Technical Specification Group Services and System Aspects ***TSGS#16(02)0311***

Meeting #16, Marco Island, USA, 10-13 June 2002

Source: **TSG SA WG2**
Title: **CRs on 23.060**
Agenda Item: **7.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #16.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

R99 CR with mirror CR to Rel-4:

S2 Tdoc #	Spec	CR #	rev	Rel	Title
S2-021307	23.060	365		R99	IPv6 transport not recommended for Iu and Gn/Gp in R99
S2-021308	23.060	366		Rel-4	IPv6 transport not recommended for Iu and Gn/Gp in R4

R99 CRs with mirror CRs to Rel-4 and Rel-5:

S2 Tdoc #	Spec	CR #	rev	Rel	Title
S2-021463	23.060	342	3	R99	Clarification of Any Time Interrogation functionality
S2-021464	23.060	343	3	Rel-4	Clarification of Any Time Interrogation functionality
S2-021465	23.060	344	3	Rel-5	Clarification of Any Time Interrogation functionality
S2-021318rev2	23.060	359	3	R99	Corrections for Authentication procedures
S2-021319rev1	23.060	360	2	Rel-4	Corrections for Authentication procedures
S2-021492rev1	23.060	369	1	Rel-5	Corrections for Authentication procedures

Rel-5 only CRs:

S2 Tdoc #	Spec	CR #	rev	Rel	Title
S2-021119	23.060	345		Rel-5	Clarification for PCO use in Secondary PDP context
S2-021459	23.060	351	1	Rel-5	Clarification on the PDP Address and PDP Context
S2-021458	23.060	348	1	Rel-5	Correction on the Restriction of Data Transfer during Mobility Management Procedures
S2-021315rev2	23.060	367	1	Rel-5	Introduction of IP transport option for Iu
S2-021456	23.060	358	3	Rel-5	MS and Network operation Modes
S2-021338rev1	23.060	357	2	Rel-5	RAB assignment during a RA update in PMM-Connected state
S2-021457	23.060	364	1	Rel-5	Update of attach procedure
S2-021506rev1	23.060	368	1	Rel-5	Update of External Network assisted Cell Change and introduction of RAN Information Management

3GPP TSG-SA2 Meeting #24
Madrid, Spain, 22-26 April 2002

Tdoc S2-021119

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **345** ⌘ **rev** **-** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Clarification for PCO use in Secondary PDP context
Source:	⌘	Nokia
Work item code:	⌘	IMS-CCR
Date:	⌘	9.4.2002
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	SA#15 approved CR 308r1 (S2-020901) added Protocol Configuration Options (PCO) field to ACTIVATE SECONDARY PDP CONTEXT REQUEST and ACCEPT messages. The approved CR had a minor inaccuracy as it does not explicitly include the PCO field in the CREATE PDP CONTEXT REQUEST and RESPONSE messages.
Summary of change:	⌘	This CR adds the Protocol Configuration Options field to CREATE PDP CONTEXT REQUEST and RESPONSE messages in Secondary PDP Context Activation Procedure.
Consequences if not approved:	⌘	Inaccurate procedure description.

Clauses affected:	⌘	9.2.2.1.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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9.2.2.1.1 Secondary PDP Context Activation Procedure

The Secondary PDP Context Activation procedure may be used to activate a PDP context while reusing the PDP address and other PDP context information from an already active PDP context, but with a different QoS profile. Procedures for APN selection and PDP address negotiation are not executed. A unique TI and a unique NSAPI shall identify each PDP context sharing the same PDP address and APN.

The Secondary PDP Context Activation procedure may be executed without providing a Traffic Flow Template (TFT) to the newly activated PDP context if all other active PDP contexts for this PDP address and APN already have an associated TFT. Otherwise a TFT shall be provided. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected packet data network to the newly activated PDP context.

The Secondary PDP Context Activation procedure may only be initiated after a PDP context is already activated for the same PDP address and APN. The procedure is illustrated in Figure 65 and Figure 66.

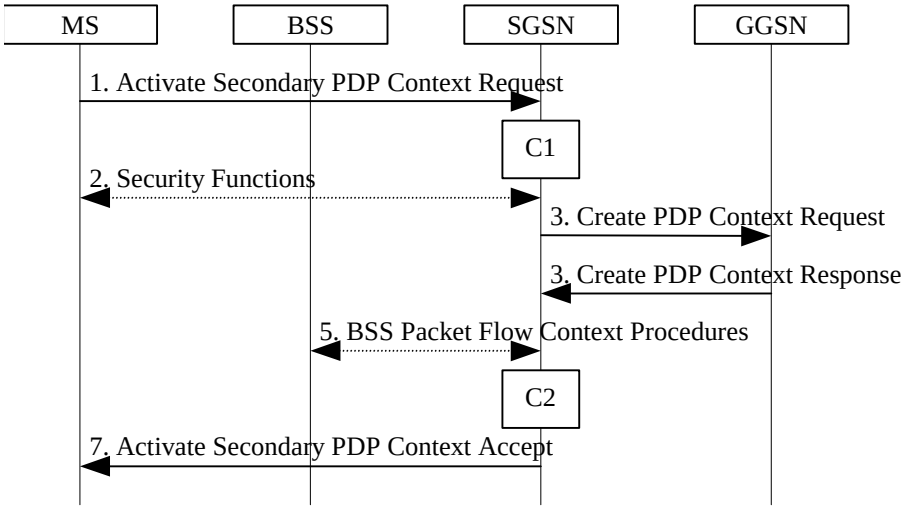

Figure 65: Secondary PDP Context Activation Procedure for A/Gb mode

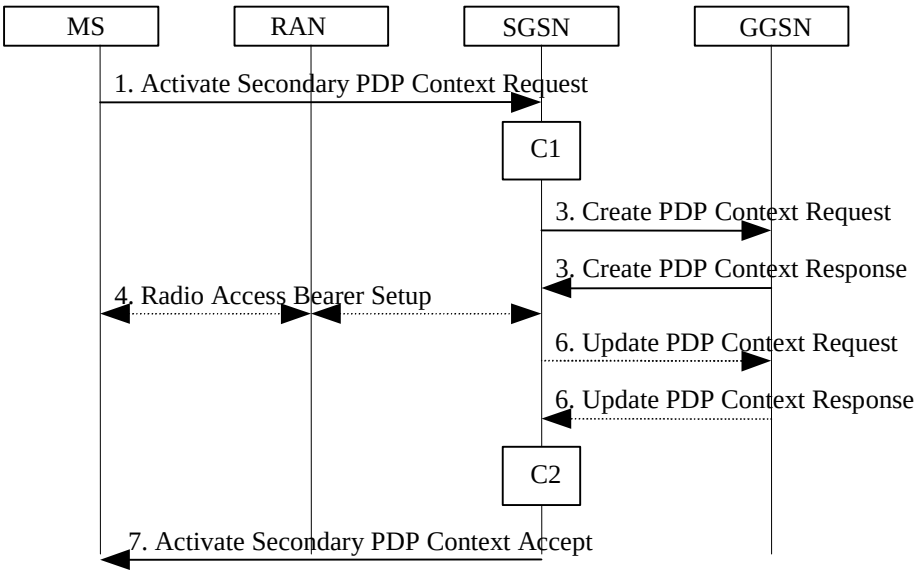

Figure 66: Secondary PDP Context Activation Procedure for Iu mode

1) The MS sends an Activate Secondary PDP Context Request (Linked TI, NSAPI, TI, QoS Requested, TFT, PDP Configuration Options) message to the SGSN. Linked TI indicates the TI value assigned to any one of the already activated PDP contexts for this PDP address and APN. QoS Requested indicates the desired QoS profile. TFT is sent transparently through the SGSN to the GGSN to enable packet classification for downlink data transfer. TI and NSAPI contain values not used by any other activated PDP context. PDP Configuration Options may be used to transfer optional PDP parameters and/or requests to the GGSN (see GSM 29.060 [26] and 24.229 [75]). PDP Configuration Options is sent transparently through the SGSN.

2) In A/Gb mode, security functions may be executed. These procedures are defined in clause "Security Function".

3) The SGSN validates the Activate Secondary PDP Context Request using the TI indicated by Linked TI. The same GGSN address is used by the SGSN as for the already-activated PDP context(s) for that TI and PDP address.

   The SGSN may restrict the requested QoS attributes given its capabilities and the current load, and it shall restrict the requested QoS attributes according to the subscribed QoS profile, which represents the maximum QoS per PDP context to the associated APN. The GGSN may restrict and negotiate the requested QoS as specified in clause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TEID, NSAPI, Primary NSAPI, TFT, PDP Configuration Options) message to the affected GGSN. Primary NSAPI indicates the NSAPI value assigned to any one of the already activated PDP contexts for this PDP address and APN. TFT is included only if received in the Activate Secondary PDP Context Request message. PDP Configuration Options is sent transparently through the SGSN if received in the Activate secondary PDP Context Request message.

   The GGSN uses the same packet data network as used by the already-activated PDP context(s) for that PDP address, generates a new entry in its PDP context table, and stores the TFT. The new entry allows the GGSN to route PDP PDUs via different GTP tunnels between the SGSN and the packet data network. The GGSN returns a Create PDP Context Response (TEID, QoS Negotiated, Cause, PDP Configuration Options) message to the SGSN. PDP Configuration Options may be used to transfer optional PDP parameters to the UE (see GSM 29.060 [26] and 24.229 [75]).

4) In Iu mode, RAB setup is done by the RAB Assignment procedure.

5) In A/Gb mode, BSS packet flow context procedures may be executed. These procedures are defined in clause "BSS Context".

6) In Iu mode and in case the QoS attributes have been downgraded in step 4, the SGSN may inform the GGSN about the downgraded QoS attributes by sending an Update PDP Context Request to the affected GGSN. The GGSN confirms the new QoS attributes by sending an Update PDP Context Response to the SGSN.

7) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. ~~PDP Configuration Options may be used to transfer optional PDP parameters to the UE (see GSM 29.060 [26] and 24.229 [75]).~~ PDP Configuration Options is sent transparently through the SGSN if received in the Create PDP Context Response message.The SGSN is now able to route PDP PDUs between the GGSN and the MS via different GTP tunnels and possibly different LLC links.

For each additionally activated PDP context a QoS profile and TFT may be requested.

If the secondary PDP context activation procedure fails or if the SGSN returns an Activate Secondary PDP Context Reject (Cause) message, the MS may attempt another activation with a different TFT, depending on the cause.

The CAMEL procedure calls shall be performed, see referenced procedures in 3GPP TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Establishment.

In Figure 65 and in Figure 66, procedures return as result "Continue".

C2) CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement.

In Figure 65 and in Figure 66, procedures return as result "Continue".

3GPP TSG-SA WG2 meeting #24 **Tdoc S2-021506rev1**

Madrid, Spain, 22nd – 26th April 2002

CR-Form-v3

CHANGE REQUEST

23.060	CR	368	rev	1	Current version:	5.1.0

Proposed change affects: (U)SIM ☐ ME/UE ☒ Radio Access Network ☒ Core Network ☐

Title:	Update of External Network assisted Cell Change and introduction of RAN Information Management		
Source:	Ericsson		
Work item code:	GERAN Improvements 2	***Date:***	2002-04-26
Category:	**F**	***Release:***	REL-5

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	1. To transfer the External NACC information the generic RAN Information Management (RIM) procedures have been specified as a general transport mechanism between BSCs. As that is not displayed in the stage 2 description, it is proposed to have mainly the RIM procedures described in 23.060 and then have the applications (such as NACC) using that feature subordinated the RIM procedure description. 2. There has been no possibility for a target BSC/RNC to stop event driven RIM messages from a source BSC/RNC. Note that these two points have already been introduced in 48.018 for R5.
Summary of change:	1. The chapter 8.1.5 has been focused on the RIM procedures; 2. A possibility to stop event driven transmission of RAN INFORMATION messages has been introduced. 3. Minor editorial corrections included.
Consequences if not approved:	1. The generic RIM procedures is not displayed in the stage 2 description; 2. Un-necessary load on the Gb and the Gn interfaces if the target BSC/RNC can not stop the messages from a source BSC/RNC. 3. Misalignment between stage 2 and stage 3 specifications.

Clauses affected:	8.1.5, 8.1.5.1, 8.1.5.2.1, 8.1.5.2.2, 8.1.5.3, 8.1.5.4, new clause 8.1.5.5	
Other specs affected:	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	

Other comments:	

8.1.5 ~~External Network Assisted Cell Change (NACC)~~RAN Information Management (RIM) procedures

8.1.5.1 General

The RAN Information Management (RIM) procedures are used as generic procedures for the exchange of arbitrary information between applications belonging to the RAN nodes. An application using the RIM procedures is the External Network Assisted Cell Change (NACC). The RAN information is transferred via the SGSN core network node(s). In order to make the information transparent for the Core Network, the message(s) conveying the RAN information include a container that shall not be interpreted by the Core Network nodes. For future extensibility of this generic mechanism to features other than external NACC, the container includes independent Container Units ~~which~~that can be customised for different applications.

The RIM procedures are optional both in the BSC and in the SGSN and ~~is~~are negotiated at start/restart of the Gb link.

~~The SGSN and BSC may provide the external NACC function. This function reduces the service outage time at cell re-selection. The support is given as system information for the target cell before the cell re-selection is performed. For the inter BSC case, changes in system information for a cell with external neighbouring cells will result in transfer of the information from the source BSC to the destination BSC responsible for the external neighbouring cells.~~

The information is transferred in containers from the source BSC to the destination BSC by use of the generic RAN Information Send procedure. The RAN Information Send procedure may include a request for acknowledgement to secure the end-to-end transport via multiple intermediate nodes. A BSC may also request information, or request to stop the transmission of information from another BSC by use of the RAN Information Request procedure which might be applicable e.g. at BSC restart procedure.

The interfaces which will be used are the Gb (BSSGP) and the Gn (GTP) interfaces. The information in the container shall be transparent for the Core Network. An SGSN supporting the RIM procedures~~external NACC~~ provides addressing, routeing and relay functions.

8.1.5.2 Addressing, routeing and relaying

8.1.5.2.1 Addressing

All the messages used for the exchange of RIM~~NACC related~~ information contain in their header the addresses of the source and destination BSSs. Source and destination address have the same format. Each address contains:

- Mobile Country Code (MCC)
- Mobile Network Code (MNC)
- Location Area Code (LAC)
- Routeing Area Code (RAC)
- Cell Identity (CI)

8.1.5.2.2 Routeing

The following description applies to all the messages used for the exchange of RIM~~NACC related~~ information.

The source BSS sends a message on the Gb interface to its SGSN including the source and destination addresses. From the Routeing Area Identity (MCC+MNC+LAC+RAC) of the destination BSS address, the SGSN shall decide whether or not it is connected to the destination BSS.

If the SGSN is not connected to the destination BSS, then it shall use the RAI to route the message to the correct SGSN via the Gn interface.

The SGSN connected to the destination BSS decides which BSS to send it to based on the CI of the destination address.

8.1.5.2.3 Relaying

The SGSN performs relaying between BSSGP messages and GTP messages.

8.1.5.3 RAN Information Request procedure

The RAN Information Request procedure is used to request information or to stop transmission of event driven information from another BSC.
The RAN Information Request procedure is illustrated in Figure 56a.

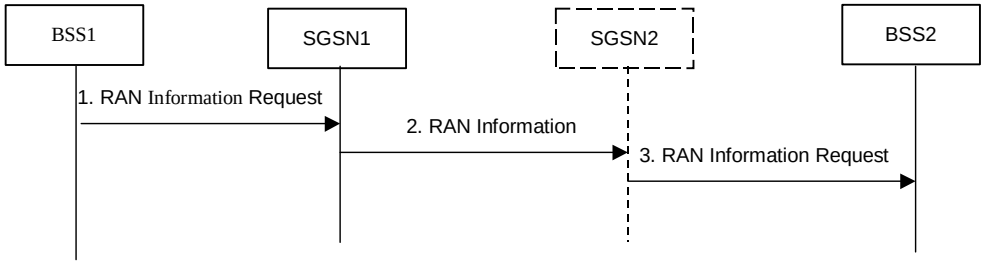

Figure 56a – RAN Information Request procedure.

1) The RAN Information Request procedure is initiated by the BSS1 by sending the RAN INFORMATION REQUEST message with the application information and with the message header including the addresses of the source and destination BSSs. The destination BSS is the BSS2 from which the information is required.

2) The SGSN1 determines from the Routeing Area Identity (MCC+MNC+LAC+RAC) in the address of BSS2 whether or not it is connected to BSS2. If the SGSN1 is not directly connected to BSS2, then it shall use the RAI to route the message to SGSN2 via the Gn interface.

3) The SGSN2 sends the message to BSS2 via the Gb interface based on the CI of the destination address.

The RAN Information Request procedure initiates the RAN Information send procedure as described in clause 8.1.5.4.

8.1.5.4 RAN Information Send procedure

This procedure may be event triggered (e.g. change of System Information for external NACC) or scheduled (e.g. by a RAN Information Request procedure). The RAN Information Send procedure is illustrated in Figure 56b.

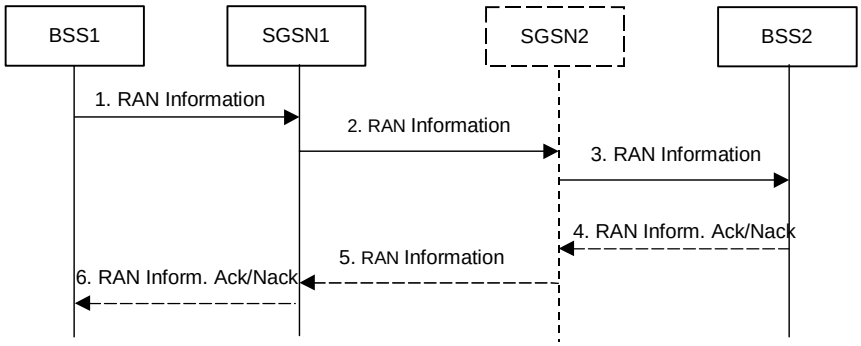

Figure 56b – RAN Information Send procedure.

1) The RAN Information Send procedure is initiated by the BSS1 when it has information to be sent, or if the information has been previously requested by a RAN Information Request procedure (see sub-clause 8.1.5.3). The procedure is initiated by sending a RAN INFORMATION message with application information and with

the message header including the addresses of the source and destination BSSs. The destination BSS is the BSS2 to which the information is sent.

2) The SGSN1 determines from the Routeing Area Identity (MCC+MNC+LAC+RAC), whether or not it is connected to BSS2. If the SGSN1 is not directly connected to BSS2, then it shall use the RAI to route the message to SGSN2 via the Gn interface.

3) The SGSN2 sends the message to BSS2 via the Gb interface based on the CI of the destination address. The RAN INFORMATION message received at the BSS2 contains an indication of whether or not acknowledgement is needed. If such indication is not present, the procedure concludes.

4) If the RAN INFORMATION message requests for acknowledgement, the BSS2 shall send a RAN INFORMATION ACK/NACK message to its SGSN via the Gb interface.

5) The SGSN2 determines from the Routeing Area Identity (MCC+MNC+LAC+RAC) of the destination BSS address, whether or not it is connected to BSS1. If the SGSN2 is not directly connected to BSS1, then it shall use the RAI to route the message to SGSN1 via the Gn interface

6) The SGSN1 sends the message to BSS1 via the Gb interface based on the CI of the destination address. The RAN Information Send procedure is completed when the BSS1 receives the RAN INFORMATION ACK/NACK message.

8.1.5.5 Applications using the RIM Procedures

The first application using the RIM procedures is the Network Assisted Cell Change (NACC) application. The Network Assisted Cell Change (NACC) function reduces the service outage time at cell re-selection. The support is given to the mobile stations as system information for the target cell before the mobile station performs the cell re-selection. If cell re-selection is performed between cells controlled by different PCUs (external cells) the system information is made available to the mobile station via the External NACC function. The SGSN and the BSC may provide the external NACC function. If provided, changes in system information for a cell with external neighbouring cells will be the event which triggers the transfer of the information from the source BSC to the target BSC(s) responsible for the external neighbouring cells.

The system information is transferred in containers from the source BSC to the destination BSC by use of the generic RAN Information Send procedure. The RAN Information Send procedure may include a request for acknowledgement to secure the end-to-end transport via multiple intermediate nodes.

A BSC may also request information, or request to stop the transmission of information from another BSC by use of the RAN Information Request procedure.

3GPP TSG SA WG2 #24
Madrid, Spain, 22nd – 26th April 2002

S2-021492r1

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CHANGE REQUEST

⌘ **23.060** **CR** **369** ⌘ **rev** **1** ⌘ Current version: **5.1.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network **X**

Title:	⌘	Corrections for Authentication procedures
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	06.05.2002
Category:	⌘	**A**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	The GSM authentication procedure and the SGSN as well as MS context tables exclude the GSM authetication by means of authentication quintets. MS and SGSN not necessarily need to store GSM security parameters if these were used only to derive Iu mode parameters. The same applies for UMTS security parameters if these were used to derive A/Gb mode parameters.
Summary of change:	⌘	Corrections for the authentication procedures.
Consequences if not approved:	⌘	Inconsistencies and errors within 23.060 and discrepancies to security specification 33.102.

Clauses affected:	⌘	6.8.1, 6.8.1.1, 13.2, 13.4
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.8.1 Authentication

The Authentication function includes two types of authentication: "UMTS authentication" and "GSM authentication". These procedures are independent of the RAN modes, i.e. each procedure may be executed in A/Gb mode or in Iu mode. UMTS authentication requires a USIM for the MS and Authentication Quintets in the SGSN. GSM authentication bases on a SIM ~~or a GSM capable USIM~~ for the MS and Authentication Triplets in the SGSN or it bases on a GSM capable USIM for the MS and parameters derived from Authentication Quintets in the SGSN.

"UMTS authentication" implies mutual authentication, i.e. authentication of the MS by the network and authentication of the network by the MS. It also implies establishment of a new UMTS ciphering key (CK) and integrity key (IK) agreement between the SGSN and the MS.

"GSM authentication" implies authentication of the MS by the network and establishment of a new GSM ciphering key (Kc) agreement between the SGSN and the MS.

6.8.1.1 GSM Authentication procedure

The GSM Authentication procedure performs subscriber authentication, or selection of the ciphering algorithm, or both. In A/Gb mode it performs in addition the synchronisation of the start of ciphering. Authentication triplets are stored in the SGSN. The MSC/VLR shall not authenticate the MS via the SGSN upon IMSI attach, nor location update, but may authenticate the MS during CS connection establishment. Security-related network functions are described in GSM 03.20 [6].

The GSM Authentication procedure is illustrated in Figure 27.

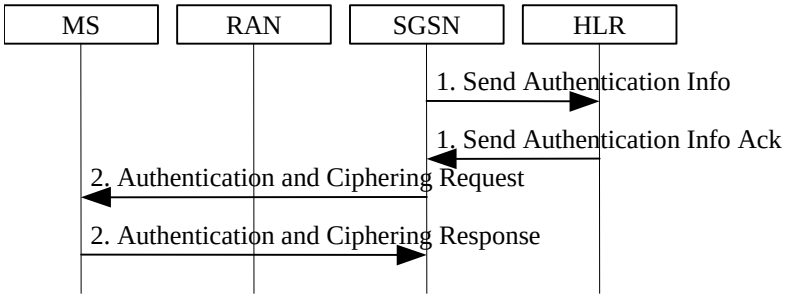

Figure 27: GSM Authentication Procedure

1) If the SGSN does not have a previously stored authentication vector~~triplets~~, a Send Authentication Info (IMSI) message is sent to the HLR. The HLR responds with a Send Authentication Info Ack (Authentication Triplets or quintets) message. ~~Each Authentication Triplet includes RAND, SRES, and Kc.~~

2) The SGSN sends an Authentication and Ciphering Request (RAND, CKSN, Ciphering Algorithm) message to the MS. The MS responds with an Authentication and Ciphering Response (SRES) message.

In A/Gb mode, the MS starts ciphering after sending the Authentication and Ciphering Response message as described in clause "Start of Ciphering".

In Iu mode, the SGSN and the MS shall generate the UMTS CK and IK from the GSM Kc using the standardised conversion functions specified for this purpose in 3GPP TS 33.102.

In Iu mode, the start of ciphering is controlled by the security mode procedure described in 3GPP TS 33.102.

If the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue, the GSM Authentication of Procedure fails.

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA does not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

Table 6: SGSN MM and PDP Contexts

Field	Description	A/Gb mode	Iu mode
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
~~Authentication Triplets~~	~~GSM Authentication and ciphering parameters.~~	~~2)~~	~~2)~~
Authentication Vectors~~Quintets~~	~~UMTS~~ Authentication and ciphering parameters (authentication triplets or quintets).	X~~1)~~	X~~1)~~
Kc	Currently used A/Gb mode ciphering key.	X	2)
CKSN	Ciphering key sequence number of Kc.	X	2)
Ciphering algorithm	Selected ciphering algorithm.	X	X
CK	Currently used Iu mode ciphering key.	1)	X
IK	Currently used Iu mode integrity key.	1)	X
KSI	Key Set Identifier.	1)	X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	X
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g. normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g. operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3GPP TS 23.016	X	X
ODB for PS parameters	Indicates that the status of the operator determined barring for packet oriented services.	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g. PPP or IP.	X	X
PDP Address	PDP address, e.g. an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used. This APN shall be composed of the APN Network Identifier and the APN Operator Identifier.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X

Field	Description	A/Gb mode	Iu mode
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g. normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC/BSC currently used.		X

The information marked with a "1)" in table 6 may be~~is~~ maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 6 may be~~is~~ maintained if authentication is performed by the GSM authentication procedure.

13.4 MS

Each MS supporting GPRS maintains MM and PDP context information in IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, and PMM-CONNECTED states. The information may be contained in the MS and the TE. Table 8 shows the MS context fields.

