

Source: TSG SA WG2
Title: CRs on 23.060 v 3.1.0
Agenda Item: 5.2.3

The following CRs have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #6.

On 23.060 v.3.1.0

TDoc #	CR #	spec	Title	cat
S2-99B75	013r2	23.060	Traffic Flow Templates (TFT) for packet filtering	
S2-99B01	017r1	23.060	Removal of BB Protocol	F
S2-99B72	043r2	23.060	GPRS QoS Parameters	B
S2-99C32	046r3	23.060	Addition of the sections of NSAPI, RB identity, RAB ID for UMTS and of TEID	
S2-99B76	047r1	23.060	MS Initiated TFT modification, addition and deletion	
S2-99B83	048r1	23.060	interaction points for GPRS/CAMEL interwork	
S2-99B90	049r1	23.060	Description of Mobility Agents in Mobile IP	B
S2-99B06	051	23.060	No (P-)TMSI in Complete messages	F
S2-99E73	053r3	23.060	Releases 97, 98 and 99 interactions	B
S2-99B95	055r1	23.060	Clarification of MM procedures in PMM-IDLE for common UMTS/GSM RA	C
S2-99E65	059r1	23.060	UMTS <-> GPRS Intersystem change (handover)	D
S2-99C30	060r2	23.060	UMTS-GPRS Intersystem Handover	
S2-99E78	061r1	23.060	N2 would like to ask S1 and S2 advice on how to handle the UMTS PS domain to GPRS handover from a service aspects point of view, in view of	F
S2-99E09	066r1	23.060	Improving charging efficiency - conditionally agreed	
S2-99F51	067r2	23.060	Subscriber and equipment trace for PS domain	
S2-99E22	068r1	23.060	BSS QoS involvement improvements	F
S2-99D75	069	23.060	GPRS Mobile Stations classes	
S2-99E10	070r1	23.060	Usage of TI in the secondary PDP context activation procedure - CA	F
S2-99D77	071	23.060	Logical Link Management Functions for GPRS	D
S2-99D78	072	23.060	Packet Domain Core Network Nodes	D
S2-99D79	073	23.060	User Plane for UMTS	D
S2-99D89	074	23.060	UTRAN Registration Area Identity and Cell Identity - CHECK	
S2-99F28	075r2	23.060	Unnecessary of cell identity and cell identity age in 3G-SGSN MM context	F
S2-99D91	076	23.060	Deletion of TFT in 3G-SGSN PDP context	F
S2-99D92	077	23.060	The number of RNC RAB contexts in a RNC context	F
S2-99E67	078r1	23.060	The usage of reordering required parameter	B
S2-99E68	079r1	23.060	Information storage in USIM	
S2-99E54	081	23.060	CS paging response	F
S2-99E55	082	23.060	SMS support in 3G-SGSN	B
S2-99F30	083r2	23.060	Usage of secondary PDP context activation procedure	

3.2 Abbreviations

For the purposes of the present document the following abbreviations apply. Additional applicable abbreviations can be found in GSM 01.04 [1].

ESP Encapsulating Security Payload

SPI Security Parameter Index

TFT Traffic Flow Template

TOS Type of Service

5.3.1.4 Message Screening Function

A screening function concerned with filtering out unauthorised or unsolicited messages is required. This should be supported through packet filtering functions. It is FFS if/how user-controlled screening can be provided by utilizing TFTs.

9.3 Packet Routing and Transfer Function

The packet routing and transfer function:

- routes and transfers packets between a mobile TE and an external network, i.e., between reference point R and reference point Gi;
- routes and transfers packets between mobile TE and other GPRS PLMN, i.e., between reference point R and reference point Gi via interface Gp; and
- routes and transfers packets between TEs, i.e., between the R reference point in different MSs.

The PDP PDUs shall be routed and transferred between the MS and the GGSN as N-PDUs. The maximum size of each N-PDU shall be 1 500 octets [FFS]. When the MS or the GGSN receives a PDP PDU that is not larger than the maximum N-PDU size, then the PDP PDU shall be routed and transferred as one N-PDU. When the MS or the GGSN receives a PDP PDU that is larger than the maximum N-PDU size, then the PDP PDU shall be segmented, discarded or rejected, depending on the PDP type and the implementation. The packet data protocol in the MS may limit the maximum size of the PDP PDUs that are routed and transferred, e.g., due to MS memory limitations.

Between the 2G-SGSN and the MS, PDP PDUs are transferred with SNDCP. Between the 3G-SGSN and the MS, PDP PDUs are transferred with GTP-U and PDCP.

Between the SGSN and the GGSN, PDP PDUs are routed and transferred with either the TCP/IP or the UDP/IP protocols. The GPRS Tunnelling Protocol transfers data through tunnels. A tunnel is identified by a tunnel identifier (TID) and a GSN address.

When multiple PDP contexts exist for one PDP address of a MS, the GGSN routes down-link N-PDUs to the different GTP tunnels based on the TFTs assigned to the PDP contexts. On reception of a N-PDU, the GGSN evaluates for a match, first the packet filter amongst all TFTs that has the smallest evaluation precedence index and, in case no match is found, proceeds with the evaluation of packet filters in increasing order of their evaluation precedence index. This procedure shall be executed until a match is found, in which case the N-PDU is tunnelled to the SGSN via the PDP context that is associated with the TFT of the matching packet filter. When no match is found, the N-PDU shall be sent via the PDP context which does not have a TFT assigned to it; if all PDP contexts have a TFT assigned, the GGSN shall silently discard the N-PDU.

The MS is responsible of creating or modifying PDP contexts and their QoS. The MS should define TFTs in such a way that down-link N-PDUs are routed to a PDP context which best matches the QoS requested by the receiver of this PDU (e.g. an application supporting QoS).

For each up-link PDU, the MS should choose a PDP context which best matches the QoS requested by the sender of this PDU (e.g. an application supporting QoS). Packet classification and routing within the MS is a MS-local matter. The GGSN shall not match up-link PDUs against TFTs.

TFTs are used for PDP-type IP and PPP only. For PDP-type PPP a TFT is applicable only when IP traffic is

49 carried over PPP. If PPP carries header-compressed IP packets, then a TFT cannot be used.

50 To support roaming GPRS subscribers, and for forward compatibility, the SGSN is not required to know the
51 tunnelled PDP. Every SGSN shall have the capability to transfer PDUs belonging to PDPs not supported in
52 the PLMN of the SGSN.

53 15.3 Traffic Flow Template

54 A TFT consists of from one and up to eight packet filters, each identified by a unique packet filter identifier.
55 A packet filter also has an evaluation precedence index that is unique within all TFTs associated with all PDP
56 contexts that share the same PDP address. This evaluation precedence index is in the range of 255 (lowest
57 evaluation precedence) down to 0 (highest evaluation precedence). The MS manages packet filter identifiers,
58 their evaluation precedence indexes and creates the packet filter contents.

59 A TFT is always associated to a PDP context during the Secondary PDP Context Activation Procedure. A
60 TFT may be added to a PDP context that was created with the PDP Context Activation Procedure, by means
61 of the MS Initiated PDP Context Modification Procedure. By means of the MS Initiated PDP Context
62 Modification Procedure any TFT can be modified. A PDP context can never have more than one TFT
63 associated with it.

64 15.3.1 Rules for Operations on TFTs

65 For handling of the TFTs and packet filters the MS shall use the TFT and packet filter identifiers in each
66 operation.

67 When the MS creates a new TFT, or modifies an existing TFT, it has to include at least one valid packet
68 filter. If no valid packet filter is included in the newly created or modified TFT, then the procedure used for
69 the creation or modification of the TFT shall fail, an error code shall be sent to the MS.

70 During the modification of a TFT, one or more existing packet filter can be modified or deleted, whereas a
71 new packet filter can be created. In order to modify an existing packet filter, the new values for the packet
72 filter attributes along with the packet filter identifier is sent from the MS to the GGSN.

73 The MS may also modify the evaluation precedence index only of one or several packet filters by means of
74 the MS Initiated PDP Context Modification Procedure.

75 A TFT is deleted when the associated PDP Context is deleted.

76 A TFT can also be deleted by means of the MS Initiated PDP Context Modification Procedure. At any time
77 there may exist only one PDP context with no associated TFT amongst all PDP contexts associated to one
78 PDP address. At an attempt by the MS to delete a TFT, which would violate this rule, the deletion procedure
79 shall be rejected by the GGSN.

80

81 15.3.2 Packet Filter Attributes

82 Each valid packet filter contains of at least one of the following attributes in addition to its unique identifier
83 within a given TFT and an evaluation precedence index which is unique within all TFTs for one PDP address:

- 84 – Source address and subnet mask,
- 85 – Protocol Number (IPv4) / Next Header (IPv6),
- 86 – Destination port range,
- 87 – Source port range,
- 88 – IPSec Security Parameter Index (SPI),
- 89 – Type of Service (TOS) (IPv4) / Traffic class (IPv6) and mask,
- 90 – Flow label (IPv6),

91 Some of the above listed attributes may coexist in a packet filter while others mutually exclude each other.
92 In table 1 below, the possible combinations are shown. Only those attributes marked with an 'X' may be
93 specified for a single packet filter. All marked attributes may be specified, but at least one shall be
94 specified.

95 | If the parameters of the header of a received PDU match all specified attribute values in a packet filter a
96 | match is considered to be found for this packet filter. In this case the evaluation procedure is aborted.
97 | Other packet filters in increasing order of their evaluation precedence index are evaluated until such a
98 | match is found.

99 | There may be potential conflicts if attribute values are combined in such a way that the defined filter can
100 | never achieve a match to a valid IP packet header. However, the determination of such conflicts are
101 | outside the scope of GPRS standardisation.

102

<u>Packet filter attribute</u>	<u>Valid combination types</u>		
	<u>I</u>	<u>II</u>	<u>III</u>
<u>Source address and subnet mask</u>	X	X	X
<u>Protocol Number (IPv4) / Next Header (IPv6)</u>	X	X	
<u>Destination port range</u>	X		
<u>Source port range</u>	X		
<u>IPSec Security Parameter Index (SPI)</u>		X	
<u>Type of Service (TOS) (IPv4) / Traffic Class (IPv6) and mask,</u>	X	X	X
<u>Flow label (IPv6)</u>			X

103

104

Table 1: Valid packet filter attribute combinations

15.3.2.1 Source Address and Subnet Mask

This attribute of a valid packet filter shall contain an IPv4 or IPv6 address along with a subnet mask.

As an example, the source address and subnet mask attribute to classify packets coming from all hosts within the IPv4 domain A.B.C.0/24 is {A.B.C.0 [255.255.255.0]}.

108

15.3.2.2 Protocol Number/Next Header

The Protocol Number/Next Header attribute of a valid packet filter shall contain either an IPv4 Protocol Number or an IPv6 Next Header value. The value range is from 0 to 255.

111

15.3.2.3 Port numbers

The destination and source port range attributes of a valid packet filter shall contain one port number, or a range of port numbers. Port numbers range between 0 and 65535.

114

15.3.2.4 IPSec Security Parameter Index

The IPSec security parameter index attribute of a valid packet filter shall contain one SPI which is a 32-bit field.

117

15.3.2.5 Type of Service/Traffic Class and Mask

The Type of Service/Traffic Class attribute of a valid packet filter shall contain either an IPv4 TOS octet or an IPv6 Traffic Class octet along with a mask defining which of the 8 bits should be used for matching.

120

15.3.2.6 Flow label

The flow label attribute of a valid packet filter shall contain an IPv6 flow label which is a 20-bit field.

122

15.3.3 Example Usage of Packet Filters

123

Based on the type of traffic or the external network QoS capabilities, different types of packet filters can be used to classify a given PDU in order to determine the right PDP context. Some examples are given below.

125

126 **15.3.3.1 IPv4 multi-field classification**

127 In the case of multi-field classification, the packet filter consists of a number of packet header fields. For
128 example to classify TCP/IPv4 packets originating from 172.168.8.0/24 destined to port 5003 at the TE, the
129 following packet filter can be used.

130 Packet filter identifier: 1,

131 IPv4 source address: {172.168.8.0 [255.255.255.0]},

132 Protocol Number for TCP: 6,

133 Destination Port: 5003.

134 **15.3.3.2 IPv4 TOS-based classification**

135 In the case of TOS-based classification, the packet filter consists of only the TOS octet coding. For example
136 to classify IPv4 packets marked with TOS coding 001010xx, the following packet filter can be used.

137 Packet filter identifier: 3,

138 Type of Service/Traffic Class: 00101000.

139 Mask: 11111100

140 Note: The TOS-based classification can always be augmented with the source address attribute if it is known
141 that different source domains use different TOS octet codings for the same traffic class.

142 **15.3.3.3 IPv4 multi-field classification for IPSec traffic**

143 In the case of multi-field classification of IPSec traffic, the packet filter contains the SPI instead of the port
144 numbers which are not available due to encryption. If IPSec (ESP) was used with an SPI of 0x0F80F000, then
145 the following packet filter can be used.

146 Packet filter identifier: 4,

147 Protocol Number for ESP: 50,

148 SPI: 0x0F80F000.

London, UK, 25-29 October 1999

3G CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060 CR **017**
r1

Current Version: **3.1.0**

3G specification number ↑

↑ CR number as allocated by 3G support team

For submission to TSG **SA#6**
list TSG meeting no. here ↑

for approval (only one box should
for information be marked with an X)

Form: 3G CR cover sheet, version 1.0 The latest version of this form is available from: ftp://ftp.3gpp.org/Information/3GCRRF-xx.rtf

Proposed change affects:
(at least one should be marked with an X)

USIM

ME

UTRAN

Core Network

Source: **GPRS**

Date: **21 Oct 1999**

Subject: **Nortel Networks, Motorola**

3G Work item: **Removal of BB Protocol**

Category:

- F Correction
- A Corresponds to a correction in a 2G specification
- B Addition of feature
- C Functional modification of feature
- D Editorial modification

(only one category shall be marked with an X)

Reason for change:

This change request aims to remove all reference to the BB Protocol from GSM 03.60 to align GSM 03.60 with the GTP protocol definition in GSM 09.60. The BB Protocol is covered by the Reliability Class attribute of the QoS IE.

Clauses affected: **9.2.2.1, 9.2.2.1.1, 9.2.2.3, and 15.2.3.**

Other specs affected:

- Other 3G core specifications → List of CRs:
- Other 2G core specifications → List of CRs: **03.60 A172r1(R97), A173 (R98)**
- MS test specifications → List of CRs:
- BSS test specifications → List of CRs:
- O&M specifications → List of CRs:

Other comments:



help.doc

<----- double-click here for help and instructions on how to create a CR.

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1. Each step is explained in the following list.

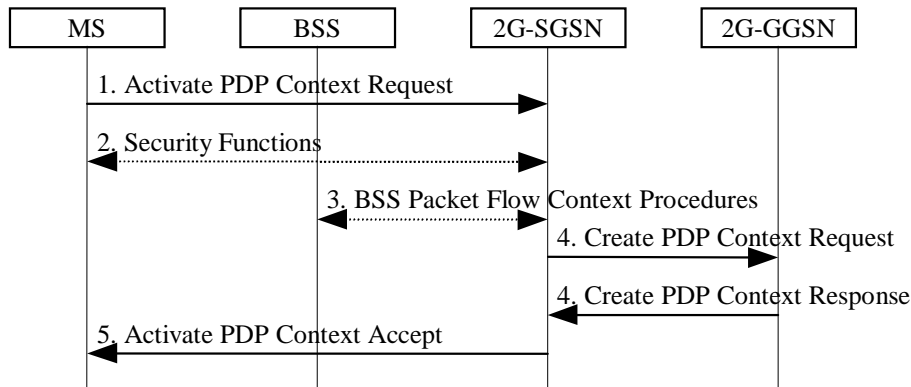


Figure 1: PDP Context Activation Procedure for GPRS

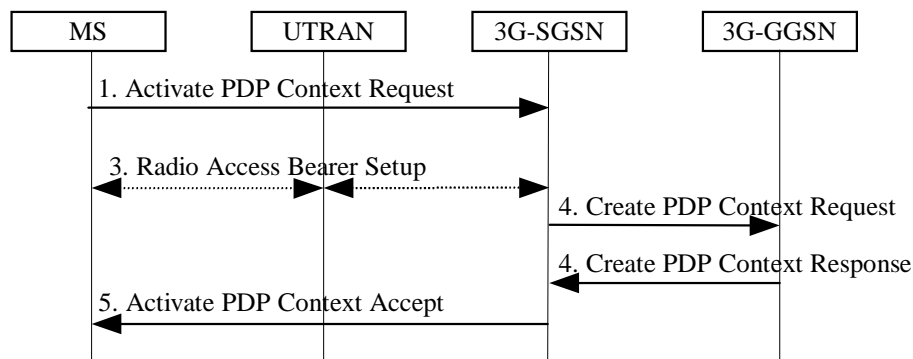


Figure 2: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, ~~BB Protocol~~, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. ~~BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN.~~ Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

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. All PDP contexts sharing the same PDP address are identified by one and the same TI but a unique NSAPI value.

The Secondary PDP Context Activation procedure associates a Traffic Flow Template (TFT) to the newly activated PDP context. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external 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. The procedure is illustrated in Figure 3. Each step is explained in the following list.

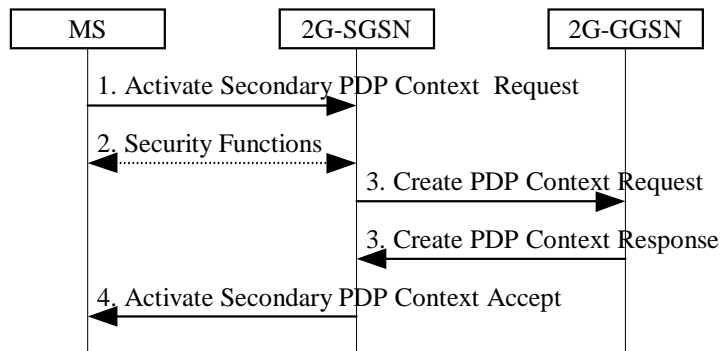


Figure 3: Secondary PDP Context Activation Procedure for GPRS

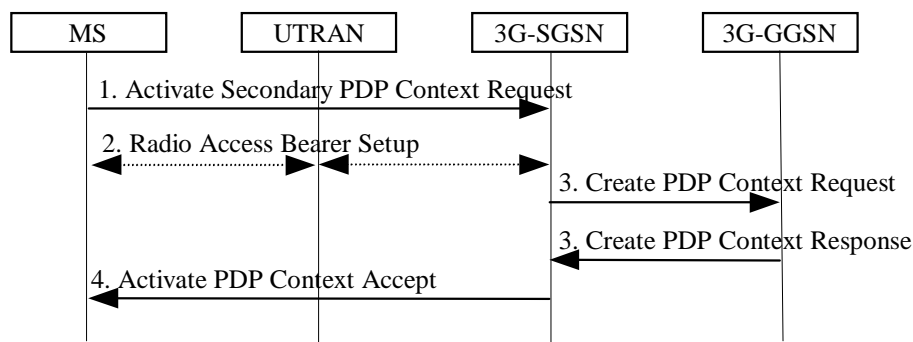


Figure 4: Secondary PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate Secondary PDP Context Request (NSAPI, TI, QoS Requested, TFT) message to the SGSN. 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 is the same TI used by the already-activated PDP context(s) for that PDP address, and NSAPI contains a value not used by any other activated PDP context.

- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

For UMTS, , the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 3) The SGSN validates the Activate Secondary PDP Context Request using the 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TID, TFT) message to the affected GGSN. The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TID, ~~BB-Protocol~~, Reordering Required, QoS Negotiated, Cause) message to the SGSN.

- 4) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.

9.2.2.3 Anonymous Access PDP Context Activation Procedure

The MS can anonymously initiate PDP Context Activation in IDLE, STANDBY, and READY states. An existing MM context in the SGSN is neither required nor used in this case. Only dynamic PDP addressing is applicable.

The Anonymous Access PDP Context Activation procedure is illustrated in Figure 5. Each step is explained in the following list.

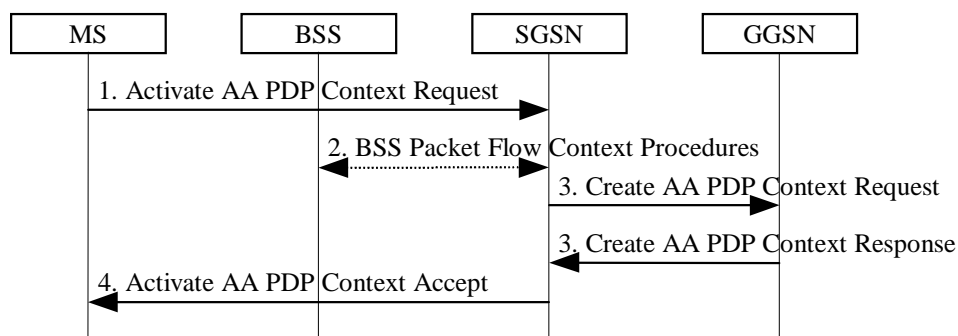


Figure 5: Anonymous Access PDP Context Activation Procedure

- 1) The MS sends an Activate AA PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use a Random TLLI at the RLC/MAC layer for identification purposes. The MS shall use PDP Address to indicate that it requires the use of a dynamic PDP address. The MS shall use Access Point Name to select a reference point to a certain external network that provides anonymous services. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".
- 3) The SGSN may restrict the requested QoS value given its capabilities and the current load. The SGSN assigns an Auxiliary TLLI and creates an AA-TID for the PDP-Context. The SGSN sends a Create AA PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, AA-TID, Selection Mode, PDP Configuration Options) message to the GGSN indicated by Access Point Name in the Activate AA PDP Context Request message. Selection Mode indicates how the APN was selected. The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the server(s) that provide services for anonymous MSs, and to start charging. The GGSN may use Access Point Name to find an external network that provides anonymous services. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then allocates a dynamic PDP Address and returns a Create AA PDP Context Response (AA-TID, PDP Address, ~~BB Protocol~~, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. ~~BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN.~~ Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The GGSN shall check the source and destination address in all subsequent anonymous MO PDP PDUs received from the SGSN. If the GGSN detects a not allowed address in an MO PDP PDU, then the PDP PDU shall be discarded and the MM and PDP contexts shall be deleted in the GGSN, SGSN, and MS, as defined in subclause "Anonymous Access PDP Context Deactivation Initiated by GGSN Procedure".

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create AA PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 4) The SGSN inserts the NSAPI along with the PDP address received from the GGSN in its PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated and returns an Activate AA PDP Context Accept (A-TLLI, PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route anonymous PDP PDUs between the GGSN and the MS and to start charging.

After an SGSN has successfully updated the GGSN, the MM and PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the AA PDP Context Activation procedure fails or if the SGSN returns an Activate AA PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same GGSN up to a maximum number of attempts.

15.2.3 Reliability Class

Data reliability is defined in terms of the residual error rates for the following cases (see GSM 02.60):

- probability of data loss;
- probability of data delivered out of sequence;
- probability of duplicate data delivery; and
- probability of corrupted data.

The reliability class specifies the requirements of the various network protocol layers. The combinations of the GTP, LLC, and RLC transmission modes support the reliability class performance requirements. TCP is used to transport user data on the GPRS backbone network in acknowledged GTP mode, while UDP is used in unacknowledged GTP mode. The reliability classes are summarised in **Error! Reference source not found.**

Table 1: Reliability Classes

Reliability Class	GTP Mode	LLC Frame Mode	LLC Data Protection	RLC Block Mode	Traffic Type
1	Acknowledged	Acknowledged	Protected	Acknowledged	Non real-time traffic, error-sensitive application that cannot cope with data loss.
2	Unacknowledged	Acknowledged	Protected	Acknowledged	Non real-time traffic, error-sensitive application that can cope with infrequent data loss.
3	Unacknowledged	Unacknowledged	Protected	Acknowledged	Non real-time traffic, error-sensitive application that can cope with data loss, GMM/SM, TOM, and SMS.
4	Unacknowledged	Unacknowledged	Protected	Unacknowledged	Real-time traffic, error-sensitive application that can cope with data loss.
5	Unacknowledged	Unacknowledged	Unprotected	Unacknowledged	Real-time traffic, error non-sensitive application that can cope with data loss.

NOTE: For real-time traffic, the QoS profile also requires appropriate settings for delay and throughput.

Each reliability class in combination with the Reordering Required information specifies the target residual error rates for a PDP context. The residual error rate targets are given in GSM 02.60. A PLMN may support only a subset of the reliability classes. Signalling and SMS shall be transferred with reliability class 3.

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London, United Kingdom, 25-29.10.1999**

Document S2-99B72

*e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx*

15.2 Quality of Service Profile

~~[Not yet updated for UMTS.]~~

A QoS profile is associated with each PDP context. The QoS profile is considered to be a single parameter with multiple data transfer attributes. ~~The definition of the QoS attributes for the packet domain can be found in UMTS 23.907, which also defines the mapping between the packet-domain QoS attributes and the QoS attributes for GPRS releases 97 and 98. It defines the quality of service expected in terms the following attributes:~~

- ~~—precedence class;~~
- ~~—delay class;~~
- ~~—reliability class;~~
- ~~—peak throughput class; and~~
- ~~—mean throughput class.~~

There are many possible QoS profiles defined by the combinations of the attributes. A PLMN may support only a limited subset of the possible QoS profiles.

During the QoS profile negotiation defined in subclause "Activation Procedures", it shall be possible for the MS to request a value for each of the QoS attributes, including the HLR-stored subscribed default values. The network shall negotiate each attribute to a level that is in accordance with the available GPRS resources. The network shall always attempt to provide adequate resources to support the negotiated QoS profiles.

15.2.1 Radio Priority Levels for GPRS

The RLC/MAC layer supports four radio priority levels and an additional level for signalling messages as defined in GSM 03.64 and GSM 04.60. Upon uplink access the MS can indicate one of the four priority levels, and whether the cause for the uplink access is user data or signalling message transmission. This information is used by the BSS to determine the radio access precedence (i.e., access priority) and the service precedence (i.e., transfer priority under congested situation), see GSM 04.60. The radio priority levels to be used for transmission of MO SMS shall be determined by the SGSN and delivered to the MS in the Attach Accept message. The radio priority level to be used for user data transmission shall be determined by the SGSN based on the negotiated QoS profile and shall be delivered to the MS during the PDP Context Activation and PDP Context Modification procedures.

15.2.1 Precedence Class

~~Under normal operating conditions, the network shall attempt to meet the service commitments of all QoS profiles. The service precedence indicates the relative importance of maintaining the service commitments under abnormal conditions, for example which packets are discarded in the event of problems such as limited resources or network congestion. The precedence classes are defined in Table 15.~~

Table 15: Precedence Classes

Precedence	Precedence Name	Interpretation
1	High priority	Service commitments shall be maintained ahead of precedence classes 2 and 3.
2	Normal priority	Service commitments shall be maintained ahead of precedence class 3.
3	Low priority	Service commitments shall be maintained after precedence classes 1 and 2.

15.2.2—Delay Class

GSM 02.60 defines four delay classes (1 to 4). The network operator should provision adequate transmission resources on the radio and network communication channels in order to support the expected number of subscribers within each cell at a given delay class. A PLMN may support only a subset of the delay classes. As a minimum, the PLMN shall support the best effort delay class (4).

15.2.3—Reliability Class

Data reliability is defined in terms of the residual error rates for the following cases (see GSM 02.60):

- probability of data loss;
- probability of data delivered out of sequence;
- probability of duplicate data delivery; and
- probability of corrupted data.

The reliability class specifies the requirements of the various network protocol layers. The combinations of the GTP, LLC, and RLC transmission modes support the reliability class performance requirements. The reliability classes are summarised in Table 16.

Table 16: Reliability Classes

Reliability Class	GTP Mode	LLC Frame Mode	LLC Data Protection	RLC Block Mode	Traffic Type
1	Acknowledged	Acknowledged	Protected	Acknowledged	Non-real-time traffic, error-sensitive application that cannot cope with data loss.
2	Unacknowledged	Acknowledged	Protected	Acknowledged	Non-real-time traffic, error-sensitive application that can cope with infrequent data loss.
3	Unacknowledged	Unacknowledged	Protected	Acknowledged	Non-real-time traffic, error-sensitive application that can cope with data loss, GMM/SM, TOM, and SMS.
4	Unacknowledged	Unacknowledged	Protected	Unacknowledged	Real-time traffic, error-sensitive application that can cope with data loss.
5	Unacknowledged	Unacknowledged	Unprotected	Unacknowledged	Real-time traffic, error non-sensitive application that can cope with data loss.

NOTE: — For real-time traffic, the QoS profile also requires appropriate settings for delay and throughput.

Each reliability class in combination with the Reordering Required information specifies the target residual error rates for a PDP context. The residual error rate targets are given in GSM 02.60. A PLMN may support only a subset of the reliability classes. Signalling and SMS shall be transferred with reliability class 3.

15.2.4—Throughput Classes

User data throughput is specified in terms of a set of throughput classes that characterise the expected bandwidth required for a PDP context. The throughput is defined by both peak and mean classes.

15.2.4.1—Peak Throughput Class

The peak throughput is measured at the Gi and R reference points in units of octets per second. It specifies the maximum rate at which data is expected to be transferred across the network for an individual PDP context. There is no guarantee that this peak rate can be achieved or sustained for any time period, this depends upon the MS capability and available radio resources. The network may limit the subscriber to the negotiated peak data rate, even if additional transmission

capacity is available. The peak throughput is independent of the delay class, that determines the per packet GPRS network transit delay. The peak throughput classes are defined in Table 17.

Table 17: Peak Throughput Classes

Peak Throughput Class	Peak Throughput in octets per second
1	Up to 1 000 (8 kbit/s).
2	Up to 2 000 (16 kbit/s).
3	Up to 4 000 (32 kbit/s).
4	Up to 8 000 (64 kbit/s).
5	Up to 16 000 (128 kbit/s).
6	Up to 32 000 (256 kbit/s).
7	Up to 64 000 (512 kbit/s).
8	Up to 128 000 (1 024 kbit/s).
9	Up to 256 000 (2 048 kbit/s).

15.2.4.2 Mean Throughput Class

The mean throughput is measured at the Gi and R reference points in units of octets per hour. It specifies the average rate at which data is expected to be transferred across the GPRS network during the remaining lifetime of an activated PDP context. The network may limit the subscriber to the negotiated mean data rate (e.g., for flat rate charging), even if additional transmission capacity is available. A "best effort" mean throughput class may be negotiated, and means that throughput shall be made available to the MS on a per need and availability basis.

The mean throughput classes are defined in Table 18.

Table 18: Mean Throughput Classes

Mean Throughput Class	Mean Throughput in octets per hour
1	100 (~0.22 bit/s).
2	200 (~0.44 bit/s).
3	500 (~1.11 bit/s).
4	1 000 (~2.2 bit/s).
5	2 000 (~4.4 bit/s).
6	5 000 (~11.1 bit/s).
7	10 000 (~22 bit/s).
8	20 000 (~44 bit/s).
9	50 000 (~111 bit/s).
10	100 000 (~0.22 kbit/s).
11	200 000 (~0.44 kbit/s).
12	500 000 (~1.11 kbit/s).
13	1 000 000 (~2.2 kbit/s).
14	2 000 000 (~4.4 kbit/s).
15	5 000 000 (~11.1 kbit/s).
16	10 000 000 (~22 kbit/s).
17	20 000 000 (~44 kbit/s).
18	50 000 000 (~111 kbit/s).
19	100 000 000 (~0.22 Mbit/s).
20	200 000 000 (~0.44 Mbit/s).
31	Best effort.

<h2 style="margin: 0;">CHANGE REQUEST</h2>		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.
23.060	CR 046r3	Current Version: 3.1.0
GSM (AA.BB) or 3G (AA.BBB) specification number ↑	↑ CR number as allocated by MCC support team	
For submission to: SA#6 <small>list expected approval meeting # here ↑</small>	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	strategic <input type="checkbox"/> non-strategic <input type="checkbox"/> <small>(for SMG use only)</small>

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: NTT Communicationware **Date:** 25.10.99

Subject: Addition of the sections of NSAPI, RB identity, RAB ID for UMTS and of TEID

Work item: _____

Category:	F Correction <input type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input checked="" type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: This CR represents the modification and addition for the identities for GPRS/UMTS release 99.

- Addition of RAB ID and RB identity for UMTS based on the R2/3 agreement
- Addition of TEID based on the N2 agreement
- Deletion of TID based on the N2 agreement and replacement to TEID

Clauses affected: 14

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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Other comments: _____



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3.2 Abbreviations

For the purposes of the present document the following abbreviations apply. Additional applicable abbreviations can be found in GSM 01.04 [1].

AA	Anonymous Access
APN	Access Point Name
ATM	Asynchronous Transfer Mode
AUTN	Authentication Token
BG	Border Gateway
BSSAP+	Base Station System Application Part +
BSSGP	Base Station System GPRS Protocol
BVCI	BSSGP Virtual Connection Identifier
CCU	Channel Codec Unit
CDR	Call Detail Record
CGF	Charging Gateway Functionality
CGI	Cell Global Identification
CK	Cipher Key
CS	Circuit Switched
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
EGPRS	Enhanced GPRS
GEA	GPRS Encryption Algorithm
GGSN	Gateway GPRS Support Node
GMM/SM	GPRS Mobility Management and Session Management
GSIM	GSM Service Identity Module
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
GTP-C	GTP Control Plane
GTP-U	GTP User Plane
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IHOSS	Internet-Hosted Octet Stream Service
IK	Integrity Key
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IPX	Internet Packet eXchange
ISP	Internet Service Provider
KSI	Key Set Identifier
L2TP	Layer-2 Tunnelling Protocol
LL-PDU	LLC PDU
LLC	Logical Link Control
MAC	Medium Access Control
MIP	Mobile IP
MNRF	Mobile station Not Reachable Flag
MNRG	Mobile station Not Reachable for GPRS flag
MNRR	Mobile station Not Reachable Reason
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NGAF	Non-GPRS Alert Flag
NS	Network Service
NSAPI	Network layer Service Access Point Identifier
NSS	Network SubSystem
OSP	Octet Stream Protocol
P-TMSI	Packet TMSI
PCU	Packet Control Unit
PDCH	Packet Data CHannel
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g., IP or X.25 [34]
PDU	Protocol Data Unit

PPF	Paging Proceed Flag
PPP	Point-to-Point Protocol
PTM	Point To Multipoint
PTP	Point To Point
PVC	Permanent Virtual Circuit
RA	Routeing Area
RAC	Routeing Area Code
RAI	Routeing Area Identity
RANAP	Radio Access Network Application Protocol
RLC	Radio Link Control
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SGSN	Serving GPRS Support Node
SM	Short Message
SM-SC	Short Message service Service Centre
SMS-GMSC	Short Message Service Gateway MSC
SMS-IWMSC	Short Message Service Interworking MSC
SN-PDU	SNDCP PDU
SNDC	SubNetwork Dependent Convergence
SNDCP	SubNetwork Dependent Convergence Protocol
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TFT	Traffic Flow Template
TEID	Tunnel Endpoint Identifier
TLLI	Temporary Logical Link Identity
TOM	Tunnelling Of Messages
TRAU	Transcoder and Rate Adaptor Unit
UDP	User Datagram Protocol
UEA	UMTS Encryption Algorithm
UIA	UMTS Integrity Algorithm
URA	UTRAN Registration Area
USIM	User Service Identity Module
UTRAN	UMTS Terrestrial Radio Access Network

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 134. Each step is explained in the following list.

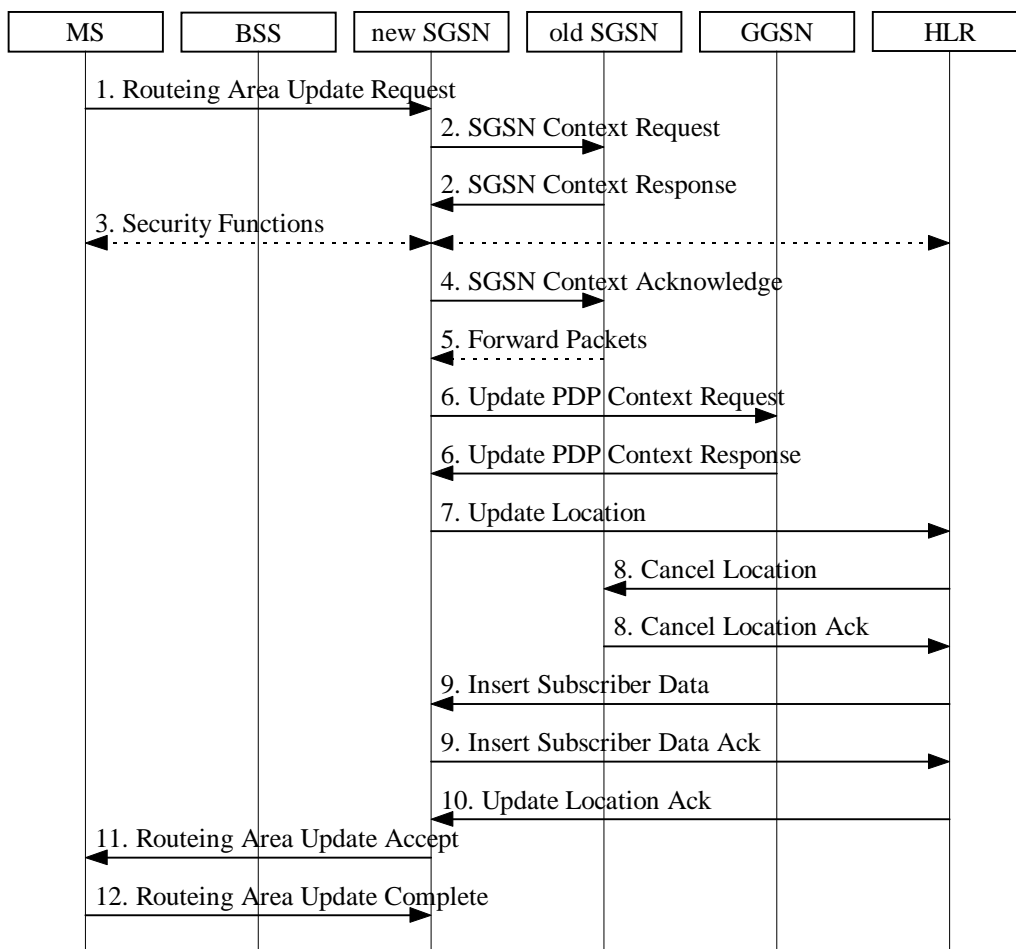


Figure 134: Inter SGSN Routeing Area Update Procedure

- 1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.
- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) 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 (old RAI, TLLI, MS Validated, New SGSN Address) 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 stops assigning SMDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, 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. The old SGSN starts a timer and stops the transmission of N-PDUs to the MS.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.

- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new 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. If the security functions do not authenticate the MS correctly, then 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) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SMDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TEID).
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) 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, then the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are 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).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS 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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) 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 SGSN, or if subscription checking fails, then the new SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 12) The MS acknowledges the new P-TMSI with a Routeing Area Update Complete (P-TMSI, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, then these N-PDUs shall be discarded by the new SGSN. LLC and SMDCP in the MS are reset.

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 SGSN is unable to update the PDP context in one or more GGSNs, then the 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 timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, then the old SGSN shall stop forwarding N-PDUs to the new SGSN.

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 IDLE state.

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter SGSN) procedure is illustrated in Figure 36. Each step is explained in the following list.

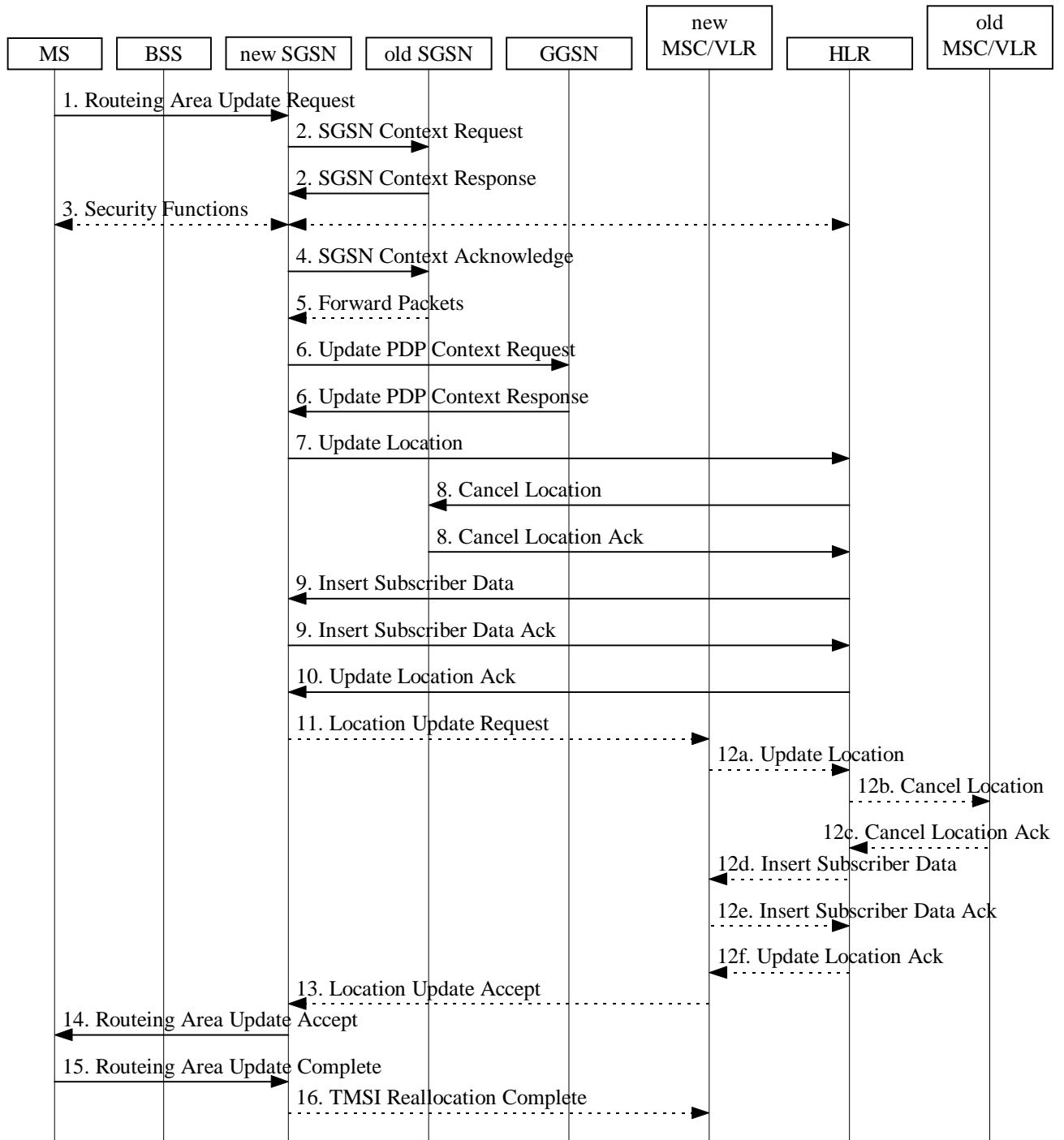


Figure 36: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

- 1) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.

- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) 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 (old RAI, TLLI, MS Validated, New SGSN Address) 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 stops assigning SMDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, 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. The old SGSN starts a timer and stops the downlink transfer.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.
- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new 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. If the security functions do not authenticate the MS correctly, then 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) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SMDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TEID).
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) 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, then the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are 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).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS 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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) 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, then 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 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 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.

- 12) 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.
- 13) 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.
- 14) 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 SGSN, or if subscription checking fails, then the SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 15) The MS confirms the reallocation of the TMSIs by sending Routing Area Update Complete (P-TMSI, VLR TMSI, Receive N-PDU Number) to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, then these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.
- 16) The new SGSN sends TMSI Reallocation Complete (VLR TMSI) to the new VLR if the VLR TMSI is confirmed by the MS.

In the case of a rejected routing 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 routing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the SGSN is unable to update the PDP context in one or more GGSNs, then the 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 routing area update.

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter IDLE state.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, then the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful location update is performed.

6.13.2 Intersystem Handover at RA Change

6.13.2.1 UMTS to GPRS Handover

An inter system handover from UMTS to GPRS takes place when the MS in PMM-IDLE or PMM-CONNECTED state moves to a new GSM/GPRS cell in a new RA. In this case the MS shall initiate a GPRS RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

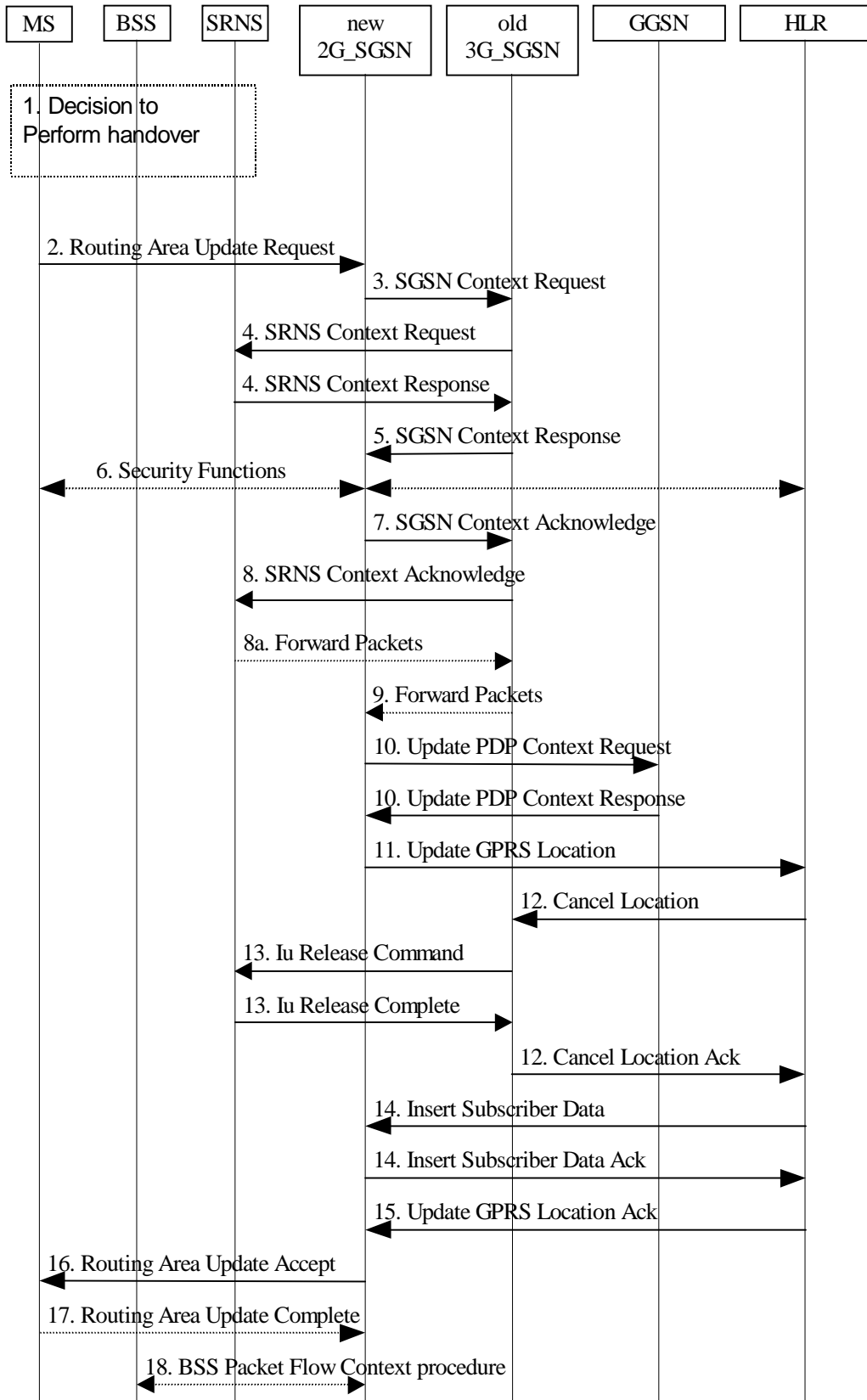


Figure 559: UMTS to GPRS Inter SGSN Routing Area Update Procedure

- 1) The MS and/or BSS/UTRAN decides to perform handover, which leads to that the MS switch to the new cell supporting GPRS radio technology and that the PDU transmission is suspended.
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the new 2G-SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the new 2G-SGSN.

17) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.

18) The 2G-SGSN and the BSS may execute the BSS Packet Flow Context Procedure

The sequence applied for the intra SGSN RA update case is identical to the cell change case within the same RA as shown in subclause "Intersystem Handover within an RA between Cells in Different Systems" used with a different update type.

6.13.2.2 GPRS to UMTS Handover

An intersystem handover from GPRS to UMTS takes place when the PS-attached MS moves to a new UMTS cell of a new RA. In this case the MS shall initiate a UMTS RA update procedure by establishing a RRC connection and initiating the RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

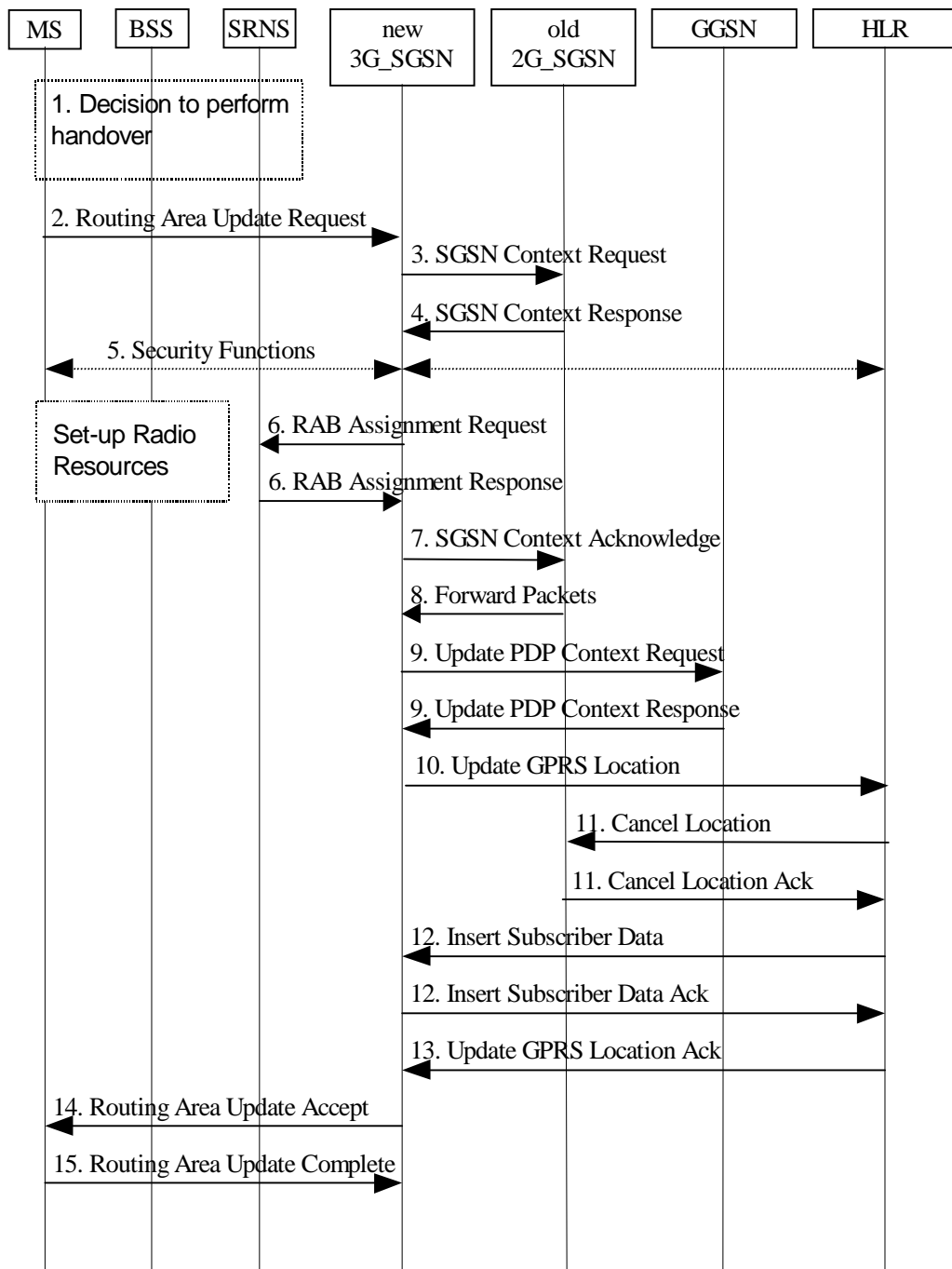


Figure 654: GPRS to UMTS Inter SGSN Routing Area Update Procedure

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type, CM) to the new 3G-SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 3G-SGSN.
- 3) The new 3G-SGSN sends SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) to the old 2G-SGSN to get the MM and PDP contexts for the MS (The old RAI received from the MS is used to derive the old 2G-SGSN address). The old 2G-SGSN starts a timer for supervision of the MS's context and stops the transmission of N-PDUs to the MS.
The new 3G-SGSN uses the received SMDCP N-PDU sequence number for reliable data transmission (FFS).
- 5) Security functions may be executed.
- 6) The new 3G-SGSN request the SRNS to establish of a radio access bearer by sending RAB Assignment Request to the SRNS. The SRNS responds with RAB Assignment Response.
- 7) The new 3G-SGSN sends a 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 routing area update procedure back to the old SGSN before completing the ongoing routing area update procedure.
- 8) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. The 3G-SGSN shall ignore any SMDCP sequence numbers received with the tunnelled N-PDUs 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. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.
- 9) The new 3G-SGSN sends a Update PDP Context Request (new SGSN Address, TEID, QoS Negotiated) to the GGSN (s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TEID).
- 10) The new 3G-SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 11) The HLR sends Cancel Location (IMSI, Cancellation Type) 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. When the timer is running the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with Cancel Location Ack (IMSI).
- 12) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 3G-SGSN. The 3G-SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 13) The HLR acknowledges the Update GPRS Location by sending Update Location Ack (IMSI) to the new 3G-SGSN.
- 14) 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 3G-SGSN, or if subscription checking fails, then the new 3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 3G-SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 3G-SGSN and the MS. The new 3G-SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI signature Receive N-PDU Number (FFS)).
- 15) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number (FFS)).

The sequence applied for the intra SGSN RA update case is identical to the cell change within the same RA case as shown in subclause "Intersystem Handover within an RA between Cells in Different Systems" used with a different update type.

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in [Figure 758](#). Each step is explained in the following list.

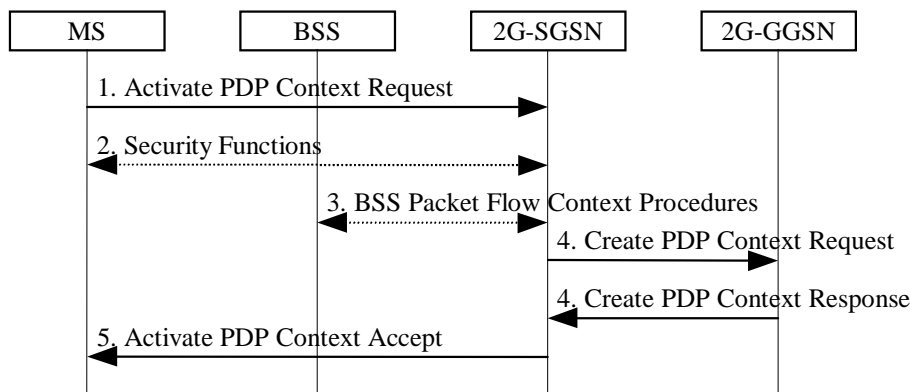


Figure 758: PDP Context Activation Procedure for GPRS

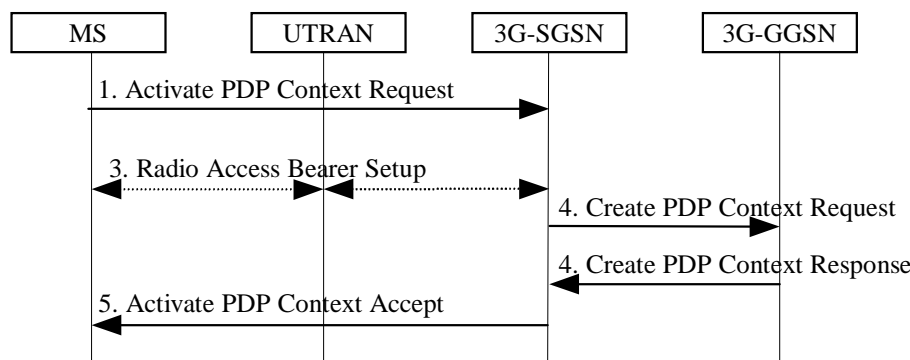


Figure 959: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TEID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TEID, MSISDN, Selection Mode, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TEID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

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. All PDP contexts sharing the same PDP address are identified by one and the same TI but a unique NSAPI value.

The Secondary PDP Context Activation procedure associates a Traffic Flow Template (TFT) to the newly activated PDP context. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external 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. The procedure is illustrated in Figure 10Figure 60. Each step is explained in the following list.

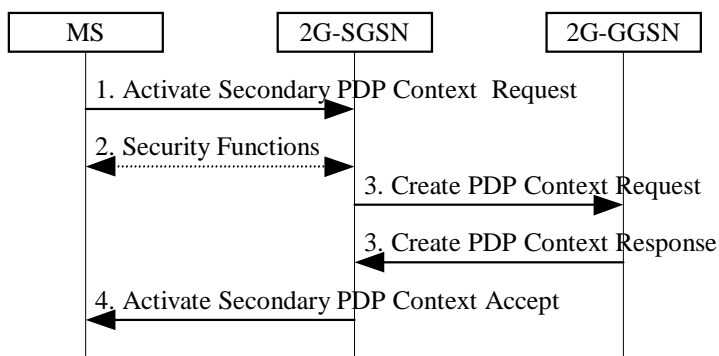


Figure 1060: Secondary PDP Context Activation Procedure for GPRS

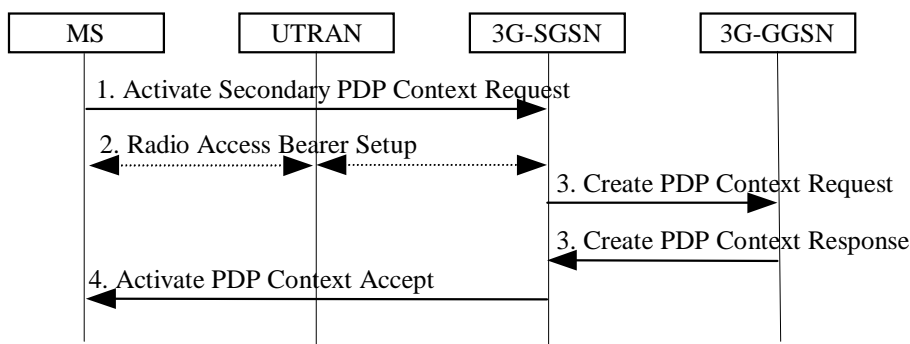


Figure 1264: Secondary PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate Secondary PDP Context Request (NSAPI, TI, QoS Requested, TFT) message to the SGSN. 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 is the same TI used by the already-activated PDP context(s) for that PDP address, and NSAPI contains a value not used by any other activated PDP context.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

For UMTS, , the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 3) The SGSN validates the Activate Secondary PDP Context Request using the 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TEID, TFT) message to the affected GGSN. The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TEID, BB Protocol, Reordering Required, QoS Negotiated, Cause) message to the SGSN.

- 4) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the

MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.

9.2.2.3 Anonymous Access PDP Context Activation Procedure

The MS can anonymously initiate PDP Context Activation in IDLE, STANDBY, and READY states. An existing MM context in the SGSN is neither required nor used in this case. Only dynamic PDP addressing is applicable.

The Anonymous Access PDP Context Activation procedure is illustrated in Figure 1365. Each step is explained in the following list.

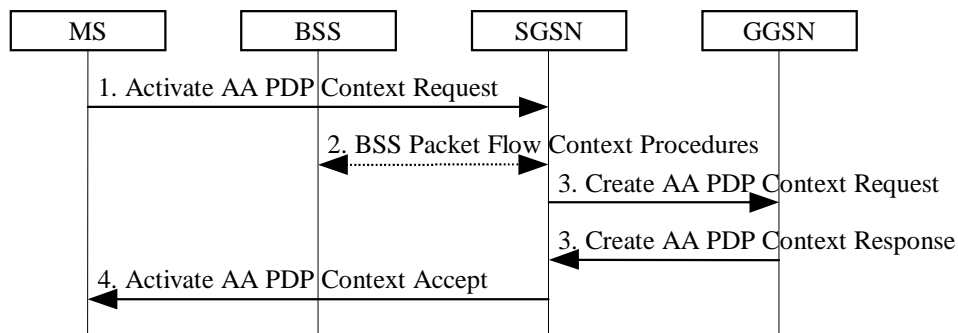


Figure 1365: Anonymous Access PDP Context Activation Procedure

- 1) The MS sends an Activate AA PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use a Random TLLI at the RLC/MAC layer for identification purposes. The MS shall use PDP Address to indicate that it requires the use of a dynamic PDP address. The MS shall use Access Point Name to select a reference point to a certain external network that provides anonymous services. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".
- 3) The SGSN may restrict the requested QoS value given its capabilities and the current load. The SGSN assigns an Auxiliary TLLI and creates an AA-TEID for the PDP-Context. The SGSN sends a Create AA PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, AA-TEID, Selection Mode, PDP Configuration Options) message to the GGSN indicated by Access Point Name in the Activate AA PDP Context Request message. Selection Mode indicates how the APN was selected. The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the server(s) that provide services for anonymous MSs, and to start charging. The GGSN may use Access Point Name to find an external network that provides anonymous services. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then allocates a dynamic PDP Address and returns a Create AA PDP Context Response (AA-TEID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The GGSN shall check the source and destination address in all subsequent anonymous MO PDP PDUs received from the SGSN. If the GGSN detects a not allowed address in an MO PDP PDU, then the PDP PDU shall be discarded and the MM and PDP contexts shall be deleted in the GGSN, SGSN, and MS, as defined in subclause "Anonymous Access PDP Context Deactivation Initiated by GGSN Procedure".

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create AA PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 4) The SGSN inserts the NSAPI along with the PDP address received from the GGSN in its PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated and returns an Activate AA PDP Context Accept (A-TLLI, PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route anonymous PDP PDUs between the GGSN and the MS and to start charging.

After an SGSN has successfully updated the GGSN, the MM and PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the AA PDP Context Activation procedure fails or if the SGSN returns an Activate AA PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same GGSN up to a maximum number of attempts.

9.2.3 Modification Procedures

An MS or GGSN can request, or an SGSN can decide, possibly triggered by the HLR as explained in subclause "Insert Subscriber Data Procedure", to modify parameters that were negotiated during an activation procedure for one or several PDP contexts. The following parameters can be modified:

- QoS Negotiated;
- Radio Priority;
- Packet Flow Id; and
- PDP Address (in case of the GGSN-initiated modification procedure).

The SGSN can request the modification of parameters by sending a Modify PDP Context Request message to the MS.

A GGSN can request the modification of parameters by sending an Update PDP Context Request message to the SGSN.

An MS can request the modification of parameters by sending a Modify PDP Context Request message to the SGSN.

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in [Figure 15-66](#). Each step is explained in the following list.

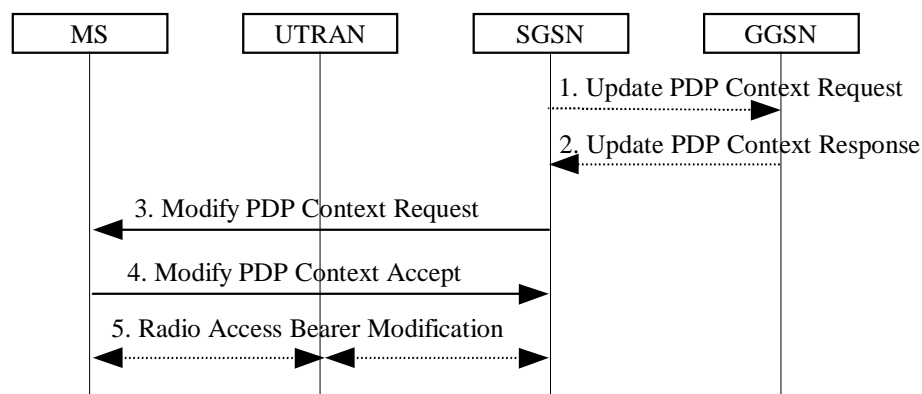


Figure 15-66: SGSN-Initiated PDP Context Modification Procedure

- 1) The SGSN may send an Update PDP Context Request (TEID, QoS Negotiated) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.

- 2) The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TEID, QoS Negotiated) message.
- 3) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.
- 4) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 5) The radio access bearer modification procedure may be executed.

9.2.3.2 GGSN-Initiated PDP Context Modification Procedure

The GGSN-Initiated PDP Context Modification procedure is illustrated in Figure 1767. Each step is explained in the following list.

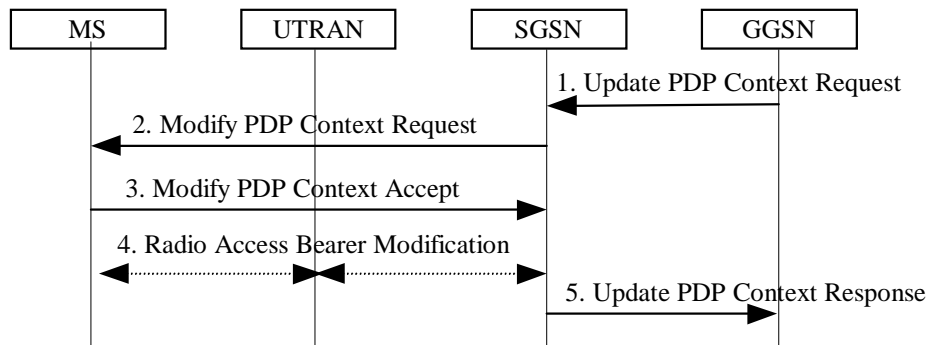


Figure 1767: GGSN-Initiated PDP Context Modification Procedure

- 1) The GGSN sends an Update PDP Context Request (TEID, PDP Address, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile. PDP Address is optional.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, the current QoS profile, and the subscribed QoS profile. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, NSAPI, PDP Address, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. PDP Address is optional.
- 3) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 4) For UMTS, the radio access bearer modification procedure may be executed.
- 5) Upon receipt of the Modify PDP Context Accept message, or upon completion of the RAB modification procedure, the SGSN returns an Update PDP Context Response (TEID, QoS Negotiated) message to the GGSN. If the SGSN receives a Deactivate PDP Context Request message, it shall instead follow the PDP Context Deactivation Initiated by MS procedure.

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in [Figure 19](#)~~Figure 68~~. Each step is explained in the following list.

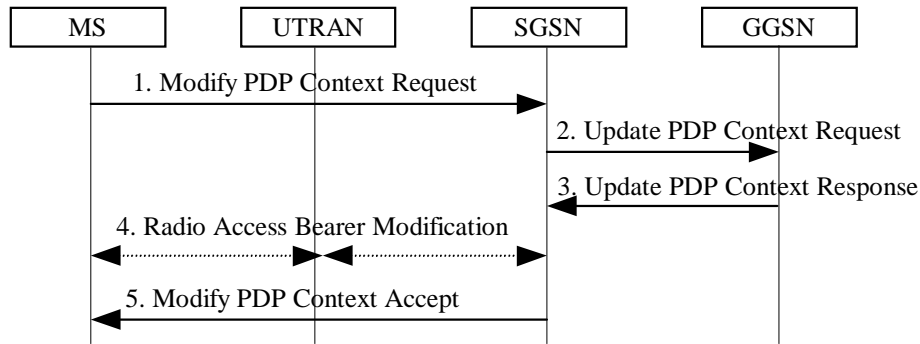


Figure 19~~68~~: MS-Initiated PDP Context Modification Procedure

- 1) The MS sends a Modify PDP Context Request (TI, NSAPI, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, and the subscribed QoS profile. The SGSN sends an Update PDP Context Request (TEID, QoS Negotiated) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.
- 3) The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TEID, QoS Negotiated) message.
- 4) For UMTS, the radio access bearer modification procedure may be executed.
- 5) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns a Modify PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.

NOTE: If the SGSN does not accept QoS Requested, then steps 2 and 3 of this procedure are skipped, and the existing QoS Negotiated is returned to the MS in step 4.

9.2.4 Deactivation Procedures

9.2.4.1 PDP Context Deactivation Initiated by MS Procedure

The PDP Context Deactivation Initiated by MS procedure is illustrated in [Figure 21](#)~~Figure 69~~. Each step is explained in the following list.

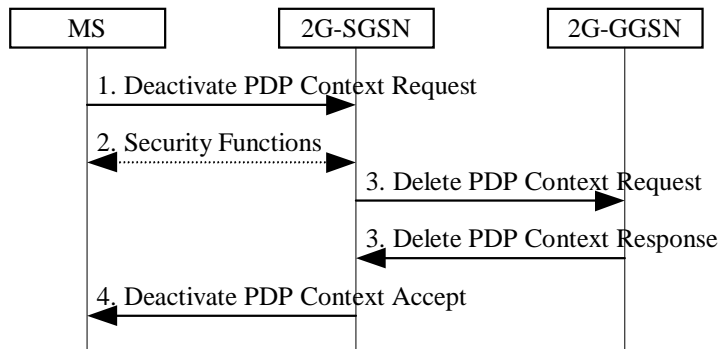


Figure 21~~69~~: PDP Context Deactivation Initiated by MS Procedure for GPRS

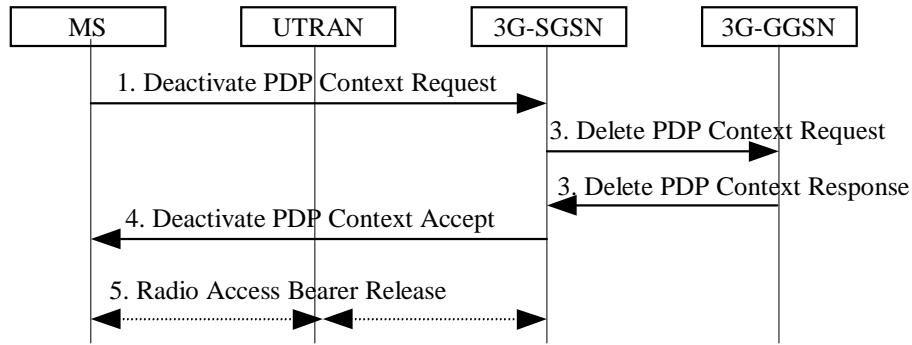


Figure 2370: PDP Context Deactivation Initiated by MS Procedure for UMTS

- 1) The MS sends a Deactivate PDP Context Request (TI, NSAPI) message to the SGSN.
- 2) For GPRS security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) The SGSN sends a Delete PDP Context Request (TEID, Teardown Ind) message to the GGSN. If NSAPI was not included by the MS in the Deactivate PDP Context Request message, then the SGSN deactivates all PDP contexts associated with this TI and PDP address by including Teardown Ind in the Delete PDP Context Request message. The GGSN removes the PDP context(s) and returns a Delete PDP Context Response (TEID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network.
- 4) The SGSN returns a Deactivate PDP Context Accept (TI, NSAPI) message to the MS.
- 5) For UMTS, the radio access bearer release procedure is executed.

At GPRS detach, all PDP contexts for the MS are implicitly deactivated.

If the SGSN receives a Deactivate PDP Context Request (TI) message for a PDP context that is currently being activated, then the SGSN shall stop the PDP Context Activation procedure without responding to the MS, and continue with the PDP Context Deactivation initiated by MS procedure.

9.2.4.2 PDP Context Deactivation Initiated by SGSN Procedure

The PDP Context Deactivation Initiated by SGSN procedure is illustrated in Figure 2474. Each step is explained in the following list.

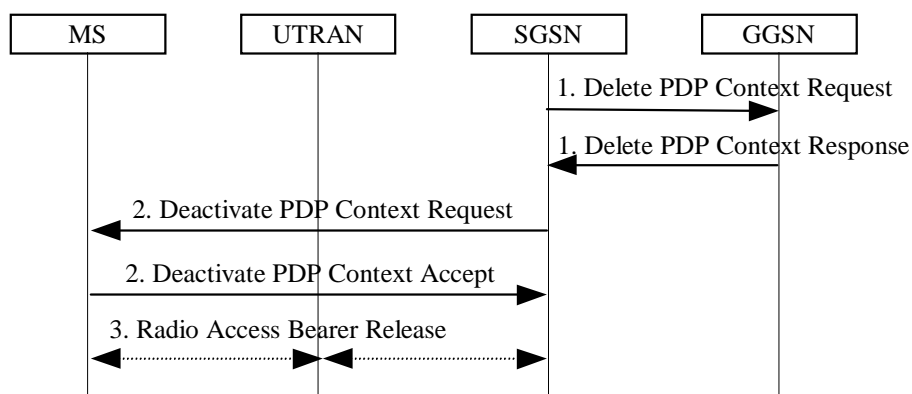


Figure 2474: PDP Context Deactivation Initiated by SGSN Procedure

- 1) The SGSN sends a Delete PDP Context Request (TEID, Teardown Ind) message to the GGSN. If Teardown Ind is included by the SGSN, then the GGSN deactivates all PDP contexts associated with this PDP address. The GGSN removes the PDP context and returns a Delete PDP Context Response (TEID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network.

The SGSN may not wait for the response from the GGSN before sending the Deactivate PDP Context Request message.

- 2) The SGSN sends a Deactivate PDP Context Request (TI, NSAPI) message to the MS. If NSAPI is not included, then all PDP contexts associated with this TI and PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, NSAPI) message to the SGSN. NSAPI is included if received from the SGSN.
- 3) For UMTS, the radio access bearer release procedure is executed.

9.2.4.3 PDP Context Deactivation Initiated by GGSN Procedure

The PDP Context Deactivation Initiated by GGSN procedure is illustrated in [Figure 26](#)~~Figure 72~~. Each step is explained in the following list.

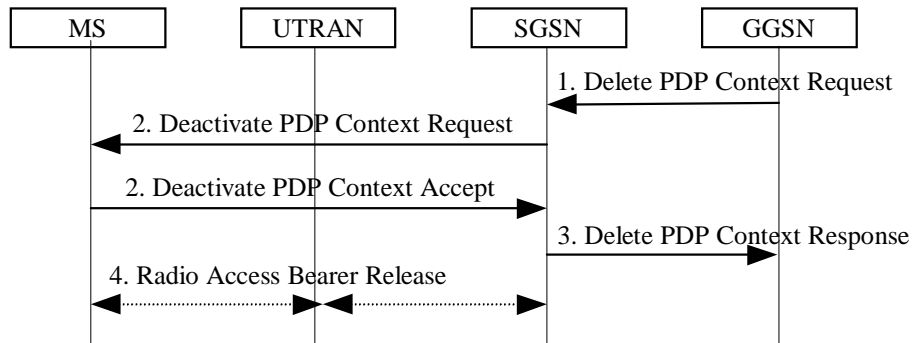


Figure 26~~72~~: PDP Context Deactivation Initiated by GGSN Procedure

- 1) The GGSN sends a Delete PDP Context Request (TEID, Teardown Ind) message to the SGSN. Teardown Ind indicates whether or not all PDP contexts associated with this PDP address shall be deactivated.
- 2) The SGSN sends a Deactivate PDP Context Request (TI, NSAPI) message to the MS. If NSAPI was not included by the SGSN, then all PDP contexts associated with this TI and PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, NSAPI) message to the SGSN. NSAPI is included if received from the SGSN.
- 3) The SGSN returns a Delete PDP Context Response (TEID, Teardown Ind) message to the GGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the MS before sending the Delete PDP Context Response message.
- 3) For UMTS, the radio access bearer release procedure is executed.

9.2.4.4 Anonymous Access PDP Context Deactivation Initiated by MS Procedure

The MS shall not issue explicit deactivation request messages to delete anonymous contexts in the network. Instead, the READY timer shall be used as an implicit deactivation timer to save signalling traffic on the radio interface.

The Anonymous Access PDP Context Deactivation Initiated by MS procedure is illustrated in [Figure 28](#)~~Figure 73~~. Each step is explained in the following list.

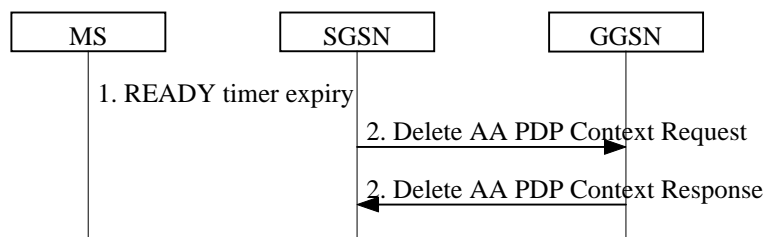


Figure 28~~73~~: Anonymous Access PDP Context Deactivation Initiated by MS Procedure

- 1) The READY timer expires in the MS and SGSN.

- 2) The SGSN sends a Delete AA PDP Context Request (AA-TEID) message. The GGSN removes the PDP context and returns a Delete AA PDP Context Response (AA-TEID) message to the SGSN. The GGSN releases this PDP address and makes it available for subsequent anonymous activation by other MSs.

9.2.4.5 Anonymous Access PDP Context Deactivation Initiated by GGSN Procedure

If the GGSN detects a misuse or fraud of the anonymous context as described in subclause "Anonymous Access PDP Context Activation Procedure", step 2, it shall initiate the deactivation independently of the READY timer expiry.

If the anonymous server detects a misuse or fraud, it may request the GGSN to deactivate the AA context. The method that the anonymous server uses to inform the GGSN is outside the scope of the GSM specifications.

The Anonymous Access PDP Context Deactivation Initiated by GGSN procedure is illustrated in [Figure 30](#)~~Figure 74~~. Each step is explained in the following list.

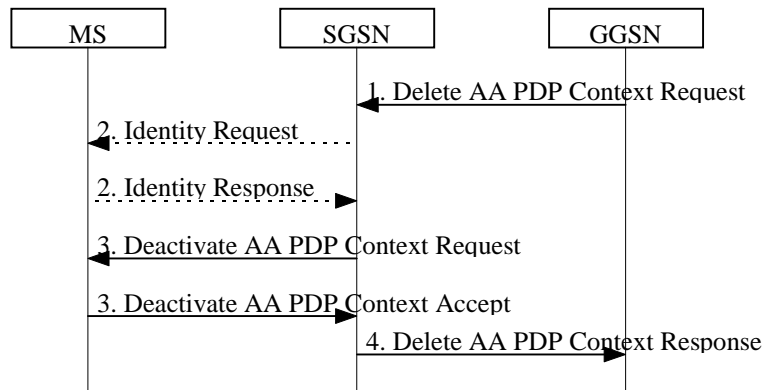


Figure 3074: Anonymous Access PDP Context Deactivation Initiated by GGSN Procedure

- 1) The GGSN sends a Delete AA PDP Context Request (AA-TEID) message to the SGSN.
- 2) The SGSN may send an Identity Request (Identity Type = IMSI or IMEI) message to the MS. The MS shall respond with an Identity Response (IMSI or IMEI) message.
- 3) The SGSN sends a Deactivate AA PDP Context Request (TI) message to the MS. The MS removes the PDP context and returns a Deactivate AA PDP Context Accept (TI) message to the SGSN.
- 4) The SGSN returns a Delete AA PDP Context Response (AA-TEID) message to the GGSN. The GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete AA PDP Context messages are sent over the backbone network. The SGSN may not wait for the accept from the MS before sending the Delete AA PDP Context Response message.

9.3 Packet Routing and Transfer Function

The packet routing and transfer function:

- routes and transfers packets between a mobile TE and an external network, i.e., between reference point R and reference point Gi;
- routes and transfers packets between mobile TE and other GPRS PLMN, i.e., between reference point R and reference point Gi via interface Gp; and
- routes and transfers packets between TEs, i.e., between the R reference point in different MSs.

The PDP PDUs shall be routed and transferred between the MS and the GGSN as N-PDUs. The maximum size of each N-PDU shall be 1 500 octets [FFS]. When the MS or the GGSN receives a PDP PDU that is not larger than the maximum N-PDU size, then the PDP PDU shall be routed and transferred as one N-PDU. When the MS or the GGSN receives a PDP PDU that is larger than the maximum N-PDU size, then the PDP PDU shall be segmented, discarded or rejected, depending on the PDP type and the implementation. The packet data protocol in the MS may limit the maximum size of the PDP PDUs that are routed and transferred, e.g., due to MS memory limitations.

Between the 2G-SGSN and the MS, PDP PDUs are transferred with SNDCP. Between the 3G-SGSN and the MS, PDP PDUs are transferred with GTP-U and PDCCP.

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 16 shows the context fields for one MS.

Table 16: SGSN MM and PDP Contexts

Field	Description	GPRS	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	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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 Gn/Gp	X	X
TEID for Iu	Tunnel Endpoint Identifier for Iu		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
TFT [FFS]	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 downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected	X	

	from the MS.		
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. Table 37 shows the context fields for one MS.

Table 37: SGSN MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
AA-TEID	Anonymous Access Tunnel Endpoint Identifier.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN currently used.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
GGSN Address in Use	The IP address of the GGSN currently used.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.
SND	GTP sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 5Table 8 shows the PDP context fields for one PDP Address.

Table 58: GGSN PDP Context

Field	Description	GPRS	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TEID	Tunnel Endpoint Identifier	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.	X	X

If a PDP context is enabled for network-requested PDP context activation, then IMSI, PDP Type, PDP Address, SGSN Address and MNRG contain valid information also when the PDP context is inactive and when the MS is GPRS-detached.

In case of anonymous access (GPRS only) the GGSN maintains activated PDP contexts. Table 7Table 9 shows the PDP context fields for one MS.

Table 79: GGSN PDP Context for Anonymous Access

Field	Description
AA-TEID	Anonymous Access Tunnel End point Identifier.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN Network Identifier currently used.
QoS Profile Negotiated	The quality of service profile negotiated.
SGSN Address	The IP address of the SGSN serving this MS.
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.

A GGSN that supports anonymous access shall have a list of server addresses that are allowed to be accessed by anonymous MSs. The method to maintain the list of the servers is outside the scope of the present document.

14.3 NSAPI and TLLI for GPRS

The Network layer Service Access Point Identifier (NSAPI) and Temporary Logical Link Identity (TLLI) are used for network layer routing. An NSAPI / TLLI pair is unambiguous within a routing area.

In the MS, NSAPI identifies the PDP-SAP. In the SGSN and GGSN, NSAPI identifies the PDP context associated with a PDP address. Between the MS and SGSN, TLLI unambiguously identifies the logical link.

When the MS requests the activation of a PDP context, the MS selects one of its unused NSAPIs.

NSAPI is a part of the tunnel identifier (TID).

For example (shown figuratively below), an X.25 packet is received by the MS from a connected TE at the X.121 address SAP. The X.25 PDU is encapsulated and NSAPI is initialised to NSAPI-1. TLLI is set to the MS's TLLI before the encapsulated X.25 packet is passed to the SNDC function.

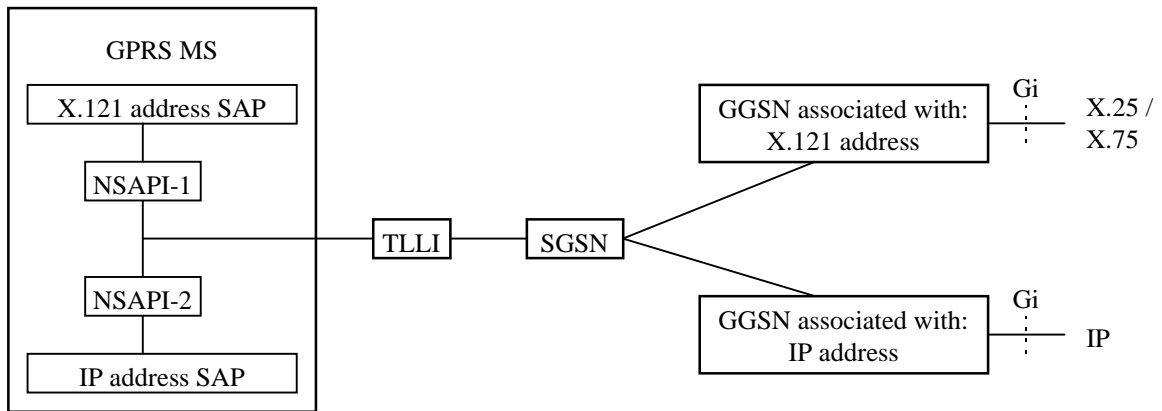


Figure 3294: Use of NSAPI and TLLI

Within a routing area, there is a one-to-one correspondence between TLLI and IMSI that is only known in the MS and SGSN. If it is not clear from the context which routing area a TLLI belongs to, then TLLI is used together with RAI. TLLI is derived from a P-TMSI, and does then provide user identity confidentiality as described in subclause "User Identity Confidentiality".

The TLLI address range is divided into four ranges: Local, Foreign, Random, and Auxiliary. The TLLI structure allows the MS and SGSN to deduce the range that a TLLI belongs to. A Local TLLI is derived from the P-TMSI allocated by the SGSN, and is valid only in the RA associated with the P-TMSI. A Foreign TLLI is derived from a P-TMSI allocated in another RA. A Random TLLI is selected randomly by the MS, and is used when the MS does not have a valid P-TMSI available, or when the MS originates an anonymous access. An Auxiliary TLLI is selected by the SGSN and is used by the SGSN and MS to unambiguously identify an Anonymous Access MM and PDP Context.

If the MS has a valid P-TMSI associated with the RA where the MS is currently located, then the MS shall use a Local TLLI derived from its P-TMSI, unless the MS performs a GPRS attach.

If the MS does not have a valid P-TMSI associated with the current RA, or if the MS performs a GPRS attach, then it shall derive a Foreign TLLI from its P-TMSI, or allocate a Random TLLI if no valid P-TMSI is available.

When a TLLI is exchanged between the MS and an SGSN, then the TLLI is transmitted at the RLC/MAC layer within the Um protocol stack, and at the BSSGP layer within the Gb protocol stack. NSAPI is transmitted within the SNDCP layer in the user plane, and within the GMM/SM layer in the control plane. NSAPI is represented by a transaction identifier (TI) in some SM signalling messages. The TI is dynamically allocated by the MS for MS-requested (AA) PDP context activation, and by the network for network-requested PDP context activation. The TI is deallocated when a PDP context has been deactivated. TI usage is defined in UMTS 24.007 and UMTS 24.008.

By default, unless explicitly specified in the procedures, the TLLI transmitted at the RLC/MAC and BSSGP layers shall be used to identify the MS.

14.4 NSAPI, RB identity and RAB ID for UMTS

The Network layer Service Access Point Identifier (NSAPI) is used for network layer routing. In the MS, NSAPI identifies the PDP-SAP. In the SGSN and GGSN, NSAPI identifies the PDP context, and in the RNC, NSAPI identifies the RNC RAB context. Radio Bearer identity (RB identity) is used to identify the Uu interface logical channel associating with the Radio Access Bearer. Radio Access Bearer Identifier (RAB ID) is used to identify the Iu interface logical channel associating with the Radio Access Bearer.

In Packet Domain, a network allocates one Radio Access Bearer for one PDP context. In addition, one Uu interface logical radio bearer is allocated for one Radio Access Bearer.

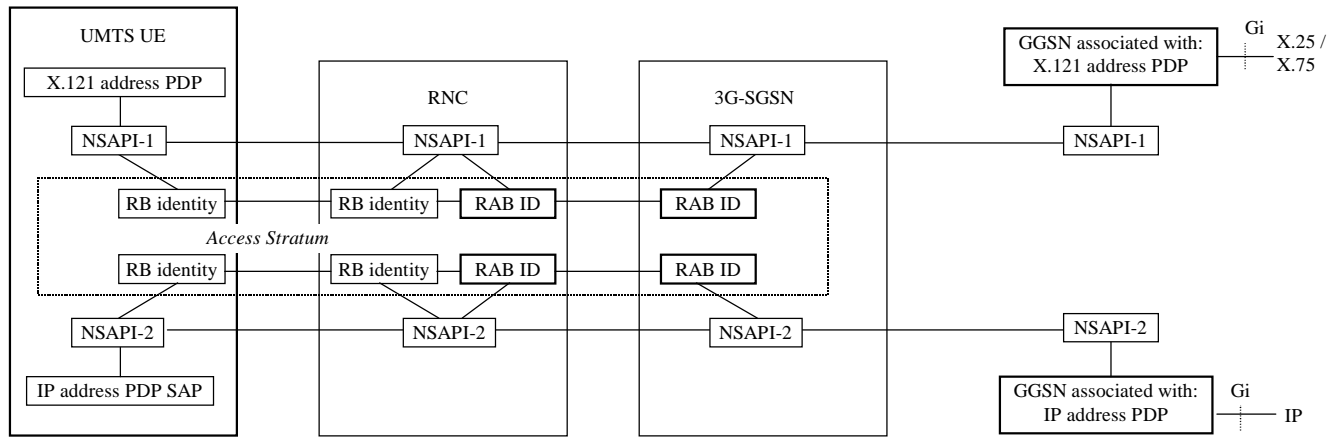


Figure X: Use of NSAPI, RB identity and RAB ID

When the MS requests the activation of a PDP context, the MS selects one of its unused NSAPIs. When the SGSN initiates RAB assignment procedure, the SGSN shall allocate RAB ID(s) in which NSAPI(s) are used as those values in order to recognise them in RNC.

14.45 PDP Address

A packet-domain subscriber identified by an IMSI, shall have one or more network layer addresses, i.e., PDP addresses, temporarily and/or permanently associated with it that conforms to the standard addressing scheme of the respective network layer service used, e.g.:

- an IP version 4 address;
- an IP version 6 address; or
- an X.121 address.

PDP addresses are activated and deactivated through MM procedures described in subclause "PDP Context Activation, Modification, and Deactivation Functions".

14.56 TEID

A Tunnel Endpoint Identifier (TEID) is used by the GPRS Tunnelling protocol between GSNs and between RNCs to identify a PDP context. A TEID consists of an IMSI and an NSAPI. The combination of IMSI and NSAPI uniquely identifies a single PDP context, tunnel endpoint in the receiving GTP-C or GTP-U protocol entity and identify a PDP context. The receiving end side of a GTP tunnel locally assigns the TEID value the transmitting side has to use. The TEID values are exchanged between tunnel endpoints using the control GTP-C (or RANAP, over the Iu) messages

The TEID is forwarded to the GGSN upon PDP Context Activation and it is used in subsequent tunnelling of user data between the GGSN and the SGSN to identify the MS's PDP contexts in the SGSN and GGSN. The TEID is also used to forward N-PDUs from the old SGSN to the new SGSN at and after an inter SGSN routing area update. In UMTS, the TEID is also forwarded to the RNC upon RAB assignment and it is used in subsequent tunneling of user data between the 3G-SGSN and the RNC to identify the MS's PDP contexts in the SGSN and the MS's RNC RAB contexts in the RNC. It is also used to forward N-PDUs from the SRNC to the target RNC at SRNS relocation.

In the anonymous access case, AA-TEID is allocated locally by the SGSN. An AA-TEID consists of an A-TLLI and an NSAPI similar to TEID. Since the IMSI is longer than A-TLLI, the unused digits shall be used to create a unique identity within one PLMN. The allocated AA-TEID shall not collide with the TEID address space.

~~[TID may be changed with GTP header modification, TID may become TEID]~~

3G CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060 CR **047r1**

Current Version: **DRAFT-3**
3.1.0

3G specification number ↑

↑ CR number as allocated by 3G support team

For submission to TSG **SA#**
list TSG meeting no. here ↑

for approval (only one box should
for information be marked with an X)

Form: 3G CR cover sheet, version 1.0

The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf>

Proposed change affects:

(at least one should be marked with an X)

USIM

ME

UTRAN

Core Network

Source:

Ericsson

Date:

21st Oct., 1999

Subject:

MS Initiated TFT modification, addition and deletion

3G Work item:

Enhanced QoS Support in GPRS

Category:

*(only one category
shall be marked
with an X)*

- | | |
|---|-------------------------------------|
| F Correction | <input type="checkbox"/> |
| A Corresponds to a correction in a 2G specification | <input type="checkbox"/> |
| B Addition of feature | <input checked="" type="checkbox"/> |
| C Functional modification of feature | <input type="checkbox"/> |
| D Editorial modification | <input type="checkbox"/> |

Reason for change:

This CR introduces the MS initiated operations for adding, deleting and modifying TFTs for already established PDP contexts. To that purpose the MS initiated PDP context modification procedure is updated to include also the TFT sent by the MS. The SGSN treats the TFT transparently, as already done during the Secondary PDP Context Activation Procedure.

