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**Universal Mobile Telecommunications System (UMTS);
LTE;
Mobility Management Entity (MME)
- Visitor Location Register (VLR)
SGs interface specification
(3GPP TS 29.118 version 10.6.0 Release 10)**



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Foreword

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1 Scope

CS Fallback in the Evolved Packet System (EPS) enables the provisioning of CS-domain services (e.g. voice call, Location Services (LCS) or supplementary services) by reuse of CS infrastructure when the UE is served by E-UTRAN. Additionally, SMS delivery via the CS core network is realized without CS fallback.

The present document specifies the procedures and the SGs Application Part (SGsAP) messages used on the SGs interface between the Mobility Management Entity (MME) in the EPS and the Visitor Location Register (VLR), to allow location management coordination and to relay certain messages related to GSM circuit switched services over the EPS system.

The present document also specifies the use of Stream Control Transmission Protocol (SCTP) for the transport of SGsAP messages.

The present document is applicable to the MME in the EPS and to the VLR. The functional split between the MME and the VLR is defined in 3GPP TS 23.272 [7].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 22.101: "Service aspects; Service principles".
- [3] 3GPP TS 23.003: "Numbering, addressing and identification".
- [4] 3GPP TS 23.007: "Restoration procedures".
- [5] 3GPP TS 23.018: "Basic call handling; Technical realization".
- [5AA] 3GPP TS 23.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 4; Stage 2".
- [5A] 3GPP TS 23.081: "Line identification supplementary services".
- [5B] 3GPP TS 23.082: "Call Forwarding (CF) supplementary services".
- [6] Void.
- [6A] 3GPP TS 23.236: "Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes".
- [7] 3GPP TS 23.272: "Circuit Switched Fallback in Evolved Packet System; Stage 2".
- [8] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".
- [9] 3GPP TS 24.010: "Supplementary services specification; General aspects".
- [10] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

- [11] 3GPP TS 24.030: "Location Services (LCS); Supplementary service operations; Stage 3".
- [12] 3GPP TS 24.081: "Line Identification Supplementary Services - Stage 3".
- [13] 3GPP TS 24.082: "Call Forwarding (CF) supplementary services; Stage 3".
- [14] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".
- [15] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".
- [15A] 3GPP TS 29.011: "Signalling interworking for supplementary services".
- [16] 3GPP TS 29.018: "Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR) Gs interface layer 3 specification".
- [17] 3GPP TS 29.272: "MME and SGSN Related Interfaces Based on Diameter Protocol".
- [17A] 3GPP TS 29.274: "3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".
- [17B] 3GPP TS 32.250: "Telecommunication management; Charging management; Circuit Switched (CS) domain charging".
- [18] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management (CM)".
- [19] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".
- [20] IETF RFC 791 (September 1981): "Internet Protocol".
- [21] IETF RFC 1035 (November 1987): "Domain Names - Implementation and Specification".
- [22] IETF RFC 2460 (December 1998): "Internet Protocol, Version 6 (IPv6) Specification".
- [23] IETF RFC 4960 (September 2007): "Stream Control Transmission Protocol".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] apply. Additionally the following definitions of 3GPP TS 24.301 [14] apply:

Non-EPS services

SMS only

SMS over SGs

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

LCS	Location Services
MME	Mobility Management Entity
NEAF	Non-EPS Alert Flag
SCTP	Stream Control Transmission Protocol
SGsAP	SGs Application Part

SMS Short Message Service
PSI Provide Subscriber Information

4 Description of the SGs association between a VLR and an MME

4.1 General

CS fallback function and SMS delivery via the CS core network is realized by reusing Gs interface mechanisms as defined in 3GPP TS 29.018 [16] on the interface between the MME in the EPS and the VLR. This interface is called SGs interface.

NOTE: Within this specification, the term VLR refers to MSC/VLR or MSC Server/VLR.

The SGs interface connects the databases in the VLR and the MME. The procedures described in the present document are used to co-ordinate the location information of UEs that are IMSI attached to both EPS and non-EPS services. The SGs interface is also used to convey some circuit switched related procedures via the MME.

The basis for the interworking between a VLR and an MME is the existence of a SGs association between those entities per UE. The SGs association is applicable to UEs which are configured to use CS fallback and SMS over SGs, or SMS over SGs only.

The behaviour of the VLR and the MME entities related to the SGs interface are defined by the state of the SGs association for a UE. Individual SGs association states are maintained at both the VLR and the MME for each UE.

4.2 SGs association at the VLR

4.2.1 General

The states associated to the SGs interface in the VLR are specified in subclause 4.2.2 and the state diagram at the VLR is shown in figure 4.2.2.1. The state diagram does not include the message error handling specified in clause 7.

4.2.2 States at the VLR

SGs-NULL

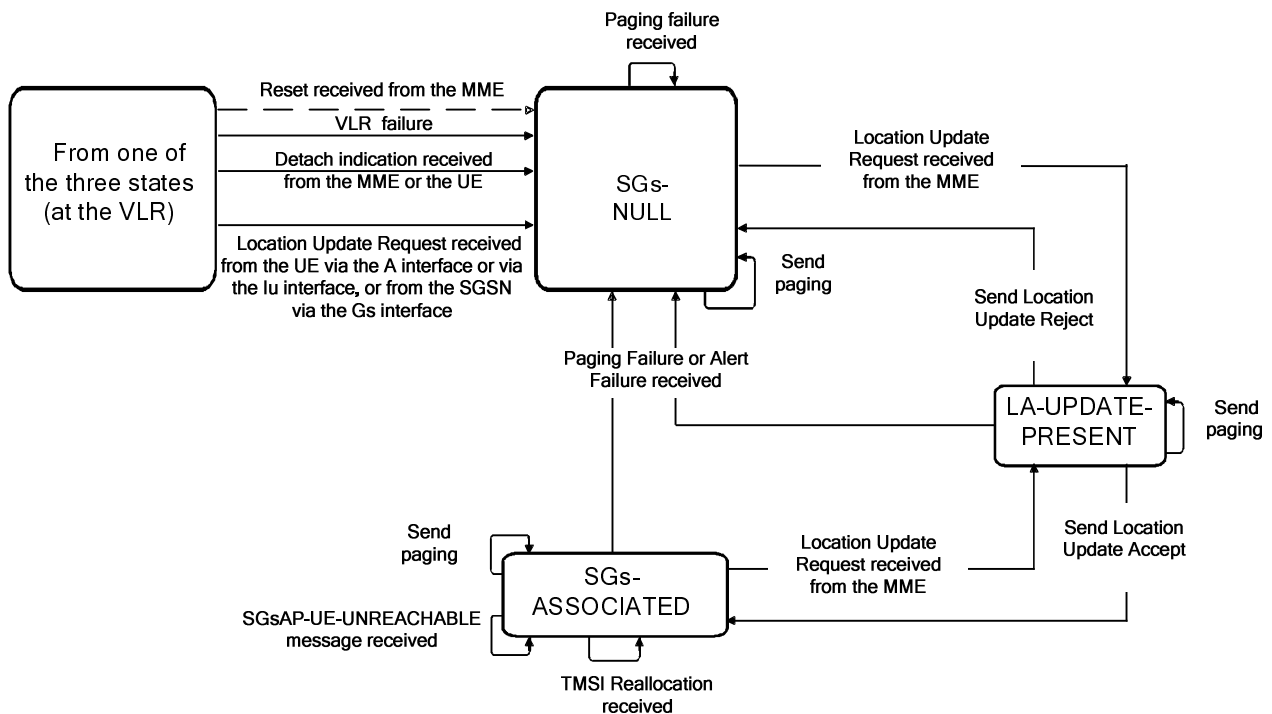
There is no SGs association with an MME for the UE and therefore the VLR considers that the UE is IMSI detached for EPS services. In this state no SGsAP-MM-INFORMATION-REQUEST messages are sent to the MME. The VLR may initiate paging on the SGs interface if the "Confirmed by Radio Contact" restoration indicator in the VLR is set to "false" (see 3GPP TS 23.007 [4]). Any message from the MME is ignored except SGsAP-LOCATION-UPDATE-REQUEST, SGsAP-IMSI-DETACH-INDICATION and SGsAP-EPS-DETACH-INDICATION.

LA-UPDATE-PRESENT

The VLR has received an SGsAP-LOCATION-UPDATE-REQUEST message from the MME. In this state, the VLR may be waiting for the outcome of the Update Location procedure from the HSS, if the IMSI is not known in the VLR. For UEs which are configured to use CS fallback and SMS over SGs, or SMS over SGs only, the VLR sends SGsAP-PAGING-REQUEST messages via the SGs interface.

SGs-ASSOCIATED

The VLR considers that the UE is attached to both EPS and non-EPS services. For UEs which are configured to use CS fallback and SMS over SGs, or SMS over SGs only, the VLR sends SGsAP-PAGING-REQUEST messages via the SGs interface. The VLR can perform the MM information procedure.



NOTE: Receipt of an SGsAP-RESET-INDICATION message from the MME may change or not the state of the SGs interface of all the associations associated to the restarted MME, see subclause 5.8.3.

Figure 4.2.2.1: State diagram at the VLR

4.3 SGs association at the MME

4.3.1 General

The MM context variables associated to the SGs interface in the MME are specified in subclause 4.3.2 and states associated to the SGs interface in the MME are specified in subclause 4.3.3. The state diagram at the MME is shown in figure 4.3.3.1. The state diagram does not include the message error handling specified in clause 7.

4.3.2 MM context variables at the MME

VLR-Reliable:

Boolean set to "false" when the MME has received a reset indication from the VLR. The MME may request the UE, upon reception of the next tracking area update (periodic or combined) procedure, to re-attach to non-EPS services if the UE is still IMSI attached to non-EPS services. Alternatively, the MME may, upon reception of a periodic or combined tracking area update request from a UE that is still attached for non-EPS services, perform immediately the location update for non-EPS services procedure.

MME-Reset:

Boolean set to "true" when the MME restarts after a failure. The "MME-Reset" restoration indicator is unique within an MME and it applies to all the MM contexts stored in the MME.