Table 8: MS MM and PDP Contexts

Field	SIM	Description	A/Gb mode	Iu mode
IMSI	G, U	International Mobile Subscriber Identity.	X	X
MM State		Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	G, U	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	G, U	A signature used for identification checking purposes.	X	X
Routeing Area	G, U	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	G	Current A/Gb mode ciphering key.	X	2)
KSI / CKSN	G, U	Key Set Identifier for IK Next, CK Next / key sequence number of Kc.	X	X
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK		Currently used Iu mode ciphering key.	1)	X
CK Next	U	Iu mode ciphering key to be used after the next security mode command.	1)	X
IK		Currently used Iu mode integrity key.	1)	X
IK Next	U	Integrity key to be used after the next security mode command.	1)	X
MS Radio Access Capability		MS radio access capabilities.	X	X
UE Capability		UE radio capabilities.		X
MS Network Capability		MS network capabilities.	X	X
DRX Parameters		Discontinuous reception parameters.	X	X
Radio Priority SMS		The RLC/MAC radio priority level for uplink SMS transmission.	X	
Each MM context contains zero or more of the following PDP contexts:				
PDP Type		PDP type, e.g. PPP or IP.	X	X
PDP Address		PDP address; e.g. an IP address.	X	X
PDP State		Packet data protocol state, INACTIVE or ACTIVE.	X	X
Dynamic Address Allowed		Specifies whether the MS is allowed to use a dynamic address.	X	X
APN Requested		The APN requested.	X	X
NSAPI		Network layer Service Access Point Identifier.	X	X
TI		Transaction Identifier.	X	X
QoS Profile Requested		The quality of service profile requested.	X	X
QoS Profile Negotiated		The quality of service profile negotiated.	X	X
TFT		Traffic flow template.	X	X
Radio Priority		The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id		Packet flow identifier.	X	
Send N-PDU Number		SNDCP sequence number of the next uplink N-PDU to be sent to the SGSN.	X	X
Receive N-PDU Number		SNDCP sequence number of the next downlink N-PDU expected from the SGSN.	X	X
PDCP-SND		Sequence number of the next downlink in-sequence PDCP-PDU expected from the RNC.		X
PDCP-SNU		Sequence number of the next uplink in-sequence PDCP-PDU to be sent to the RNC.		X

The information marked with a "1)" in table 8 may be~~is~~ maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 8 may be~~is~~ maintained if authentication is performed by the GSM authentication procedure.

The information marked with a "U" in table 8 shall be stored in the USIM.

The information marked with a "G" in table 8:

- shall be stored in the GSIM if the connected SIM is GPRS-aware; and

- may be stored in the ME after GPRS detach if the connected GSIM is not GPRS-aware.

If the GSIM is GPRS service-aware, then the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the GSIM shall be used for GPRS services.

If the GSIM is not GPRS service-aware, the P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the ME shall be used if and only if the IMSI stored in the GSIM is identical to the IMSI image maintained in the ME. If the IMSI stored in the GSIM is different from the IMSI image in the ME, the IMSI image in the ME shall not be used, and the MS shall identify itself with the IMSI stored in the SIM when performing a GPRS attach. IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN may be stored in the ME after the GPRS attach has been successfully performed.

When using a USIM, the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK Next, IK Next, and CKSN / KSI stored in the USIM, and the CK and IK stored in the ME, shall be used for GPRS services.

3GPP TSG-SA2 Meeting #24
Madrid, Spain, 22-26 April 2002

Tdoc S2-021465

revision of *Tdoc S2-021336*
revision of *Tdoc S2-021290* revision of Tdoc S2-021114

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **344** ⌘ **rev** **3** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network [X] Core Network [X]

Title:	⌘	Clarification of Any Time Interrogation functionality
Source:	⌘	Nokia
Work item code:	⌘	TEI5
Date:	⌘	25~~19~~.4.2002
Category:	⌘	**A**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	S2#22 prepared a set of 23.060 CR's for R99/Rel-4/Rel-5 (S2-020881r2/S2-020882r2/S2-020883r2) to solve the problem described in S2-020276 LS "Restoration of R´96 Any Time Interrogation functionality". This proposal required inclusion of a new IE in to RANAP signalling LOCATION REPORT message. Both RAN#15 and SA#15 plenaries discussed about the issue and desided it is not essential to change R99 RANAP signalling. Following this decission SA#15 rejected the R99 CR (S2-020881r2) and approved only the Rel-4 and Rel-5 CR's. For R99 RANAP signalling RAN#15 approved 25.413 CR434r4(RP-020262), that clarifies RNC shall indicate the UE location to be "Undetermined" in case the RNC is not able to reach the mobile. This CR proposes to clarify SGSN functionality in "MS Information Procedure", when RNC cannot determine the current Service Area.
Summary of change:	⌘	For MS information procedure it is clarified that, if UTRAN node cannot determine current Service Area of the mobile and last known Service Area is not reported, SGSN shall include in the MS Information Response message the last successfully received SAI with time elapsed since it was saved by SGSN.
Consequences if not approved:	⌘	SGSN behaviour is not defined in the case when an Iu connection for UE exists, but the RNC is not able to reach the mobile and last known Service Area is not reported.

Clauses affected:	⌘	6.3.6, 12.5.5
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications

	☐ O&M Specifications	
Other comments:	⌘	From R4 onwards RANAP signalling may also optionally include the "Last Known Service Area" IE (see 25.413 CR435r4 in RP-020260).

6.3.6 MS Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MS Information procedure via the SGSN. If the information requested by the VLR in the MS Information procedure is known by the SGSN, then the SGSN shall return this information to the VLR without interrogating the MS.

If the information requested is MS identity information (e.g. IMEI) that is not known by the SGSN but is known by the MS, then the SGSN shall interrogate the MS in a similar manner to that described in clause "Identity Check Procedures".

In A/Gb mode, if the information requested is MS location information, then this indicates a request for Cell Global Identity and Cell Identity Age. In Iu mode, if the information requested is MS location information, then this indicates a request for Service Area Identity and Service Area Identity Age, and in this case if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure (see clause "Location Reporting Procedure") in order to retrieve the Service Area Identity.

The MS Information procedure is illustrated in Figure 20. Procedure steps are explained in the following list.

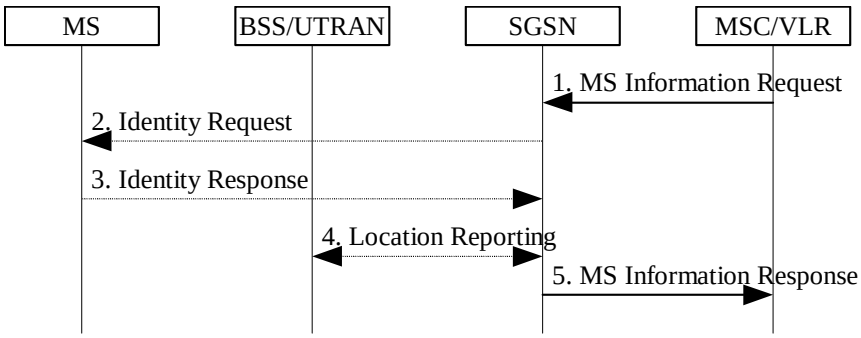

Figure 20: MS Information Procedure

1) The MSC/VLR sends an MS Information Request (IMSI, Information Type) message to the SGSN. Information Type indicates the information that the MSC/VLR is requesting for that IMSI.

2) If the information requested is not known by the SGSN but should be known by the MS, then the SGSN interrogates the MS in a similar manner to that described in the subclause "Identity Check Procedures". The SGSN sends an Identity Request (Identity Type) message to the MS.

3) The MS responds with an Identity Response (Mobile Identity) message to the SGSN.

4) In Iu mode, if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure to retrieve the Service Area Identity.

   If ~~UT~~RAN node cannot determine current Service Area of the mobile, it indicates ~~a cause value shall be included~~ in the ~~Identity Response~~Location Report message ~~to indicate~~ that the request could not be fulfilled and ~~it~~ may report L~~l~~ast K~~k~~nown Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area.

5) The SGSN sends an MS Information Response (IMSI, Information) message to the MSC/VLR. Information contains the information requested by the MSC/VLR.
   If an Iu connection for MS exist and RAN node cannot determine current Service Area and Last Known Service Area is not reported, the SGSN shall include in the MS Information Response message the last successfully received Service Area Identity with time elapsed since it was saved by SGSN.

NEXT MODIFICATION

12.7.5 Location Reporting Procedure

This procedure is used by an SGSN to request the RAN to report where the MS is currently located, or to report when the MS moves into or out of a given service area. This procedure relates to location services (LCS) and other services (e.g. CAMEL and emergency calls) in Iu mode. The overall LCS procedure is ~~to be~~ described in the LCS stage-2 specification, see 3GPP TS 23.~~171~~271.

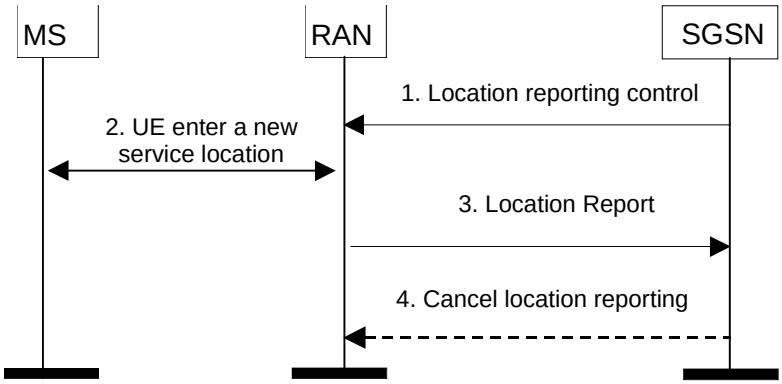

Figure 91: Location Reporting Procedure

1) The SGSN detects from the subscriber data the need to monitor in which service area an MS in the PMM-CONNECTED state with an Iu interface connection is located. The SGSN sends a Location Reporting Control (Service Area Code(s), Reporting Type) message to the RAN. The RAN stores the Service Area Code(s) as reporting area(s) for this MS. For example, a service area may be a location area with restricted access. Reporting Type indicates whether the message is intended to start a reporting period or trigger a stand-alone report about the current location of the MS.

2) The RAN detects that the MS moves into or out of a reporting area. Alternatively, the RAN derives the current location of the MS if this was requested by the SGSN.

3) The RAN sends a Location Report ~~(location information)~~ message informing the SGSN about where the MS is ~~now~~ located. ~~If no Service Area Code is included, it indicates that the MS is outside the requested service area.~~ When the SGSN has requested the current location of the MS, the RAN shall include the requested location information , i.e. the Service Area Indication, in the Location Report message~~, e.g. in the format of a cell id~~, if the ~~SRNC~~ RAN cannot determine current Service Area of the mobile, it indicates that the request could not be fulfilled, ~~i.e. "undetermined" location~~ and may report L~~l~~ast K~~k~~nown Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area. The SGSN may then perform specific actions ~~(e.g. detach an MS entering a forbidden location area or route an emergency call to the nearest local emergency number)~~.

4) The SGSN can send a Cancel Location Reporting message to inform the RAN that it should terminate location reporting for a given MS. This message is needed only when the reporting was requested for a reporting period.

The procedure is implicitly cancelled at SRNC/SBSC relocation. If the service is still required in the new SRNC/SBSC or new SGSN, a new Location Reporting Control message shall be sent.

3GPP TSG-SA2 Meeting #24
Madrid, Spain, 22-26 April 2002

Tdoc S2-021464

revision of *Tdoc S2-021335*revision of *Tdoc S2-021289*revision of *Tdoc S2-021113*

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **343** ⌘ **rev** **3** ⌘ Current version: **4.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Clarification of Any Time Interrogation functionality
Source:	⌘	Nokia
Work item code:	⌘	TEI4
Date:	⌘	25~~19~~.4.2002
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	S2#22 prepared a set of 23.060 CR's for R99/Rel-4/Rel-5 (S2-020881r2/S2-020882r2/S2-020883r2) to solve the problem described in S2-020276 LS "Restoration of R´96 Any Time Interrogation functionality". This proposal required inclusion of a new IE in to RANAP signalling LOCATION REPORT message. Both RAN#15 and SA#15 plenaries discussed about the issue and desided it is not essential to change R99 RANAP signalling. Following this decission SA#15 rejected the R99 CR (S2-020881r2) and approved only the Rel-4 and Rel-5 CR's. For R99 RANAP signalling RAN#15 approved 25.413 CR434r4(RP-020262), that clarifies RNC shall indicate the UE location to be "Undetermined" in case the RNC is not able to reach the mobile. This CR proposes to clarify SGSN functionality in "MS Information Procedure", when RNC cannot determine the current Service Area.
Summary of change:	⌘	For MS information procedure it is clarified that, if UTRAN node cannot determine current Service Area of the mobile and last known Service Area is not reported, SGSN shall include in the MS Information Response message the last successfully received SAI with time elapsed since it was saved by SGSN.
Consequences if not approved:	⌘	SGSN behaviour is not defined in the case when an Iu connection for UE exists, but the RNC is not able to reach the mobile and last known Service Area is not reported.

Clauses affected:	⌘	6.3.6, 12.5.5
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications

	☐ O&M Specifications	
Other comments:	⌘	From R4 onwards RANAP signalling may optionally include the "Last Known Service Area" IE (see 25.413 CR435r4 in RP-020260).

6.3.6 MS Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MS Information procedure via the SGSN. If the information requested by the VLR in the MS Information procedure is known by the SGSN, then the SGSN shall return this information to the VLR without interrogating the MS.

If the information requested is MS identity information (e.g. IMEI) that is not known by the SGSN but is known by the MS, then the SGSN shall interrogate the MS in a similar manner to that described in clause "Identity Check Procedures".

In A/Gb mode, if the information requested is MS location information, then this indicates a request for Cell Global Identity and Cell Identity Age. In Iu mode, if the information requested is MS location information, then this indicates a request for Service Area Identity and Service Area Identity Age, and in this case if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure (see clause "Location Reporting Procedure") in order to retrieve the Service Area Identity.

The MS Information procedure is illustrated in Figure 20. Procedure steps are explained in the following list.

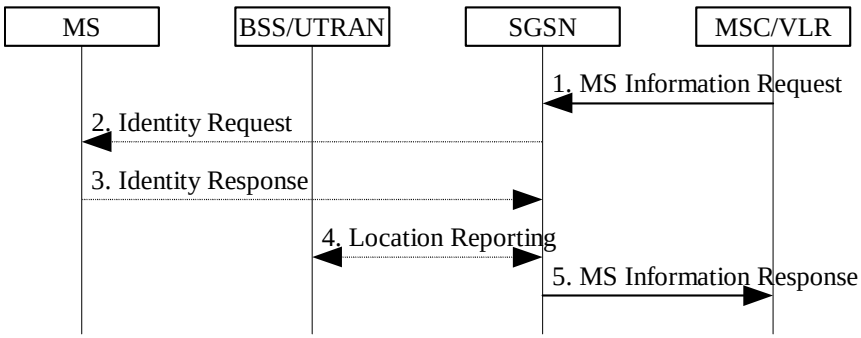

Figure 20: MS Information Procedure

1) The MSC/VLR sends an MS Information Request (IMSI, Information Type) message to the SGSN. Information Type indicates the information that the MSC/VLR is requesting for that IMSI.

2) If the information requested is not known by the SGSN but should be known by the MS, then the SGSN interrogates the MS in a similar manner to that described in the subclause "Identity Check Procedures". The SGSN sends an Identity Request (Identity Type) message to the MS.

3) The MS responds with an Identity Response (Mobile Identity) message to the SGSN.

4) In Iu mode, if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure to retrieve the Service Area Identity.~~.~~

   If UTRAN node cannot determine current Service Area of the mobile, it indicates ~~a cause value shall be included~~ in the ~~Identity Response~~Location Report message ~~to indicate~~ that the request could not be fulfilled and ~~it~~ may report L~~l~~ast K~~k~~nown Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area.

5) The SGSN sends an MS Information Response (IMSI, Information) message to the MSC/VLR. Information contains the information requested by the MSC/VLR.
   If an Iu connection for MS exist and UTRAN node cannot determine current Service Area and Last Known Service Area is not reported, the SGSN shall include in the MS Information Response message the last successfully received Service Area Identity with time elapsed since it was saved by SGSN.

NEXT MODIFICATION

12.7.5 Location Reporting Procedure

This procedure is used by a 3G-SGSN to request the SRNC to report where the MS is currently located, or to report when the MS moves into or out of a given service area. This procedure relates to location services (LCS) and other services (e.g. CAMEL and emergency calls) in Iu mode. The overall LCS procedure is ~~to be~~ described in the LCS stage-2 specification, see 3GPP TS 23.2~~1~~71.

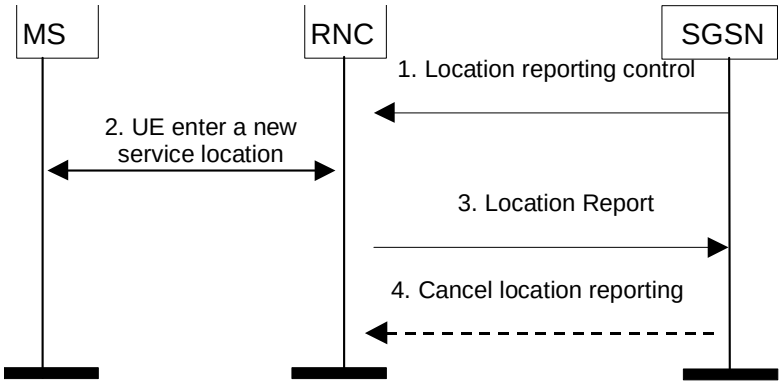

Figure 91: Location Reporting Procedure

1) The SGSN detects from the subscriber data the need to monitor in which service area an MS in the PMM-CONNECTED state with an Iu interface connection is located. The SGSN sends a Location Reporting Control (Service Area Code(s), Reporting Type) message to the SRNC. The SRNC stores the Service Area Code(s) as reporting area(s) for this MS. For example, a service area may be a location area with restricted access. Reporting Type indicates whether the message is intended to start a reporting period or trigger a stand-alone report about the current location of the MS.

2) The SRNC detects that the MS moves into or out of a reporting area. Alternatively, the SRNC derives the current location of the MS if this was requested by the SGSN.

3) The SRNC sends a Location Report ~~(location information)~~ message informing the 3G-SGSN about where the MS is ~~now~~ located. ~~If no Service Area Code is included, it indicates that the MS is outside the requested service area.~~ When the SGSN has requested the current location of the MS, the SRNC shall include the requested location information, i.e. the Service Area Indication, in the Location Report message~~, e.g. in the format of a cell id~~, if the SRNC cannot determine current Service Area of the mobile, it indicates that the request could not be fulfilled, ~~i.e. "undetermined" location~~ and, ~~it~~ may report L~~l~~ast K~~k~~nown Service Area with an indication of how long has past since the mobile was known to be in the indicated Service Area. The SGSN may then perform specific actions ~~(e.g. detach an MS entering a forbidden location area or route an emergency call to the nearest local emergency number)~~.

4) The SGSN can send a Cancel Location Reporting message to inform the SRNC that it should terminate location reporting for a given MS. This message is needed only when the reporting was requested for a reporting period.

The procedure is implicitly cancelled at SRNC relocation. If the service is still required in the new SRNC or new SGSN, a new Location Reporting Control message shall be sent.

3GPP TSG-SA2 Meeting #24
Madrid, Spain, 22-26 April 2002

Tdoc S2-021463

revision ofTdoc S2-021334
revision ofTdoc S2-021288 revision of *Tdoc S2-021112*

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **342** ⌘ **rev** **3** ⌘ Current version: **3.11.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Clarification of Any Time Interrogation functionality
Source:	⌘	Nokia
Work item code:	⌘	TEI
Date:	⌘	2619.4.2002
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	S2#22 prepared a set of 23.060 CR's for R99/Rel-4/Rel-5 (S2-020881r2/S2-020882r2/S2-020883r2) to solve the problem described in S2-020276 LS "Restoration of R´96 Any Time Interrogation functionality". This proposal required inclusion of a new IE in to RANAP signalling LOCATION REPORT message. Both RAN#15 and SA#15 plenaries discussed about the issue and decided it is not essential to change R99 RANAP signalling. Following this decision SA#15 rejected the R99 CR (S2-020881r2) and approved only the Rel-4 and Rel-5 CR's. For R99 RANAP signalling RAN#15 approved 25.413 CR434r4 (RP-020262), which clarifies that RNC shall indicate the UE location to be "Undetermined" in case the RNC is not able to reach the mobile. This CR proposes to clarify SGSN functionality in "MS Information Procedure", when RNC reports location "Undetermined".
Summary of change:	⌘	For MS information procedure it is clarified that, if UTRAN node cannot determine current Service Area of the mobile, it indicates ~~a cause value shall be included~~ in the ~~Identity Responce~~Location Report message ~~to indicate~~ that the request could not be fulfilled. In this case SGSN shall include in the MS Information Response message the last successfully received SAI with time elapsed since it was saved by SGSN. The CR also incorporates relevant changes to align with the approved CR's in S2-020882/S2-020883.
Consequences if not approved:	⌘	SGSN behaviour is not defined in the case when an Iu connection for UE exists, but the RNC is not able to reach the mobile.

Clauses affected:	⌘	6.3.6, 12.5.5
Other specs	⌘ ☐ Other core specifications	⌘

affected:	☐ Test specifications ☐ O&M Specifications	
Other comments:	⌘	From R4 onwards RANAP signalling may optionally include the "Last Known Service Area" IE (see 25.413 CR435r4 in RP-020260).

6.3.6 MS Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MS Information procedure via the SGSN. If the information requested by the VLR in the MS Information procedure is known by the SGSN, then the SGSN shall return this information to the VLR without interrogating the MS.

If the information requested is MS identity information (e.g., IMEI) that is not known by the SGSN but is known by the MS, then the SGSN shall interrogate the MS in a similar manner to that described in subclause "Identity Check Procedures".

In A/Gb mode, if the information requested is MS location information, then this indicates a request for Cell Global Identity and Cell Identity Age. In Iu mode, if the information requested is MS location information, then this indicates a request for Service Area Identity and Service Area ~~Code~~ Identity Age, and in this case if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure (see subclause "Location Reporting Procedure") in order to retrieve the Service Area Identity.

The MS Information procedure is illustrated in Figure 20. Procedure steps are explained in the following list.

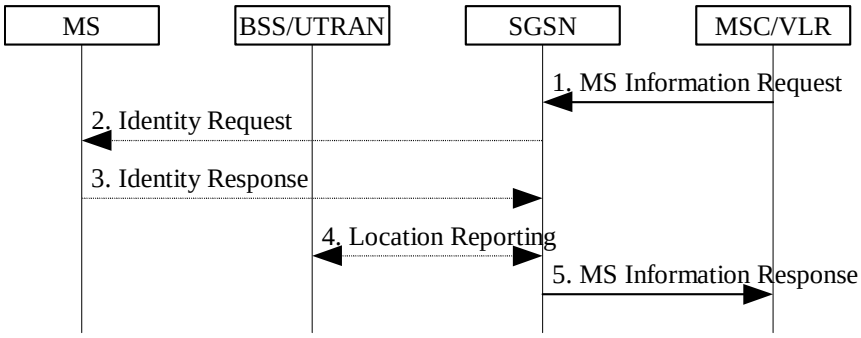

Figure 20: MS Information Procedure

1) The MSC/VLR sends an MS Information Request (IMSI, Information Type) message to the SGSN. Information Type indicates the information that the MSC/VLR is requesting for that IMSI.

2) If the information requested is not known by the SGSN but should be known by the MS, then the SGSN interrogates the MS in a similar manner to that described in the subclause "Identity Check Procedures". The SGSN sends an Identity Request (Identity Type) message to the MS.

3) The MS responds with an Identity Response (Mobile Identity) message to the SGSN.

4) In Iu mode, if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure to retrieve the Service Area Identity.
If UTRAN node cannot determine current Service Area of the mobile, it indicates ~~a cause value shall be included~~ in the~~Identity Response~~ Location Report message ~~to indicate~~ that the request could not be fulfilled.

5) The SGSN sends an MS Information Response (IMSI, Information) message to the MSC/VLR. Information contains the information requested by the MSC/VLR.
If an Iu connection for MS exist and UTRAN node cannot determine current Service Area, the SGSN shall include in the MS Information Response message the last successfully received Service Area Identity with time elapsed since it was saved by SGSN.

NEXT MODIFICATION

12.7.5 Location Reporting Procedure

This procedure is used by a 3G-SGSN to request the SRNC to report where the MS is currently located, or to report when the MS moves into or out of a given service area. This procedure relates to location services (LCS) and other services (e.g., CAMEL and emergency calls) in Iu mode. The overall LCS procedure is ~~to be~~ described in the LCS stage-2 specification, see 3G TS 23.171.

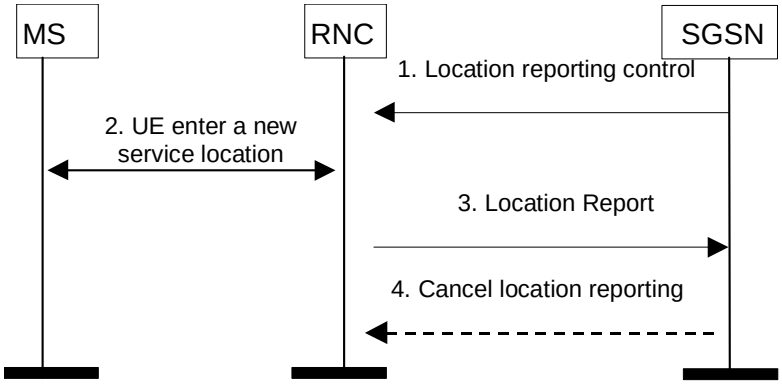

Figure 89: Location Reporting Procedure

1) The SGSN detects from the subscriber data the need to monitor in which service area an MS in the PMM-CONNECTED state with an Iu interface connection is located. The SGSN sends a Location Reporting Control (Service Area Code(s), Reporting Type) message to the SRNC. The SRNC stores the Service Area Code(s) as reporting area(s) for this MS. For example, a service area may be a location area with restricted access. Reporting Type indicates whether the message is intended to start a reporting period or trigger a stand-alone report about the current location of the MS.

2) The SRNC detects that the MS moves into or out of a reporting area. Alternatively, the SRNC derives the current location of the MS if this was requested by the SGSN.