Clauses affected:

9.2.3.3

Other specs affected:

- | | | | |
|------------------------------|--------------------------|----------------|--|
| Other 3G core specifications | <input type="checkbox"/> | → List of CRs: | |
| Other 2G core specifications | <input type="checkbox"/> | → List of CRs: | |
| MS test specifications | <input type="checkbox"/> | → List of CRs: | |
| BSS test specifications | <input type="checkbox"/> | → List of CRs: | |
| O&M specifications | <input type="checkbox"/> | → List of CRs: | |

Other comments:



help.doc

<----- double-click here for help and instructions on how to create a CR.

9.2.3 Modification Procedures

An MS or GGSN can request, or an SGSN can decide, possibly triggered by the HLR as explained in subclause "Insert Subscriber Data Procedure", to modify parameters that were negotiated during an activation procedure for one or several PDP contexts. The following parameters can be modified:

- QoS Negotiated;
- Radio Priority;
- Packet Flow Id; and
- PDP Address (in case of the GGSN-initiated modification procedure).
- TFT (in case of MS-initiated modification procedure).

The SGSN can request the modification of parameters by sending a Modify PDP Context Request message to the MS.

A GGSN can request the modification of parameters by sending an Update PDP Context Request message to the SGSN.

An MS can request the modification of parameters by sending a Modify PDP Context Request message to the SGSN.

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in Figure 1. Each step is explained in the following list.

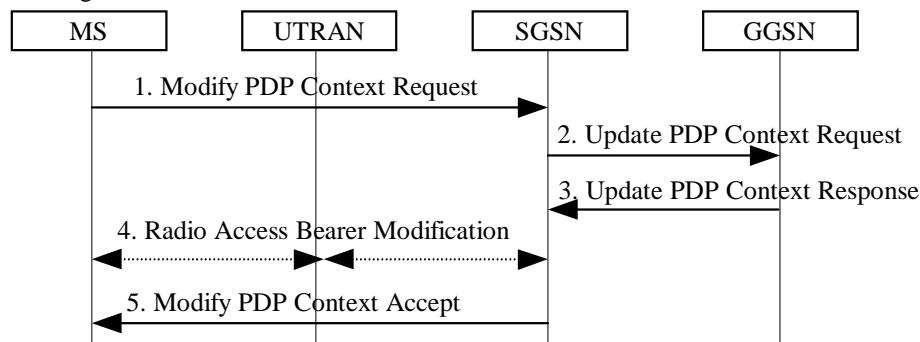


Figure 2: MS-Initiated PDP Context Modification Procedure

- 1) The MS sends a Modify PDP Context Request (TI, NSAPI, QoS Requested, TFT) message to the SGSN. Either a TFT or the QoS Requested, or both may be included. QoS Requested indicates the desired QoS profile, while the TFT indicates the TFT that is to be added or modified or deleted from the PDP context.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, and the subscribed QoS profile. The SGSN sends an Update PDP Context Request (TID, QoS Negotiated, TFT) message to the GGSN. If QoS Negotiated and/or the TFT received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type or the TFT contains inconsistent packet filters), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.
- 3) The GGSN may further restrict QoS Negotiated given its capabilities and the current load. It shall further store, modify or delete the TFT of that PDP context as indicated in the TFT. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TID, QoS Negotiated) message.
- 4) For UMTS, the radio access bearer modification procedure may be executed.

- 5) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns a Modify PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.

NOTE: If the SGSN does not accept QoS Requested, then steps 2 and 3 of this procedure are skipped, and the existing QoS Negotiated is returned to the MS in step 4.

1 Scope

The present document defines the stage-2 service description for the packet domain, which includes the General Packet Radio Service (GPRS) in GSM, and the packet side of UMTS. CCITT I.130 [29] describes a three-stage method for characterisation of telecommunication services, and CCITT Q.65 [31] defines stage 2 of the method.

This document does not cover the Access Network functionality. GSM 03.64 [11] contains an overall description of the GSM GPRS Access Network. UMTS 25.301 contains an overall description of the UMTS Terrestrial Radio Access Network.

2 References

[All references need to be checked once release 99 stabilizes.]

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 01.61: "Digital cellular telecommunications system (Phase 2+); GPRS ciphering algorithm requirements".
- [3] UMTS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".
- [4] UMTS 23.003: "Numbering, addressing and identification".
- [5] UMTS 23.007: "Restoration procedures".
- [5b] UMTS 23.016: "3rd Generation Partnership Project; Subscriber Data Management; Stage 2".
- [6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".
- [7] UMTS 23.022: "Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [8] UMTS 23.040: "Technical realization of the Short Message Service (SMS); Point-to-Point (PP)".
- [8b] UMTS 23.078: "3rd Generation Partnership Project; Customised Applications for Mobile Network Enhanced Logic (CAMEL) Phase 3 – Stage 2".
- [11] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); Overall description of the General Packet Radio Service (GPRS) Radio interface; Stage 2".
- [12] UMTS 24.007: "Mobile radio interface signalling layer 3; General aspects".
- [13] UMTS 24.008: "Mobile radio interface layer 3 specification; Core Network Protocols – Stage 3".

- [14] GSM 04.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".
- [15] GSM 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Serving GPRS Support Node (SGSN); Logical Link Control (LLC) layer specification".
- [16] GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDTCP)".
- [17] UMTS 27.060: "General Packet Radio Service (GPRS); Mobile Station (MS) supporting GPRS".
- [18] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification".
- [19] GSM 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface layer 1".
- [20] GSM 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".
- [21] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".
- [22] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels."
- [23] UMTS 29.002: "Mobile Application Part (MAP) specification".
- [24] UMTS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".
- [25] UMTS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".
- [26] UMTS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".
- [27] UMTS 29.061: "General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".
- [27b] UMTS 29.078: "3rd Generation Partnership Project; Customised Applications for Mobile Network Enhanced Logic (CAMEL) Phase 3; CAMEL Application Part (CAP) Specification".
- [28] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".
- [28a] GSM 12.15: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); GPRS Charging".
- [29] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".
- [30] CCITT Recommendation E.164: "Numbering plan for the ISDN era".
- [31] CCITT Recommendation Q.65: "Methodology – Stage 2 of the method for the characterization of services supported by an ISDN".

- [32] CCITT Recommendation V.42 bis: "Data communication over the telephone network – Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".
- [33] CCITT Recommendation X.3: "Packet assembly disassembly facility (PAD) in a public data network".
- [34] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [35] CCITT Recommendation X.28: "DTE / DCE interface for a start-stop mode data terminal equipment accessing the packet assembly / disassembly facility (PAD) in a public data network situated in the same country".
- [36] CCITT Recommendation X.29: "Procedures for the exchange of control information and user data between a packet assembly / disassembly (PAD) facility and a packet mode DTE or another PAD".
- [37] CCITT Recommendation X.75: "Packet-switched signalling system between public networks providing data transmission services".
- [38] CCITT Recommendation X.121: "International Numbering Plan for Public Data Networks".
- [39] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).
- [40] IETF RFC 791 (1981): "Internet Protocol" (STD 5).
- [41] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).
- [42] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).
- [43] IETF RFC 1034 (1987): "Domain Names – Concepts and Facilities" (STD 7).
- [44] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).
- [45] IETF RFC 1542 (1993): "Clarification and Extensions for the Bootstrap Protocol".
- [46] IETF RFC 2002 (1996): "IPv4 Mobility Support".
- [47] IETF RFC 2131 (1997): "Dynamic Host Configuration Protocol".
- [48] Bellcore GR-000301 Issue 2 December 1997: "Public Packet Switched Network Generic Requirements (PPSNGR)".
- [49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.
- [50] UMTS 25.301: "Radio Interface Protocol Architecture".
- [51] UMTS 25.303: "UE Functions and Interlayer Procedures in Connected Mode".
- [52] UMTS 25.331: "RRC Protocol Specification".
- [53] UMTS 25.401: "UTRAN Overall Description [UMTS <spec>]".
- [54] UMTS 23.121: "Architectural Requirements for Release 1999".
- [55] UMTS 25.322: "RLC Protocol Specification".
- [56] UMTS 25.412: "UTRAN Iu Interface Signalling Transport".
- [57] UMTS 25.323: "FFS".

3 Definitions, abbreviations and symbols

3.1 Definitions

Refer to UMTS 22.060 and UMTS 25.401.

2G- / 3G- The prefixes 2G- and 3G- refers to functionality that supports only GSM GPRS or UMTS, respectively, e.g., 2G-SGSN refers only to the GSM GPRS functionality of an SGSN. When the prefix is omitted, reference is made independently from the GSM GPRS or UMTS functionality.

3.2 Abbreviations

For the purposes of the present document the following abbreviations apply. Additional applicable abbreviations can be found in GSM 01.04 [1].

AA	Anonymous Access
APN	Access Point Name
ATM	Asynchronous Transfer Mode
AUTN	Authentication Token
BG	Border Gateway
BSSAP+	Base Station System Application Part +
BSSGP	Base Station System GPRS Protocol
BVCI	BSSGP Virtual Connection Identifier
CCU	Channel Codec Unit
CDR	Call Detail Record
CGF	Charging Gateway Functionality
CGI	Cell Global Identification
CK	Cipher Key
CS	Circuit Switched
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
EGPRS	Enhanced GPRS
GEA	GPRS Encryption Algorithm
GGSN	Gateway GPRS Support Node
GMM/SM	GPRS Mobility Management and Session Management
<u>gprsSSF</u>	<u>GPRS Service Switching Function</u>
<u>gprs-CSI</u>	<u>GPRS CAMEL Subscription Information</u>
<u>gsmSCF</u>	<u>GSM Service Control Function</u>
GSIM	GSM Service Identity Module
GSN	GPRS Support Node
GTP	GPRS Tunnelling Protocol
GTP-C	GTP Control Plane
GTP-U	GTP User Plane
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IHOSS	Internet-Hosted Octet Stream Service
IK	Integrity Key
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IPX	Internet Packet eXchange
ISP	Internet Service Provider
KSI	Key Set Identifier
L2TP	Layer-2 Tunnelling Protocol
LL-PDU	LLC PDU
LLC	Logical Link Control
MAC	Medium Access Control
MIP	Mobile IP

MNRF	Mobile station Not Reachable Flag
MNRG	Mobile station Not Reachable for GPRS flag
MNRR	Mobile station Not Reachable Reason
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NGAF	Non-GPRS Alert Flag
NS	Network Service
NSAPI	Network layer Service Access Point Identifier
NSS	Network SubSystem
OSP	Octet Stream Protocol
P-TMSI	Packet TMSI
PCU	Packet Control Unit
PDCH	Packet Data CHannel
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDP	Packet Data Protocol, e.g., IP or X.25 [34]
PDU	Protocol Data Unit
PPF	Paging Proceed Flag
PPP	Point-to-Point Protocol
PTM	Point To Multipoint
PTP	Point To Point
PVC	Permanent Virtual Circuit
RA	Routeing Area
RAC	Routeing Area Code
RAI	Routeing Area Identity
RANAP	Radio Access Network Application Protocol
RLC	Radio Link Control
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SGSN	Serving GPRS Support Node
SM	Short Message
SM-SC	Short Message service Service Centre
SMS-GMSC	Short Message Service Gateway MSC
SMS-IWMSC	Short Message Service Interworking MSC
SN-PDU	SNDCP PDU
SNDC	SubNetwork Dependent Convergence
SNDCP	SubNetwork Dependent Convergence Protocol
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TFT	Traffic Flow Template
TID	Tunnel Identifier
TLLI	Temporary Logical Link Identity
TOM	Tunnelling Of Messages
TRAU	Transcoder and Rate Adaptor Unit
UDP	User Datagram Protocol
UEA	UMTS Encryption Algorithm
UIA	UMTS Integrity Algorithm
URA	UTRAN Registration Area
USIM	User Service Identity Module
UTRAN	UMTS Terrestrial Radio Access Network

4 Main Concepts

The packet domain uses a packet-mode technique to transfer high-speed and low-speed data and signalling in an efficient manner. The packet domain optimises the use of network and radio resources. Strict separation between the radio subsystem and network subsystem is maintained, allowing the network subsystem to be reused with other radio access technologies.

A common packet domain Core Network is used for both GPRS and UMTS. This common Core Network provides packet-switched (PS) services and is designed to support several quality of services levels in order to allow efficient transfer of non real-time traffic (e.g., intermittent and bursty data transfers, occasional transmission of large volumes of data) and real-time traffic (e.g., voice, video). Applications based on standard data protocols and SMS are supported, and interworking is defined with IP networks and X.25 networks. Charging should be flexible and allow to bill according to the amount of data transferred, the QoS supported, and the duration of the connection.

The Serving GPRS Support Node (SGSN) keeps track of the individual MSs' location and performs security functions and access control. The SGSN is connected to the GPRS base station system through the Gb interface and/or to the UMTS Radio Access Network through the Iu interface.

The Gateway GPRS Support Node (GGSN) provides interworking with external packet-switched networks, and is connected with SGSNs via an IP-based packet domain PLMN backbone network.

The Charging Gateway Functionality (CGF) collects charging records from SGSNs and GGSNs.

The HLR contains GPRS and UMTS subscriber information.

The SMS-GMSCs and SMS-IWMSCs support SMS transmission via the SGSN.

Optionally, the MSC/VLR can be enhanced for more-efficient co-ordination of packet-switched and circuit-switched services and functionality: e.g., combined GPRS and non-GPRS location updates.

In order to access the PS services, an MS shall first make its presence known to the network by performing a PS attach. This makes the MS available for SMS over PS, paging via the SGSN, and notification of incoming PS data.

In order to send and receive PS data, the MS shall activate the Packet Data Protocol context that it wants to use. This operation makes the MS known in the corresponding GGSN, and interworking with external data networks can commence.

User data is transferred transparently between the MS and the external data networks with a method known as encapsulation and tunnelling: data packets are equipped with PS-specific protocol information and transferred between the MS and the GGSN. This transparent transfer method lessens the requirement for the PLMN to interpret external data protocols, and it enables easy introduction of additional interworking protocols in the future.

[SGSN node also interfaces via gprsSSF with gsmSCF for option CAMEL session and cost control service support.](#)

5 General Packet Domain Architecture and Transmission Mechanism

5.4.1 Packet Domain Core Network Nodes

A GPRS Support Node (GSN) contains functionality required to support GPRS and/or to support UMTS packet domain functionality. In one PLMN, there may be more than one GSN.

The Gateway GPRS Support Node (GGSN) is the node that is accessed by the packet data network due to evaluation of the PDP address. It contains routing information for attached GPRS users. The routing information is used to tunnel N-PDUs to the MS's current point of attachment, i.e., the Serving GPRS Support Node. The GGSN may request location information from the HLR via the optional Gc interface. The GGSN is the first point of PDN interconnection with a GSM PLMN supporting GPRS (i.e., the Gi reference point is supported by the GGSN). GGSN functionality is common for GPRS and for the UMTS packet domain.

The Serving GPRS Support Node (SGSN) is the node that is serving the MS. The SGSN supports GPRS (i.e., the Gb interface is supported by the SGSN) and/or UMTS (i.e., the Iu interface is supported by the SGSN). At GPRS attach, the SGSN establishes a mobility management context containing information pertaining to e.g., mobility and security for the MS. At PDP Context Activation, the SGSN establishes a PDP context, to be used for routing purposes, with the GGSN that the subscriber will be using.

The SGSN and GGSN functionalities may be combined in the same physical node, or they may reside in different physical nodes. SGSN and GGSN contain IP or other (operator's selection, e.g., ATM-SVC routing functionality, and they may be interconnected with IP routers. When SGSN and GGSN are in different PLMNs, they are interconnected via the Gp interface. The Gp interface provides the functionality of the Gn interface, plus security functionality required for inter-PLMN communication. The security functionality is based on mutual agreements between operators.

The SGSN may send location information to the MSC/VLR via the optional Gs interface. The [FFS: 2G-]SGSN may receive paging requests from the MSC/VLR via the Gs interface.

SGSN nodes also interface with SCF for optional CAMEL cost control. Depending on result from CAMEL interaction the session and packet data transfer may proceed normally. This also applies if the SGSN node does not support CAMEL interaction. Otherwise interaction with gsmSCF will continue as described in UMTS 23.078 [8b]. In this specification only the points in the signalling procedures are indicated for interwork with SCF.

6 Mobility Management Functionality

6.5.1 GPRS Attach Function

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, then the MS makes IMSI attach as already defined in GSM. An IMSI-attached MS in class-A mode of operation engaged in a CS connection shall use the (non-combined) GPRS Attach procedure when it performs a GPRS attach.

In the attach procedure, the MS shall provide its identity and an indication of which type of attach that is to be executed. The identity provided to the network shall be the MS's Packet TMSI (P-TMSI) or IMSI. P-TMSI and the RAI associated with the P-TMSI shall be provided if the MS has a valid P-TMSI. If the MS does not have a valid P-TMSI, then the MS shall provide its IMSI. The different types of attach are GPRS attach and combined GPRS / IMSI 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 subclause "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 subclause "Paging Co-ordination"), then an MS that is both GPRS-attached and IMSI-attached 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) Routing 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 1. Each step is explained in the following list.

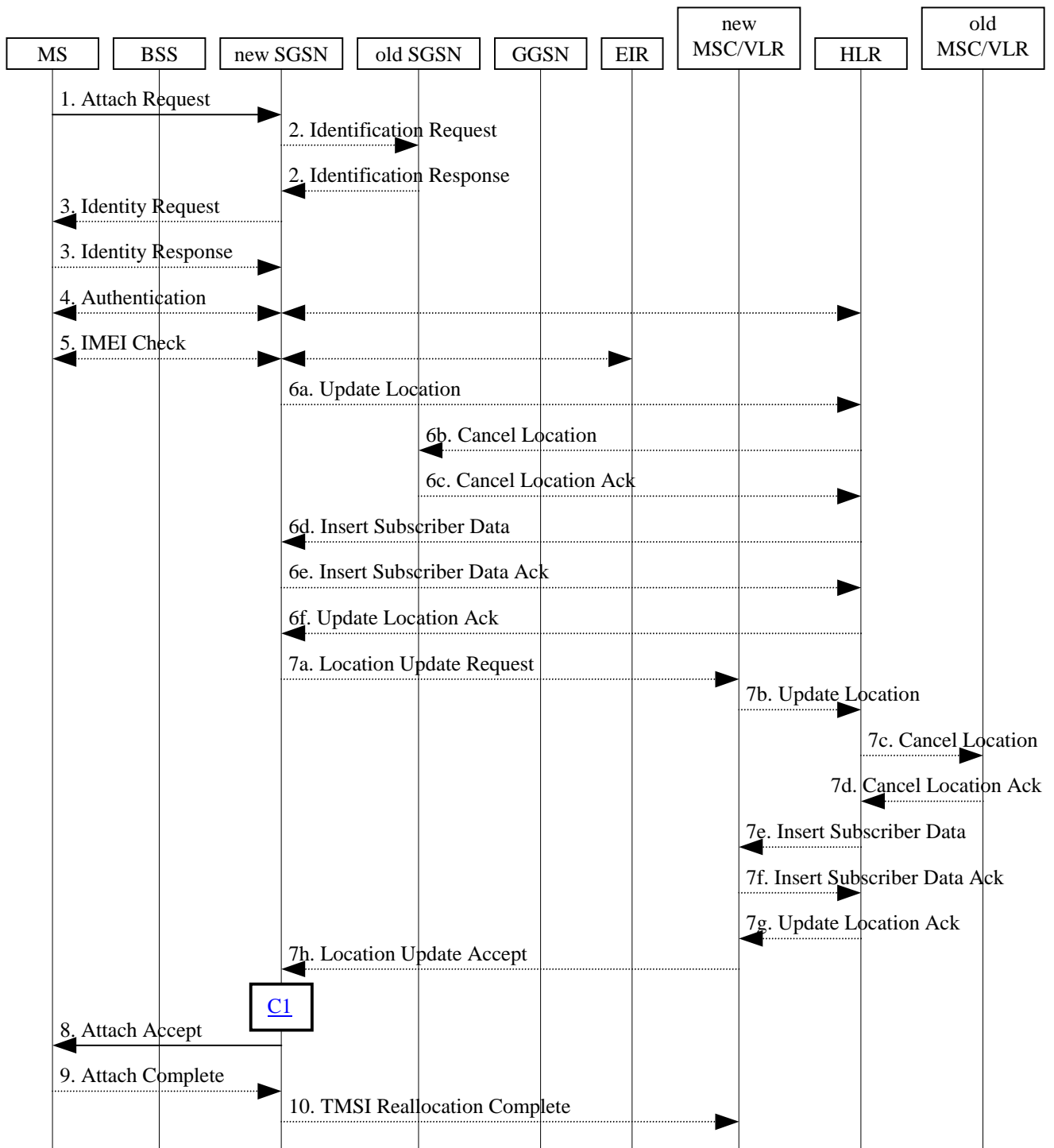


Figure 1: Combined GPRS / IMSI Attach Procedure

- 1) 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 that 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.

- 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. The old SGSN responds with Identification Response (IMSI, Authentication Triplets). 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 subclause "Security Function". If no MM context for the MS exists anywhere in the network, then authentication is mandatory. Ciphering procedures are described in subclause "Security Function". If P-TMSI allocation is going to be done, and if ciphering is supported by the network, ciphering mode shall be set.
- 5) The equipment checking functions are defined in the subclause "Identity Check Procedures". Equipment checking is optional.
- 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 HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new SGSN.
 - 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.
 - 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.
- 7) If Attach Type in step 1 indicated GPRS Attach while already IMSI attached, or combined GPRS / IMSI attach, then the VLR shall be updated if the Gs interface is installed. The VLR number is derived from the RA information. 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 6 d). 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, GSM 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.
- 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.
- 9) If P-TMSI or VLR TMSI was changed, the MS acknowledges the received TMSI(s) with Attach Complete (P-TMSI, VLR TMSI).
- 10) If VLR TMSI was changed, the SGSN confirms the VLR TMSI re-allocation by sending TMSI Reallocation Complete (VLR TMSI) to the VLR.

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

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Attach Request

6.5.2 UMTS PS Attach Function

[It is an outstanding task to merge this subclause with "GPRS Attach Function".]

A PS-attached MS makes a CS attach via the SGSN with the combined RA / LA update procedure if the network operates in mode I. In network operates in mode II, or if the MS is not PS-attached, then the MS makes a normal CS attach. A CS-attached MS engaged in a CS connection shall use the (non-combined) PS Attach procedure when it performs a PS attach.

In the attach procedure, the MS shall provide its identity and an indication of which type of attach that is to be executed. The identity provided to the network shall be the MS's Packet TMSI (P-TMSI) or IMSI. P-TMSI and the RAI associated with the P-TMSI shall be provided if the MS has a valid P-TMSI. If the MS does not have a valid P-TMSI, then the MS shall provide its IMSI. The different types of attach are PS attach and combined PS / CS attach.

After having executed the PS attach, the MS is in the PMM-CONNECTED state and MM contexts are established in the MS and the SGSN. The MS may then activate PDP contexts as described in subclause "Activation Procedures".

An CS-attached MS that cannot operate in CS/PS mode of operation shall follow the normal CS detach procedure before it makes a PS attach. A PS-attached MS that cannot operate in CS/PS mode of operation shall perform a PS detach before it makes a CS attach.

The Combined PS / CS Attach procedure is illustrated in Figure 1. Each step is explained in the following list.

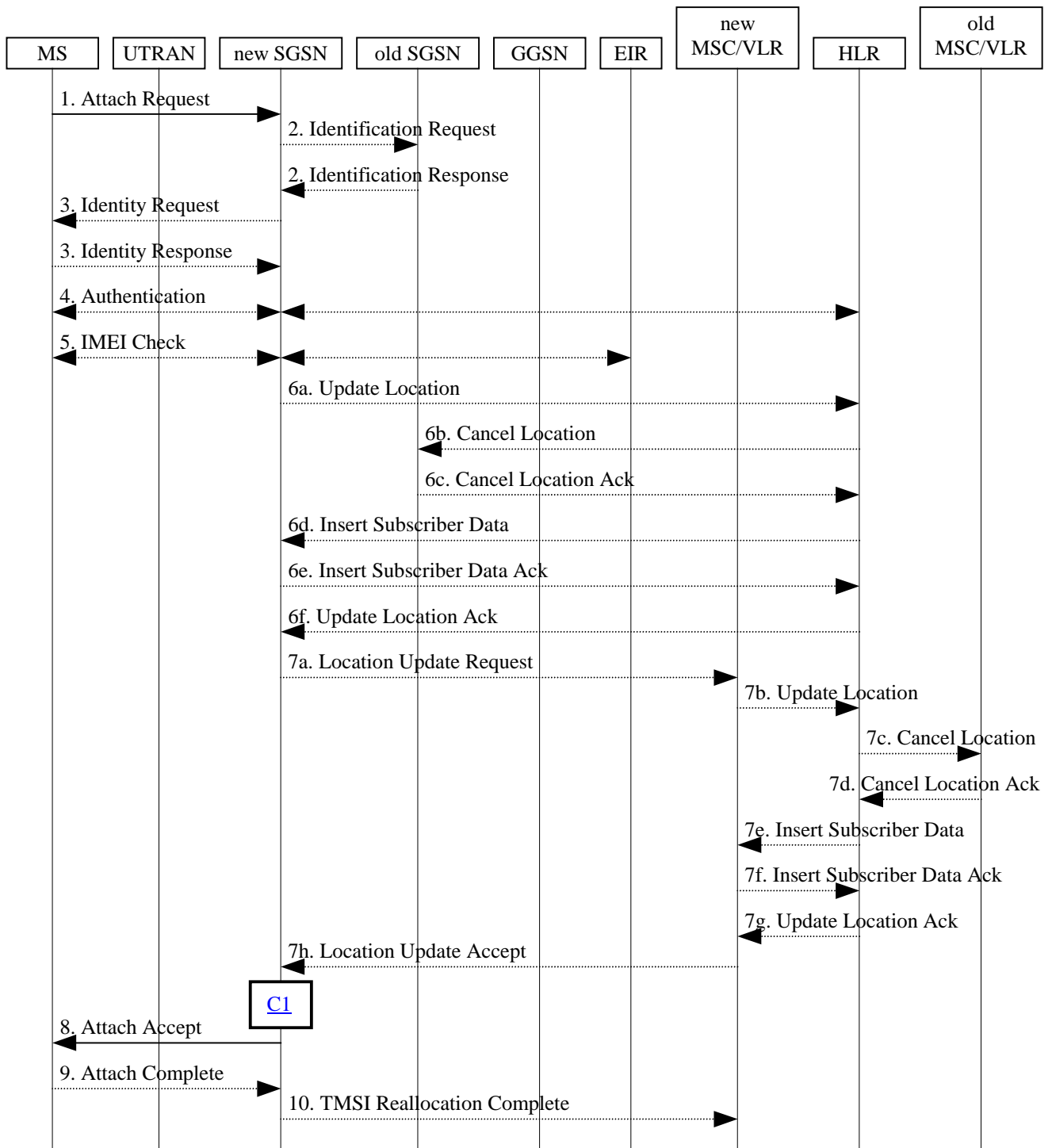


Figure 2: Combined PS / CS Attach Procedure

- 1) 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) 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 describe in subclause "Core Network Classmark". Follow on request shall be set by MS if there is pending uplink traffic (signaling 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 PS Attach procedure.Attach

Type indicates which type of attach that is to be performed, i.e., PS attach only, PS Attach while already CS attached, or combined PS / CS attach.

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. The old SGSN responds with Identification Response (IMSI, Authentication vector). 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 subclause "Security Function". If no MM context for the MS exists anywhere in the network, then authentication is mandatory. Ciphering procedures are described in subclause "Security Function". If P-TMSI allocation is going to be done, and if ciphering is supported by the network, ciphering mode shall be set.
- 5) The equipment checking functions are defined in the subclause "Identity Check Procedures". Equipment checking is optional.
- 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 HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new SGSN.
 - 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.
 - 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.
- 7) If Attach Type in step 1 indicated PS Attach while already CS attached, or combined PS / CS attach, then the VLR shall be updated if the Gs interface is installed. The VLR number is derived from the RA information. 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 6 d). 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 CS attach if Attach Type indicated combined PS / CS 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, GSM 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.
- 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.
- 9) If P-TMSI or VLR TMSI was changed, the MS acknowledges the received TMSI(s) with Attach Complete (P-TMSI, VLR TMSI).
- 10) If VLR TMSI was changed, the SGSN confirms the VLR TMSI re-allocation by sending TMSI Reallocation Complete (VLR TMSI) to the VLR.

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

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL_GPRS_Attach_Request

6.6.1 MS-Initiated Detach Procedure

The MS-Initiated Detach procedure when initiated by the MS is illustrated in Figure 3. Each step is explained in the following list.

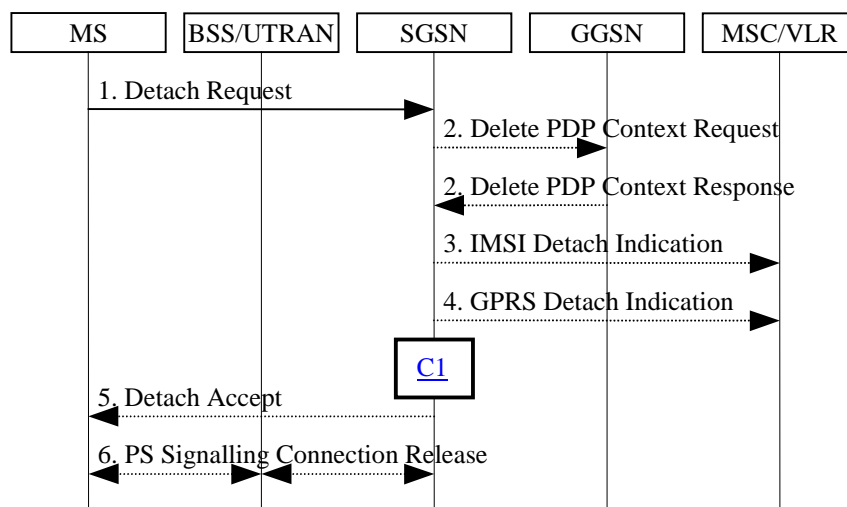


Figure 3: MS-Initiated Combined PS / CS Detach Procedure

- 1) The MS detaches by sending Detach Request (Detach Type, P-TMSI, P-TMSI Signature, Switch Off) to the SGSN. Detach Type indicates which type of detach that is to be performed, i.e., PS Detach only, CS Detach only or combined PS and CS Detach. Switch Off indicates whether the detach is due to a switch off situation or not. For UMTS, the Detach Request message includes P-TMSI and P-TMSI Signature. P-TMSI Signature is used to check the validity of the Detach Request message. If P-TMSI Signature is not valid or is not included, then authentication procedure should be performed.
- 2) If PS detach, the active PDP contexts in the GGSNs regarding this particular MS are deactivated by the SGSN sending Delete PDP Context Request (TEID) to the GGSNs. The GGSNs acknowledge with Delete PDP Context Response (TEID).
- 3) If CS detach, the SGSN sends CS Detach Indication (IMSI) to the VLR.

- 4) If the MS wants to remain CS-attached and is doing a PS detach, the SGSN sends a PS 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.
- 5) If Switch Off indicates that the detach is not due to a switch off situation, the SGSN sends a Detach Accept to the MS.
- 6) If the MS was PS detached, then the 3G-SGSN releases the PS signalling connection.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Detach

6.6.2 Network-Initiated Detach Procedure

6.6.2.1 SGSN-Initiated Detach Procedure

The SGSN-Initiated Detach procedure when initiated by the SGSN is illustrated in Figure 4. Each step is explained in the following list.

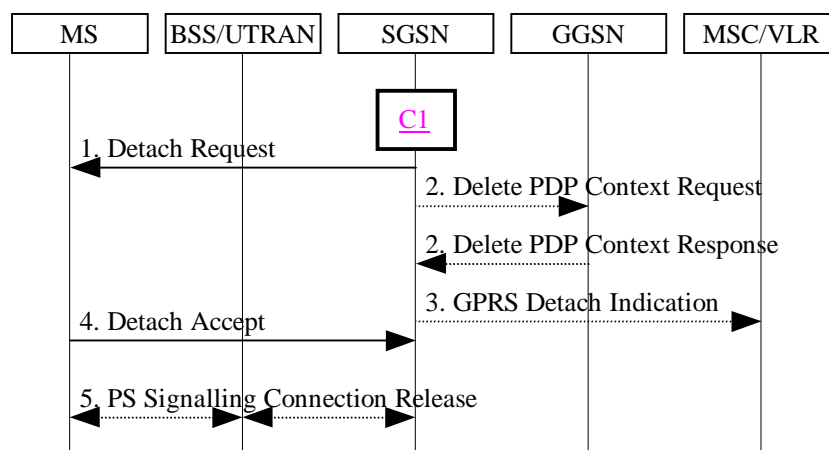


Figure 4: SGSN-Initiated PS Detach Procedure

- 1) The SGSN informs the MS that it has been detached by sending Detach Request (Detach Type) to the MS. Detach Type indicates if the MS is requested to make a new attach and PDP context activation for the previously activated PDP contexts. If so, the attach procedure shall be initiated when the detach procedure is completed.
- 2) The active PDP contexts in the GGSNs regarding this particular MS are deactivated by the SGSN sending Delete PDP Context Request (TEID) messages to the GGSNs. The GGSNs acknowledge with Delete PDP Context Response (TEID) messages.
- 3) If the MS was both CS- and PS-attached, the SGSN sends a PS 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.
- 4) The MS sends a Detach Accept message to the SGSN any time after step 1.
- 5) After receiving the Detach Accept message, if Detach Type did not request the MS to make a new attach, then the 3G-SGSN releases the PS signalling connection.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Detach

6.6.2.2 HLR-Initiated Detach Procedure

The HLR-Initiated Detach procedure is initiated by the HLR. The HLR uses this procedure for operator-determined purposes to request the removal of a subscriber's MM and PDP contexts at the SGSN. The HLR-Initiated Detach Procedure is illustrated in Figure 5. Each step is explained in the following list.

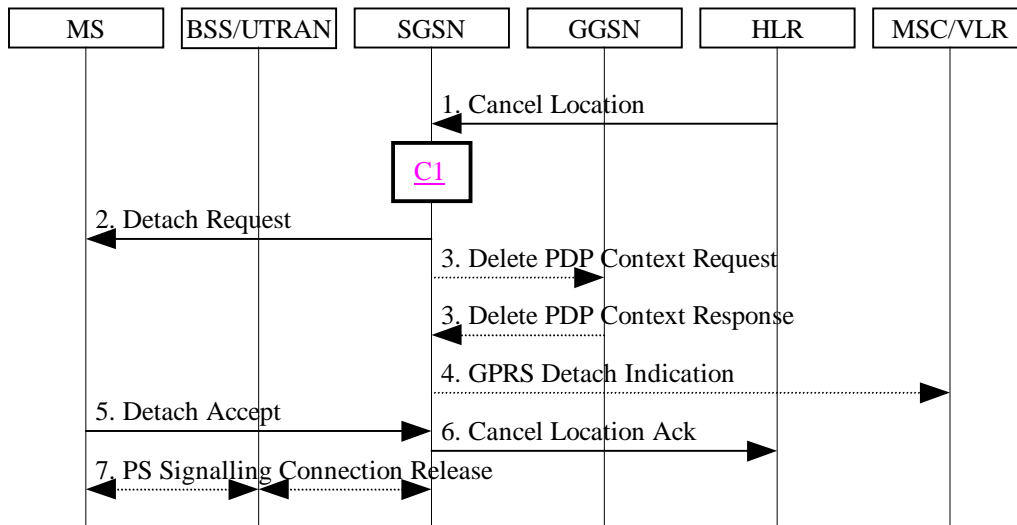


Figure 5: HLR-Initiated PS Detach Procedure

- 1) If the HLR wants to request the immediate deletion of a subscriber's MM and PDP contexts from the SGSN, the HLR shall send a Cancel Location (IMSI, Cancellation Type) message to the SGSN with Cancellation Type set to Subscription Withdrawn.
- 2) The SGSN informs the MS that it has been detached by sending Detach Request (Detach Type) to the MS. Detach Type shall indicate that the MS is not requested to make a new attach and PDP context activation.
- 3) The active PDP contexts in the GGSNs regarding this particular MS are deactivated by the SGSN sending Delete PDP Context Request (TEID) messages to the GGSNs. The GGSNs acknowledge with Delete PDP Context Response (TEID) messages.
- 4) If the MS was both CS- and PS-attached, the SGSN sends a PS 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.
- 5) The MS sends a Detach Accept message to the SGSN any time after step 2.
- 6) The SGSN shall confirm the deletion of the MM and PDP contexts with a Cancel Location Ack (IMSI) message.
- 7) After receiving the Detach Accept message, if Detach Type did not request the MS to make a new attach, then the 3G-SGSN releases the PS signalling connection.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Detach

6.9 Location Management Function

6.9.1 Location Management Procedures for GPRS

6.9.1.2 Routeing Area Update Procedure

A routeing area update takes place when a PS-attached MS detects that it has entered a new RA, when the periodic RA update timer has expired, or, for GPRS, when a suspended MS is not resumed by the BSS (see subclause "Suspension of GPRS Services"). 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 routing area update.

An MS in READY state due to anonymous access shall not perform routing area updates for the AA MM context. If the MS has entered a new routing area, a new Anonymous Access PDP Context Activation procedure shall be initiated. The old context is implicitly deleted upon expiry of the READY timer.

6.9.1.2.1 Intra SGSN Routing Area Update

The Intra SGSN Routing Area Update procedure is illustrated in Figure 6. Each step is explained in the following list.

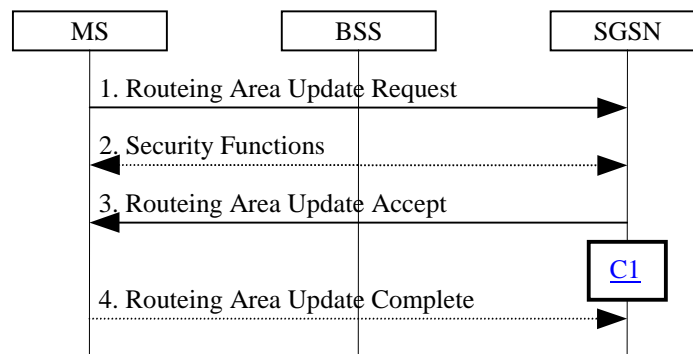


Figure 6: Intra SGSN Routing Area Update Procedure

- 1) The MS sends a Routing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type) to the SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN, see GSM 08.18.
- 2) Security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) The 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, or if subscription checking fails, then the SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the SGSN updates the MM context for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature) is returned to the MS.
- 4) If P-TMSI was reallocated, the MS acknowledges the new P-TMSI with Routing Area Update Complete (P-TMSI).

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter IDLE state.

[For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:](#)

[C1\) CAMEL GPRS Routing Area Update](#)

6.9.1.2.2 Inter SGSN Routing Area Update

The Inter SGSN Routing Area Update procedure is illustrated in Figure 7. Each step is explained in the following list.

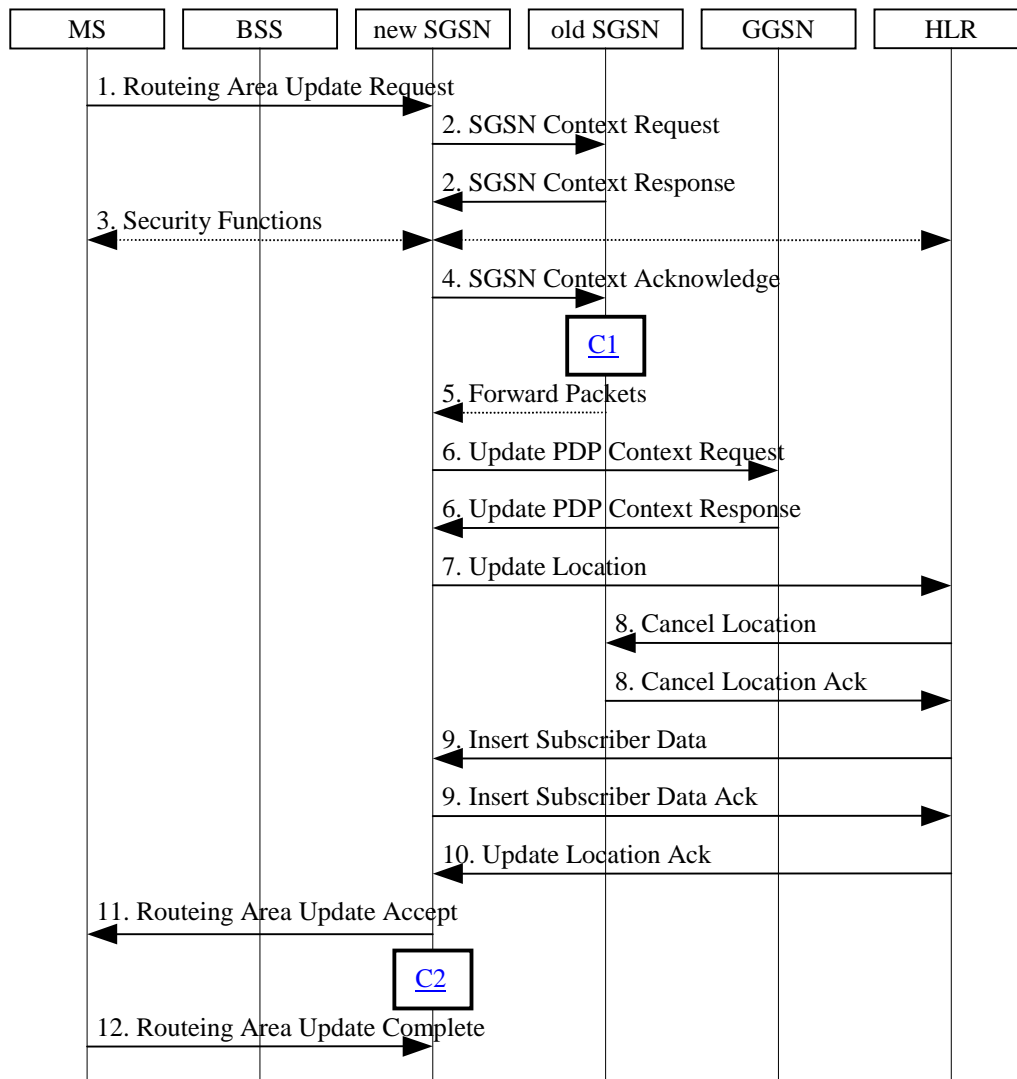


Figure 7: Inter SGSN Routing Area Update Procedure

- 1) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.
- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) 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 (old RAI, TLLI, MS Validated, New SGSN Address) 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 stops assigning SNDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SNDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, 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. The old SGSN starts a timer and stops the transmission of N-PDUs to the MS.

- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.
- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new 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 routing area update procedure back to the old SGSN before completing the ongoing routing area update procedure. If the security functions do not authenticate the MS correctly, then the routing 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) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SNDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TID).
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) 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, then the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are kept in the old SGSN in case the MS initiates another inter SGSN routing area update before completing the ongoing routing area update to the new SGSN. The old SGSN acknowledges with Cancel Location Ack (IMSI).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS 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 Routing 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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) 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 SGSN, or if subscription checking fails, then the new SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 12) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, then these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.

In the case of a rejected routing 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 routing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the SGSN is unable to update the PDP context in one or more GGSNs, then the 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 routing area update.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, then the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter IDLE state.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL_GPRS_SGSN_Context_Acknowledge

C2) CAMEL_GPRS_Routeing_Area_Update

6.9.1.3 Combined RA / LA Update Procedure

A combined RA / LA update takes place in network operation mode I when the MS enters a new RA or when a GPRS-attached MS performs IMSI attach. The MS sends a Routing Area Update Request indicating that an LA update may also need to be performed, in which case the SGSN forwards the LA update to the VLR. This concerns only idle mode (see GSM 03.22), as no combined RA / LA updates are performed during a CS connection.

6.9.1.3.1 Combined Intra SGSN RA / LA Update

The Combined RA / LA Update (intra SGSN) procedure is illustrated in Figure 8. Each step is explained in the following list.

