TS 101 346 V6.1.0 (1998-07)

Technical Specification

Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification (GSM 09.18 version 6.1.0 Release 1997)

Reference
DTS/SMG-030918Q6 (cgo030c3.PDF)

Keywords
Digital cellular telecommunications system,
Global System for Mobile communications
(GSM), GPRS, Packet Radio, Phase2+

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Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This TS specifies procedures used between the Serving GPRS Support Node (SGSN) and the Visitors Location Register (VLR) for co-ordination between GSM circuit switched services and GSM packet data services within the digital cellular telecommunications system (Phase 2+).

The contents of this TS are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TS it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 6.x.y

where:

6 GSM Phase 2+ Release 1997

x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated in the specification;

Introduction

This document specifies or references the procedures to provide co-ordination between the GSM circuit switched services controlled at the Visitors Location Register (VLR) and the GSM packet switched services controlled at the Serving GPRS Support Node (SGSN). The procedures specified in this document are intended to optimise the use of the resources when an MS supports both GSM circuit switched services and GSM packet switched services.

1 Scope

This Global System for Mobile communications Technical Specification (TS) specifies or references procedures used on the Serving GPRS Support Node (SGSN) to Visitors Location Register (VLR) interface for interoperability between GSM circuit switched services and GSM packet data services.

This document specifies the layer 3 messages and procedures on the Gs interface to allow coordination between databases and to relay certain messages related to GSM circuit switched services over the GPRS subsystem.

The functional split between VLR and SGSN is defined in GSM 03.60. The required procedures between VLR and SGSN are defined in detail in this Technical Specification.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

2.1 Normative references

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.06: "Digital cellular telecommunications system (Phase 2+); Types of Mobile Stations (MS)".

[3] GSM 02.07: "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) features".

[4] GSM 02.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 1".

[5] GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".

[6] GSM 03.07: "Digital cellular telecommunications system (Phase 2+); Restoration procedures".

[7] GSM 03.22: "Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode".

[8] GSM 03.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2".

[9] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); Overall description of the General Packet Radio Service (GPRS) Radio interface; Stage 2".

[10] GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".

[11] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[12] GSM 04.64: "Digital cellular telecommunications system (Phase 2+), General Packet Radio Service (GPRS); Logical Link Control (LLC)".

[13] GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Subnetwork Dependent Convergence Protocol (SNDCP)".

[14] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification".

[15] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS): BSS GPRS Protocol (BSSGP)".

[16] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels."

[17] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".

[18] GSM 09.08: "Digital cellular telecommunications system (Phase 2+); Application of Base Station System Application Part (BSSAP) on the E-interface".

[19] GSM 09.10: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR): Gs interface Layer 2 specification".

[20] GSM 09.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR): Gs interface Layer 2 specification".

[21] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

2.2 Informative references

[22] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); GPRS ciphering algorithm requirements".

[23] GSM 02.01: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".

[24] GSM 02.02: "Digital cellular telecommunications system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[25] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[26] GSM 02.08: "Digital cellular telecommunications system (Phase 2+); Quality of service".

[27] GSM 02.09: "Digital cellular telecommunications system (Phase 2+); Security aspects".

[28] GSM 02.11: "Digital cellular telecommunications system (Phase 2+); Service accessibility".

[29] GSM 02.16: "Digital cellular telecommunications system (Phase 2+); International Mobile station Equipment Identities (IMEI)".

[30] GSM 02.17: "Digital cellular telecommunications system (Phase 2+); Subscriber identity modules Functional characteristics".

[31] GSM 02.30: "Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)".

[32] GSM 03.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Point to Multipoint Multicast Service Description; Stage 2".

[33] GSM 03.62: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Point to Multipoint Group Call Service Description; Stage 2".

[34] GSM 04.01: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface General aspects and principles".

[35] GSM 04.02: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[36] GSM 04.03: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[37] GSM 04.04: "Digital cellular telecommunications system (Phase 2+); layer 1 General requirements".

[38] GSM 04.05: "Digital cellular telecommunications system (Phase 2+); Data Link (DL) layer General aspects".

[39] GSM 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[40] GSM 04.11: "Digital cellular telecommunications system (Phase 2+); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[41] GSM 04.22: "Digital cellular telecommunications system (Phase 2+); Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[42] GSM 07.60: "Digital cellular telecommunications system (Phase 2+), Mobile Station (MS) supporting GPRS".

[43] GSM 08.06: "Digital cellular telecommunications system (Phase 2+); Signalling transport mechanism specification for the Base Station System - Mobile Switching Centre (BSS - MSC) interface".

[44] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS): Gb interface layer 1".

[45] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS): Network Service".[46] GSM 09.60: "Digital cellular telecommunications system (Phase 2+), General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[47] GSM 09.61: "Digital cellular telecommunications system (Phase 2+), General requirements on interworking between the Public Land Mobile Network (PLMN) supporting General Packet Radio Service (GPRS) and Packet Data Networks (PDN)".

[48] GSM 12.00 (ETS 300 612-1): "Digital cellular telecommunications system (Phase 2+); Objectives and structure of Network Management (NM)".

[49] GSM 12.01 (ETS 300 612-2): "Digital cellular telecommunications system (Phase 2+); Common aspects of GSM Network Management (NM)".

[50] GSM 12.02: "Digital cellular telecommunications system (Phase 2+); Subscriber, Mobile Equipment (ME) and services data administration".

[51] GSM 12.03: "Digital cellular telecommunications system (Phase 2+); Security management".

[52] GSM 12.13: "Digital cellular telecommunications system (Phase 2+); Maintenance of the Mobile-services Switching Centre (MSC)".

[53] GSM 12.14: "Digital cellular telecommunications system (Phase 2+); Maintenance of location registers".

[54] GSM 12.20: "Digital cellular telecommunications system (Phase 2+); Network Management (NM) procedures and messages".

[55] GSM 12.22: "Digital cellular telecommunications system (Phase 2+); Interworking of GSM Network Management (NM) procedures and messages at the Base Station Controller (BSC)".

[56] CCITT Recommendations I.130: "General modelling methods - Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[57] CCITT Recommendation Q.65: "Methodology - Stage 2 of the method for the characterization of services supported by an ISDN".

[58] CCITT Recommendation Q.702: "Specifications of Signalling System No. 7 - Signalling data link".

[59] CCITT Recommendation Q.703: "Signalling link".

[60] CCITT Recommendation Q.704: "Signalling network functions and messages".

[61] CCITT Recommendation Q.711 (3/93): "Functional description of the signalling connection control part".

[62] CCITT Recommendation Q.712 (3/93): "Definition and function of SCCP messages".

[63] CCITT Recommendation Q.713 (3/93): "SCCP formats and codes".

[64] CCITT Recommendation Q.714 (3/93): "Signalling connection control part procedures".

3 Definitions, symbols and abbreviations

Unless listed below, the definitions, symbols and abbreviations are listed in GSM 01.04 or GSM 03.60.

4 Description of the association between a VLR and an SGSN

The Gs interface connects the databases in the MSC/VLR and the SGSN. The procedures described in this technical specification are used to co-ordinate the location information of MSs that are IMSI attached to both GPRS and non-GPRS services. The Gs interface is also used to convey some circuit switched related procedures via the SGSN.

The basis for the interworking between a VLR and an SGSN is the existence of an association between those entities per MS. An association consists of the SGSN storing the address of the VLR serving the MS for circuit switched services and the VLR storing the address of the SGSN serving the MS for packet switched services. The association is only applicable to class A and B MSs.

All the messages described in this TS use the SCCP class 0 connectionless service.

When the return option in SCCP is used and the sender receives an N_NOTICE indication from SCCP, the sending entity shall report to the Operation and Maintenance system (see ITU-T Q.714).

The behaviour of the VLR and the SGSN entities related to the Gs interface are defined by the state of the association for an MS. Individual states per association, i.e. per class A and B MS, are held at both the VLR and the SGSN.

4.1 Association at the VLR

The states associated to the Gs interface in the VLR are specified in this subclause. The state diagram at the VLR is shown in figure 4.1. The state diagram does not include the message error handling specified in clause 17.

4.1.1 States at the VLR

Gs-NULL

There is no association stored to an SGSN for the MS and therefore the VLR considers that the MS is IMSI detached of GPRS services. In this state no BSSAP+-IDENTITY-REQUEST or BSSAP+-MM-INFORMATION-REQUEST messages are sent to the SGSN. The VLR may initiate paging on the Gs interface if the 'Confirmed by Radio Contact' restoration indicator in the VLR is set to 'false' (see GSM 03.07). Any message from the SGSN is ignored apart from the BSSAP+-LOCATION-UPDATE-REQUEST message.

LA-UPDATE PRESENT

The VLR has received a BSSAP+-LOCATION-UPDATE-REQUEST message from the SGSN. In this state the VLR waits for the outcome of the Update Location procedure from the HLR. The VLR shall send BSSAP+-PAGING-REQUEST messages to class A and B MSs via the Gs interface only.

Gs-ASSOCIATED

The VLR considers that the MS is attached to both GPRS and non-GPRS services. In this state the VLR sends BSSAP+-PAGING-REQUEST messages to class A and B MSs via the Gs interface only. The VLR also performs the MS Identification procedure and the MM information procedure.