4.3.3 States at the MME

SGs-NULL

There is no SGs association with a VLR for the UE and therefore the MME considers that the UE is IMSI detached for non-EPS services. In this state the MME accepts SGsAP-PAGING-REQUEST messages to UEs only if the "MME-Reset" restoration indicator in the MME is set to "true".

LA-UPDATE-REQUESTED

The MME has sent an SGsAP-LOCATION-UPDATE-REQUEST message to the VLR. In this state the MME waits for the outcome of the Update Location for non-EPS services procedure at the VLR before sending the response to the UE. In this state the MME accepts SGsAP-PAGING-REQUEST messages.

SGs-ASSOCIATED

The MME stores an SGs association for the UE. In this state the MME performs the location update for non-EPS services procedure towards the VLR, e.g. when the location area is changed. All conditions describing when to trigger the location update for non-EPS services procedure are listed in subclause 5.2.2.2.

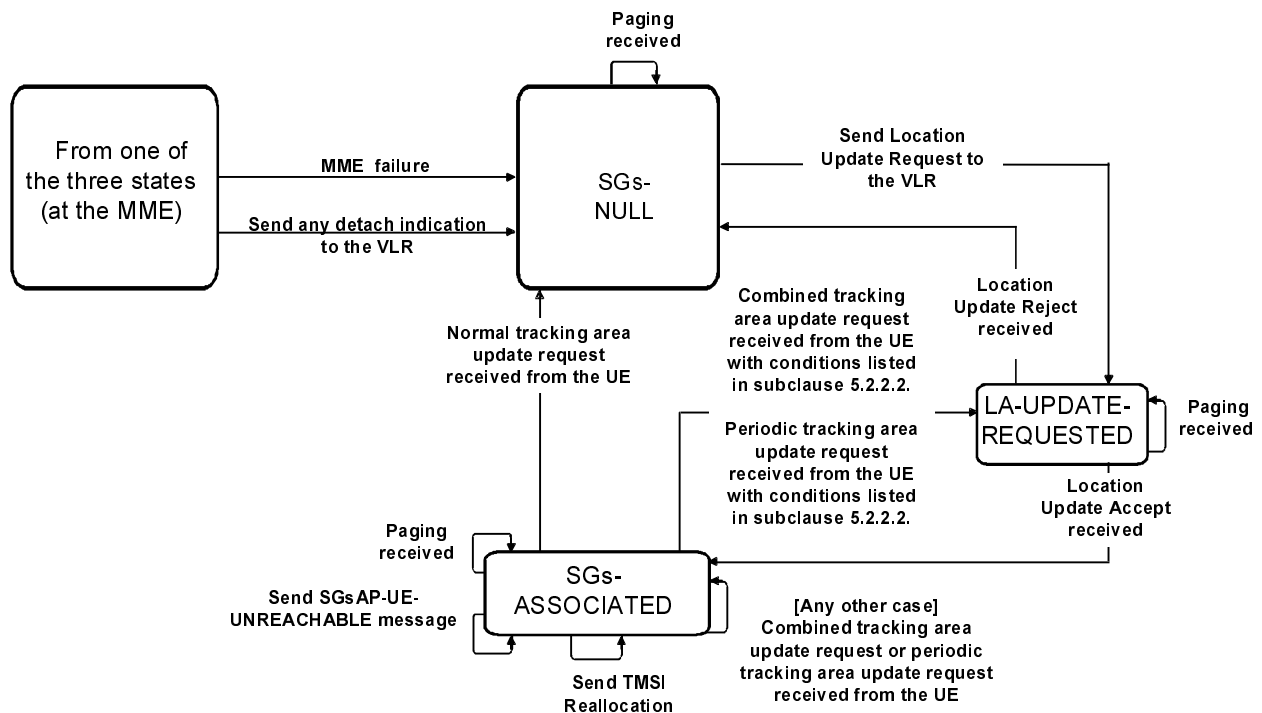


Figure 4.3.3.1: State diagram at the MME

5 Procedures for SGs

5.1 Paging for non-EPS services procedure

5.1.1 General description

This procedure is used by the VLR to send an SGsAP-PAGING-REQUEST message to a UE. This procedure applies to UEs that are simultaneously attached for EPS services and non-EPS services, or for EPS services and SMS only.

5.1.2 Procedures in the VLR

5.1.2.1 General

The VLR shall handle the timers, queuing and retransmission for sending the SGsAP-PAGING-REQUEST message on the SGs interface in the same way that it handles the sending of a PAGING message on the A or Iu interface.

5.1.2.2 Paging Initiation

When a VLR has to page a UE, the VLR shall check whether the VLR has a SGs association for that UE. The VLR sends SGsAP-PAGING-REQUEST messages to the MME if the state of the SGs association for the UE is SGs-ASSOCIATED, LA-UPDATE-PRESENT or if the state of the SGs association is SGs-NULL and the "Confirmed by Radio Contact" restoration indicator is set to "false". The sending of the SGsAP-PAGING-REQUEST message does not change the state of the SGs association with the MME.

If the "Confirmed by Radio Contact" restoration indicator is set to "true", the VLR shall include the Location area identifier information element into the SGsAP-PAGING-REQUEST message, otherwise (i.e. after a VLR failure), the VLR shall not include the Location area identifier information element. When sending the SGsAP-PAGING-REQUEST message, the VLR shall start timer Ts5.

If the state of the SGs association is SGs-NULL and the "Confirmed by Radio Contact" restoration indicator is set to "false", the VLR shall also perform a search procedure as specified in 3GPP TS 23.018 [5].

In this message, the VLR includes the Service indicator information element which will be used to indicate the type of CS service. If the SGs paging request is sent as a result of reception of Provide Subscriber Information Request message, the VLR sets the Service indicator information element to either "SMS indicator" or "CS call indicator" as specified in subclause 7.2.3.5 of 3GPP TS 23.018 [5]. For SMS, SMS indicator is used. For all the other CS services, CS call indicator is used.

If the Calling Line Identification of the service (see 3GPP TS 24.081 [12]) is available in the VLR, the VLR may include the CLI information element in the SGsAP-PAGING-REQUEST message. The conditions specified in 3GPP TS 23.081 [5A] and 3GPP TS 29.011 [15A] apply also here. If the paging is due to a NW-initiated Call Independent SS procedure as defined in 3GPP TS 24.010 [9], the VLR shall include the SS code as defined in 3GPP TS 29.002 [15]. If the paging is due to a Mobile Terminated Location Request as defined in 3GPP TS 24.030 [11], the VLR shall include LCS client identity and LCS indicator as defined in 3GPP TS 29.002 [15] in the SGsAP-PAGING-REQUEST.

While domain specific access control of the PS domain is ongoing, the VLR shall be configured to send paging messages on both the SGs and the A/Iu interface. The VLR may apply implementation specific rules for sending the paging on the A/Iu interface; e.g. paging on the A/Iu interface may be limited to cases when the UE does not respond to a first paging on SGs interface.

5.1.2.3 Paging Response

The VLR stops the paging procedure on expiry of timer Ts5 or on receipt of a SGsAP-SERVICE-REQUEST message from the MME.

NOTE 1: On receipt of an SCCP connection establishment containing the Initial L3 message from the UE via the A or Iu interface, the VLR stops the paging procedure if ongoing, see 3GPP TS 24.008 [8].

Upon receiving the SGsAP-SERVICE-REQUEST message with the UE EMM mode information element indicating "EMM-CONNECTED", if Call Forwarding on No Reply (CFNRy) is activated for the subscriber, the VLR shall start the CFNRy timer as specified in 3GPP TS 23.082 [5B].

If the paging response is received via the A or Iu interface from a location area which differs from the one stored in the VLR, the VLR shall move the SGs association to the SGs-NULL state after the UE has been authenticated successfully.

NOTE 2: UE sends this paging response as a result of receiving paging request with IMSI and with CN domain indicator set to "CS" (see 3GPP TS 24.301 [14]).

5.1.2.4 Paging Failure

On receipt of an SGsAP-PAGING-REJECT message before the timer Ts5 expires, the VLR stops timer Ts5. If the SGs cause information element in the SGsAP-PAGING-REJECT message does not indicate "Mobile terminating CS fallback call rejected by the user", the SGs association is moved to the SGs-NULL state and within this state the SGs association is marked with the contents of the SGs cause information element. If the SGs cause information element in the SGsAP-PAGING-REJECT message indicates "IMSI detached for EPS services" the VLR shall send the paging message on the A/Iu interface. If the SGs cause information element indicates "Mobile terminating CS fallback call rejected by the user", the SGs association state shall not be changed.

When the VLR receives the SGsAP-PAGING-REJECT message with the SGs cause information element indicating "Mobile terminating CS fallback call rejected by the user", the VLR shall trigger User Determined User Busy (UDUB) as specified in 3GPP TS 24.082 [13].

5.1.2.5 UE unreachable

On receipt of an SGsAP-UE-UNREACHABLE message before the timer Ts5 expires, the VLR stops timer Ts5, and the paging procedure for that paging request towards the MME is stopped. The state of the SGs association at the VLR is unchanged.

NOTE 1: A/Iu paging can be ongoing.

NOTE 2: If the VLR considers the paging procedure completed, and no response from the UE has been received, and CFNRc has been configured and activated for the terminating UE, the VLR applies the equivalent handling as for Call Forwarding on Not Reachable, as specified in 3GPP TS 23.082 [5B] and 3GPP TS 29.011 [15A].

5.1.3 Procedures in the MME

5.1.3.1 General

The MME accepts SGsAP-PAGING-REQUEST messages in any state of the SGs association. In the SGs-NULL state, the MME accepts SGsAP-PAGING-REQUEST messages only if the "MME-Reset" restoration indicator is set to "true". When a MME receives a SGsAP-PAGING-REQUEST message from a VLR, the MME shall first check if the UE is known by the MME. The handling of the paging request depends on the state of the SGs association, the EMM context variables at the MME, and the Service indicator information element in the SGsAP-PAGING-REQUEST message. The MME may process the paging request and subsequent SGs procedures related to this request preferentially compared to other normal procedures if the SGsAP-PAGING-REQUEST message includes the eMLPP priority information element (see 3GPP TS 23.272 [7]).

