in clause 4.3.5.8.

For UE using CIoT EPS Optimisation without any activated PDN connection, there is no EPS bearer status included in the TAU Accept message.

The MME indicates the CIoT EPS Optimisations it supports and prefers in the Supported Network Behaviour information as defined in clause 4.3.5.10.

If there is a Service Gap timer running for the UE in the MME, and the active flag or the signalling active flag is received in the TAU Request message, the MME shall ignore the active flag and signalling active flag and not perform any of the actions related to these flags.

The MME shall include the Service Gap Time in the TAU Accept message if the UE has indicated Service Gap Control capability and either if Service Gap Time was received in step 17 from HSS in the subscription information or if the Service Gap Time in the subscription information has been updated by HSS User Profile management (i.e. the Insert Subscriber Data procedure in clause 5.3.9.2).

If the UE included support for restriction of use of Enhanced Coverage in step 1, the MME sends Enhanced Coverage Restricted parameter to the eNB in the S1-AP message as defined in clause 4.3.28. The MME also sends the Enhanced Coverage Restricted parameter to the UE in the TAU Accept message. UE shall store Enhanced Coverage Restricted parameter and shall use the value of Enhanced Coverage Restricted parameter to determine if enhanced coverage feature should be used or not.

If the MME successfully obtained Header Compression Configuration parameters in step 5 it indicates the continued use of previous negotiated configuration to the UE in the Header Compression Context Status for each EPS Bearer of the UE. When Header Compression Context Status indicates that the previous negotiated configuration can no longer be used for some EPS bearers, the UE shall stop performing header compression and decompression, when sending or receiving data using Control Plane CIoT EPS Optimisation on these EPS bearers.

If the MME did not receive the Voice Support Match Indicator in the MM Context, then the MME may send a UE Radio Capability Match Request to the eNB as described in clause 5.3.14. If the MME hasn't received Voice Support Match Indicator from the eNB then, based on implementation, MME may set IMS Voice over PS session supported Indication and update it at a later stage. After step 12, and in parallel to any of the preceding steps, the MME shall send a Notify Request (Homogeneous Support of IMS Voice over PS Sessions) message to the HSS:

- If the MME has evaluated the support of IMS Voice over PS Sessions, see clause 4.3.5.8, and

- If the MME determines that it needs to update the Homogeneous Support of IMS Voice over PS Sessions, see clause 4.3.5.8A.

The Emergency Service Support indicator informs the UE that Emergency bearer services are supported. LCS Support Indication indicates whether the network supports the EPC-MO-LR and/or CS-MO-LR as described in TS 23.271 [57]. Indication for support of 15 EPS bearers per UE indicates the network support for up to 15 EPS bearers per UE as defined in clause 4.12.

If the UE included extended idle mode DRX parameters information element, the MME includes extended idle mode DRX parameters information element if it decides to enable extended idle mode DRX with Paging Time Window length assigned considering Subscribed Paging Time Window (if available) and the local policy.

If the UE provided the UE paging probability information in Step 2, the MME takes it into account when generating the WUS Assistance Information. The MME may send the WUS Assistance Information to the UE (see TS 36.300 [5]).

When receiving the TAU Accept message and there is no ISR Activated indication the UE shall set its TIN to "GUTI".

For a S‑GW change, ISR Activated is never indicated by the MME as it needs a RAU with the same S‑GW first to activate ISR. For an MME change, ISR is not activated by the new MME to avoid context transfer procedures with two old CN nodes.

If the TAU procedure is initiated by manual CSG selection and occurs via a CSG cell, the UE upon receiving the TAU Accept message shall add the CSG ID and associated PLMN to its Allowed CSG list if it is not already present. Manual CSG selection is not supported if the UE has emergency bearers established.

If the user plane setup is performed in conjunction with the TAU Accept message and the TAU is performed via a hybrid cell, then the MME shall send an indication whether the UE is a CSG member to the RAN along with the S1-MME control message. Based on this information the RAN may perform differentiated treatment for CSG and non-CSG members.