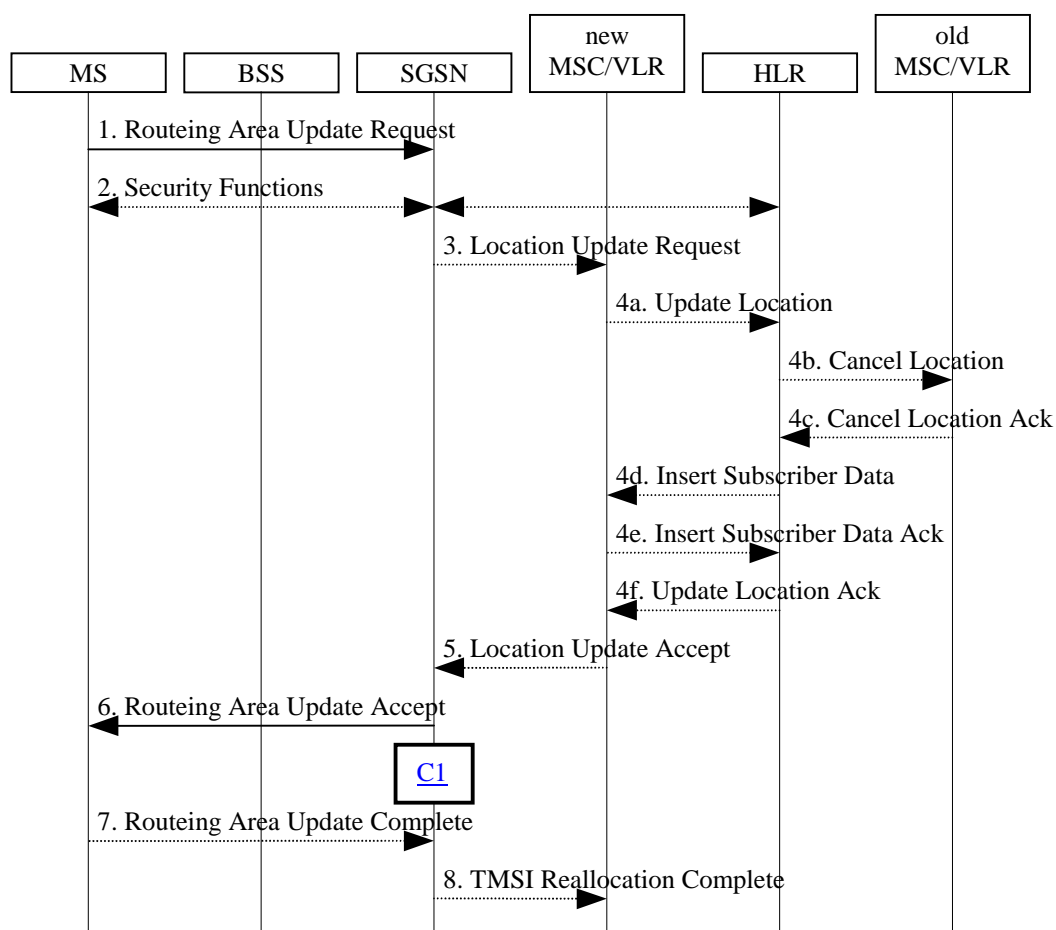


Figure 8: Combined RA / LA Update in the Case of Intra SGSN RA Update Procedure

- 1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.
- 2) Security functions may be executed. This procedure is defined in subclause "Security Function".
- 3) 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, then the 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 via a table in the SGSN. The VLR creates or updates the association with the SGSN by storing SGSN Number.
- 4) If the subscriber data in the VLR is marked as not confirmed by the HLR, then the new VLR informs the HLR. The HLR cancels the data in 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.
- 5) The new VLR allocates a new VLR TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.
- 6) The 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, or if subscription checking fails, then the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the SGSN updates the MM context for the MS. A new P-TMSI may be allocated. The SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).
- 7) If a new P-TMSI or VLR TMSI was received, then the MS confirms the reallocation of the TMSIs by sending Routeing Area Update Complete (P-TMSI, VLR TMSI) message to the SGSN.
- 8) The SGSN sends TMSI Reallocation Complete (VLR TMSI) to the VLR if the VLR TMSI is confirmed by the MS.

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 IDLE state.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful Location Update is performed.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Routeing Area Update

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter SGSN) procedure is illustrated in Figure 9. Each step is explained in the following list.

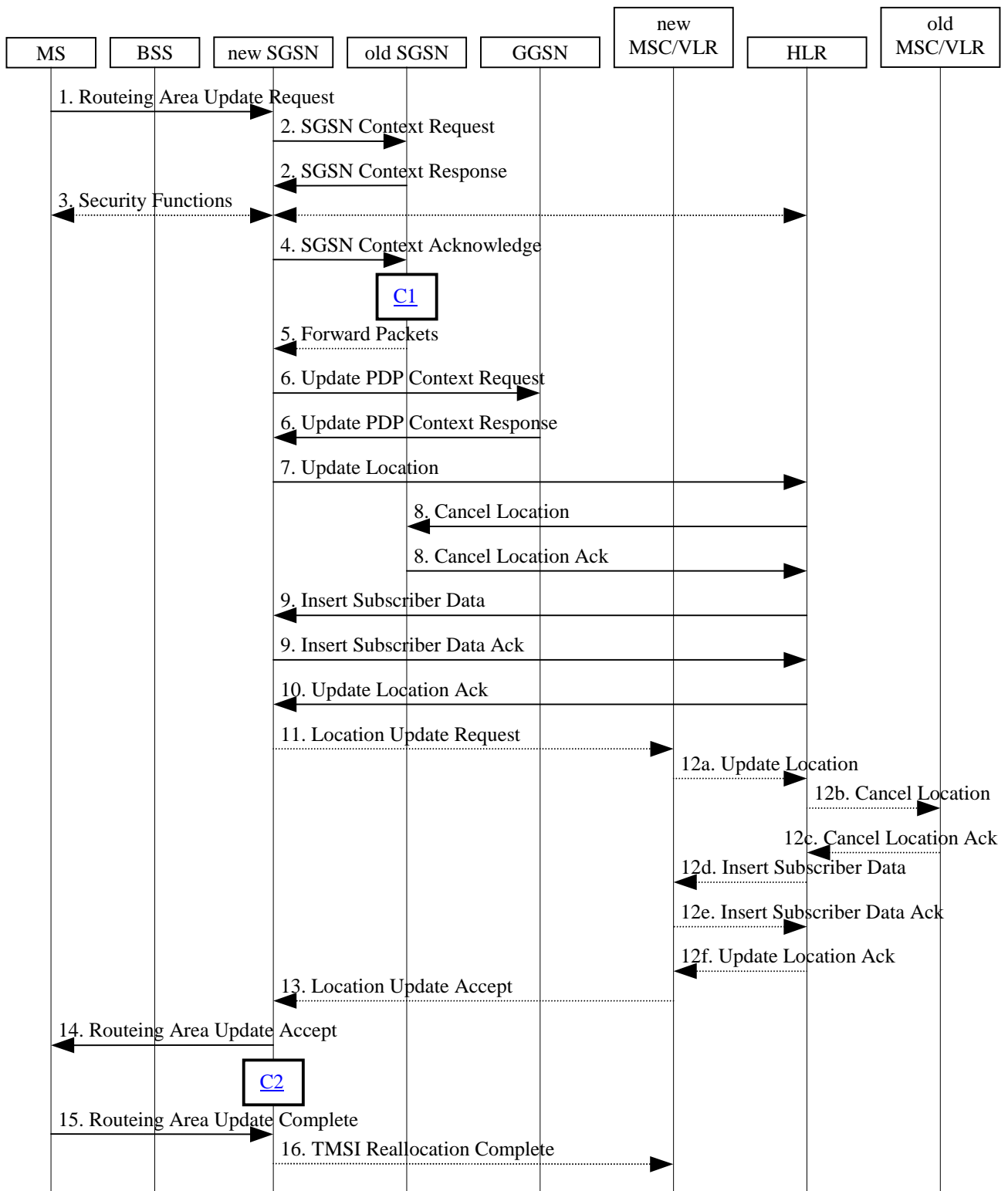


Figure 9: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

- 1) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach,

combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.

- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) 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 (old RAI, TLLI, MS Validated, New SGSN Address) 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 stops assigning SMDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, 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. The old SGSN starts a timer and stops the downlink transfer.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.
- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new 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. If the security functions do not authenticate the MS correctly, then 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) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SMDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TID).
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) 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, then the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are 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).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS 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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) 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, then 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 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 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.

- 12) 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.
- 13) 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.
- 14) 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 SGSN, or if subscription checking fails, then the SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 15) The MS confirms the reallocation of the TMSIs by sending Routing Area Update Complete (P-TMSI, VLR TMSI, Receive N-PDU Number) to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, then these N-PDUs shall be discarded by the new SGSN. LLC and SMDCP in the MS are reset.
- 16) The new SGSN sends TMSI Reallocation Complete (VLR TMSI) to the new VLR if the VLR TMSI is confirmed by the MS.

In the case of a rejected routing 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 routing area update to that RA. The RAI value shall be deleted when the MS is powered-up.

If the SGSN is unable to update the PDP context in one or more GGSNs, then the 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 routing area update.

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter IDLE state.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, then the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful location update is performed.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL_GPRS_SGSN_Context_Acknowledge

C2) CAMEL_GPRS_Routing_Area_Update

6.9.2 Location Management Procedures for UMTS

Refer to UMTS 25.301 for further information on the location management procedures for the UMTS radio.

The PLMN shall provide information for the MS to be able to:

- detect when it has entered a new cell or a new RA; and
- determine when to perform periodic RA updates.

In this specification, only the Location Management procedures related to the CN are described. These procedures are:

- a routeing area update procedure; and
- SERVING RNC relocation procedure.

An MS detects that a new cell has been entered by comparing the cell's identity with the cell identity stored in the MS. The MS detects that a RA Update shall be performed by comparing the RAI stored in its MM context with the RAI received from the network. In RRC-CONNECTED mode (PMM-CONNECTED state or CS MM CONNECTED state), the MS is informed of RAI and Cell Identity by the Serving RNC via an "MM information" message at the RRC layer. In RRC-IDLE state, the MS is informed of RAI and Cell Identity by the broadcasted system information at the RRC layer.

In network mode of operation II, whenever an MS determines that it shall perform both an LA update and an RA update, the MS shall start the LA update first. The MS should start RA Update procedure before the LA update is completed.

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. 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, then an MS that is both PS-attached and CS-attached shall perform the Combined RA / LA Update procedures.

In UMTS, a RA Update is either intra-SGSN or inter-SGSN RA Update, either combined RA/LA update or only RA update, either initiated by an MS in PMM-CONNECTED or in PMM-IDLE state. All the RA Update cases are contained in the procedure illustrated in Figure 10. Each step is explained in the following list.

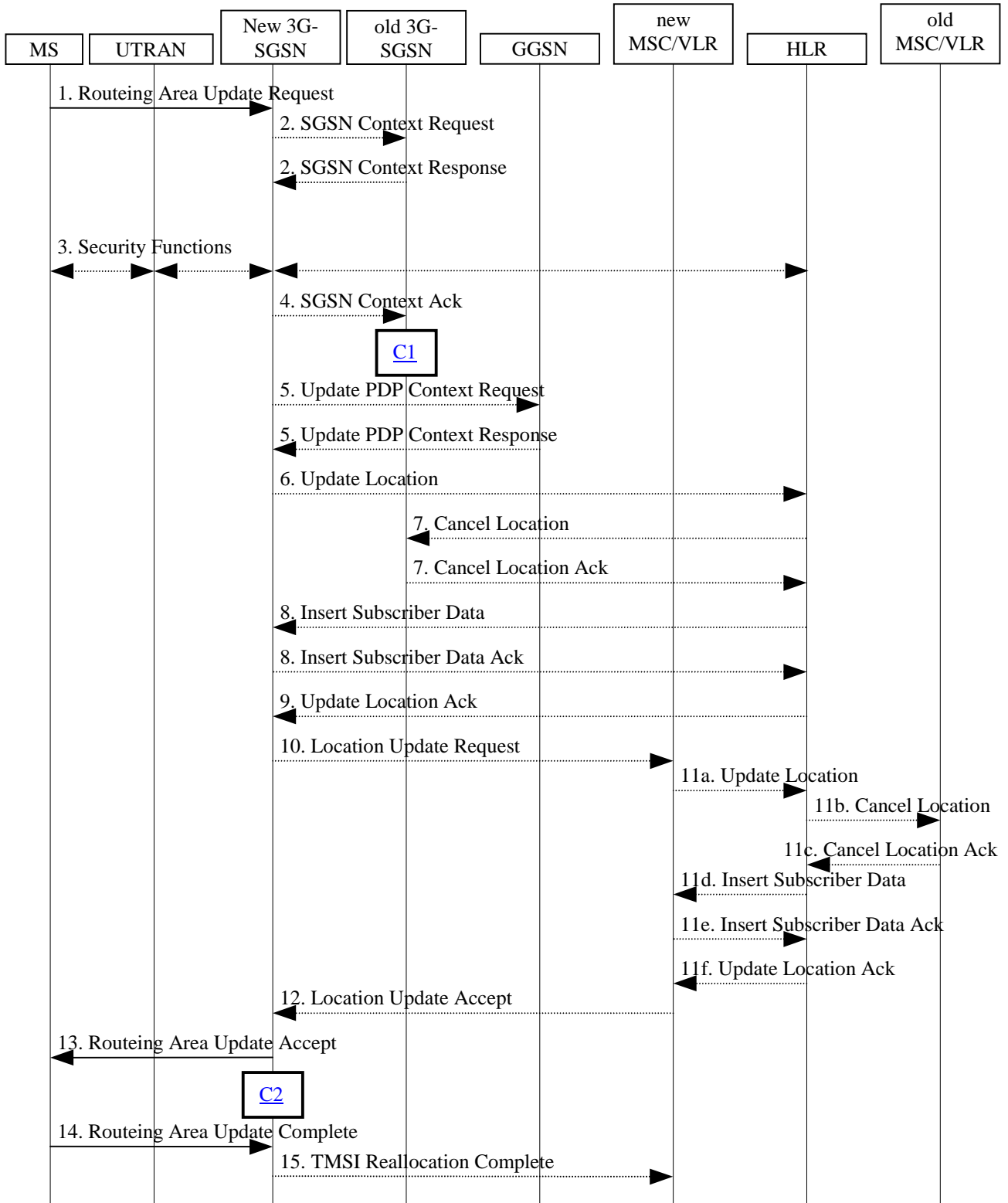


Figure 10: UMTS RA Update Procedure

- 1) The RRC connection is established, if not already done. The MS sends a Routing Area Update Request message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request) to the new SGSN. Follow on request

shall be set by MS if there is pending uplink traffic (signaling 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 CS 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 CS attach requested if the MS wants to perform an CS attach in network operation mode I.

The UTRAN shall add the Routing Area Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. (FFS)

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 Routing area update and if the MS was in PMM-IDLE state, the new SGSN sends SGSN Context Request message (old PTMSI, 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 responds with SGSN Context Response (Cause, IMSI, MM Context, PDP contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN starts a timer.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". If the security functions do not authenticate the MS correctly, then 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.
- 4) If the RA Update is an Inter-SGSN Routing 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.
- 5) If the RA Update is an Inter-SGSN RA Update and if the MS was in PMM-IDLE state, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, SGSN Tunnel Endpoint Identifier, GGSN Tunnel Endpoint Identifier) to the GGSNs concerned. GGSN Tunnel Endpoint Identifier is used by GGSN to identify the PDP context. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier). Note: If the RA Update is an Inter-SGSN Routing area update initiated by an MS is in PMM-CONNECTED state, the update PDP Context Request is sent as described in subclause "SRNC relocation".
- 6) 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.
- 7) 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, then 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).
- 8) If the RA Update is an Inter-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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.

- 9) 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.
- 10) If Update Type indicates combined RA / LA update with CS attach requested, or if the LA changed with the routing area update, then 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 CS attach if Update Type in step 1 indicated combined RA / LA update with CS 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.
- 11) 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.
- 12) 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.
- 13) 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 SGSN, or if subscription checking fails, then the SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).
- 14) The MS confirms the reallocation of the TMSIs by sending Routing Area Update Complete (P-TMSI, VLR TMSI) to the SGSN.
- 15) The new SGSN sends TMSI Reallocation Complete (VLR TMSI) to the new VLR if the VLR TMSI is confirmed by the MS.

NOTE: Steps 11, 12, and 15, are performed only if step 9 is performed.

In the case of a rejected routing 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 routing area update to that RA. The RAI value shall be deleted when the MS is powered up.

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-PS services until a successful location update is performed.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL_GPRS_SGSN_Context_Acknowledge

C2) CAMEL_GPRS_Routing_Area_Update

6.9.2.2 Serving RNC Relocation procedure

This procedure is only perform for MS in PMM-CONNECTED state.

The Serving RNC relocation procedure is used to move the UTRAN-CORE NETWORK connection point at UTRAN side from the Serving RNC to the target RNC. In the procedure, the Iu links are relocated. If the Target RNC is connected to the same SGSN as the Serving RNC, an intra-SGSN SERVING RNC Relocation procedure is performed. This procedure is followed by an Intra-SGSN RA Update procedure. If the Target RNC is connected to a different SGSN than the Serving RNC, an inter-SGSN SERVING RNC Relocation procedure is performed. This procedure is followed by an Inter-SGSN RA Update procedure.

Figure 11 shows SRNS relocation when source RNC and target RNC are connected to different 3G-SGSN. Figure 12 shows the situation after the procedure has been completed.

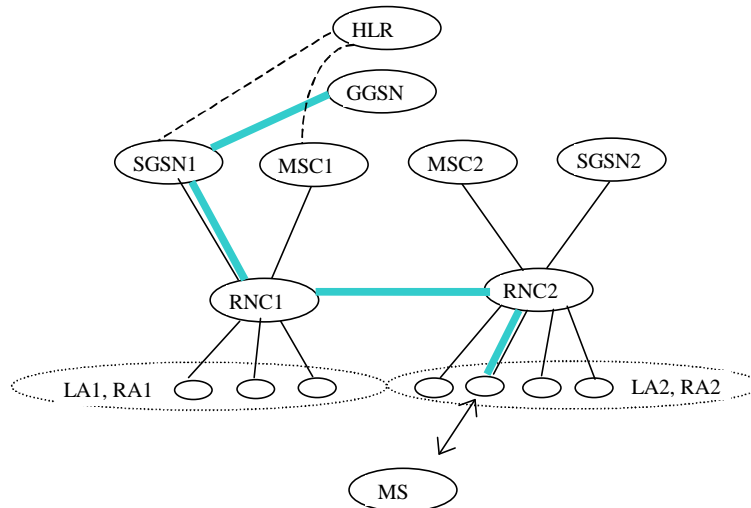


Figure 11: Before SRNS Relocation and Location Registration

Before the SRNS relocation and location registration the MS is registered in SGSN1 and in MSC1. The RNC1 is acting as SERVING RNC and the RNC2 is acting as Drift RNC.

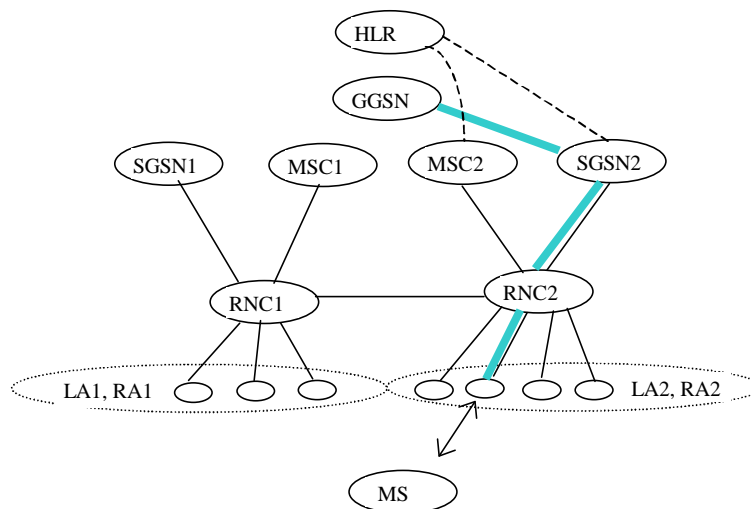


Figure 12: After SRNS Relocation and RA Update

After the SRNS relocation and RA Update, the MS is registered in MSC2 and in SGSN2. The MS is in state PMM-CONNECTED towards the SGSN2 and in state CMM-IDLE towards the MSC2. The RNC2 is acting as SERVING RNC.

The SRNS relocation procedure can be divided into 3 stages:

- 1) Resource Reservation: The path of the data traffic is not changed.
- 2) Actual handover of Serving RNC Phase: The UTRAN connection point is moved to the target RNC (new Serving RNS) and downlink traffic is forwarded from (old) Serving RNC to the Target RNC
- 3) Routing Area Update initiated by an MS is in PMM-CONNECTED state, which is described in the RA update subclause.

The SRNS relocation procedure is described in the procedure illustrated in Figure 13. Each step is explained in the following list.

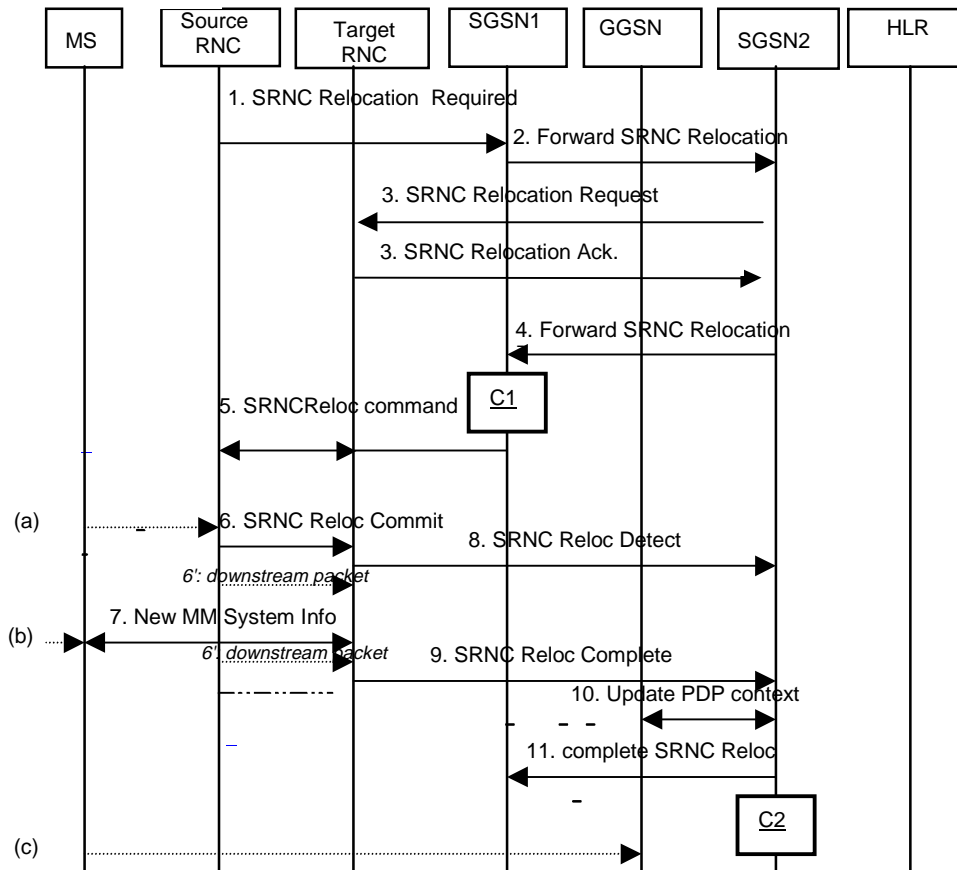


Figure 13: Phases 1 and 2 of Serving RNC Relocation

1. "Resource reservation" phase:

During this phase, the transmission of packets between GGSN and MS through the source SRNC continues.

- 1) UTRAN (source SRNC) makes the decision to perform the Serving RNC relocation procedure. This includes decision on into which RNC (Target RNC) the Serving RNC functionality is to be relocated. The source SRNC sends SRNC Relocation required message (target RNC identifier, transparent information field) to the SGSN1. Transparent information field shall be passed transparently to the target RNC.
- 2) If the SGSN1 determines from target RNC Identifier that the SRNC relocation is an inter-SGSN SERVING RNC Relocation, then SGSN1 sends a Forward SRNC relocation request to SGSN2 (target RNC identifier, transparent information field, IMSI, MM context, PDP contexts).

NOTE: Forward SRNC relocation request does not contain any information linked with packet transmission (sequence numbers) because such information is under the responsibility of the UTRAN.

- 3) The SGSN2 sends a SRNC Relocation Request message (target RNC identifier, transparent information field, IMSI) to the target RNC. When the Iu user plane transport bearers have been established, and target RNC completed its preparation phase, SRNC Relocation Acknowledge message (RNC IP address(es), and Tunnel End Point Identifier(s)) is sent to the SGSN2. The RNC IP address(es) (possibly one address per PDP context) on which the target RNC is willing to receive these packets. Tunnel End Point Identifier(s) are the Identifiers to be used in GTP level when sending packets to this RNC.
- 4) When the traffic resources between target RNC and SGSN2 has been allocated and the SGSN2 is ready for the SRNC move, then the Forward SRNC Relocation Response message (RNC IP address(es), and Tunnel End Point Identifier(s)) is sent from SGSN2 to SGSN1. This message indicates that SGSN2 / target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by MS.
- 5) When the Forward SRNC Relocation Response has been received in the SGSN1, the SGSN1 indicates the completion of preparation phase at the CN PS domain side for the SRNC relocation by sending the SRNC Relocation Command message (RNC IP address(es), and Tunnel End Point Identifier(s)) to the Source RNC. The RNC IP address(es), and Tunnel End Point Identifier(s) are used by SRNC to send the downstream packets not yet acknowledged by MS to the target RNC.

2. "Actual handover of Serving RNC" phase:

- 6) When the source RNC has received the SRNC Relocation Proceeding 2 message, the source RNC sends a SRNC Relocation Commit message to the target RNC(list of (SNU, UP-RLC-ack, SND)). SND is the GTP sequence number for the next downlink packet received from the GGSN. SNU is the GTP sequence number for the next uplink packet to be tunnelled to the GGSN. UP-RLC-Ack contains the acknowledgements for upstream PDU received by the source SRNC on each RLC connection used by the MS (i.e. the Receive State Variable V(R) for all RLC SAPI in acknowledged mode). The source SRNC starts a timer T3-TUNNEL , stops the exchange of the packets with the MS (point (a)), and starts tunnelling the buffered and incoming downstream packets towards the target SRNC using RNC IP address(es), and Tunnel End Point Identifier(s). The target RNC executes switch for all bearers at the earliest suitable time instance.
- 7) The target RNC starts acting as SRNC. The target SRNC:
 - Restarts the RLC connections. This includes the exchange between the target SRNC and the MS of the UP-RLC-Ack and DOWN-RLC-ACK. DOWN-RLC-ACK confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If DOWN-RLC-ACK confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. UP-RLC Ack confirms all mobile-originated packets successfully transferred before the start of the relocation procedure. From now on the exchange of the packets with the MS can restart (point (b)).
 - Sends New MM System Information to the MS indicating e.g. relevant Routing Area and Location Area. Additional RRC information may then also be sent to the MS, e.g. new RNTI identity. The new RAI triggers a RA Update procedure (case initiated by MS in PMM-CONNECTED state). This is point (c). The uplink traffic shall not be stopped due to the new MM System Information or the RA Update procedure.

NOTE: The new SGSN may send uplink packets to the GGSN before the update PDP context is performed.

- 8) Immediately after a successful switch at RNC, target RNC (=SRNC) sends SRNC Relocation Detect message to the SGSN2.
- 9) After sending out the New MM System Information, the target RNC sends an SRNC relocation complete to SGSN2. In case of intra-SGSN SERVING RNC Relocation, the SGSN use this indication to send an Iu release message to old SRNC.
- 10) If the SRNC relocation is an Inter-SGSN SRNC relocation, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, SGSN Tunnel Endpoint Identifier, GGSN Tunnel Endpoint Identifier) to the GGSNs concerned. GGSN Tunnel Endpoint Identifier is used by GGSN to identify the PDP context. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).
- 11) If the SRNC relocation is an Inter-SGSN SRNC relocation, the new SGSN sends Complete SERVING RNC relocation message (IMSI) to the old SGSN when all GGSNs have been updated.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL GPRS SGSN Context Acknowledge

C2) CAMEL GPRS Routing Area Update

6.12 Service Request Procedure for UMTS

The Service Request procedure is used by a 3G-MS in PMM-IDLE state to request the establishment of a secure connection to a 3G-SGSN. The MS in PMM-IDLE state initiates this procedure in order to send uplink signalling messages (e.g., Activate PDP Context Request) or user data. This procedure is also used by an MS in PMM-CONNECTED state to request resource reservation for active PDP contexts.

6.12.1 Service Request Initiated by MS Procedure

The MS in PMM-IDLE state sends the Service Request message to the 3G-SGSN in order to establish the PS signalling connection for the upper layer signalling or for the resource reservation for active PDP contexts. After receiving the Service Request message the 3G-SGSN may perform authentication and it shall perform the security mode procedure. After the establishment of the secure PS signalling connection to a 3G-SGSN the MS may send signalling messages, e.g., Activate PDP Context Request, to the 3G-SGSN, or the 3G-SGSN may start the resource reservation for the active PDP contexts depending on the requested service in the Service Request message. This procedure is also used by an MS in PMM-CONNECTED state to request the resource reservation for the active PDP contexts.

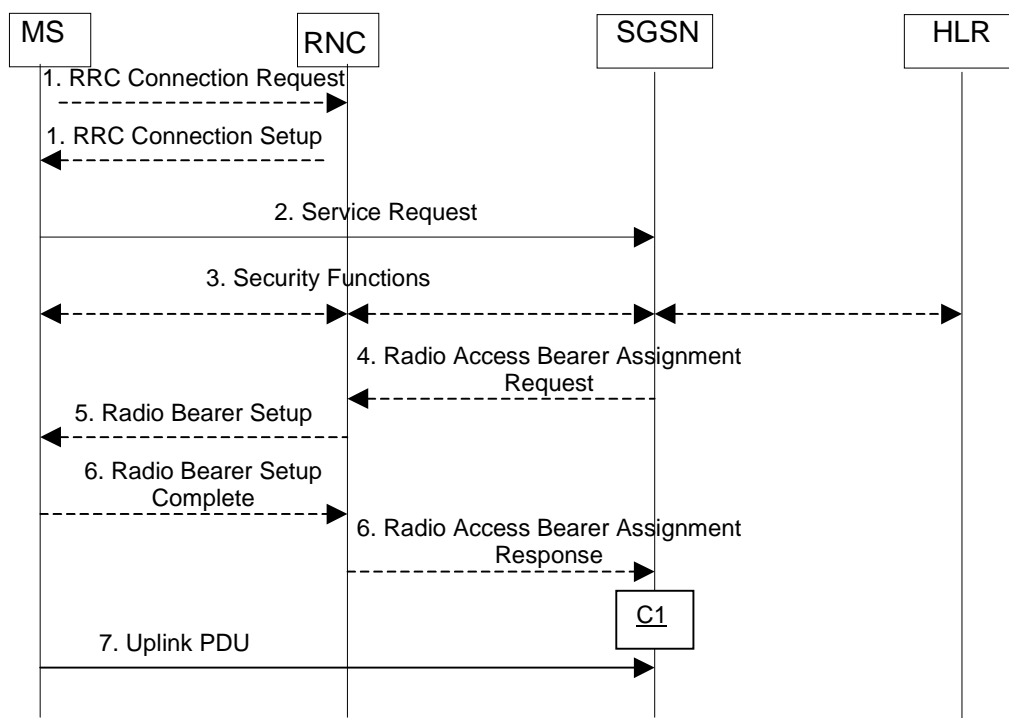


Figure 14: Service Request Initiated by MS Procedure

- 1) The MS establishes an RRC connection, if none exists for CS traffic.
- 2) The MS sends a Service Request (P-TMSI, P-TMSI Signature, 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. At this point, the SGSN may perform the authentication procedure.

If Service Type indicates Data then a signalling connection is requested established between the MS and the SGSN, and resources for active PDP context(s) are requested allocated, i.e., RAB establishment for the activated PDP context(s).

If Service Type indicates Signalling then the signalling connection is requested established between the MS and the SGSN for sending upper-layer signalling messages, e.g., Activate PDP Context Request. The resources for active PDP context(s) are not requested allocated.

- 3) The SGSN shall perform the security functions if the service request was initiated by an MS in PMM-IDLE state.
- 4) In case Service Type indicates Data, the SGSN sends a Radio Access Bearer Assignment Request (NSAPI(s), Tunnel Identity(ies), QoS Profile(s), SGSN IP Address(es)) message to re-establish radio access bearer for every activated PDP context.
- 5) The RNC indicates to the MS the new Radio Bearer Identity established and the corresponding NSAPI with the RRC radio bearer set up procedure.
- 6) SRNC responds with the Radio Access Bearer Assignment Response (NSAPI(s), Tunnel Identity(ies), QoS Profile(s), RNC IP Address(es)) message. The GTP tunnel(s) are established on the Iu interface.
- 7) The MS sends the uplink packet.

The MS knows that the Service Request message was successfully received in the SGSN when the MS receives the RRC Security Mode Control Command message. It is, however, possible that the security mode procedure is not performed, e.g., if the Service Request message indicating Service Type = Data is sent after an RA update procedure via the same PS signalling connection. For such cases, the Service Accept message may be needed and it should be treated by the MS as a service acceptance indication.

If the service request cannot be accepted, the network returns a Service Reject message to the mobile station.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL_GPRS_Attach_Request

6.12.2 Service Request Initiated by Network Procedure

When the 3G-SGSN receives a downlink packet (e.g., Request PDP Context Activation, MT SMS, user data) for an MS in PMM-IDLE state, the 3G-SGSN sends a paging request to UTRAN. The paging request triggers the Service Request procedure in the UMS

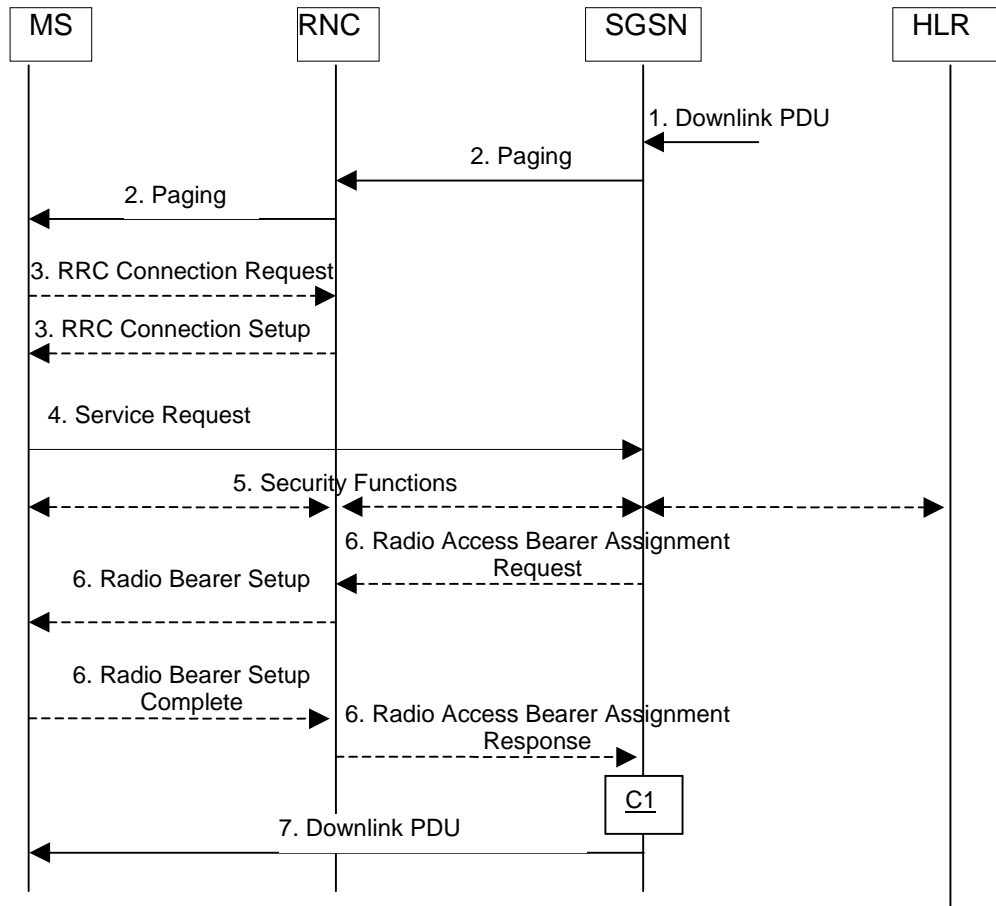


Figure 15: Service Request Initiated by Network Procedure

- 1) The SGSN receives a downlink PDP PDU for an MS in PMM-IDLE state.
- 2) The SGSN sends a Paging (IMSI, P-TMSI, RAI, Paging Cause) message to the RNC. The RNC pages the MS by sending a Paging (P-TMSI or IMSI, Paging Cause) message to the MS.
- 3) The MS establishes an RRC connection if none exists for CS traffic.
- 4) The MS sends a Service Request (P-TMSI, P-TMSI Signature, RAI, CKSN, Service Type) message to the SGSN. Service Type specifies Paging Response. The Service Request is carried over the radio in an RRC Direct Transfer message and over the Iu interface in the RANAP Initial MS message. At this point, the SGSN may perform the authentication procedure. The SGSN knows whether the downlink packet requires RAB establishment (e.g., downlink PDU) or not (e.g., Request PDP Context Activation or MT SMS).
- 5) The SGSN shall perform the security mode procedure.
- 6) If resources for the PDP contexts are re-established, the SGSN sends a Radio Access Bearer Assignment Request (NSAPI(s), Tunnel Identity(ies), QoS Profile(s), SGSN IP Address(es)) message to the RNC. The RNC sends a Radio Access Bearer Setup (RAB Identity, NSAPI) to the MS. The MS responds by returning a Radio Access Bearer Complete message to the RNC. The RNC sends a Radio Access Bearer Assignment Response (NSAPI(s), Tunnel Identity(ies), QoS Profile(s), RNC IP Address(es)) message to the SGSN in order to indicate that GTP tunnels are established on the Iu interface and radio access bearers are established between the RNC and the MS.
- 7) The SGSN sends the downlink packet.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Attach Request

6.13 UMTS-GPRS Intersystem Handover

6.13.1.1 UMTS to GPRS Handover

An Inter System handover from UMTS to GPRS takes place when the MS in PMM-CONNECTED state enters a new GSM/GPRS cell inside the current RA. In this case the MS shall perform a Routing Area Update procedure with the Update Type set to 'Inter System Cell Change'.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Gb interface to the new cell.

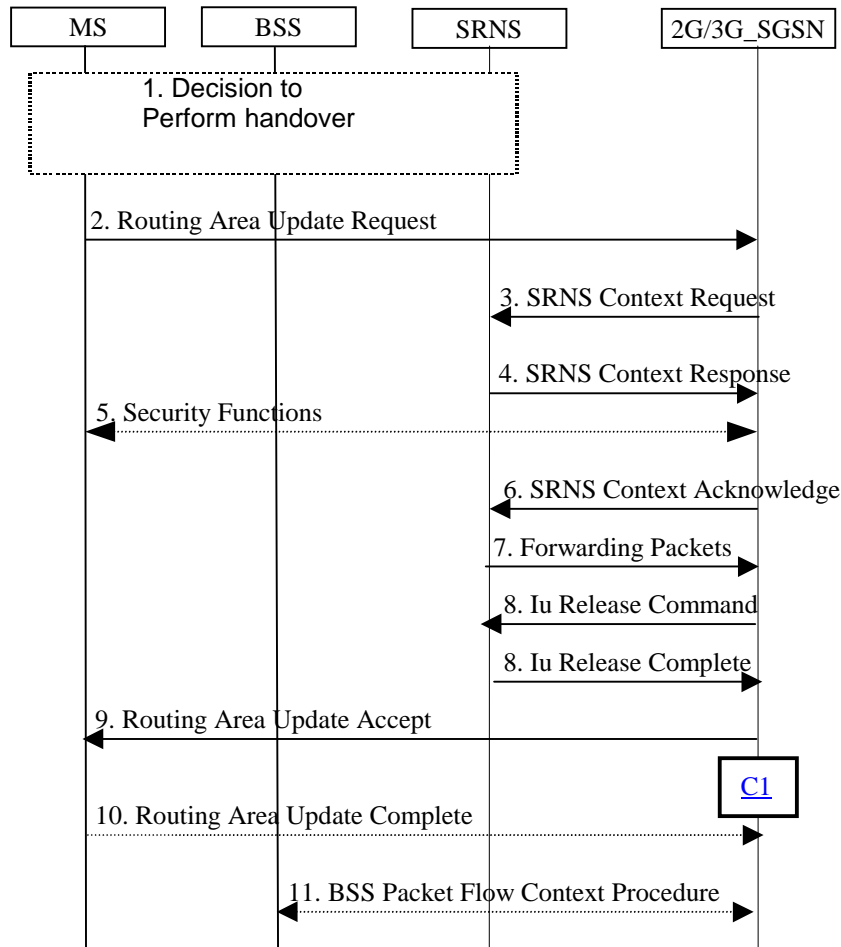


Figure 16: UMTS to GPRS Handover Between Cells in same RA

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting GPRS radio technology and suspends PDU transmission to the network
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the 2G/3G-SGSN. Update Type shall indicate 'Inter system cell change'. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the 2G/3G-SGSN.
- 3) The 2G/3G-SGSN sends SRNS Context Request (IMSI) to the SRNS, starts a timer on the MM and PDP Context and stops the transmission of GTP PDUs to the SRNS.
- 4) The SRNS responds with SRNS Context Response (IMSI, GTP SNDs, GTP SNU, RLC counters). The GTP sequence numbers are included for each PDP context indicating the next downlink PDU to be sent to the MS (i.e. the last GTP PDU in the buffer of the SRNS, which is not sent to the MS) and the next GTP PDU to be tunnelled

to the GGSN. For each active PDP context the SRNS also includes the uplink and downlink RLC counters for PDP contexts using acknowledged mode.

- 5) Security functions may be executed.
- 6) The 2G/3G-SGSN sends SRNS Context Acknowledge to the SRNS. This informs the SRNS that the 2G/3G-SGSN is ready to receive data packets.
- 7) The buffered downlink GTP PDUs are tunnelled back to the 2G/3G-SGSN.
- 8) When the timer described under 3 has expired, the 2G/3G-SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 9) The 2G/3G-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, then the 2G/3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the 2G/3G-SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number) is returned to the MS. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure. The 2G/3G-SGSN deduces the N-PDU Numbers from the RLC numbers received from the SRNS (FFS).
- 10) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.
- 11) The 2G/3G-SGSN and the BSS may execute the BSS Packet Flow Context Procedure.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Routing Area Update

6.13.1.2 GPRS to UMTS Handover

An Inter System handover from GPRS to UMTS takes place when a PS-attached MS enters a new UMTS cell inside the current RA. In this case the MS shall perform a UMTS Inter System Cell Change procedure by performing a RRC connection establishment and an Intra SGSN Routing Area Update procedure with the Update Type set to 'Inter System Cell Change'.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Iu interface to the new cell.

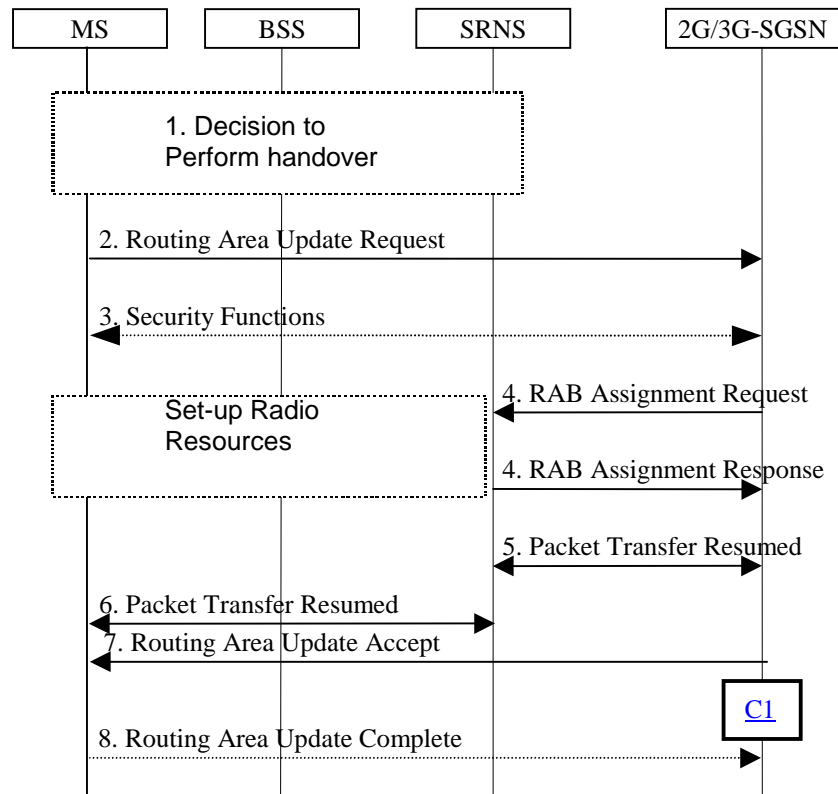


Figure 17: GPRS to UMTS Handover Between Cells in same RA

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology and Suspend PDU Transmission to the Network.
- 2) The MS initiate a RRC connection establishment and sends Routing Area Update Request (Old RA, Old P-TMSI Signature, Update Type, CM) to the combined 2G/3G-SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 2G/3G-SGSN. The 2G/3G-SGSN stops the transmission of N-PDUs to the MS.
- 3) Security functions may be executed.
- 4) The 2G/3G-SGSN request the SRNS to establish of a radio access bearer by sending RAB Assignment Request to the SRNS. The SRNS responds with RAB Assignment Response.
- 5) The traffic flow is resumed between the 2G/3G-SGSN and the SRNS
- 6) The traffic flow is resumed between the SRNS and the MS.
- 7) The 2G/3G-SGSN updates the MM context for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number (FFS)) is returned to the MS.
- 8) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number (FFS)).