If the Service indicator information element in the SGsAP-PAGING-REQUEST message indicates "CS call indicator", the MME shall handle the paging request as follows:

- a) If the UE is known:
 - if the UE is considered to be IMSI attached for EPS services and "SMS only", the MME shall return an SGsAP-PAGING-REJECT message to the VLR indicating in the SGs cause information element "Mobile terminating CS fallback call rejected by the user";
 - if the UE is considered to be IMSI attached for EPS and non-EPS services (i.e. the SGs association is not in the state SGs-NULL), the MME shall page the UE based on the location information stored in the MME. If the location area stored in the MME differs from the one received in the SGsAP-PAGING-REQUEST message, or the SGsAP-PAGING-REQUEST message does not include the location area identifier information element, the MME shall use the IMSI to page the UE. If the SGsAP-PAGING-REQUEST message does not include the Location area identifier information element, the MME may set the "VLR-Reliable" MM context variable to "false";
 - if the UE is marked as IMSI detached for EPS services or IMSI (implicitly or explicitly) detached for non-EPS services (i.e. the state of the SGs association is SGs-NULL), the MME shall return an SGsAP-PAGING-REJECT message to that VLR indicating in the SGs cause information element the detach circumstance ("IMSI detached for EPS services", "IMSI detached for non-EPS services" or "IMSI implicitly detached for non-EPS services"); or
 - if the UE is marked as unreachable, indicated by Paging Proceed Flag set to "false", the MME shall return an SGsAP-UE-UNREACHABLE message to that VLR indicating in the SGs cause information element "UE unreachable". The state of the SGs association does not change at the MME.
- b) If the UE is not known and the "MME-Reset" restoration indicator at the MME is set to "false":
 - the MME shall return an SGsAP-PAGING-REJECT message to that VLR indicating in the SGs cause information element "IMSI unknown".

- c) If the UE is not known and the "MME-Reset" restoration indicator at the MME is set to "true", the MME shall handle the paging request as follows:
- if the MME only supports "SMS only", the MME shall return an SGsAP-PAGING-REJECT message to the VLR indicating in the SGs cause information element "Mobile terminating CS fallback call rejected by the user";
 - if the SGsAP-PAGING-REQUEST message includes the Location area identifier information element, the MME shall page the UE in all the tracking areas served by the MME that can be mapped to the location area indicated in the Location area identifier information element; or
 - if the SGsAP-PAGING-REQUEST message does not include the Location area identifier information element, the MME may page in all the tracking areas served by the MME, or the tracking areas served by the MME and by the VLR.

NOTE 1: The MME can initiate the paging procedure using IMSI with CN domain indicator set to "PS" to request the UE to initiate the attach procedure as described in 3GPP TS 24.301 [14].

If the Service indicator information element in the SGsAP-PAGING-REQUEST message indicates "SMS indicator", the MME shall handle the paging request as follows:

- a) If the UE is known:
- if the UE is considered to be IMSI attached for EPS and non-EPS services or IMSI attached for EPS services and "SMS only", the MME shall page the UE based on the location information stored in the MME. If the SGsAP-PAGING-REQUEST message does not include the Location area identifier information element, the MME may set the "VLR-Reliable" MM context variable to "false"; or

NOTE 2: If location area identifier information element is included in the SGsAP-PAGING-REQUEST, it is not used in paging the UE.

- if the UE is marked as IMSI detached for EPS services or IMSI (implicitly or explicitly) detached for non-EPS services, or as unreachable, the MME shall proceed as specified for the case when the service indicator indicates "CS call indicator".
- b) If the UE is not known and the "MME-Reset" restoration indicator at the MME is set to "false":
- the MME shall return an SGsAP-PAGING-REJECT message to that VLR indicating in the SGs cause information element "IMSI unknown".
- c) If the UE is not known and the "MME-Reset" restoration indicator at the MME is set to "true", the MME shall handle the paging request as follows:
- if the SGsAP-PAGING-REQUEST message includes the Location area identifier information element, the MME shall page the UE in all the tracking areas served by the MME that can be mapped to the location area indicated in the Location area identifier information element; or
 - if the SGsAP-PAGING-REQUEST message does not include the Location area identifier information element, the MME may page in all the tracking areas served by the MME, or the tracking areas served by the MME and by the VLR.

5.1.3.2 Procedure when no NAS signalling connection exists

If the Service indicator information element in the SGsAP-PAGING-REQUEST message indicates "CS call indicator", the MME shall proceed as follows:

- If the MME accepts the paging request, and the VLR TMSI is omitted or the UE is not known in the MME, the IMSI is used instead of the S-TMSI as a paging address at the radio interface. If location information is reliably known by the MME (i.e. MME stores the list of tracking areas), the MME shall page the UE in all the tracking areas of the stored list. If the MME does not have a stored tracking area list for the UE, the MME shall use the location information received from the VLR, if any, to page the UE. The MME shall take action as described in 3GPP TS 24.301 [14], subclause 5.6.2.3.

If the Service indicator information element in the SGsAP-PAGING-REQUEST message indicates "SMS indicator", the MME shall proceed as follows:

- If the MME accepts the paging request, and the UE is not known in the MME, the IMSI is used instead of the S-TMSI as a paging address at the radio interface. If the UE is known in the MME, the MME shall use the S-TMSI as paging address at the radio interface. The MME shall take action as described in 3GPP TS 24.301 [14], subclause 5.6.2.4.
- If the SGsAP-PAGING-REQUEST message does not include the Location area identifier information element or the "VLR-Reliable" MM context variable is set to "false", then after the paging procedure is completed, the MME requests the UE to re-attach for non-EPS services as specified in 3GPP TS 24.301 [14].

Independent of the Service indicator information element, if the MME has activated Idle mode Signalling Reduction for the UE, the MME shall forward the paging request to the associated SGSN, as described in 3GPP TS 29.274 [17A].

Independent of the Service indicator information element, the MME shall not retransmit the paging message to the UE. Additionally, if the MME has activated Idle mode Signalling Reduction for the UE, the MME shall not retransmit the paging request to the associated SGSN.

5.1.3.3 Procedure when a NAS signalling connection exists

If the Service indicator information element in the SGsAP-PAGING-REQUEST message indicates "CS call indicator", the MME shall proceed as follows:

- If the MME accepts the paging request and a NAS signalling connection exists, the MME shall send the CS SERVICE NOTIFICATION message to the UE through the NAS signalling connection, including the CS service related parameters (CLI, SS code, LCS indicator and LCS client identity), received from the VLR.

If the Service indicator information element in the SGsAP-PAGING-REQUEST message indicates "SMS indicator" and the MME accepts the paging request, the MME shall proceed as follows:

- If the Location area identifier information element is not included in the SGsAP-PAGING-REQUEST message or the "VLR-Reliable" MM context variable is set to "false", the MME requests the UE to re-attach for non-EPS services as specified in 3GPP TS 24.301 [14]; or
- Otherwise, the MME need not take any action towards the UE.

5.2 Location update for non-EPS services procedure

5.2.1 General description

The location update for non-EPS services procedure is a general procedure used by UEs which are configured to use CS fallback and SMS over SGs, or SMS over SGs only. This procedure allows UEs and the network to perform:

- combined IMSI attach for EPS and non-EPS services or for SMS only;
- IMSI attach for non-EPS services or for SMS only if the UE is already IMSI attached for EPS services;
- normal location update procedure to the VLR if the UE is IMSI attached for both EPS and non-EPS services, or for SMS only; or
- allocation of new TMSI to an UE.

The location update for non-EPS services procedure in the SGs interface is always started as a consequence of a direct action from the UE. The combined attach and tracking area update procedures are further specified in 3GPP TS 23.272 [7] and 3GPP TS 24.301 [14].

When a UE is IMSI attached for EPS and non-EPS services, the VLR shall stop any implicit detach timer. Instead the MME uses the "Paging Proceed Flag" to determine the likely availability of the UE to the network. Upon reception of the periodic Tracking Area Update message, the MME does not report to the VLR, and the MME shall not change the state of the SGs association. When the UE performs a detach only for EPS services, and the VLR's implicit detach timer is not already running, the EPS detach indication to the VLR shall cause the VLR's implicit detach timer to be restarted from its initial value.

If the MME performs an implicit detach for both EPS and non-EPS services, then the MME shall send to the VLR an SGsAP-IMSI-DETACH-INDICATION message with cause "Implicit network initiated IMSI detach from EPS and non-

EPS services", as further described in subclause 5.6 (the implicit IMSI detach message indicates that the UE is unavailable for both EPS and non-EPS services).

5.2.2 Procedures in the MME

5.2.2.1 General

The location update for non-EPS services procedure is initiated with a combined attach or a combined tracking area update procedure. On receipt of an ATTACH REQUEST message or a TRACKING AREA UPDATE REQUEST message from the UE, the MME shall handle the EPS related request as specified in 3GPP TS 24.301 [14]. The location update for non-EPS services procedure is started by the MME when it receives the Update Location Ack message containing subscription data from the HSS. The MME shall wait for the outcome of both location update procedures towards the VLR and the HSS before sending the response message to the UE. If the Update Location Answer message indicates that the UE has subscription for packet only (see 3GPP TS 29.272 [17]), the MME sends the response message to the UE without starting the location update for non-EPS services procedure.

5.2.2.2 Location update initiation

If timer Ts6-1 is not running, the MME shall start the location update for non-EPS services procedure when it receives from the UE:

- an attach request indicating combined EPS/IMSI attach;
- a combined tracking area update request indicating Combined TA/LA updating with IMSI attach;
- a combined tracking area update request and the MME detects that the LAI has changed;
- a combined tracking area update request and the state of the SGs association is SGs-NULL; or
- a combined tracking area update request and the MME serving the UE has changed.