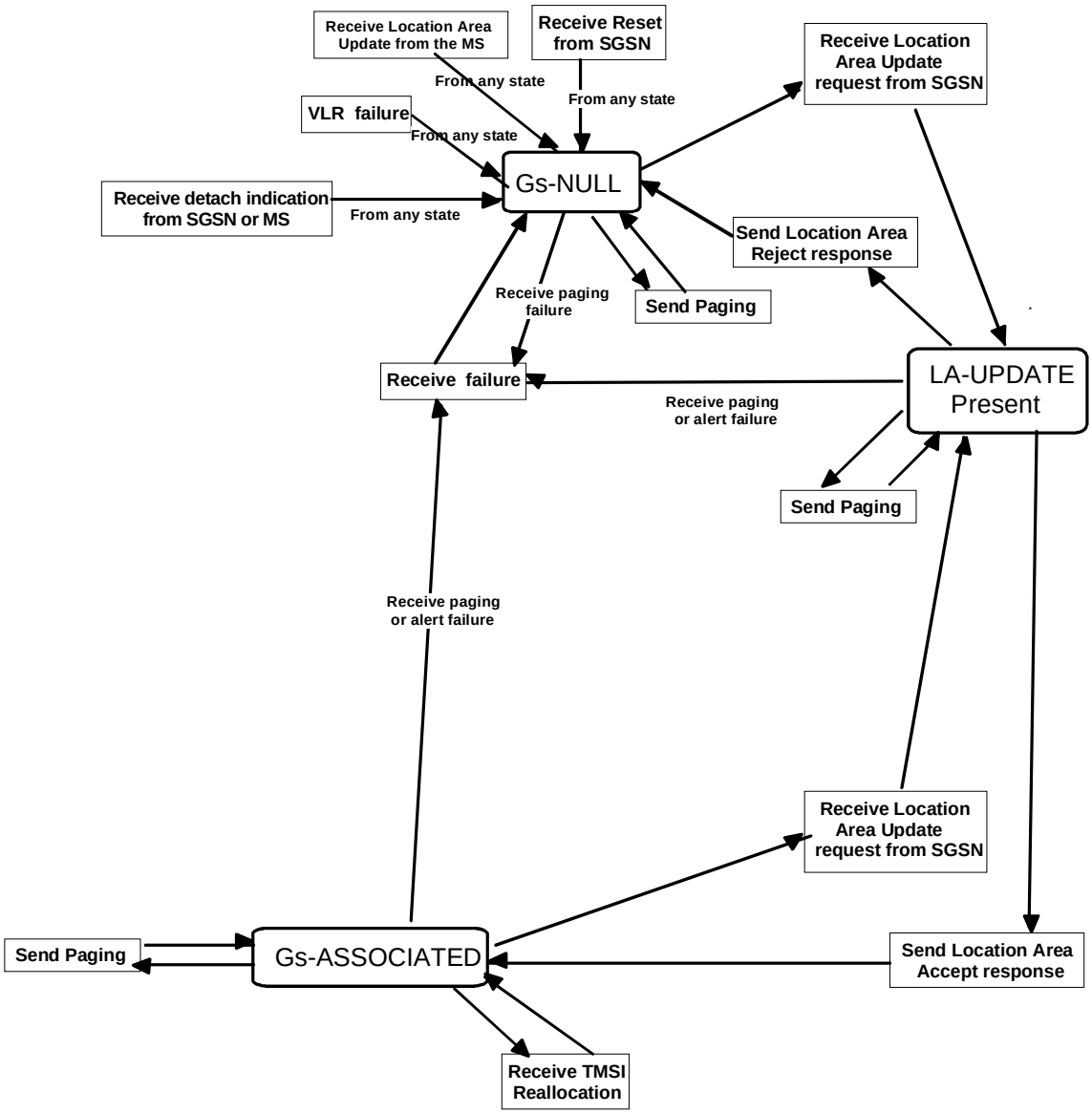

Figure 4.1: State diagram at the VLR

4.2 Association at the SGSN

The states and MM context variables associated to the Gs interface in the SGSN are specified in this subclause. The state diagram at the SGSN is shown in figure 4.2. The state diagram does not include the message error handling specified in clause 17.

4.2.1 MM context variables at the SGSN

VLR-Reliable: Boolean

Set to ‘false’ when the SGSN has received a reset indication from the VLR. The SGSN shall request to the MS, upon reception of the next routeing area update (either routeing area update only or combined routeing and location area update) procedure, to re-attach to non-GPRS services if the MS is still IMSI attached to non-GPRS services.

SGSN-Reset: Boolean

Set to ‘true’ when the SGSN restarts after a failure. The ‘SGSN-Reset’ variable is unique within an SGSN and it applies to all the MM context stored in the SGSN.

4.2.2 States at the SGSN

Gs-NULL

There is no association to a VLR stored for the MS and therefore the SGSN considers that the MS is IMSI detached of non-GPRS services. In this state the SGSN accepts BSSAP+-PAGING-REQUEST messages to MSs only if the ‘SGSN-Reset’ restoration indicator in the SGSN is set to ‘true’.

LA-UPDATE Requested

The SGSN has sent a BSSAP+-LOCATION-UPDATE-REQUEST message to the VLR. In this state the SGSN waits for the outcome of the Location Update for non-GPRS procedure at the VLR before sending the response to the MS. In this state the SGSN accepts BSSAP+-PAGING-REQUEST messages.

Gs-ASSOCIATED

The SGSN stores an association for that MS. In this state the SGSN performs the Location Update for non-GPRS services procedure towards the VLR for class A and B MSs when the MS moves to a new LA.

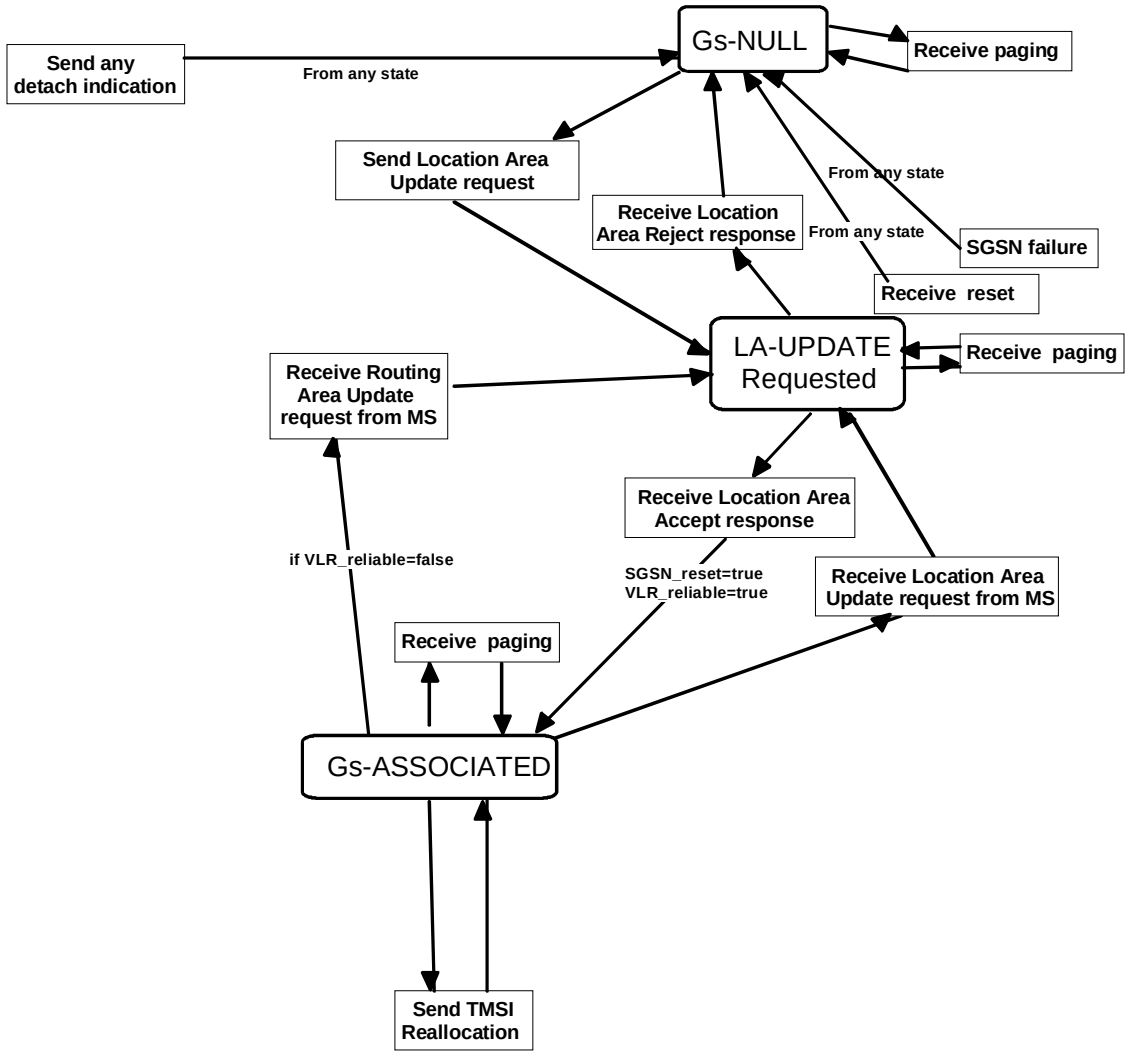

Figure 4.2: State diagram at the SGSN

5 Paging for non-GPRS services procedure

5.1 General description

This procedure is used by the VLR to send a BSSAP+-PAGING-REQUEST message to an MS via the GPRS service. This procedure applies to MSs that are simultaneously IMSI attached for GPRS services and non-GPRS services. The procedure can be performed simultaneously with any other procedure at the Gs interface.

5.2 Procedures in the VLR

The VLR shall handle the timers, queuing and retransmission for sending the BSSAP+-PAGING-REQUEST message on the Gs interface in the same way that handles the sending of a PAGING message on the A interface.

5.2.1 Paging Initiation

When a VLR has to page a GPRS MS it shall check whether the MSC has an SCCP connection for that MS. If no SCCP connection exists the VLR checks the state of the association to an SGSN and the value of the restoration indicators for that MS. The VLR sends BSSAP+-PAGING-REQUEST messages to the SGSN if the state of the association for the MS is Gs-ASSOCIATED, LA-UPDATE-PRESENT or if the state of the association is Gs-NULL and the ‘Confirmed by

Radio Contact' restoration indicator is set to 'false'. The sending of the BSSAP+-PAGING-REQUEST message does not change the state of the association to the SGSN.