NOTE 7: If the UE receives a TAU Accept message via a hybrid cell, the UE does not add the corresponding CSG ID and associated PLMN to its Allowed CSG list. Adding a CSG ID and associated PLMN to the UE's local Allowed CSG list for a hybrid cell is performed only by OTA or OMA DM procedures.

If the UE receives a Service Gap Time in the TAU Accept message, the UE shall store this parameter and apply Service Gap Control (see clause 4.3.17.9).

If the UE has indicated support for dual connectivity with NR in the TAU Request and the UE is not allowed to use NR as Secondary RAT, the MME indicates that to the UE in the TAU Accept message.

If the user plane setup is performed and if RACS is supported and MME has UE Radio Capability ID in UE context, it signals the UE Radio Capability ID to the eNB as defined in clause 5.11.3a. If the eNB does not have mapping between the specific UE Radio Capability ID and the UE radio capabilities, it shall use the procedure described in TS 36.413 [36] to retrieve the mapping from the Core Network.

When the UE supports RACS, and the MME needs to configure the UE with a UE Radio Capability ID, and the MME already has the UE radio capabilities for the UE, the MME may provide the UE with the UE Radio Capability ID for the UE radio capabilities the UCMF returns to the MME for this UE.

21. If GUTI was included in the TAU Accept, the UE acknowledges the received message by returning a TAU Complete message to the MME.

When the "Active flag" is not set in the TAU Request message and the Tracking Area Update was not initiated in ECM-CONNECTED state, the new MME releases the signalling connection with UE, according to clause 5.3.5. For a UE using Control Plane CIoT EPS Optimisation, when the "Signalling active flag" is set, the new MME shall not release the NAS signalling connection with the UE immediately after the TAU procedure is completed.

NOTE 8: The new MME may initiate E‑RAB establishment (see TS 36.413 [36]) after execution of the security functions, or wait until completion of the TA update procedure. For the UE, E‑RAB establishment may occur anytime after the TA update request is sent.

In the case of a rejected tracking area update operation, due to regional subscription, roaming restrictions or access restrictions (see TS 23.221 [27] and TS 23.008 [28]) the new MME should not construct an MM context for the UE. In the case of receiving the subscriber data from HSS, the new MME may construct an MM context and store the subscriber data for the UE to optimise signalling between the MME and the HSS. A reject shall be returned to the UE with an appropriate cause and the S1 connection shall be released. Upon return to idle, the UE shall act according to TS 23.122 [10].

The new MME shall determine the Maximum APN restriction based on the received APN Restriction of each bearer context in the Context Response message and then store the new Maximum APN restriction value.

The bearer contexts shall be prioritized by the new MME. If the new MME is unable to support the same number of active bearer contexts as received from old MME/SGSN, the prioritisation is used to decide which bearer contexts to maintain active and which ones to delete. In any case, the new MME shall first update all contexts in one or more P‑GWs and then deactivate the bearer context(s) that it cannot maintain as described in the clause "MME Initiated Dedicated Bearer Deactivation Procedure". This shall not cause the MME to reject the tracking area update.

The new MME shall not deactivate emergency service related EPS bearers, i.e. EPS bearers with ARP value reserved for emergency services.

NOTE 9: If MS (UE) was in PMM-CONNECTED state the bearer contexts are sent already in the Forward Relocation Request message as described in the clause "Serving RNS relocation procedures" of TS 23.060 [7].

If the tracking area update procedure fails a maximum allowable number of times, or if the MME returns a Tracking Area Update Reject (Cause) message, the UE shall enter EMM DEREGISTERED state.

If the new MME identifies that the RAT type has changed, the MME checks the subscription information to identify for each APN whether to maintain the PDN connection, disconnect the PDN connection with a reactivation request, or, disconnect the PDN connection without reactivation request. If the MME decides to deactivate a PDN connection it performs MME-initiated PDN Connection Deactivation procedure after the tracking area update procedure is completed but before the S1/RRC interface connection is released. Existing ESM cause values as specified in TS 24.301 [46] (e.g. #39, "reactivation requested"; #66 "Requested APN not supported in current RAT and PLMN combination"; and for a dedicated bearer, possibly #37 "EPS QoS not accepted") are used to cause predictable UE behaviour. If all the PDN connections are disconnected and the UE does not support "attach without PDN connectivity", the MME shall request the UE to detach and reattach.