If timer Ts6-1 is not running, the MME may start the location update for non-EPS services procedure when it receives from the UE:

- a combined tracking area update request or a periodic tracking area update, if the MM context variable "VLR-Reliable" for the MS is set to "false" (see subclause 5.7.3).

If multiple PLMNs are available for the CS domain, the MME shall select a PLMN for CS domain as specified in 3GPP TS 23.272 [7]. If the MME cannot select any PLMN for CS domain for the UE, the MME informs the UE that the CS domain is not available.

The MME shall determine the new location area identification as follows:

- if the MME received a combined attach request or combined tracking area update request from the UE with an indication for "SMS only", or the network only supports "SMS only" or the network only has a few VLRs that support SGs interface, the MME may allocate a default location area identification specifically configured for that case;
- else the MME derives the location area identification from the current tracking area identity where the UE is located. For this the MME may take any access restrictions provided by the HSS into account, if the network is using separate location areas for GERAN and UTRAN cells.

The MME shall derive the VLR name from the location area identification which was determined. In case multiple VLRs serve this location area identification, the MME shall use the location area identification and an IMSI hash value to retrieve the VLR name. The MME shall include the location area identification in the new location area identifier information element in the SGsAP-LOCATION-UPDATE-REQUEST message.

NOTE: The selection of the VLR in the MME follows the same rule as the selection of the VLR in the SGSN, as defined in 3GPP TS 23.236 [6A], and the same IMSI hash values and IMSI hash tables are used by the MME and the SGSN.

In networks supporting the feature "Intra Domain Connection of RAN Nodes to Multiple CN Nodes" as defined in 3GPP TS 23.236 [6A], the MME shall support load re-distribution of UEs to another VLR than the current one. When

the MME receives a periodic tracking area update request or a combined tracking area update request, the MME shall check whether for this UE there is a SGs association to a VLR for which load re-distribution has been initiated in the MME by O&M. If this is the case, the MME derives the new VLR name using the new IMSI hash table configured in the MME. The MME shall then send the SGsAP-LOCATION-UPDATE-REQUEST message to the new selected VLR.

The SGsAP-LOCATION-UPDATE-REQUEST message includes the type of location update performed by the UE in the EPS location update type information element. If the UE has performed a combined attach or a combined tracking area update indicating "combined TA/LA updating with IMSI attach", the MME indicates "IMSI attach", otherwise the MME indicates "Normal location update".

The MME shall include the TMSI status in the SGsAP-LOCATION-UPDATE-REQUEST message if the UE indicates in the ATTACH REQUEST or the TRACKING AREA UPDATE REQUEST message that it has no valid TMSI available. The MME shall also include the old location area identifier in the SGsAP-LOCATION-UPDATE-REQUEST message if the UE included the old location area identification in the ATTACH REQUEST or TRACKING AREA UPDATE REQUEST message.

If the MME supports the "Automatic Device Detection" (see 3GPP TS 22.101 [2]) or the "Trace for Management Based Activation/Deactivation" (see 3GPP TS 32.422 [18]), the MME shall include the IMEISV in the SGsAP-LOCATION-UPDATE-REQUEST message.

The MME shall include the UE's current TAI and E-CGI in the SGsAP-LOCATION-UPDATE-REQUEST message.

When the MME sends the SGsAP-LOCATION-UPDATE-REQUEST, the MME shall start timer Ts6-1.

If timer Ts6-1 is running and the MME receives from the UE:

- an attach request indicating combined EPS/IMSI attach; or
- a combined tracking area update with or without IMSI attach.

Then:

- if the LAI determined by the MME is the same as in the outstanding request, the MME shall not process this new request and shall wait for the VLR response to the ongoing procedure;
- if the LAI determined by the MME is different but the VLR name is the same as for previous LAI, any response from the VLR to the outstanding request is ignored, the MME shall stop and reset timer Ts6-1 and the MME shall start the location update for non-EPS services procedure; or
- if the LAI determined by the MME is different and the VLR name is different as for previous LAI, any response from the previously addressed VLR to the outstanding request is ignored, the MME shall stop and reset timer Ts6-1, and the MME shall start the location update for non-EPS services procedure.

When the MME receives from the UE a tracking area update request and the MME serving the UE has changed, the MME shall stop and reset timer Ts6-1.

5.2.2.3 Location update response

If the MME receives an SGsAP-LOCATION-UPDATE-ACCEPT message from the VLR, the MME shall stop timer Ts6-1 and:

- move the state of the SGs association to SGs-ASSOCIATED;
- set the MM context variable "VLR-Reliable" to "true"; and
- indicate to the UE the acceptance of the VLR to the location update procedure. The message sent to the UE includes the Location Area Identity (see 3GPP TS 24.301 [14]).

The MME shall wait for the outcome of the location update for non-EPS services procedure towards the VLR before sending a response to location update procedure to the UE. When the MME receives an SGsAP-LOCATION-UPDATE-REJECT message from the VLR, it will map the reject cause received to the appropriate reject cause as specified in 3GPP TS 24.301 [14], and report this reject cause to the UE.

If the VLR included the Mobile identity information element in the SGsAP-LOCATION-UPDATE-ACCEPT message, the MME shall relay the information received to the UE. If the Mobile identity information element contains a new

TMSI, this will cause the UE to perform a TMSI reallocation procedure. In this case, the MME shall send to the VLR the SGsAP-TMSI-REALLOCATION-COMPLETE message when the MME receives the ATTACH COMPLETE or the TRACKING AREA UPDATE COMPLETE message from the UE. If the Mobile identity information element contains an IMSI, this will cause the UE to deallocate its TMSI.

5.2.2.4 Location update failure

If the MME receives an SGsAP-LOCATION-UPDATE-REJECT message from the VLR, the MME shall

- stop timer Ts6-1;
- move the state of the SGs association to SGs-NULL; and
- indicate to the UE the rejection of the Location Update procedure by the VLR as specified in 3GPP TS 24.301 [14]. The Reject cause value sent by the VLR shall be mapped to the appropriate reject cause as specified in 3GPP TS 24.301 [14], and the latter is forwarded to the UE.

5.2.2.5 Abnormal cases

If timer Ts6-1 expires, the MME shall abort the Location Update for non-EPS service procedure and indicate this to the UE with the Reject cause value 'MSC temporarily not reachable'. The state of the SGs association to the VLR shall be SGs-NULL.

If the MME receives an SGsAP-LOCATION-UPDATE-ACCEPT message and timer Ts6-1 is not running then:

- if timer Ts8 is running (see subclause 5.4), the message shall be ignored;
- if timer Ts9 is running (see subclause 5.5), the message shall be ignored; or
- if timers Ts8 and Ts9 are not running:
 - if the state of the SGs association to the VLR is SGs-ASSOCIATED, the message shall be ignored; or
 - if the state of the SGs association to the VLR is different than SGs-ASSOCIATED, the message shall be treated as a message incompatible with the protocol state of the MME (see subclause 7.3).

5.2.3 Procedures in the VLR

5.2.3.1 General

When a VLR receives an SGsAP-LOCATION-UPDATE-REQUEST message, the VLR shall check whether the IMSI is known. If the IMSI is not known, the VLR shall retrieve the MM context of the UE from the HSS.

5.2.3.2 Location update response

If the location update is accepted by the VLR and, if necessary, by the HSS, the VLR shall:

- move the SGs association to the SGs-ASSOCIATED state;
- set the "Confirmed by Radio Contact" restoration indicator to "true";
- update the SGs association by storing the MME address included in SGsAP-LOCATION-UPDATE-REQUEST message; and
- send an SGsAP-LOCATION-UPDATE-ACCEPT message to the sending MME. This message includes the location area identifier received in the New location area identifier information element in the previous SGsAP-LOCATION-UPDATE-REQUEST message.

5.2.3.3 Location update failure

If the location update is rejected by the VLR, the VLR shall:

- send an SGsAP-LOCATION-UPDATE-REJECT message to the MME with the appropriate reject cause as indicated in 3GPP TS 24.008 [8] and shall indicate to the MME the Location area identifier received in the corresponding SGsAP-LOCATION-UPDATE-REQUEST message; and
- move the SGs association to SGs-NULL.

5.2.3.4 TMSI reallocation procedure

If the VLR decides to allocate a new TMSI to the UE, the VLR shall include the new TMSI in the SGsAP-LOCATION-UPDATE-ACCEPT message. After sending the SGsAP-LOCATION-UPDATE-ACCEPT message with a new TMSI the VLR shall start timer Ts6-2. If the VLR decides to deallocate the TMSI of the UE, the VLR shall include the IMSI of the UE in the SGsAP-LOCATION-UPDATE-ACCEPT message.

Upon receipt of the SGsAP-TMSI-REALLOCATION-COMPLETE message, the VLR shall stop the timer Ts6-2 and consider the new TMSI as valid.

If the IMSI was sent to the UE, the VLR considers the old TMSI as deleted.

If no SGsAP-TMSI-REALLOCATION-COMPLETE message is received by the VLR before the timer Ts6-2 expires, the VLR aborts the TMSI reallocation procedure. The outcome of the TMSI reallocation procedure does not change the state of the SGs association. The VLR uses the IMSI or the new TMSI for paging.