If the 'Confirmed by Radio Contact' restoration indicator is set to 'true', the VLR shall include the Location area identifier IE into the BSSAP+-PAGING-REQUEST message, otherwise (i.e. after a VLR failure) the Location area identifier IE shall not be included. When sending the BSSAP+-PAGING-REQUEST message, the VLR shall start timer T5.

If the state of the association is Gs-NULL and the restoration indicator 'Confirmed by Radio Contact' is set to 'false', the VLR shall perform a search procedure as specified in GSM 03.18.

5.2.2 Paging Response

The VLR stops the paging procedure on expiry of timer T5 or on receipt of an SCCP connection establishment initial L3 message from the MS via the A interface.

5.2.3 Paging Failure

On receipt of a BSSAP+-PAGING-REJECT message before the timer T5 expires, the VLR stops timer T5, the association is moved to the Gs-NULL state and within this state the association is marked with the contents of the Cause IE.

5.2.4 MS unreachable

On receipt of a BSSAP+-MS-UNREACHABLE message before the timer T5 expires, the VLR stops timer T5 and the paging procedure for that paging request towards the SGSN is stopped. The state of the association at the VLR is not changed.

5.3 Procedures in the SGSN

The SGSN accepts BSSAP+-PAGING-REQUEST messages in any state of the association apart from Gs-NULL. Nevertheless the SGSN also accepts BSSAP+-PAGING-REQUEST messages in the Gs-NULL state if the 'SGSN-Reset' restoration indicator at the SGSN is set to 'true'. When an SGSN receives a BSSAP+-PAGING-REQUEST message from a VLR, the SGSN shall first check if the MS is known by the SGSN. The handling of the paging request depends on the state of the association and the MM context variables at the SGSN:

a) The MS is known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'false':

- If the MS is considered to be IMSI attached for GPRS and non-GPRS services (i.e. the association is not in the state Gs-NULL), the SGSN shall page the MS based on the location information stored in the SGSN.

- If the MS is marked as IMSI detached for GPRS services or IMSI (implicitly or explicitly) detached for non-GPRS services (i.e. the state of the association is Gs-NULL), the SGSN shall return a BSSAP+-PAGING-REJECT message to that VLR indicating in the Cause IE the detach circumstance ('IMSI detached for GPRS services', 'IMSI detached for non-GPRS services' or 'IMSI implicitly detached for non-GPRS services').

- If the MS is marked as unreachable (i.e. the PPF flag is set to 'false') the SGSN shall return a BSSAP+-MS-UNREACHABLE message to that VLR indicating in the Cause IE 'MS unreachable'. The state of the association does not change at the SGSN.

b) The MS is known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'true':

- If the BSSAP+-PAGING-REQUEST message includes the Location area identifier IE, the SGSN shall page the MS in all the routeing areas served by the SGSN that are included in the location area indicated in the Location area identifier IE.

- If the BSSAP+-PAGING-REQUEST message does not include the Location area identifier IE, the SGSN may page in all the routeing areas served by the SGSN that are also served by the sending VLR.

c) The MS is not known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'false':

- The SGSN shall return a BSSAP+-PAGING-REJECT message to that VLR indicating in the Cause IE 'IMSI unknown'.

d) The MS is not known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'true':

- If the VLR provides the Location area identifier IE, the SGSN shall page within the location area indicated by the VLR. Otherwise the SGSN may page in all the routeing areas served by the SGSN that are also served by the sending VLR.

If the SGSN accepts the paging request, the SGSN shall process the BSSAP+-PAGING-REQUEST message before sending the message on the Gb interface. The result of the processing on the BSSAP+-PAGING-REQUEST message is the PAGING CS message (see GSM 08.18) sent on the Gb interface.

The SGSN shall not retransmit the PAGING CS message.

If within the SGSN area there are cells that do not support GPRS services, the SGSN shall group these cell under a 'null RA'. The SGSN will perform the paging procedure described above within both the RA(s) derived from the location information and the 'null RA' (see GSM 04.08).

Note: the eMLPP priority information element relates to relative priorities within the paged MS and not to the priority in the sending of PAGING CS messages by the BSS.

6 Location Update for non-GPRS services procedure

6.1 General description

The location update for non-GPRS services procedure is a general procedure used by class A or B MSs. This procedure allows MSs and network to perform:

- Combined IMSI attach for GPRS and non-GPRS services.
- IMSI attach for non-GPRS services if the MS is already IMSI attached for GPRS services.
- IMSI attach for GPRS services indication to the VLR if the MS is already IMSI attached for non-GPRS services
- Normal Location Update procedure to the VLR if the MS is IMSI attached for both GPRS and non-GPRS services.
- Reallocation of TMSI to an MS.

The Location Update for non-GPRS services procedures in the Gs interface is always started as a consequence of a direct action by the MS. The combined routeing area update procedure is further specified in GSM 03.60 and 04.08.

The Location Update for non-GPRS services procedure is used by the SGSN to forward to the VLR those parts of the combined routeing area update or IMSI attach procedure which belong to the non-GPRS services. This means that non-GPRS related requests which are included in the combined request, are sent from the SGSN to the VLR. The procedure is also used by the SGSN to indicate to the VLR when an IMSI attach to GPRS services has been performed by an MS that was already IMSI attached to non-GPRS services. The SGSN may also forward a BSSAP+-TMSI-REALLOCATION-COMPLETE message from the MS to the VLR.

The VLR shall acknowledge the BSSAP+-LOCATION-UPDATE-REQUEST message. When the VLR processes the request it does not perform authentication because it relies on the SGSN's security functions.

When an MS is IMSI attached for GPRS and non-GPRS services, any implicit detach timer in the VLR shall be stopped. Instead the Standby timer in the SGSN is used to determine the likely availability of the MS to the network. The SGSN does not report to the VLR upon reception of the periodic Routeing Area Update message. When the MS performs a detach only from the GPRS system the GPRS detach indication to the VLR shall cause the implicit detach timer to be restarted from its initial value. If the Standby timer at the SGSN expires, the SGSN shall indicate to the VLR a BSSAP+-IMSI-DETACH-INDICATION message with cause 'Implicit SGSN initiated IMSI detach from non-GPRS service', as further described in section 'Implicit IMSI detach from non-GPRS service procedure'.

The IMSI attach for GPRS services to the VLR, when the MS is already IMSI attached for non-GPRS services, is requested by the MS sending a combined IMSI attach for GPRS and non-GPRS services message to the SGSN, as further specified in GSM 03.60 and 04.08.

6.2 Procedures in the SGSN

The Location Update for non-GPRS services is initiated with a routeing area update procedure or a IMSI/GPRS attach procedure. On receipt of a Routeing Area Update message, the SGSN shall handle the GPRS related request as specified in GSM 04.08. The Location Update for non-GPRS services procedure may be handled by the SGSN in parallel to the Update Location procedure to the HLR. The SGSN shall wait for the outcome of both location update procedures towards the VLR and the HLR before sending the response message to the MS (see GSM 04.08).

6.2.1 Location Update Initiation

The SGSN shall start the Location Update for non-GPRS service procedure when it receives from the MS:

- Attach request indicating combined IMSI and GPRS attach.
- Attach request indicating IMSI only attach.
- Routeing Area Update request indicating that the Location Area has changed.
- Routeing Area Update request when the SGSN serving the MS has changed.

The address of the VLR is derived from the RAI where the MS is camping. The SGSN starts Timer T6-1. The BSSAP+-LOCATION-UPDATE-REQUEST message includes the old Location Area Identifier received from the MS. The SGSN shall also include the new Location Area Identifier where the MS is currently camping. The new LAI is derived from the RAI.

The BSSAP+-LOCATION-UPDATE-REQUEST message includes the type of location update performed by the MS in the GPRS location update type IE. If the MS has performed an attach request, the SGSN indicates ‘IMSI attach’, otherwise the SGSN indicates ‘Normal location update’.

6.2.2 Location Update Response

If the SGSN receives a BSSAP+-LOCATION-UPDATE-ACCEPT message from the VLR, the SGSN shall stop timer T6-1 and:

- Move the state of the association to Gs-ASSOCIATED.
- Set the the MM context variable ‘VLR-Reliable’ to ‘true’.
- Indicate to the MS the acceptance of the VLR to the Location Update procedure. The message to the MS includes the Routeing Area Identity, from which the MS is able to extract the location area identity for which the location update procedure succeeded (see GSM 04.08).

The SGSN shall wait for the outcome of the Location Update procedure towards the VLR before sending a response to location update procedure to the MS. The error cause reported to the MS is explained in GSM 04.08

If the VLR included the Mobile Identity IE in the BSSAP+-LOCATION-UPDATE-ACCEPT message, the SGSN shall forward the information received to the MS. This will cause the MS to perform a TMSI reallocation procedure. The SGSN shall send to the VLR the BSSAP+-TMSI-REALLOCATION-COMPLETE message when the SGSN receives the Routeing Area Complete message from the MS.

6.2.3 Location Update Failure

If the SGSN receives a BSSAP+-LOCATION-UPDATE-REJECT message from the VLR, the SGSN shall stop timer T6-1 and:

- Move the state of the association to Gs-NULL.

- Indicate to the MS the rejection of the VLR to the Location Update procedure as specified in GSM 04.08. The rejection cause value is forwarded to the MS.

6.2.4 Abnormal cases

If the SGSN has not received a response from the VLR to a previous BSSAP+-LOCATION-UPDATE-REQUEST message before timer T6-1 has expired, the SGSN shall reject the Location Update Request for the VLR and indicate it to the MS with the cause value 'MSC temporarily not reachable'. The state of the association to the VLR shall be Gs-NULL.