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL_GPRS_Routeing_Area_Update

6.13.2 Intersystem Handover at RA Change

6.13.2.1 UMTS to GPRS Handover

An inter system handover from UMTS to GPRS takes place when the MS in PMM-IDLE or PMM-CONNECTED state moves to a new GSM/GPRS cell in a new RA. In this case the MS shall initiate a GPRS RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

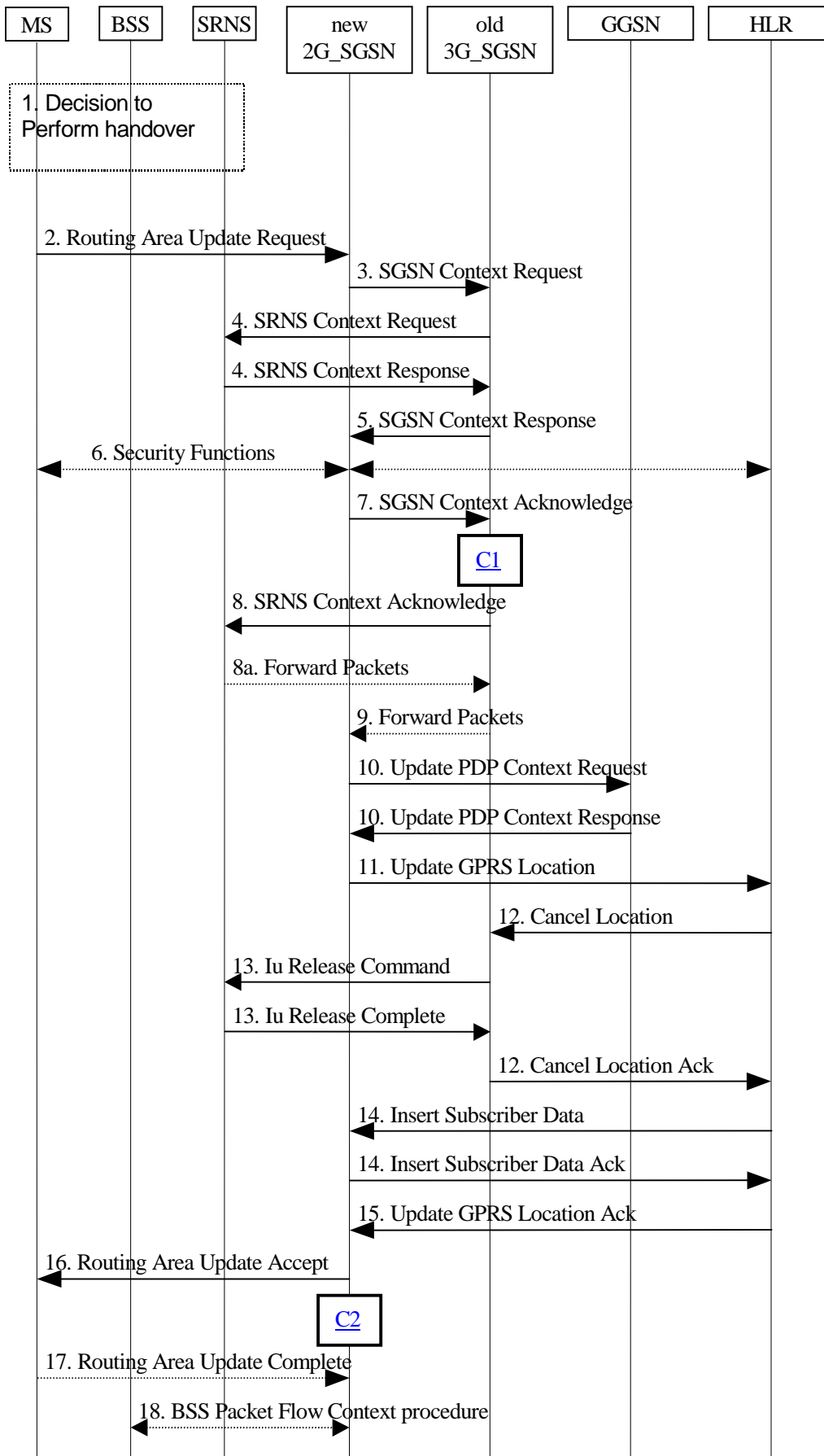


Figure 18: UMTS to GPRS Inter SGSN Routing Area Update Procedure

- 1) The MS and/or BSS/UTRAN decides to perform handover, which leads to that the MS switch to the new cell supporting GPRS radio technology and that the PDU transmission is suspended.
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the new 2G-SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the new 2G-SGSN.
- 3) The new 2G-SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old 3G-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 3G-SGSN. The old 3G-SGSN starts a timer for supervision of the MS's context. If the MS is not known in the old 3G-SGSN, the old 3G-SGSN responds with an appropriate error cause.
- 4) The old 3G-SGSN sends SRNS Context Request (IMSI) to the SRNS. Upon reception of this message the SRNS buffers and stops sending downlink PDUs to the MS and answers with SRNS Context Response (IMSI, GTP SNDs, GTP SNUs, RLC counters). The SRNS shall include for each PDP context the GTP sequence number of the next GTP sequence number to be sent in downlink to the MS (i.e. the last not yet transferred N-PDU) and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context the SRNS also includes the uplink and downlink RLC transmission counters for PDP contexts using acknowledged mode (FFS).
- 5) The old 3G-SGSN responds with SGSN Context Response (MM Context, e.g. IMSI, PDP Contexts, e.g. APN). For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP-U PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next N-PDU to be sent to the MS. Each PDP Context also includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS. The SMDCP N-PDU numbers are derived from the RLC counters received from the SRNS (FFS).
- 6) Security functions may be executed.
- 7) The new 2G-SGSN sends an SGSN Context Acknowledge message to the old 3G-SGSN. This informs the old 3G-SGSN that the new 2G-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 RA update procedure back to the old SGSN before completing the ongoing RA update procedure.
- 8) The old 3G-SGSN sends SRNS Context Acknowledge (IMSI) to the SRNS.
- 8a) The SRNS shall start duplicating and tunnelling the buffered GTP-U PDUs to the old 3G-SGSN.
- 9) The old 3G-SGSN tunnels the GTP-U PDUs to the new 2G-SGSN. No SMDCP sequence numbers shall be included in the GTP header of the tunnelled PDUs.
- 10) The new 2G-SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSN(s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TID).
- 11) The new 2G-SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 12) The HLR sends Cancel Location (IMSI) to the old 3G-SGSN. The old 3G-SGSN acknowledges with Cancel Location Ack (IMSI). The old 3G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. When the timer is running the MM and PDP contexts are removed when the timer expires.
- 13) When the timer described in step 3 expires the old 3G-SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 14) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 2G-SGSN. The 2G-SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 15) The HLR acknowledges the Update Location by sending Update GPRS Location Ack (IMSI) to the new 2G-SGSN.

- 16) The new 2G-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 2G-SGSN, or if subscription checking fails, then the new 2G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 2G-SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 2G-SGSN and the MS. The new 2G-SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI Signature Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 17) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.
- 18) The 2G-SGSN and the BSS may execute the BSS Packet Flow Context Procedure

The sequence applied for the intra SGSN RA update case is identical to the cell change case within the same RA as shown in subclause "Intersystem Handover within an RA between Cells in Different Systems" used with a different update type.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL GPRS SGSN Context Acknowledge

C2) CAMEL GPRS Routeing Area Update

6.13.2.2 GPRS to UMTS Handover

An intersystem handover from GPRS to UMTS takes place when the PS-attached MS moves to a new UMTS cell of a new RA. In this case the MS shall initiate a UMTS RA update procedure by establishing a RRC connection and initiating the RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

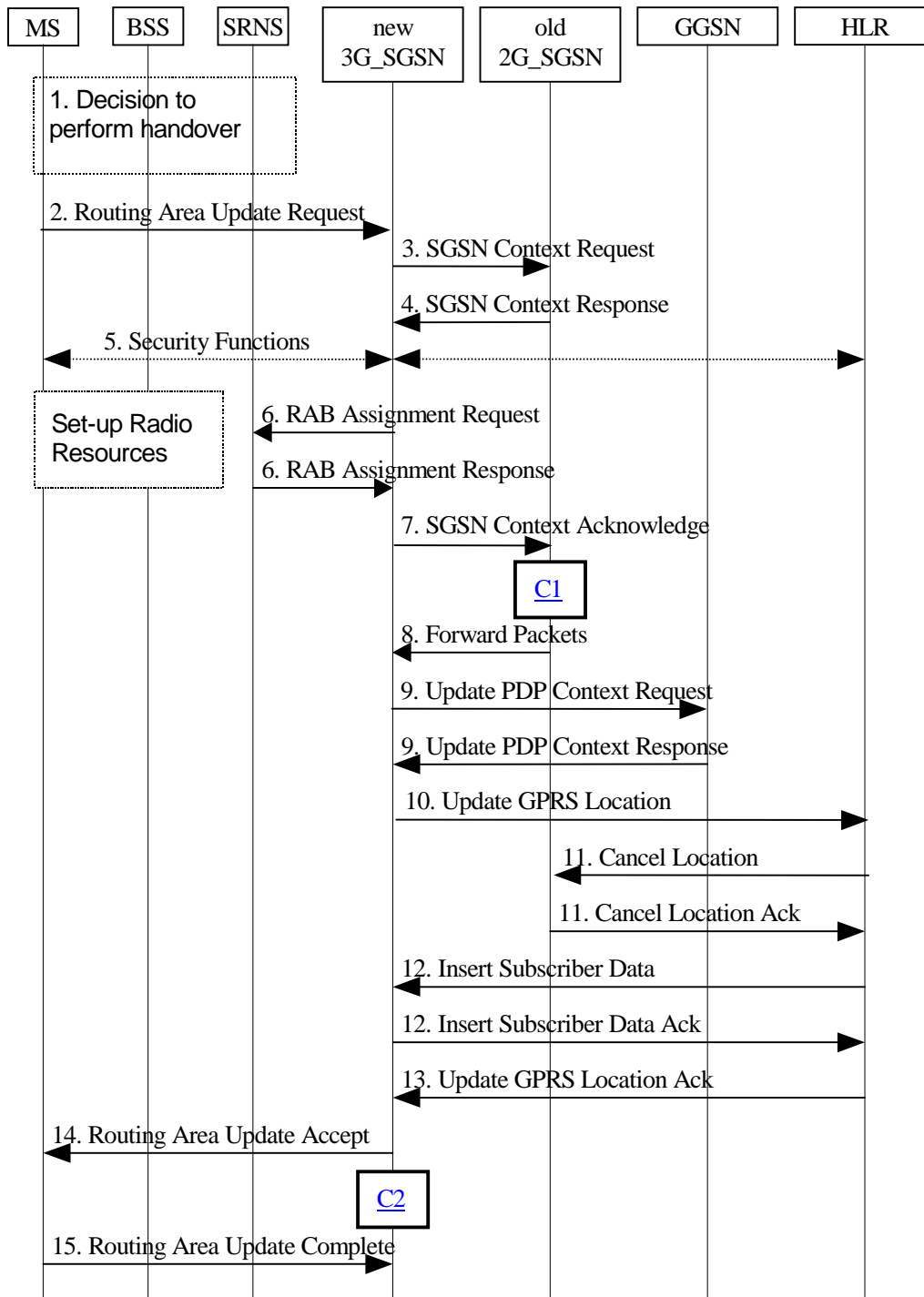


Figure 19: GPRS to UMTS Inter SGSN Routing Area Update Procedure

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type, CM) to the new 3G-SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 3G-SGSN.
- 3) The new 3G-SGSN sends SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) to the old 2G-SGSN to get the MM and PDP contexts for the MS (The old RAI received from the MS is used to derive the old 2G-SGSN address). The old 2G-SGSN starts a timer for supervision of the MS's context and stops the transmission of N-PDUs to the MS.

- 4) The old 2G-SGSN responds with SGSN Context Response (MM Context, e.g. IMSI, PDP Contexts, e.g. APN). 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 SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS. The new 3G-SGSN shall use the GTP sequence numbers for in-sequence delivery over the Iu interface.
The new 3G-SGSN uses the received SMDCP N-PDU sequence number for reliable data transmission (RRS).
- 5) Security functions may be executed.
- 6) The new 3G-SGSN requests the SRNS to establish a radio access bearer by sending RAB Assignment Request to the SRNS. The SRNS responds with RAB Assignment Response.
- 7) The new 3G-SGSN sends a 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 routing area update procedure back to the old SGSN before completing the ongoing routing area update procedure.
- 8) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. The 3G-SGSN shall ignore any SMDCP sequence numbers received with the tunnelled N-PDUs. 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. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.
- 9) The new 3G-SGSN sends a Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSN (s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TID).
- 10) The new 3G-SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 11) The HLR sends Cancel Location (IMSI, Cancellation Type) 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. When the timer is running the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with Cancel Location Ack (IMSI).
- 12) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 3G-SGSN. The 3G-SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 13) The HLR acknowledges the Update GPRS Location by sending Update Location Ack (IMSI) to the new 3G-SGSN.
- 14) The new 3G-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 3G-SGSN, or if subscription checking fails, then the new 3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 3G-SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 3G-SGSN and the MS. The new 3G-SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI signature Receive N-PDU Number (RRS)).
- 15) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number (RRS)).

The sequence applied for the intra SGSN RA update case is identical to the cell change within the same RA case as shown in subclause "Intersystem Handover within an RA between Cells in Different Systems" used with a different update type.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL GPRS SGSN Context Acknowledge

C2) CAMEL GPRS Routing Area Update

7 Network Management Functionality

The Network Management function provides mechanisms to support O&M functions related to the packet domain.

8 Radio Resource Functionality

9 Packet Routing and Transfer Functionality

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 20. Each step is explained in the following list.

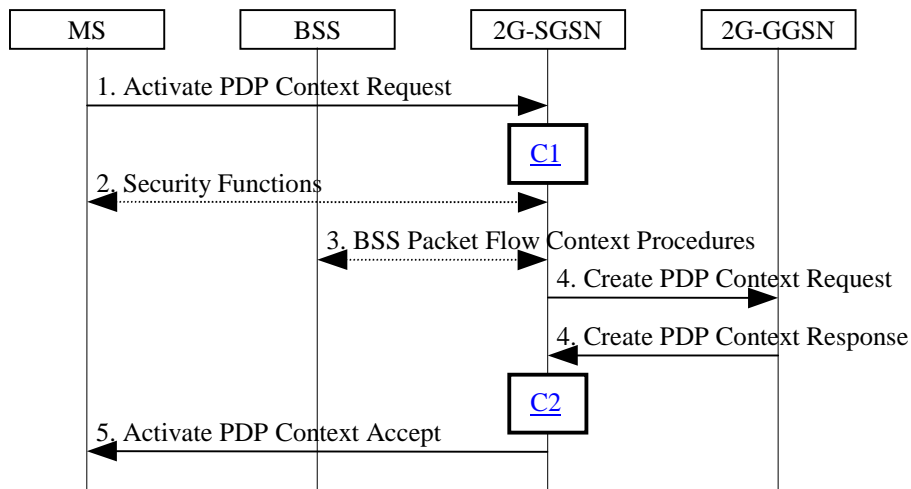


Figure 20: PDP Context Activation Procedure for GPRS

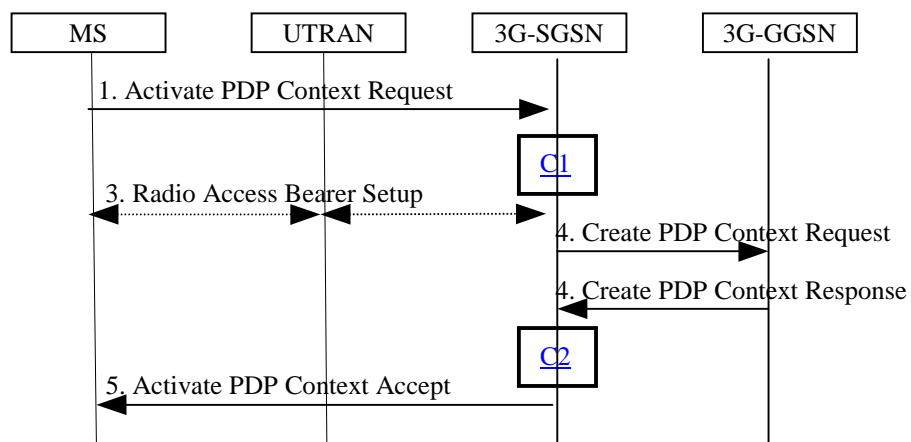


Figure 21: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The

MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.

- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects

Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL GPRS Activate PDP Context

C2) CAMEL GPRS SGSN Create PDP Context

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. All PDP contexts sharing the same PDP address are identified by one and the same TI but a unique NSAPI value.

The Secondary PDP Context Activation procedure associates a Traffic Flow Template (TFT) to the newly activated PDP context. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external 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. The procedure is illustrated in Figure 22. Each step is explained in the following list.

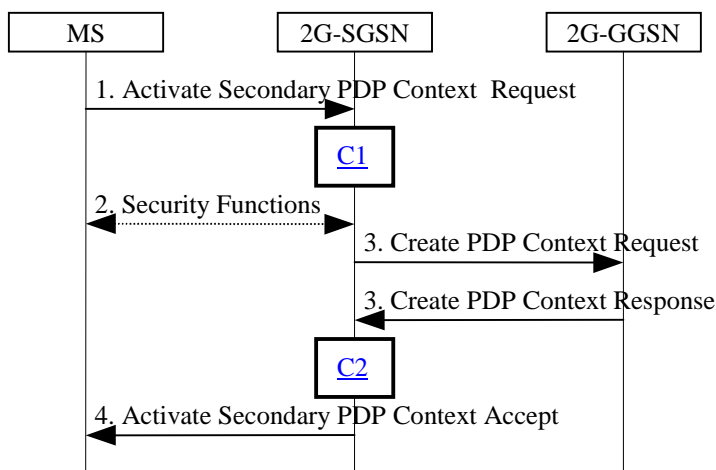


Figure 22: Secondary PDP Context Activation Procedure for GPRS

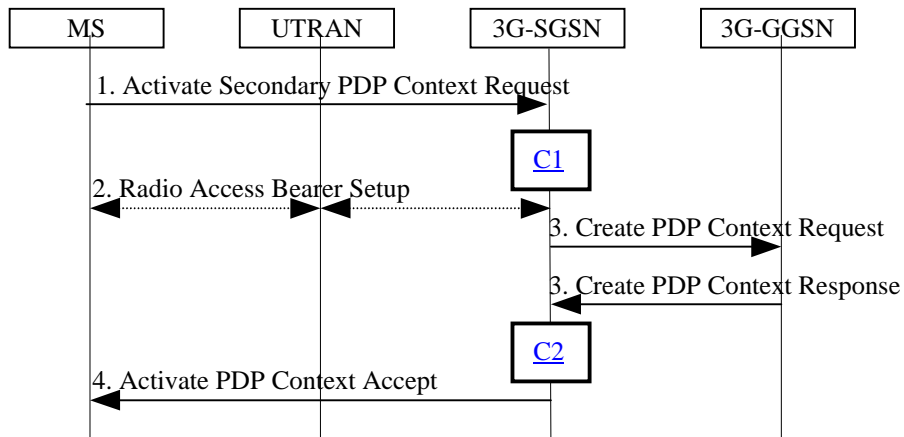


Figure 23: Secondary PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate Secondary PDP Context Request (NSAPI, TI, QoS Requested, TFT) message to the SGSN. 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 is the same TI used by the already-activated PDP context(s) for that PDP address, and NSAPI contains a value not used by any other activated PDP context.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

For UMTS, , the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 3) The SGSN validates the Activate Secondary PDP Context Request using the 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TID, TFT) message to the affected GGSN. The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TID, BB Protocol, Reordering Required, QoS Negotiated, Cause) message to the SGSN.

- 4) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL GPRS Activate PDP Context

C2) CAMEL GPRS SGSN Create PDP Context

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in Figure 24. Each step is explained in the following list.

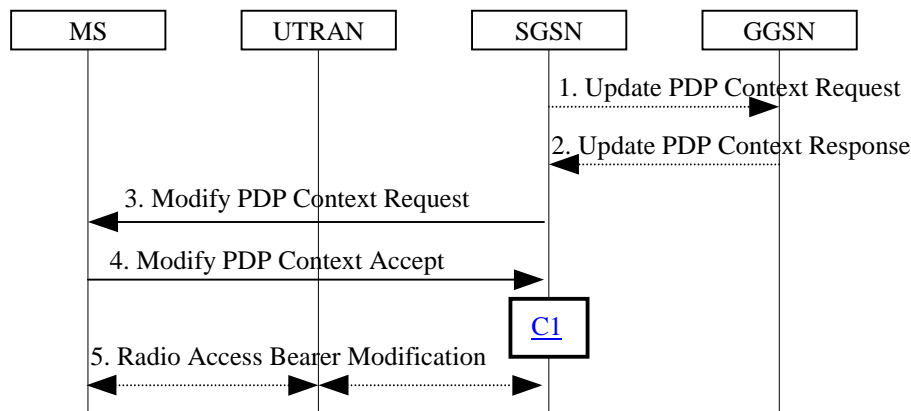


Figure 24: SGSN-Initiated PDP Context Modification Procedure

- 1) The SGSN may send an Update PDP Context Request (TID, QoS Negotiated) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.
- 2) The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TID, QoS Negotiated) message.
- 3) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.
- 4) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 5) The radio access bearer modification procedure may be executed.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL_GPRS_Modify_PDP_Context

9.2.3.2 GGSN-Initiated PDP Context Modification Procedure

The GGSN-Initiated PDP Context Modification procedure is illustrated in Figure 25. Each step is explained in the following list.

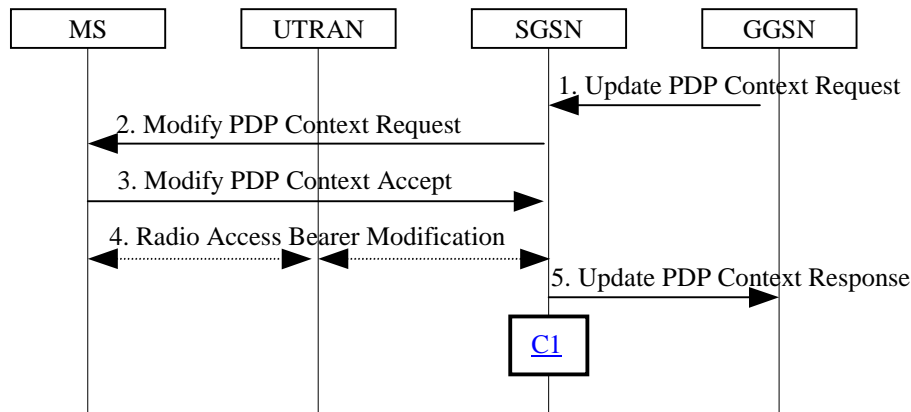


Figure 25: GGSN-Initiated PDP Context Modification Procedure

- 1) The GGSN sends an Update PDP Context Request (TID, PDP Address, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile. PDP Address is optional.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, the current QoS profile, and the subscribed QoS profile. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, NSAPI, PDP Address, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. PDP Address is optional.
- 3) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 4) For UMTS, the radio access bearer modification procedure may be executed.
- 5) Upon receipt of the Modify PDP Context Accept message, or upon completion of the RAB modification procedure, the SGSN returns an Update PDP Context Response (TID, QoS Negotiated) message to the GGSN. If the SGSN receives a Deactivate PDP Context Request message, it shall instead follow the PDP Context Deactivation Initiated by MS procedure.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Modify PDP Context

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in Figure 26. Each step is explained in the following list.

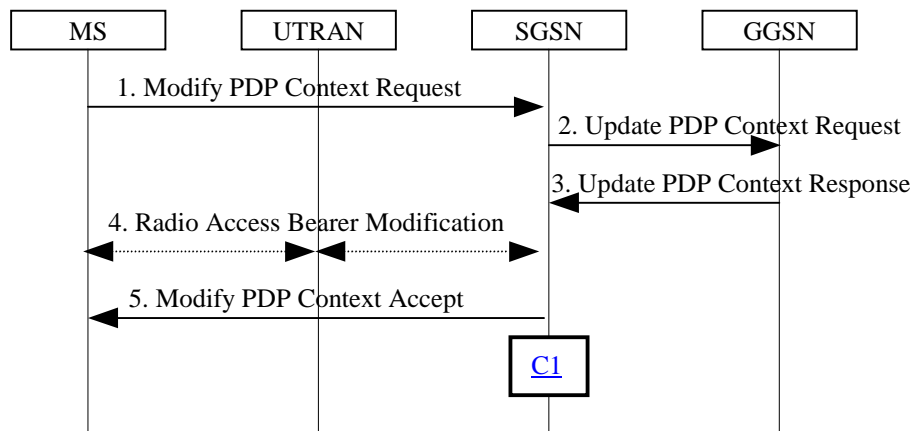


Figure 26: MS-Initiated PDP Context Modification Procedure

- 1) The MS sends a Modify PDP Context Request (TI, NSAPI, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, and the subscribed QoS profile. The SGSN sends an Update PDP Context Request (TID, QoS Negotiated) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.
- 3) The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TID, QoS Negotiated) message.
- 4) For UMTS, the radio access bearer modification procedure may be executed.
- 5) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns a Modify PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.

NOTE: If the SGSN does not accept QoS Requested, then steps 2 and 3 of this procedure are skipped, and the existing QoS Negotiated is returned to the MS in step 4.

[For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:](#)

[C1\) CAMEL GPRS Modify PDP Context](#)

9.2.4 Deactivation Procedures

9.2.4.1 PDP Context Deactivation Initiated by MS Procedure

The PDP Context Deactivation Initiated by MS procedure is illustrated in Figure 27. Each step is explained in the following list.

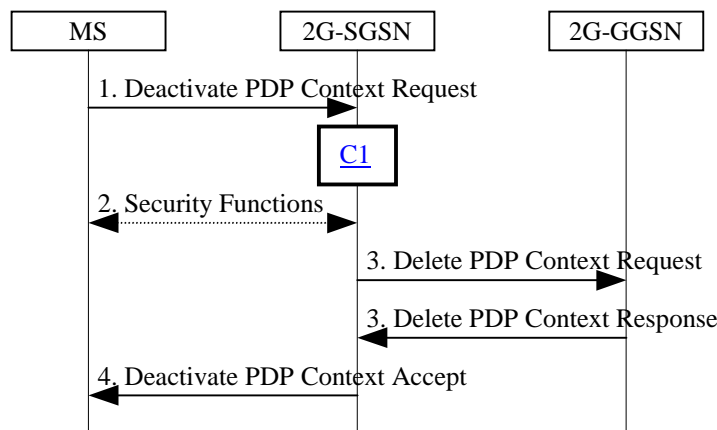


Figure 27: PDP Context Deactivation Initiated by MS Procedure for GPRS

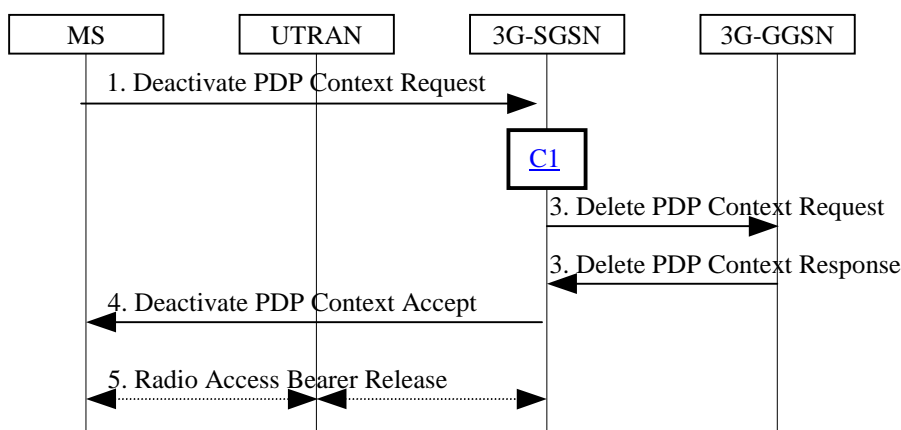


Figure 28: PDP Context Deactivation Initiated by MS Procedure for UMTS

- 1) The MS sends a Deactivate PDP Context Request (TI, NSAPI) message to the SGSN.
- 2) For GPRS security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) The SGSN sends a Delete PDP Context Request (TID, Teardown Ind) message to the GGSN. If NSAPI was not included by the MS in the Deactivate PDP Context Request message, then the SGSN deactivates all PDP contexts associated with this TI and PDP address by including Teardown Ind in the Delete PDP Context Request message. The GGSN removes the PDP context(s) and returns a Delete PDP Context Response (TID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network.
- 4) The SGSN returns a Deactivate PDP Context Accept (TI, NSAPI) message to the MS.
- 5) For UMTS, the radio access bearer release procedure is executed.

At GPRS detach, all PDP contexts for the MS are implicitly deactivated.

If the SGSN receives a Deactivate PDP Context Request (TI) message for a PDP context that is currently being activated, then the SGSN shall stop the PDP Context Activation procedure without responding to the MS, and continue with the PDP Context Deactivation initiated by MS procedure.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Deactivate PDP Context

9.2.4.2 PDP Context Deactivation Initiated by SGSN Procedure

The PDP Context Deactivation Initiated by SGSN procedure is illustrated in Figure 29. Each step is explained in the following list.

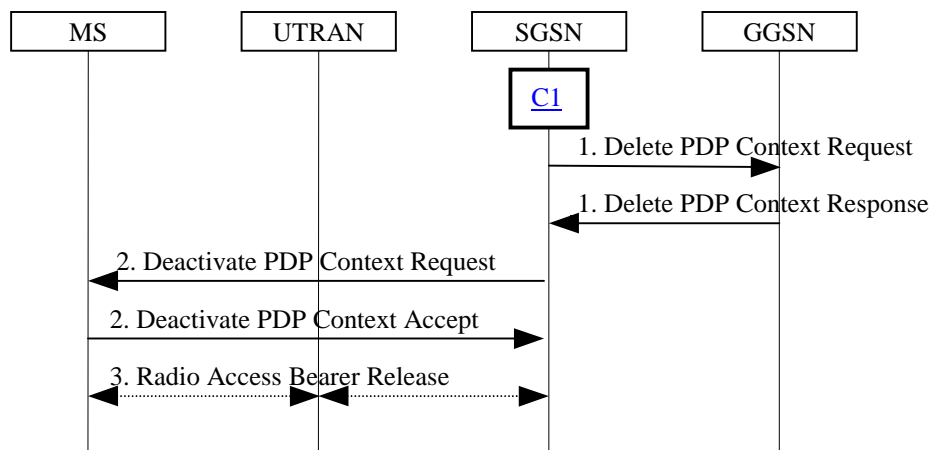


Figure 29: PDP Context Deactivation Initiated by SGSN Procedure

- 1) The SGSN sends a Delete PDP Context Request (TID, Teardown Ind) message to the GGSN. If Teardown Ind is included by the SGSN, then the GGSN deactivates all PDP contexts associated with this PDP address. The GGSN removes the PDP context and returns a Delete PDP Context Response (TID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the GGSN before sending the Deactivate PDP Context Request message.
- 2) The SGSN sends a Deactivate PDP Context Request (TI, NSAPI) message to the MS. If NSAPI is not included, then all PDP contexts associated with this TI and PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, NSAPI) message to the SGSN. NSAPI is included if received from the SGSN.
- 3) For UMTS, the radio access bearer release procedure is executed.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL GPRS Deactivate PDP Context

9.2.4.3 PDP Context Deactivation Initiated by GGSN Procedure

The PDP Context Deactivation Initiated by GGSN procedure is illustrated in Figure 30. Each step is explained in the following list.

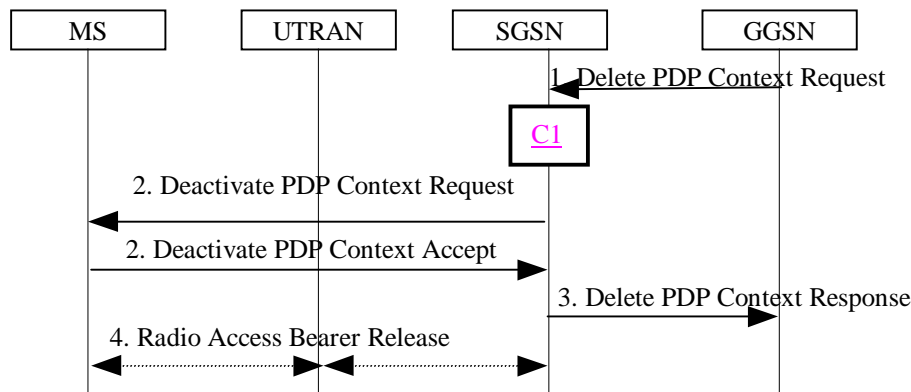


Figure 30: PDP Context Deactivation Initiated by GGSN Procedure

- 1) The GGSN sends a Delete PDP Context Request (TID, Teardown Ind) message to the SGSN. Teardown Ind indicates whether or not all PDP contexts associated with this PDP address shall be deactivated.
- 2) The SGSN sends a Deactivate PDP Context Request (TI, NSAPI) message to the MS. If NSAPI was not included by the SGSN, then all PDP contexts associated with this TI and PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, NSAPI) message to the SGSN. NSAPI is included if received from the SGSN.
- 3) The SGSN returns a Delete PDP Context Response (TID, Teardown Ind) message to the GGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the MS before sending the Delete PDP Context Response message.
- 3) For UMTS, the radio access bearer release procedure is executed.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedure in UMTS 23.078:

C1) CAMEL_GPRS_Deactivate_PDP_Context

13 Information Storage

This clause describes information storage structures required for the packet domain, and the recovery and restoration procedures needed to maintain service if inconsistencies in databases occur and at lost or invalid database information.

13.1 HLR

IMSI is the prime key to the packet domain subscription data stored in the HLR. There may be several sets of packet domain subscription data per IMSI. This is illustrated in Figure 31.

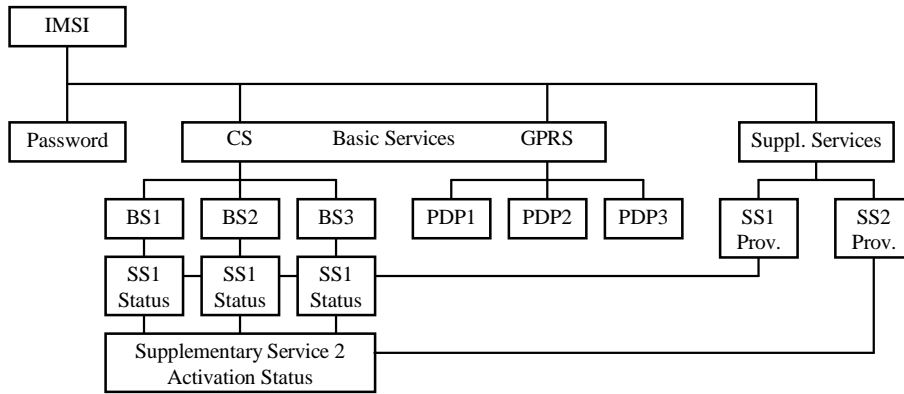


Figure 31: Packet Domain Subscription Data

As Figure 31 indicates, the packet domain subscription data is at the same level as basic services. Each PDP subscription is seen as a basic service. Supplementary services are provisioned as part of the overall subscription. Activation of SSs is either at the basic service level (SS1) or at the overall subscription level (SS2).

Table 1 shows the packet domain subscription data contained in the HLR.

Table 1: HLR Packet Domain Subscription Data

Field	Description	GPRS	UMTS
IMSI	IMSI is the main reference key.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
SGSN Number	The SS7 number of the SGSN currently serving this MS.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
MS PS Purged for	Indicates that the MM and PDP contexts of the MS are deleted from the SGSN.	X	X
MNRG	Indicates that the MS is not reachable through an SGSN, and that the MS is marked as not reachable at the SGSN and possibly at the GGSN.	X	X
GGSN-list	The GSN number and optional IP address pair related to the GGSN that shall be contacted when activity from the MS is detected and MNRG is set. The GSN number shall be either the number of the GGSN or the protocol-converting GSN as described in the subclauses "MAP-based GGSN - HLR Signalling" and "GTP and MAP-based GGSN - HLR Signalling".	X	X
Each IMSI contains zero or more of the following PDP context subscription records:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address. This field shall be empty if dynamic addressing is allowed.	X	X
Access Point Name	A label according to DNS naming conventions describing the access point to the external packet data network.	X	X
QoS Profile Subscribed	The quality of service profile subscribed. QoS Profile Subscribed is the default level if a particular QoS profile is not requested.	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
<u>gprs-CS!</u>	<u>Specifies optional GPRS CAMEL Subscription Information. See UMTS 23.016</u>	<u>X</u>	<u>X</u>

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 2 shows the context fields for one MS.

Table 2: SGSN MM and PDP Contexts

Field	Description	GPRS	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
Routing Area	Current routing area.	X	X
Cell Identity	Current cell in READY state, last known cell in STANDBY or IDLE state.	X	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	Specifies optional GPRS CAMEL Subscription Information. See UMTS 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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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
TFT [FFS]	Traffic flow template.	X	X
Radio Priority	The RLC/MAC radio priority level for uplink user data	X	

	transmission.		
Packet Flow Id	Packet flow identifier.	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	
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. **Error! Reference source not found.** shows the context fields for one MS.

13.8.2 SGSN Failure

When an SGSN fails, it deletes all MM and PDP contexts affected by the failure. SGSN storage of subscriber data is volatile. Based on configuration data, the SGSN shall send a Reset message to each of its associated VLRs. The VLRs shall mark all associations containing the restarted SGSN as unreliable. See UMTS 23.007.

[In the case of optional CAMEL interaction the failing SGSN shall invoke the CAMEL_GPRS_exception_procedure towards SCFs.](#)

If data or signalling, except GPRS attach and RA update, is received in an SGSN from an MS for which no MM context exists in the SGSN, then the SGSN shall discard the data or signalling.

If an RA update request is received in an SGSN from an MS for which no MM context exists neither in the SGSN, nor in the old SGSN for the inter-SGSN RA update case, then the SGSN shall reject the RA update with an appropriate cause. In order to remain PS-attached, the MS shall then perform a new PS attach and should (re-)activate PDP contexts.

If a service request is received in a 3G-SGSN from an MS for which no MM context exists in the 3G-SGSN, then the 3G-SGSN shall reject the service request with an appropriate cause. In order to remain PS-attached, the MS shall then perform a new PS attach and should (re-)activate PDP contexts.

NOTE: In some cases, user interaction may be required, and then the MS cannot (re-)activate the PDP contexts automatically.

When the SGSN receives a GTP PDU for which no PDP context exists it discards the GTP PDU and sends an error indication to the originating GGSN. The GGSN marks the related PDP context as invalid. If there is no MM context for the MS, the SGSN may search the MS by paging with the IMSI in the SGSN area. An MS that is paged for PS services with IMSI as the identifier shall perform a new PS attach and should (re-)activate PDP contexts.

When the SGSN receives a mobile-terminated SM from the SMS-GMSC for an IMSI unknown in the SGSN, it rejects the request.

When the SGSN receives a paging request over the Gs interface for an IMSI unknown in the SGSN and the SGSN has not completed recovery, then the SGSN may page the MS for packet services with IMSI as identifier in the area specified by the location information provided by the MSC/VLR. If no such location information is provided, then the SGSN may page the MS in the routing areas corresponding to that MSC/VLR. After the MS performs a combined PS attach, the SGSN may continue serving the Gs interface paging request.

16 Interactions with Other GSM Services

This clause describes the interaction between GPRS and the following other GSM services:

- point-to-point Short Message Service (SMS);
 - circuit-switched services; and
 - supplementary services.
- CAMEL services.

16.1.2 Mobile-originated SMS Transfer

Figure 32 and the description below explain the steps involved in sending a SM from an MS over a GPRS radio channel.

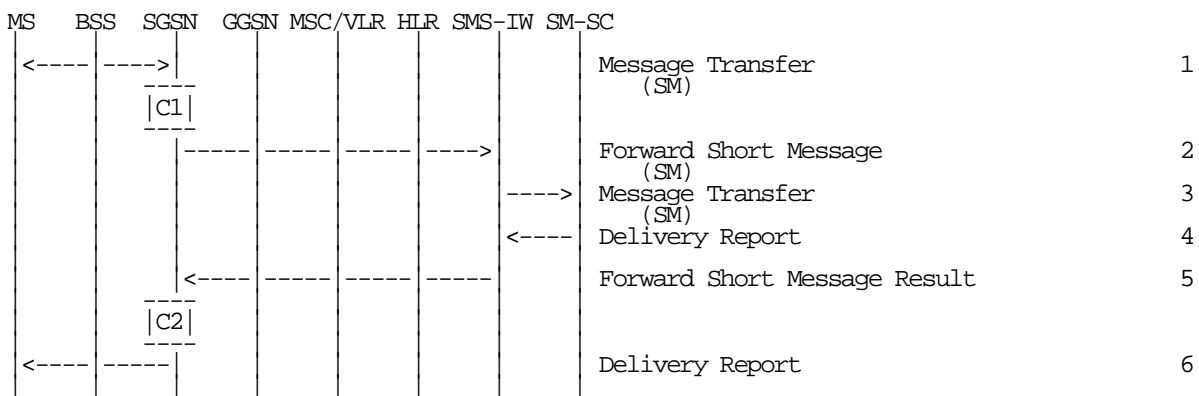


Figure 32: MO SMS Transfer, Successful

- 1) The MS has a SM to send, and transfers the SM to the SGSN via RP, CP, and LLC.
- 2) SGSN checks the MS subscription data, and determines that the MS is allowed to originate the SMS. SGSN forwards the SM to a SMS interworking MSC (SMS-IWMSC).
- 3) SMS-IWMSC passes the SM to the addressed SM-SC.
- 4) SM-SC returns a Delivery Report to the SMS-IWMSC indicating successful delivery of the SM.
- 5) SMS-IWMSC returns a Forward Short Message Result message to the SGSN indicating successful delivery of the SM.
- 6) SGSN returns a Delivery Report to the MS indicating successful delivery of the SM.

For a MS with gprs-CSI defined, CAMEL interaction may be performed. See referenced procedures in UMTS 23.078:

C1) CAMEL GPRS SMS MO Request

C2) CAMEL GPRS SMS MO Result

16.3 Supplementary Services

No supplementary services are defined for the packet domain. Supplementary services may be available in the interworked-with networks (e.g., the X.25 Call Redirection user facility), but this is outside the scope of this specification.

16.4 CAMEL Services

CAMEL may be used for session and cost control. It may also be used for other Operator Specific Services.

Annex A (normative): APN and GGSN Selection

This annex contains the rules applied upon PDP context activation to determine the APN and the corresponding GGSN.

History

Document history		
V3.0.0	August 1999	Approved at TSGN #4. Under TSG CN Change Control.
DRAFT-1 V3.1.0	September 1999	For use at the 5-7 October 1999 23.060 drafting session in Helsinki.
DRAFT-2 V3.1.0	October 1999	Developed during the 5-7 October 1999 23.060 drafting session in Helsinki.
V3.1.0	October 1999	incorporation of all the CRs approved by SA2 and SA#5.

5.6.3.8.2 GTP and MAP-based GGSN - HLR Signalling

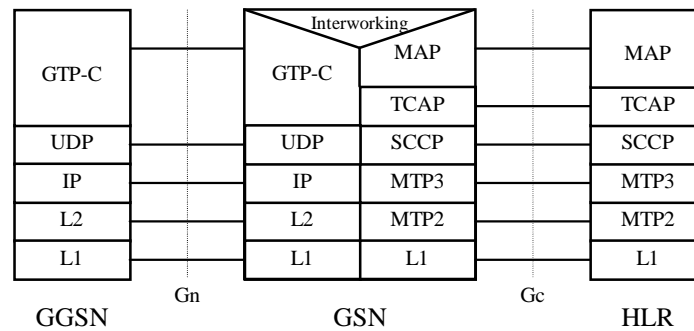


Figure 1: Control Plane GGSN - HLR Using GTP and MAP

Legend:

- GPRS Tunnelling Protocol for the control plane (GTP-C): This protocol tunnels signalling messages between the GGSN and the protocol-converting GSN in the backbone network.
- Interworking: This function provides interworking between GTP and MAP for GGSN - HLR signalling.

5.7 Functionality needed for Mobile IP [using IPv4](#)

To support [the optional](#) Mobile IP services [\[54\]](#) efficiently in [GPRS and UMTS the packet domain](#), Foreign Agent (FA) functionality needs to be provided. This functionality will be located in the GGSN. The interface between the GGSN and FA, including the mapping between the [care of-IP address](#) and the [local address GTP tunnel](#) in the [visited network-PLMN i.e. the TID \(GPRS Tunnel ID\)](#), is assumed not be standardized as the GGSN/FA is considered being one integrated node.

Mobile IP services needs a Home Agent (HA). The HA is a router which tunnels datagrams to [an FAMSs. The FA detunnels the datagram and sends it towards the UE](#) that are in a [PLMN visiting network](#). The HA maintains current location information for each of the departed [usersMSs](#). The [location of the HA is not specified by 3GPP may or may not be within the UMTS operator's network](#).

The FA and HA functionality is specified by IETF, [\[RFC2002\]](#). [however, as a UMTS/GPRS release is finalized, the specific IETF standards that should be taken into account may be specified by 3GPP/ETSI for easier interoperability between operators.](#)

6 Mobility Management Functionality

6.1 Definition of Mobility Management States

The Mobility Management (MM) activities related to a subscriber are characterised by one of three different MM states. The MM states for a GPRS subscriber are IDLE, STANDBY, and READY, and the MM states for a UMTS subscriber are PMM-DETACHED, PMM-IDLE, and PMM-CONNECTED. Each state describes a certain level of functionality and information allocated. The information sets held at the MS and the SGSN are denoted MM context.

In the non-anonymous access case, the MM state relates only to GPRS MM activities of a subscriber. The MM state is independent of the number and state of PDP contexts for that subscriber.

In the anonymous access case, the MM state relates to GPRS MM activities of an MS represented only by an Auxiliary TLLI.

6.5.1 GPRS Attach Function

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, then the MS makes IMSI attach as already defined in GSM. An IMSI-attached MS in class-A mode of operation engaged in a CS connection shall use the (non-combined) GPRS Attach procedure when it performs a GPRS attach.

In the attach procedure, the MS shall provide its identity and an indication of which type of attach that is to be executed. The identity provided to the network shall be the MS's Packet TMSI (P-TMSI) or IMSI. P-TMSI and the RAI associated with the P-TMSI shall be provided if the MS has a valid P-TMSI. If the MS does not have a valid P-TMSI, then the MS shall provide its IMSI. The different types of attach are GPRS attach and combined GPRS / IMSI 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 subclause "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 subclause "Paging Co-ordination"), then an MS that is both GPRS-attached and IMSI-attached 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) Routing 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 1. Each step is explained in the following list.