\*\*\*\*\* NEXT CHANGE \*\*\*\*\*

#### 5.3.4.3 Network Triggered Service Request



Figure 5.3.4.3-1: Network triggered Service Request procedure

If the MME needs to signal with the UE that is in ECM-IDLE state, e.g. to perform the MME/HSS-initiated detach procedure for the ECM-IDLE mode UE or the S‑GW receives control signalling (e.g. Create Bearer Request or Update Bearer Request), the MME starts network triggered service request procedure from step 3a in the Network Triggered Service request procedure.

If the MME wishes to use the Control Plane CIoT EPS Optimisation for mobile terminating services, then the procedure of clause 5.3.4B.3 is used to replace the procedure of this clause.

If ISR is activated, when the Serving GW receives a Create Bearer Request or Update Bearer Request for a UE, and the S‑GW does not have a downlink S1-U and the SGSN has notified the Serving GW that the UE has moved to PMM-IDLE or STANDBY state, the Serving GW buffers signalling messages and sends a Downlink Data Notification to trigger the MME and SGSN to page the UE. If the Serving GW, while waiting for the user plane to be established, is triggered to send a second Downlink Data Notification with higher priority (i.e. ARP priority level) than the first Downlink Data Notification was sent with, the Serving GW sends a new Downlink Data Notification message indicating the higher priority to the MME. If the Serving GW receives additional downlink signalling messages for a bearer with same or lower priority than the first Downlink Data Notification was sent for or if the Serving GW has sent the second Downlink Data Notification message indicating the higher priority and receives additional downlink signalling messages for this UE, the Serving GW buffers these downlink signalling messages and does not send a new Downlink Data Notification. The S‑GW will be notified about the current RAT type based on the UE triggered service request procedure. The S‑GW will go on executing the dedicated bearer activation or dedicated bearer modification procedure, i.e. send the corresponding buffered signalling to MME or SGSN which UE resides in now and inform the current RAT type to the PDN GW if the RAT type has been changed compared to the last reported RAT Type. If dynamic PCC is deployed, the current RAT type information shall also be conveyed from the PDN GW to the PCRF. If the PCRF response leads to an EPS bearer modification the PDN GW should initiate a bearer update procedure as specified in clause 5.4.2.1 below.

When the Serving GW sends a Downlink Data Notification, it shall include both EPS Bearer ID and ARP. If the Downlink Data Notification is triggered by the arrival of downlink data packets at the Serving GW, the Serving GW shall include the EPS Bearer ID and ARP associated with the bearer on which the downlink data packet was received. If the Downlink Data Notification is triggered by the arrival of control signalling, the Serving GW shall include the EPS Bearer ID and ARP if present in the control signalling. If the ARP is not present in the control signalling, the Serving GW shall include the ARP in the stored EPS bearer context.

If a LIPA PDN connection exists, when the L-GW receives the downlink data for a UE that is in ECM-IDLE state, the L-GW sends the first downlink user packet to Serving GW and buffers all other downlink user packets. The Serving GW will trigger the MME to page the UE.

1. When the Serving GW receives a downlink data packet/control signalling for a UE known as not user plane connected (i.e. the S‑GW context data indicates no downlink user plane TEID), it buffers the downlink data packet and identifies which MME or SGSN is serving that UE.

If that MME has requested the Serving GW to throttle downlink low priority traffic and if the downlink data packet is received on a low priority bearer to be throttled (see clause 4.3.7.4.1a), the SGW drops the downlink data. The steps below are not executed.

If that MME has requested the S‑GW to delay sending the Downlink Data Notification (see clause 5.3.4.2 on "Handling of abnormal conditions in UE triggered Service Request"), the Serving GW buffers the downlink data and waits until the timer expires before continuing with step 2. If the DL-TEID and eNodeB address for that UE is received before the expiry of the timer, the timer shall be cancelled and the Network triggered Service Request procedure is finished without executing the steps below, i.e. DL data are sent to the UE.