6.3 Procedures in the VLR

When a VLR receives a BSSAP+-LOCATION-UPDATE-REQUEST message it shall check whether the IMSI is known. If the IMSI is not know the VLR shall retrieve the MM context of the MS from the HLR.

6.3.1 Location Update Response

If the Location Update is accepted by the VLR and possibly by the HLR, the VLR shall:

- Move the association to the Gs-ASSOCIATED state.
- Set the restoration indicator 'Confirmed by Radio Contact' to 'true'
- Update the association by storing the SGSN address included in the BSSAP+-LOCATION-UPDATE-REQUEST message.
- Send a BSSAP+-LOCATION-UPDATE-ACCEPT message to the sending SGSN. This message includes the Location Area Identification received in the new Location Area Identification IE in the previous BSSAP+-LOCATION-UPDATE-REQUEST message.

6.3.2 Location Update Failure

If the Location Update is rejected by the VLR it shall:

- Send a BSSAP+-LOCATION-UPDATE-REJECT message to the SGSN with the appropriate reject cause as indicated in GSM 04.08.
- Move the association from any state to Gs-NULL

6.3.3 TMSI reallocation procedure

If the VLR decides to reallocate the TMSI to the MS it shall include the new TMSI in the BSSAP+-LOCATION-UPDATE-ACCEPT message. If the VLR decides to deallocate the TMSI of the MS it shall include the IMSI of the MS in the BSSAP+-LOCATION-UPDATE-ACCEPT message. After sending the BSSAP+-LOCATION-UPDATE-ACCEPT message the VLR starts timer T6-2.

Upon receipt of the BSSAP+-TMSI-REALLOCATION-COMPLETE message, the VLR stops the timer T6-2 and either considers the new TMSI as valid or, if an IMSI was sent to the MS, considers the old TMSI as deleted.

If no BSSAP+-TMSI-REALLOCATION-COMPLETE message is received by the VLR before the timer T6-2 expires, the VLR aborts the TMSI reallocation procedure. The VLR may still perform the TMSI reallocation procedure via the A interface. The outcome of the TMSI reallocation procedure does not change the state of the association.

6.3.4 Abnormal cases

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

7 Non-GPRS alert procedure

7.1 General description

This procedure is used by the VLR to request from an SGSN an indication when activity (either signalling or data transmission) from an MS is detected. This procedure can be invoked at any time by the VLR. The BSSAP+-ALERT-REQUEST message shall be acknowledged by the SGSN.

7.2 Procedures in the VLR

7.2.1 Alert Initiation

The VLR may start the Non-GPRS alert procedure at any time. When the VLR wants to request to an SGSN that further activity from an MS shall reported by the SGSN, the VLR shall send an BSSAP+-ALERT-REQUEST message to that SGSN. The VLR starts timer T7 when the BSSAP+-ALERT-REQUEST message is sent.

7.2.2 Alert Response

When a BSSAP+-ALERT-ACK message is received, the VLR shall stop the timer T7.

7.2.3 Alert failure

If a BSSAP+-ALERT-REJECT message is received, the VLR shall stop the timer T7, move the state of the association to Gs-NULL and within this state the association is marked with the contents of the Cause IE.

7.2.4 Alert Indication

The VLR shall not change the state of the association upon reception of an BSSAP+-MS-ACTIVITY-INDICATION message.

7.2.5 Abnormal cases

If no BSSAP+-ALERT-ACK message is received before the timer T7 expires, the VLR shall retransmit the BSSAP+-ALERT-REQUEST message a maximum of N7 times. If no BSSAP+-ALERT-ACK message is received after that, a report shall be made to the O&M system.

7.3 Procedures in the SGSN

7.3.1 Alert response

The SGSN may receive a BSSAP+-ALERT-REQUEST message at any state of the association. Upon receipt of an BSSAP+-ALERT-REQUEST message from the VLR the SGSN shall reply with a BSSAP+-ALERT-ACK message. If the IMSI is known at the SGSN, the SGSN shall set the NGAF.

7.3.2 Alert failure

If a BSSAP+-ALERT-REQUEST message is received for an MS that is unknown at the SGSN, the SGSN shall return a BSSAP+-ALERT-REJECT message to the VLR indicating the Cause IE value ‘IMSI unknown’.

7.3.3 Alert indication

The SGSN shall to report to the VLR upon detection of any activity (either signalling or data) from the MS if the NGAF is set. If the SGSN detects GPRS signalling that leads to a procedure towards the VLR, the SGSN shall follow this

procedure and reset the NGAF. If the SGSN detects activity that does not lead to any procedure towards the VLR, the SGSN shall send an BSSAP+-MS-ACTIVITY-INDICATION message towards the VLR and reset the NGAF.

8 Explicit IMSI detach from GPRS services procedure

8.1 General description

This procedure is used by the SGSN to indicate the VLR that the MS has been IMSI detached from GPRS service and therefore the association between the SGSN and the VLR is no longer active. This procedure only applies to MSs that are simultaneously IMSI attached for GPRS and non-GPRS services. The procedures specified in this section applies to GPRS detach indication initiated by the MS or by the network as specified in GSM 03.60.

The procedure is also used by the SGSN to indicate to the VLR when a Location Update procedure has been rejected by the SGSN.

The Explicit IMSI detach from GPRS services procedure aborts any other ongoing procedure on the Gs interface in the SGSN and in the VLR.

The VLR and the MS should be synchronised in order to avoid loss of BSSAP+-PAGING-REQUEST messages. The SGSN shall attempt to inform the VLR about the GPRS detach event by using a retry scheme if the initial delivery of the BSSAP+-GPRS-DETACH-INDICATION message fails.

8.2 Procedures in the SGSN

8.2.1 Explicit GPRS detach initiation

The SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION message to a VLR in the next circumstances:

- The SGSN receives a GPRS only detach from the MS.
- The SGSN performs network-initiated GPRS detach procedure.
- The combined Routing and Location Area Update procedure is rejected at the SGSN.

If the SGSN receives a Detach Request from an MS and the state of the association to a VLR for that MS is not Gs-NULL, the SGSN shall check the detach type indicated in the message. If the MS is indicating GPRS detach the SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION message to the VLR indicating ‘MS initiated IMSI detach from GPRS service’.

If the SGSN decides to perform a network-initiated GPRS detach and the state of the association to a VLR for that MS is not Gs-NULL, the SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION message to the VLR indicating ‘SGSN initiated IMSI detach from GPRS service’.

If the combined Routing and Location Area Update procedure is rejected at the SGSN for a MS with an association state different from Gs-NULL, the SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION to the VLR indicating ‘SGSN initiated IMSI detach from GPRS service’. The SGSN shall then send a Location Update Accept message as specified in GSM 04.08.

After the sending of the BSSAP+-GPRS-DETACH-INDICATION message, the SGSN shall move the state of the association to Gs-NULL. The SGSN shall start timer T8 upon transmission of the BSSAP+-GPRS-DETACH-INDICATION message.

8.2.2 Explicit GPRS detach Response

The SGSN shall not wait for the reception of the BSSAP+-GPRS-DETACH-ACK message before sending (if needed) the confirmation of the detach to the MS.

8.2.3 Abnormal cases

If no BSSAP+-GPRS-DETACH-ACK message is received by the SGSN to a previous BSSAP+-GPRS-DETACH-INDICATION message before timer T8 expires, the SGSN shall repeat the BSSAP+-GPRS-DETACH-INDICATION message a maximum of N8 times. If no BSSAP+-GPRS-DETACH-ACK message is received after that, a report shall be made to the O&M system. The state of the association during the acknowledgement procedure remains Gs-NULL.

8.3 Procedures in the VLR

When a VLR receives a BSSAP+-GPRS-DETACH-INDICATION message, the VLR shall send a BSSAP+-GPRS-DETACH-ACK message to the sending SGSN. The state of the association for the MS shall be moved from any state to Gs-NULL. The VLR marks the association as 'IMSI detached for GPRS services' with the reason indicated in the IMSI detach from GPRS service type IE

The VLR shall restart the implicit detach timer upon reception of a BSSAP+-GPRS-DETACH-INDICATION message.

9 Explicit IMSI detach from non-GPRS services procedure

9.1 General description

This procedure is used by the SGSN to indicate the VLR that the MS has performed IMSI detach from non-GPRS services and therefore the association between the SGSN and the VLR is no longer active. This procedure only applies to MSs that are simultaneously IMSI attached for GPRS and non-GPRS services. The procedures specified in this section only applies to IMSI detach or combined IMSI and GPRS detach requests.

The explicit IMSI detach from non-GPRS services procedure aborts any other ongoing procedure on the Gs interface in the SGSN and in the VLR.

The VLR and the MS should be synchronised in order to avoid loss of BSSAP+-PAGING-REQUEST messages. The SGSN shall attempt to inform the VLR about the GPRS detach event by using a retry scheme if the initial delivery of the BSSAP+-IMSI-DETACH-INDICATION message fails.

9.2 Procedures in the SGSN

9.2.1 Explicit IMSI detach initiation

When an SGSN receives a Detach Request from an MS, it shall check the detach type indicated. If the MS is indicating IMSI detach or combined IMSI and GPRS detach the SGSN shall send an BSSAP+-IMSI-DETACH-INDICATION message to the VLR indicating 'Explicit MS initiated IMSI detach from non-GPRS service' or 'Combined explicit MS initiated IMSI detach from GPRS and non-GPRS services'.

After the sending of the BSSAP+-IMSI-DETACH-INDICATION message to the VLR, the SGSN shall move the state of the association to Gs-NULL. The SGSN shall start timer T9 upon transmission of the BSSAP+-IMSI-DETACH-INDICATION message.