3) The SRNC sends a Location Report ~~(Service Area Code)~~ message informing the 3G-SGSN about where the MS is ~~now~~ located. ~~If no Service Area Code is included, it indicates that the MS is outside the requested service area.~~ When the SGSN has requested the current location of the MS, the SRNC shall include the requested location information, i.e. the Service Area indication, in the Location Report message~~, e.g., in the format of a cell id, if the SRNC cannot determine current Service Area of the mobile, a cause value shall be included in the Identity Response message to indicate that the request could not be fulfilled~~. The SGSN may then perform specific actions ~~(e.g., detach an MS entering a forbidden location area or route an emergency call to the nearest local emergency number)~~.
In case the SRNC cannot determine current Service Area of the mobile, it indicates in the Location Report message that the request could not be fulfilled~~, i.e. "undetermined" location~~.

4) The SGSN can send a Cancel Location Reporting message to inform the SRNC that it should terminate location reporting for a given MS. This message is needed only when the reporting was requested for a reporting period.

The procedure is implicitly cancelled at SRNC relocation. If the service is still required in the new SRNC or new SGSN, a new Location Reporting Control message shall be sent.

3GPP TSG-SA2 Meeting #24
Madrid, Spain, April 22-26, 2002

Tdoc S2-~~021192~~021459

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **351** ⌘ ev **1** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network ☐ Core Network **X**

Title:	⌘	Clarification on the PDP Address and PDP Context.
Source:	⌘	Motorola
Work item code:	⌘	TEI5
Date:	⌘	April 16, 2002
Category:	⌘	**F** ~~**A**~~
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	The sentence in sub-clause 9.1 states that PDP Context describes the PDP Address. This is incorrect logical statement. The PDP Address is a member of the PDP Context array, thus the PDP Address and other PDP context parameters define the PDP Context. Therefore, it should be stated that the PDP Address is contained within the PDP Context.
Summary of change:	⌘	The sentence was revised in order to reflect better relation between the PDP Address and the PDP Context.
Consequences if not approved:	⌘	Incorrect statement will exist in the specification.

Clauses affected:	⌘	9.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

9.1 Definition of Packet Data Protocol States

A GPRS subscription contains the subscription of one or more PDP addresses. Each PDP address is ~~described by~~ an element of a PDP context. The same PDP address may appear in one or more PDP contexts in the MS, the SGSN, and the GGSN. Each PDP context may be associated with a TFT. At most one PDP context associated with the same PDP address may exist at any time with no TFT assigned to it. Every PDP context exists independently in one of two PDP states. The PDP state indicates whether data transfer is enabled for that PDP address and TFT or not. In case all PDP contexts associated with the same PDP address are deactivated, data transfer for that PDP address is disabled. Activation and deactivation are described in clause "PDP Context Activation, Modification, Deactivation, and

Preservation Functions". All PDP contexts of a subscriber are associated with the same MM context for the IMSI of that subscriber.

3GPP TSG-SA2 Meeting #24
Madrid, Spain, April 22-26, 2002

Tdoc S2-~~021153~~021458

CR-Form-v4

CHANGE REQUEST

⌘	23.060	CR	348	⌘	ev	1	⌘	Current version:	~~4.4~~5.1.0	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Correction on Restriction of Data Transfer during Mobility Management Procedures
Source:	⌘	Motorola
Work item code:	⌘	TEI5
Date:	⌘	April 16, 2002
Category:	⌘	~~A~~ F
Release:	⌘	REL-5

Use one of the following categories:
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A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	The general description of mobility management procedures in subclause 6.4 specifies that during these procedures data transfer should not be transmitted neither by the MS nor the SGSN. In case of Routeing Area Update, however, this statement is in contradiction with the procedure description, which specifies the condition under which the data may be transmitted.
Summary of change:	⌘	The reference to routeing area update was removed from the sentence and a new sentence was added referring to RAU description procedures.
Consequences if not approved:	⌘	Incorrect statement will exist in the specification.

Clauses affected:	⌘	6.4		
Other specs affected:	⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘	
Other comments:	⌘			

6.4 MM Procedures

In A/Gb mode, the MM procedures shall use the LLC and RLC/MAC protocols for message transmission across the Gb and Um interfaces. The MM procedures shall provide information to the underlying layers to enable reliable

transmission of MM messages on the Um interface. GSM 03.64 defines the mapping between LLC and the radio channels used.

In Iu mode, the MM procedures shall use the RANAP and RRC protocols for message transmission across the Iu and Uu interfaces, respectively.

Furthermore, the MM procedures use MAP interfaces between SGSN and HLR (Gr), and between SGSN and EIR (Gf), and a BSSAP+ interface between SGSN and MSC/VLR (Gs).

User data can in general be transmitted during MM signalling procedures. In A/Gb mode, user data transmitted during attach, authentication, and routeing area update procedures may be lost and may therefore have to be retransmitted. In order to minimise the need for retransmission, the MS and SGSN should not transmit user data during attach and~~,~~ authentication procedures. In case of~~, and~~ routeing area update procedures, the user data transfer is allowed with restriction specified in description of these procedures in sub-clauses 6.9.1.2 and 6.9.1.3.

The compatibility of SIMs and USIMs with A/Gb mode MSs or Iu mode MSs is defined in 3GPP TS 22.102.

3GPP TSG-SA2 Meeting #24 ***Tdoc S2*-021457**
Madrid, Spain, April 22- 26, 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **364** ⌘ ev **1** ⌘ Current version: **5.1.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Update of attach procedure
Source:	⌘	L.M. Ericsson
Work item code:	⌘	TEI5
Date:	⌘	26th April 2002
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The attach procedure does not show that there might be active PDP contexts in the old SGSN, or new SGSN if the MS re-attaches to the same SGSN. If there are, these PDP contexts should be deactivated in the old SGSN and in the involved GGSNs.
Summary of change:	⌘	Clarification that the old SGSN, or new SGSN if the MS re-attaches to the same SGSN, in the attach procedure should also initiate deactivation of PDP contexts in the involved GGSN(s), if there is any active PDP contexts.
Consequences if not approved:	⌘	Incomplete description of the attach procedure, with the risk of hanging PDP contexts in GGSNs.

Clauses affected:	⌘	6.5.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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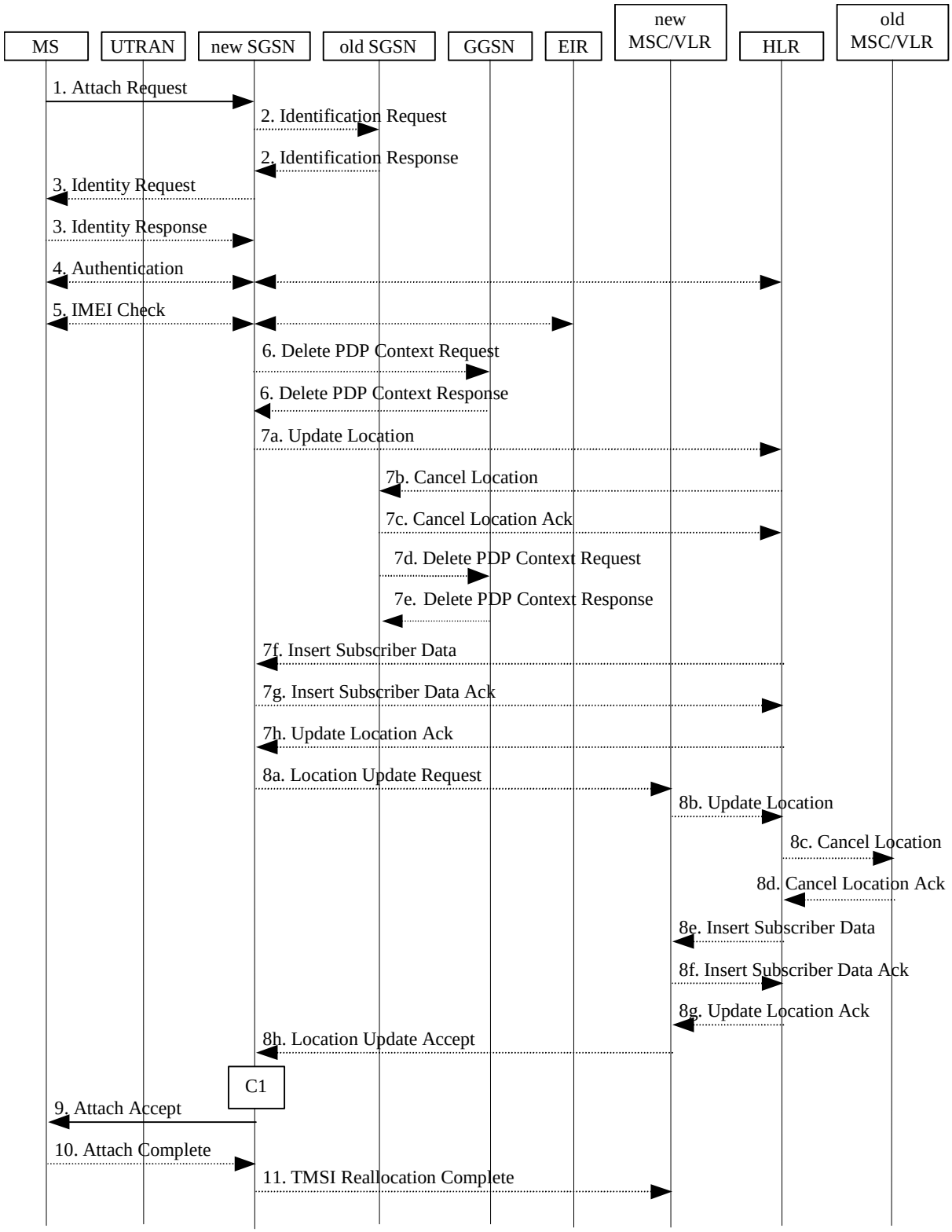
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

****** FIRST MODIFIED SECTION ******

6.5.3 Combined GPRS / IMSI Attach procedure

The Combined GPRS / IMSI Attach procedure is illustrated in Figure 22.


MS
UTRAN
new SGSN
old SGSN
GGSN
EIR
new MSC/VLR
HLR
old MSC/VLR
1. Attach Request
2. Identification Request
2. Identification Response
3. Identity Request
3. Identity Response
4. Authentication
5. IMEI Check
6. Delete PDP Context Request
6. Delete PDP Context Response
7a. Update Location
7b. Cancel Location
7c. Cancel Location Ack
7d. Delete PDP Context Request
7e. Delete PDP Context Response
7f. Insert Subscriber Data
7g. Insert Subscriber Data Ack
7h. Update Location Ack
8a. Location Update Request
8b. Update Location
8c. Cancel Location
8d. Cancel Location Ack
8e. Insert Subscriber Data
8f. Insert Subscriber Data Ack
8g. Update Location Ack
8h. Location Update Accept
C1
9. Attach Accept
10. Attach Complete
11. TMSI Reallocation Complete

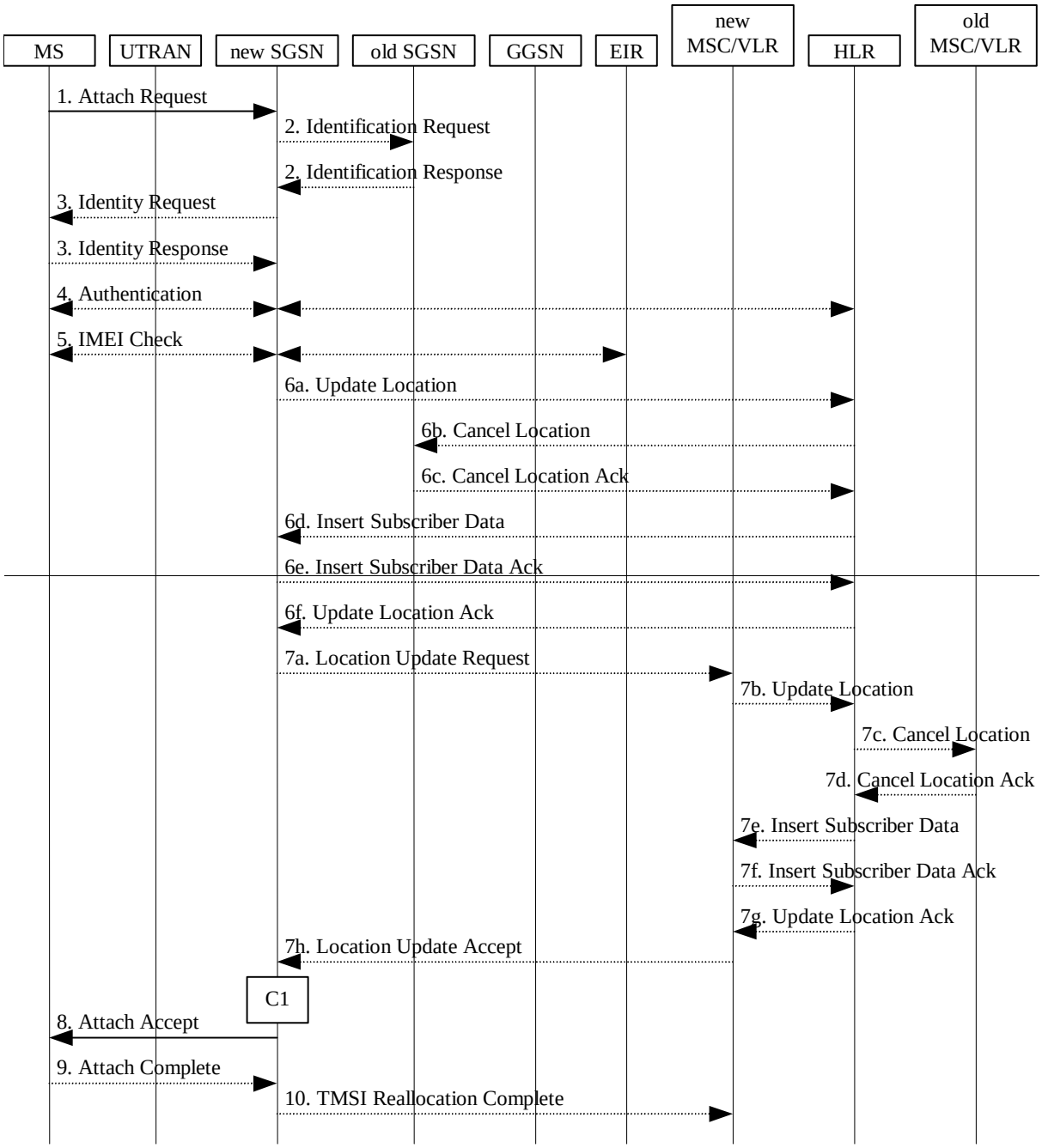


Figure 22: Combined GPRS / IMSI Attach Procedure

1) For GPRS, the MS initiates the attach procedure by the transmission of an Attach Request (IMSI or P-TMSI and old RAI, Classmark, CKSN, Attach Type, DRX Parameters, old P-TMSI Signature) message to the SGSN. IMSI shall be included if the MS does not have a valid P-TMSI available. If the MS has a valid P-TMSI, then P-TMSI and the old RAI associated with P-TMSI shall be included. Classmark contains the MS's GPRS multislot capabilities and supported GPRS ciphering algorithms in addition to the existing classmark parameters defined in GSM 04.08. Attach Type indicates which type of attach is to be performed, i.e. GPRS attach only, GPRS Attach while already IMSI attached, or combined GPRS / IMSI attach. DRX Parameters indicates whether the MS uses discontinuous reception or not. If the MS uses discontinuous reception, then DRX Parameters also indicate when the MS is in a non-sleep mode able to receive paging requests and channel assignments. If the MS uses P-TMSI for identifying itself and if it has also stored its old P-TMSI Signature, then the MS shall include the old P-TMSI Signature in the Attach Request message.

   For Iu mode, the MS initiates the attach procedure by the transmission of an Attach Request (IMSI or P-TMSI and old RAI, Core Network Classmark, KSI, Attach Type, old P-TMSI Signature, Follow On Request, DRX Parameters) message to the SGSN. IMSI shall be included if the MS does not have a valid P-TMSI available. If the MS uses P-TMSI for identifying itself and if it has also stored its old P-TMSI Signature, then the MS shall include the old P-TMSI Signature in the Attach Request message. If the MS has a valid P-TMSI, then P-TMSI and the old RAI associated with P-TMSI shall be included. KSI shall be included if the MS has valid security parameters. Core Network Classmark is described in clause "MS Network Capability". The MS shall set "Follow On Request" if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow on request indication to release or keep the Iu connection after the completion of the GPRS Attach procedure. Attach Type indicates which type of attach is to be performed, i.e. GPRS attach only, GPRS Attach while already IMSI attached, or combined GPRS / IMSI attach. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

2) If the MS identifies itself with P-TMSI and the SGSN has changed since detach, the new SGSN sends an Identification Request (P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to request the IMSI. If the new SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the new SGSN may derive the old SGSN from the old RAI and the old P-TMSI and send the Identification Request message to this old SGSN. Otherwise, the new SGSN derives the old SGSN from the old RAI. In any case the new SGSN will derive an SGSN that it believes is the old SGSN. This derived SGSN is itself the old SGSN, or it is associated with the same pool area as the actual old SGSN and it will determine the correct old SGSN from the P-TMSI and relay the message to that actual old SGSN. The old SGSN responds with Identification Response (IMSI, Authentication Triplets or Authentication Quintets). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN also validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN.

3) If the MS is unknown in both the old and new SGSN, the SGSN sends an Identity Request (Identity Type = IMSI) to the MS. The MS responds with Identity Response (IMSI).

4) The authentication functions are defined in the clause "Security Function". If no MM context for the MS exists anywhere in the network, then authentication is mandatory. Ciphering procedures are described in clause "Security Function". If P-TMSI allocation is going to be done and the network supports ciphering, the network shall set the ciphering mode.

5) The equipment checking functions are defined in the clause "Identity Check Procedures". Equipment checking is optional.

6) If there are active PDP contexts in the new SGSN for this particular MS (i.e. the MS re-attaches to the same SGSN without having properly detached before), the new SGSN deletes these PDP contexts by sending Delete PDP Context Request (TEID) messages to the GGSNs involved. The GGSNs acknowledge with Delete PDP Context Response (TEID) messages.

7~~6~~) If the SGSN number has changed since the GPRS detach, or if it is the very first attach, then the SGSN informs the HLR:

   a) The SGSN sends an Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

   b) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure.

c) The old SGSN acknowledges with Cancel Location Ack (IMSI). If there are any ongoing procedures for that MS, the old SGSN shall wait until these procedures are finished before removing the MM and PDP contexts.

d) ~~The~~If there are active PDP contexts in the old ~~G~~GSGSN~~s regarding~~ for this particular MS, ~~are deactivated by~~ the old SGSN deletes these PDP contexts by sending Delete PDP Context Request (TEID) messages to the GGSNs involved.

e) The GGSNs acknowledge with Delete PDP Context Response (TEID) messages.

~~If the MS was both IMSI- and GPRS-attached, the old SGSN sends a GPRS Detach Indication (IMSI) message to the VLR. The VLR removes the association with the SGSN and handles paging and location update without going via the SGSN.~~

f) ~~d)~~ The HLR sends Insert Subscriber Data (IMSI, GPRS Subscription Data) to the new SGSN.

g) ~~e)~~ The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to attach in the RA, the SGSN rejects the Attach Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If subscription checking fails for other reasons, the SGSN rejects the Attach Request with an appropriate cause and returns an Insert Subscriber Data Ack (IMSI, Cause) message to the HLR. If all checks are successful then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

h) ~~f)~~ The HLR acknowledges the Update Location message by sending an Update Location Ack to the SGSN after the cancelling of old MM context and insertion of new MM context are finished. If the Update Location is rejected by the HLR, the SGSN rejects the Attach Request from the MS with an appropriate cause.

8~~7~~) If Attach Type in step 1 indicated GPRS Attach while already IMSI attached, or combined GPRS / IMSI attached, then the VLR shall be updated if the Gs interface is installed. When the SGSN does not provide functionality for the Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the VLR number is derived from the RAI. When the SGSN provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes, the SGSN uses the RAI and a hash value from the IMSI to determine the VLR number. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 6d). This operation marks the MS as GPRS-attached in the VLR.

a) The SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) message to the VLR. Location Update Type shall indicate IMSI attach if Attach Type indicated combined GPRS / IMSI attach. Otherwise, Location Update Type shall indicate normal location update. The VLR creates an association with the SGSN by storing SGSN Number.

b) If the LA update is inter-MSC, the new VLR sends Update Location (IMSI, new VLR) to the HLR.

c) If the LA update is inter-MSC, the HLR sends a Cancel Location (IMSI) to the old VLR.

d) The old VLR acknowledges with Cancel Location Ack (IMSI).

e) If the LA update is inter-MSC, the HLR sends Insert Subscriber Data (IMSI, subscriber data) to the new VLR.

f) The VLR acknowledges with Insert Subscriber Data Ack (IMSI).

g) After finishing the inter-MSC location update procedures, the HLR responds with Update Location Ack (IMSI) to the new VLR.

h) The VLR responds with Location Update Accept (VLR TMSI) to the SGSN.

9~~8~~) The SGSN selects Radio Priority SMS, and sends an Attach Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Radio Priority SMS) message to the MS. P-TMSI is included if the SGSN allocates a new P-TMSI.

10~~9~~) If P-TMSI or VLR TMSI was changed, the MS acknowledges the received TMSI(s) by returning an Attach Complete message to the SGSN.

11~~0~~) If VLR TMSI was changed, the SGSN confirms the VLR TMSI re-allocation by sending a TMSI Reallocation Complete message to the VLR.

If the Attach Request cannot be accepted, the SGSN returns an Attach Reject (IMSI, Cause) message to the MS.

The CAMEL procedure call shall be performed, see referenced procedure in 3GPP TS 23.078:

C1) CAMEL_GPRS_Attach

In Figure 22, the procedure returns as result "Continue".

****** END OF MODIFICATIONS ******

3GPP TSG SA WG2 #24 **S2-021456**
Madrid, Spain, 22nd – 26th April 2002

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **358** ⌘ **rev** **1** ⌘ Current version: **5.1.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☐

Title:	⌘	MS and Network operation Modes
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	25.4.02
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
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C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘

Various changes were already made to support A/Gb and Iu modes of GERAN. Some further clarifications as well as corrections are necessary for the MS and network operation modes.

No restrictions are assumed for CS/PS parallel operation in UTRAN Iu mode. A GERAN MS in Iu mode may always signal CS/PS in parallel. Parallel operation of CS and PS services may be restricted by the MS capabilities. The CS/PS mode of GERAN Iu mode MSs needs clarifications.

The MS operation modes are described for GPRS (A/Gb) or for PS domain (Iu) allthough related to the same CN domain. Consistency is needed.

It is not yet clarified that a CS connected Iu mode MS shall not perform combined RA update procedures.

The clauses “Interactions Between SGSN and MSC/VLR” are clarified to be applicable to A/Gb and Iu mode unless stated differently.

“Paging co-ordination for GPRS” for an MS is described as depending on a Gs interface at the MSC. Clarification that it depends on an SGSN – MSC/VLR association for the MS.

The “Network Operation Modes for Iu mode” seem to allow the MS to choose combined procedures or not. The description of the combined procedures require it for network operation mode I.

Some replacements of GPRS by A/Gb mode. GPRS comprises Iu mode also.

The changes made for the MS information procedure were made for the UTRAN and forgot the GERAN.

Summary of change: ⌘ Corrections for MS and network operation modes.

Consequences if ⌘ The specification of MS and network modes of the Iu mode is incomplete and

not approved:	inconsistent. Interoperability problems may occur between different implementations.

Clauses affected:	⌘	5.4.5, 5.4.6, 6.3, 6.4, 6.5.1, 6.5.3, 6.9.2.1		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

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Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.4.5 Mobile Stations (A/Gb mode)

An A/Gb mode~~capable~~ MS operates in one of three modes of operation. The mode of operation depends on the network domains~~services~~ that the MS is attached to, i.e. only PS~~GPRS~~ or both PS~~GPRS~~ and CS domain ~~services~~, and upon the MS's capabilities to operate PS~~GPRS~~ and CS domain services simultaneously.

- Class-A mode of operation: The MS is attached to both PS~~GPRS~~ and CS domain ~~services~~, and the MS supports simultaneous operation of PS~~GPRS~~ and CS domain services.
- Class-B mode of operation: The MS is attached to both PS~~GPRS~~ and CS domain ~~services~~, but the MS can only operate one set of services, PS or CS services, at a time.
- Class-C mode of operation: The MS is exclusively attached to the PS domain~~GPRS services~~.

The three modes of operation are defined in 3GPP TS 22.060 [3].

NOTE: Other technical specifications may refer to the MS modes of operation as GPRS class-A MS, GPRS class-B MS, and GPRS class-C MS.

5.4.6 Mobile Stations (Iu mode)

An Iu mode MS ~~mobile station can~~ operate~~s~~ in one of three modes of operation. However, these operation modes are different from the ones of an~~in~~ A/Gb mode MS ~~GPRS~~ due to the capabilities of an Iu mode RAN to multiplex CS and PS connections, due to paging co-ordination for PS services and CS services that are offered by the CN or the UTRAN/GERAN-Iu, etc. The different Iu mode MS~~mobile station~~ operation modes are defined as follows:

- ~~PS/~~CS/PS mode of operation: The MS is attached to both the PS domain and CS domain, and the MS is capable of simultaneously signalling~~operating~~with the PS ~~services~~ and CS core network domains~~services~~. This mode of operation is comparable~~equivalent~~ to the ~~A/Gb mode GPRS~~ class-A mode of operation defined for A/Gb mode. The ability to operate CS and PS services simultaneously depends on the MS capabilities (for example an A/Gb mode MS of class B, which can not operate simultaneously CS and PS services, may have the same limitations when changing to Iu mode and CS/PS mode of operation).
- PS mode of operation: The MS is attached to the PS domain only and may only operate services of the PS domain. However, this does not prevent CS-like services to be offered over the PS domain (e.g. VoIP). This mode of operation is equivalent to the A/Gb mode GPRS class-C mode of operation.
- CS mode of operation: The MS is attached to the CS domain only and may only operate services of the CS domain. However, this does not prevent PS-like service to be offered over the CS domain. The CS mode of operation is outside the scope of this specification.