If the Serving GW receives additional downlink data packets/control signalling for this UE before the expiry of the timer, the Serving GW does not restart this timer.

2. The Serving GW sends a Downlink Data Notification message (ARP, EPS Bearer ID, Paging Policy Indication) to the MME and SGSN nodes for which it has control plane connectivity for the given UE. The ARP and EPS Bearer ID are always set in Downlink Data Notification. The MME and SGSN respond to the S‑GW with a Downlink Data Notification Ack message. When supporting Paging Policy Differentiation, the Serving GW indicates in the message the Paging Policy Indication related to the downlink data that triggered the Downlink Data Notification message, as described in clause 4.9.

NOTE 1: The ARP, the EPS Bearer ID and optionally the Paging Policy Indication are sent to the SGSN as well as MME, but the usage of these parameters at SGSN is not specified in this release of the specification.

If the MME holds stored paging restriction information for the UE when it receives the Downlink Data Notification message, the MME may restrict paging for this UE, based on local policy and the stored paging restriction information. In case the MME restricts paging, the MME sends the Downlink Data Notification Ack to the Serving GW, with an indication that the paging has been restricted, and skips Step 3a.

An MME and an SGSN that detects that the UE is in a power saving state (e.g. Power Saving Mode or extended idle mode DRX) and cannot be reached by paging at the moment, shall invoke extended buffering depending on operator configuration, except for cases described in next paragraphs. MME/SGSN derives the expected time before radio bearers can be established to the UE. The MME/SGSN then indicates DL Buffering Requested to the Serving GW in the Downlink Data Notification Ack message and includes a DL Buffering Duration time and optionally a DL Buffering Suggested Packet Count. The MME/SGSN stores a new value for the DL Data Buffer Expiration Time in the MM context for the UE based on the DL Buffering Duration time and skips the remaining steps of this procedure. The DL Data Buffer Expiration Time is used for UEs using power saving state and indicates that there are buffered data in the Serving GW and that the user plane setup procedure is needed when the UE makes signalling with the network. When the DL Data Buffer Expiration Time has expired, the MME/SGSN considers no DL data to be buffered and no indications of Buffered DL Data Waiting are sent during context transfers at TAU procedures.

If there is a "Availability after DDN Failure" monitoring event configured for the UE in the MME/SGSN, the MME/SGSN does not invoke extended buffering. Instead, the MME/SGSN sets the Notify-on-available-after-DDN-failure flag to remember to send an "Availability after DDN Failure" notification when the UE becomes available. If there is a "UE Reachability" monitoring event configured for the UE in the MME/SGSN, the MME/SGSN should not need to invoke extended buffering.

NOTE 2: When "Availability after DDN failure" and "UE reachability" monitoring events are used for a UE, the application server is assumed to send data when the UE is reachable or about to become reachable, hence no extended buffering is needed. If there are multiple application servers, the event notifications and extended buffering may be needed simultaneously. It is assumed this is handled through additional information based on SLA as described in the next paragraph.

The MME/SGSN may use additional information based on a SLA with the MTC user for when to invoke extended buffering, e.g. only invoke it for a certain APN, do not invoke it for certain subscribers, invoke extended buffering in conjunction with "Availability after DDN failure" and "UE reachability" monitoring events, etc.

A Serving GW that receives a DL Buffering Requested indication in a Downlink Data Notification Ack message stores a new value for the DL Data Buffer Expiration Time based on the DL Buffering Duration time and does not send any additional Downlink Data Notification if subsequent downlink data packets are received in the Serving GW before the buffer time DL Data Buffer Expiration Time has expired for the UE.

If the Serving GW, while waiting for the user plane to be established, is triggered to send a second Downlink Data Notification for a bearer with higher priority (i.e. ARP priority level) than the first Downlink Data Notification was sent for, the SGW sends a new Downlink Data Notification message indicating the higher priority to the MME. If the Serving GW receives additional downlink data packets for a bearer with same or lower priority than the first Downlink Data Notification was sent for or if the Serving GW has sent the second Downlink Data Notification message indicating the higher priority and receives additional downlink data packets for this UE, the Serving GW buffers these downlink data packets and does not send a new Downlink Data Notification.