9.2.2 Explicit IMSI detach Response

If the detach type indicated IMSI only detach or combined IMSI and GPRS detach not due to switch off, the SGSN shall wait for the reception of the BSSAP+-IMSI-DETACH-ACK message before sending the confirmation of the detach to the MS.

9.2.3 Abnormal cases

If no BSSAP+-IMSI-DETACH-ACK message is received by the SGSN to a previous BSSAP+-IMSI-DETACH-INDICATION message for a IMSI only detach or a combined IMSI and GPRS detach due to switch off before timer T9 expires, the SGSN shall repeat the BSSAP+-IMSI-DETACH-INDICATION message a maximum of N9 times.

If no BSSAP+-IMSI-DETACH-ACK message is received by the SGSN to a previous BSSAP+-IMSI-DETACH-INDICATION message for a combined IMSI and GPRS detach not due to switch off before timer T9 expires, the SGSN shall repeat the BSSAP+-IMSI-DETACH-INDICATION message a maximum of N9 times. If no BSSAP+-IMSI-DETACH-ACK is received after that the SGSN shall send a detach message to the mobile indicating that the VLR does not respond to the Detach indication. The mobile may, after a determined period of time, try again the detach indication to the VLR.

9.3 Procedures in the VLR

When a VLR receives an BSSAP+-IMSI-DETACH-INDICATION message , the VLR shall send an BSSAP+-IMSI-DETACH-ACK message to the sending SGSN. The state of the association for the MS shall be moved from any state to Gs-NULL. If the BSSAP+-IMSI-DETACH-INDICATION message indicated ‘Explicit MS initiated IMSI detach from non-GPRS service’, the VLR marks the association as ‘IMSI detached for non-GPRS services’. If the BSSAP+-IMSI-DETACH-INDICATION message indicated ‘Combined explicit MS initiated IMSI detach from GPRS and non-GPRS services’, the VLR marks the association as ‘IMSI detached for GPRS and non-GPRS services’.

10 Implicit IMSI detach from non-GPRS services procedure

10.1 General description

This procedure is used by the SGSN to indicate when the Standby timer of an MS has expired. This procedure only applies to mobiles with an association is different from Gs-NULL at the SGSN.

The implicit IMSI detach from non-GPRS services procedure aborts any other ongoing procedure on the Gs interface in the SGSN and in the VLR.

The VLR and the mobile have to be synchronised in order to avoid lost of BSSAP+-PAGING-REQUEST messages. The SGSN shall attempt to inform the VLR about the GPRS detach event by using a retry scheme if the initial delivery of the BSSAP+-IMSI-DETACH-INDICATION message fails.

10.2 Procedures in the SGSN

When the Standby timer of an MS expires at the SGSN, the SGSN shall send a BSSAP+-IMSI-DETACH-INDICATION message to the VLR indicating ‘Implicit SGSN initiated IMSI detach from non-GPRS service’.

After the sending of the BSSAP+-IMSI-DETACH-INDICATION message, the SGSN shall move the state of the association to Gs-NULL. The SGSN shall start timer T10 upon transmission of the BSSAP+-IMSI-DETACH-INDICATION message. The SGSN shall not wait for the reception of the BSSAP+-IMSI-DETACH-ACK message before sending (if needed) the confirmation of the detach to the MS.

If no BSSAP+-IMSI-DETACH-ACK message is received by the SGSN to a previous BSSAP+-IMSI-DETACH-INDICATION message before timer T10 expires, the SGSN shall repeat the BSSAP+-IMSI-DETACH-INDICATION message a maximum of N10 times. The state of the association during the acknowledgement procedure remains Gs-NULL.

10.3 Procedures in the VLR

When a VLR receives the BSSAP+-IMSI-DETACH-INDICATION message when the state of the association is not Gs-NULL, the state of the association for the MS shall be moved from any state to Gs-NULL. The VLR marks the association as 'IMSI implicitly detached for non-GPRS services'. The VLR shall also send a BSSAP+-IMSI-DETACH-ACK message to the sending SGSN.

The VLR shall continue the procedure like the IMSI detach procedure as described in GSM 04.08.

11 VLR failure procedure

11.1 General description

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

The VLR recovery procedure shall be handled in such a way that the signalling load on the VLR and SGSN does not create any overload problem.

11.2 Procedures in the VLR

11.2.1 VLR Reset Initiation

In the event of a failure at the VLR which has resulted in the loss of SGSN association information on some MSs, the VLR shall move from any state to the Gs-NULL state for all the associations with SGSNs per MS. The VLR shall also set the 'Confirmed by Radio Contact' restoration indicator to 'false' (see GSM 03.07). The VLR shall not send any BSSAP+-IDENTITY-REQUEST or BSSAP+-MM-INFORMATION-REQUEST messages to MSs with the SGSN association in the Gs-NULL state.

When the VLR restarts a BSSAP+-RESET-INDICATION message shall be sent to all the SGSNs connected to the VLR by the Gs interface. This message indicates to the SGSN that for the MSs with an association to that VLR, the associations are no longer reliable. The VLR shall also start timer T11.

11.2.2 VLR Reset Response

Upon receipt of a BSSAP+-RESET-ACK message, the VLR shall stop the timer T11.

11.2.3 Abnormal cases

If the VLR does not receive a BSSAP+-RESET-ACK message from that SGSN before the T11 timer expires, the VLR shall retransmit the BSSAP+-RESET-INDICATION message. The retransmission is repeated a maximum of N11 times. If no BSSAP+-RESET-ACK is received after that a report shall be made to the O&M system.

11.3 Procedures in the SGSN

Upon receipt of a BSSAP+-RESET-INDICATION message from the VLR, the SGSN is informed that all the associations with that VLR for all the MSs registered in the SGSN are no longer reliable because the VLR may have lost information about the state of the MSs and during the failure the VLR may have missed signalling messages. The SGSN shall set the 'VLR-Reliable' MM context variable to 'false' and shall move all the associations containing the restarted VLR to the Gs-NULL state. The detach procedures for deleting the association are still applicable (sections 'Explicit IMSI detach from GPRS services procedure', 'Explicit IMSI detach from non-GPRS services procedure' and 'Implicit IMSI detach from non-GPRS services procedure'). If the 'VLR-Reliable' MM context variable is set to 'false', upon reception of any Routeing Area Update or Combined Routeing and Location Area update request from the MS, the SGSN request the re-attach to non-GPRS services.

The SGSN sends a BSSAP+-RESET-ACK message to the VLR. This indicates to the VLR that all the associations for the MSs which have an association with that VLR will be moved to the Gs-NULL state.

12 SGSN failure procedure

12.1 General description

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

The SGSN recovery procedure shall be handled in such a way that the signalling load on the VLR and SGSN does not create any overload problem.

12.2 Procedures in the SGSN

12.2.1 SGSN Reset Initiation

In the event of a failure at the SGSN which has resulted in the loss of VLR association information on some MSs, the SGSN shall move from any state to the Gs-NULL state for all the associations with VLRs per MS. The SGSN shall also set the 'SGSN-Reset' MM context variable to 'true' and start the timer T12-1. When the timer T12-1 expires the 'SGSN-Reset' MM context variable is set to 'false'. The value of the timer T12-1 shall be longer that the periodic routing area update timer at the SGSN.

A BSSAP+-RESET-INDICATION message shall be sent to all the VLRs connected to the SGSN by Gs interfaces. The BSSAP+-RESET-INDICATION message indicates to the VLR that all the associations with that particular SGSN for all the MSs registered in the VLR are no longer reliable. The normal procedures for updating the association are still applicable (sections 'Location Update for non-GPRS services procedure', 'Explicit IMSI detach from GPRS services procedure', 'Explicit IMSI detach from non-GPRS services procedure' and 'Implicit IMSI detach from non-GPRS services procedure'). The SGSN shall also start timer T12-2.

12.2.2 SGSN Reset Response

Upon receipt of a BSSAP+-RESET-ACK message, the SGSN shall stop the timer T12-2.

12.2.3 Abnormal cases

If the SGSN does not receive a BSSAP+-RESET-ACK message from that VLR before the T12-2 timer expires, the SGSN shall retransmit the BSSAP+-RESET-INDICATION message. The retransmission is repeated a maximum of N12 times. If no BSSAP+-RESET-ACK is received after a report shall be to made the O&M system.

12.3 Procedures in the VLR

Upon receipt of a BSSAP+-RESET-INDICATION message from the SGSN, the VLR is informed that all the associations with that SGSN for all the MSs registered in the SGSN are no longer reliable because the SGSN may have lost information about the state of the MSs for that VLR and during the failure the SGSN may have missed signalling messages. The VLR shall set the 'Confirmed by Radio Contact' restoration indicator to 'false' in all the associations containing the restarted SGSN. If the 'Confirmed by Radio Contact' restoration indicator is 'false' the VLR may send paging messages on both the Gs and the A interface.

The VLR sends a BSSAP+-RESET-ACK message to the SGSN. This indicates to the SGSN that all the associations for the MSs which have an association with that SGSN will be moved to the Gs-NULL state.

13 MS Information procedure

13.1 General description

The MS information procedure is used by the VLR to request specific parameters about the MS. If the target MS for an MS identification procedure or a Provide Subscriber Info procedure is GPRS attached (i.e. the state of the association to Gs-ASSOCIATED) the VLR may decide to perform the procedure via GPRS. The outcome of the MS Information procedure does not change the state of the association at the VLR or SGSN.

13.2 Procedures in the VLR

If the target MS for the MS information procedure is GPRS attached and the state of the association for the MS Gs-ASSOCIATED, the VLR may initiate the MS information procedure by transferring a BSSAP+-MS-INFORMATION-REQUEST message to the SGSN. If the state of the association is LA-UPDATE PRESENT, the VLR shall wait until this state is exited. The VLR starts the timer T13. The BSSAP+-MS-INFORMATION-REQUEST message specifies the requested information parameters in the Information requested information element.