All combinations of different operation modes as described for A/Gb mode and Iu mode MSs shall be allowed for GERAN and UTRAN multisystem terminals.

6.3 Interactions Between SGSN and MSC/VLR

The interactions described in this clause shall be supported if the optional Gs interface is installed. All functionality of this clause and sub-clauses applies for A/Gb mode and Iu mode unless stated differently.

An association is created between SGSN and MSC/VLR to provide for interactions between SGSN and MSC/VLR. The association is created when the VLR stores the SGSN number and the SGSN stores the VLR number. The association is used for co-ordinating MSs that are both GPRS-attached and IMSI-attached.

The association supports the following actions:

- IMSI attach and detach via SGSN. This makes combined GPRS / IMSI attach and combined GPRS / IMSI detach possible, thus saving radio resources.
- Co-ordination of LA update and RA update, including periodic updates, thus saving radio resources. A combined RA / LA update is sent from the MS to the SGSN. The SGSN forwards the LA update to the VLR.
- Paging for a CS connection via the SGSN.
- Alert procedures for non-PS services.
- Identification procedure.
- MM Information procedure.

6.3.1 Administration of the SGSN - MSC/VLR Association

The SGSN - MSC/VLR association is created at the following occasions:

- Combined GPRS / IMSI attach.
- GPRS attach when the MS is already IMSI-attached.
- Combined RA / LA update when the MS performs IMSI attach and is already GPRS-attached.
- Combined RA / LA update when an IMSI and GPRS-attached MS changes from an area of network operation mode II or III to an area of network operation mode I.

The association is initiated by the SGSN. The SGSN creates an association by sending a BSSAP+ message concerning a particular MS to the VLR. An SGSN that does not provide functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes uses the RAI to determine the VLR number~~.~~. An SGSN that provides functionality for Intra Domain Connection of RAN Nodes to Multiple CN Nodes uses the RAI and a hash value from the IMSI to determine the VLR number. During a CS connection, an MS in class-B mode of operation (A/Gb mode) cannot perform GPRS attach nor routeing area updates, only MSs in class-A mode of operation can perform these procedures. If a GPRS attach was made during a CS connection, the association shall be initiated by a combined RA / LA update after the CS connection has been released.

The association is updated on the following occasions:

- When an MS changes VLR.
- When an MS changes SGSN.

The association is not updated during a CS connection.

When the MS is in idle mode (see GSM 03.22 [7] and 3GPP TS 23.122 [7b]), the association is updated with the combined RA / LA updates procedure.

In relation to a CS connection, the association is managed in the following way:

MS in class-A or CS/PS mode of operation:

An MS in class-A or CS/PS mode of operation makes RA updates but no combined RA / LA updates during the CS connection. In the case when the MS changes SGSN, the SGSN (according to normal RA update procedures, see clause "Inter SGSN Routeing Area Update") updates the HLR and the GGSN, but not the VLR, about the new SGSN number.

In the case when the MS changes MSC during the CS connection, the subscriber data still remains in the old VLR until the CS connection is released and a combined RA / LA update or LA update is made. The association is also not updated during the CS connection.

After the CS connection has been released, a combined RA / LA update is performed (if there has been a change of RA, or if a GPRS attach was performed and the new cell indicates network operation mode I), and the association is updated according to combined RA / LA update procedures, see clause "Combined RA / LA Update Procedure". If the new cell indicates network operation mode II or III, then the MS performs an LA update.

MS in class-B mode of operation (A/Gb mode):

An MS in class-B mode of operation does not make any RA updates during a CS connection. The SGSN number therefore remains the same during the CS connection and does not need to be updated in the VLR. In the case when the MS changes MSC during the CS connection, the subscriber data still remains in the old VLR until the CS connection has been released and a combined RA / LA update or LA update is made. Therefore, the VLR number remains the same during the CS connection. After the CS connection has been released, the MS performs an RA update and an LA update if the RA has changed and the new cell indicates network operation mode II or III, or a combined RA / LA update if the RA has changed and the new cell indicates network operation mode I. The association is updated according to the combined RA / LA update procedures, see clauses "Inter SGSN Routeing Area Update" and "Combined RA / LA Update Procedure".

The SGSN - MSC/VLR association is removed at the following occasions:

- At IMSI detach.
- At GPRS detach.

When the MSC/VLR receives an LA update via the A or Iu interface from an MS for which an association exists, the MSC/VLR shall remove the association without notifying the SGSN. When the SGSN receives a (non-combined) RA update from an MS for which an association exists, the SGSN shall remove the association without notifying the MSC/VLR. When the MSC/VLR receives a BSSAP+ MS Unreachable message from the SGSN indicating that PPF is cleared, the state of the association shall not be changed at the MSC/VLR.

6.3.2 Combined RA / LA Updating

When the MS is both IMSI and GPRS-attached, the LA and RA updating is done in a co-ordinated way to save radio resources if supported by the network operation mode. When the MS enters a new RA in network operation mode I, the MS sends a Routeing Area Update Request message to the SGSN, as described in clause "Combined RA / LA Update Procedure". The LA update is included in the RA update. The SGSN then forwards the LA update to the MSC/VLR. The MSC/VLR optionally returns a new VLR TMSI that is sent to the MS via the SGSN.

An MS in class-A mode of operation involved in a CS connection makes only RA updates and no combined RA / LA updates to the SGSN.

An MS in CS/PS mode of operation involved in a CS connection makes only RA updates and no combined RA / LA updates to the SGSN.

An MS in class-B mode of operation involved in a CS connection does not make any updates during the CS connection.

An MS in class-C mode of operation never makes combined RA / LA updates. MSs in CS mode of operation and MSs in PS mode of operation never make combined RA / LA updates.

6.3.3 CS Paging (A/Gb mode)

When an MS is both IMSI and GPRS-attached in a network that operates in mode I, the MSC/VLR executes paging for circuit-switched services via the SGSN. If the MS is in STANDBY state, it is paged in the routeing area and in the null routeing area (see clause "Routeing Area Identity "). If the MS is in READY state, it is paged in the cell. A paging timer in the MSC supervises the paging procedure. The SGSN converts the MSC paging message into an SGSN paging message.

The CS Paging procedure is illustrated in figure 18. Each step is explained in the following list.

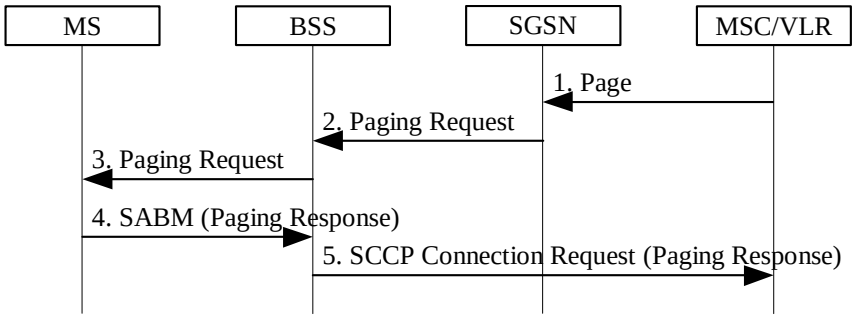


Figure 18: CS Paging Procedure in A/Gb mode

1) The SGSN receives a Page (IMSI, VLR TMSI, Channel Needed, Priority, Location Information) message from the MSC. Channel Needed is defined in GSM 08.08 [18] and indicates to the MS which type of CS channel is needed to be requested in the response. VLR TMSI and Channel Needed are optional parameters. Priority is the circuit-switched paging priority parameter as defined in GSM 08.08.

2) The SGSN sends a BSSGP Paging Request (IMSI, TLLI, VLR TMSI, Area, Channel Needed, QoS) message to the BSS serving the MS. Area is derived from either the MS's MM context in the SGSN or, if no such information is available, from the Location Information received from the MSC/VLR. Area indicates a single cell for a READY state MS or a routeing area for a STANDBY state MS. VLR TMSI and Channel Needed are included if received from the MSC. If Channel Needed was not received from the MSC, then a default Channel Needed parameter indicating circuit-switched paging is included by the SGSN. QoS indicates the priority of this Paging Request relative to other Paging Request messages buffered in the BSS. If the location area where the MS was last known to be located has an associated null routeing area, then the SGSN shall send an additional BSSGP Paging Request message to each BSS serving this null RA.

3) The BSS translates the incoming BSSGP Paging Request message into one radio Paging Request message per cell. If a dedicated radio resource is assigned to the MS in a cell, then the BSS transmits one Paging Request (VLR TMSI or IMSI, Channel Needed) message on this radio resource, without stopping possibly ongoing data transfers for the MS. Otherwise, the BSS pages the MS with one Paging Request (VLR TMSI or IMSI, Channel Needed) message on the appropriate paging channel in each addressed cell. This is described in GSM 03.64.

4) Upon receipt of a Paging Request message for a circuit-switched service the MS may accept to respond to this request and shall follow the CS procedures for paging response (random access, immediate assignment, and paging response) as specified in GSM 04.08 [13].

5) When received at the BSS, the Paging Response message is sent to the MSC, which shall stop the paging response timer.

6.3.3.1 Paging Co-ordination in A/Gb mode~~for GPRS~~

The network may provide co-ordination of paging for circuit-switched and packet-switched services. Paging co-ordination means that the network sends paging messages for circuit-switched services on the same channel as used for packet-switched services, i.e. on the GPRS paging channel or on the GPRS traffic channel, and the MS needs only to monitor that channel. Three network operation modes are defined:

- Network operation mode I: the network sends a CS paging message for a GPRS-attached MS, either on the same channel as the GPRS paging channel (i.e. the packet paging channel or the CCCH paging channel), or on a GPRS traffic channel. This means that the MS needs only to monitor one paging channel, and that it receives CS paging messages on the packet data channel when it has been assigned a packet data channel.

- Network operation mode II: the network sends a CS paging message for a GPRS-attached MS on the CCCH paging channel, and this channel is also used for GPRS paging. This means that the MS needs only to monitor the CCCH paging channel, but that CS paging continues on this paging channel even if the MS has been assigned a packet data channel.

- Network operation mode III: the network sends a CS paging message for a GPRS-attached MS on the CCCH paging channel, and sends a GPRS paging message on either the packet paging channel (if allocated in the cell) or on the CCCH paging channel. This means that an MS that wants to receive pages for both circuit-switched and packet-switched services shall monitor both paging channels in the cell, if the packet-paging channel is allocated. The network performs no paging co-ordination.

Table 2: Network Operation Modes for A/Gb mode

Mode	Circuit Paging Channel	GPRS Paging Channel	Paging co-ordination
I	Packet Paging Channel	Packet Paging Channel	Yes
	CCCH Paging Channel	CCCH Paging Channel	
	Packet Data Channel	Not Applicable	
II	CCCH Paging Channel	CCCH Paging Channel	No
III	CCCH Paging Channel	Packet Paging Channel	No
	CCCH Paging Channel	CCCH Paging Channel	

For MSs with an SGSN – MSC/VLR association, which is established via the GS interface~~When the Gs interface is present~~, all MSC-originated paging of GPRS-attached MSs shall go via the SGSN, thus allowing network co-ordination of paging. Paging co-ordination shall be made by the SGSN based on the IMSI, and is provided independently of whether the MS is in STANDBY or in READY state. The network operates in mode I.

When no SGSN – MSC/VLR association exists~~the Gs interface is not present~~, all MSC-originated paging of GPRS-attached MSs shall go via the A interface, and co-ordination of paging cannot be performed. The network shall then either:

- operate in mode II, meaning that the packet common control channel shall not be allocated in the cell; or

- operate in mode III, meaning that the packet common control channel shall be used for GPRS paging when the packet paging channel is allocated in the cell.

The network operation mode (mode I, II, or III) shall be indicated as system information to MSs. For proper operation, the mode of operation should be the same in each cell of a routeing area.

Based on the mode of operation provided by the network, the MS can then choose, according to its capabilities, whether it can attach to GPRS services, to non-GPRS services, or to both.

6.3.4 CS Paging (Iu mode)

When an MS is both IMSI- and GPRS-attached in a network that operates in mode I, the MSC/VLR executes paging for circuit-switched services via the SGSN.

In the MSC, a paging timer supervises the paging procedure.

The CS Paging procedure is illustrated in Figure 19. Each step is explained in the following list.

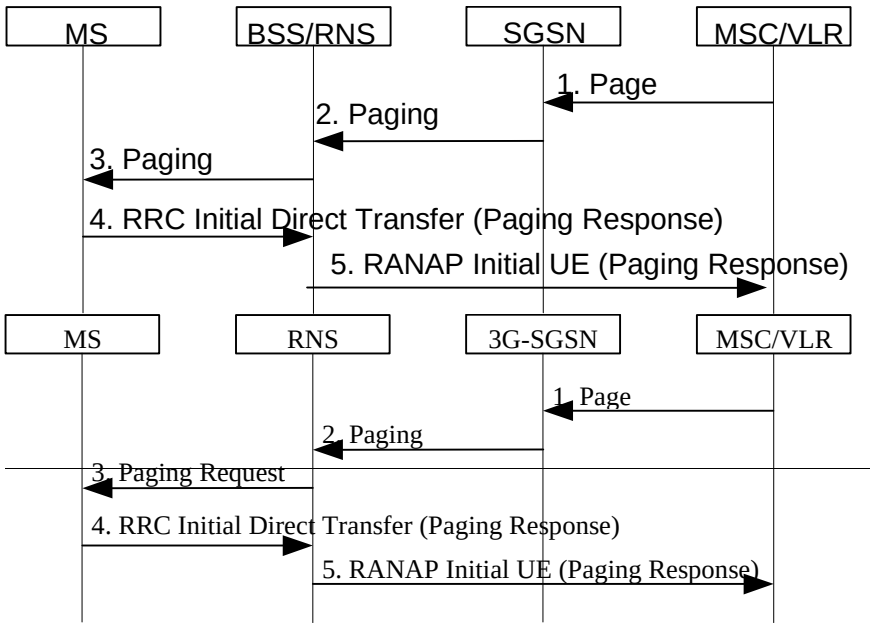


Figure 19: CS Paging Procedure in Iu mode

1) The SGSN receives a Page (IMSI, VLR TMSI, Location Information) message from the MSC. If VLR TMSI is omitted, the IMSI is used instead of the TMSI as a paging address at the radio interface. If location information 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.

2) The 3G-SGSN sends a RANAP Paging (IMSI, TMSI, Area, CN Domain Indicator) message to each RNS. IMSI is needed by the RNS in order to calculate the MS paging group and to identify the paged MS. TMSI is included if received from the MSC. Area indicates the area in which the MS is paged, and is derived from either the MS's MM context in the SGSN or, if no such information is available, from the Location Information received from the MSC/VLR. CN Domain Indicator indicates which domain (CS or PS) initiated the paging message, and in this case it must be set to "CS" by the SGSN.

3) For more details on the radio resource part of the paging procedure, see subclause "Paging Initiated by CN".

4) Upon receipt of a Paging Request message for a circuit-switched service, the MS responds to this request and returns the paging response as specified in GSM 04.18 in an RRC Initial Direct Transfer message as specified in 3GPP 25.331. CN Domain Indicator is set to "CS" in the Initial Direct Transfer message.

5) When received at the RNS, the Paging Response message is sent in an RANAP Initial UE message to the MSC, which shall then stop the paging response timer.

6.3.4.1 Network Operation Modes for Iu mode

The network operation mode is used to indicate whether the Gs interface is installed or not. When the Gs interface is present, MSs~~T can~~ initiate combined procedures.

Table 3: Network Operation Modes for Iu mode

Mode	Network configuration	Combined procedure by MT
I	Gs interface is present	Yes
II	Gs interface is not present	No

The network operation mode (mode I or II) shall be indicated as system information to the MSs. For proper operation, the mode of operation should be the same in each cell of a routeing area.

Based on the mode of operation provided by the network, the MS derives~~can then choose, according to its capabilities, whether it can attach to CS domain services, to PS domain services, or to both. Furthermore, based on the mode of operation, the MS can choose~~ whether to~~it can~~ initiate combined update procedures or separate update procedures~~, according to its capabilities~~.

NOTE: Network operation modes I and II for Iu mode correspond to modes I and II for A/Gb mode, respectively. Mode III applies to A/Gb mode only, but not to Iu mode.

6.3.5 Non-GPRS Alert

The MSC/VLR may request an SGSN to report activity from a specific MS. In this case, the MSC/VLR shall send a BSSAP+ Alert Request (IMSI) message to the SGSN where the MS is currently GPRS-attached.

Upon reception of the Alert Request (IMSI) message, the SGSN shall set NGAF. If NGAF is set for an MS, the SGSN shall inform the MSC/VLR when the next activity from that MS (and the MS is both IMSI- and GPRS-attached) is detected, and shall clear NGAF.

If the activity detected by the SGSN leads to a procedure towards the MSC/VLR, the SGSN shall just follow this procedure. If the activity detected by the SGSN does not lead to any procedure towards the MSC/VLR, the SGSN shall send an MS Activity Indication (IMSI) message towards the MSC/VLR.

6.3.6 MS Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MS Information procedure via the SGSN. If the information requested by the VLR in the MS Information procedure is known by the SGSN, then the SGSN shall return this information to the VLR without interrogating the MS.

If the information requested is MS identity information (e.g. IMEI) that is not known by the SGSN but is known by the MS, then the SGSN shall interrogate the MS in a similar manner to that described in clause "Identity Check Procedures".

In A/Gb mode, if the information requested is MS location information, then this indicates a request for Cell Global Identity and Cell Identity Age. In Iu mode, if the information requested is MS location information, then this indicates a request for Service Area Identity and Service Area Identity Age, and in this case if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure (see clause "Location Reporting Procedure") in order to retrieve the Service Area Identity.

The MS Information procedure is illustrated in Figure 20. Procedure steps are explained in the following list.

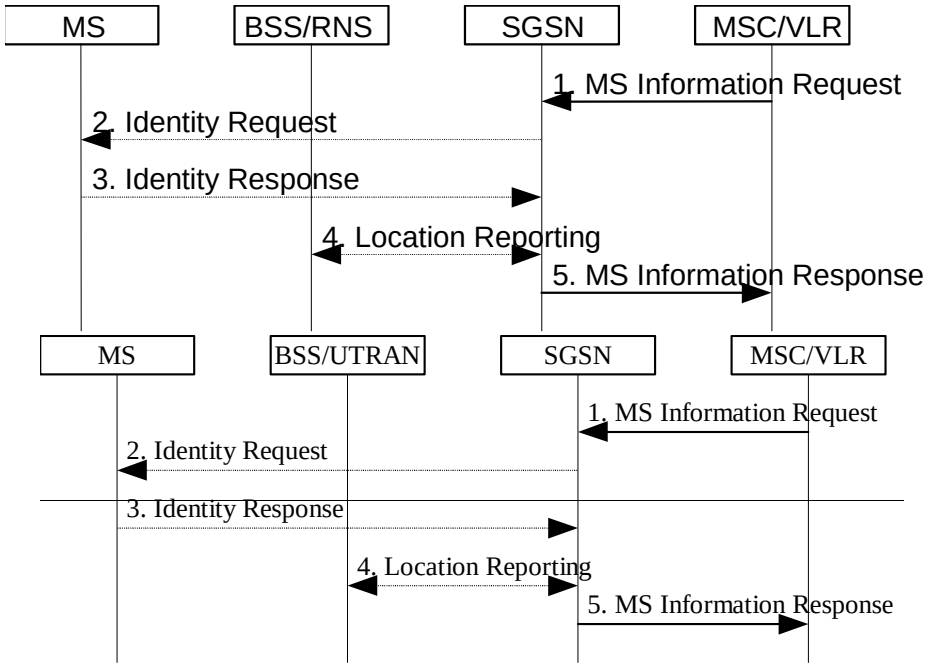


Figure 20: MS Information Procedure

1) The MSC/VLR sends an MS Information Request (IMSI, Information Type) message to the SGSN. Information Type indicates the information that the MSC/VLR is requesting for that IMSI.

2) If the information requested is not known by the SGSN but should be known by the MS, then the SGSN interrogates the MS in a similar manner to that described in the subclause "Identity Check Procedures". The SGSN sends an Identity Request (Identity Type) message to the MS.

3) The MS responds with an Identity Response (Mobile Identity) message to the SGSN.

4) In Iu mode, if an Iu connection for the MS exists, then the SGSN shall use the Location Reporting procedure to retrieve the Service Area Identity. If the BSS/RNS~~UTRAN node~~ cannot determine the current Service Area of the MS~~mobile~~, it may report the last known Service Area with an indication of how long has past since the MS~~mobile~~ was known to be in the indicated Service Area.

5) The SGSN sends an MS Information Response (IMSI, Information) message to the MSC/VLR. Information contains the information requested by the MSC/VLR.

6.3.7 MM Information Procedure

When the MS is marked at the VLR as both IMSI- and GPRS-attached, the VLR may perform the MM Information procedure via the SGSN. The MM Information procedure is typically used to inform the MS about such things as the network name and the local time zone of the mobile.

The MM Information procedure is illustrated in Figure 21.

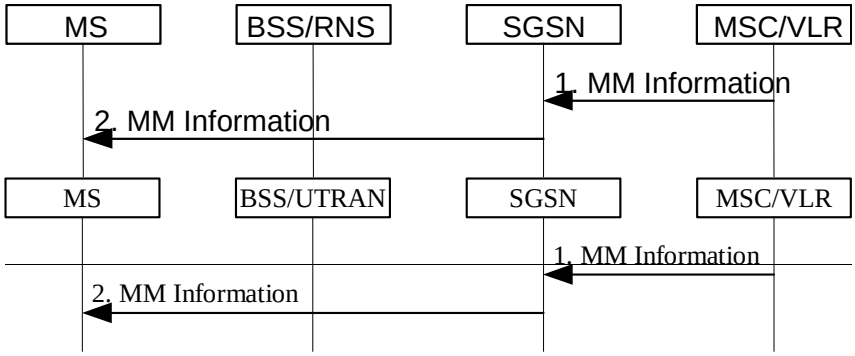


Figure 21: MM Information Procedure

1) The SGSN receives an MM Information (IMSI, Information) message from the MSC/VLR. Information is the information that the MSC/VLR is sending to the MS.

2) The SGSN sends an MM Information (Information) message to the MS including the information received by the MSC/VLR.

6.4 MM Procedures

In A/Gb mode, the MM procedures shall use the LLC and RLC/MAC protocols for message transmission across the Gb and Um interfaces. The MM procedures shall provide information to the underlying layers to enable reliable transmission of MM messages on the Um interface. GSM 03.64 defines the mapping between LLC and the radio channels used.

In Iu mode, the MM procedures shall use the RANAP and RRC protocols for message transmission across the Iu and radio~~U~~u interfaces, respectively.

Furthermore, the MM procedures use MAP interfaces between SGSN and HLR (Gr), and between SGSN and EIR (Gf), and a BSSAP+ interface between SGSN and MSC/VLR (Gs).

User data can in general be transmitted during MM signalling procedures. In A/Gb mode, user data transmitted during attach, authentication, and routeing area update procedures may be lost and may therefore have to be retransmitted. In order to minimise the need for retransmission, the MS and SGSN should not transmit user data during the attach, authentication, and routeing area update procedures.

6.5.1 A/Gb mode GPRS Attach Procedure

A GPRS attach is made to the SGSN. A GPRS-attached MS makes IMSI attach via the SGSN with the combined RA / LA update procedure if the network operation mode is I. In network operation modes II and III, or if the MS is not GPRS-attached, the MS makes an IMSI attach as already defined in A/Gb mode. An IMSI-attached MS in class-A mode of operation engaged in a CS connection shall use the (non-combined) GPRS Attach procedures when it performs a GPRS attach.

At the RLC/MAC layer, the MS shall identify itself with a Local or Foreign TLLI if the MS is already GPRS-attached and is performing an IMSI attach. Otherwise, the MS shall identify itself with a Foreign TLLI, or a Random TLLI if a valid P-TMSI is not available. The Foreign or Random TLLI is used as an identifier during the attach procedure until a new P-TMSI is allocated.

After having executed the GPRS attach, the MS is in READY state and MM contexts are established in the MS and the SGSN. The MS may then activate PDP contexts as described in clause "Activation Procedures".

An IMSI-attached MS that can only operate in class-C mode of operation shall follow the normal IMSI detach procedure before it makes a GPRS attach. A GPRS-attached MS in class-C mode of operation shall always perform a GPRS detach before it makes an IMSI attach.

If the network operates in mode I (see clause "Paging Co-ordination in A/Gb mode~~for GPRS~~"), then an MS that is both GPRS-attached and IMSI-attached~~. It~~ shall perform the Combined RA / LA Update procedures.