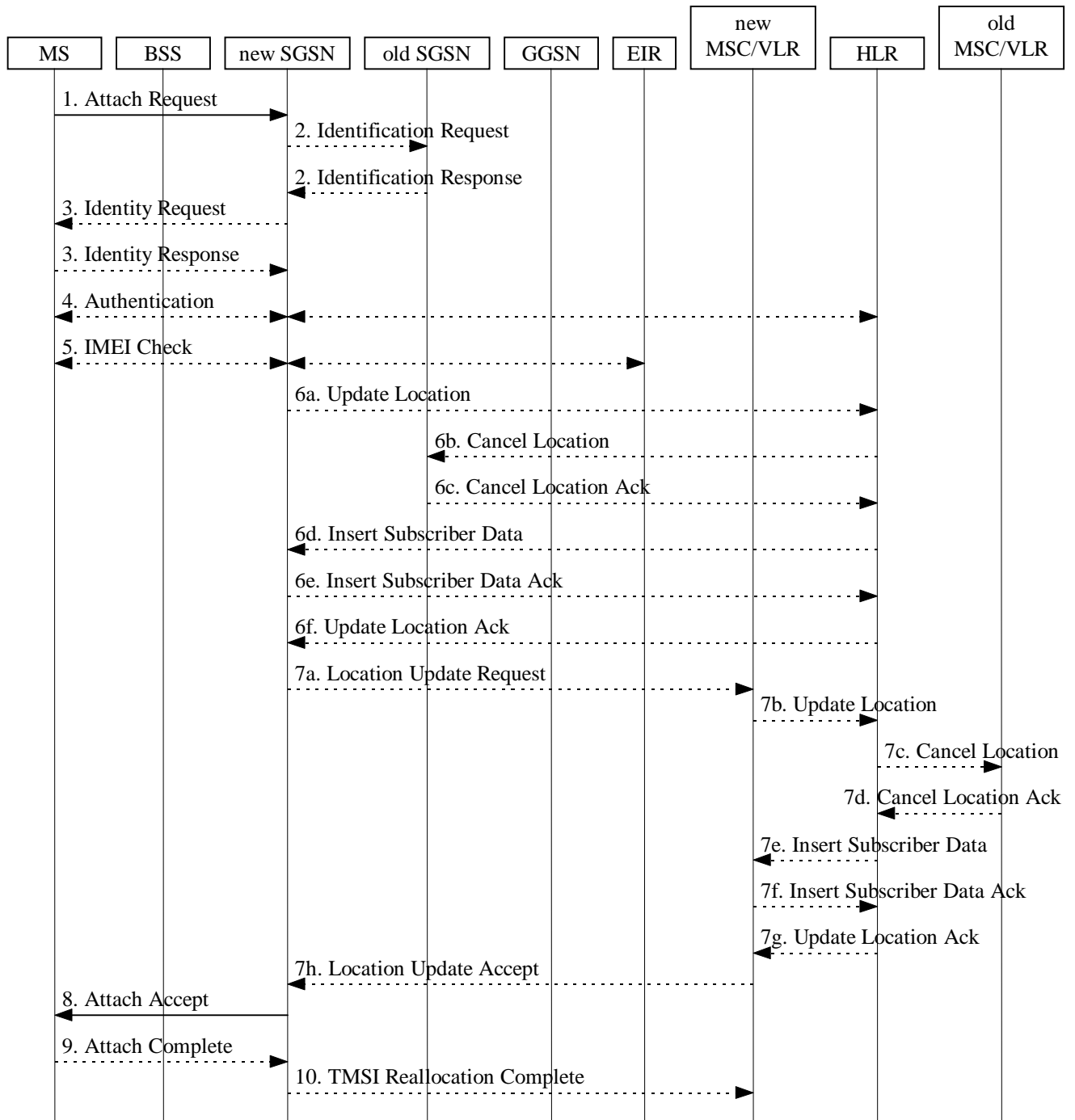


Figure 1: Combined GPRS / IMSI Attach Procedure

- 1) 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 that 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.
- 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. The old SGSN responds with Identification Response (IMSI, Authentication Triplets). 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 subclause "Security Function". If no MM context for the MS exists anywhere in the network, then authentication is mandatory. Ciphering procedures are described in subclause "Security Function". If P-TMSI allocation is going to be done, and if ciphering is supported by the network, ciphering mode shall be set.
- 5) The equipment checking functions are defined in the subclause "Identity Check Procedures". Equipment checking is optional.
- 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 HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new SGSN.
 - 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.
 - 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.
- 7) If Attach Type in step 1 indicated GPRS Attach while already IMSI attached, or combined GPRS / IMSI attach, then the VLR shall be updated if the Gs interface is installed. The VLR number is derived from the RA information. 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 6 d). 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, GSM 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.

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

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

6.5.2 UMTS PS Attach Function

[It is an outstanding task to merge this subclause with "GPRS Attach Function".]

A PS-attached MS makes a CS attach via the SGSN with the combined RA / LA update procedure if the network operates in mode I. In network operates in mode II, or if the MS is not PS-attached, then the MS makes a normal CS attach. A CS-attached MS engaged in a CS connection shall use the (non-combined) PS Attach procedure when it performs a PS attach.

In the attach procedure, the MS shall provide its identity and an indication of which type of attach that is to be executed. The identity provided to the network shall be the MS's Packet TMSI (P-TMSI) or IMSI. P-TMSI and the RAI associated with the P-TMSI shall be provided if the MS has a valid P-TMSI. If the MS does not have a valid P-TMSI, then the MS shall provide its IMSI. The different types of attach are PS attach and combined PS / CS attach.

After having executed the PS attach, the MS is in the PMM-CONNECTED state and MM contexts are established in the MS and the SGSN. The MS may then activate PDP contexts as described in subclause "Activation Procedures".

An CS-attached MS that cannot operate in CS/PS mode of operation shall follow the normal CS detach procedure before it makes a PS attach. A PS-attached MS that cannot operate in CS/PS mode of operation shall perform a PS detach before it makes a CS attach.

The Combined PS / CS Attach procedure is illustrated in Figure 1. Each step is explained in the following list.

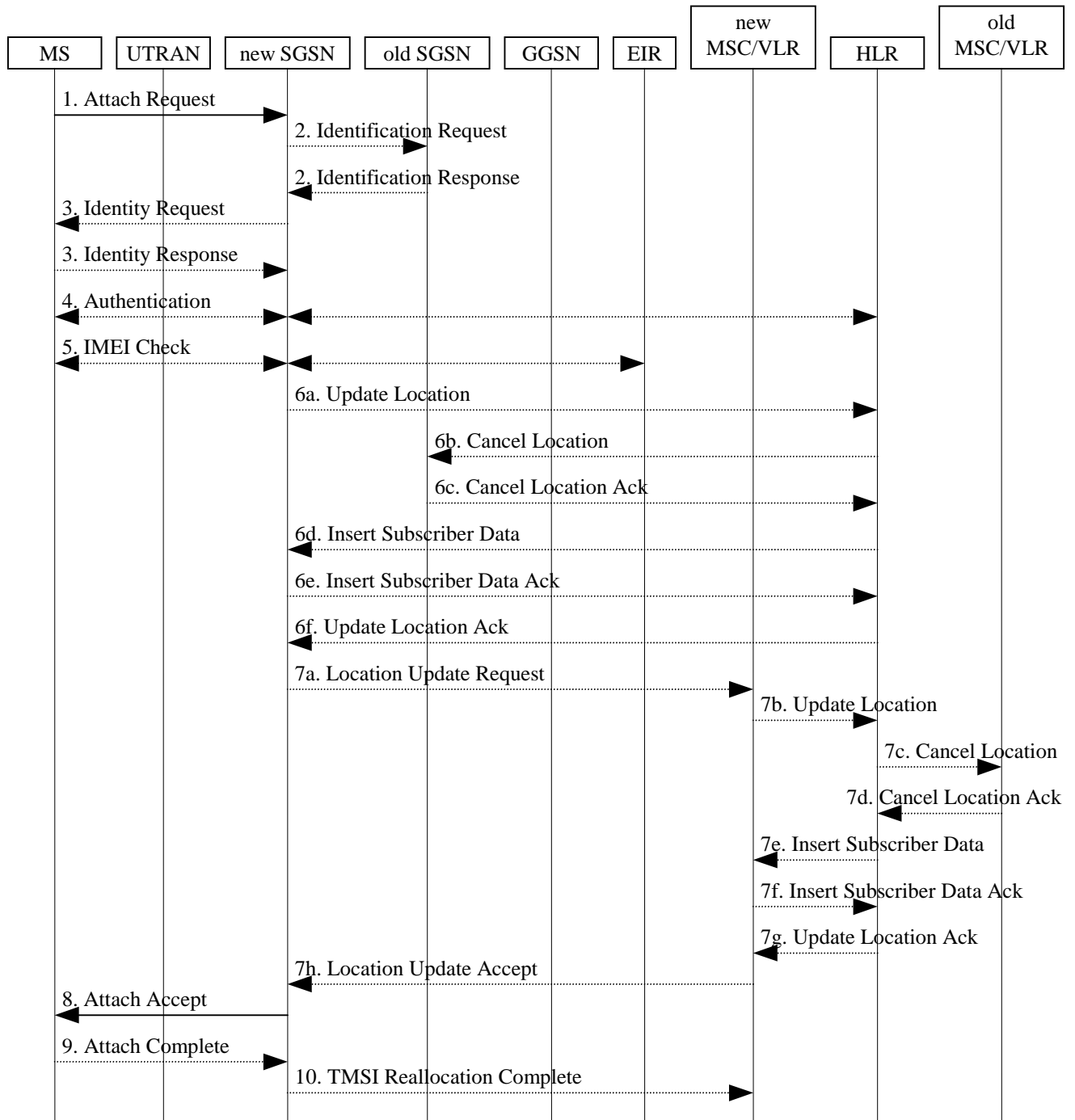


Figure 2: Combined PS / CS Attach Procedure

- 1) 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) 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 describe in subclause "Core Network Classmark". Follow on request shall be set by MS if there is pending uplink traffic (signaling 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 PS Attach procedure. Attach Type indicates which type of attach that is to be performed, i.e., PS attach only, PS Attach while already CS attached, or combined PS / CS attach.

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. The old SGSN responds with Identification Response (IMSI, Authentication vector). 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 subclause "Security Function". If no MM context for the MS exists anywhere in the network, then authentication is mandatory. Ciphering procedures are described in subclause "Security Function". If P-TMSI allocation is going to be done, and if ciphering is supported by the network, ciphering mode shall be set.
- 5) The equipment checking functions are defined in the subclause "Identity Check Procedures". Equipment checking is optional.
- 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 HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new SGSN.
 - 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.
 - 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.
- 7) If Attach Type in step 1 indicated PS Attach while already CS attached, or combined PS / CS attach, then the VLR shall be updated if the Gs interface is installed. The VLR number is derived from the RA information. 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 6 d). 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 CS attach if Attach Type indicated combined PS / CS 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, GSM 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.
- 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.

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

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

6.9.1.2.1 Intra SGSN Routeing Area Update

The Intra SGSN Routeing Area Update procedure is illustrated in Figure 3. Each step is explained in the following list.

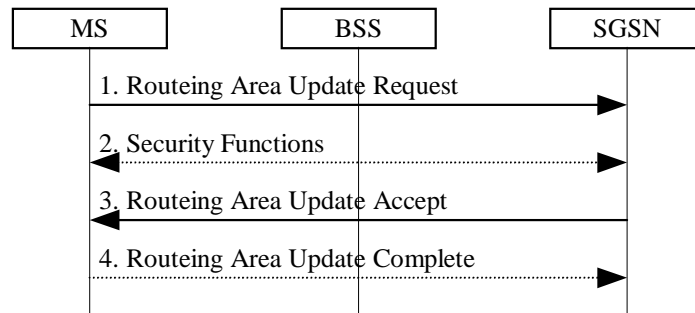


Figure 3: Intra SGSN Routeing Area Update Procedure

- 1) The MS sends a Routeing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type) to the SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN, see GSM 08.18.
- 2) Security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) The 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, or if subscription checking fails, then the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the SGSN updates the MM context for the MS. A new P-TMSI may be allocated. A Routeing Area Update Accept (P-TMSI, P-TMSI Signature) is returned to the MS.
- 4) If P-TMSI was reallocated, the MS acknowledges the new P-TMSI ~~with~~ by returning a Routeing Area Update Complete (P-TMSI) message to the SGSN.

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 IDLE state.

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 4. Each step is explained in the following list.

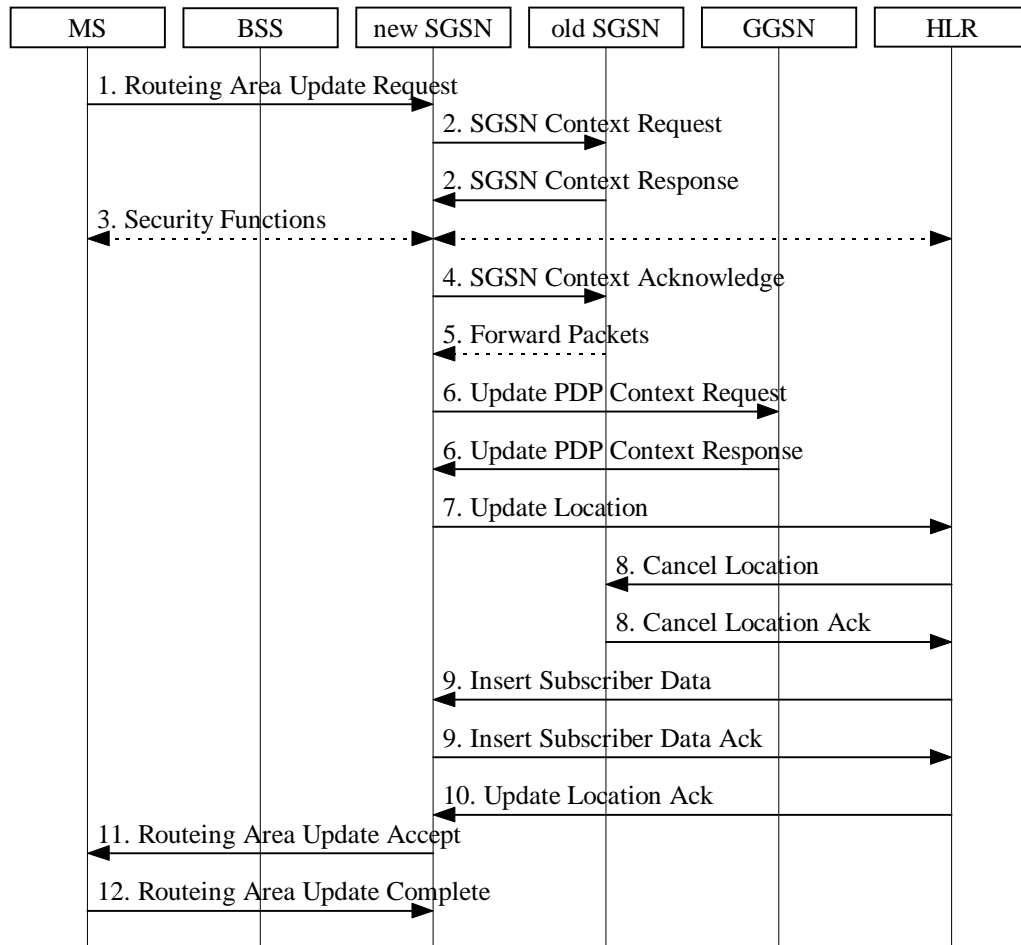


Figure 4: Inter SGSN Routeing Area Update Procedure

- 1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the new SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.
- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) 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 (old RAI, TLLI, MS Validated, New SGSN Address) 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 stops assigning SMDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, 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. The old SGSN starts a timer and stops the transmission of N-PDUs to the MS.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.

- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new 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. If the security functions do not authenticate the MS correctly, then 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) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SMDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return Update PDP Context Response (TID).
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) 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, then the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are 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).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS 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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) 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 SGSN, or if subscription checking fails, then the new SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the new SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 12) The MS acknowledges the new P-TMSI ~~with~~ by returning a Routeing Area Update Complete (~~P-TMSI, Receive N-PDU Number~~) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, then these N-PDUs shall be discarded by the new SGSN. LLC and SMDCP in the MS are reset.

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 SGSN is unable to update the PDP context in one or more GGSNs, then the 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 timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, then the old SGSN shall stop forwarding N-PDUs to the new SGSN.

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 IDLE state.

6.9.1.3 Combined RA / LA Update Procedure

A combined RA / LA update takes place in network operation mode I when the MS enters a new RA or when a GPRS-attached MS performs IMSI attach. The MS sends a Routing Area Update Request indicating that an LA update may also need to be performed, in which case the SGSN forwards the LA update to the VLR. This concerns only idle mode (see GSM 03.22), as no combined RA / LA updates are performed during a CS connection.

6.9.1.3.1 Combined Intra SGSN RA / LA Update

The Combined RA / LA Update (intra SGSN) procedure is illustrated in Figure 5. Each step is explained in the following list.

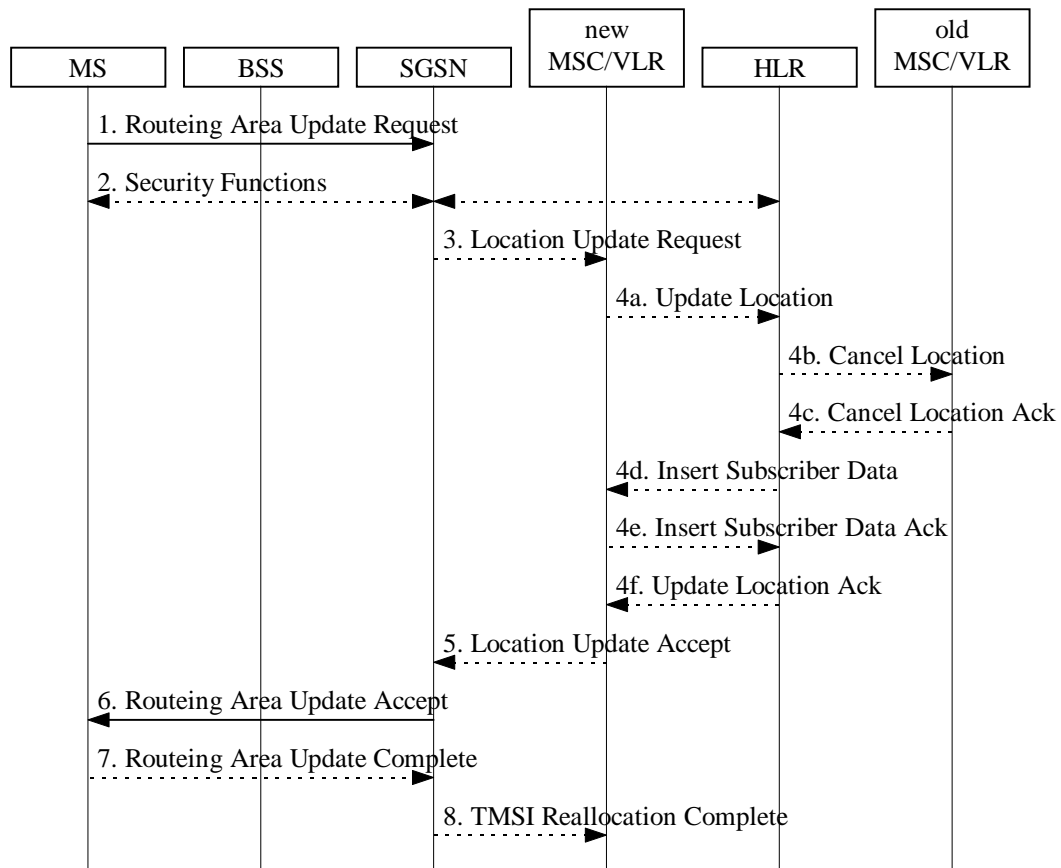


Figure 5: Combined RA / LA Update in the Case of Intra SGSN RA Update Procedure

- 1) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.
- 2) Security functions may be executed. This procedure is defined in subclause "Security Function".
- 3) 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 routing area update, then the 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 via a table in the SGSN. The VLR creates or updates the association with the SGSN by storing SGSN Number.
- 4) If the subscriber data in the VLR is marked as not confirmed by the HLR, then the new VLR informs the HLR. The HLR cancels the data in 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.
- 5) The new VLR allocates a new VLR TMSI and responds with Location Update Accept (VLR TMSI) to the SGSN. VLR TMSI is optional if the VLR has not changed.
 - 6) The 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, or if subscription checking fails, then the SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the SGSN updates the MM context for the MS. A new P-TMSI may be allocated. The SGSN responds to the MS with Routing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).
 - 7) If a new P-TMSI or VLR TMSI was received, then the MS confirms the reallocation of the TMSIs by ~~sending~~returning a Routing Area Update Complete (~~P-TMSI, VLR TMSI~~) message to the SGSN.
 - 8) The SGSN sends a TMSI Reallocation Complete (~~VLR TMSI~~) message to the VLR if the VLR TMSI is confirmed by the MS.

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter IDLE state.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful Location Update is performed.

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter SGSN) procedure is illustrated in Figure 6. Each step is explained in the following list.

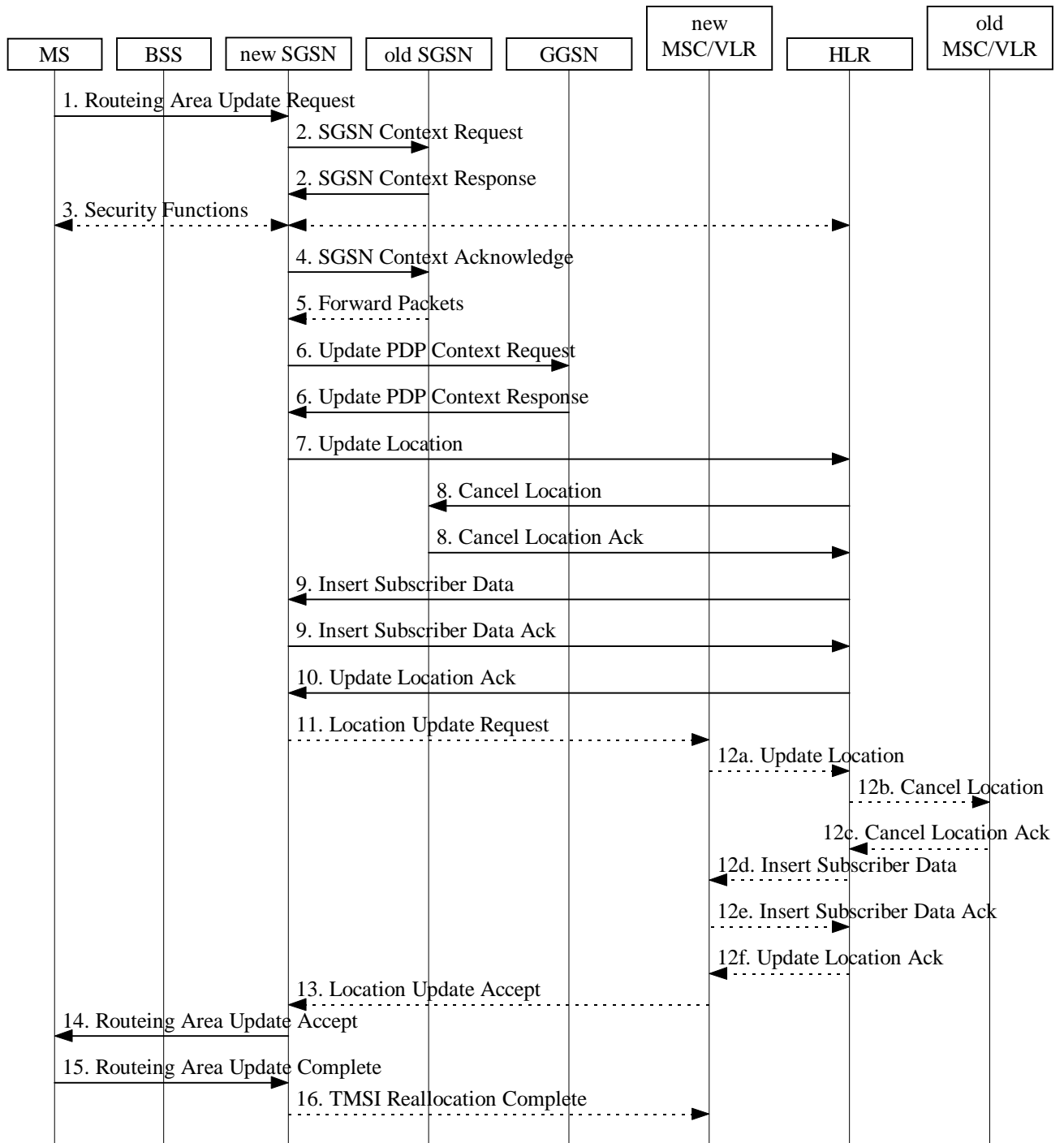


Figure 6: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

- 1) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type) to the new SGSN. Update Type shall indicate combined RA / LA update, or, if the MS wants to perform an IMSI attach, combined RA / LA update with IMSI attach requested. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN.

- 2) The new SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) 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 (old RAI, TLLI, MS Validated, New SGSN Address) 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 stops assigning SMDCP N-PDU numbers to downlink N-PDUs received, and responds with SGSN Context Response (MM Context, PDP Contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN stores New SGSN Address until the old MM context is cancelled, to allow the old SGSN to forward data packets to the new SGSN. Each PDP Context includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS, 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. The old SGSN starts a timer and stops the downlink transfer.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". Ciphering mode shall be set if ciphering is supported.
- 4) The new SGSN sends an SGSN Context Acknowledge message to the old SGSN. This informs the old SGSN that the new 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. If the security functions do not authenticate the MS correctly, then 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) The old SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new SGSN. Additional N-PDUs received from the GGSN before the timer described in step 2 expires are also duplicated and tunnelled to the new SGSN. N-PDUs that were already sent to the MS in acknowledged mode and that are not yet acknowledged by the MS are tunnelled together with the SMDCP N-PDU number. No N-PDUs shall be forwarded to the new SGSN after expiry of the timer described in step 2.
- 6) The new SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (TID).
- 7) The new SGSN informs the HLR of the change of SGSN by sending Update Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 8) 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, then the old SGSN removes the MM and PDP contexts. Otherwise, the contexts are removed only when the timer expires. This allows the old SGSN to complete the forwarding of N-PDUs. It also ensures that the MM and PDP contexts are 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).
- 9) The HLR sends Insert Subscriber Data (IMSI, GPRS 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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 10) The HLR acknowledges the Update Location by sending Update Location Ack (IMSI) to the new SGSN.
- 11) 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, then 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 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 9). The VLR creates or updates the association with the SGSN by storing SGSN Number.

- 12) 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.
- 13) 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.
- 14) 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 SGSN, or if subscription checking fails, then the SGSN rejects the routeing area update with an appropriate cause. If all checks are successful then the new SGSN establishes MM and PDP contexts for the MS. A logical link is established between the new SGSN and the MS. The new SGSN responds to the MS with Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 15) The MS confirms the reallocation of the TMSIs by ~~sending~~returning a Routeing Area Update Complete (~~P-TMSI, VLR TMSI, Receive N-PDU Number~~) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. If Receive N-PDU Number confirms reception of N-PDUs that were forwarded from the old SGSN, then these N-PDUs shall be discarded by the new SGSN. LLC and SNDCP in the MS are reset.
- 16) The new SGSN sends a TMSI Reallocation Complete (~~VLR TMSI~~) message to the new VLR if the VLR TMSI is confirmed by the MS.

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 SGSN is unable to update the PDP context in one or more GGSNs, then the 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 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 IDLE state.

If the timer described in step 2 expires and no Cancel Location (IMSI) was received from the HLR, then the old SGSN shall stop forwarding N-PDUs to the new SGSN.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-GPRS services until a successful location update is performed.

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. 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, then an MS that is both PS-attached and CS-attached shall perform the Combined RA / LA Update procedures.

In UMTS, a RA Update is either intra-SGSN or inter-SGSN RA Update, either combined RA/LA update or only RA update, either initiated by an MS in PMM-CONNECTED or in PMM-IDLE state. All the RA Update cases are contained in the procedure illustrated in Figure 7. Each step is explained in the following list.

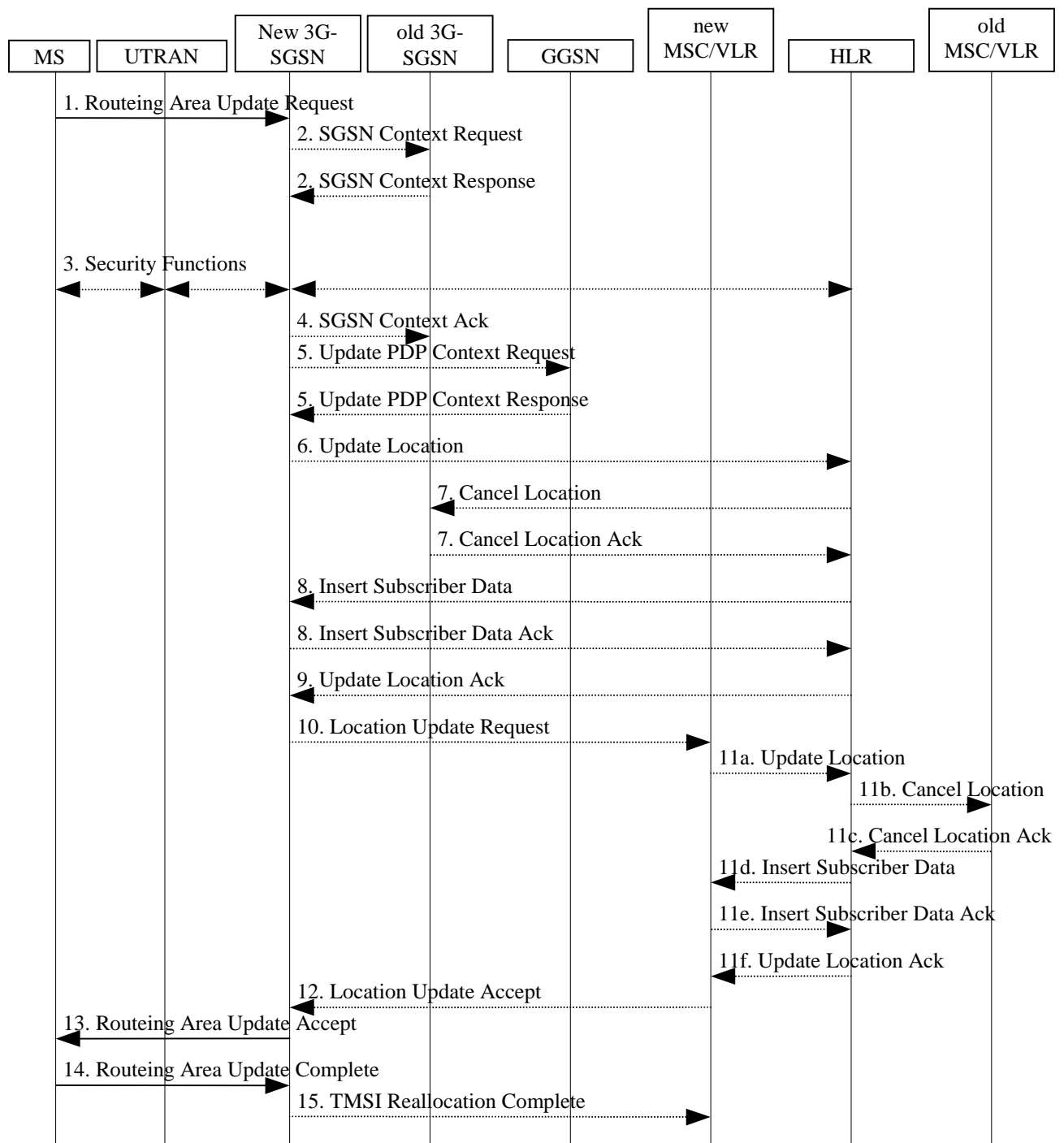


Figure 7: UMTS RA Update Procedure

- 1) The RRC connection is established, if not already done. The MS sends a Routing Area Update message (P-TMSI, old RAI, old P-TMSI Signature, Update Type, follow on request) to the new SGSN. Follow on request shall be set by MS if there is pending uplink traffic (signaling 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 CS 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 CS attach requested if the MS wants to perform an CS attach in network operation mode I.

The UTRAN shall add the Routing Area Identity including the RAC and LAC of the cell where the message was received before passing the message to the SGSN. (FFS)

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 Routing area update and if the MS was in PMM-IDLE state, the new SGSN sends SGSN Context Request message (old PTMSI, 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 responds with SGSN Context Response (Cause, IMSI, MM Context, PDP contexts). If the MS is not known in the old SGSN, the old SGSN responds with an appropriate error cause. The old SGSN starts a timer.
- 3) Security functions may be executed. These procedures are defined in subclause "Security Function". If the security functions do not authenticate the MS correctly, then 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.
- 4) If the RA Update is an Inter-SGSN Routing 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.
- 5) If the RA Update is an Inter-SGSN RA Update and if the MS was in PMM-IDLE state, the new SGSN sends Update PDP Context Request (new SGSN Address, QoS Negotiated, SGSN Tunnel Endpoint Identifier, GGSN Tunnel Endpoint Identifier) to the GGSNs concerned. GGSN Tunnel Endpoint Identifier is used by GGSN to identify the PDP context. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier). Note: If the RA Update is an Inter-SGSN Routing area update initiated by an MS is in PMM-CONNECTED state, the update PDP Context Request is sent as described in subclause "SRNC relocation".
- 6) 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.
- 7) 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, then 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).
- 8) If the RA Update is an Inter-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 then the SGSN constructs an MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 9) 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.
- 10) If Update Type indicates combined RA / LA update with CS attach requested, or if the LA changed with the routeing area update, then 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 CS attach if Update Type in step 1 indicated combined RA / LA update with CS 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.

- 11) 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.
- 12) 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.
- 13) 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 SGSN, or if subscription checking fails, then the SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new SGSN establishes MM context for the MS. The new SGSN responds to the MS with Routing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).
- 14) The MS confirms the reallocation of the TMSIs by ~~sending~~returning a Routing Area Update Complete (~~P-TMSI, VLR TMSI~~)message to the SGSN.
- 15) The new SGSN sends a TMSI Reallocation Complete (~~VLR TMSI~~)message to the new VLR if the VLR TMSI is confirmed by the MS.

NOTE: Steps 11, 12, and 15, are performed only if step 9 is performed.

In the case of a rejected routing 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 routing area update to that RA. The RAI value shall be deleted when the MS is powered up.

If the routing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.

If the Location Update Accept message indicates a reject, then this should be indicated to the MS, and the MS shall not access non-PS services until a successful location update is performed.

6.13.1 Intersystem Handover within an RA between Cells in Different Systems

Inter-system handover without performing a RA update is supported only in case the SGSN is a combined 2G/3G-SGSN supporting both the Gb and Iu PS interfaces within the same physical node.

6.13.1.1 UMTS to GPRS Handover

An Inter System handover from UMTS to GPRS takes place when the MS in PMM-CONNECTED state enters a new GSM/GPRS cell inside the current RA. In this case the MS shall perform a Routing Area Update procedure with the Update Type set to 'Inter System Cell Change'.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Gb interface to the new cell.

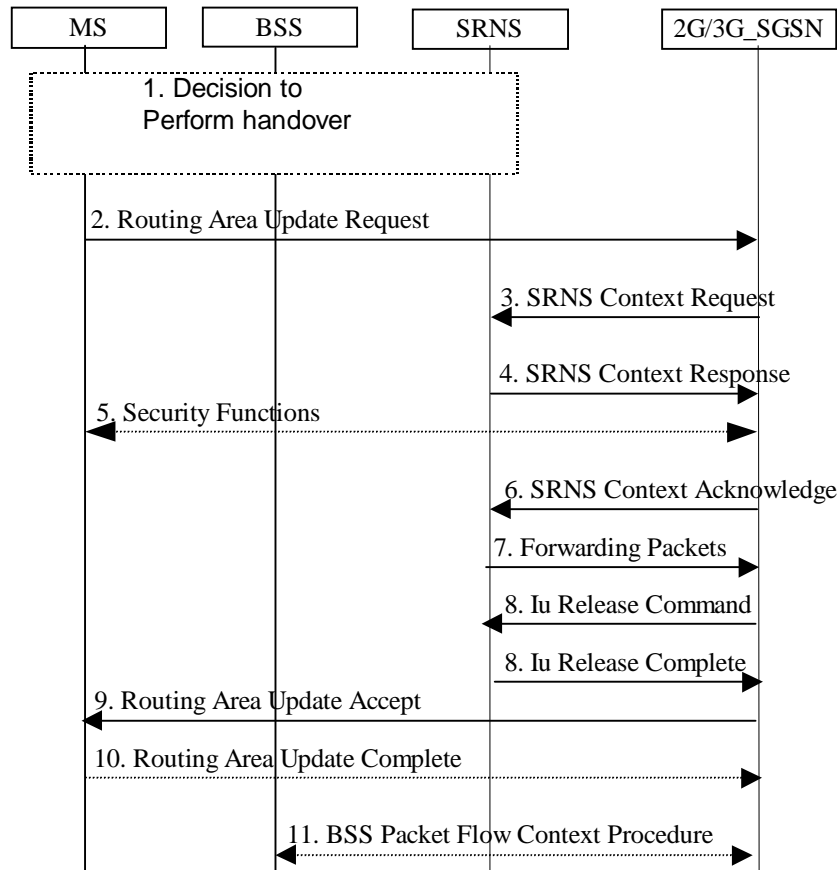


Figure 8: UMTS to GPRS Handover Between Cells in same RA

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting GPRS radio technology and suspends PDU transmission to the network
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the 2G/3G-SGSN. Update Type shall indicate 'Inter system cell change'. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the 2G/3G-SGSN.
- 3) The 2G/3G-SGSN sends SRNS Context Request (IMSI) to the SRNS, starts a timer on the MM and PDP Context and stops the transmission of GTP PDUs to the SRNS.
- 4) The SRNS responds with SRNS Context Response (IMSI, GTP SNDs, GTP SNUs, RLC counters). The GTP sequence numbers are included for each PDP context indicating the next downlink PDU to be sent to the MS (i.e. the last GTP PDU in the buffer of the SRNS, which is not sent to the MS) and the next GTP PDU to be tunnelled to the GGSN. For each active PDP context the SRNS also includes the uplink and downlink RLC counters for PDP contexts using acknowledged mode.
- 5) Security functions may be executed.
- 6) The 2G/3G-SGSN sends SRNS Context Acknowledge to the SRNS. This informs the SRNS that the 2G/3G-SGSN is ready to receive data packets.
- 7) The buffered downlink GTP PDUs are tunnelled back to the 2G/3G-SGSN.
- 8) When the timer described under 3 has expired, the 2G/3G-SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 9) The 2G/3G-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, then the 2G/3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the 2G/3G-SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number) is returned to the MS. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-

originated N-PDUs successfully transferred before the start of the update procedure. The 2G/3G-SGSN deduces the N-PDU Numbers from the RLC numbers received from the SRNS (FFS).

10) The MS acknowledges the new P-TMSI ~~with~~ by returning a Routing Area Update Complete (~~P-TMSI, Receive N-PDU Number~~) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.

11) The 2G/3G-SGSN and the BSS may execute the BSS Packet Flow Context Procedure.

6.13.1.2 GPRS to UMTS Handover

An Inter System handover from GPRS to UMTS takes place when a PS-attached MS enters a new UMTS cell inside the current RA. In this case the MS shall perform a UMTS Inter System Cell Change procedure by performing a RRC connection establishment and an Intra SGSN Routing Area Update procedure with the Update Type set to 'Inter System Cell Change'.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Iu interface to the new cell.

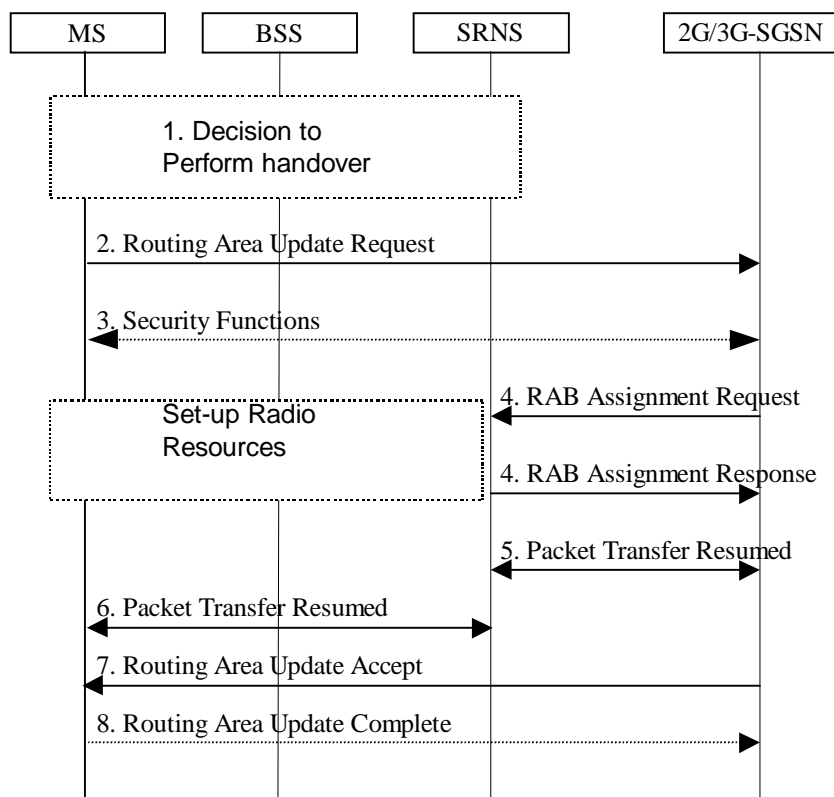


Figure 9: GPRS to UMTS Handover Between Cells in same RA

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology and Suspend PDU Transmission to the Network.
- 2) The MS initiate a RRC connection establishment and sends Routing Area Update Request (Old RA, Old P-TMSI Signature, Update Type, CM) to the combined 2G/3G-SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 2G/3G-SGSN. The 2G/3G-SGSN stops the transmission of N-PDUs to the MS.
- 3) Security functions may be executed.
- 4) The 2G/3G-SGSN request the SRNS to establish of a radio access bearer by sending RAB Assignment Request to the SRNS. The SRNS responds with RAB Assignment Response.
- 5) The traffic flow is resumed between the 2G/3G-SGSN and the SRNS
- 6) The traffic flow is resumed between the SRNS and the MS.

- 7) The 2G/3G-SGSN updates the MM context for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number (FFS)) is returned to the MS.
- 8) The MS acknowledges the new P-TMSI ~~with~~ by returning a Routing Area Update Complete (~~P-TMSI, Receive N-PDU Number (FFS))~~ message to the SGSN.

6.13.2 Intersystem Handover at RA Change

6.13.2.1 UMTS to GPRS Handover

An inter system handover from UMTS to GPRS takes place when the MS in PMM-IDLE or PMM-CONNECTED state moves to a new GSM/GPRS cell in a new RA. In this case the MS shall initiate a GPRS RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

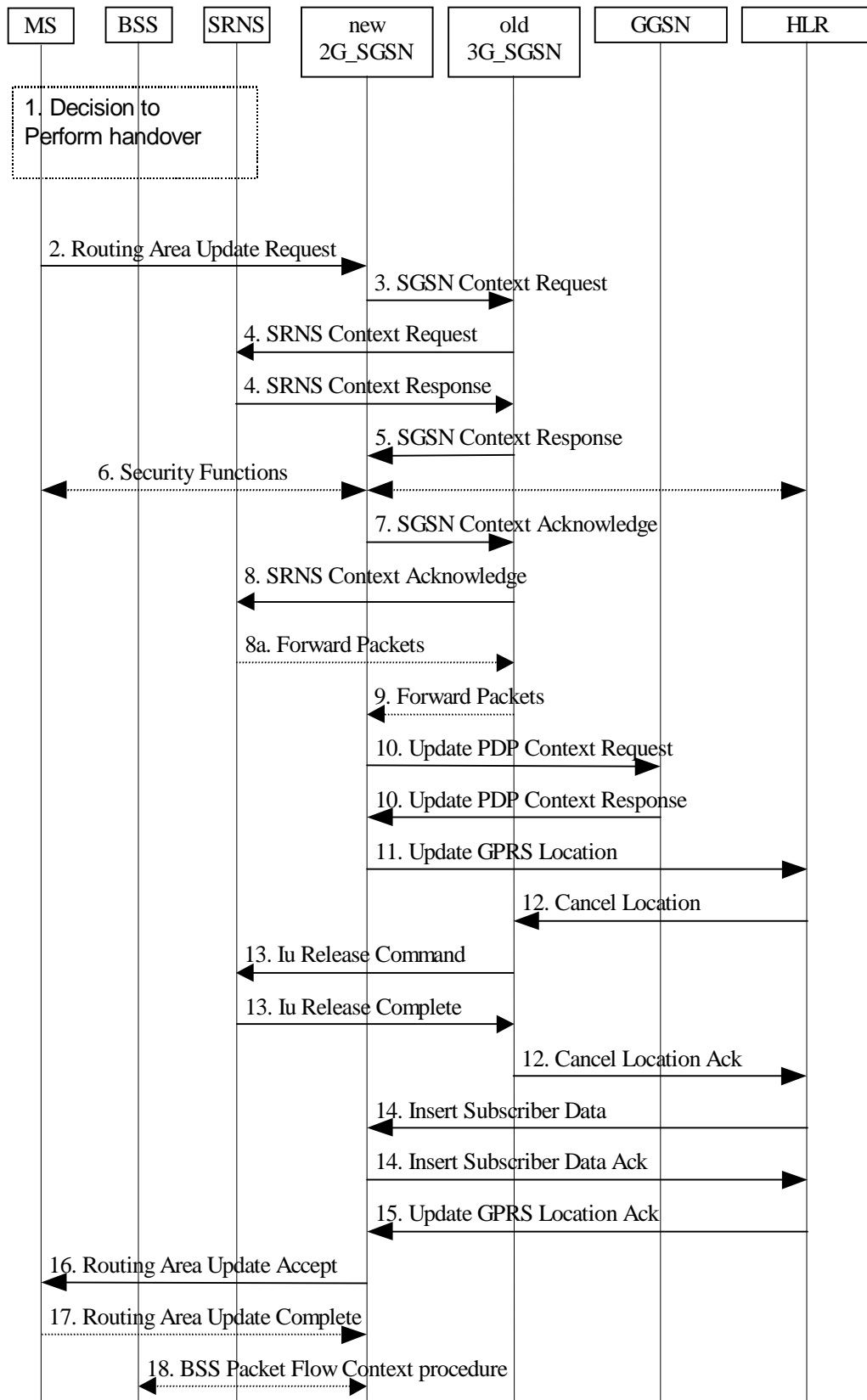


Figure 10: UMTS to GPRS Inter SGSN Routing Area Update Procedure

- 1) The MS and/or BSS/UTRAN decides to perform handover, which leads to that the MS switch to the new cell supporting GPRS radio technology and that the PDU transmission is suspended.
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the new 2G-SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the new 2G-SGSN.