Upon receipt of a BSSAP+-MS-INFORMATION-RESPONSE the VLR shall stop timer T13. If no BSSAP+-MS-INFORMATION-RESPONSE for that MS is received before the expiry of timer T13 the VLR shall stop the Gs interface MS information procedure. The VLR may perform other actions to obtain the information about the MS (e.g. retry, or send a DTAP IDENTITY REQUEST message on the A interface).

13.3 Procedures in the SGSN

The SGSN shall examine the type of information that is requested and if it is stored in its database shall use this information in its response to the VLR. The BSSAP+-MS-INFORMATION-RESPONSE message contains the information parameters as requested by the VLR.

If the information is not locally available and it is a request for mobile identity information, the SGSN forwards the IDENTITY REQUEST message to the MS indicated in the message unless the GPRS activities of the MS are suspended. Upon receipt of the IDENTITY RESPONSE message from the MS, the SGSN shall send a BSSAP+-MS-INFORMATION-RESPONSE message. The BSSAP+-MS-INFORMATION-RESPONSE message contains the information parameters as requested by the VLR. If the GPRS activities of the MS are suspended the SGSN shall return a BSSAP+-MS-INFORMATION-RESPONSE message indicating in the MS state IE ‘SUSPENDED’ If the requested information is not available or obtainable at the SGSN, the SGSN shall return a BSSAP+-MS-INFORMATION-RESPONSE message to the VLR without the requested information. The SGSN should include the MS status IE in all BSSAP+-MS-INFORMATION-RESPONSE messages.

If the IMSI is not known at the SGSN, the SGSN shall return a BSSAP+-MS-INFORMATION-RESPONSE message indicating in the MS state IE ‘IMSI unknown’.

14 MM information procedure

14.1 General description

The MM information procedure may be performed by the VLR via GPRS if the target MS for the MM information procedure is IMSI attached to both GPRS and non-GPRS services (i.e. the state of the association is Gs-ASSOCIATED). The outcome of the MM Information procedure does not change the state of the association at the VLR or SGSN.

14.2 Procedures in the VLR

If the target MS for the MM information procedure is GPRS attached class A or B MS, the state of the association is Gs-ASSOCIATED, the VLR may initiate the MM information procedure by transferring a BSSAP+-MM-INFORMATION-REQUEST message to the SGSN.

14.3 Procedures in the SGSN

If the state of the association at the SGSN is not Gs-NULL, the SGSN shall forward the MM-INFORMATION message to the MS indicated.

15 Error Handling and Future Compatibility

15.1 General

This clause specifies procedures for the handling of unknown, unforeseen, and erroneous protocol data by the receiving entity. 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 clause the following terminology is used:

- an IE 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 IE specifies in its Length Indicator a greater length than defined in the relevant clause; 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 GSM 09.18.

When a receiving entity detects the need to send a BSSAP+-MOBILE-STATUS message (see errors detailed below), the entity shall copy the IMSI IE value (if included) of the incorrect message to the IMSI IE on the BSSAP+-MOBILE-STATUS message. The message in error is also included in the BSSAP+-MOBILE-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.

Both the receiving and the sending entity shall inform the O&M entity upon sending or receiving a BSSAP+-MOBILE-STATUS message.

The next subclauses in this clause shall be applied in order of precedence.

15.2 Message too short

When a message is received that is too short to contain a complete message type information element, that message shall be ignored.

15.3 Unknown or unforeseen message type

If a message is received with a message type not defined or not implemented by the receiver it shall ignore the message. A BSSAP+-MOBILE-STATUS message with the Cause Value set to “message unknown” and the erroneous message shall be returned.

If a message is received that is not compatible with the protocol state, a BSSAP+-MOBILE-STATUS message with the Cause Value set to “message not compatible with the protocol state” and the erroneous message is returned.

If a message is received that is not defined to be received by that entity (i.e. the message is sent in the wrong direction) it shall be treated as un unknown message and the message shall be ignored. A BSSAP+-MOBILE-STATUS message with the Cause Value set to “message unknown” and the erroneous message shall be returned.

15.4 Missing mandatory information element

When on receipt of a message, and a "missing mandatory IE" error is diagnosed, the receiver shall ignore the message and return a BSSAP+-MOBILE-STATUS message with the Cause Value set to "missing mandatory information element" and the erroneous message.

15.5 IEs unknown or unforeseen in the message

All IEs unknown or unforeseen in a message shall be ignored.

15.6 Out of sequence IEs

All IEs that are out of sequence shall be ignored.

15.7 Repeated IEs

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, only the contents of the information element appearing first shall be handled and all subsequent repetitions of the information element shall be ignored. When repetition of information elements is specified, only the contents of specified repeated information elements shall be handled. If the limit on repetition of information elements is exceeded, the contents of information elements appearing first up to the limit of repetitions shall be handled and all subsequent repetitions of the information element shall be ignored.

15.8 Syntactically incorrect mandatory IE.

On receipt of a message which contains a syntactically incorrect mandatory IE, the receiver shall ignore the message and return a BSSAP+-MOBILE-STATUS message with the Cause Value set to "invalid mandatory information" and the erroneous message.

15.9 Syntactically incorrect optional IEs

All optional IEs that are syntactically incorrect in a message shall be treated as not present in the message.

15.10 Conditional IE errors

When a VLR or SGSN receives a message and diagnoses a "missing conditional IE" error or an "unexpected conditional IE" error or when it receives a message containing at least one syntactically incorrect conditional IE which is required to be present in the message, a VLR or SGSN shall ignore the message and return a BSSAP+-MOBILE-STATUS message with the Cause Value set to "conditional IE error" and the erroneous message.

When a VLR or SGSN receives a message containing a syntactically incorrect conditional IE which is not required to be present in the message, nor required to be absent in the message, then a VLR or SGSN shall ignore that IE.

15.11 IEs with semantically incorrect contents

When an IE with semantically incorrect contents is received, the foreseen reactions of the procedural part of GSM 09.18 are performed.

If however no such reactions are specified, the receiving entity shall ignore that IE and treat the rest of the message. If, because this IE was ignored, the rest of the message can no longer be handled then the receiving entity shall return a

BSSAP+-MOBILE-STATUS message with the Cause Value set to "semantically incorrect message" and the erroneous message.

16 Message Formats and Coding

16.1 Message Contents

16.1.1 BSSAP+-PAGING-REQUEST message

This message is sent from the VLR to the SGSN and contains sufficient information to allow the paging message to be transmitted by the correct cells at the correct time.

Table 16.1: BSSAP+-PAGING_REQUEST message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
VLR address	GSM 03.03	M	TLV	18
TMSI	GSM 09.18	O	TLV	6
Location area identifier	GSM 08.18	O*	TLV	6-n
Channel needed	GSM 08.08	O#	TLV	3
eMLPP priority	GSM 08.08	O**	TLV	3

The coding of the Type field to apply to the VLR address, Location area identifier, Channel needed and eMLPP priority Es is specified in subclause ‘Information Element Identifier’.

* If the cell identifier is not included the SGSN shall page the MS in all the cells served by the VLR and the SGSN, unless the SGSN has reliable information about the location of the MS.

\# If the channel needed element is not present, the default value is assumed to be 00 (any channel).

** This information element may be included when the subscriber has a subscription for eMLPP.

16.1.2 BSSAP+-PAGING-REJECT message

This message is sent from the SGSN to the VLR to indicate that the delivery of a previous BSSAP+-PAGING-REQUEST message has failed.

Table 16.2 : BSSAP+-PAGING-REJECT message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Cause	GSM 09.18	M	TLV	3

16.1.3 BSSAP+-LOCATION-UPDATE-REQUEST message

This message is sent by the SGSN to the VLR either to request update of its location file (normal update) or to request IMSI attach.

Table 16.3 : BSSAP+-LOCATION-UPDATE-REQUEST message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
SGSN address	GSM 03.03	M	TLV	18
GPRS location update type	GSM 09.18	M	TLV	3
New location area identifier	GSM 08.18	M*	TLV	7
Old location area identifier	GSM 08.18	O*	TLV	7
Mobile station classmark	GSM 04.08	O	TLV	3
Cell Id	GSM 08.18	O#	TLV	9

The coding of the Type field to apply to the SGSN address, Old location area identifier, New location area identifier and Mobile station classmark IEs is specified in subclause 'Information Element Identifier'.

* The coding of the Type field in the Old location area identifier and the New location area identifier IEs is the same as the coding of the Location area identifier IE specified in GSM 08.18.

\# The SGSN shall include the Cell Id where the mobile is in the current radio contact

16.1.4 BSSAP+-LOCATION-UPDATE-ACCEPT message

This message is sent by the VLR to the SGSN to indicate that update or IMSI attach in the VLR has been completed.

Table 16.4 : BSSAP+-LOCATION-UPDATE-ACCEPT message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Location area identifier	GSM 08.18	M	TLV	7
Mobile identity	GSM 04.08	O	TLV	6-10

The coding of the Type field to apply to the Mobile identity IE is specified in subclause 'Information Element Identifier'.

16.1.5 BSSAP+-LOCATION-UPDATE-REJECT message

This message is sent by the VLR to the SGSN to indicate that location update or IMSI attach has failed.

Table 16.5 : BSSAP+-LOCATION-UPDATE-REJECT message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Reject cause	GSM 04.08	M	TLV	3-n

The coding of the Type field to apply to the Reject cause IE is specified in subclause 'Information Element Identifier'.

16.1.6 BSSAP+-TMSI-REALLOCATION-COMPLETE message

This message is sent by the SGSN to the VLR to indicate that TMSI reallocation or deletion on the MS has been successfully completed.