5.2.3.5 Abnormal cases

The following abnormal cases can be identified:

i) MM signalling via A or Iu interface

If the VLR receives a Location Update request or an IMSI detach indication from the UE by the A or Iu interface when the state of the SGs association in the VLR is not SGs-NULL, the VLR shall move the state of the SGs association to SGs-NULL.

ii) Additional Location Update Request

If the state of the SGs association in the VLR is LA-UPDATE PRESENT and an SGsAP-LOCATION-UPDATE-REQUEST message is received, then:

- if the message is from the same MME and indicates the same New location area identifier information element as the outstanding location update request, then the VLR shall ignore this additional SGsAP-LOCATION-UPDATE-REQUEST message;
- if the message is from the same MME but indicates a different New location area identifier information element to the outstanding location update request, then the VLR shall treat this additional SGsAP-LOCATION-UPDATE-REQUEST message and the VLR shall not send any response to the previous SGsAP-LOCATION-UPDATE-REQUEST message; or
- if the message is from a different MME (indicating either the same or different New location area identifier information element) to the outstanding location update request, then the VLR shall treat this additional SGsAP-LOCATION-UPDATE-REQUEST message and the VLR shall not send any response to the previous SGsAP-LOCATION-UPDATE-REQUEST message.

iii) Detach signalling from the MME

If the state of the SGs association in the VLR is LA-UPDATE PRESENT and either an SGsAP-EPS-DETACH-INDICATION or an SGsAP-IMSI-DETACH-INDICATION message is received, then the VLR shall abandon the Location Update for non-EPS services procedure (neither an SGsAP-LOCATION-UPDATE-ACCEPT nor an SGsAP-LOCATION-UPDATE-REJECT messages is sent) and the further actions described in subclauses 5.4 or 5.5 or 5.6 are followed.

iv) Signalling via Gs interface

If the VLR receives for a UE a BSSAP+-LOCATION-UPDATE-REQUEST message (as defined in 3GPP TS 29.018 [16]) from an SGSN when the state of the SGs association for this UE in the VLR is not SGs-NULL, the VLR shall move the state of the SGs association to SGs-NULL.

v) New Location Update Request during TMSI reallocation procedure

If the VLR receives an SGsAP-LOCATION-UPDATE-REQUEST message while Ts6-2 is running, the VLR shall stop timer Ts6-2, abort the TMSI reallocation procedure and proceed with the new location update for non-EPS services procedure. If the VLR needs to page the MS during the new location update for non-EPS services procedure, the VLR uses the IMSI or the new TMSI from the aborted TMSI reallocation procedure for paging.

5.3 Non-EPS alert procedure

5.3.1 General description

This procedure is used by the VLR to request from an MME an indication when any signalling activity from the UE is detected. This procedure can be invoked at any time by the VLR. The MME shall acknowledge the SGsAP-ALERT-REQUEST message.

5.3.2 Procedures in the VLR

5.3.2.1 Alert Initiation

The VLR may start the Non-EPS alert procedure at any time. When the VLR wants to request from an MME that further activity from a UE is reported by the MME, the VLR shall send an SGsAP-ALERT-REQUEST message to that MME. The VLR starts timer Ts7 when the SGsAP-ALERT-REQUEST message is sent.

5.3.2.2 Alert Response

When an SGsAP-ALERT-ACK message is received, the VLR shall stop the timer Ts7. The state of the SGs association is not changed.

5.3.2.3 Alert Failure

If an SGsAP-ALERT-REJECT message is received, the VLR shall stop the timer Ts7, move the state of the SGs association to SGs-NULL and within this state the SGs association is marked with the contents of the SGs cause information element.

5.3.2.4 Alert Indication

The VLR shall not change the state of the SGs association upon reception of an SGsAP-UE-ACTIVITY-INDICATION message.

5.3.2.5 Abnormal cases

If no SGsAP-ALERT-ACK message is received before the timer Ts7 expires, the VLR shall retransmit the SGsAP-ALERT-REQUEST message a maximum of Ns7 times.

NOTE: If no SGsAP-ALERT-ACK message is received after that, a report is made to the O&M system. The state of the SGs association is not changed.

5.3.3 Procedures in the MME

5.3.3.1 Alert response

The MME may receive an SGsAP-ALERT-REQUEST message in any state of the SGs association. Upon receipt of an SGsAP-ALERT-REQUEST message from the VLR and if the IMSI is known in the MME, the MME shall reply with an SGsAP-ALERT-ACK message and set the NEAF. If the MME has activated Idle mode Signaling Reduction for the UE, the MME shall send an Alert MME Notification message to the associated SGSN, as described in 3GPP TS 29.274 [17A], except for the conditions specified in subclause 8.2.5c of 3GPP TS 23.272 [7].

5.3.3.2 Alert failure

If an SGsAP-ALERT-REQUEST message is received for an IMSI that is unknown at the MME, the MME shall return an SGsAP-ALERT-REJECT message to the VLR indicating the SGs cause information element value "IMSI unknown".

5.3.3.3 Alert indication

The MME shall report to the VLR upon detection of any activity in E-UTRAN (either signalling or, indirectly detected via S-GW, data transfer) from the UE if the NEAF is set. If the MME detects EPS signalling that leads to a procedure towards the VLR, the MME shall follow this procedure and reset the NEAF. If the MME detects activity that does not lead to any procedure towards the VLR, the MME shall send an SGsAP-UE-ACTIVITY-INDICATION message towards the VLR and reset the NEAF. Upon receipt of a UE Activity Notification message from the SGSN, the MME shall reply with a UE Activity Acknowledge message, send an SGsAP-UE-ACTIVITY-INDICATION message to the VLR and reset the NEAF flag.

5.4 Explicit IMSI detach from EPS services

5.4.1 General description

This procedure is used by the MME to indicate to the VLR that the UE has been detached from EPS services and therefore the SGs association between the MME and the VLR has to be deactivated. This procedure only applies to UEs which are not in the SGs-NULL state at the MME. The procedures specified in this subclause apply to EPS detach indication initiated by the UE or by the network as specified in 3GPP TS 24.301 [14].

The procedure is also used by the MME to indicate to the VLR when a combined tracking area update procedure has been rejected by the MME or the MME receives the Detach Notification from the SGSN, as described in 3GPP TS 29.274 [17A], when Idle mode Signalling Reduction is activated.

The procedure is also used by the MME to indicate to the VLR when a periodic tracking area update procedure has been rejected by the MME for a UE for which an SGs association exists.

The Explicit IMSI detach from EPS services procedure aborts any other ongoing procedure related to this UE on the SGs interface in the MME and in the VLR.

5.4.2 Procedures in the MME

5.4.2.1 Explicit EPS detach initiation

The MME shall send an SGsAP-EPS-DETACH-INDICATION message to a VLR if:

- the MME receives a detach for EPS from the UE;
- the MME performs network initiated EPS detach procedure;
- the combined tracking area update procedure is rejected by the MME;
- the periodic tracking area update procedure is rejected by the MME for a UE for which an SGs association exists; or
- the MME receives a Detach Notification from the SGSN with the Detach type indicating "PS Detach".

If the MME receives a Detach Request from a UE or Detach Notification from an SGSN and the state of the SGs association to a VLR for that UE is not SGs-NULL, the MME shall check the detach type indicated in the Detach Request message or the detach type indicated in the Detach Notification message. If the UE has indicated EPS detach the MME shall send an SGsAP-EPS-DETACH-INDICATION message to the VLR indicating "UE initiated IMSI detach from EPS services".

If the MME performs a network initiated detach procedure and the state of the SGs association to a VLR for that UE is not SGs-NULL, the MME shall send an SGsAP-EPS-DETACH-INDICATION message to the VLR indicating "Network initiated IMSI detach from EPS services".

If the combined or periodic tracking area update procedure is rejected at the MME for a UE with an SGs association state different from SGs-NULL, the MME shall send an SGsAP-EPS-DETACH-INDICATION to the VLR indicating "EPS services not allowed".

After sending of the SGsAP-EPS-DETACH-INDICATION message, the MME shall move the state of the SGs association to SGs-NULL. The MME shall start timer Ts8 upon transmission of the SGsAP-EPS-DETACH-INDICATION message and the MME shall stop and reset timer Ts6-1 if running.

5.4.2.2 Explicit EPS detach response

If the MME receives an SGsAP-EPS-DETACH-ACK message from the VLR, the MME shall stop timer Ts8. If a confirmation of the detach needs to be sent to the UE, the MME shall not wait for the reception of the SGsAP-EPS-DETACH-ACK message to send such confirmation.

5.4.2.3 Abnormal cases

If no SGsAP-EPS-DETACH-ACK message is received by the MME in response to a previous SGsAP-EPS-DETACH-INDICATION message before timer Ts8 expires, the MME shall repeat the SGsAP-EPS-DETACH-INDICATION message a maximum of Ns8 times.

NOTE: If no SGsAP-EPS-DETACH-ACK message is received after that, a report is made to the O&M system. The state of the SGs association during the acknowledgement procedure remains SGs-NULL.

5.4.3 Procedures in the VLR

When a VLR receives an SGsAP-EPS-DETACH-INDICATION message, the VLR shall send an SGsAP-EPS-DETACH-ACK message to the sending MME. The VLR shall check the MME name indicated in the SGsAP-EPS-DETACH-INDICATION message. If the received MME name is not changed comparing to the MME name stored in the VLR, the VLR shall move the state of the SGs association for the UE from any state to SGs-NULL and marks the SGs association as "detached for EPS services". Otherwise, the VLR shall not change the state of the SGs association.

If the VLR's implicit detach timer is not running then the VLR shall set and restart the implicit detach timer upon reception of an SGsAP-EPS-DETACH-INDICATION message. If the VLR's implicit detach timer is running (the state of the SGs association was already SGs-NULL) then the reception of an SGsAP-EPS-DETACH-INDICATION message shall not affect VLR's implicit detach timer.

5.5 Explicit IMSI detach from non-EPS services

5.5.1 General description

This procedure is used by the MME to indicate to the VLR that the UE has performed IMSI detach from non-EPS services and therefore the SGs association between the MME and the VLR has to be deactivated. This procedure applies only to UEs for which there is a SGs association at the MME. The procedures specified in this subclause apply only to IMSI detach request, combined IMSI and EPS detach requests from the UE or Detach Notification message from an SGSN.

The explicit IMSI detach from non-EPS services procedure aborts any other ongoing procedure related to this UE on the SGs interface in the MME and in the VLR.

In order to ensure that the VLR and the UE are synchronized as to which paging channel to use for any of the subsequent paging events, the MME shall attempt to inform the VLR about the detach event by using a retry scheme if the initial delivery of the SGsAP-IMSI-DETACH-INDICATION message fails.