- 3) The new 2G-SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old 3G-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 3G-SGSN. The old 3G-SGSN starts a timer for supervision of the MS's context. If the MS is not known in the old 3G-SGSN, the old 3G-SGSN responds with an appropriate error cause.
- 4) The old 3G-SGSN sends SRNS Context Request (IMSI) to the SRNS. Upon reception of this message the SRNS buffers and stops sending downlink PDUs to the MS and answers with SRNS Context Response (IMSI, GTP SNDs, GTP SNU, RLC counters). The SRNS shall include for each PDP context the GTP sequence number of the next GTP sequence number to be sent in downlink to the MS (i.e. the last not yet transferred N-PDU) and the GTP sequence number of the next uplink PDU to be tunnelled to the GGSN. For each active PDP context the SRNS also includes the uplink and downlink RLC transmission counters for PDP contexts using acknowledged mode (FFS).
- 5) The old 3G-SGSN responds with SGSN Context Response (MM Context, e.g. IMSI, PDP Contexts, e.g. APN). For each PDP context the old 3G-SGSN shall include the GTP sequence number for the next uplink GTP-U PDU to be tunnelled to the GGSN and the next downlink GTP sequence number for the next N-PDU to be sent to the MS. Each PDP Context also includes the SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS. The SMDCP N-PDU numbers are derived from the RLC counters received from the SRNS (FFS).
- 6) Security functions may be executed.
- 7) The new 2G-SGSN sends an SGSN Context Acknowledge message to the old 3G-SGSN. This informs the old 3G-SGSN that the new 2G-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 RA update procedure back to the old SGSN before completing the ongoing RA update procedure.
- 8) The old 3G-SGSN sends SRNS Context Acknowledge (IMSI) to the SRNS.
- 8a) The SRNS shall start duplicating and tunnelling the buffered GTP-U PDUs to the old 3G-SGSN.
- 9) The old 3G-SGSN tunnels the GTP-U PDUs to the new 2G-SGSN. No SMDCP sequence numbers shall be included in the GTP header of the tunnelled PDUs.
- 10) The new 2G-SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSN(s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TID).
- 11) The new 2G-SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 12) The HLR sends Cancel Location (IMSI) to the old 3G-SGSN. The old 3G-SGSN acknowledges with Cancel Location Ack (IMSI). The old 3G-SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. When the timer is running the MM and PDP contexts are removed when the timer expires.
- 13) When the timer described in step 3 expires the old 3G-SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 14) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 2G-SGSN. The 2G-SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 15) The HLR acknowledges the Update Location by sending Update GPRS Location Ack (IMSI) to the new 2G-SGSN.
- 16) The new 2G-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 2G-SGSN, or if subscription checking fails, then the new 2G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 2G-SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 2G-SGSN and the MS. The new 2G-SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI Signature Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.

17) The MS acknowledges the new P-TMSI ~~with~~ by returning a Routing Area Update Complete (P-TMSI-Receive N-PDU Number) message to the SGSN. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.

18) The 2G-SGSN and the BSS may execute the BSS Packet Flow Context Procedure

The sequence applied for the intra SGSN RA update case is identical to the cell change case within the same RA as shown in subclause "Intersystem Handover within an RA between Cells in Different Systems" used with a different update type.

6.13.2.2 GPRS to UMTS Handover

An intersystem handover from GPRS to UMTS takes place when the PS-attached MS moves to a new UMTS cell of a new RA. In this case the MS shall initiate a UMTS RA update procedure by establishing a RRC connection and initiating the RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

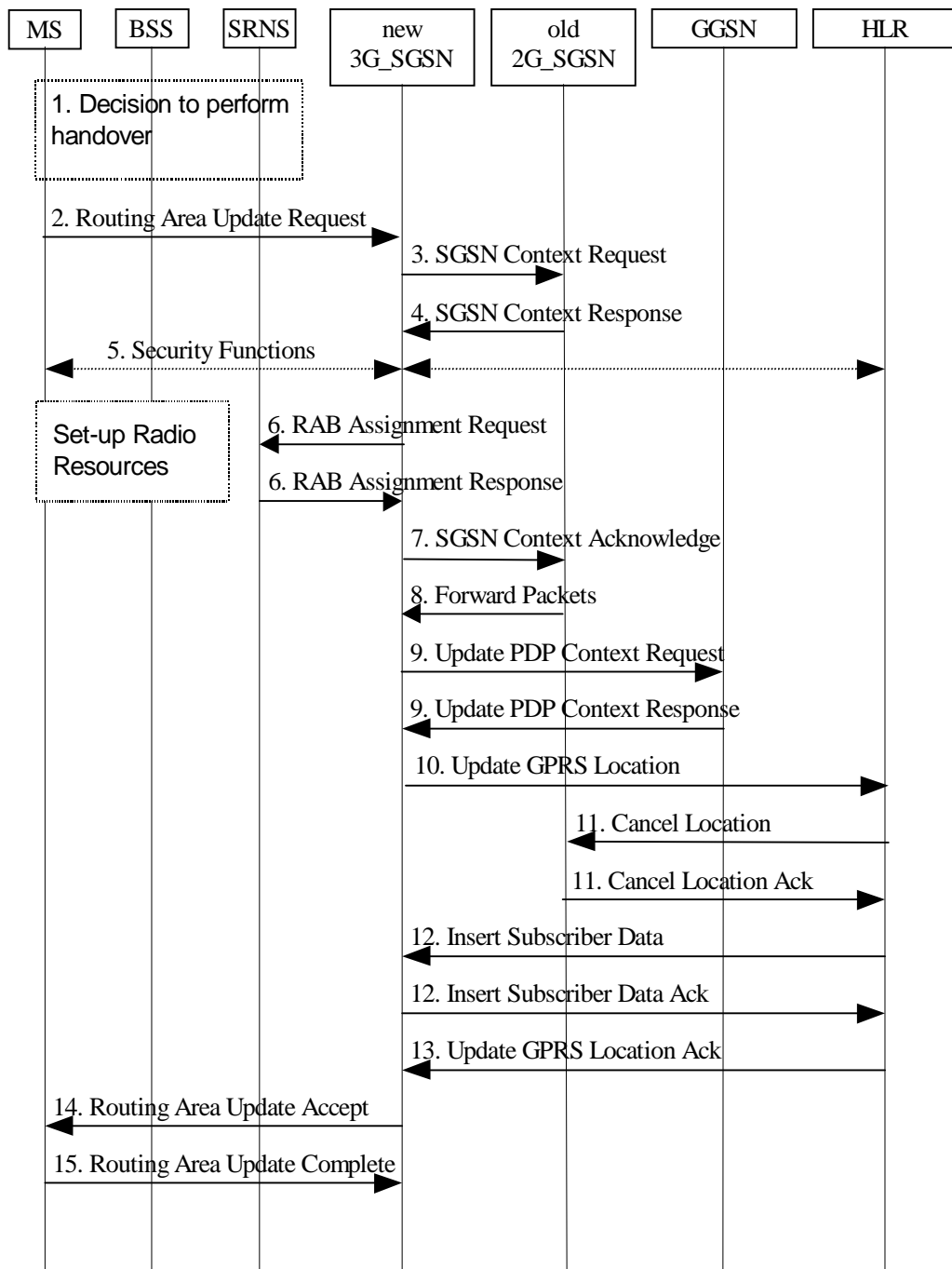


Figure 11: GPRS to UMTS Inter SGSN Routing Area Update Procedure

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update Type, CM) to the new 3G-SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 3G-SGSN.
- 3) The new 3G-SGSN sends SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) to the old 2G-SGSN to get the MM and PDP contexts for the MS (The old RAI received from the MS is used to derive the old 2G-SGSN address). The old 2G-SGSN starts a timer for supervision of the MS's context and stops the transmission of N-PDUs to the MS.
- 4) The old 2G-SGSN responds with SGSN Context Response (MM Context, e.g. IMSI, PDP Contexts, e.g. APN). 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 SMDCP Send N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the SMDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS. The new 3G-SGSN shall use the GTP sequence numbers for in-sequence delivery over the Iu interface.
The new 3G-SGSN uses the received SMDCP N-PDU sequence number for reliable data transmission (FRS).
- 5) Security functions may be executed.
- 6) The new 3G-SGSN request the SRNS to establish of a radio access bearer by sending RAB Assignment Request to the SRNS. The SRNS responds with RAB Assignment Response.
- 7) The new 3G-SGSN sends a 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 routing area update procedure back to the old SGSN before completing the ongoing routing area update procedure.
- 8) The old 2G-SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new 3G-SGSN. The 3G-SGSN shall ignore any SMDCP sequence numbers received with the tunnelled N-PDUs 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. No N-PDUs shall be forwarded to the new 3G-SGSN after expiry of the timer described in step 3.
- 9) The new 3G-SGSN sends a Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSN (s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TID).
- 10) The new 3G-SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 11) The HLR sends Cancel Location (IMSI, Cancellation Type) 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. When the timer is running the MM and PDP contexts are removed when the timer expires. The old 2G-SGSN acknowledges with Cancel Location Ack (IMSI).
- 12) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 3G-SGSN. The 3G-SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 13) The HLR acknowledges the Update GPRS Location by sending Update Location Ack (IMSI) to the new 3G-SGSN.
- 14) 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 3G-SGSN, or if subscription checking fails, then the new 3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 3G-SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 3G-SGSN and the MS. The new 3G-SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI signature Receive N-PDU Number (FRS)).
- 15) The MS acknowledges the new P-TMSI ~~with~~ by returning a Routing Area Update Complete (~~P-TMSI, Receive N-PDU Number (FRS))~~ message to the SGSN.

The sequence applied for the intra SGSN RA update case is identical to the cell change within the same RA case as shown in subclause "Intersystem Handover within an RA between Cells in Different Systems" used with a different update type.

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060 CR 053r3

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **SA#6**
list expected approval meeting # here
↑

for approval
for information

strategic
non-strategic (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: Motorola, Nokia **Date:** 30.11.1999

Subject: Releases 97, 98 and 99 interactions

Work item: Release '99 Stage 2

Category: F Correction
A Corresponds to a correction in an earlier release
B Addition of feature
C Functional modification of feature
D Editorial modification
(only one category shall be marked with an X)

Release: Phase 2
Release 96
Release 97
Release 98
Release 99
Release 00

Reason for change: The proposed CR describes the interaction between R97 and R99 elements. It is proposed that secondary PDP contexts are deactivated before a move to R97-98 SGSN. The reason are:

- An R97 SGSN is not prepared to receive 2 context with same APN and IP address. Internal R97 SGSN checks might have strange results, for example dropping primary and keeping secondary context (But the MS will be unable to modify TFT, and how GGSN is reacting?).
- Also, QoS profile needs to be converted from 3G to 2G, and after that the 2G SGSN is likely to downgrade QoS for these contexts so that primary and secondary are likely to end up anyway with QoS fairly different than what was expected. So keeping the secondary context may not be a real improvement for customer.
- the MS can notice from LLC reset that one context has been dropped.

The description of interworking between HLR and SGSN of different release is kept at high level, as exact description is N2 responsibility.

Clauses affected: 11

Other specs affected: Other 3G core specifications → List of CRs:
Other GSM core specifications → List of CRs:
MS test specifications → List of CRs:
BSS test specifications → List of CRs:
O&M specifications → List of CRs:

Other comments:

11 Compatibility Issues

Non-GPRS MSs in GSM PLMNs that support GPRS shall, without changes, be able to continue operation.

GSM PLMNs that do not support GPRS shall, without changes, be able to continue interworking with GSM PLMNs that do support GPRS.

A GPRS ME shall be able to access GPRS services with GPRS-aware SIMs, and with SIMs that are not GPRS-aware. A GPRS-aware SIM is able to store information in the elementary files EF_{KcGPRS} and $EF_{LOCIGPRS}$, as defined in GSM 11.11 [28].

The compatibility of SIMs and USIMs with GPRS MEs or UMTS MEs is defined in UMTS 22.102.

11.1 Interaction between Releases 97/98 and 99

NOTE: Unless specifically indicated, references to release 97 in this subclause refer to both release 97 and release 98.

11.1.1 Interactions between GTP v0 (R97) and GTP v1 (R99)

When a first GSN receives a GTP PDU from a second GSN using a version not supported, then the first GSN shall return a "version not supported" error message to the second GSN. The second GSN shall then fall back to the most-recent version supported by the first GSN. A GSN shall use its most-recent GTP version when initiating GTP PDU transmission to a new GSN.

When an SGSN that supports GTP v1 establishes a GTP tunnel to a GGSN that supports GTP v0, then the SGSN shall convert a release 99 QoS profile to a release 97 QoS profile before transmitting the QoS profile to the GGSN. If the MS supports the R99 QoS profile, then the SGSN shall convert the negotiated R97 QoS profile to an R99 QoS profile before transmitting the QoS profile to the MS.

When an inter SGSN RA update procedure is performed from a first SGSN that supports GTP v1 to a second SGSN that supports GTP v0, then the first SGSN shall convert the R99 QoS profile to an R97 QoS profile before sending the SGSN Context Response message. If several PDP contexts have been activated for the same APN and PDP address in the first SGSN (secondary PDP context activation), then all PDP contexts except the PDP context with the highest-quality QoS profile are deleted in the MS and in the first SGSN, and the first SGSN shall initiate deletion of these PDP contexts in the GGSN. 3G TS 23.107 specifies how to determine the highest-quality QoS profile. The second SGSN shall be responsible for updating the remaining PDP context in the GGSN, and the GGSN shall remove the TFT if present when it receives the GTP v0 Update PDP Context Request message.

NOTE: The conversion between an R99 QoS profile and an R97 QoS profile is defined in 3G TS 23.107.

When an inter SGSN RA update procedure is performed from a first SGSN that supports GTP v0 to a second SGSN that supports GTP v1, then the second SGSN shall convert the R97 QoS profile to an R99 QoS profile, and use GTP v1 to send the Update PDP Context Request message to the GGSN.

11.1.2 Interactions between MS R97 and CN R99

When an R97 MS activates a PDP context and both the SGSN and the GGSN support R99, then the QoS profile shall not be converted to R99.

11.1.3 Interactions between SM R97 and SM R99

The SM protocol shall be backward compatible.

11.1.4 Interactions between MAP R97 and MAP R99

The MAP protocol shall be backward compatible to allow interworking between HLRs and SGSNs that support different releases.

<h2 style="margin: 0;">CHANGE REQUEST</h2>		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.
23.060	CR 055 r1	Current Version: <input style="width: 100px;" type="text"/>
GSM (AA.BB) or 3G (AA.BBB) specification number ↑	↑ CR number as allocated by MCC support team	
For submission to: <input style="width: 100px;" type="text" value="SA#6"/> <small>list expected approval meeting # here ↑</small>	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	Strategic <input type="checkbox"/> non-strategic <input type="checkbox"/> <small>(for SMG use only)</small>

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: **Date:**

Subject:

Work item:

Category:	F Correction <input type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input checked="" type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: During the introduction of UMTS (3G), its radio coverage may be patchy resulting in pockets (such as in-building) where 3G coverage may not be available and the mobile must revert to 2G. The most significant impact will come from mobiles in "idle" mode (called STANDBY in GPRS), where no data is being transferred. Such mobiles will be forced to carry out RA updates whenever coverage is lost.

The use of a RA which is allowed to span both 2G and 3G systems can allow for a significant decrease in this RA update signalling load.

TDOC S2G99043 outlined procedures for inter-system handover between UMTS and GPRS cells belonging to the same RA. This document clarifies the behaviour of the MS and SGSN in PMM-IDLE / GPRS READY state for such a system.

Clauses affected:

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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Other comments: This idea was initially presented in the 3GPP Joint Meeting on GSM-UTRAN handover and SRNS relocation in August 99 in **Tdoc WHS-99012**.



<----- double-click here for help and instructions on how to create a CR.

6.13 UMTS-GPRS Intersystem Handover

The UMTS-GPRS inter system handover procedures may be supported for network elements supporting GSM Releases 97, 99 and UMTS Release 99. At intersystem handover the release 99 network elements shall use on the Gn interface the GTP version 97 when interworking with release 97 network elements.

[It appears the above forgets release 98]

An intersystem handover from UMTS to GPRS or GPRS to UMTS takes place when an MS supporting both UMTS and GPRS moves to a cell where the radio technology which the MS was using is not any longer supported. Prerequisite for an inter system handover is that the MS is PS-attached in the UMTS PS domain or PS-attached for GPRS. The transition of the mobility management states is as specified for the corresponding mobility management procedures.

There is no transition of the session management states at an intersystem handover.

6.13.1 Intersystem Handover within an RA between Cells in Different Systems

Inter-system handover without performing a RA update is supported only in case the SGSN is a combined 2G/3G-SGSN supporting both the Gb and Iu PS interfaces within the same physical node.

6.13.1.1 UMTS to GPRS Handover

An Inter System handover from UMTS to GPRS takes place when the MS in PMM-CONNECTED state enters a new GSM/GPRS cell inside the current RA. In this case the MS shall perform a Routing Area Update procedure with the Update Type set to 'Inter System Cell Change'.

When an MS in PMM-IDLE state enters a new GSM/GPRS cell inside the current RA, the MS shall follow the deferred RA update procedures.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Gb interface to the new cell.

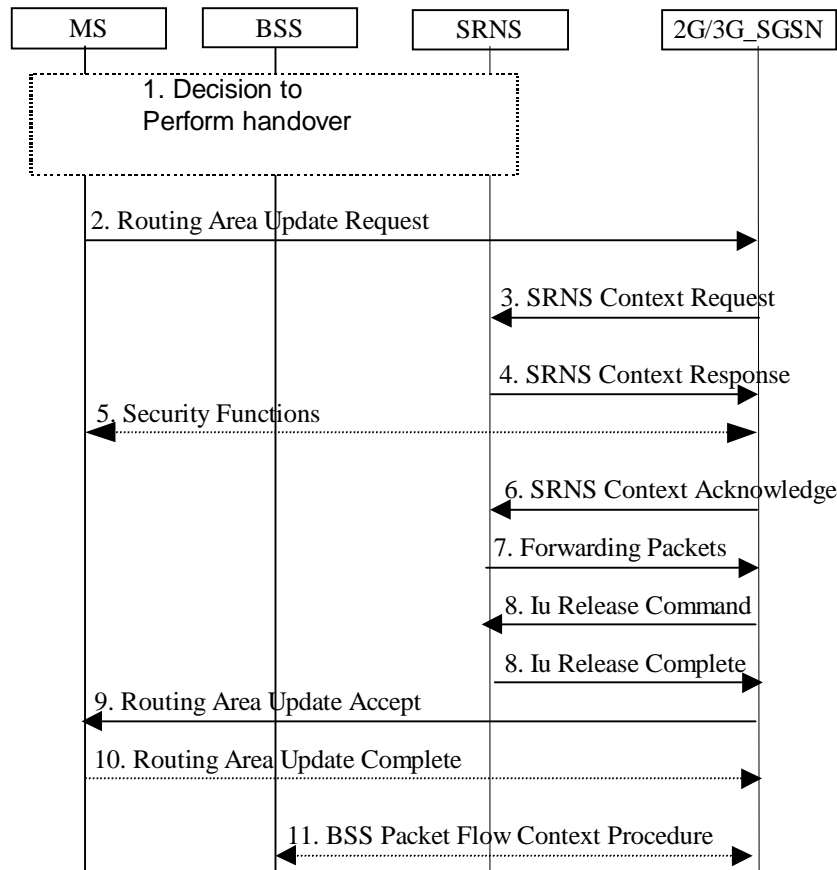


Figure 148: UMTS to GPRS Handover Between Cells in same RA

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting GPRS radio technology and suspends PDU transmission to the network.
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the 2G/3G-SGSN. Update Type shall indicate 'Inter system cell change'. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the 2G/3G-SGSN.
- 3) The 2G/3G-SGSN sends SRNS Context Request (IMSI) to the SRNS, starts a timer on the MM and PDP Context and stops the transmission of GTP PDUs to the SRNS.
- 4) The SRNS responds with SRNS Context Response (IMSI, GTP SNDs, GTP SNUs, RLC counters). The GTP sequence numbers are included for each PDP context indicating the next downlink PDU to be sent to the MS (i.e. the last GTP PDU in the buffer of the SRNS, which is not sent to the MS) and the next GTP PDU to be tunnelled to the GGSN. For each active PDP context the SRNS also includes the uplink and downlink RLC counters for PDP contexts using acknowledged mode.
- 5) Security functions may be executed.
- 6) The 2G/3G-SGSN sends SRNS Context Acknowledge to the SRNS. This informs the SRNS that the 2G/3G-SGSN is ready to receive data packets.
- 7) The buffered downlink GTP PDUs are tunnelled back to the 2G/3G-SGSN.
- 8) When the timer described under 3 has expired, the 2G/3G-SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 9) The 2G/3G-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, then the 2G/3G-SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the 2G/3G-SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number) is returned to the MS. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-

originated N-PDUs successfully transferred before the start of the update procedure. The 2G/3G-SGSN deduces the N-PDU Numbers from the RLC numbers received from the SRNS (FFS).

- 10) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.
- 11) The 2G/3G-SGSN and the BSS may execute the BSS Packet Flow Context Procedure.

6.13.1.2 GPRS to UMTS Handover

An Inter System handover from GPRS to UMTS takes place when a PS-attached MS in GPRS READY state enters a new UMTS cell inside the current RA. In this case the MS shall perform a UMTS Inter System Cell Change procedure by performing a RRC connection establishment and an Intra SGSN Routing Area Update procedure with the Update Type set to 'Inter System Cell Change'.

When an MS in GPRS STANDBY state enters a new UMTS cell inside the current RA, the MS shall follow the deferred RA update procedures.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Iu interface to the new cell.

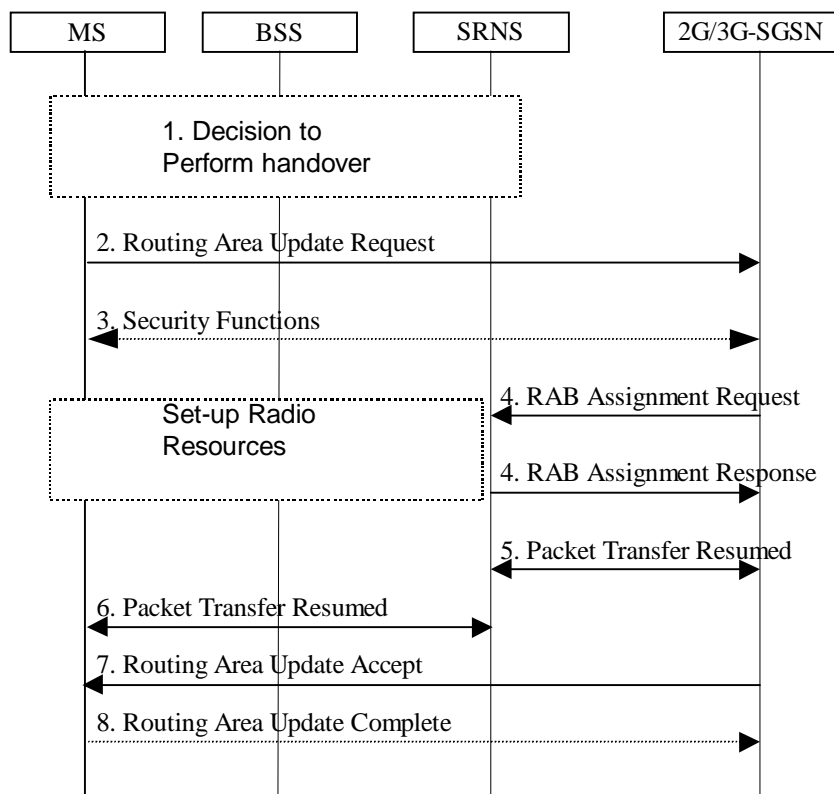


Figure 249: GPRS to UMTS Handover Between Cells in same RA

- 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology and Suspend PDU Transmission to the Network.
- 2) The MS initiate a RRC connection establishment and sends Routing Area Update Request (Old RA, Old P-TMSI Signature, Update Type, CM) to the combined 2G/3G-SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 2G/3G-SGSN. The 2G/3G-SGSN stops the transmission of N-PDUs to the MS.
- 3) Security functions may be executed.
- 4) The 2G/3G-SGSN request the SRNS to establish of a radio access bearer by sending RAB Assignment Request to the SRNS. The SRNS responds with RAB Assignment Response.

- 5) The traffic flow is resumed between the 2G/3G-SGSN and the SRNS
- 6) The traffic flow is resumed between the SRNS and the MS.
- 7) The 2G/3G-SGSN updates the MM context for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number (FFS)) is returned to the MS.
- 8) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI, Receive N-PDU Number (FFS)).

6.13.1.3 Deferred RA update

The MS shall follow the following procedures when in GPRS STANDBY / PMM-IDLE state.

Note that upon expiry of the periodic RA update timer, the MS shall carry out the periodic routing area update procedure as currently defined.

6.13.1.3.1 Uplink signalling / data transmission

In GPRS STANDBY / PMM-IDLE state the MS shall not perform a RA update procedure until up-link data or signalling information is to be sent from the MS.

- If the MS is in the same access network as when it last sent data / signalling, the procedures defined for that access system shall be followed. This shall be sending of an LLC PDU in a GPRS or for example a sending of a SERVICE REQUEST message in UMTS.
- If the MS is in a different access network as when it last sent data / signalling, the RA update procedure shall be performed before the sending of data / signalling.

6.13.1.3.2 Downlink signalling / data transmission

If the 2G/3G-SGSN receives data for an MS in GPRS STANDBY / PMM-IDLE, the SGSN shall page the RA where the MS is located. This may include both 2G and 3G cells.

- If the MS receives this page in the same access network as when it last sent data / signalling, the procedures defined for that access system shall be followed. This shall be sending of an LLC PDU in a GPRS or for example a sending of a SERVICE REQUEST message in UMTS.
- If the MS receives this page in a different access network as when it last sent data / signalling, the RA update procedure shall be performed. The 2G/3G-SGSN shall accept this RAU as a valid response.

<h2 style="margin: 0;">CHANGE REQUEST</h2>		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.
23.060	CR 059r1	Current Version: 3.1.0
GSM (AA.BB) or 3G (AA.BBB) specification number ↑	↑ CR number as allocated by MCC support team	
For submission to: TSG#6 <small>list expected approval meeting # here ↑</small>	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	strategic <input type="checkbox"/> non-strategic <input checked="" type="checkbox"/> <small>(for SMG use only)</small>

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: Ericsson **Date:** 1999-11-30

Subject: UMTS <-> GPRS Intersystem change (handover)

Work item: UMTS R99

Category:	F Correction <input type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input checked="" type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category Shall be marked With an X)

Reason for change: This CR changes the name for 'UMTS <-> GPRS intersystem handover' to 'UMTS <-> GPRS intersystem change' and proposes other small editorial changes. RLC sequence numbers are added to the SGSN and MS contexts.

Clauses affected: _____

Other specs Affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: _____ → List of CRs: _____ → List of CRs: _____ → List of CRs: _____ → List of CRs: _____
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Other comments: This CR is written on 23.060 version 3.1.0 in draft version 3 plus the assumption that CR S2-99C30 and S2-99B95 are merged with the document



<----- double-click here for help and instructions on how to create a CR.

6.13 UMTS-GPRS Intersystem HandoverChange

The UMTS-GPRS inter system ~~handover change~~ procedures may be supported for network elements ~~supporting conforming to~~ GSM Release '97, '98, '99 and UMTS Release '99. At intersystem ~~handover change~~ the release '99 network elements shall use ~~on the Gn interface the~~ GTP version '97 on the Gn interface when interworking with release '97 or '98 network elements.

An intersystem ~~handover change~~ from UMTS to GPRS or GPRS to UMTS takes place when a MS supporting both UMTS and GPRS moves to a cell where the radio technology which the MS was using is not any longer supported. Prerequisite for an inter system ~~handover change~~ is that the MS is PS-attached in the UMTS PS-domain or PS-attached for GPRS. The transition of the mobility management states is as specified for the corresponding mobility management procedures.

There is no transition of the session management states at an intersystem ~~handover change~~.

The UMTS RLC Sequence Number parameters, RLC_SND and RLC_SNU, are not relevant for the ~~handover intersystem change~~ of real-time PGDP contexts (because these contexts ~~which~~ use RLC transparent mode).

6.13.1 Intra SGSN Intersystem HandoverChange

~~6.13.1.1~~ ~~An combined 2G+3G-SGSN that supporting~~ both the Gb and Iu Ps interfaces can support an Intra SGSN intersystem ~~handover change~~ if the old and the new cell are both served by this SGSN.

6.13.1.1 UMTS to GPRS Intra SGSN HandoverChange

The ~~handover intersystem change~~ from UMTS to GPRS takes place when the MS in PMM-Connected state enters the new GSM/GPRS cell. In this case the MS shall perform a Routing Area Update procedure independent of whether just the cell has changed or also the RA has changed..

When an MS in PMM-IDLE state enters a new GSM/GPRS cell inside the current RA, the MS shall follow the ~~deferred selective~~ RA update procedures.

The SGSN records this UE's change of cell, and further traffic directed towards the MS is conveyed over the Gb interface to the new cell.

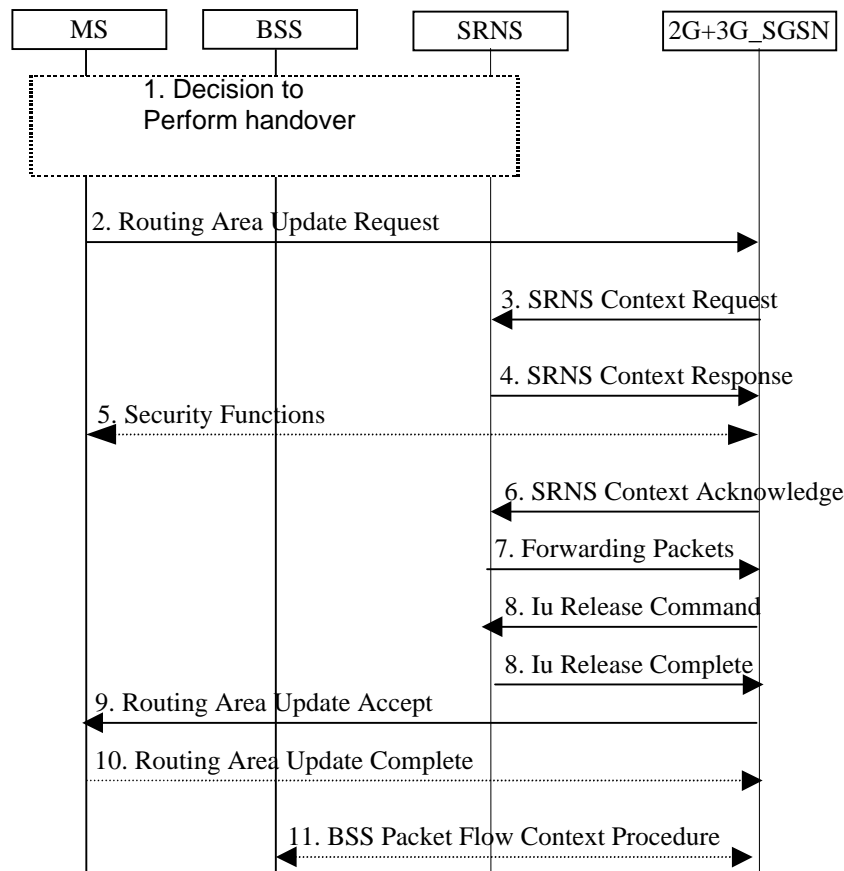


Figure ZZD: UMTS to GPRS Intra SGSN Handover Change

- 1) The MS and/or BSS/UTRAN decides to perform ~~handover~~ an intersystem change which ~~makes leads to that~~ the MS switches to the a new cell ~~that supporting supports~~ GPRS radio technology and ~~suspends stops~~ PDU-transmission to the network
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the 2G+3G_SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the 2G+3G_SGSN.
- 3) The 2G+3G_SGSN sends SRNS Context Request (IMSI) to the SRNS, starts a timer on the MM and PDP Context and stops the transmission of GTP-PDUs to the SRNS.
- 4) The SRNS responds with SRNS Context Response (IMSI, GTP_SNDs, GTP_SNUs, RLC_SNDs, RLC_SNUs). The GTP sequence numbers are included for each PDP context indicating the next in-sequence downlink PDU to be sent to the MS and the next in-sequence GTP-PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the SRNS also includes the uplink RLC Sequence Number (RLC_SNU) and the downlink RLC Sequence Number (RLC_SND). The RLC_SNU shall be the next in-sequence RLC Sequence Number expected from the MS. The RLC_SND shall be the next in-sequence RLC Sequence number to be sent to the MS. The 2G+3G SGSN shall strip off the four most significant bits of the passed RLC Sequence Numbers, thus converting them to SNDCP N-PDU numbers of the respective 2G GPRS PDP contexts.
- 5) Security functions may be executed.

- 6) The 2G+3G_SGSN sends SRNS Context Acknowledge to the SRNS. This informs the SRNS that the 2G+3G_SGSN is ready to receive data packets.
- 7) The partly transmitted and transmitted but not acknowledged N-PDUs together with the RLC DL sequence number of the last RLC segment of that N-PDU and the buffered downlink GTP-PDUs are tunnelled back to the 2G+3G_SGSN. The 2G+3G_SGSN shall strip off the four most significant bits of the RLC ~~send~~-sequence numbers ~~of~~accompanying the received N-PDUs before sending them to the MS.
- 8) When the timer described under 3 has expired, the 2G+3G_SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 9) The 2G/3G_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, then the 2G/3G_SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the 2G/3G_SGSN updates MM and PDP contexts for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number) is returned to the MS. Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 10) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure.
The MS deducts ~~the a~~ Receive N-PDU number from ~~the a~~ UMTS DL RLC Sequence Number RLC-SND by stripping off the four most significant bits of the RLC ~~Sequence Number~~ SND of the next expected in-sequence RLC frame.
- 11) The 2G+3G_SGSN and the BSS may execute the BSS Packet Flow Context Procedure.

6.13.1.2 GPRS to UMTS Intra SGSN ~~Handover~~Change

The ~~handover~~intersystem change from GPRS to UMTS takes place when a PS-attached MS ~~enters the new a~~ UMTS cell. In this case the MS shall perform an RRC connection establishment and an Intra SGSN Routing Area Update procedure independent of whether just the cell has changed or also the RA has changed.:

When an MS in GPRS STANDBY state enters a new UMTS cell inside the current RA, the MS shall follow the ~~deferred selective~~RA update procedures.

The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed over the Iu interface to the new cell.

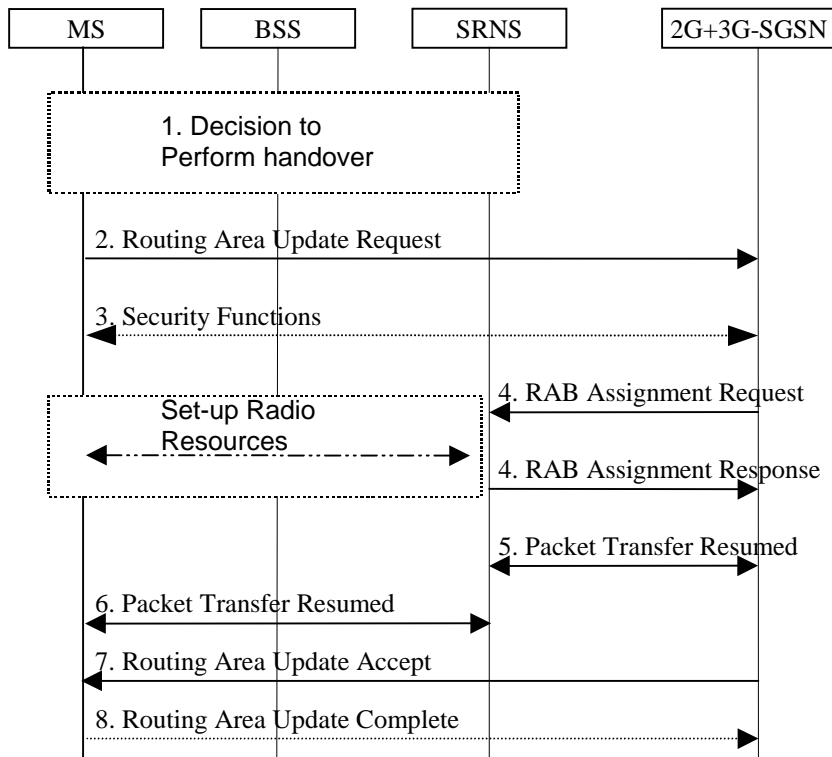


Figure ZZD: GPRS to UMTS Intra SGSN Handover Change

- 1) The MS and/or BSS/UTRAN decides to perform handover an intersystem change which leads to that which makes the MS switches to the a new cell that supporting UMTS radio technology and stops suspend PDU transmission to the nNetwork.
- 2) The MS initiates an RRC connection establishment and sends Routing Area Update Request (P-TMSI, Old RA, Old P-TMSI Signature, Update Type, CM) to the combined 2G+3G_SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 2G+3G_SGSN. The 2G+3G_SGSN stops the transmission of N-PDUs to the MS.
- 3) Security functions may be executed.
- 4) The 2G+3G_SGSN request the SRNS to establish a radio access bearer by sending RAB Assignment Request (GTP-SNDs, GTP-SNUs, RLC_SNDs, RLC_SNUs) to the SRNS. The RLC Sequence Numbers shall be derived (shifted left 4 times) from the N-PDU sequence numbers stored in the PDP contexts. The SRNS sends Radio Bearer Setup Request (RLC-SNUs) to the MS which includes the next expected in-sequence UL RLCN-PDU sequence number. The MS responds with Radio Bearer Setup Complete (RLC-SNDs) which includes the next expected in-sequence DL RLCN-PDU sequence number. The SRNS responds with a RAB Assignment Response.
- 5) The traffic flow is resumed between the 2G+3G_SGSN and the SRNS. The SRNS shall discard all N-PDUs tunnelled from the 2G+3G_SGSN with N-PDU sequence numbers older than the DL N-PDU sequence number received from the MS. If this is not the case, the N-PDU shall be transmitted to the MS. The MS shall discard all N-PDUs with sequence numbers older than the GTP-SNU received from the SRNS. If this is not the case the N-PDU shall be transmitted to the SRNS.
- 6) The traffic flow is resumed between the SRNS and the MS.
- 7) The 2G+3G_SGSN updates the MM context for the MS. A new P-TMSI may be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature) is returned to the MS.

8) The MS acknowledges the new P-TMSI with a Routing Area Update Complete .

6.13.1.3 ~~Deferred~~ Selective RA update

The MS shall ~~follow~~ use the following procedures when in GPRS STANDBY ~~or~~ PMM-IDLE state.

Note that upon expiry of the periodic RA update timer, the MS shall carry out the periodic routing area update procedure as currently defined.

6.13.1.3.1 Uplink signalling / data transmission

In GPRS STANDBY / PMM-IDLE state the MS shall not perform an RA update procedure until up-link data or signalling information is to be sent from the MS.

If the MS is in the same access network as when it last sent data / signalling, the procedures defined for that access system shall be followed. This shall be sending of an LLC PDU in a GPRS or for example a sending of a SERVICE REQUEST message in UMTS.

- If the MS is in a different access network as when it last sent data / signalling, the RA update procedure shall be performed before the sending of data / signalling.

6.13.1.3.2 Downlink signalling / data transmission

If the 2G/3G-SGSN receives data for an MS in GPRS STANDBY / PMM-IDLE, the SGSN shall page the RA where the MS is located. This may include both 2G and 3G cells.

If the MS receives this page in the same access network as when it last sent data / signalling, the procedures defined for that access system shall be followed. This shall be sending of an LLC PDU in a GPRS cell or for example a sending of a SERVICE REQUEST message in a UMTS cell.

- If the MS receives this page in a different access network as when it last sent data / signalling, the RA update procedure shall be performed. The 2G/3G-SGSN shall accept this RAU as a valid response.

6.13.2 Inter SGSN Intersystem ~~Handover~~ Change

6.13.2.1 UMTS to GPRS Inter SGSN ~~Handover~~ Change

An Inter SGSN inter system ~~handover~~ change from UMTS to GPRS takes place when the MS in PMM-Idle or PMM-Connected state moves to a new GSM/GPRS cell and this cell is served by a different SGSN. In this case the MS shall initiate a GPRS RA update procedure. The sequence applied for the inter SGSN ~~handover~~ change case is shown in the following figure:

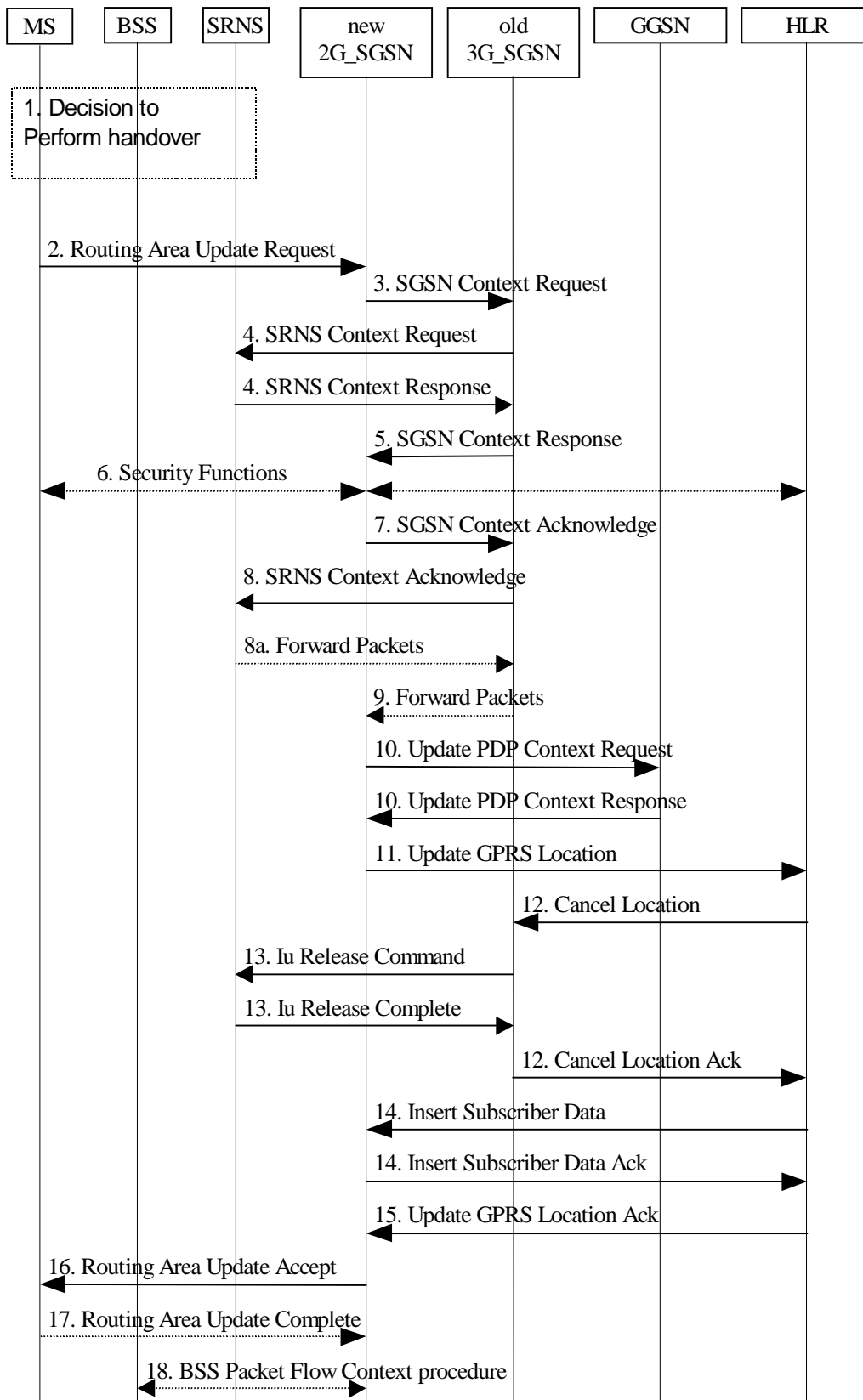


Figure ZZD: UMTS to GPRS, Inter SGSN Handover Change

- 1) The MS ~~and/or~~ BSS/UTRAN decides to perform handover ~~an intersystem change~~, which ~~makes leads to that~~ the MS switch to ~~the a~~ new cell ~~that supporting supports~~ GPRS radio technology and ~~stops that the PDU-transmission to the network is suspended~~.
- 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to the new 2G_SGSN. Update Type shall indicate RA update or periodic RA update. The BSS shall add the Cell Global Identity including the RAC and LAC of the cell where the message was received before passing the message to the new 2G_SGSN.
- 3) The new 2G_SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature, New SGSN Address) to the old 3G_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 3G_SGSN. The old 3G_SGSN starts a timer for supervision of the MS's context. If the MS is not known in the old 3G_SGSN, the old 3G_SGSN responds with an appropriate error cause.
- 4) The old 3G_SGSN sends SRNS Context Request (IMSI) to the SRNS. Upon reception of this message the SRNS buffers and stops sending downlink PDUs to the MS and answers with SRNS Context Response (IMSI, GTP-SNDs, GTP-SNUs, RLC-SNDs, RLC-SNU_s). 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 using acknowledged mode, the SRNS also includes the RLC_SNU and RLC_SND. The RLC_SNU shall be the next in-sequence RLC Sequence Number expected from the MS. The RLC_SND shall be the next in-sequence RLC Sequence number to be sent to the MS. The 3G SGSN shall strip off the four most significant bits of the passed RLC Sequence Numbers, thus converting them to SNDCP N-PDU numbers.
- 5) The old 3G_SGSN responds with SGSN Context Response (MM Context, ~~e.g. IMSI~~, PDP Contexts, ~~e.g. APN~~). 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 in-sequence N-PDU to be sent to the MS. Each PDP Context also includes the SNDCP Send N-PDU Number for the next in-sequence downlink N-PDU to be sent in acknowledged mode to the MS, ~~and~~ the SNDCP Receive N-PDU Number for the next in-sequence uplink N-PDU to be received in acknowledged mode from the MS.
- 6) Security functions may be executed.
- 7) The new 2G_SGSN sends an SGSN Context Acknowledge message to the old 3G_SGSN. This informs the old 3G_SGSN that the new 2G_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 RA update procedure back to the old SGSN before completing the ongoing RA update procedure.
- 8) The old 3G_SGSN sends SRNS Context Acknowledge (IMSI) to the SRNS.
The SRNS shall start tunnelling the partly transmitted ~~and/or partly~~ transmitted but not acknowledged N-PDUs together with the RLC DL Sequence Number (stripped off the four most significant bits) of the last RLC segment of that N-PDU and start duplicating and tunnelling the buffered GTP-PDUs to the old 3G_SGSN.
- 9) The old 3G_SGSN tunnels the ~~GTP~~-PDUs to the new 2G_SGSN. The SNDCP sequence numbers shall not be modified in the GTP header of the tunnelled PDUs.
- 10) The new 2G_SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSN(s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TID).
- 11) The new 2G_SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.