Table 16.6 : BSSAP+-TMSI-REALLOCATION-COMPLETE message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Cell Id	GSM 08.18	O*	TLV	9

* The SGSN shall include the Cell Id where the mobile was in the last radio contact

16.1.7 BSSAP+-ALERT-REQUEST message

This message is sent by the VLR to the SGSN to request an indication when next activity from the MS is detected.

Table 16.7 : BSSAP+-ALERT-REQUEST message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10

16.1.8 BSSAP+-ALERT-ACK message

This message is sent by the SGSN to the VLR to acknowledge a previous BSSAP+-ALERT-REQUEST message.

Table 16.8 : BSSAP+-ALERT-ACK message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10

16.1.9 BSSAP+-ALERT-REJECT message

This message is sent from the SGSN to the VLR to indicate that the SGSN could not identify the IMSI indicated in the BSSAP+-ALERT-Request message.

Table 16.9 : BSSAP+-ALERT-REJECT message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Cause	GSM 09.18	M	TLV	3

16.1.10 BSSAP+-MS-ACTIVITY-INDICATION message

This message is sent by the SGSN to the VLR to indicate that activity from an MS has been detected.

Table 16.10 : BSSAP+-MS-ACTIVITY-INDICATION message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Cell Id	GSM 08.18	O*	TLV	9

* The SGSN shall include the Cell Id where the mobile was in the last radio contact

16.1.11 BSSAP+-GPRS-DETACH-INDICATION message

This message is sent by the SGSN to the VLR to indicate a GPRS detach performed from the MS or the SGSN. The type of detach is indicated in the GPRS detach type IE.

Table 16.11 : BSSAP+-GPRS-DETACH-INDICATION message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
SGSN address	GSM 03.03	M	TLV	18
IMSI detach from GPRS service type	GSM 09.18	M	TLV	3
Cell Id	GSM 08.18	O*	TLV	9

The coding of the Type field to apply to the SGSN address IE is specified in subclause ‘Information Element Identifier’.

* The SGSN shall include the Cell Id where the mobile was in the last radio contact

16.1.12 BSSAP+-GPRS-DETACH-ACK message

This message is sent by the VLR to the SGSN to acknowledge a previous BSSAP+-GPRS-DETACH-Indication message. The type of detach acknowledged is indicated in the GPRS detach type IE.

Table 16.12 : BSSAP+-GPRS-DETACH-ACK message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10

16.1.13 BSSAP+-IMSI-DETACH-INDICATION message

This message is sent by the SGSN to the VLR to indicate an IMSI detach performed from the MS. The type of detach is indicated in the IMSI detach type IE.

Table 16.13 : BSSAP+-IMSI-DETACH-INDICATION message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
SGSN address	GSM 03.03	M	TLV	18
IMSI detach from non-GPRS service type	GSM 09.18	M	TLV	3
Cell Id	GSM 08.18	O*	TLV	9
Location information age	GSM 09.18	O#	TLV	4

The coding of the Type field to apply to the SGSN address IE is specified in subclause 'Information Element Identifier'.

* The SGSN shall include the Cell Id where the mobile was in the last radio contact

If the detach is due to implicit detach and the Cell Id information is available, the SGSN should include the time in minutes since the MS last established a radio transaction.

16.1.14 BSSAP+-IMSI-DETACH-ACK message

This message is sent by the VLR to the SGSN to acknowledge a previous BSSAP+-IMSI-DETACH-Indication message. The type of detach acknowledged is indicated in the IMSI detach type IE.

Table 16.14 : BSSAP+-IMSI-DETACH-ACK message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10

16.1.15 BSSAP+-RESET-INDICATION message

This message is sent from the VLR to the SGSN to indicate that the a failure in the VLR has occurred and all the associations to the VLR shall be marked as invalid.

This message is also sent from the SGSN to the VLR to indicate that the a failure in the SGSN has occurred and all the associations to the SGSN shall be marked as invalid.

The sending entity (either SGSN or VLR) shall include its identity in the BSSAP+-RESET-INDICATION message.

Table 16.15 : BSSAP+-RESET-INDICATION message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
SGSN address	GSM 03.03	O	TLV	18
VLR address	GSM 03.03	O	TLV	18

The coding of the Type field to apply to the SGSN address and VLR address IE is specified in subclause 'Information Element Identifier'.

16.1.16 BSSAP+-RESET-ACK message

This message is sent from the SGSN or the VLR to acknowledge a previous BSSAP+-RESET-INDICATION message. This message indicates that all the associations to the VLR or the SGSN have been be marked as invalid.

The sending entity (either SGSN or VLR) shall include its identity in the BSSAP+-RESET-ACK message.

Table 16.16 : BSSAP+-RESET-ACK message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
SGSN address	GSM 03.03	O	TLV	18
VLR address	GSM 03.03	O	TLV	18

The coding of the Type field to apply to the SGSN address and VLR address IE is specified in subclause 'Information Element Identifier'. Only the address of the sending entity shall be included.

16.1.17 BSSAP+-MS-INFORMATION-REQUEST message

This message is sent from the VLR to the SGSN to indicate to request an identifier associated to the IMSI indicated. The identifier requested is specified in the Identity requested IE.

Table 16.17 : BSSAP+-MS-INFORMATION-REQUEST message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Information requested	GSM 09.18	M	TLV	3

16.1.18 BSSAP+-MS-INFORMATION-RESPONSE message

This message is sent from the SGSN to the VLR as a response to a previous BSSAP+-IDENTITY-REQUEST message. At least one of the requested identities shall be sent.

Table 16.18 : BSSAP+-MS-INFORMATION-RESPONSE message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
TMSI	GSM 09.18	O	TLV	6
PTMSI	GSM 09.18	O	TLV	6
IMEI	GSM 09.18	O	TLV	10
IMEISV	GSM 09.18	O	TLV	10
Cell Id	GSM 08.18	O	TLV	9
Location information age	GSM 09.18	O#	TLV	4
MS state	GSM 09.18	O	TLV	3

Time in minutes since the MS last established a radio transaction. This IE should be present if the Cell Id IE is present, otherwise it should be absent.

16.1.19 BSSAP+-MM-INFORMATION-REQUEST

This message is sent by the VLR to the SGSN to provide the MS with subscriber specific information.

Table 16.19 BSSAP+-MM-INFORMATION-REQUEST message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1

IMSI	GSM 09.18	M	TLV	6-10
MM information	GSM 09.18	O	TLV	3-n

16.1.20 BSSAP+-MOBILE-STATUS message

This message is sent by both the SGSN or the VLR to indicate an error.

Table 16.20 : BSSAP+-MOBILE-STATUS message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	O	TLV	6-10
Cause	GSM 09.18	M	TLV	3
Erroneous message	GSM 09.18	M	TLV	3-n

16.1.21 BSSAP+-MS-UNREACHABLE message

This message is sent from the SGSN to the VLR to indicate that, for example, paging could not be performed because the MS is marked as unreachable at the SGSN.

Table 16.21 : BSSAP+-MS-UNREACHABLE message content

Information element	Type / Reference	Presence	Format	Length
Message type	GSM 09.18	M	V	1
IMSI	GSM 09.18	M	TLV	6-10
Cause	GSM 09.18	M	TLV	3

16.2 Information element coding

This clause specifies the coding of the Information Elements used in by the BSSAP+ protocol. The spare bits in the coding of an IE shall be set to zero by the sender and shall be ignored by the receiver. All unassigned codes shall be treated as unknown (see clause ‘Error Handling and Future Compatibility’).

16.2.1 Message type

Message type uniquely identifies the message being sent. It is a single octet element, mandatory in all messages.

Table 16.22: Message type information element

5 4 3 2 1	
0 0 0 0 1	BSSAP+-PAGING-REQUEST
0 0 0 1 0	BSSAP+-PAGING-REJECT
0 1 0 0 1	BSSAP+-LOCATION-UPDATE-REQUEST
0 1 0 1 0	BSSAP+-LOCATION-UPDATE-ACCEPT
0 1 0 1 1	BSSAP+-LOCATION-UPDATE-REJECT
0 1 1 0 0	BSSAP+-TMSI-REALLOCATION-COMPLETE
0 1 1 0 1	BSSAP+-ALERT-REQUEST
0 1 1 1 0	BSSAP+-ALERT-ACK
0 1 1 1 1	BSSAP+-ALERT-REJECT
1 0 0 0 0	BSSAP+-MS-ACTIVITY-INDICATION
1 0 0 0 1	BSSAP+-GPRS-DETACH-INDICATION
1 0 0 1 0	BSSAP+-GPRS-DETACH-ACK
1 0 0 1 1	BSSAP+-IMSI-DETACH-INDICATION
1 0 1 0 0	BSSAP+-IMSI-DETACH-ACK
1 0 1 0 1	BSSAP+-RESET-INDICATION
1 0 1 1 0	BSSAP+-RESET-ACK
1 0 1 1 1	BSSAP+-MS-INFORMATION-REQUEST
1 1 0 0 0	BSSAP+-MS-INFORMATION-RESPONSE
1 1 0 1 0	BSSAP+-MM-INFORMATION-REQUEST
1 1 1 0 1	BSSAP+-MOBILE-STATUS

16.2.2 Information Element Identifiers

The next list shows the coding of the Information Element Identifiers used in this specification.