5.5.2 Procedures in the MME

5.5.2.1 Explicit IMSI detach initiation

When an MME receives a Detach Request from a UE for which an SGs association exists, the MME shall check the detach type indicated. If the UE is indicating IMSI detach or combined EPS/IMSI detach, the MME shall send an SGsAP-IMSI-DETACH-INDICATION message to the VLR indicating "Explicit UE initiated IMSI detach from non-EPS services" or "Combined UE initiated IMSI detach from EPS and non-EPS services".

When an MME receives a Detach Notification message for a UE from an SGSN and an SGs association for the UE exists, the MME shall check the cause and detach type indicated. If the cause is indicating "IMSI Detach only", the MME shall send an SGsAP-IMSI-DETACH-INDICATION message to the VLR indicating "Explicit UE initiated IMSI detach from non-EPS services". If the cause is indicating "Complete Detach" and detach type is indicating "Combined PS/CS Detach" as specified in 3GPP TS 29.274 [17A], the MME shall send an SGsAP-IMSI-DETACH-INDICATION message to the VLR indicating "Combined UE initiated IMSI detach from EPS and non-EPS services".

After the sending of the SGsAP-IMSI-DETACH-INDICATION message to the VLR, the MME shall move the state of the SGs association to SGs-NULL. The MME shall start timer Ts9 upon transmission of the SGsAP-IMSI-DETACH-INDICATION message and the MME shall stop and reset timer Ts6-1, if running.

5.5.2.2 Explicit IMSI detach response

If the MME receives an SGsAP-IMSI-DETACH-ACK message from the VLR, the MME shall stop timer Ts9. If the detach type received from the UE indicated IMSI only detach or combined EPS/IMSI detach not due to switch off, the MME shall wait for the reception of the SGsAP-IMSI-DETACH-ACK message before sending the confirmation of the detach to the UE.

5.5.2.3 Abnormal cases

The following abnormal cases can be identified:

- i) no SGsAP-IMSI-DETACH-ACK received for a detach with switch off

If the MME sent an SGsAP-IMSI-DETACH-INDICATION message for a combined IMSI and EPS detach due to switch off and timer Ts9 expires, the MME shall repeat the SGsAP-IMSI-DETACH-INDICATION message a maximum of Ns9 times.

- ii) no SGsAP-IMSI-DETACH-ACK received for a detach with no switch off

If the MME sent an SGsAP-IMSI-DETACH-INDICATION message for an IMSI only detach or a combined IMSI and EPS detach not due to switch off and timer Ts9 expires, the MME shall repeat the SGsAP-IMSI-DETACH-INDICATION message a maximum of Ns9 times. If no SGsAP-IMSI-DETACH-ACK is received after that the MME shall send the confirmation of the detach to the UE.

5.5.3 Procedures in the VLR

When a VLR receives an SGsAP-IMSI-DETACH-INDICATION message, the VLR shall send an SGsAP-IMSI-DETACH-ACK message to the sending MME.

The VLR shall check the MME name indicated in the SGsAP-IMSI-DETACH-INDICATION message. If the received MME name is not changed comparing to the MME name stored in the VLR, the VLR shall move the state of the SGs association for the UE from any state to SGs-NULL. If the SGsAP-IMSI-DETACH-INDICATION message indicated "Explicit UE initiated IMSI detach from non-EPS services", the VLR marks the SGs association as "IMSI detached for non-EPS services". If the SGsAP-IMSI-DETACH-INDICATION message indicated "Combined UE initiated IMSI detach from EPS and non-EPS services", the VLR marks the SGs association as "IMSI detached for EPS and non-EPS services". The VLR shall mark the UE as detached.

If the received MME name is different from the MME name stored in the VLR, the VLR shall not change the state of the SGs association.

5.6 Implicit IMSI detach from non-EPS services

5.6.1 General description

This procedure is used by the MME to indicate when an internal MME timer mechanism has caused the MME to delete the EMM context of an UE or mark its EMM context as detached. This procedure only applies to UEs for which there is an SGs association at the MME.

The implicit IMSI detach from non-EPS services procedure aborts any other ongoing procedure related to this UE on the SGs interface in the MME and in the VLR.

In order to ensure that the VLR and the UE are synchronized as to which paging channel to use for any of the subsequent paging events the MME shall attempt to inform the VLR about the detach event by using a retry scheme if the initial delivery of the SGsAP-IMSI-DETACH-INDICATION message fails.

5.6.2 Procedures in the MME

When the implicit IMSI detach from non-EPS services procedure is started for a UE by the above mentioned internal MME timer mechanism, the MME shall send an SGsAP-IMSI-DETACH-INDICATION message to the VLR indicating "Implicit network initiated IMSI detach from EPS and non-EPS services".

After the sending of the SGsAP-IMSI-DETACH-INDICATION message, the MME shall move the state of the SGs association to SGs-NULL. The MME shall start timer Ts10 upon transmission of the SGsAP-IMSI-DETACH-INDICATION message.

If the MME receives an SGsAP-IMSI-DETACH-ACK message from the VLR, the MME shall stop timer Ts10.

If no SGsAP-IMSI-DETACH-ACK message is received by the MME to a previous SGsAP-IMSI-DETACH-INDICATION message before timer Ts10 expires, the MME shall repeat the SGsAP-IMSI-DETACH-INDICATION message a maximum of Ns10 times. The state of the SGs association during the acknowledgement procedure remains SGs-NULL.

5.6.3 Procedures in the VLR

When a VLR receives the SGsAP-IMSI-DETACH-INDICATION message, the VLR shall send an SGsAP-IMSI-DETACH-ACK message to the sending MME.

The VLR shall check the MME name indicated in the SGsAP-IMSI-DETACH-INDICATION message. If the received MME name is not changed comparing to the MME name stored in the VLR and the state of the SGs association is not SGs-NULL, the VLR proceeds as follows:

- The VLR shall move the state of the SGs association for the UE to SGs-NULL. If the VLR does not have an SCCP connection for the UE, the VLR shall mark the UE as detached. Additionally, the VLR marks the SGs association as "IMSI implicitly detached for EPS and non-EPS services".

If the received MME name is different from the MME name stored in the VLR, the VLR shall not change the state of the SGs association.

5.7 VLR failure procedure

5.7.1 General description

This procedure is used by the VLR to inform the MMEs with an SGs association about the recovery from an internal failure that has affected the SGs association with the MMEs.

- NOTE: The VLR recovery procedure is handled in such a way that the signalling load on the VLR and MMEs does not create any overload problem.

5.7.2 Procedures in the VLR

5.7.2.1 VLR Reset Initiation

In the event of a failure at the VLR which has resulted in the loss of the SGs association information for some UEs, the VLR shall move from any state to the SGs-NULL state for these UEs. The VLR shall also set the "Confirmed by Radio Contact" restoration indicator to "false" (see 3GPP TS 23.007 [4]) for affected UEs. The VLR shall not send any SGsAP-MM-INFORMATION-REQUEST messages to UEs with the SGs association in the SGs-NULL state.

When the VLR restarts, the VLR shall send an SGsAP-RESET-INDICATION message to all the MMEs connected to the VLR by the SGs interface. This message indicates to the MME that for the UEs with an SGs association to that VLR, the SGs association is no longer reliable. The VLR shall also start a separate timer Ts11 for each MME.

5.7.2.2 VLR Reset Response

Upon receipt of an SGsAP-RESET-ACK message from an MME, the VLR shall stop the timer Ts11 for that MME.

5.7.2.3 Abnormal cases

If the VLR does not receive an SGsAP-RESET-ACK message from that MME before the timer Ts11 expires, the VLR shall retransmit the SGsAP-RESET-INDICATION message. The retransmission is repeated a maximum of Ns11 times.

NOTE: If no SGsAP-RESET-ACK is received after that a report is made to the O&M system.

5.7.3 Procedures in the MME

Upon receipt of an SGsAP-RESET-INDICATION message from the VLR, the MME is informed that all the SGs associations with that VLR for all the UEs registered in the MME are no longer reliable because the VLR has lost information about the state of the UEs and during the failure the VLR might have missed signalling messages. The MME shall set the "VLR-Reliable" MM context variable to "false". The detach procedures for deleting the SGs association are still applicable (see subclauses 5.4, 5.5 and 5.6). If the "VLR-Reliable" MM context variable is set to "false", upon reception of a Combined Tracking Area update request or a periodic Tracking Area Update from the UE that is attached for non-EPS service, the MME may request the re-attach to non-EPS services, or may alternatively immediately perform the Location Update for non-EPS services procedure towards the VLR as described in subclause 5.2.

The MME sends an SGsAP-RESET-ACK message to the VLR.

5.8 MME failure procedure

5.8.1 General description

This procedure is used by the MME to inform the associated VLRs about the recovery from an internal failure that has affected the SGs association with the VLRs.

NOTE: The MME recovery procedure is handled in such a way that the signalling load on the MME and VLRs does not create any overload problem.

5.8.2 Procedures in the MME

5.8.2.1 MME Reset Initiation

In the event of a failure at the MME which has resulted in the loss of the SGs association information on some UEs, the MME shall move from any state to the SGs-NULL state for these affected UEs. The MME shall also set the "MME-Reset" MM context variable to "true" and start the timer Ts12-1. When the timer Ts12-1 expires the "MME-Reset" MM context variable is set to "false".

The MME may send an SGsAP-RESET-INDICATION message to all the VLRs connected to the MME by SGs interfaces. The SGsAP-RESET-INDICATION message indicates to the VLR that all the SGs associations with that particular MME for all the UEs registered in the VLR are no longer reliable. The normal procedures for updating the SGs association are still applicable (see subclauses 5.2, 5.4, 5.5 and 5.6). The MME shall also start a separate timer Ts12-2 for each VLR.

If the MME does not send an SGsAP-RESET-INDICATION message, the MME shall move from any state to the SGs-NUL state only for the associations of the UEs affected by the loss of VLR association information.

NOTE: The option to not send any SGsAP-RESET-INDICATION message to all the VLRs connected to the MME by SGs interfaces reduces subsequent paging signalling initiated by VLRs by avoiding a complete search of the UE on the entire VLR area.