If the network operates in mode II or III, then a GPRS-attached MS that has the capability to be simultaneously GPRS-attached and IMSI-attached shall perform the (non-combined) Routeing Area Update procedures, and either:

- access the non-GPRS common control channels for CS operation (the way that CS operation is performed in parallel with GPRS operation is an MS implementation issue outside the scope of the present document); or

- if CS operation is not desired, depending on system information that defines whether or not explicit detach shall be used, either:

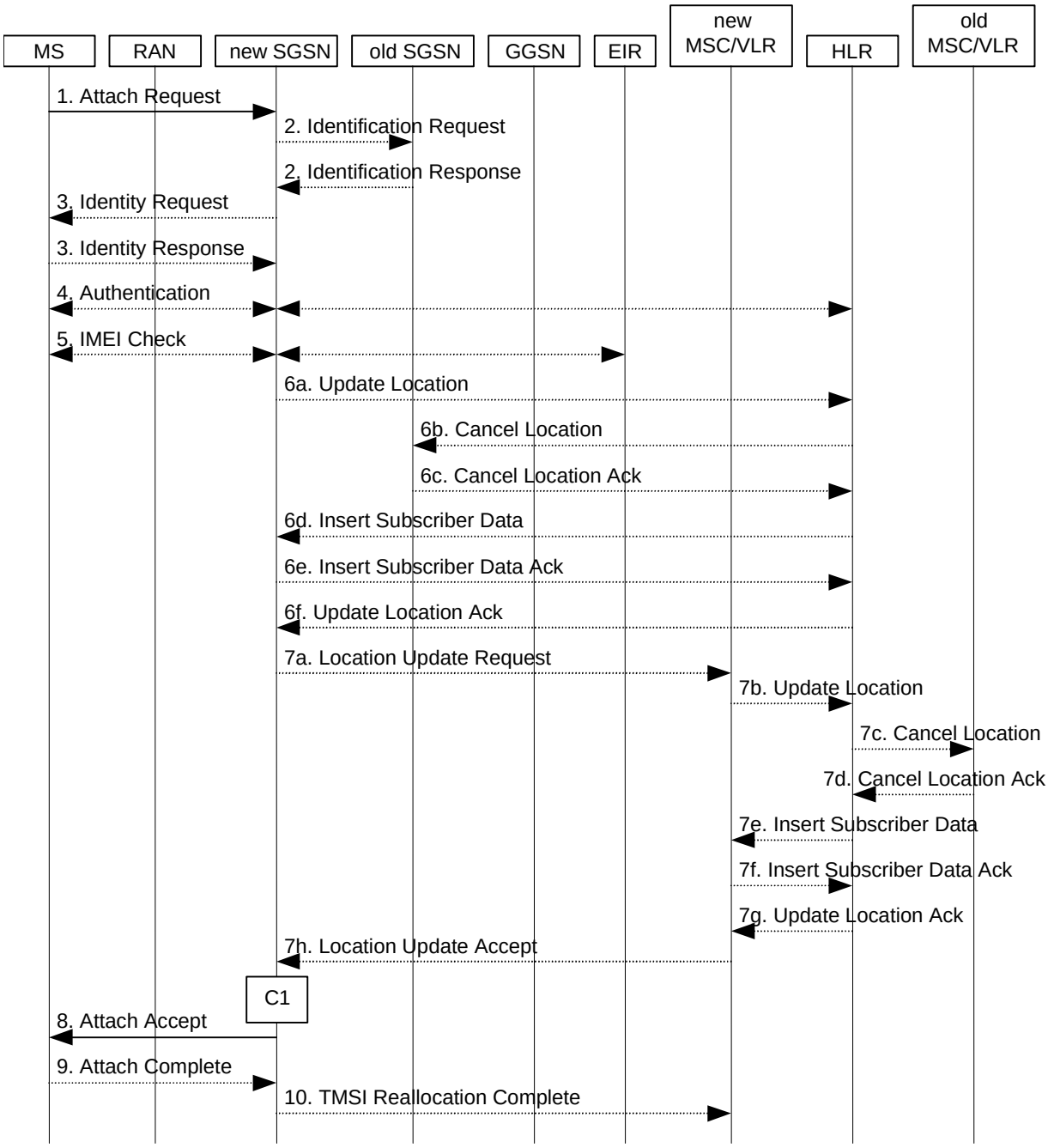
- avoid all CS signalling (in which case the MS may be implicitly IMSI detached after a while); or

- perform an explicit IMSI detach via the non-GPRS common control channels (if the MS was already IMSI-attached).

The Combined GPRS / IMSI Attach procedure is illustrated in Figure 22.

6.5.3 Combined GPRS / IMSI Attach procedure

The Combined GPRS / IMSI Attach procedure is illustrated in Figure 22.


MS
RAN
new SGSN
old SGSN
GGSN
EIR
new MSC/VLR
HLR
old MSC/VLR
1. Attach Request
2. Identification Request
2. Identification Response
3. Identity Request
3. Identity Response
4. Authentication
5. IMEI Check
6a. Update Location
6b. Cancel Location
6c. Cancel Location Ack
6d. Insert Subscriber Data
6e. Insert Subscriber Data Ack
6f. Update Location Ack
7a. Location Update Request
7b. Update Location
7c. Cancel Location
7d. Cancel Location Ack
7e. Insert Subscriber Data
7f. Insert Subscriber Data Ack
7g. Update Location Ack
7h. Location Update Accept
C1
8. Attach Accept
9. Attach Complete
10. TMSI Reallocation Complete

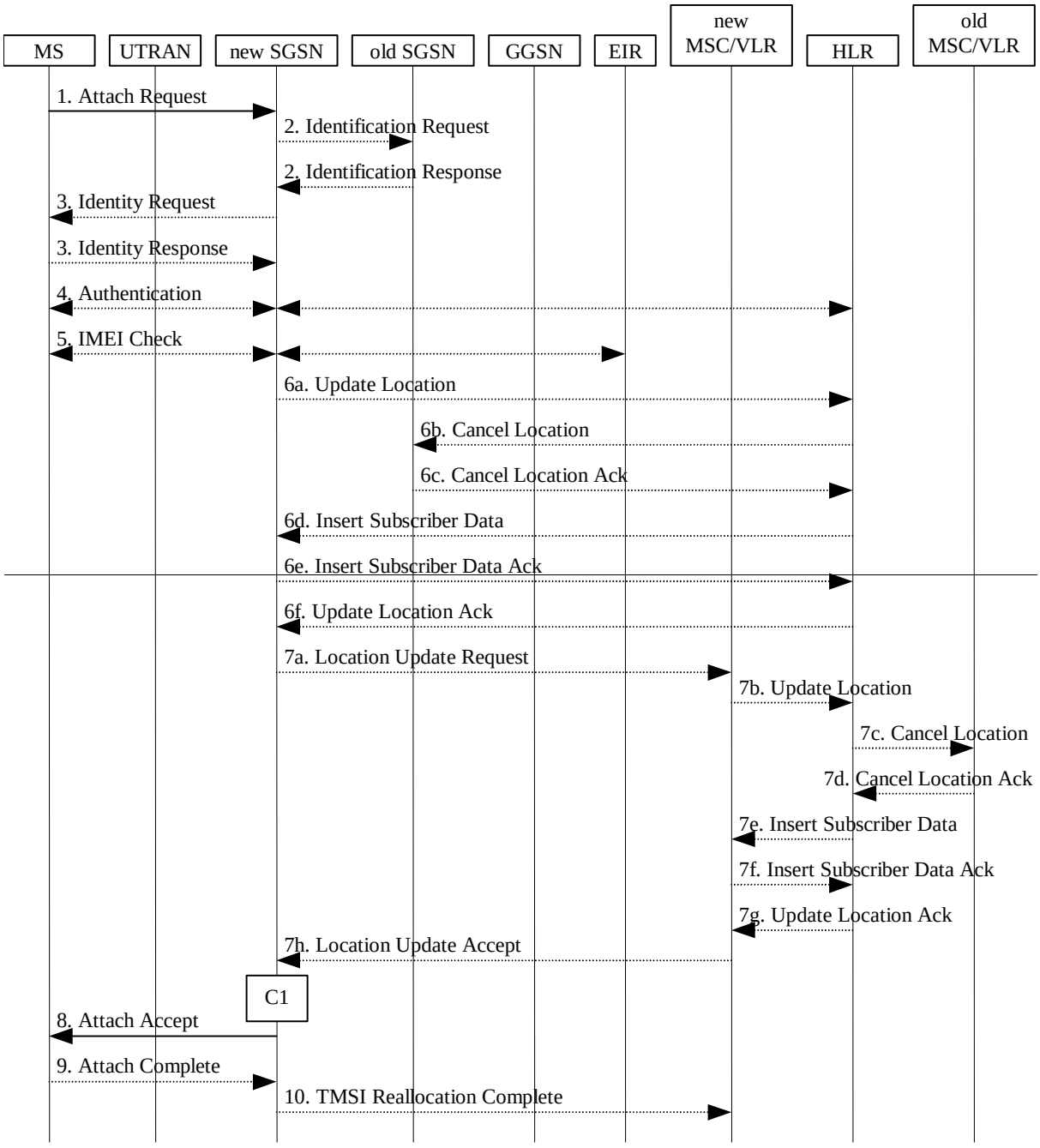


Figure 22: Combined GPRS / IMSI Attach Procedure

1) In A/Gb mode~~For GPRS~~, the MS initiates the attach procedure by the transmission of an Attach Request (IMSI or P-TMSI and old RAI, Classmark, CKSN, Attach Type, DRX Parameters, old P-TMSI Signature) message to the SGSN. IMSI shall be included if the MS does not have a valid P-TMSI available. If the MS has a valid P-TMSI, then P-TMSI and the old RAI associated with P-TMSI shall be included. Classmark contains the MS's GPRS multislot capabilities and supported GPRS ciphering algorithms in addition to the existing classmark parameters defined in GSM 04.08. Attach Type indicates which type of attach is to be performed, i.e. GPRS attach only, GPRS Attach while already IMSI attached, or combined GPRS / IMSI attach. DRX Parameters indicates whether the MS uses discontinuous reception or not. If the MS uses discontinuous reception, then DRX Parameters also indicate when the MS is in a non-sleep mode able to receive paging requests and channel assignments. If the MS uses P-TMSI for identifying itself and if it has also stored its old P-TMSI Signature, then the MS shall include the old P-TMSI Signature in the Attach Request message.

6.9.2.1 Routeing Area Update Procedure

A routeing area update takes place when an attached MS detects that it has entered a new RA or when the periodic RA update timer has expired or when RRC connection is released with cause "Directed Signalling connection re-establishment" or when the MS has to indicate new access capabilities to the network.

The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the GGSNs or the HLR about the new MS location. A periodic RA update is always an intra-SGSN routeing area update. If the network operates in mode I, an MS that is in CS/PS mode of operation~~both GPRS-attached and IMSI-attached~~ shall perform the Combined RA / LA Update procedures except this CS/PS mode MS is engaged in a CS connection, then it shall perform (non combined) RA Update procedures.

In Iu mode, an RA update is either an intra-SGSN or inter-SGSN RA update, either combined RA / LA update or only RA update, either initiated by an MS in PMM-CONNECTED (only valid after a Serving RNS Relocation Procedure, see clause 6.9.2.2) or in PMM-IDLE state. All the RA update cases are contained in the procedure illustrated in Figure 36.

NOTE 1: The network may receive an RA update from a UE in PMM-CONNECTED state over a new Iu signalling connection. This could happen when the UE enters PMM-IDLE state on receipt of RRC Connection Release with cause "Directed Signalling connection re-establishment" and initiates an RA or Combined RA update procedure (see clause 6.1.2.4.1).

3GPP TSG-SA2 Meeting #24
Madrid, Spain, 22-26 April 2002

Tdoc ~~S2-021293~~S2-021338r1

CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **357** ⌘ **rev** **2** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	RAB assignment during a RA update in PMM-Connected state
Source:	⌘	Alcatel
Work item code:	⌘	TEI5
Date:	⌘	22.4.2002
Category:	⌘	~~A~~ F
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The scenarios for Inter SGSN RA Update and Inter System Change (GSM to UMTS) consider only the case that the MS requests the establishment of the RAB with a Service Request procedure after completion of the RA Update procedure. The SGSN initiated RAB assignment in case of pending downlink data (from the old SGSN and/or theGGSN) is not considered at all in 23.060. SGSN initiated RAB assignment could be done either within the RA Update procedure, as soon as the MS is authenticated and ciphering/integrity protection is switched on, or after the RA Update procedure. To have the gap in the data transfer as small as possible, it is proposed to allow RAB assignment within the RA Update. As long as this is not described in 23.060, there is a risk that SGSN manufacturers and mobile manufacturers take different assumption for point when SGSN initiated RAB assignment is allowed. In consequence this may result in interworking problems.
Summary of change:	⌘	It is clarified that ~~as soon as~~ the new SGSN ~~receives tunnelled PDUs (from the old SGSN or from the old SRNS in case of intra-SGSN), it~~ may initiate RAB establishment after the security functions are executed or wait until completion of the RA update procedure ~~.~~ For the MS, RAB establishment may occur anytime after RA update request is sent.
Consequences if not approved:	⌘	Different assumption concerning the point of RAB assignment may result in interworking problems between the MS and the SGSN

Clauses affected:	⌘	6.9.2.1 , 6.13.2.2
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6.9.2.1 Routeing Area Update Procedure

A routeing area update takes place when an attached MS detects that it has entered a new RA or when the periodic RA update timer has expired or when RRC connection is released with cause "Directed Signalling connection re-establishment", or when the MS has to indicate new access capabilities to the network.
The SGSN detects that it is an intra-SGSN routeing area update by noticing that it also handles the old RA. In this case, the SGSN has the necessary information about the MS and there is no need to inform the GGSNs or the HLR about the new MS location. A periodic RA update is always an intra-SGSN routeing area update. If the network operates in mode I, an MS that is both GPRS-attached and IMSI-attached shall perform the Combined RA / LA Update procedures. In Iu mode, an RA update is either an intra-SGSN or inter-SGSN RA update, either combined RA / LA update or only RA update, either initiated by an MS in PMM-CONNECTED (only valid after a Serving RNS Relocation Procedure, see sub-clause 6.9.2.2) or in PMM-IDLE state. All the RA update cases are contained in the procedure illustrated in Figure 1.

Note: The network may receive an RA update from a UE in PMM-CONNECTED state over a new Iu signalling connection. This could happen when the UE enters PMM-IDLE state on receipt of RRC Connection Release with cause "Directed Signalling connection re-establishment" and initiates an RA or Combined RA update procedure (see sub-clause 6.1.2.4.1).

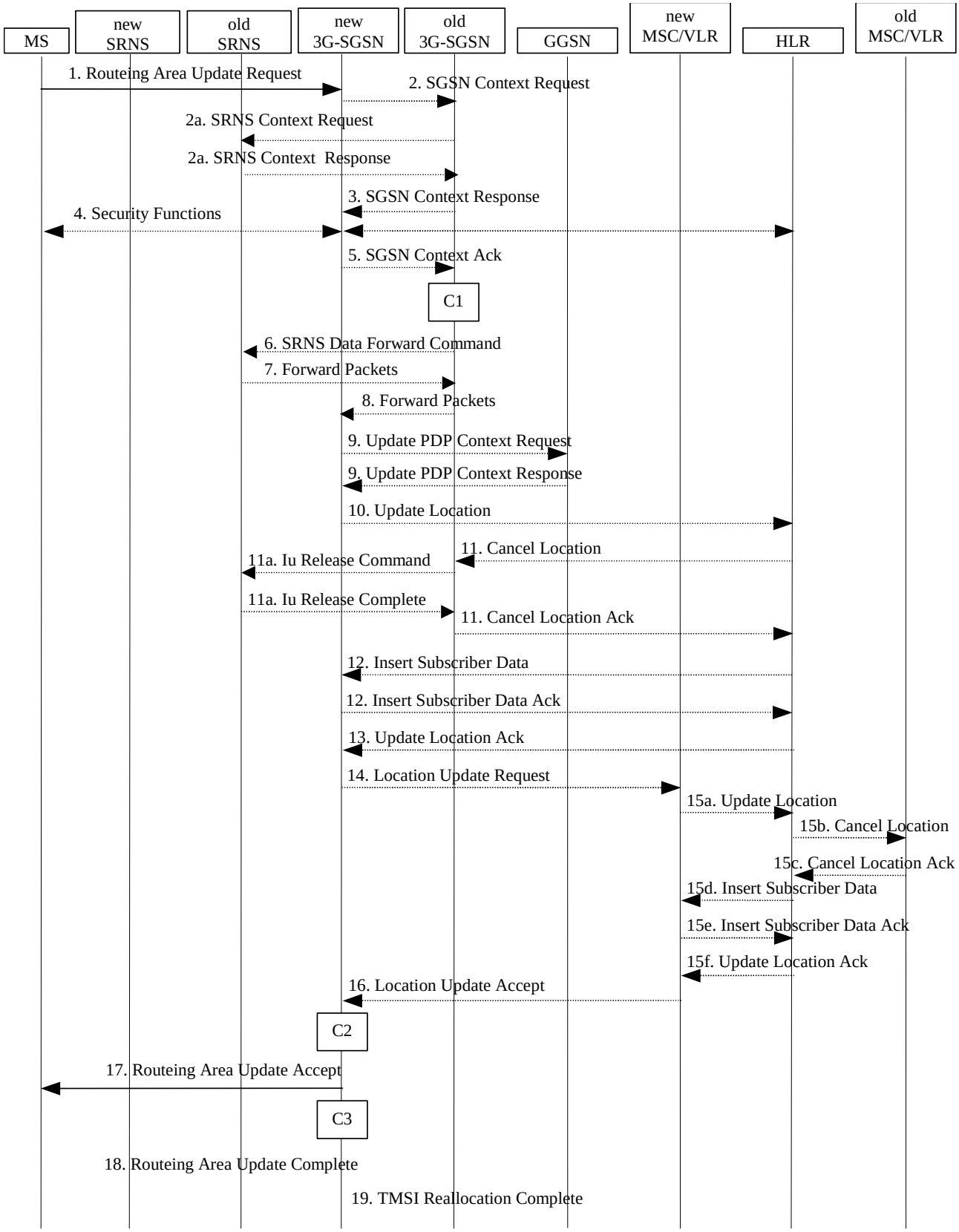


Figure 1: UMTS RA Update Procedure

1) The RRC connection is established, if not already done. The MS sends a Routeing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request, Classmark, DRX Parameters, MS Network Capability) to the new SGSN. The MS shall set a follow-on request if there is pending uplink traffic (signalling or user data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. Update Type shall indicate:

   - RA Update if the RA Update is triggered by a change of RA;
   - Periodic RA Update if the RA update is triggered by the expiry of the Periodic RA Update timer;
   - Combined RA / LA Update if the MS is also IMSI-attached and the LA update shall be performed in network operation mode I (see subclause "Interactions Between SGSN and MSC/VLR"); or
   - Combined RA / LA Update with IMSI attach requested if the MS wants to perform an IMSI attach in network operation mode I.

   The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS. Classmark is described in subclause "MS Network Capability". DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

NOTE: Sending the Routeing Area Update Request message to the SGSN triggers the establishment of a signalling connection between UTRAN and SGSN for the concerned MS.

2) If the RA update is an Inter-SGSN Routeing area update and if the MS was in PMM-IDLE state, the new SGSN sends an SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN starts a timer. If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause.

2a) If the MS is PMM-CONNECTED in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old SGSN shall sends SRNS Context Request (IMSI) message to the old SRNS to retrieve the sequence numbers for the PDP context for inclusion in the SGSN Context Response message. Upon reception of this message, the SRNS buffers and stops sending downlink PDUs to the MS and returns an SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, PDCP-SNUs) message. The SRNS shall include for each PDP context the next in-sequence GTP sequence number to be sent to the MS and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context which uses lossless PDCP, the SRNS also includes the uplink PDCP sequence number (PDCP-SNU). PDCP-SNU shall be the next in-sequence PDCP sequence number expected from the MS (per each active radio bearer). No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

3) The old 3G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next PDU to be sent to the MS. Each PDP Context also includes PDCP sequence numbers if PDCP sequence numbers are received from the old SRNS. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request. The GTP sequence numbers received from the old 3G-SGSN are only relevant if delivery order is required for the PDP context (QoS profile).

4) Security functions may be executed. These procedures are defined in subclause "Security Function". If the security functions do not authenticate the MS correctly, the routeing area update shall be rejected, and the new SGSN shall send a reject indication to the old SGSN. The old SGSN shall continue as if the SGSN Context Request was never received.

5) If the RA update is an Inter-SGSN Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be

updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

6) If the MS is in PMM-CONNECTED state in the old 3G-SGSN or, in case of an intra-SGSN RA update, if the MS is PMM connected and the RAU was received over another Iu connection than the established one, the old 3G-SGSN sends an SRNS Data Forward Command (RAB ID, Transport Layer Address, Iu Transport Association) message to the SRNS. Upon receipt of the SRNS Data Forward Command message from the 3G-SGSN, the SRNS shall start the data-forwarding timer.

7) For each indicated RAB the SRNS starts duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. For each radio bearer which uses lossless PDCP the SRNS shall start tunnelling the partly transmitted and the transmitted but not acknowledged PDCP-PDUs together with their related PDCP downlink sequence number, and start duplicating and tunnelling the buffered GTP PDUs to the old 3G-SGSN. Upon receipt of the SRNS Data Forward Command message from the 3G□SGSN, the SRNS shall start the data-forwarding timer.

8) If the RA update is an Inter-SGSN RA Update, the old 3G-SGSN tunnels the GTP PDUs to the new 3G-SGSN. No conversion of PDCP sequence numbers to SNDCP sequence numbers shall be done in the 3G-SGSN.

~~From now on , the new SGSN may initiate the RAB establishment in order to send the tunnelled GTP PDUs to the UE.~~

9) If the RA update is an Inter-SGSN RA Update and if the MS was not in PMM-CONNECTED state in the new 3G-SGSN, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, Tunnel Endpoint Identifier,) to the GGSNs. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier). Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state in the new 3G-SGSN, the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

10) If the RA update is an Inter-SGSN RA Update, the new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.

11) If the RA update is an Inter-SGSN RA Update, the HLR sends Cancel Location (IMSI, Cancellation Type) to the old SGSN with Cancellation Type set to Update Procedure. If the timer described in step 2 is not running, the old SGSN removes the MM context. Otherwise, the contexts are removed only when the timer expires. It also ensures that the MM context is kept in the old SGSN in case the MS initiates another inter SGSN routeing area update before completing the ongoing routeing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).

11a) On receipt of Cancel Location, if the MS is PMM-CONNECTED in the old 3G-SGSN, the old 3G-SGSN sends an Iu Release Command message to the old SRNC. When the data-forwarding timer expires, the SRNS responds with an Iu Release Complete message.

12) If the RA update is an nter-SGSN RA Update, the HLR sends Insert Subscriber Data (IMSI, subscription data) to the new SGSN. The new SGSN validates the MS's presence in the (new) RA. If due to regional subscription restrictions the MS is not allowed to be attached in the RA, the SGSN rejects the Routeing Area Update Request with an appropriate cause, and may return an Insert Subscriber Data Ack (IMSI, SGSN Area Restricted) message to the HLR. If all checks are successful, the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

13) If the RA update is an Inter-SGSN RA Update, the HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.

14) If Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the association has to be established, and the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with ISI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI via a table in the SGSN. The SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 8). The VLR creates or updates the association with the SGSN by storing SGSN Number.

15) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

   a) The new VLR sends an Update Location (new VLR) to the HLR.

   b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

   c) The old VLR acknowledges with Cancel Location Ack (IMSI).

   d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

   e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

   f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

16) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.

17) The new SGSN validates the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).

18) The MS confirms the reallocation of the TMSIs by returning a Routeing Area Update Complete message to the SGSN.

19) The new SGSN sends a TMSI Reallocation Complete message to the new VLR if the MS confirms the VLR TMSI.

NOTE: Steps 15, 16, and 19 are performed only if step 14 is performed.

NOTE: The new SGSN may initiate RAB establishment after execution of the security functions (step 4), or wait until completion of the RA update procedure. For the MS, RAB establishment may occur anytime after the RA update request is sent (step 1).

In the case of a rejected routeing area update operation, due to regional subscription or roaming restrictions, the new SGSN shall not construct an MM context. A reject shall be returned to the MS with an appropriate cause. The MS shall not re-attempt a routeing area update to that RA. The RAI value shall be deleted when the MS is powered up.
If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.
If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.

NOTE: In case MS was in PMM-CONNECTED state the PDP Contexts are sent already in the Forward Relocation Request message as described in subclause "Serving RNS relocation procedures".

If the routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.
If the Location Update Accept message indicates a reject, this should be indicated to the MS, and the MS shall not access non-PS services until a successful location update is performed.
CAMEL procedure calls shall be performed; see referenced procedures in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach.

They are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. The procedure returns as result "Continue".

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

6.13.2.2 GSM to UMTS Inter-SGSN Change

The inter-system change from GSM to UMTS takes place when a GPRS-attached MS changes from GSM radio access to UTRAN and the UTRAN node serving the MS is served by a different SGSN. In this case the RA changes. Therefore, the MS shall initiate a UMTS RA update procedure by establishing an RRC connection and initiating the RA update procedure. The RA update procedure is either combined RA / LA update or only RA update, these RA update cases are illustrated in Figure 2.
If the network operates in mode I, then an MS, that is both PS-attached and CS-attached, shall perform the Combined RA / LA Update procedures. This concerns only idle mode (see 3G TS 23.122), as no combined RA / LA updates are performed during a CS connection.

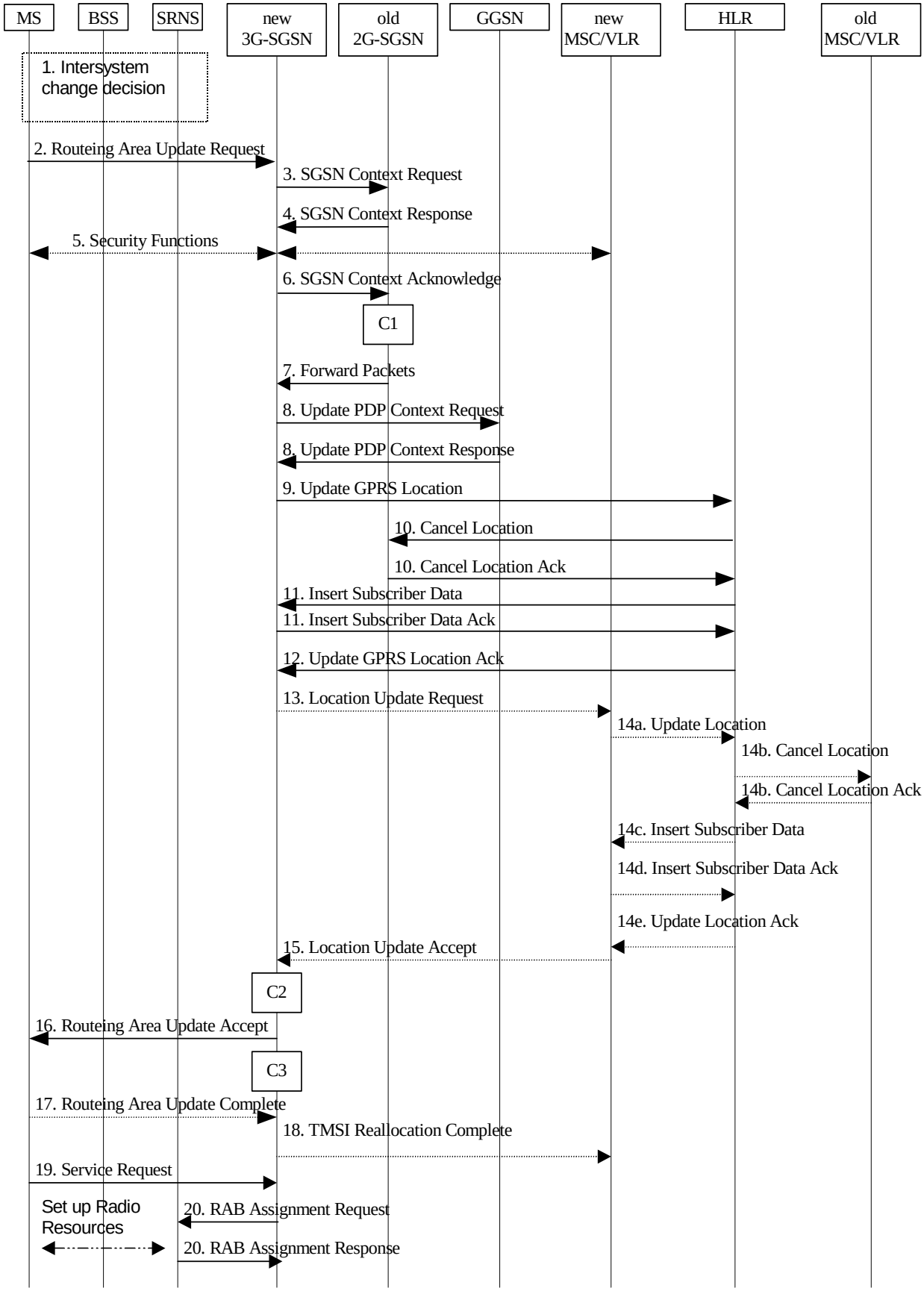


Figure 2: GSM to UMTS Inter SGSN Change

1) The MS or BSS or UTRAN decides to perform an inter-system change, which makes the MS switch to a new cell that supports UMTS radio technology, and stops transmission to the network.

2) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM, MS Network Capability) message to the new 3G-SGSN. Update Type shall indicate RA update or combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested, and also if the MS has a follow-on request, i.e. if there is pending uplink traffic (signalling or data). The SGSN may use, as an implementation option, the follow-on request indication to release or keep the Iu connection after the completion of the RA update procedure. The SRNC shall add the Routeing Area Identity including the RAC and LAC of the area where the MS is located before forwarding the message to the 3G-SGSN. This RA identity corresponds to the RAI in the MM system information sent by the SRNC to the MS.

3) The new 3G-SGSN uses the old RAI received from the MS to derive the old 2G-SGSN address, and sends an SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) message to the old 2G-SGSN to get the MM and PDP contexts for the MS. The old 2G-SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old 2G-SGSN. If the received old P-TMSI Signature does not match the stored value, the old 2G-SGSN should initiate the security functions in the new 3G-SGSN. If the security functions authenticate the MS correctly, the new 3G-SGSN shall send an SGSN Context Request (old RAI, IMSI, MS Validated, New SGSN Address) message to the old 2G-SGSN. MS Validated indicates that the new 3G-SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new 3G-SGSN indicates that it has authenticated the MS correctly, the old 2G-SGSN starts a timer and stops the transmission of N-PDUs to the MS.

4) The old 2G-SGSN responds with an SGSN Context Response (MM Context, PDP Contexts) message. Each PDP Context includes the GTP sequence number for the next downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode SNDCP to the MS and the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode SNDCP from the MS. The new 3G-SGSN derives the corresponding PDCP sequence numbers from these N-PDU sequence numbers by adding eight most significant bits "1". These PDCP sequence numbers are stored in the 3G-SGSN PDP contexts. The new 3G-SGSN shall ignore the MS Network Capability contained in MM Context of SGSN Context Response only when it has previously received an MS Network Capability in the Routeing Area Request.

5) Security functions may be executed.

6) The new 3G-SGSN sends an SGSN Context Acknowledge message to the old 2G-SGSN. This informs the old 2G-SGSN that the new 3G-SGSN is ready to receive data packets belonging to the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

7) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. Additional N-PDUs received from the GGSN before the timer described in step 3 expires are also duplicated and tunnelled to the new 3G-SGSN. N-PDUs that were already sent to the MS in acknowledged mode SNDCP and that are not yet acknowledged by the MS are tunnelled together with the corresponding SNDCP N-PDU sequence numbers. No PDCP sequence numbers shall be indicated for these N-PDUs. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.

~~From now on , the new 3G-SGSN may initiate the RAB establishment in order to send the tunnelled GTP PDUs to the UE.~~

8) The new 3G-SGSN sends an Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) message to each GGSN concerned. Each GGSN updates its PDP context fields and returns an Update PDP Context Response (TEID) message.

9) The new 3G-SGSN informs the HLR of the change of SGSN by sending an Update GPRS Location (SGSN Number, SGSN Address, IMSI) message to the HLR.

10) The HLR sends a Cancel Location (IMSI, Cancellation Type) message to the old 2G-SGSN. The old 2G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. If the timer is running, the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with a Cancel Location Ack (IMSI) message.

11) The HLR sends an Insert Subscriber Data (IMSI, GPRS Subscription Data) message to the new 3G-SGSN. The 3G-SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

12) The HLR acknowledges the Update GPRS Location by returning an Update GPRS Location Ack (IMSI) message to the new 3G-SGSN.

13) If the association has to be established, if Update Type indicates combined RA / LA update with IMSI attach requested, or if the LA changed with the routeing area update, the new SGSN sends a Location Update Request (new LAI, IMSI, SGSN Number, Location Update Type) to the VLR. Location Update Type shall indicate IMSI attach if Update Type in step 1 indicated combined RA / LA update with IMSI attach requested. Otherwise, Location Update Type shall indicate normal location update. The VLR number is translated from the RAI by the 3G-SGSN. The 3G-SGSN starts the location update procedure towards the new MSC/VLR upon receipt of the first Insert Subscriber Data message from the HLR in step 12). The VLR creates or updates the association with the 3G-SGSN by storing SGSN Number.

14) If the subscriber data in the VLR is marked as not confirmed by the HLR, the new VLR informs the HLR. The HLR cancels the old VLR and inserts subscriber data in the new VLR (this signalling is not modified from existing GSM signalling and is included here for illustrative purposes):

    a) The new VLR sends an Update Location (new VLR) to the HLR.

    b) The HLR cancels the data in the old VLR by sending Cancel Location (IMSI) to the old VLR.

    c) The old VLR acknowledges with Cancel Location Ack (IMSI).

    d) The HLR sends Insert Subscriber Data (IMSI, GSM subscriber data) to the new VLR.

    e) The new VLR acknowledges with Insert Subscriber Data Ack (IMSI).

    f) The HLR responds with Update Location Ack (IMSI) to the new VLR.

15) The new VLR allocates a new TMSI and responds with Location Update Accept (VLR TMSI) to the 3G-SGSN. VLR TMSI is optional if the VLR has not changed.

16) The new 3G-SGSN validate the MS's presence in the new RA. If due to roaming restrictions the MS is not allowed to be attached in the RA, or if subscription checking fails, the new 3G-SGSN rejects the routeing area update with an appropriate cause. If all checks are successful, the new 3G-SGSN constructs MM and PDP contexts for the MS. The new 3G-SGSN responds to the MS with a Routeing Area Update Accept (P-TMSI, P-TMSI signature) message.

17) The MS acknowledges the new P-TMSI by returning a Routeing Area Update Complete message to the SGSN.

18) The new 3G-SGSN sends TMSI Reallocation Complete message to the new VLR, if the MS confirms the VLR TMSI.

19) If the MS has uplink data or signalling pending it shall send a Service Request (P-TMSI, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies the requested service. Service Type shall indicate one of the following: Data or Signalling.

20) If the MS sent the Service Request, the new 3G-SGSN requests the SRNS to establish a radio access bearer by sending a RAB Assignment Request (RAB ID(s), QoS Profile(s), GTP-SNDs, GTP-SNUs, PDCP-SNUs) message to the SRNS. The PDCP sequence numbers are derived from the N-PDU sequence numbers in step 4 and are stored in the SGSN PDP context. The SRNS sends a Radio Bearer Setup Request (PDCP-SNUs) message to the MS. The MS responds with a Radio Bearer Setup Complete (PDCP-SNDs) message. The MS deducts PDCP-SND from its Receive N-PDU Number by adding eight most significant bits "1". The SRNS responds with a RAB Assignment Response message. The SRNS shall discard all N-PDUs tunnelled from the SGSN with N-PDU sequence numbers older than the eight least significant bits of the PDCP-SNDs received from the MS. Other N-PDUs shall be transmitted to the MS. The MS shall discard all N-PDUs with SNDCP sequence numbers older than the eight least significant bits of the PDCP-SNUs received from the SRNS. Other N-PDUs shall be transmitted to the SRNS. The SRNS negotiates with the MS for each radio bearer the use of lossless PDCP or not regardless whether the old 2G-SGSN used acknowledged or unacknowledged SNDCP for the related NSAPI or not.

NOTE: The NSAPI value is carried in the RAB ID IE.

NOTE: The new SGSN may initiate RAB establishment after execution of the security functions (step 5), or wait until completion of the RA update procedure. For the MS, RAB establishment may occur anytime after the RA update request is sent (step 2).

If the new SGSN is unable to update the PDP context in one or more GGSNs, the new SGSN shall deactivate the corresponding PDP contexts as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.
If the new SGSN is unable to support the same number of active PDP contexts as received from old SGSN, the new SGSN shall first update all contexts in one or more GGSNs and then deactivate the context(s) that it cannot maintain as described in subclause "PDP Context Deactivation Initiated by SGSN Procedure". This shall not cause the SGSN to reject the routeing area update.
CAMEL procedure calls shall be performed, see referenced procedure in 3G TS 23.078:

C1) CAMEL_GPRS_PDP_Context_Disconnection and CAMEL_GPRS_Detach

These procedures are called in the following order:

- The CAMEL_GPRS_PDP_Context_Disconnection procedure is called several times: once per PDP context. The procedure returns as result "Continue".

- Then the CAMEL_GPRS_Detach procedure is called once. It returns as result "Continue".

C2) CAMEL_GPRS_Routeing_Area_Update_Session.

The procedure returns as result "Continue".

C3) CAMEL_GPRS_Routeing_Area_Update_Context.

This procedure is called several times: once per PDP context. It returns as result "Continue".

3GPP TSG SA WG2 #24
Madrid, Spain, 22nd – 26th April 2002

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CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **360** ⌘ **rev** **2** ⌘ Current version: **4.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network **X**

Title:	⌘	Corrections for Authentication procedures
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	06.05.2002
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘

There are a number of inconsistencies and errors in the description of the authentication procedures:

The descriptions of the main GSM and UMTS concepts describe only the use of GSM authentication for GSM access allthough authentication procedures are independent of the access. Comparison with “existing GSM” is made ?

The differences between and the use of the GSM or UMTS authentication procedures may be misunderstood, especially it is not made clear that both procedures may be used via GSM or UTRAN radio access. The comparison with earlier GSM procedus is misleading and not to understand as GSM was changed some time ago to A/Gb mode.

GSM authentication synchronises ciphering only for A/Gb mode and not when used in Iu mode.

Quintet is the term used in security specifications (Ex. TS 33.102), not Quintuplet. The UMTS authentication uses the parameter KSI not CKSN.

The start of ciphering is not described for UMTS authentication although the same as for GSM authentication applies.

The scope of ciphering is shown for GPRS and UMTS. GPRS covers GSM and UMTS. The scope needs to be corrected to GSM GPRS.

The security parameters stored in MS and SGSN contexts need to be corrected as the availability of certain parameters depend on GSM or UMTS authentication procedures while the columns in the tables represent the radio access GSM or UMTS.

A note above table 6 defines R99 SGSNs.

Summary of change: ⌘ Corrections for the authentication procedures.

Consequences if not approved: ⌘ Inconsistencies and errors within 23.060 and discrepancies to security specification 33.102.

Clauses affected:	⌘	4.1, 4.2, 6.8, 6.8.1, 6.8.3.1, 13.2, 13.4		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

4.1 Main GSM Concepts

For GPRS, specific GSM radio channels are defined, and the allocation of these channels is flexible: from 1 to 8 radio interface timeslots can be allocated per TDMA frame. The active users share timeslots, which are allocated separately for uplink and downlink. The radio interface resources can be shared dynamically between speech and data services as a function of service load and operator preference. Various radio channel coding schemes are specified to allow bit rates from 9 to more than 150 kbit/s per user. EGPRS is an enhancement of GSM allowing higher bit rates on the radio interface. The higher bit rates are achieved by using a new modulation and new coding schemes in the MS and the BSS.

Three GSM MS modes of operation are supported. An MS in class-A mode of operation operates GPRS and other GSM services simultaneously. An MS in class-B mode of operation monitors control channels for GSM GPRS and other GSM services simultaneously, but can only operate one set of services at one time. An MS in class-C mode of operation exclusively operates GPRS services.

User data can be compressed and protected with retransmission protocols for efficiency and reliability.

~~In A/Gb mode, GPRS security functionality is equivalent to the existing GSM security. The SGSN performs authentication and cipher setting procedures based on the same algorithms, keys, and criteria as in existing GSM.~~ GPRS uses a ciphering algorithm optimised for packet data transmission. A GPRS ME can access the GPRS services with SIMs that are not GPRS-aware, and with GPRS-aware SIMs.

An MS may autonomously select a cell, or the base station system may instruct the MS to select a certain cell. The MS informs the network when it re-selects another cell or group of cells known as a routeing area.

4.2 Main UMTS Concepts

In Iu mode, radio resources are allocated to MSs in a very flexible manner. Depending on the level of activity, MSs are allocated shared contention-based radio resources or dedicated radio resources for user packet transmission.

Three UMTS MS modes of operation are supported in Iu mode: The PS/CS mode of operation corresponds to class-A mode of operation in A/Gb mode. The PS mode of operation corresponds to class-C mode of operation in A/Gb mode. The CS mode of operation is the outside the scope of this specification.

~~UMTS security functionality is equivalent to or of higher functionality than the existing GSM security.~~ UMTS may use a security algorithm different from GSM. The 3G-SGSN performs the authentication procedure, and the RNC performs the ciphering procedure based on the algorithm for UMTS.

In Iu mode, different levels of mobility procedures are executed depending upon the MS state. When an MS has an active RRC connection to UTRAN, the MS performs either UTRAN Registration Area updating procedures or handover or cell update procedures depending on the level that UTRAN is tracking the MS position. When an MS does not have an active RRC connection (i.e., it is in idle mode), the MS performs RA updating procedures. In all the procedures, the network controls the cell selection by setting cell selection parameters and/or restriction information.

6.8 Security Function

The Security function:

- Guards against unauthorised packet-domain service usage (authentication of the MS by the network and service request validation).
- Provides user identity confidentiality (temporary identification and ciphering).
- Provides user data and signalling confidentiality (ciphering).
- Provides, for UMTS radio access only, data integrity and origin authentication of signalling data (integrity protection).

- Provides, by~~for~~ UMTS authentication~~subscriber~~ (USIM) only, authentication of the network by the MS.

Security-related network functions are described in GSM 03.20 and in 3G TS 33.102.

6.8.1 Authentication

The Authentication function includes two types of authentication: "UMTS authentication" and "GSM authentication". These procedures are used independent of the GSM or UTRAN RANs, i.e. each procedure may be executed in A/Gb mode or in Iu mode. UMTS authentication requires a USIM for the MS and Authentication Quintets in the SGSN. GSM authentication bases on a SIM for the MS and Authentication Triplets in the SGSN or it bases on a GSM capable USIM for the MS and parameters derived from Authentication Quintets in the SGSN.

"UMTS authentication" implies mutual authentication, i.e., authentication of the MS by the network and authentication of the network by the MS. It also implies establishment of a new UMTS ciphering key (CK) and integrity key (IK) agreement between the SGSN and the MS.

"GSM authentication" implies authentication of the MS by the network and establishment of a new GSM ciphering key (Kc) agreement between the SGSN and the MS.

6.8.1.1 GSM Authentication ~~of GSM Subscriber~~

~~Authentication procedures already defined in A/Gb mode shall be used, with the distinction that the procedures are executed from the SGSN.~~ The GSM~~PRS~~ Authentication procedure performs subscriber authentication, or selection of the ciphering algorithm, or both. ~~and~~In A/Gb mode it performs in addition the synchronisation of the start of ciphering~~, or both~~. Authentication triplets are stored in the SGSN. The MSC/VLR shall not authenticate the MS via the SGSN upon IMSI attach, nor location update, but may authenticate the MS during CS connection establishment. Security-related network functions are described in GSM 03.20 [6].

The GSM Authentication ~~of GSM Subscriber~~ procedure is illustrated in Figure 27.

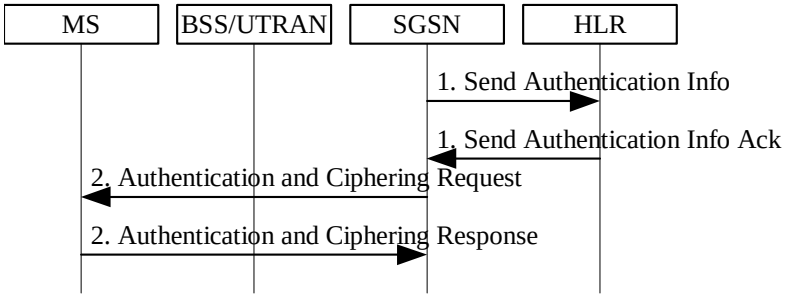

Figure 27: GSM Authentication ~~of GSM Subscriber~~ Procedure

1) If the SGSN does not have a previously stored authentication vector~~triplets~~, a Send Authentication Info (IMSI) message is sent to the HLR. The HLR responds with a Send Authentication Info Ack (Authentication Triplets or Quintets) message. ~~Each Authentication Triplet includes RAND, SRES, and Kc.~~

2) The SGSN sends an Authentication and Ciphering Request (RAND, CKSN, Ciphering Algorithm) message to the MS. The MS responds with an Authentication and Ciphering Response (SRES) message.

In A/Gb mode, the MS starts ciphering after sending the Authentication and Ciphering Response message as described in subclause "Start of Ciphering".

In Iu mode, the 3G-SGSN and the MS shall generate the UMTS CK and IK from the GSM Kc using the standardised conversion functions specified for this purpose in 3G TS 33.102.

In Iu mode, the start of ciphering is controlled by the security mode procedure described in 3G TS 33.102.

If the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue, the GSM Authentication ~~of GSM Subscriber~~ Procedure fails.

6.8.1.2 UMTS Authentication ~~of UMTS Subscriber~~

The UMTS authentication procedure is described in 3G TS 33.102. The UMTS authentication procedure executed from the SGSN performs both the mutual authentication and security keys agreement. Authentication quint~~upl~~ets are stored in the SGSN. The MSC/VLR shall not authenticate the MS via the SGSN upon IMSI attach nor upon location update, but may authenticate the MS during CS connection establishment.

The UMTS Authentication ~~of UMTS Subscriber procedure (USIM)~~ is illustrated in Figure 28.

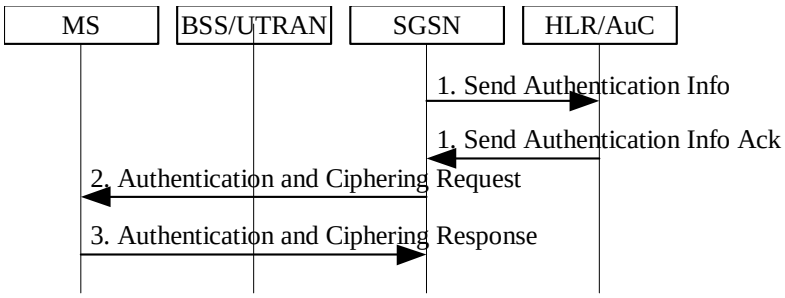

Figure 28: UMTS Authentication ~~of UMTS Subscriber~~ Procedure

1) If the SGSN does not have a previously stored UMTS Authentication Vector~~s~~ (quint~~upl~~et~~s~~), a Send Authentication Info (IMSI) message is sent to the HLR. Upon receipt of this message ~~for a UMTS user~~, the HLR/AuC responds with a Send Authentication Info Ack message including an ordered array of quint~~upl~~ets to the SGSN. Each quint~~upl~~et contains RAND, XRES, AUTN, CK, and IK. The generation of quint~~upl~~ets in HLR/AuC for a UMTS user is performed as specified in 3G TS 33.102.

2) At authentication of a UMTS subscriber, the SGSN selects the next in-order quint~~upl~~et and transmits the RAND and AUTN, that belong to this quint~~upl~~et, to the MS in the Authentication and Ciphering Request (RAND, AUTN, KSI~~CKSN~~) message. The SGSN also selects a Key Set Identifier(~~,~~ KSI)~~ciphering key sequence number, CKSN~~, and includes this in the message.

3) At reception of this message, the USIM in the MS verifies AUTN and, if accepted, the USIM computes the signature of RAND, RES, in accordance with 3G TS 33.102. If the USIM considers the authentication as being successful, the MS returns an Authentication and Ciphering Response (RES) message to the SGSN. During generation of authentication vectors, the USIM in the MS also~~p~~ computes a new Ciphering Key(~~,~~ CK), and a new Integrity Key(~~,~~ IK). These keys are stored together with the KSI~~CKSN~~ until KSI~~CKSN~~ is updated at the next authentication.

   If the USIM considers the authentication being unsuccessful, e.g., in case of an authentication synchronisation failure, the MS returns the Authentication and Ciphering Failure message to the SGSN. The actions then taken are described in 3G TS 33.102.

In A/Gb mode, the SGSN and the MS shall generate the Kc from the UMTS CK and IK using the standardised conversion function specified for this purpose in 3G TS 33.102.

In A/Gb mode, the MS starts ciphering after sending the Authentication and Ciphering Response message as described in clause "Start of Ciphering".

In Iu mode, the start of ciphering is controlled by the security mode procedure described in 3GPP TS 33.102.

If the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue, the UMTS Authentication ~~of UMTS Subscriber~~ Procedure fails.

6.8.3.1 Scope of Ciphering

In A/Gb mode, the scope of ciphering is from the ciphering function in the SGSN to the ciphering function in the MS. Ciphering is done in the LLC layer, and from the perspective of the existing GSM MS-BTS radio path, an LLC PDU is transmitted as plain text.

In Iu mode, the scope of ciphering is from the ciphering function in the UTRAN to the ciphering function in the MS.

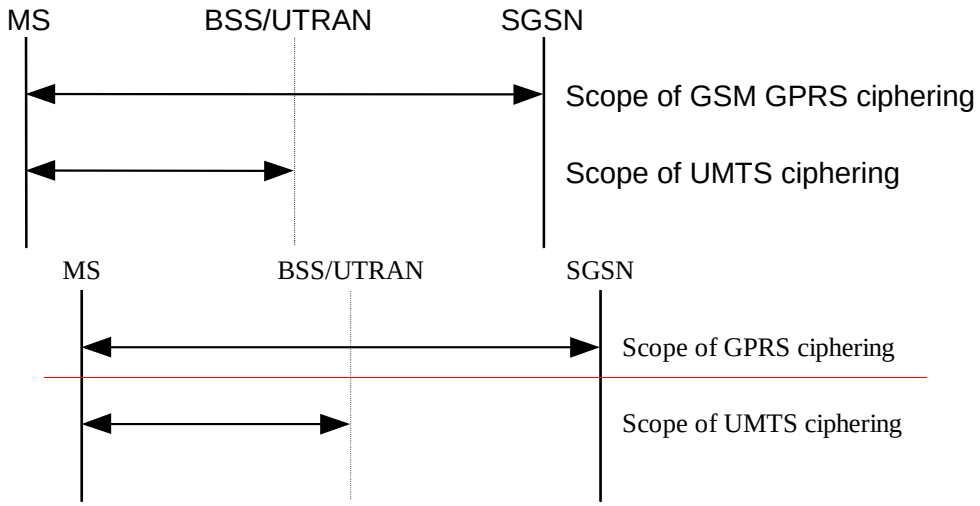

Figure 30: Scope of Ciphering

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA des not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

Note: 2G-SGSN and 3G-SGSN refer to R99 SGSNs with either GSM or UMTS access.

Table 6: SGSN MM and PDP Contexts

Field	Description	A/Gb mode~~G SM~~	Iu mode~~U MTS~~
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
~~Authentication Triplets~~	~~Authentication and ciphering parameters.~~	~~X~~	~~X~~
Authentication Vectors	Authentication and ciphering parameters (authentication triplets or quintets)~~for UMTS~~.	X	X
Kc	Currently used A/Gb mode ciphering key.	X	2)~~X~~
CKSN	Ciphering key sequence number of Kc.	X	2)
Ciphering algorithm	Selected ciphering algorithm ~~(GEA)~~.	X	X
CK	Currently used Iu mode ciphering key.	1)~~X~~	X
IK	Currently used Iu mode integrity key.	1)~~X~~	X
KSI	Key Set Identifier.	1)	X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	X
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g., normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3G TS 23.016	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g., PPP or IP.	X	X
PDP Address	PDP address, e.g., an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data	X	

Field	Description	A/Gb mode GSM	Iu mode UMTS
	transmission.		
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g., normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

The information marked with a "1)" in table 6 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 6 may be maintained if authentication is performed by the GSM authentication procedure.

13.4 MS

Each packet domain MS maintains MM and PDP context information in IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, and PMM-CONNECTED states. The information may be contained in the MS and the TE. Table 8 shows the MS context fields.