Table 18.23: Information Element Identifier coding

5 4 3 2 1	
0 0 0 0 1	IMSI
0 0 0 1 0	VLR address
0 0 0 1 1	TMSI
0 0 1 0 0	Location area identifier
0 0 1 0 1	Channel Needed
0 0 1 1 0	Priority
0 0 1 1 1	Subscription information
0 1 0 0 0	Cause
0 1 0 0 1	SGSN address
0 1 0 1 0	GPRS location update type
0 1 0 1 1	Old location area identifier
0 1 1 0 0	New location area identifier
0 1 1 0 1	Mobile station classmark
0 1 1 1 0	Mobile identity
0 1 1 1 1	Reject cause
1 0 0 0 0	IMSI detach from GPRS service type
1 0 0 0 1	IMSI detach from GPRS non-service type
1 0 0 1 0	Identity requested
1 0 0 1 1	PTMSI
1 0 1 0 0	IMEI
1 0 1 0 1	IMEISV
1 0 1 1 1	MM information
1 1 0 0 0	Cell Id
1 1 0 0 1	Location information age
1 1 0 1 0	MS state
1 1 0 0 0	Erroneous message

16.2.3 IMSI

TheIMSI is coded as a sequence of BCD digits, compressed two into each octet. This is a variable length element, and includes a length indicator. The IMSI shall not exceed 15 digits (see GSM 03.03).

Table 16.24: IMSI information element

	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
octet 1	IEI							
octet 2	length indicator							
octet 3	MCC digit 1				* parity	0	0	1
octet 4	MCC digit 3				MCC digit 2			
octet 5	MNC digit 2				MNC digit 1			
octet 5+x	MSIN digit i+1				MSIN digit i			

Where x = (i+1)/2 and i is always odd

* The value of the parity bit (bit 4 in octect 3) indicates:

0 Even number of MSIN digits

1 Odd number of MSIN digits

If the number of MSIN digits is odd then bits 5 to 8 of the last octet shall be filled with an end mark coded as 1111.

16.2.4 IMEI

TheIMEI is coded as a sequence of BCD digits, compressed two into each octet. The IMEI consists of 15 digits (see GSM 03.03).

Table 16.25: IMEI information element

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	TAC digit 2				TAC digit 1			
octet 4	TAC digit 4				TAC digit 3			
octet 5	TAC digit 6				TAC digit 5			
octet 6	FAC digit 2				FAC digit 1			
octet 7	SNR digit 2				SNR digit 1			
octet 8	SNR digit 4				SNR digit 3			
octet 9	SNR digit 6				SNR digit 5			
octet 10	1	1	1	1	0	0	0	0

16.2.5 IMEISV

TheIMEISV is coded as a sequence of BCD digits, compressed two into each octet. The IMEISV consists of 16 digits (see GSM 03.03).

Table 16.26: IMEISV information element

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	TAC digit 2				TAC digit 1			
octet 4	TAC digit 4				TAC digit 3			
octet 5	TAC digit 6				TAC digit 5			
octet 6	FAC digit 2				FAC digit 1			
octet 7	SNR digit 2				SNR digit 1			
octet 8	SNR digit 4				SNR digit 3			
octet 9	SNR digit 6				SNR digit 5			
octet 10	SVN digit 2				SVN digit 1			

16.2.6 TMSI

The TMSI consists of 4 octets. It can be coded using a full hexadecimal representation (see GSM 03.03).

Table 16.27: TMSI information element

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	TMSI octet 1							
octet 4	TMSI octet 2							
octet 5	TMSI octet 3							
octet 6	TMSI octet 4							

16.2.7 PTMSI

The PTMSI consists of 4 octets. It can be coded using a full hexadecimal representation (see GSM 03.03).

Table 16.28: PTMSI information element

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	PTMSI octet 1							
octet 4	PTMSI octet 2							
octet 5	PTMSI octet 3							
octet 6	PTMSI octet 4							

16.2.8 Information requested

The Information requested IE is a TLV IE that indicates to the SGSN the type of information requested by the VLR. The coding of the V field is as follows. Bits 8 to 5 are spare bits and shall be set to 0.

Table 16.29: Information requested type information element

4 3 2 1	
0 0 0 1	PTMSI
0 0 1 0	IMEI
0 0 1 1	IMEISV
0 1 0 0	PTMSI and IMEI
0 1 0 1	PTMSI and IMEISV
0 1 1 0	IMEI and IMEISV
0 1 1 1	PTMSI, IMEI and IMEISV
1 0 0 0	Mobile location information
1 0 0 1 to 1 1 1 1	Reserved

16.2.9 GPRS location update type

The purpose of the GPRS location update type information element is to indicate to the VLR whether an IMSI attach or a normal location update combined IMSI and GPRS detach has been performed by the MS.

Table 16.30: GPRS location update type information element

2 1	
0 1	IMSI attach
1 0	Normal location update
1 1	Reserved

16.2.10 IMSI detach from GPRS service type

The purpose of the IMSI detach from GPRS service type information element is to indicate to the VLR the type of IMSI detach from GPRS service performed by the MS or the SGSN.

Table 16.31: IMSI detach from GPRS service type information element

2 1	
0 1	Network initiated IMSI detach from GPRS service
1 0	MS initiated IMSI detach from GPRS service

16.2.11 IMSI detach from non-GPRS service type

The purpose of the IMSI detach from non-GPRS service type information element is to indicate to the VLR if the type of IMSI detach from non-GPRS service was explicitly performed by the MS, implicitly performed by the SGSN or due to a location update rejection.

Table 16.32: IMSI detach from non-GPRS service type information element

3 2 1	
0 0 1	Explicit MS initiated IMSI detach from non-GPRS service
0 1 0	Combined explicit MS initiated IMSI detach from GPRS and non-GPRS services
0 1 1	Implicit SGSN initiated IMSI detach from non-GPRS service
1 0 0	Location Update failure

16.2.12 MM information

The User information IE is a TLV IE that encapsulates the user information that the SGSN forwards to the MS.

Table 16.33: MM information information element

	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
octet 1	IEI							
octet 2	length indicator							
octet 3-n	User information							

The different values that the User information field can take are specified in GSM 04.08.

16.2.13 Erroneous message

The Erroneous message IE is a TLV IE that encapsulates the message in error.

Table 16.34: Erroneous message information element

	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
octet 1	IEI							
octet 2	length indicator							
octet 3-n	Erroneous message							

16.2.14 Cause value

The purpose of the Cause value information element is to indicate to the an error to the receiving entity. This could be a protocol data error or to indicate to the VLR the reason why a paging procedure could not be performed.

Table 16.35: Cause information element

4 3 2 1	
0 0 0 1	IMSI detached for GPRS services
0 0 1 0	IMSI detached for GPRS and non-GPRS services
0 0 1 1	IMSI unknown
0 1 0 0	IMSI detached for non-GPRS services
0 1 0 1	IMSI implicitly detached for non-GPRS services
0 1 1 0	MS unreachable
0 1 1 1	message not compatible with the protocol state
1 0 0 0	missing mandatory information element
1 0 0 1	invalid mandatory information
1 0 1 0	conditional IE error
1 0 1 1	semantically incorrect message
1 1 0 0	message unknown
1 1 0 1	address error

16.2.15 Location information age

The Location information age IE is a TLV IE that indicates the elapsed time in minutes since the last network contact of the mobile station.

Table 17.36: Location information age information element

	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
octet 1	IEI							
octet 2	length indicator							
octet 3-4	Location information age *							

* The coding of the V field of the Location information age is the same as the coding of the AgeOfLocationInformation as specified in GSM 09.02.

16.2.16 MS state

The MS state IE is a TLV IE that indicates to the VLR the GMM and GSM states of the MS in the SGSN. The coding of the V field is as follows. Bits 8 to 5 are spare bits and shall be set to 0.

Table 16.37: MS state information element

4 3 2 1	
0 0 0 0	IDLE
0 0 0 1	STANDBY, 0 PDP contexts active
0 0 1 0	STANDBY, 1 or more PDP contexts active
0 0 1 1	SUSPENDED, 0 PDP contexts active
0 1 0 0	SUSPENDED, 1 or more PDP contexts active
0 1 0 1	READY, 0 PDP contexts active
0 1 1 0	READY, 1 or more PDP contexts active
0 1 1 1	IMSI unknown
1 0 0 0 }	

to } 1 1 1 1 }	Shall not be sent. If received, shall be treated as "IDLE"

17 List of system variables

17.1 Timers

This subclause lists the management timers specified for the operation of the BSSAP+ protocol. All the implementation shall support the range of values specified below. The specific value of the timers shall be under the control of the operator.

Table 17.1: 09.18 management timers

timer pne-monic	timer range	notes	relation to other timers
T5	x-y s	Guards the Paging procedure at the VLR	none
T6-1	x-y s	Guards the Location Update procedure	It should be higher than 2 times the maximum transmission time in the Gs interface, plus the supervision timer of the Update Location procedure [GSM 09.02]
T6-2	x-y s	Guards the TMSI reallocation procedure	It should be higher than 2 times the maximum transmission time in the Gs interface, plus 4 times T3350 [GSM 04.08]
T7	x-y s	Guards the Non-GPRS alert procedure	none
T8	x-y s	Guards the Explicit IMSI detach from GPRS services procedure	none
T9	x-y s	Guards the Explicit IMSI detach from non-GPRS services procedure	none
T10	x-y s	Guards the Implicit IMSI detach from non-GPRS services procedure	none
T11	x-y s	Guards the VLR reset procedure	none
T12-1	x-y s	Guards the SGSN reset procedure	none
T12-2	x-y s	Controls the reseting of the 'SGSN-Reset' variable	longer than the longest PRAU timer running on the SGSN
T13	x-y s	Guards the MS Information procedure	none

17.2 Retry counters

This subclause lists the management retry counters specified for the operation of the BSSAP+ protocol. The values indicated are recommended values.

Table 17.2: 09.18 management retry counters

retry nuemonic	retry value	notes
N7	2	recommend value
N8	2	recommend value
N9	2	recommend value
N10	2	recommend value
N11	2	recommend value
N12	2	recommend value

Annex A (Informative): Document history

Document history		
6.0.0	17/3/1998	Approved at SMG#25
6.1.0	1/7/1998	Incorporation of CRs approved at SMG#26: A004r1, A002, A003, A001r1

History

Document history		
V6.1.0	July 1998	Publication

ISBN 2-7437-2451-X
Dépôt légal : Juillet 1998