5.8.2.2 MME Reset Response

Upon receipt of an SGsAP-RESET-ACK message, the MME shall stop the timer Ts12-2 for that VLR.

5.8.2.3 Abnormal cases

If the MME does not receive an SGsAP-RESET-ACK message from that VLR before the timer Ts12-2 expires, the MME shall retransmit the SGsAP-RESET-INDICATION message. The retransmission is repeated a maximum of Ns12 times.

NOTE: If no SGsAP-RESET-ACK is received after that a report is made to the O&M system.

5.8.3 Procedures in the VLR

Upon receipt of an SGsAP-RESET-INDICATION message from the MME, the VLR is informed that all the SGs associations with that MME for all the UEs registered in the MME are no longer reliable because the MME has lost information about the state of the UEs for that VLR and during the failure the MME might have missed signalling messages. The VLR shall either:

- set the "Confirmed by Radio Contact" restoration indicator to "false" in all the SGs associations containing the restarted MME and set the state of all the SGs associations containing the restarted MME to the SGs-NUL state; or
- keep the 'Confirmed by Radio Contact' restoration indication and the state of all the SGs associations containing the restarted MME unchanged.

NOTE: The option to not set the 'Confirmed by Radio Contact' restoration indicator to 'false' in all the associations containing the restarted MME reduces subsequent paging signalling the VLR can initiate by avoiding a complete search of the UE on the entire VLR area.

The VLR shall then send an SGsAP-RESET-ACK message to the MME.

If the "Confirmed by Radio Contact" restoration indicator is "false" the VLR may send paging messages on both the SGs and the A/Iu interface.

5.9 HSS failure

5.9.1 General description

This subclause describes the MME behaviour towards the VLR as a consequence of an HSS reset.

In the case of an HSS failure, the HSS informs the associated MMEs about the recovery from an internal failure that has affected the SGs association with the MMEs according to the HSS reset procedure specified in 3GPP TS 29.272 [17].

This information is used in the MME to trigger the VLR to perform a location update towards the HSS in order to restore the HSS subscriber data.

5.9.2 Procedures in the MME

Upon receipt of a HSS reset indication from the HSS, the MME shall set the NEAF for all registered UEs in the MME for which a valid SGs association with a VLR exists.

Upon detection of any signalling activity from the UE, the MME shall report to the VLR if the NEAF, as defined in subclause 5.3.3, is set for this UE. If the MME detects signalling that leads to a procedure towards the VLR, the MME shall follow this procedure and reset the NEAF. If the MME detects activity that does not lead to any procedure towards the VLR, the MME shall send an SGsAP-UE-ACTIVITY-INDICATION message towards the VLR and reset the NEAF. The MME may delay sending the activity indication for a maximum operator-configuration depending time period to avoid high signalling load.

5.10 MM information procedure

5.10.1 General description

The MM information procedure is performed between the VLR and the MME via the SGs interface if the target UE for the MM information procedure is IMSI attached to both EPS and non-EPS services (i.e. the state of the SGs association is SGs-ASSOCIATED). The outcome of the MM Information procedure does not change the state of the SGs association at the VLR or MME.

5.10.2 Procedures in the VLR

If for the target UE for the MM information procedure the state of the SGs association in the VLR is SGs-ASSOCIATED, the VLR may initiate the MM information procedure by transferring an SGsAP-MM-INFORMATION-REQUEST message to the MME.

5.10.3 Procedures in the MME

If an SGsAP-MM-INFORMATION-REQUEST message is received for a UE for which there exists an SGs association at the MME, and the network only spans one time zone, the MME shall check and update the contents of the MM information information element as follows:

- if LSA Identity has been included in the MM information, the MME shall discard the LSA Identity; and
- other user information in the MM information are kept unchanged.

NOTE: For the determination of the number of time zones, both CS and PS domain are taken into account.

If the network spans more than one time zone, the MME shall check and update the contents of the MM information information element as follows:

- if Network Daylight Saving Time has been included in the MM information, then the MME shall discard the Network Daylight Saving Time;
- if Local Time Zone has been included in the MM information, then the MME shall replace the Local Time Zone with the Local Time Zone applicable for this UE. In addition, if the local time zone in the MME has been adjusted for daylight saving time, the MME shall indicate this by including the value used for adjustment in Network Daylight Saving Time IE in the MM information;
- if Universal time and local time zone has been included in the MM information, then the MME shall replace it with the Universal time and local time zone applicable for this UE. In addition, if the local time zone in the MME has been adjusted for daylight saving time, the MME shall indicate this by including the value used for adjustment in Network Daylight Saving Time IE in the MM information;
- if LSA Identity has been included in the MM information, the MME shall discard the LSA Identity; and
- other user information in the MM information are kept unchanged.

The MME shall then send the resultant contents of the MM information information element to the UE indicated in the SGsAP-MM-INFORMATION-REQUEST message, using an EMM INFORMATION message as defined in 3GPP TS 24.301 [14].

5.11 Procedure for tunnelling of NAS messages

5.11.1 General description

The tunnelling of NAS messages procedure is used to encapsulate the NAS messages exchanged between the UE and the VLR. This procedure can be used by either the VLR or the MME depending on the direction of the NAS message. The two procedures are identified as uplink unitdata, in the direction from the MME to the VLR, and downlink unitdata in the direction from the VLR to the MME.

5.11.2 Uplink unitdata procedure

5.11.2.1 Procedures in the MME

When the MME receives an Uplink NAS Transport message (see 3GPP TS 24.301 [14]) from a UE, the MME shall copy the value part of the NAS message container information element to the value part of the NAS message container information element of the SGsAP-UPLINK-UNITDATA message and send the SGsAP-UPLINK-UNITDATA message to the VLR if the "VLR-Reliable" MM context variable is not set to "false". If the "VLR-Reliable" MM context variable is set to "false", the MME requests the UE to re-attach for non-EPS services as specified in 3GPP TS 24.301 [14].

In order to permit the VLR to create an accurate charging record, the MME shall add the IMEISV, the UE Time Zone, the Mobile Station Classmark 2, and the UE's current TAI and E-CGI to the SGsAP-UPLINK-UNITDATA message.

5.11.2.2 Procedures in the VLR

5.11.2.2.1 General description

Upon reception of an SGsAP-UPLINK-UNITDATA, the VLR shall extract the NAS message container information element and treat the value part of this information element according to the procedures defined in 3GPP TS 24.011 [10].

Other parameters in the message may be used as specified in 3GPP TS 32.250 [17B] and 3GPP TS 23.078 [5AA].

5.11.2.2.2 Abnormal cases

The following abnormal cases can be identified:

- i) subscriber data does not exist or is not confirmed by HLR

If the VLR receives an SGsAP-UPLINK-UNITDATA message from the MME for a UE for which subscriber data does not exist or is not confirmed by HLR, then the VLR shall ignore the received message, and return an SGsAP-RELEASE-REQUEST message to the MME with an SGs cause information element indicating "IMSI unknown".

- ii) subscriber data exists, but there is no SGs association for the UE at the VLR

If the VLR receives an SGsAP-UPLINK-UNITDATA message from the MME for a UE for which no SGs association exists, then the VLR shall ignore the received message, and return an SGsAP-RELEASE-REQUEST message to the MME with an SGs cause information element indicating "IMSI detached for non-EPS services".

5.11.2.3 Void

5.11.3 Downlink unitdata procedure

5.11.3.1 Procedures in the VLR

When the VLR needs to send a NAS message to the UE, the VLR shall first verify whether or not it has an SGs association for the UE. If the state of the SGs association for the UE is SGs-ASSOCIATED and LA-UPDATE-PRESENT, then the VLR continues with the procedure. The VLR shall build and encapsulate the NAS message into the value part of the NAS message container information element of an SGsAP-DOWNLINK-UNITDATA message and send the SGsAP-DOWNLINK-UNITDATA message to the MME.

5.11.3.2 Procedures in the MME

5.11.3.2.1 General description

Upon reception of an SGsAP-DOWNLINK-UNITDATA message, the MME shall copy the value part of the NAS message container information element to the value part of the NAS message container information element of a Downlink NAS Transport message (see 3GPP TS 24.301 [14]) and send the Downlink NAS Transport message to the UE.

5.11.3.2.2 Abnormal cases

The following abnormal cases can be identified:

- i) subscriber data does not exist or is not confirmed by HSS

If the MME receives an SGsAP-DOWNLINK-UNITDATA message from the VLR for a UE for which subscriber data does not exist or is not confirmed by HSS, then the MME shall ignore the received message.

- ii) subscriber data exists, but there is no SGs association for the UE at the MME

If the MME receives an SGsAP-DOWNLINK-UNITDATA message from the VLR for a UE for which there is no SGs association, then the MME shall ignore the received message.

5.11.3.3 Void

5.11.4 Release procedure

When the VLR determines that there are no more NAS messages to be exchanged between the VLR and the UE, or when a further exchange of NAS messages for the specified UE is not possible due to an error, the VLR shall send the SGsAP-RELEASE-REQUEST message to the MME, including the IMSI of the UE for which there are no more NAS messages to be tunnelled.

NOTE: For the SMS transport, the VLR can send the SGsAP-RELEASE-REQUEST message when the SMS transaction is complete (reception of a CP-ACK message for the MO case, sending of a CP-ACK message for the MT case), upon reception of a CP-ERROR message, abort of SMS transaction by upper layers, or upon some error cases such as TC1 expiry, no SGs association for the UE or IMSI unknown.

Upon receipt of an SGsAP-RELEASE-REQUEST message with an SGs cause information element indicating "IMSI unknown" or "IMSI detached for non-EPS services", the MME shall set the "VLR-Reliable" MM context variable to "false". In addition, the MME requests the UE to re-attach for non-EPS services as specified in 3GPP TS 24.301 [14].

5.12 Service request procedure

5.12.1 General description

After the reception of an SGsAP-PAGING-REQUEST message from the VLR, the MME will use this procedure to indicate to the VLR that a NAS signalling connection exists between the UE and the MME. The procedure can be invoked, by the MME, either upon reception of a Service Request message from the UE or directly after receiving the SGsAP-PAGING-REQUEST message from the VLR, based on the UE's EMM mode.