Table 8: MS MM and PDP Contexts

Field	SIM	Description	A/Gb mode~~G~~SM	Iu mode~~U~~MTS
IMSI	G, U	International Mobile Subscriber Identity.	X	X
MM State		Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	G, U	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	G, U	A signature used for identification checking purposes.	X	X
Routeing Area	G, U	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	G	Current A/Gb mode~~GPRS~~ ciphering key.	X	2)
KSI / CKSN ~~/ KSI~~	G, U	Key Set Identifier for IK Next, CK Next~~,~~ /~~and~~ key sequence number of Kc.	X	X
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK		Currently used Iu mode ciphering key.	1)	X
CK Next	U	Iu mode~~UMTS~~ ciphering key to be used after the next security mode command.	1)	X
IK		Currently used Iu mode integrity key.	1)	X
IK Next	U	Integrity key to be used after the next security mode command.	1)	X
MS Radio Access Capability		MS radio access capabilities.	X	X
UE Capability		UE radio capabilities.		X
MS Network Capability		MS network capabilities.	X	X
DRX Parameters		Discontinuous reception parameters.	X	X
Radio Priority SMS		The RLC/MAC radio priority level for uplink SMS transmission.	X	
Each MM context contains zero or more of the following PDP contexts:				
PDP Type		PDP type, e.g., PPP or IP.	X	X
PDP Address		PDP address, e.g., an IP address.	X	X
PDP State		Packet data protocol state, INACTIVE or ACTIVE.	X	X
Dynamic Address Allowed		Specifies whether the MS is allowed to use a dynamic address.	X	X
APN Requested		The APN requested.	X	X
NSAPI		Network layer Service Access Point Identifier.	X	X
TI		Transaction Identifier.	X	X
QoS Profile Requested		The quality of service profile requested.	X	X
QoS Profile Negotiated		The quality of service profile negotiated.	X	X
TFT		Traffic flow template.	X	X
Radio Priority		The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id		Packet flow identifier.	X	
Send N-PDU Number		SNDCP sequence number of the next uplink N-PDU to be sent to the SGSN.	X	X
Receive N-PDU Number		SNDCP sequence number of the next downlink N-PDU expected from the SGSN.	X	X
PDCP-SND		Sequence number of the next downlink in-sequence PDCP-PDU expected from the RNC.		X
PDCP-SNU		Sequence number of the next uplink in-sequence PDCP-PDU to be sent to the RNC.		X

The information marked with a "1)" in table 8 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 8 may be maintained if authentication is performed by the GSM authentication procedure.

The information marked with a "U" in table 8 shall be stored in the USIM.

The information marked with a "G" in table 8:

- shall be stored in the GSIM if the connected SIM is GPRS-aware; and
- may be stored in the ME after GPRS detach if the connected GSIM is not GPRS-aware.

If the GSIM is packet domain service-aware, then the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the GSIM shall be used for packet domain services.

If the GSIM is not packet domain service-aware, the P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the ME shall be used if and only if the IMSI stored in the GSIM is identical to the IMSI image maintained in the ME. If the IMSI stored in the GSIM is different from the IMSI image in the ME, the IMSI image in the ME shall not be used, and the MS shall identify itself with the IMSI stored in the SIM when performing a GPRS attach. IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN may be stored in the ME after the GPRS attach has been successfully performed.

When using a USIM, the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK Next, IK Next, and CKSN / KSI stored in the USIM, and the CK and IK stored in the ME, shall be used for packet domain services.

3GPP TSG SA WG2 #24
Madrid, Spain, 22nd – 26th April 2002

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CR-Form-v5

CHANGE REQUEST

⌘ **23.060** **CR** **359** ⌘ **rev** **3** ⌘ Current version: **3.11.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network **X**

Title:	⌘	Corrections for Authentication procedures
Source:	⌘	Siemens
Work item code:	⌘	TEI
Date:	⌘	06.05.2002
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change: ⌘

There are a number of inconsistencies and errors in the description of the authentication procedures:

The descriptions of the main GSM and UMTS concepts describe only the use of GSM authentication for GSM access allthough authentication procedures are independent of the access. Comparison with “existing GSM” is made ?

The differences between and the use of the GSM or UMTS authentication procedures may be misunderstood, especially it is not made clear that both procedures may be used via GSM or UTRAN radio access. The comparison with earlier GSM procedus is misleading and not to understand as GSM was changed some time ago to A/Gb mode.

GSM authentication synchronises ciphering only for A/Gb mode and not when used in Iu mode.

Quintet is the term used in security specifications (Ex. TS 33.102), not Quintuplet. The UMTS authentication uses the parameter KSI not CKSN.

The start of ciphering is not described for UMTS authentication although the same as for GSM authentication applies.

The scope of ciphering is shown for GPRS and UMTS. GPRS covers GSM and UMTS. The scope needs to be corrected to GSM GPRS.

The security parameters stored in MS and SGSN contexts need to be corrected as the availability of certain parameters depend on GSM or UMTS authentication procedures while the columns in the tables represent the radio access GSM or UMTS.

Summary of change: ⌘ Corrections for the authentication procedures.

Consequences if not approved: ⌘ Inconsistencies and errors within 23.060 and discrepancies to security specification 33.102.

Clauses affected: ⌘ 4.1, 4.2, 6.8, 6.8.1, 6.8.3.1, 13.2, 13.4

Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘			

4.1 Main GSM Concepts

For GPRS, specific GSM radio channels are defined, and the allocation of these channels is flexible: from 1 to 8 radio interface timeslots can be allocated per TDMA frame. The active users share timeslots, which are allocated separately for uplink and downlink. The radio interface resources can be shared dynamically between speech and data services as a function of service load and operator preference. Various radio channel coding schemes are specified to allow bit rates from 9 to more than 150 kbit/s per user. EGPRS is an enhancement of GSM allowing higher bit rates on the radio interface. The higher bit rates are achieved by using a new modulation and new coding schemes in the MS and the BSS.

Three GSM MS modes of operation are supported. An MS in class-A mode of operation operates GPRS and other GSM services simultaneously. An MS in class-B mode of operation monitors control channels for GSM GPRS and other GSM services simultaneously, but can only operate one set of services at one time. An MS in class-C mode of operation exclusively operates GPRS services.

User data can be compressed and protected with retransmission protocols for efficiency and reliability.

~~In A/Gb mode, GPRS security functionality is equivalent to the existing GSM security. The SGSN performs authentication and cipher setting procedures based on the same algorithms, keys, and criteria as in existing GSM.~~ GPRS uses a ciphering algorithm optimised for packet data transmission. A GPRS ME can access the GPRS services with SIMs that are not GPRS-aware, and with GPRS-aware SIMs.

An MS may autonomously select a cell, or the base station system may instruct the MS to select a certain cell. The MS informs the network when it re-selects another cell or group of cells known as a routeing area.

4.2 Main UMTS Concepts

In Iu mode, radio resources are allocated to MSs in a very flexible manner. Depending on the level of activity, MSs are allocated shared contention-based radio resources or dedicated radio resources for user packet transmission.

Three UMTS MS modes of operation are supported in Iu mode: The PS/CS mode of operation corresponds to class-A mode of operation in A/Gb mode. The PS mode of operation corresponds to class-C mode of operation in A/Gb mode. The CS mode of operation is the outside the scope of this specification.

~~UMTS security functionality is equivalent to or of higher functionality than the existing GSM security.~~ UMTS may use a security algorithm different from GSM. The 3G-SGSN performs the authentication procedure, and the RNC performs the ciphering procedure based on the algorithm for UMTS.

In Iu mode, different levels of mobility procedures are executed depending upon the MS state. When an MS has an active RRC connection to UTRAN, the MS performs either UTRAN Registration Area updating procedures or handover or cell update procedures depending on the level that UTRAN is tracking the MS position. When an MS does not have an active RRC connection (i.e., it is in idle mode), the MS performs RA updating procedures. In all the procedures, the network controls the cell selection by setting cell selection parameters and/or restriction information.

6.8 Security Function

The Security function:

- Guards against unauthorised packet-domain service usage (authentication of the MS by the network and service request validation).
- Provides user identity confidentiality (temporary identification and ciphering).
- Provides user data and signalling confidentiality (ciphering).
- Provides, for UMTS radio access only, data integrity and origin authentication of signalling data (integrity protection).

- Provides, by~~for~~ UMTS authentication~~subscriber~~ (USIM) only, authentication of the network by the MS.

Security-related network functions are described in GSM 03.20 and in 3G TS 33.102.

6.8.1 Authentication

The Authentication function includes two types of authentication: "UMTS authentication" and "GSM authentication". These procedures are used independent of the GSM or UTRAN RANs, i.e. each procedure may be executed in A/Gb mode or in Iu mode. UMTS authentication requires a USIM for the MS and Authentication Quintets in the SGSN. GSM authentication bases on a SIM for the MS and Authentication Triplets in the SGSN or it bases on a GSM capable USIM for the MS and parameters derived from Authentication Quintets in the SGSN.

"UMTS authentication" implies mutual authentication, i.e., authentication of the MS by the network and authentication of the network by the MS. It also implies establishment of a new UMTS ciphering key (CK) and integrity key (IK) agreement between the SGSN and the MS.

"GSM authentication" implies authentication of the MS by the network and establishment of a new GSM ciphering key (Kc) agreement between the SGSN and the MS.

6.8.1.1 GSM Authentication ~~of GSM Subscriber~~

~~Authentication procedures already defined in A/Gb mode shall be used, with the distinction that the procedures are executed from the SGSN.~~ The GSM~~PRS~~ Authentication procedure performs subscriber authentication, or selection of the ciphering algorithm, or both. ~~and~~In A/Gb mode it performs in addition the synchronisation of the start of ciphering~~, or both~~. Authentication triplets are stored in the SGSN. The MSC/VLR shall not authenticate the MS via the SGSN upon IMSI attach, nor location update, but may authenticate the MS during CS connection establishment. Security-related network functions are described in GSM 03.20 [6].

The GSM Authentication ~~of GSM Subscriber~~ procedure is illustrated in Figure 27.

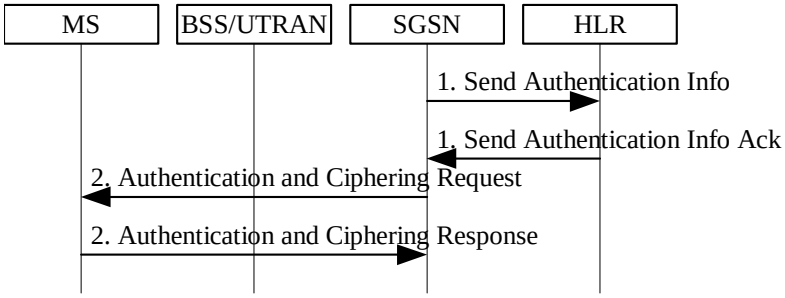

Figure 27: GSM Authentication ~~of GSM Subscriber~~ Procedure

1) If the SGSN does not have a previously stored authentication vector~~triplets~~, a Send Authentication Info (IMSI) message is sent to the HLR. The HLR responds with a Send Authentication Info Ack (Authentication Triplets or Quintets) message. ~~Each Authentication Triplet includes RAND, SRES, and Kc.~~

2) The SGSN sends an Authentication and Ciphering Request (RAND, CKSN, Ciphering Algorithm) message to the MS. The MS responds with an Authentication and Ciphering Response (SRES) message.

In A/Gb mode, the MS starts ciphering after sending the Authentication and Ciphering Response message as described in subclause "Start of Ciphering".

In Iu mode, the 3G-SGSN and the MS shall generate the UMTS CK and IK from the GSM Kc using the standardised conversion functions specified for this purpose in 3G TS 33.102.

In Iu mode, the start of ciphering is controlled by the security mode procedure described in 3G TS 33.102.

If the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue, the GSM Authentication ~~of GSM Subscriber~~ Procedure fails.

6.8.1.2 UMTS Authentication ~~of UMTS Subscriber~~

The UMTS authentication procedure is described in 3G TS 33.102. The UMTS authentication procedure executed from the SGSN performs both the mutual authentication and security keys agreement. Authentication quint~~upl~~ets are stored in the SGSN. The MSC/VLR shall not authenticate the MS via the SGSN upon IMSI attach nor upon location update, but may authenticate the MS during CS connection establishment.

The UMTS Authentication ~~of UMTS Subscriber procedure (USIM)~~ is illustrated in Figure 28.

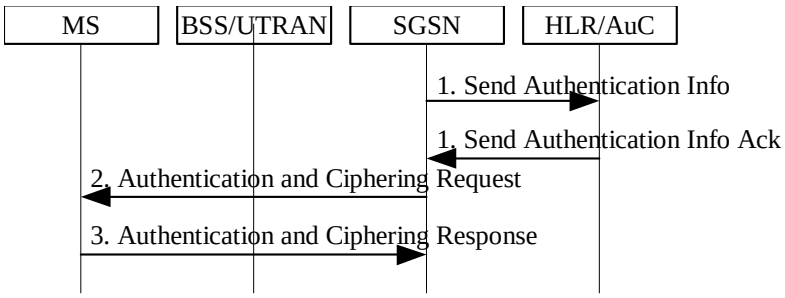

Figure 28: UMTS Authentication ~~of UMTS Subscriber~~ Procedure

1) If the SGSN does not have a previously stored UMTS Authentication Vector~~s~~ (quint~~upl~~et~~s~~), a Send Authentication Info (IMSI) message is sent to the HLR. Upon receipt of this message ~~for a UMTS user~~, the HLR/AuC responds with a Send Authentication Info Ack message including an ordered array of quint~~upl~~ets to the SGSN. Each quint~~upl~~et contains RAND, XRES, AUTN, CK, and IK. The generation of quint~~upl~~ets in HLR/AuC for a UMTS user is performed as specified in 3G TS 33.102.

2) At authentication of a UMTS subscriber, the SGSN selects the next in-order quint~~upl~~et and transmits the RAND and AUTN, that belong to this quint~~upl~~et, to the MS in the Authentication and Ciphering Request (RAND, AUTN, KSI~~CKSN~~) message. The SGSN also selects a Key Set Identifier(~~,~~ KSI)~~ciphering key sequence number, CKSN~~, and includes this in the message.

3) At reception of this message, the USIM in the MS verifies AUTN and, if accepted, the USIM computes the signature of RAND, RES, in accordance with 3G TS 33.102. If the USIM considers the authentication as being successful, the MS returns an Authentication and Ciphering Response (RES) message to the SGSN. During generation of authentication vectors, the USIM in the MS also~~p~~ computes a new Ciphering Key(~~,~~ CK), and a new Integrity Key(~~,~~ IK). These keys are stored together with the KSI~~CKSN~~ until KSI~~CKSN~~ is updated at the next authentication.

   If the USIM considers the authentication being unsuccessful, e.g., in case of an authentication synchronisation failure, the MS returns the Authentication and Ciphering Failure message to the SGSN. The actions then taken are described in 3G TS 33.102.

In A/Gb mode, the SGSN and the MS shall generate the Kc from the UMTS CK and IK using the standardised conversion function specified for this purpose in 3G TS 33.102.

In A/Gb mode, the MS starts ciphering after sending the Authentication and Ciphering Response message as described in clause "Start of Ciphering".

In Iu mode, the start of ciphering is controlled by the security mode procedure described in 3GPP TS 33.102.

If the SGSN cannot determine the HLR address to establish the Send Authentication Info dialogue, the UMTS Authentication ~~of UMTS Subscriber~~ Procedure fails.

6.8.3.1 Scope of Ciphering

In A/Gb mode, the scope of ciphering is from the ciphering function in the SGSN to the ciphering function in the MS. Ciphering is done in the LLC layer, and from the perspective of the existing GSM MS-BTS radio path, an LLC PDU is transmitted as plain text.

In Iu mode, the scope of ciphering is from the ciphering function in the UTRAN to the ciphering function in the MS.

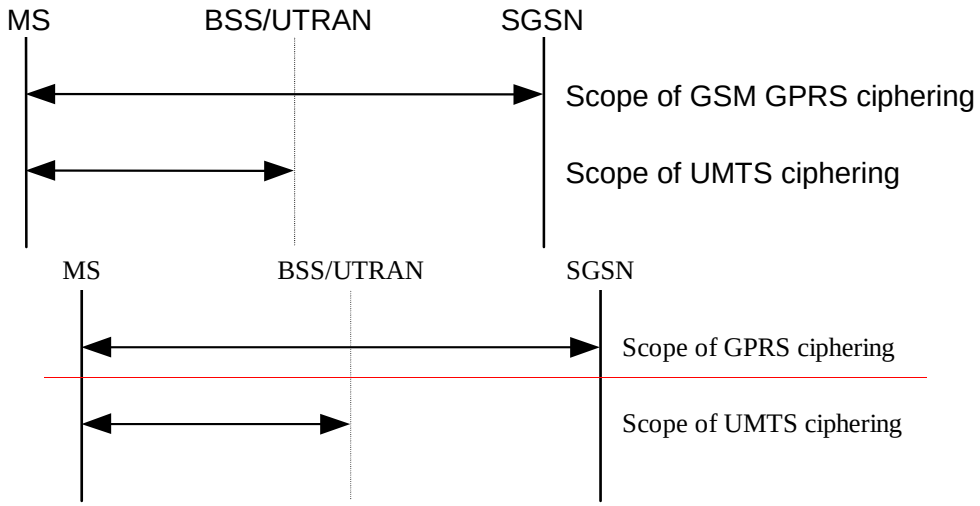

Figure 30: Scope of Ciphering

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 6 shows the context fields for one MS.

During the Intersystem Change, when new Authentication and Key Agreement is not performed, the KSI in the new 3G-SGSN shall be assigned the value of the CKSN, which has been sent by the MS. Similarly, in the new 2G-SGSN, when AKA des not take place, the CKSN shall be assigned the value of the KSI, which has been sent by the MS.

Note: 2G-SGSN and 3G-SGSN refer to R99 SGSNs with either GSM or UMTS access.

Table 6: SGSN MM and PDP Contexts

Field	Description	A/Gb mode~~GSM~~	Iu mode~~UMTS~~
IMSI	IMSI is the main reference key.	X	X
MM State	Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	A signature used for identification checking purposes.	X	X
IMEI	International Mobile Equipment Identity	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Routeing Area	Current routeing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	
Service Area Code	Last known SAC when initial UE message was received or Location Reporting procedure was executed.		X
Service Area Code Age	Time elapsed since the last SAC was received at the 3G-SGSN.		X
VLR Number	The VLR number of the MSC/VLR currently serving this MS.	X	X
New SGSN Address	The IP address of the new SGSN where buffered and not sent N-PDUs should be forwarded to.	X	X
~~Authentication Triplets~~	~~Authentication and ciphering parameters.~~	~~X~~	~~X~~
Authentication Vectors	Authentication and ciphering parameters (authentication triplets or quintets)~~for UMTS~~.	X	X
Kc	Currently used A/Gb mode ciphering key.	X	2)~~X~~
CKSN	Ciphering key sequence number of Kc.	X	2)
Ciphering algorithm	Selected ciphering algorithm ~~(GEA)~~.	X	X
CK	Currently used Iu mode ciphering key.	1)~~X~~	X
IK	Currently used Iu mode integrity key.	1)~~X~~	X
KSI	Key Set Identifier.	1)	X
MS Radio Access Capability	MS radio access capabilities.	X	
MS Network Capability	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	X	X
MNRG	Indicates whether activity from the MS shall be reported to the HLR.	X	X
NGAF	Indicates whether activity from the MS shall be reported to the MSC/VLR.	X	X
PPF	Indicates whether paging for PS and CS services can be initiated.	X	X
Subscribed Charging Characteristics	The charging characteristics for the MS, e.g., normal, prepaid, flat-rate, and/or hot billing subscription.	X	X
Trace Reference	Identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates the type of trace.	X	X
Trigger Id	Identifies the entity that initiated the trace.	X	X
OMC Identity	Identifies the OMC that shall receive the trace record(s).	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
Recovery	Indicates if HLR or VLR is performing database recovery.	X	X
Radio Priority SMS	The RLC/MAC radio priority level for uplink SMS transmission.	X	
GPRS-CSI	Optional GPRS CAMEL subscription information, see 3G TS 23.016	X	X
Each MM context contains zero or more of the following PDP contexts:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP State	Packet data protocol state, INACTIVE or ACTIVE.	X	X
PDP Type	PDP type, e.g., PPP or IP.	X	X
PDP Address	PDP address, e.g., an IP address.	X	X
APN Subscribed	The APN received from the HLR.	X	X
APN in Use	The APN currently used.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
TI	Transaction Identifier.	X	X
TEID for Gn/Gp	Tunnel Endpoint Identifier for the Gn and Gp interfaces.	X	X
TEID for Iu	Tunnel Endpoint Identifier for the Iu interface.		X
GGSN Address in Use	The IP address of the GGSN currently used.	X	X
VPLMN Address Allowed	Specifies whether the MS is allowed to use the APN in the domain of the HPLMN only, or additionally the APN in the domain of the VPLMN.	X	X
QoS Profile Subscribed	The quality of service profile subscribed.	X	X
QoS Profile Requested	The quality of service profile requested.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data	X	

Field	Description	A/Gb mode GSM	Iu mode UMTS
	transmission.		
Packet Flow Id	Packet flow identifier.	X	
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for the packet flow that this PDP context belongs to.	X	
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
PDCP-SND	Sequence number of the next downlink in-sequence PDCP-PDU to be sent to the MS.		X
PDCP-SNU	Sequence number of the next uplink in-sequence PDCP-PDU expected from the MS.		X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
PDP Context Charging Characteristics	The charging characteristics of this PDP context, e.g., normal, prepaid, flat-rate, and/or hot billing.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

The information marked with a "1)" in table 6 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 6 may be maintained if authentication is performed by the GSM authentication procedure.

13.4 MS

Each packet domain MS maintains MM and PDP context information in IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, and PMM-CONNECTED states. The information may be contained in the MS and the TE. Table 8 shows the MS context fields.

Table 8: MS MM and PDP Contexts

Field	SIM	Description	A/Gb mode~~GSM~~	Iu mode~~UMTS~~
IMSI	G, U	International Mobile Subscriber Identity.	X	X
MM State		Mobility management state, IDLE, STANDBY, READY, PMM-DETACHED, PMM-IDLE, or PMM-CONNECTED.	X	X
P-TMSI	G, U	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	G, U	A signature used for identification checking purposes.	X	X
Routeing Area	G, U	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	G	Current A/Gb mode~~GPRS~~ ciphering key.	X	2)
KSI / CKSN ~~/ KSI~~	G, U	Key Set Identifier for IK Next, CK Next~~,~~ /~~and~~ key sequence number of Kc.	X	X
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK		Currently used Iu mode ciphering key.	1)	X
CK Next	U	Iu mode~~UMTS~~ ciphering key to be used after the next security mode command.	1)	X
IK		Currently used Iu mode integrity key.	1)	X
IK Next	U	Integrity key to be used after the next security mode command.	1)	X
MS Radio Access Capability		MS radio access capabilities.	X	X
UE Capability		UE radio capabilities.		X
MS Network Capability		MS network capabilities.	X	X
DRX Parameters		Discontinuous reception parameters.	X	X
Radio Priority SMS		The RLC/MAC radio priority level for uplink SMS transmission.	X	
Each MM context contains zero or more of the following PDP contexts:				
PDP Type		PDP type, e.g., PPP or IP.	X	X
PDP Address		PDP address, e.g., an IP address.	X	X
PDP State		Packet data protocol state, INACTIVE or ACTIVE.	X	X
Dynamic Address Allowed		Specifies whether the MS is allowed to use a dynamic address.	X	X
APN Requested		The APN requested.	X	X
NSAPI		Network layer Service Access Point Identifier.	X	X
TI		Transaction Identifier.	X	X
QoS Profile Requested		The quality of service profile requested.	X	X
QoS Profile Negotiated		The quality of service profile negotiated.	X	X
TFT		Traffic flow template.	X	X
Radio Priority		The RLC/MAC radio priority level for uplink user data transmission.	X	
Packet Flow Id		Packet flow identifier.	X	
Send N-PDU Number		SNDCP sequence number of the next uplink N-PDU to be sent to the SGSN.	X	X
Receive N-PDU Number		SNDCP sequence number of the next downlink N-PDU expected from the SGSN.	X	X
PDCP-SND		Sequence number of the next downlink in-sequence PDCP-PDU expected from the RNC.		X
PDCP-SNU		Sequence number of the next uplink in-sequence PDCP-PDU to be sent to the RNC.		X

The information marked with a "1)" in table 8 may be maintained if authentication is performed by the UMTS authentication procedure.

The information marked with a "2)" in table 8 may be maintained if authentication is performed by the GSM authentication procedure.

The information marked with a "U" in table 8 shall be stored in the USIM.

The information marked with a "G" in table 8:

- shall be stored in the GSIM if the connected SIM is GPRS-aware; and
- may be stored in the ME after GPRS detach if the connected GSIM is not GPRS-aware.

If the GSIM is packet domain service-aware, then the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the GSIM shall be used for packet domain services.

If the GSIM is not packet domain service-aware, the P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN stored in the ME shall be used if and only if the IMSI stored in the GSIM is identical to the IMSI image maintained in the ME. If the IMSI stored in the GSIM is different from the IMSI image in the ME, the IMSI image in the ME shall not be used, and the MS shall identify itself with the IMSI stored in the SIM when performing a GPRS attach. IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, and CKSN may be stored in the ME after the GPRS attach has been successfully performed.

When using a USIM, the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK Next, IK Next, and CKSN / KSI stored in the USIM, and the CK and IK stored in the ME, shall be used for packet domain services.

3GPP TSG-SA2 Meeting #24
Madrid, Spain, April 22- 26, 2002

Tdoc S2-021315rev2

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **367** ⌘ ev **-1** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	Introduction of IP transport option for Iu
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	26th April 2002
Category:	⌘	**F**
Release:	⌘	REL-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘
25.412 v 5.0.0 and 25.414 v5.0.0 describe the protocol stacks applicable to the Iu interface for UTRAN in R5. In R5 a new transport option has been introduced for the control and user planes, namely the IP transport option, in which the layer 1 and layer 2 can be any technology. The ATM transport option has been kept for backward compatibility reasons. However 23.060 still only refers to the ATM transport option.

Moreover, it has been decided in RAN3 that for the ATM transport option IPv4 is mandatory and IPv6 optional, while for the IP transport option IPv6 is mandatory and IPv4 optional. In any case dual stack is recommended.

This CR introduces the IP transport option in 23.060 to align it with the stage 3.

Summary of change: ⌘
Generalised the figures in 5.6.2.2 and 5.6.3.2 showing the Iu protocol stack in the control plane and user plane, which now shows any L1/L2 instead of ATM explicitely.
Removed most of the protocol details in 12.7 describing the Iu interface and added a reference to 25.412 and 25.414 instead.
Clarified where applicable that the IP version support requirements are different for each Iu transport option.

Consequences if not approved: ⌘
Misalignment between stage 2 and stage 3.