If the Serving GW, while waiting for the user plane to be established, receives a Modify Bearer Request message from MME or SGSN other than the one it sent a Downlink Data Notification message to, the Serving GW re-sends the Downlink Data Notification message only to the new MME or SGSN from which it received the Modify Bearer Request message even if ISR is active.

If the Tracking Area Update procedure with MME change or the Routing Area Update procedure is in progress when the old MME receives a Downlink Data Notification message, the old MME may reject a Downlink Data Notification message with an indication that the Downlink Data Notification message has been temporarily rejected.

Similarly, if the Routing Area Update procedure with SGSN change or the Tracking Area Update procedure is in progress when the old SGSN receives a Downlink Data Notification message, the old SGSN may reject a Downlink Data Notification message with an indication that the Downlink Data Notification message has been temporarily rejected.

Upon reception of a Downlink Data Notification Ack message with an indication that the Downlink Data Notification message has been temporarily rejected and if the Downlink Data Notification is triggered by the arrival of downlink data packets at the Serving GW, the Serving GW may start a locally configured guard timer and buffers all downlink user packets received to the given UE and waits for a Modify Bearer Request message to come. Upon reception of a Modify Bearer Request message, the Serving GW re-sends the Downlink Data Notification message only to the new MME or SGSN from which it received the Modify Bearer Request message even if ISR is active. Otherwise the Serving GW releases buffered downlink user packets at expiry of the guard timer or receiving the Delete Session Request message from MME/SGSN.

Upon reception of a Downlink Data Notification Ack message with an indication that the Downlink Data Notification message has been temporarily rejected and if the Downlink Data Notification is triggered by the arrival of signalling messages at the Serving GW, the Serving GW may reject the PDN GW initiated EPS bearer(s) request with the same indication that the request has been temporarily rejected. Upon reception of a rejection for an EPS bearer(s) PDN GW initiated procedure with an indication that the request has been temporarily rejected, the PDN GW may start a locally configured guard timer. The PDN GW may re-attempt, up to a pre-configured number of times, when either it detects the UE accesses via a new SGW or at expiry of the guard timer.

Upon reception of a Downlink Data Notification Ack message with an indication that the paging has been restricted, the Serving GW either discards the incoming data, or starts a locally configured guard timer and buffers all the received downlink user packets for the given UE as long as this timer is running.

3a. If the UE is registered in the MME and considered reachable for paging, the MME sends a Paging message (NAS ID for paging, TAI(s), UE identity based DRX index, Paging DRX length, list of CSG IDs for paging, Paging Priority indication, Enhanced Coverage Restricted, CE mode B Restricted, Assistance Data for Recommended Cells, WUS Assistance Information) to each eNodeB belonging to the tracking area(s) in which the UE is registered. The step is described in detail in TS 36.300 [5] and TS 36.413 [36]. Steps 3-4 are omitted if the MME already has a signalling connection over S1-MME towards the UE but the S1-U tunnel has not yet been established.

If extended idle mode DRX is enabled for the UE, the MME pages the UE just before the occurrence of the UE's next paging occasion, which is determined as described in TS 23.682 [74].

NOTE 3: Steps 3a and 4a are performed also when the UE and the network support User Plane CIoT EPS Optimisation and the previous RRC connection has been suspended.

Paging priority indication is included only:

- if the MME receives a Downlink Data Notification or Create Bearer Request with an ARP priority level associated with MPS or other priority services, as configured by the operator.

- One Paging Priority level can be used for multiple ARP priority level values. The mapping of ARP priority level values to Paging Priority level (or levels) is configured by operator policy.

During a congestion situation the eNodeB may prioritise the paging of UEs according to the Paging Priority indications.

If the MME, while waiting for a UE response to the Paging Request message sent without Paging Priority indication, receives an Update Bearer Request, Create Bearer Request or Downlink Data Notification, any of which indicates an ARP priority level associated with MPS or other priority services, as configured by the operator, the MME shall send another paging message with the suitable Paging Priority.