5.12.2 Procedures in the MME

When receiving the SGsAP-PAGING-REQUEST message, the MME shall first take action as described in subclause 5.1.3 and check whether the UE, for which the paging is sent, is in EMM-IDLE or EMM-CONNECTED mode.

If the MME accepts the paging request, the MME shall proceed as follows:

- If the UE was in EMM-CONNECTED mode, the MME shall immediately create and send an SGsAP-SERVICE-REQUEST message to the VLR. If the UE subsequently rejects the CS fallback call, the MME shall send the SGsAP-PAGING-REJECT message to the VLR with the SGs cause information element indicating "Mobile terminating CS fallback call rejected by the user"; or
- If the UE was in EMM-IDLE mode, the MME shall send the SGsAP-SERVICE-REQUEST message to the VLR when the UE enters EMM-CONNECTED mode.

The MME shall set the service indicator in the SGsAP-SERVICE-REQUEST message equal to what was received in the SGsAP-PAGING-REQUEST message. Additionally, in order to permit the VLR to create an accurate charging record, the MME shall add the IMEISV, the UE Time Zone, the Mobile Station Classmark 2, and the UE's current TAI and E-CGI to the SGsAP-SERVICE-REQUEST message.

5.12.3 Procedures in the VLR

Upon reception of the SGsAP-SERVICE-REQUEST message, the VLR shall stop Timer Ts5 and consider the paging procedure as successful. If the paging procedure is for SMS, the VLR shall then start the delivery of the SMS message(s) according to the subclause 5.11.3.1. If the paging procedure with the Service indicator information element indicating "SMS Indicator" was triggered upon reception of a Provide Subscriber Information Request message, the VLR can return an SGs AP-RELEASE-REQUEST message to the MME as specified in subclause 7.2.3.5 of 3GPP TS 23.018 [5].

Other parameters in the message may be used as specified in 3GPP TS 32.250 [17B] and 3GPP TS 23.078 [5AA].

5.13 Service abort procedure

5.13.1 General description

This procedure can be invoked by the VLR to abort a mobile terminating CS fallback call during call establishment. The procedure applies to UEs that are simultaneously attached for EPS services and non-EPS services, but not to UEs attached for EPS services and SMS only.

5.13.2 Procedures in the VLR

If the VLR decides to abort a mobile terminating CS fallback call for which it has sent an SGsAP-PAGING-REQUEST message to the MME, and the VLR has not received an SCCP connection establishment containing the Initial L3 message from the UE via the A or Iu interface, the VLR shall send the SGsAP-SERVICE-ABORT-REQUEST message to the MME. The state of the SGs association is not changed.

5.13.3 Procedures in the MME

When the MME receives the SGsAP-SERVICE-ABORT-REQUEST message from the VLR, the MME shall set the Call Cancelled Flag to "true".

If the MME receives an EXTENDED SERVICE REQUEST message from the UE with Service type set to "mobile terminating CS fallback or 1xCS fallback" and CSFB response set to "CS fallback accepted by the UE" and the Call Cancelled Flag is set to "true", the MME shall reject the CS fallback call as specified in 3GPP TS 24.301 [14] and set the Call Cancelled Flag to "false".

If the Call Cancelled Flag is set to "true", the MME shall set the Call Cancelled Flag to "false":

- upon reception of the EXTENDED SERVICE REQUEST message from the UE with Service type set to a value other than "mobile terminating CS fallback or 1xCS fallback" or CSFB response set to a value other than "CS fallback accepted by the UE"; or
- upon reception of a new SGsAP-PAGING-REQUEST message from the VLR.

When the MME receives the SGsAP-SERVICE-ABORT-REQUEST message after the UE has accepted the CS fallback call, the MME shall discard the SGsAP-SERVICE-ABORT-REQUEST message. The state of the SGs association is not changed.

6 SGs transport

6.1 General

This subclause specifies the standards for signalling transport to be used across SGs interface. SGs interface is a logical interface between the MME and the VLR. All the SGsAP messages described in the present document require an SCTP association between the MME and the VLR.

6.2 IP layer

The MME and the VLR shall support IPv6 (see IETF RFC 2460 [22]) and/or IPv4 (see IETF RFC 791 [20]).

The IP layer of SGs only supports point-to-point transmission for delivering SGsAP messages.

6.3 Transport layer

SCTP (see IETF RFC 4960 [23]) shall be supported as the transport layer of SGsAP messages.

Semi-permanent SCTP associations shall be established between the MME and VLR, i.e. the SCTP associations shall remain up under normal circumstances.

Transport network redundancy can be achieved by SCTP multi-homing between two end-points, of which one or both is assigned with multiple IP addresses. SCTP end-points shall support a multi-homed remote SCTP end-point. For SCTP endpoint redundancy, an SCTP endpoint (in the MME or VLR) may send an INIT, at any time for an already established SCTP association, which the other SCTP endpoint shall handle as defined in IETF RFC 4960 [23].

MME and VLR shall support a configuration with a single SCTP association per MME/VLR pair. Configurations with multiple SCTP endpoints per MME/VLR pair may be supported.

Within the SCTP association established between one MME and one VLR, both MME and VLR shall reserve several stream identifiers, based on the INIT message exchange for the sole use of SGsAP procedures.

The MME shall establish the SCTP association.

The registered port number for SGsAP is 29118.

The payload protocol identifier to be used for SGsAP is 0.

7 Error handling

7.1 General

This subclause specifies procedures for the handling of unknown, unforeseen, and erroneous protocol data by the receiving entity (i.e. the MME or the VLR). These procedures are called "error handling procedures", but in addition to providing recovery mechanisms for error situations, they define a compatibility mechanism for future extensions of the protocol.

In this subclause, the following terminology is used:

- an information element is defined to be syntactically incorrect in a message if it contains at least one value defined as "reserved", or if its value part violates coding rules. However, it is not a syntactical error that an information element indicates in its Length Indicator a greater length than defined in the relevant subclause; and
- a message is defined to have semantically incorrect contents if it contains information which, possibly dependant on the state of the receiver, is in contradiction to the resources of the receiver and/or to the procedural part of current specification.

When a receiving entity detects the need to send an SGsAP-STATUS message (see errors detailed below), the entity shall copy the IMSI information element value (if included) of the incorrect message to the IMSI information element of the SGsAP-STATUS message. The message in error is also included in the SGsAP-STATUS message. Both the receiving and the sending entity shall abandon the procedure related to the incorrect message and return to the state from where the procedure related to the incorrect message was started.

An SGsAP-STATUS message shall not be sent in response to a received SGsAP-STATUS message.

Both the receiving and the sending entity shall inform the O&M entity upon sending or receiving an SGsAP-STATUS message.

The next subclauses shall be applied in order of precedence.

7.2 Message too short

When the receiving entity receives a message that is too short to contain a complete message type information element, the receiving entity shall ignore that message.

7.3 Unknown or unforeseen message type

The entity receiving a message with a message type not defined or not implemented shall ignore the message. The receiving entity shall return an SGsAP-STATUS message with the SGs cause information element set to "message unknown" and the Erroneous message information element containing the received message.

The entity receiving a message that is not compatible with the protocol state shall return an SGsAP-STATUS message with the SGs cause information element set to "message not compatible with the protocol state" and the erroneous message.

The entity receiving a message that is not defined to be received by that entity (i.e. the message is sent in the wrong direction) shall treat the message as unknown message and shall ignore the message. The entity shall return an SGsAP-STATUS message with the SGs cause information element set to "message unknown" and the Erroneous message information element containing the received message.

7.4 Missing mandatory information element

When the receiving entity diagnoses a "missing mandatory information element" error, the receiving entity shall ignore the message and return an SGsAP-STATUS message with the SGs cause information element set to "missing mandatory information element" and shall return the Erroneous message information element containing the received message.

7.5 Information elements unknown or unforeseen in the message

The receiving entity shall ignore all information elements unknown or unforeseen in a message.

7.6 Out of sequence information elements

The receiving entity shall ignore all information elements that are out of sequence.

7.7 Repeated information elements

If an information element with format T, TV, or TLV is repeated in a message in which repetition of the information element is not specified, the receiving entity shall only handle the contents of the information element appearing first and shall ignore all subsequent repetitions of the information element. When repetition of information elements is specified, the receiving entity shall only handle the contents of specified repeated information elements. If the limit on repetition of information elements is exceeded, the receiving entity shall handle the contents of information elements appearing first up to the limit of repetitions and shall ignore all subsequent repetitions of the information element.

7.8 Syntactically incorrect mandatory information element.

On receipt of a message which contains a syntactically incorrect mandatory information element, the receiver shall ignore the message and return an SGsAP-STATUS message with the SGs cause information element set to "invalid mandatory information" and shall return the Erroneous message information element containing the received message.

7.9 Syntactically incorrect optional information elements

The receiving entity shall treat all optional information elements that are syntactically incorrect in a message as not present in the message.

7.10 Conditional information element errors

When the entity receiving a message diagnoses a "missing conditional information element" error or an "unexpected conditional information element" error or when it receives a message containing at least one syntactically incorrect conditional information element which is required to be present in the message, the receiving entity shall ignore the message and return an SGsAP-STATUS message with the SGs cause information element set to "conditional information element error" and shall return the Erroneous message information element containing the received message.

When the entity receives a message containing a syntactically incorrect conditional information element which is not required to be present in the message, nor required to be absent in the message, then the receiving entity shall ignore that information element.

7.11 Information elements with semantically incorrect contents

When an information element with semantically incorrect contents is received, the foreseen reactions of the procedural part of the present specification are performed.

If however no such reactions are specified, the receiving entity shall ignore that information element and treat the rest of the message. If, because this information element was ignored, the rest of the message can no longer be handled then the receiving entity shall return an SGsAP-STATUS message with the SGs cause information element set to "semantically incorrect message" and shall return the Erroneous message information element containing the received message.