Clauses affected: ⌘ 5.6.2.2, 5.6.3.2, 12.7, 14.2.1

Other specs affected: ⌘
☐ Other core specifications ⌘
☐ Test specifications
☐ O&M Specifications

Other comments: ⌘

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.6.2.2 MS – GGSN user plane with UTRAN

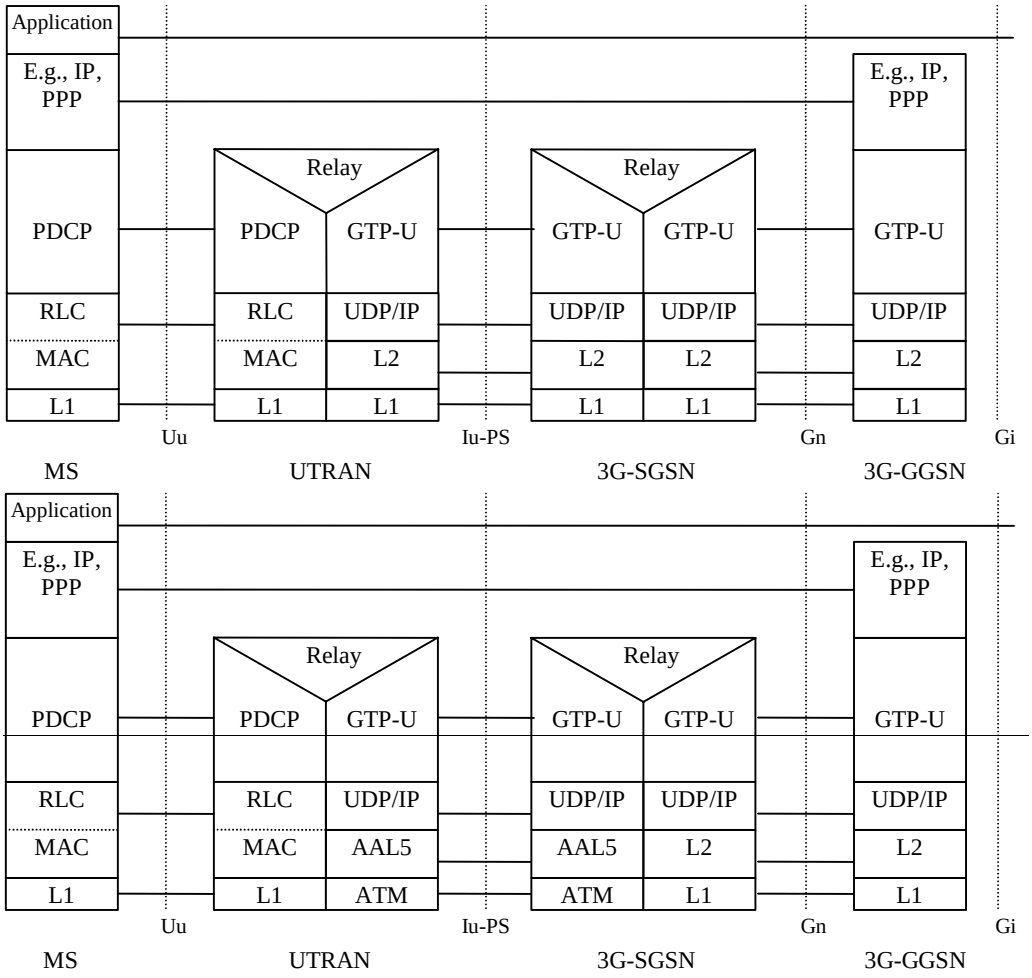

Figure 6: User Plane with UTRAN

Legend:

- Packet Data Convergence Protocol (PDCP): This transmission functionality maps higher-level characteristics onto the characteristics of the underlying radio-interface protocols. PDCP provides protocol transparency for higher-layer protocols. PDCP supports e.g. IPv4, PPP and IPv6. Introduction of new higher-layer protocols shall be possible without any changes to the radio-interface protocols. PDCP provides protocol control information compression. PDCP is specified in 3GPP TS 25.323.

NOTE: Unlike in A/Gb mode, user data compression is not supported in Iu mode, because the data compression efficiency depends on the type of user data, and because many applications compress data before transmission. It is difficult to check the type of data in the PDCP layer, and compressing all user data requires too much processing.

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- UDP/IP: These are the backbone network protocols used for routeing user data and control signalling.

~~- Asynchronous Transfer Mode (ATM): The information to be transmitted is divided into fixed-size cells (53 octets), multiplexed, and transmitted. ATM is specified in ITU-T Recommendation I.361 [59].~~

~~- ATM Adaptation Layer 5 (AAL5): This adaptation layer protocol provides support for variable-bitrate connection-oriented or connectionless data services. AAL5 is specified in ITU-T Recommendation I.363.5 [67].~~

- Radio Link Control (RLC): The RLC protocol provides logical link control over the radio interface. There may be several simultaneous RLC links per MS. Each link is identified by a Bearer Id. RLC is defined in 3GPP TS 25.322.

- Medium Access Control (MAC): The MAC protocol controls the access signalling (request and grant) procedures for the radio channel. MAC is specified in 3GPP TS 25.321.

Next modified section

5.6.3.2 MS – SGSN (Iu mode)

NOTE: Control plane for GERAN in Iu mode is described in 3GPP TS 43.051 [74].

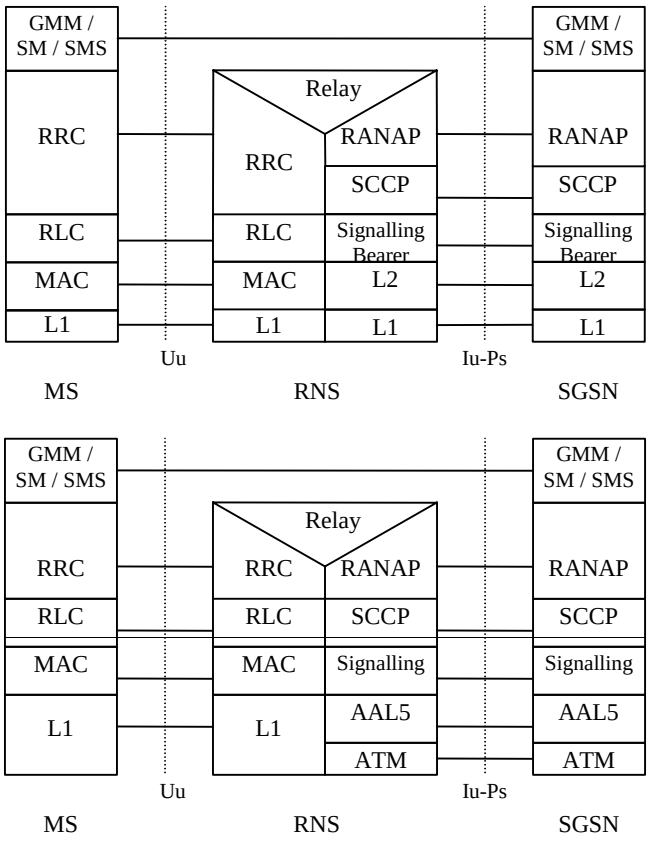


Figure 8: Control Plane MS - SGSN in Iu mode

Legend:

- Iu mode Mobility Management and Session Management (GMM/SM): GMM supports mobility management functionality such as attach, detach, security, and routeing area update, as described in clause "Mobility Management Functionality". SM supports PDP context activation and PDP context deactivation, as described in clause "PDP Context Activation, Modification, Deactivation, and Preservation Functions".

- SMS supports the mobile-originated and mobile-terminated short message service described in 3GPP TS 23.040.

- Radio Access Network Application Protocol (RANAP): This protocol encapsulates and carries higher-layer signalling, handles signalling between the 3G-SGSN and Iu mode RAN, and manages the GTP connections on the Iu interface. RANAP is specified in 3GPP TS 25.413. The layers below RANAP are defined in 3GPP TS 25.412 and 3GPP TS 25.414~~23.121~~.

- Radio Link Control (RLC): The RLC protocol offers logical link control over the radio interface for the transmission of higher layer-signalling messages and SMS. RLC is defined in 3GPP TS 25.322.

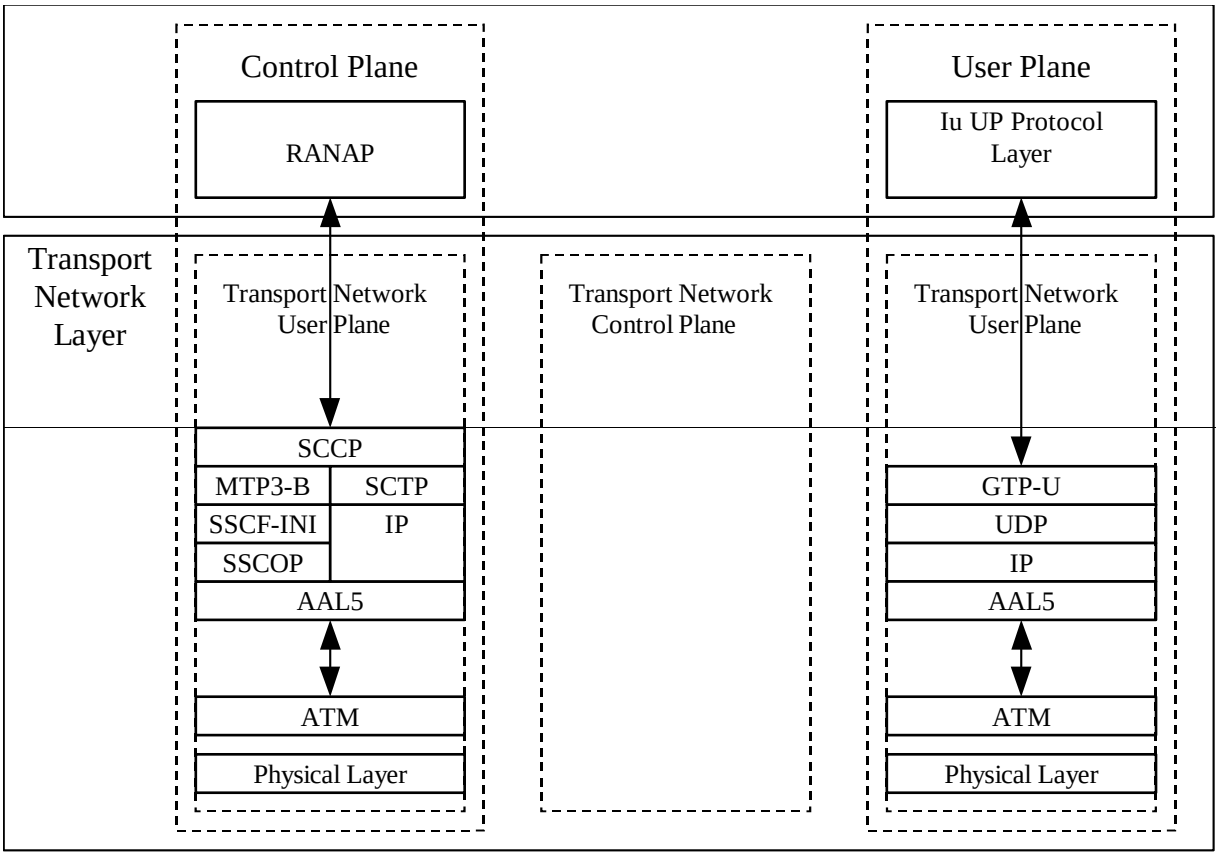
Next modified section

12.7 Iu Interface (Iu mode)

The Iu interface connects the UTRAN or Iu mode GERAN and the Core Network allowing the exchange of signalling information and user data. The user plane of the Iu interface shall allow user data from many users to be multiplexed over the same physical resource. Resources are given to a user upon activity (when data is sent or received) and are reallocated immediately thereafter.

In Iu mode only user data is transmitted on this shared physical medium. Signalling data is transferred via an SCCP connection. ~~A reference configuration for the Iu interface user plane is given in Figure 88.~~ Two different options exist for the transport of signalling and user data over Iu: the ATM transport option and the IP transport option. The different protocol stacks applicable to the Iu interface are described in 3GPP TS 25.412 for the control plane and 3GPP TS 25.414 for the user plane.

~~Two different options exist for the transport of signalling and user data over Iu: the ATM transport option and the IP transport option. With the ATM transport option IPv4 (RFC 791 [40]) shall be supported and IPv6 (RFC 2460) support is optional; when IPv6 is supported, then IPv4 shall also be supported. With the IP transport option both IPv6 and IPv4 shall be supported.~~



~~Figure 88: Iu User Plane Protocol Configuration for Packet-Switched Traffic~~

~~12.7.1 Physical Layer Protocols~~

~~The physical layer shall comply with one of a wide range of standards, according to 3GPP TS 25.411. Services provided to the upper layer shall be independent of the used underlying technology.~~

~~12.7.2 Higher-Layer Protocols~~

~~12.7.2.1 Higher-Layer Protocols for User Data Transport~~

~~The GTP-U protocol shall be used over the Iu interface between the packet switched domain and the RNS.~~

~~The path protocol used shall be UDP, as specified in RFC 768. The IPv4 (RFC 791 [40]) protocol shall be supported; IPv6 (RFC 2460) support is optional.~~

~~AAL5 shall be used according to ITU-T Recommendation I.363.5 [67].~~

~~AAL5 permanent or switched virtual circuits are used to transport the IP packets across the Iu interface between RNS and the packet switched core network domain. Multiple VCs can be used over the Iu interface.~~

~~IP over ATM protocols are used to carry the IP packets over the ATM transport network. IP over ATM is specified in RFC 2225. Multiprotocol Encapsulation over AAL5 is specified in RFC 1483.~~

~~The Iu interface protocol stack is described in more detail in 3GPP TS 25.414.~~

12.7.~~2.1.~~1 Consistent Sequence Numbering of PDUs on Iu and Gn Interfaces

The GTP-U PDU sequence numbers allocated by the GGSN (downlink) and SRNS/SBSS (uplink) are kept unchanged irrespective of the number of GTP tunnels the PDU is transferred over. Therefore, SGSN shall use on the Iu interface for downlink PDUs the GTP-U sequence number received from the GGSN, and shall use on the Gn interface for uplink PDUs the GTP-U sequence number received from the SRNS/SBSS. In case of SRNS/SBSS relocation and inter-system change, the SRNS/SBSS and SGSN shall tunnel PDUs without changing the GTP-U sequence numbers.

~~12.7.2.2 Higher-Layer Protocols for Signalling Transport~~

~~The protocol stack for signalling transport is based on ATM/AAL5. Two AAL5 signalling transport service options are available to provide services for the SCCP layer.~~

~~The first option for the SCCP signalling protocol stack uses SSCOP for reliability reasons. SSCF provides the adaptation to upper layers. MTP3-B is the network layer protocol.~~

~~The second option for the SCCP signalling protocol stack uses IP as the network layer. SCTP performs the adaptation of the IP layer and provides services to the SCCP layer.~~

Next modified section

14.12 RNC/BSC Addresses (Iu mode)

14.12.1 RNC/BSC Address

Each RNC or BSC shall have one or more IP addresses ~~of type IPv4, and optionally of type IPv6,~~ for inter-communication over the Iu interface. When the ATM transport option is applied on the Iu interface, these addresses shall be of type IPv4 and optionally of type IPv6. When the IP transport option is applied on the Iu interface, each RNC or BSC shall have both IPv6 addresses and IPv4 addresses.

3GPP TSG-SA2 Meeting #24 ***Tdoc S2-021308***
Madrid, Spain, April 22- 26, 2002

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **366** ⌘ ev **-** ⌘ Current version: **4.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	IPv6 transport not recommended for Iu and Gn/Gp in R4
Source:	⌘	Ericsson
Work item code:	⌘	TEI4
Date:	⌘	25th April 2002
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	It has been identified that R99/R4 specifications do not allow transfer of contexts (SGSN or SRNS) between SGSNs or RNCs if one supports IPv4 as transport protocol while the peer node supports IPv6, even if the later is dual-stack. As a result PDP contexts would be lost at SGSN/SRNS change. A solution has been introduced in R5 but cannot be introduced in R99/R4 as it requires functional changes to existing procedures. Consequently, in R99/R4, when GSNs or RNCs are expected to communicate with peer nodes that do not support IPv6, IPv6 should not be used as transport protocol on Iu and Gn/Gp interfaces. In other words, IPv6 transport can be used safely only if all GSNs and RNCs in the PLMN, and in all adjacent PLMNs to which a handover can take place, support IPv6.
Summary of change:	⌘	Added a corresponding recommendation in the description of the protocol stacks for the user plane.
Consequences if not approved:	⌘	GSN/RNC nodes could be implemented/deployed that lose PDP contexts at SGSN/SRNS change.

Clauses affected:	⌘	5.6.1.1, 5.6.2.1
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.6.1 User Plane (GSM only)

5.6.1.1 MS – GGSN

The user plane consists of a layered protocol structure providing user information transfer, along with associated information transfer control procedures (e.g. flow control, error detection, error correction and error recovery). The user plane independence of the Network Subsystem (NSS) platform from the underlying radio interface is preserved via the Gb interface. The following user plane is used in A/Gb mode.

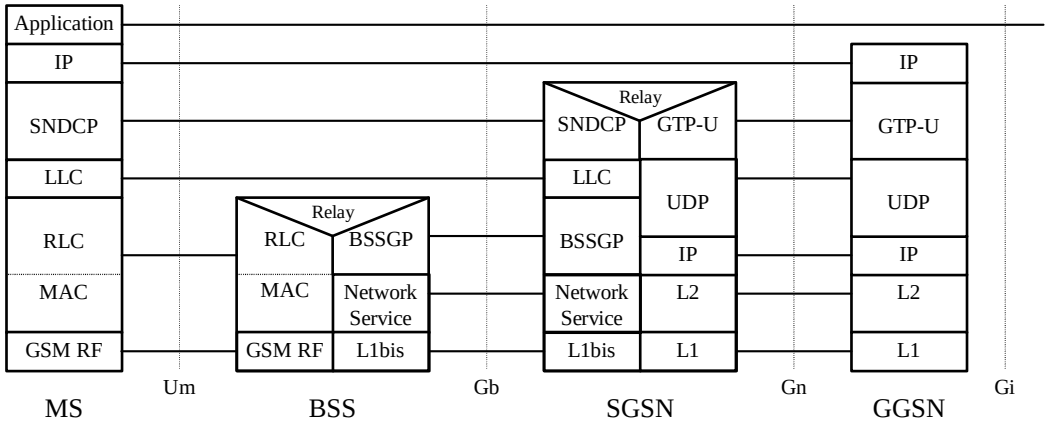

Figure 4: User Plane for GSM

Legend:

- GPRS Tunnelling Protocol for the user plane (GTP-U): This protocol tunnels user data between GPRS Support Nodes in the backbone network. The GPRS Tunnelling Protocol shall encapsulate all PDP PDUs. GTP is specified in 3GPP TS 29.060 [26].

- UDP carries GTP PDUs for protocols that do not need a reliable data link (e.g. IP), and provides protection against corrupted GTP PDUs. UDP is defined in RFC 768 [39].

- IP: This is the backbone network protocol used for routeing user data and control signalling. The backbone network may initially be based on the IPv4. Ultimately, IPv6 shall be used. IPv4 is defined in RFC 791[40]. When GSNs can potentially communicate with other GSNs supporting only IPv4 (e.g. at inter SGSN routeing area update), the use of IPv6 is not recommended in this release of the standards, as PDP contexts cannot be transferred between GSNs supporting different IP versions.

- Subnetwork Dependent Convergence Protocol (SNDCP): This transmission functionality maps network-level characteristics onto the characteristics of the underlying network. SNDCP is specified in GSM 04.65 [16].

- Logical Link Control (LLC): This layer provides a highly reliable ciphered logical link. LLC shall be independent of the underlying radio interface protocols in order to allow introduction of alternative GPRS radio solutions with minimum changes to the NSS. LLC is specified in GSM 04.64 [15].

- Relay: In the BSS, this function relays LLC PDUs between the Um and Gb interfaces. In the SGSN, this function relays PDP PDUs between the Gb and Gn interfaces.

- Base Station System GPRS Protocol (BSSGP): This layer conveys routeing- and QoS-related information between the BSS and the SGSN. BSSGP does not perform error correction. BSSGP is specified in GSM 08.18 [21].

- Network Service (NS): This layer transports BSSGP PDUs. NS is based on the Frame Relay connection between the BSS and the SGSN, and may - multi-hop and traverse a network of Frame Relay switching nodes. NS is specified in GSM 08.16 [20].

- RLC/MAC: This layer contains two functions: The Radio Link Control function provides a radio-solution-dependent reliable link. The Medium Access Control function controls the access signalling (request and grant)

procedures for the radio channel, and the mapping of LLC frames onto the GSM physical channel. RLC/MAC is defined in GSM 04.60 [14].

- GSM RF: As defined in GSM 05 series.

Next modified section

5.6.2 User Plane (UMTS only)

5.6.2.1 MS – GGSN

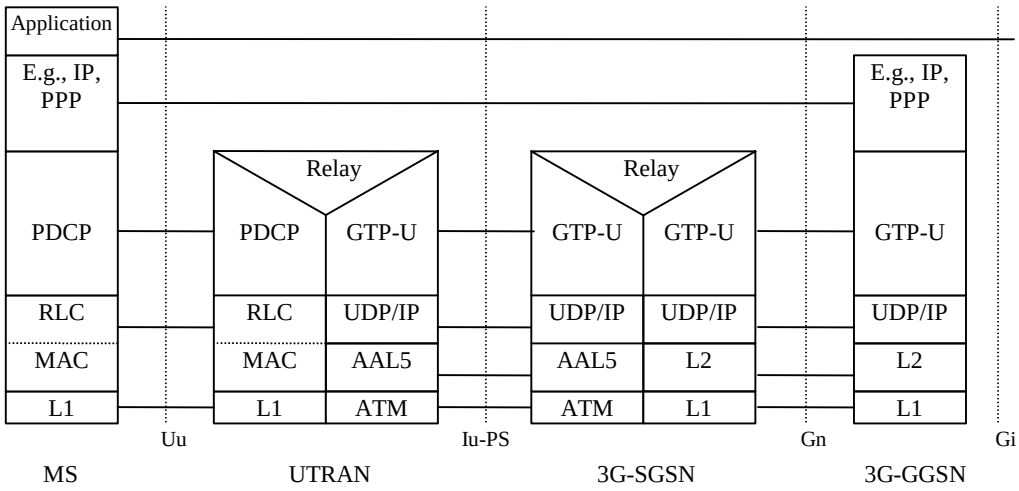

Figure 6: User Plane for UMTS

Legend:

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3GPP TSG-SA2 Meeting #24
Madrid, Spain, April 22- 26, 2002

Tdoc S2-021307

CR-Form-v4

CHANGE REQUEST

⌘ **23.060** **CR** **365** ⌘ ev **-** ⌘ Current version: **3.11.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	IPv6 transport not recommended for Iu and Gn/Gp in R99
Source:	⌘	Ericsson
Work item code:	⌘	TEI
Date:	⌘	25th April 2002
Category:	⌘	**F**
Release:	⌘	R99

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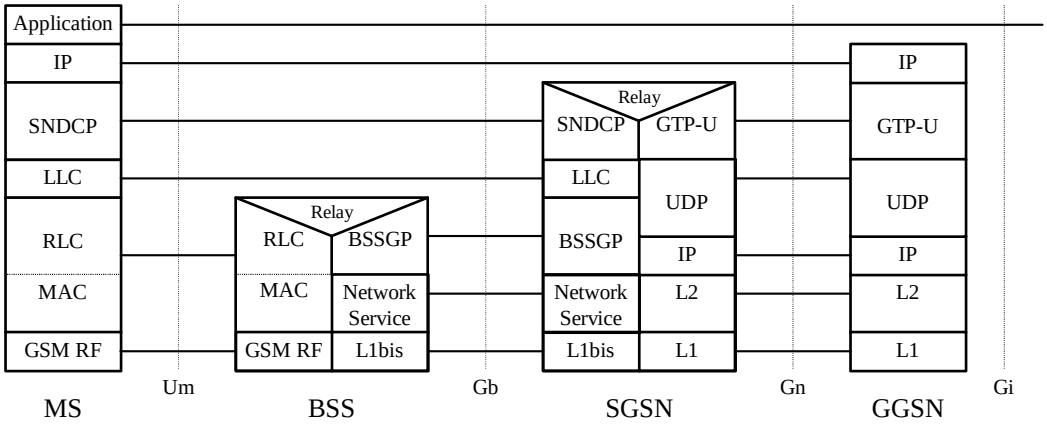

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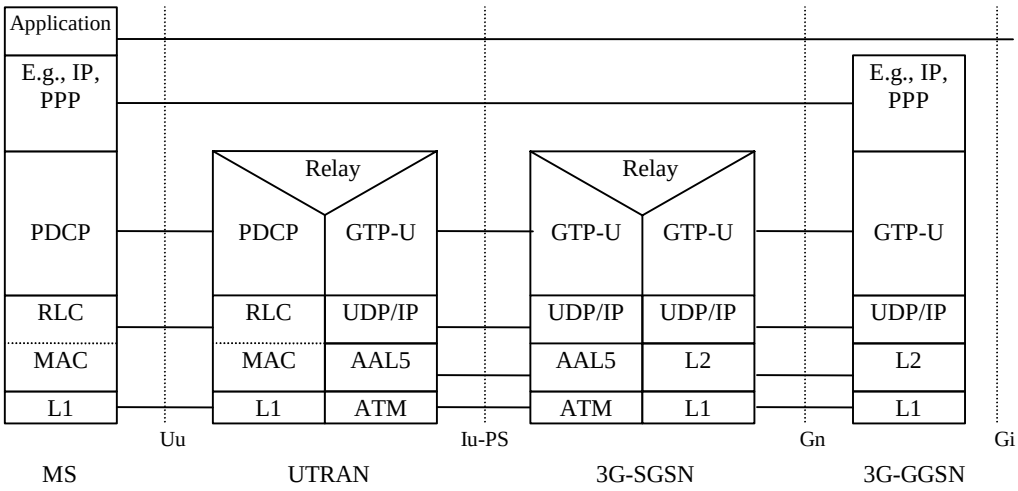

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