**3GPP TSG-WG SA2 Meeting # 166 *S2-2411576rev-2***

**Orlando, FL, USA, 18 - 22 November 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **23.401** | **CR** | **3833** | **rev** | **-** | **Current version:** | **19.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | MPS priority paging for MT SMS  |
|  |  |
| ***Source to WG:*** | Peraton Labs, CISA ECD, AT&T, Verizon, T-Mobile USA |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | MPS4msg |  | ***Date:*** | 2024-11-18 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | The specification of priority paging for Mobile Terminated SMS from the SMS Gateway Mobile Switching Center (GMSC) is missing. |
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| ***Summary of change:*** | Adds that paging priority can be included if the MME receives an MT SMS and the MPS for Messaging indication is set.  |
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| ***Consequences if not approved:*** | The concept of priority paging for a MT SMS message might be missed. |
|  |  |
| ***Clauses affected:*** | 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:*** |  |

\* \* \* \* First 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.

 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) or is only in coverage intermittently (e.g. the UE is using satellite access with a known maximum interval between coverage occasions) 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 or if the UE is only in coverage intermittently (e.g. the UE is using satellite access with a known maximum interval between coverage occasions) 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.

 If the MME holds stored Paging Restriction Information (see clause 4.3.33.6) for the UE that restricts the Downlink Data from causing paging, the MME sends Downlink Data Notification Ack 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.

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, Voice Service Indication) 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 the MME holds stored Paging Restriction Information for the UE, the MME may block the paging for this UE, based on local policy and the stored Paging Restriction Information (see clause 4.3.33.6).

 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/Update Bearer Request with an ARP priority level associated with MPS or other priority services, as configured by the operator.

When ARP is used to determine Paging Priority, 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.

- if the MME receives an MT SMS from the SMS-GMSC and has received an indication that MPS for Messaging is enabled for the UE in the HSS.

- if the MME receives an MT SMS from the SMS-GMSC marked with a DRMP associated with MPS for Messaging.

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

 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 implementing specific paging strategies (e.g. the S1 Paging message is sent to the eNodeB that served the UE last);

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

- 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 eNodeB.

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

 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 eNodeBs 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 eNodeBs 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.

 If the network supports the Paging Cause Indication for Voice Service feature if the UE context in the MME indicates that the UE supports the Paging Cause for Voice Service feature, the MME should provide the Voice Service Indication in the S1AP Paging message only when the MME detects that the downlink data which triggers the Paging message is related to voice service, as specified in clause 4.3.

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 eNodeB 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.

 If the Voice Service Indication is included in step 3a, the eNodeB supporting the Paging Cause Indication for Voice Service feature should include the Voice Service Indication in the paging message to the UE, see TS 36.300 [5].

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).

 If the Multi-USIM UE is in ECM-IDLE state, upon reception of paging indication in E-UTRAN access and if the UE decides not to accept the paging, the UE attempts to send a Reject Paging Indication via the UE Triggered Service Request procedure (clause 5.3.4.1) unless it is unable to do so, e.g. due to UE implementation constraints.

 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.

5a. After receiving the Reject Paging Indication, the MME uses the Downlink Data Notification Failure Indication message to notify the Serving GW that the UE rejected the page and no user plane radio bearers will be established. The UE remains reachable for future paging attempts based on stored (if any) Paging Restriction Information.

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 collocated, 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 be 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 \* \* \* \*