When the MME is configured to support CSG paging optimisation in the CN, the MME should avoid sending Paging messages to those eNodeB(s) with CSG cells for which the UE does not have a CSG subscription. When the MME is configured to support CSG paging optimisation in the HeNB Subsystem, the list of CSG IDs for paging is included in the Paging message. For CSG paging optimisation, the CSG IDs of expired CSG subscriptions and valid CSG subscriptions are both included in the list. If the UE has emergency bearer service the MME shall not perform the CSG paging optimisation.

NOTE 4: An expired CSG subscription indicates that the UE is not allowed service in the CSG. However, since the removal of the CSG from the UE is pending, it is possible the UE will camp on that CSG and therefore the UE is still paged for the CSG.

NOTE 5: The eNodeB reports to the MME the CSG ID supported. For More detail of this procedure refer to TS 36.413 [36].

When the MME supports SIPTO at Local Network and LIPA paging for traffic arriving on the PDN connection with L-GW function collocated with the (H)eNB the MME should only page this (H)eNB to avoid sending Paging messages to eNodeB(s) that are not handling this specific PDN connection.

Paging strategies may be configured in the MME for different combinations of APN, Paging Policy Indication from SGW when available (see clause 4.9) and other EPS bearer context information e.g. QCI. APN and any EPS bearer context information are identified by EPS bearer ID received in Downlink Data Notification. Paging strategies may include:

- paging retransmission scheme (e.g. how frequently the paging is repeated or with what time interval);

- determining whether to send the Paging message to the eNodeBs during certain MME high load conditions;

- whether to apply sub-area based paging (e.g. first page in the last known ECGI or TA and retransmission in all registered TAs).

If extended idle mode DRX was enabled in the UE, the MME may additionally take into account the Paging Time Window length for paging retransmission schemes.

NOTE 6: The Paging priority in the Paging message is set based on priority level of the ARP IE received in Downlink Data Notification or Create/Update Bearer Request message and is independent from any paging strategy.

The MME and the E-UTRAN may support further paging optimisations in order to reduce the signalling load and the network resources used to successfully page a UE by one or several following means:

- by the MME implementating specific paging strategies (e.g. the S1 Paging message is sent to the eNB that served the UE last);

- by the MME considering Information On Recommended Cells And ENBs provided by the E-UTRAN at transition to ECM IDLE. The MME takes the eNB related part of this information into account to determine the eNBs to be paged, and provides the information on recommended cells within the S1 Paging message to each of these eNBs;

- by the E-UTRAN considering the Paging Attempt Count Information provided by the MME at paging.

When implementing such optimisations/strategies, the MME shall take into account any PSM active timer and the DRX interval for the UE.

The MME shall ensure that the correct Paging DRX Length is provided based on the accepted UE Specific DRX of the current RAT.

If the UE Radio Capability for Paging Information is available in the MME for the RAT corresponding to the TAI(s) in the S1 Paging message, the MME shall add the UE Radio Capability for Paging Information for that RAT in the S1 Paging message to the eNB.

If the Information On Recommended Cells And eNBs For Paging is available in the MME, the MME shall take that information into account to determine the eNBs for paging and, when paging an eNB, the MME may transparently convey the information on recommended cells to the eNB.

The MME may include in the S1AP Paging message(s) the paging attempt count information. The paging attempt count information shall be the same for all eNBs selected by the MME for paging.

The MME may include in the S1AP Paging message(s) the WUS Assistance Information, if available.

If the MME has Information for Enhanced Coverage stored and Enhanced Coverage is not restricted then the MME shall include Information for Enhanced Coverage in the Paging message for all eNBs selected by the MME for paging. For including the Enhanced Coverage Restricted parameter in the paging message, see clause 4.3.28.

For including the CE mode B Restricted parameter in the Paging message, see clause 4.3.27a.

3b. If the UE is registered in the SGSN, the SGSN sends paging messages to RNC/BSS, which is described in detail in TS 23.060 [7].

4a. If eNodeBs receive paging messages from the MME, the UE is paged by the eNodeBs. The step is described in detail in TS 36.300 [5] and TS 36.304 [34]. If the WUS Assistance Information is included in Step 3a, the eNB takes it into account when paging the UE (see TS 36.300 [5]).

If the UE and eNodeB support WUS, then:

- if the S1-AP Paging message contains the *Assistance Data for Recommended Cells* IE (see TS 36.413 [36]), the eNodeB shall only broadcast the UE's Wake Up Signal in the last used cell;

- else (i.e. the *Assistance Data for Recommended Cells* IE is not included in the S1-AP Paging message) the eNodeB should not broadcast the UE's Wake Up Signal.

4b. If RNC/BSS nodes receive paging messages from the SGSN the UE is paged by the RNSC/BSS, which is described in detail in TS 23.060 [7].

5. When UE is in the ECM-IDLE state, upon reception of paging indication in E-UTRAN access, the UE initiates the UE triggered Service Request procedure (clause 5.3.4.1) or, if the UE is enabled to use User Plane CIoT EPS Optimisation and there is suspended access stratum context stored in the UE, the UE initiates the Connection Resume procedure (clause 5.3.5A). If the MME already has a signalling connection over S1-MME towards the UE but the S1-U tunnel has not yet been established, then the messages sequence performed start from the step when MME establishes the bearer(s).

Upon reception of paging indication in UTRAN or GERAN access, the MS shall respond in respective access as specified TS 24.008 [47] and the SGSN shall notify the S‑GW.

The MME and/or SGSN supervises the paging procedure with a timer. If the MME and/or SGSN receives no response from the UE to the Paging Request message, it may repeat the paging according to any applicable paging strategy described in step 2.

If the MME and/or SGSN receives no response from the UE after this paging repetition procedure, it shall use the Downlink Data Notification Reject message to notify the Serving GW about the paging failure, if paging was triggered by a Downlink Data Notification message, unless the MME or SGSN is aware of an ongoing MM procedure that prevents the UE from responding, i.e. the MME or SGSN received a Context Request message indicating that the UE performs TAU or RAU procedure with another MME or SGSN. If paging was triggered by control signalling from the Serving GW and if the MME or SGSN receives no response from the UE after this paging repetition procedure, the MME or SGSN shall reject that control signalling. When a Downlink Data Notification Reject message is received, if ISR is not activated, the Serving GW deletes the buffered packet(s). If ISR is activated and the Serving GW receives Downlink Data Notification Reject message from both SGSN and MME, the Serving GW deletes the buffered packet(s) or rejects the control signalling which triggers the Service Request procedure. The Serving GW may invoke the procedure PDN GW Pause of Charging (clause 5.3.6A) if UE is in ECM IDLE and the PDN GW has enabled "PDN charging pause" feature.

NOTE 7: The Serving GW may initiate the procedure PDN GW Pause of Charging at any time before step 5 if the UE is in ECM IDLE and the PDN GW has indicated that the feature is enabled for this PDN. See clause 5.3.6A.

6a. If ISR is activated and paging response is received in E‑UTRAN access the Serving GW sends a "Stop Paging" message to the SGSN.

6b. If ISR is activated and paging response is received in UTRAN or GERAN access the Serving GW sends a "Stop Paging" message to the MME.

The Serving GW transmits downlink data towards the UE via the RAT which performed the Service Request procedure.

For a LIPA PDN connection, after the UE enters connected mode, the packets buffered in the L-GW are forwarded to the HeNB on the direct path. If the UE enters connected mode at a different cell than the one where the L-GW is colocated, the MME shall deactivate the LIPA PDN connection as defined in clause 5.3.4.1 step 2.

If the network triggered service request fails due to no response from the UE, then MME and/or SGSN may based on operator policy initiate the Dedicated Bearer Deactivation procedure for preserved GBR bearers. For details, see clause 5.4.4.2 for MME and TS 23.060 [7] for SGSN.

\*\*\*\*\* END OF CHANGES \*\*\*\*\*