- 12) The HLR sends Cancel Location (IMSI) to the old 3G_SGSN. The old 3G_SGSN acknowledges with Cancel Location Ack (IMSI).
The old 3G_SGSN removes the MM and PDP contexts if the timer described in step 3 is not running. When the timer is running the MM and PDP contexts are removed when the timer expires.
- 13) When the timer described in step 3 expires the old 3G_SGSN sends an Iu Release Command to the SRNS. The SRNS responds with Iu Release Complete.
- 14) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 2G_SGSN. The 2G_SGSN constructs an MM context and PDP contexts for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
- 15) The HLR acknowledges the Update Location by sending Update GPRS Location Ack (IMSI) to the new 2G_SGSN.
- 16) The new 2G_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 2G_SGSN, or if subscription checking fails, then the new 2G_SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 2G_SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 2G_SGSN and the MS. The new 2G_SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred before the start of the update procedure.
- 17) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs successfully transferred before the start of the update procedure. The MS deducts the Receive N-PDU number from the UMTS DL RLC Sequence Number by stripping off the four most significant bits of the RLC Sequence Number of the next expected in-sequence RLC frame.
- 18) The 2G_SGSN and the BSS may execute the BSS Packet Flow Context Procedure

6.13.2.2 GPRS to UMTS Inter SGSN ~~Handover~~Change

The ~~handover~~intersystem change from GPRS to UMTS takes place when the PS-attached MS moves to a new UMTS cell. In this case the MS shall initiate a UMTS RA update procedure by establishing a RRC connection and initiating the RA update procedure. The sequence applied for the inter SGSN RA update case is shown in the following figure:

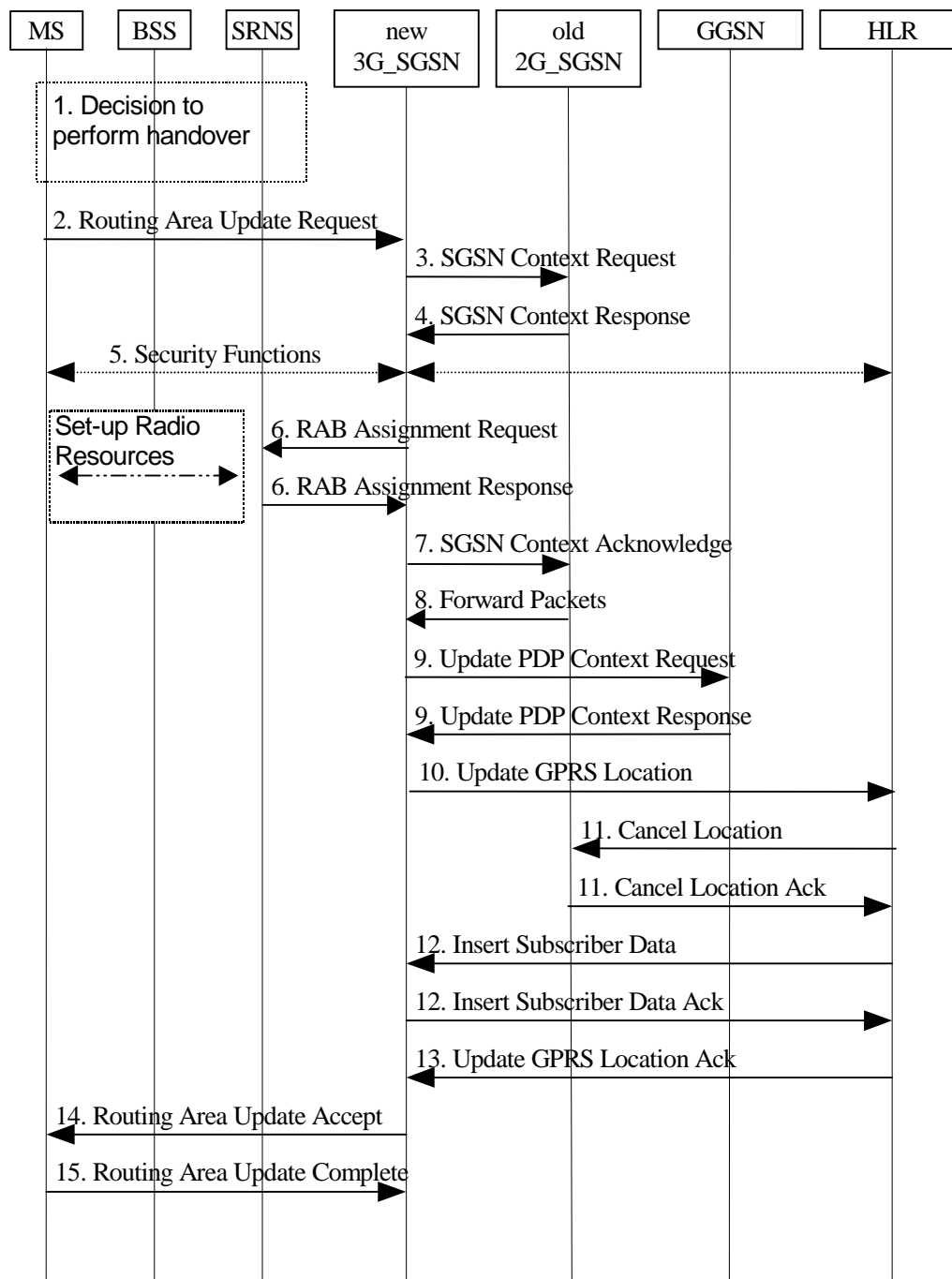


Figure ZZE: GPRS to UMTS, Inter SGSN Handover Change

- 1) The MS and/or BSS/UTRAN decides to perform handover an intersystem change which makes leads to that the MS switches to the a new cell that supportisng UMTS radio technology and stops transmission to the network.
- 2) The MS sends a Routing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM) to the new 3G_SGSN. The SRNS shall add the Cell an identifier of the area where the message was received before passing the message to the 3G_SGSN.
- 3) The new 3G_SGSN uses the old RAI received from the MS, derives the old 2G_SGSN address from it, and sends SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) to itthe old 2G_SGSN to get the MM and PDP contexts for the MS ~~(The old RAI received from the~~

- ~~MS is used to derive the old 2G_SGSN address~~). The old 2G_SGSN starts a timer for supervision of the MS's context and stops the transmission of N-PDUs to the MS.
- 4) The old 2G_SGSN responds with SGSN Context Response (MM Context, ~~e.g. IMSI~~, PDP Contexts, ~~e.g. APN~~). 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 to the MS and, the SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged mode from the MS. The new 3G_SGSN shall use the GTP sequence numbers for in-sequence delivery over the Iu interface.
The new 3G_SGSN converts the SNDCP sequence numbers to RLC ~~send and receive~~ sequence numbers by ~~(shifting them left 4 times)~~.
 - 5) Security functions may be executed.
 - 6) The new 3G_SGSN requests the SRNS to establish ~~of~~ a radio access bearer by sending RAB Assignment Request (GTP-SNDs, GTP-SNUs, RLC-SNDs, RLC-SNUs) to the SRNS. The SRNS sends Radio Bearer Setup Request (RLC-SNUs) to the MS which includes the next expected in-sequence UL ~~N-PDU~~RNC sequence number. The MS responds with Radio Bearer Setup Complete (RLC-SNDs) which includes the next expected in-sequence DL ~~N-PDU~~RLC sequence number. The SRNS responds with RAB Assignment Response.
The SRNS shall discard all N-PDUs tunnelled from the SGSN with N-PDU sequence numbers older than the RLC-SNDs~~DL N-PDU sequence number~~ received from the MS. If this is not the case the N-PDU shall be transmitted to the MS. The MS shall discard all N-PDUs with sequence numbers older than the RLC~~GTP-SNUs~~ received from the SRNS. If this is not the case, the N-PDU shall be transmitted to the SRNS.
 - 7) The new 3G_SGSN sends a 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 routing area update procedure back to the old SGSN before completing the ongoing routing area update procedure.
 - 8) 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. No N-PDUs shall be forwarded to the new 3G_SGSN after expiry of the timer described in step 3.
 - 9) The new 3G_SGSN sends a Update PDP Context Request (new SGSN Address, TID, QoS Negotiated) to the GGSN (s) concerned. The GGSN (s) updates its PDP context fields and returns Update PDP Context Response (TID).
 - 10) The new 3G_SGSN informs the HLR of the change of SGSN by sending Update GPRS Location (SGSN Number, SGSN Address, IMSI) to the HLR.
 - 11) The HLR sends Cancel Location (IMSI, Cancellation Type) 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. When the timer is running the MM and PDP contexts are removed when the timer expires. The old 2G_SGSN acknowledges with Cancel Location Ack (IMSI).
 - 12) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 3G_SGSN. The 3G_SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack (IMSI) message to the HLR.
 - 13) The HLR acknowledges the Update GPRS Location by sending Update Location Ack (IMSI) to the new 3G_SGSN.
 - 14) 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 3G_SGSN, or if subscription checking fails, then

the new 3G_SGSN rejects the routing area update with an appropriate cause. If all checks are successful then the new 3G_SGSN constructs MM and PDP contexts for the MS. A logical link is established between the new 3G_SGSN and the MS. The new 3G_SGSN responds to the MS with Routing Area Update Accept (P-TMSI, P-TMSI signature).

- 15) The MS acknowledges the new P-TMSI with a Routing Area Update Complete ().

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 1 shows the context fields for one MS.

Table 1: SGSN MM and PDP Contexts

Field	Description	GPRS	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	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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
TFT [FFS]	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	SNDSCP sequence number of the next downlink N-PDU to be sent to the MS.	X	
Receive N-PDU Number	SNDSCP sequence number of the next uplink N-PDU expected from the MS.	X	
<u>RLC-SND</u>	<u>The next in-sequence RLC Sequence number to be sent to the MS</u>		<u>X</u>
<u>RLC-SNU</u>	<u>The next in-sequence RLC Sequence Number expected from the MS</u>		<u>X</u>
<u>GTP-SND</u>	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
<u>GTP-SNU</u>	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. Table 2 shows the context fields for one MS.

Table 2: SGSN MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
AA-TID	Anonymous Access Tunnel Identifier.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN currently used.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
GGSN Address in Use	The IP address of the GGSN currently used.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDSCP sequence number of the next downlink N-PDU to be sent to the MS.
Receive N-PDU Number	SNDSCP sequence number of the next uplink N-PDU expected from the MS.
<u>GTP-SND</u>	<u>GTP sequence number of the next downlink N-PDU to be sent to the MS.</u>
<u>GTP-SNU</u>	<u>GTP sequence number of the next uplink N-PDU to be sent to the GGSN.</u>
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
<u>RLC-SND</u>	<u>The next in-sequence RLC Sequence number to be sent to the MS</u>
<u>RLC-SNU</u>	<u>The next in-sequence RLC Sequence Number expected from the MS</u>
Reordering Required	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 3 shows the PDP context fields for one PDP Address.

Table 3: GGSN PDP Context

Field	Description	GPRS	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.	X	X

If a PDP context is enabled for network-requested PDP context activation, then IMSI, PDP Type, PDP Address, SGSN Address and MNRG contain valid information also when the PDP context is inactive and when the MS is GPRS-detached.

In case of anonymous access (GPRS only) the GGSN maintains activated PDP contexts. Table 4 shows the PDP context fields for one MS.

Table 4: GGSN PDP Context for Anonymous Access

Field	Description
AA-TID	Anonymous Access Tunnel Identifier.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN Network Identifier currently used.
QoS Profile Negotiated	The quality of service profile negotiated.
SGSN Address	The IP address of the SGSN serving this MS.
GTP-SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.
GTP-SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.

A GGSN that supports anonymous access shall have a list of server addresses that are allowed to be accessed by anonymous MSs. The method to maintain the list of the servers is outside the scope of the present document.

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 5 shows the MS context fields.

Table 5: MS MM and PDP Contexts

Field	SIM	Description	GPRS	UMTS
IMSI	V	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	V	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	V	A signature used for identification checking purposes.	X	X
Routeing Area	V	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	V	Currently used ciphering key.	X	
CKSN	V	Ciphering key sequence number of Kc.	X	
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK	V	Currently used ciphering key.		X
CK Next	V	Ciphering key for the next authentication.		X
IK	V	Currently used integrity key.		X
IK Next	V	Integrity key for the next authentication.		X
KSI	V	Key Set Identifier.		X
Classmark		MS classmark.	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., X.25, PPP, or IP.	X	X
PDP Address		PDP address, e.g., an X.121 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	✗
Receive N-PDU Number		SNDCP sequence number of the next downlink N-PDU expected from the SGSN.	X	✗
<u>RLC-SND</u>		<u>The next in-sequence RLC Sequence number to be sent to the MS</u>		<u>X</u>
<u>RLC-SNU</u>		<u>The next in-sequence RLC Sequence Number expected from the MS</u>		<u>X</u>

The information marked with an "V" in Table 5:

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

If the SIM is packet domain service-aware, then the IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK, IK, and CKSN stored in the SIM shall be used when accessing the packet domain services.

[USIM is probably PS aware, and these paragraphs may need to be changed accordingly.]

If the SIM is not packet domain service-aware, then the P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK, IK, CKSN, and KSI stored in the ME shall be used if and only if the IMSI stored in the SIM is identical to the IMSI image maintained in the ME. If the IMSI stored in the SIM is different from the IMSI image in the ME, then 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 PS attach. IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, CK, IK, CKSN, and KSI may be stored in the ME after the PS attach has been successfully performed.

For anonymous access (GPRS only) each GPRS MS maintains MM and PDP context information in READY state. The information may be contained in the ME and the TE. Table 6 shows the MS context fields.

Table 6: MS MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
APN Requested	The APN requested.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next uplink N-PDU to be sent to the SGSN.
Receive N-PDU Number	SNDCP sequence number of the next downlink N-PDU expected from the SGSN.

13.7 RNC for UMTS

RNC maintains RNC Context for CN-related information in PMM-CONNECTED state. RNC also contains RNC RAB contexts for activated RABs. Table 15. RNC Context shows the context fields for one MS.

Table 15: RNC Context

Field	Description
IMSI	IMSI is the main reference key.
Each RNC context contains one [FFS: zero or more?] or more RNC RAB contexts:	
NSAPI	Network layer Service Access Point Identifier.
TEID	Tunnel Endpoint Identifier
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
GTP--SND	GTP-U sequence number of the next downlink in-sequence N-PDU to be sent to the MS.
GTP--SNU	GTP-U sequence number of the next uplink in-sequence N-PDU to be sent to the GGSN.
RLC--SND	The next in-sequence RLC Sequence number to be sent to the MS
RLC--SNU	The next in-sequence RLC Sequence Number expected from the MS

London, UK, 25th – 29th Oct. 1999**3G CHANGE REQUEST***Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.***23.060 CR 060r2**Current Version: **3.1.0**

3G specification number ↑

↑ CR number as allocated by 3G support team

For submission to TSG **SA#**
*list TSG meeting no. here ↑*for approval **X**
for information*(only one box should
be marked with an X)**Form: 3G CR cover sheet, version 1.0**The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf>***Proposed change affects:***(at least one should be marked with an X)*USIM ME UTRAN Core Network **Source:**

Ericsson

Date:Oct. 29th, 1999**Subject:**

UMTS-GPRS Intersystem Handover

3G Work item:

Release '99 Stage 2

Category:*(only one category
shall be marked
with an X)*

- F Correction
- A Corresponds to a correction in a 2G specification
- B Addition of feature
- C Functional modification of feature
- D Editorial modification

Reason for change:

This CR contains clarifications to the UMTS – GSM/GPRS intersystem Handover cases.

Main modifications are the addition of the UL and DL sequence numbers to the RAB Assignment message.

Also the conversion of SNDSCP N-PDU sequence numbers to RLC Sequence Numbers and vice versa is clarified.

P-TMSI has been removed from the Routing Area Update Complete message.

Release r1 was a revised version of Tdoc S2-99B41 and incorporates editorial corrections plus corrections to unify that sequence numbers always relate to the next expected packet rather than to the last handled one plus a comment on RLC transparent mode plus the removal of the constraint that the described handover within a combined 2G+3G-SGSN is only possible when the RA stays the same.

Release r2 incorporates a replacement of "'smaller'(older)" with "older".

Clauses affected:

6.13.1.1, 6.13.1.2, 6.13.2.1, 6.13.2.2

Other specs affected:

Other 3G core specifications	→ List of CRs:	
Other 2G core specifications	→ List of CRs:	
MS test specifications	→ List of CRs:	
BSS test specifications	→ List of CRs:	
O&M specifications	→ List of CRs:	

Other comments:

6.13 UMTS-GPRS Intersystem Handover

The UMTS-GPRS inter system handover procedures may be supported for network elements supporting GSM Release '97, '98, '99 and UMTS Release '99. At intersystem handover the release '99 network elements shall use on the Gn interface the GTP version '97 when interworking with release '97 network elements.

An intersystem handover from UMTS to GPRS or GPRS to UMTS takes place when a MS supporting both UMTS and GPRS moves to a cell where the radio technology which the MS was using is no longer supported. Prerequisite for an inter system handover is that the MS is PS-attached in the UMTS PS-domain or PS-attached for GPRS. The transition of the mobility management states is as specified for the corresponding mobility management procedures.

There is no transition of the session management states at an intersystem handover.

The UMTS RLC Sequence Number parameters, RLC_SND and RLC_SNU, are not relevant for the handover of real-time PGP contexts (which use RLC transparent mode).

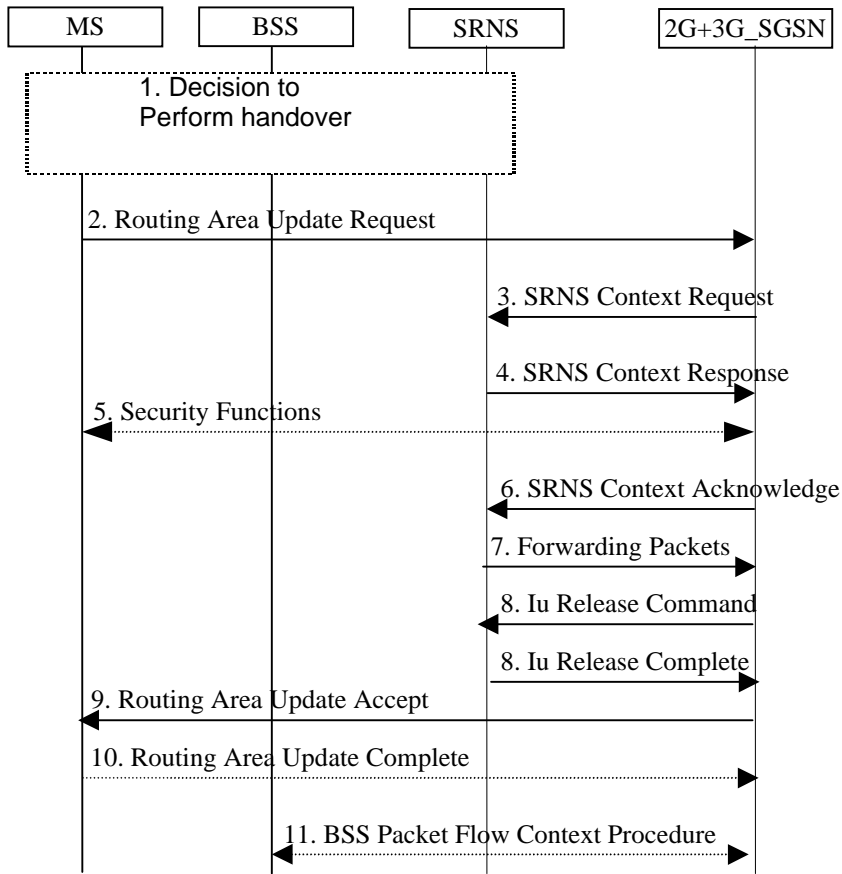
6.13.1 Intra SGSN Intersystem Handover ~~within a RA between cells belonging to different systems~~

~~Inter system handover without performing a RA update is supported only in case the SGSN is a combined 2G/3G SGSN supporting both the Gb and Iu Ps interfaces within the same physical node. -A combined 2G+3G-SGSN supporting both the Gb and Iu Ps interfaces can support an Intra SGSN intersystem handover if the old and the new cell are both served by this SGSN.~~

6.13.1.1 UMTS to GPRS Intra SGSN Handover

~~The An Inter System~~ handover from UMTS to GPRS takes place when the MS in PMM-Connected state enters ~~the a~~ new GSM/GPRS cell ~~inside the current RA~~. In this case the MS shall perform a Routing Area Update procedure ~~independent of whether just the cell has changed or also the RA has changed, with the Update Type set to 'Inter System Cell Change'~~.

25 The SGSN records this UE's change of cell, and further traffic directed towards the MS is conveyed
 26 over the Gb interface to the new cell.



27
 28 **Figure ZZD: UMTS to GSM-GPRS Intra SGSN Handover between cells belonging to the**
 29 **same RA**

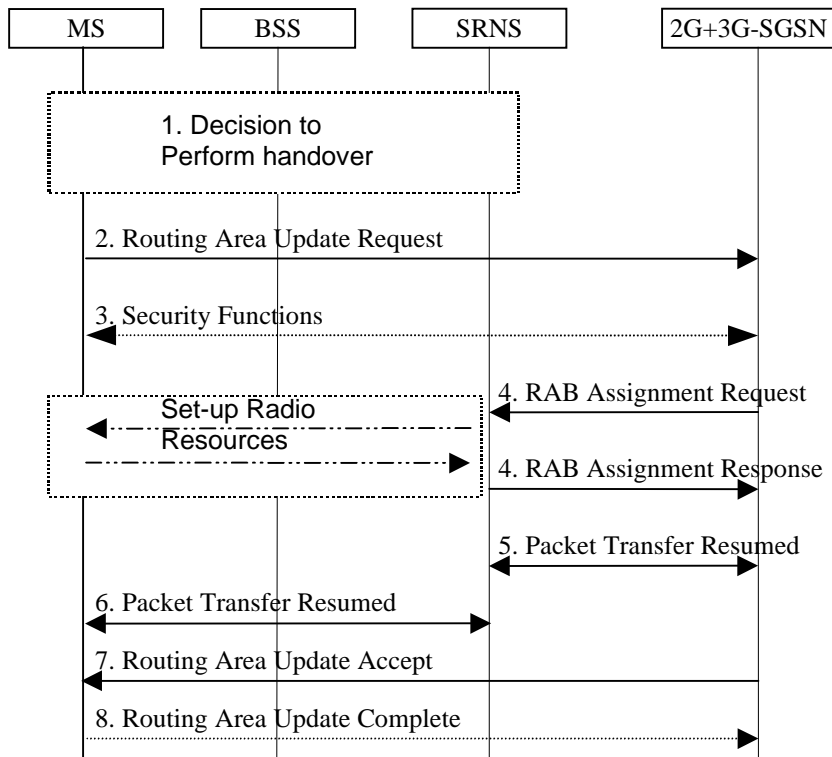
- 30 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to
 31 the new cell supporting GPRS radio technology and suspends PDU transmission to the network
- 32 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type) to
 33 the 2G+3G_SGSN. Update Type shall indicate RA update or periodic RA update-Inter-system
 34 cell change². The BSS shall add the Cell Global Identity including the RAC and LAC of the cell
 35 where the message was received before passing the message to the 2G+3G_SGSN.
- 36 3) The 2G+3G_SGSN sends SRNS Context Request (IMSI) to the SRNS, starts a timer on the MM
 37 and PDP Context and stops the transmission of GTP-PDUs to the SRNS.
- 38 4) The SRNS responds with SRNS Context Response (IMSI, GTP_SNDs, GTP_SNUs,
 39 RLC_RLC_SNDs, RLC_SNU_s-UL and DL counters). The GTP-sequence numbers are included for
 40 each PDP context indicating the next in-sequence downlink PDU to be sent to the MS (i.e. the last
 41 GTP-PDU in the buffer of the SRNS, which is not sent to the MS) and the next in-sequence GTP-
 42 PDU to be tunnelled to the GGSN. For each active PDP context using acknowledged mode, the
 43 SRNS also includes the uplink RLC Sequence Number (RLC_SNU) and the -and downlink RLC
 44 Sequence Number (countersRLC_SND), for PDP contexts using acknowledged mode. The
 45 RLC_SNUuplink RLC counter shall be the RLC counter next in-sequence RLC Sequence Number
 46 expected from the MS. of the last received RLC frame. The RLC_SND DL RLC counter shall be
 47 the RLC counter of the next last in-sequence RLC Sequence number to be sent to the MS of the
 48 sent or partly sen but not acknowledged N-PDU. The 2G+3G SGSN shall strip off the four most
 49 significant bits of the passed-received RLC counter RLC Sequence Numbers, thus converting them
 50 to a SND CP Receive N-PDU numbers of the respective 2G GPRS PDP contexts.-
- 51 5) Security functions may be executed.

- 52 | 6) The 2G+/3G_SGSN sends SRNS Context Acknowledge to the SRNS. This informs the SRNS that
53 | the 2G+/3G_SGSN is ready to receive data packets.
- 54 | ~~7) The partly transmitted and transmitted but not acknowledged N-PDUs together with the RLC~~
55 | ~~DL sequence number of the last RLC segment of that N-PDU and the buffered downlink GTP-~~
56 | ~~PDUs are tunnelled back to the 2G+/3G_SGSN. The 2G+/3G_SGSN shall strip off the four most~~
57 | ~~significant bits of the RLC send sequence numbers of the received N-PDUs before sending them to~~
58 | ~~the MS.~~
- 59 | 8) When the timer described under 3 has expired, the 2G+/3G_SGSN sends an Iu Release Command
60 | to the SRNS. The SRNS responds with Iu Release Complete.
- 61 | 9) The 2G/3G_SGSN validates the MS's presence in the new RA. If due to roaming restrictions the
62 | MS is not allowed to be attached in the RA, or if subscription checking fails, then the
63 | 2G/3G_SGSN rejects the routing area update with an appropriate cause. If all checks are
64 | successful then the 2G/3G_SGSN updates MM and PDP contexts for the MS. A new P-TMSI may
65 | be allocated. A Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU
66 | Number) is returned to the MS. Receive N-PDU Number contains the acknowledgements for each
67 | acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-originated N-PDUs
68 | successfully transferred before the start of the update procedure.
69 | ~~The 2G/3G_SGSN deduces the N-PDU Numbers from the RLC numbers received from the SRNS~~
70 | ~~(FFS).~~
- 71 | 10) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (~~P-TMSI, Receive~~
72 | ~~N-PDU Number~~). Receive N-PDU Number contains the acknowledgements for each
73 | acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated N-PDUs
74 | successfully transferred before the start of the update procedure.
75 | ~~The MS deducts the Receive N-PDU number from the UMTS DL RLC sequence number RLC~~
76 | ~~Sequence Number by stripping off the four most significant bits of the RLC counter RLC Sequence~~
77 | ~~Number of the next expected in-sequence last received RLC frame.~~
- 78 | 11) The 2G+/3G_SGSN and the BSS may execute the BSS Packet Flow Context Procedure.

79 | 6.13.1.2 GPRS to UMTS Intra SGSN Handover

80 | ~~The An Inter System~~ handover from GPRS to UMTS takes place when a PS-attached MS enters ~~the a~~
81 | ~~new UMTS cell inside the current RA~~. In this case the MS shall perform ~~a UMTS Inter System Cell~~
82 | ~~Change procedure by performing~~ a RRC connection establishment and an Intra SGSN Routing Area
83 | Update procedure ~~independent of whether just the cell has changed or also the RA has changed, with~~
84 | ~~the Update Type set to 'Inter System Cell Change'.~~

85 | The SGSN records this MS's change of cell, and further traffic directed towards the MS is conveyed
86 | over the Iu interface to the new cell.



87
88 **Figure ZZD: GSM-GPRS to UMTS Intra SGSN Handover between cells belonging to the**
89 **same RA**

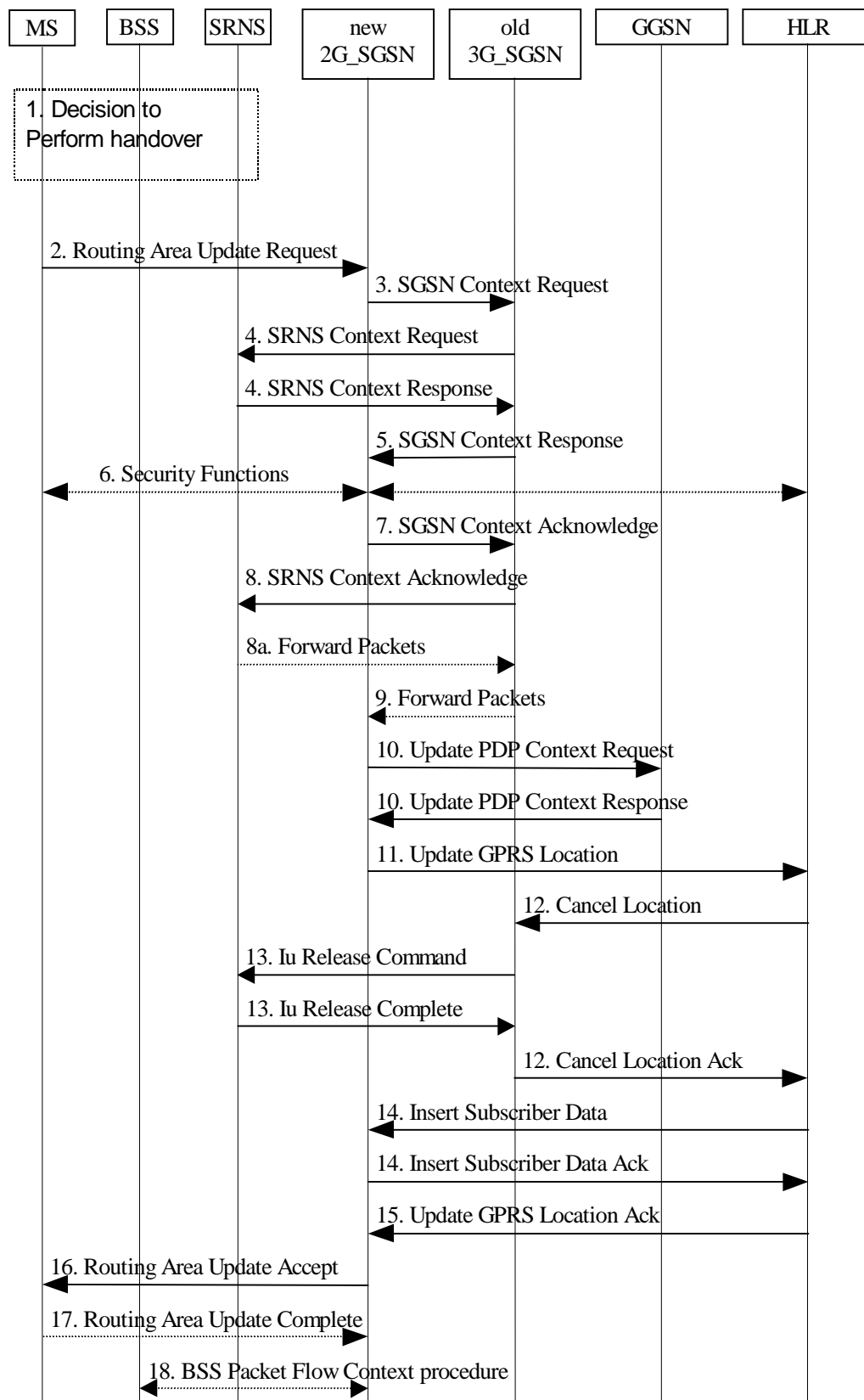
- 90 1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS
91 switches to the new cell supporting UMTS radio technology and Suspend PDU
92 Transmission to the Network.
- 93 2) The MS initiate a RRC connection establishment and sends Routing Area Update Request
94 (P-TMSI, Old RA, Old P-TMSI Signature, Update Type, CM) to the combined
95 2G+3G_SGSN. The SRNS shall add an identifier of the area where the message was
96 received before passing the message to the 2G+3G_SGSN. The 2G+3G_SGSN stops the
97 transmission of N-PDUs to the MS.
- 98 3) Security functions may be executed.
- 99 4) The 2G+3G_SGSN request the SRNS to establish ~~of~~ a radio access bearer by sending RAB
100 Assignment Request (GTP-SNDs, GTP-SNUs, RLC_SNDs, RLC_SNU, RLC_UL and DL
101 counters) to the SRNS. The RLC Sequence Numbers shall be derived (shifted left 4 times)
102 from the N-PDU sequence numbers stored in the PDP. The SRNS sends Radio Bearer Setup
103 Request to the MS which ~~This message~~ includes the next expected in-sequence last
104 received-UL N-PDU sequence number. The MS responds with Radio Bearer Setup
105 Complete which includes the next expected in-sequence last received-DL N-PDU sequence
106 number.
107 The SRNS responds with RAB Assignment Response.
- 108 5) The traffic flow is resumed between the 2G+3G_SGSN and the SRNS. The SRNS shall
109 discard all N-PDUs tunnelled from the 2G+3G_SGSN with N-PDU sequence numbers
110 equal to or older than the DL N-PDU sequence number received from the MS. If this is not
111 the case, the N-PDU shall be transmitted to the MS. The MS shall discard all N-PDUs with
112 sequence numbers equal to or older than the GTP-SNU UL N-PDU sequence number
113 received from the SRNS. If this is not the case the N-PDU shall be transmitted to the SRNS.
- 114 6) The traffic flow is resumed between the SRNS and the MS.

- 115 7) The 2G+/3G_SGSN updates the MM context for the MS. A new P-TMSI may be allocated.
116 A Routing Area Update Accept (P-TMSI, P-TMSI Signature, ~~Receive N-PDU Number~~
117 ~~(FFS)~~) is returned to the MS.
- 118 8) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (~~P-TMSI,~~
119 ~~Receive N-PDU Number (FFS)~~).

120 6.13.2 Inter SGSN Intersystem Handover ~~at RA change~~

121 6.13.2.1 UMTS to GPRS Inter SGSN Hhandover

122 An Inter SGSN inter system handover from UMTS to GPRS takes place when the MS in PMM-Idle or
123 PMM-Connected state moves to a new GSM/GPRS cell and this cell is served by a different SGSN, in
124 a new RA. In this case the MS shall initiate a GPRS RA update procedure. The sequence applied for the
125 inter SGSN handover RA update case is shown in the following figure:



126
127

128

Figure ZZD: UMTS to GSM-GPRS, Inter SGSN Routing Area Update Procedure Handover

129

130

131

- 1) The MS and/or BSS/UTRAN decides to perform handover, which leads to that the MS switch to the new cell supporting GPRS radio technology and that the PDU transmission is suspended.

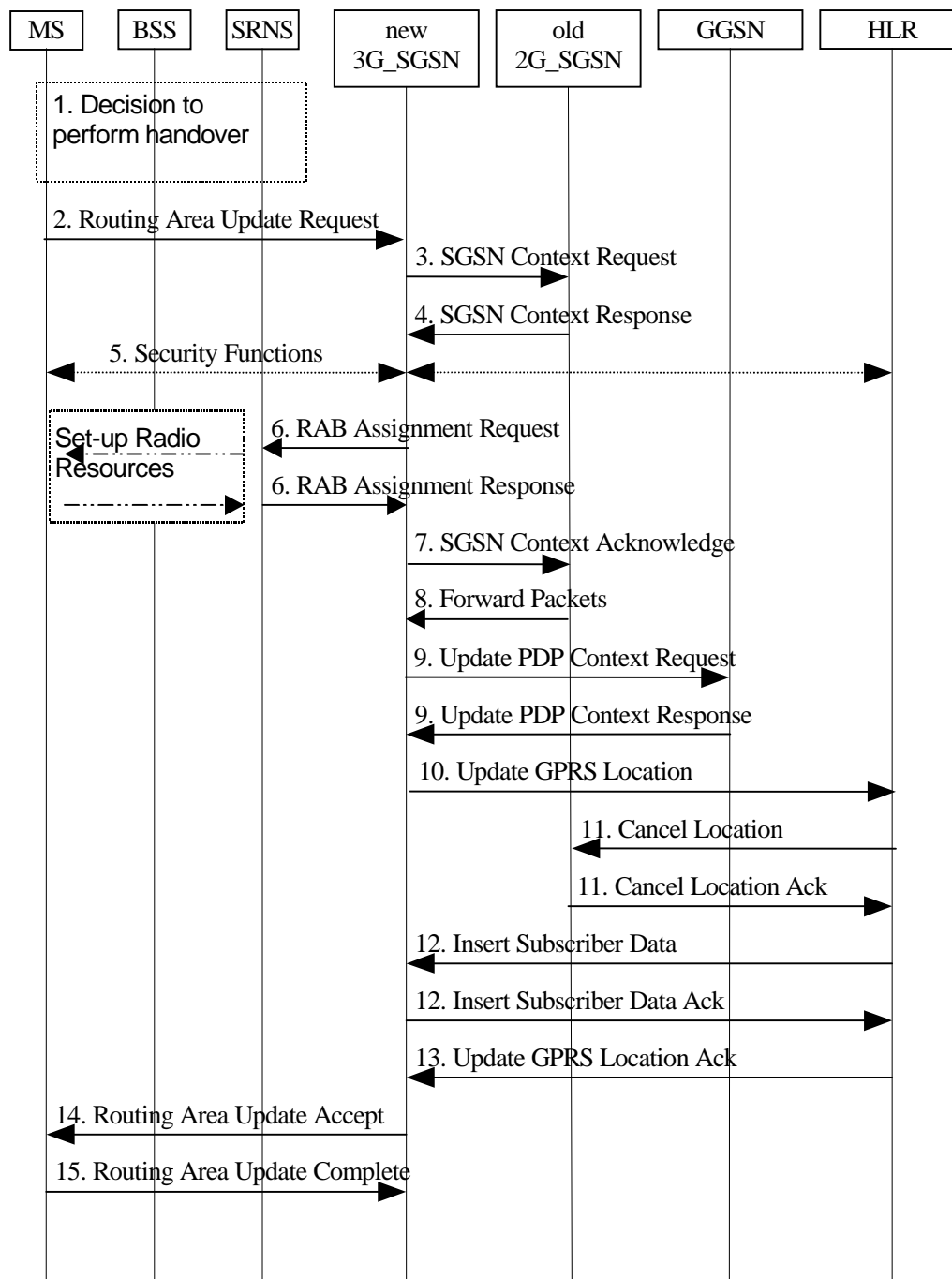
- 132 2) The MS sends a Routing Area Update Request (old RAI, old P-TMSI Signature, Update type)
133 to the new 2G_SGSN. Update Type shall indicate RA update or periodic RA update. The BSS
134 shall add the Cell Global Identity including the RAC and LAC of the cell where the message
135 was received before passing the message to the new 2G_SGSN.
- 136 3) The new 2G_SGSN sends SGSN Context Request (old RAI, TLLI, old P-TMSI Signature,
137 New SGSN Address) to the old 3G_SGSN to get the MM and PDP contexts for the MS. The
138 old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if
139 it does not match the value stored in the old 3G_SGSN. The old 3G_SGSN starts a timer for
140 supervision of the MS's context. If the MS is not known in the old 3G_SGSN, the old
141 3G_SGSN responds with an appropriate error cause.
- 142 4) The old 3G_SGSN sends SRNS Context Request (IMSI) to the SRNS. Upon reception of this
143 message the SRNS buffers and stops sending downlink PDUs to the MS and answers with
144 SRNS Context Response (IMSI, GTP-SNDs, GTP_SNUs, RLC ~~SND, RLC SNU-U and DL~~
145 ~~counters~~). The SRNS shall include for each PDP context the next in-sequence GTP sequence
146 ~~number-of the next GTP sequence number~~ to be sent in downlink to the MS ~~(i.e. the last not yet~~
147 ~~transferred N-PDU)~~ and the GTP sequence number of the next uplink PDU to be tunnelled to
148 the GGSN.
- 149
150 For each active PDP context using acknowledged mode, the SRNS also includes the ~~uplink and~~
151 ~~downlink RLC transmission counters~~ RLC SNU and RLC SND. The RLC SNU shall be the
152 next in-sequence RLC Sequence Number expected from the MS. The RLC SND shall be the
153 next in-sequence RLC Sequence number to be sent to the MS. The 3G SGSN shall strip off the
154 four most significant bits of the passed RLC Sequence Numbers, thus converting them to
155 SNDCP N-PDU numbers, for PDP contexts using acknowledged mode (FFS). ~~The uplink RLC~~
156 ~~counter shall be the RLC counter of the last received RLC frame. The downlink RLC counter~~
157 ~~shall be the RLC counter of the last RLC frame of~~ The 3G SGSN shall strip off the most
158 significant bits of the received RLC counter, thus convert them to a SNDCP Receive N-PDU
159 number.
- 160 5) The old 3G_SGSN responds with SGSN Context Response (MM Context, e.g. IMSI, PDP
161 Contexts, e.g. APN). For each PDP context the old 3G_SGSN shall include the GTP sequence
162 number for the next uplink T-PDU to be tunnelled to the GGSN and the next downlink GTP
163 sequence number for the next in-sequence N-PDU to be sent to the MS. Each PDP Context also
164 includes the SNDCP Send N-PDU Number for the next in-sequence downlink N-PDU to be
165 sent in acknowledged mode to the MS, the SNDCP Receive N-PDU Number for the next in-
166 sequence uplink N-PDU to be received in acknowledged mode from the MS.
167 ~~The SNDCP N-PDU numbers are derived from the RLC counters received from the SRNS~~
168 ~~(FFS).~~
- 169 6) Security functions may be executed.
- 170 7) The new 2G_SGSN sends an SGSN Context Acknowledge message to the old 3G_SGSN. This
171 informs the old 3G_SGSN that the new 2G_SGSN is ready to receive data packets belonging to
172 the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association
173 and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the
174 GGSNs, and the HLR to be updated if the MS initiates a RA update procedure back to the old
175 SGSN before completing the ongoing RA update procedure.
- 176 8) The old 3G_SGSN sends SRNS Context Acknowledge (IMSI) to the SRNS.
177 ~~8a)~~ The SRNS shall start tunnelling the transmitted and/or partly transmitted but not
178 acknowledged N-PDUs together with the RLC DL Ssequence Number (striped off the four
179 most significant bits) of the last RLC segment of that N-PDU and start duplicating and
180 tunnelling the buffered T-PDUs to the old 3G_SGSN.
- 181 9) The old 3G_SGSN tunnels the T-PDUs to the new 2G_SGSN. ~~The No~~ SNDCP sequence
182 numbers shall not be modified be included in the GTP header of the tunnelled PDUs.
- 183 10) The new 2G_SGSN sends Update PDP Context Request (new SGSN Address, TID, QoS
184 Negotiated) to the GGSN(s) concerned. The GGSN (s) updates its PDP context fields and
185 returns Update PDP Context Response (TID).

- 186 11) The new 2G_SGSN informs the HLR of the change of SGSN by sending Update GPRS
187 Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 188 12) The HLR sends Cancel Location (IMSI) to the old 3G_SGSN. The old 3G_SGSN
189 acknowledges with Cancel Location Ack (IMSI).
190 The old 3G_SGSN removes the MM and PDP contexts if the timer described in step 3 is not
191 running. When the timer is running the MM and PDP contexts are removed when the timer
192 expires.
- 193 13) When the timer described in step 3 expires the old 3G_SGSN sends an Iu Release Command to
194 the SRNS. The SRNS responds with Iu Release Complete.
- 195 14) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 2G_SGSN.
196 The 2G_SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack
197 (IMSI) message to the HLR.
- 198 15) The HLR acknowledges the Update Location by sending Update GPRS Location Ack (IMSI)
199 to the new 2G_SGSN.
- 200 16) The new 2G_SGSN validates the MS's presence in the new RA. If due to roaming restrictions
201 the MS is not allowed to be attached in the 2G_SGSN, or if subscription checking fails, then
202 the new 2G_SGSN rejects the routing area update with an appropriate cause. If all checks are
203 successful then the new 2G_SGSN constructs MM and PDP contexts for the MS. A logical link
204 is established between the new 2G_SGSN and the MS. The new 2G_SGSN responds to the MS
205 with Routing Area Update Accept (P-TMSI, P-TMSI Signature, Receive N-PDU Number).
206 Receive N-PDU Number contains the acknowledgements for each acknowledged-mode NSAPI
207 used by the MS, thereby confirming all mobile-originated N-PDUs successfully transferred
208 before the start of the update procedure.
- 209 17) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (P-TMSI,
210 Receive N-PDU Number). Receive N-PDU Number contains the acknowledgements for each
211 acknowledged-mode NSAPI used by the MS, thereby confirming all mobile-terminated
212 N-PDUs successfully transferred before the start of the update procedure. The MS deducts the
213 Receive N-PDU number from the last received UMTS DL RLC sequence number RLC
214 Sequence Number by stripping off the four most significant bits of the RLC counter RLC
215 Sequence Number of the next expected last in-sequence RLC frame segment of the last
216 completely received N-PDU.
- 217 18) The 2G_SGSN and the BSS may execute the BSS Packet Flow Context Procedure

218
219 ~~The sequence applied for the intra-SGSN RA update case is identical to the cell change case within~~
220 ~~the same RA as shown in section 6.13.1.1 used with a different update type.~~
221

222 6.13.2.2 GPRS to UMTS Inter SGSN Handover

223 The An intersystem handover from GPRS to UMTS takes place when the PS-attached MS moves to a
224 new UMTS cell of a new RA. In this case the MS shall initiate a UMTS RA update procedure by
225 establishing a RRC connection and initiating the RA update procedure. The sequence applied for the
226 inter SGSN RA update case is shown in the following figure:



227
228
229

Figure ZZE: GSM-GPRS to UMTS, Inter 3G_SGSN Routing Area Update Procedure Handover

230
231

1) The MS and/or BSS/UTRAN decides to perform handover which leads to that the MS switches to the new cell supporting UMTS radio technology

232
233
234

2) The MS sends a Routing Area Update Request (P-TMSI, old RAI, old P-TMSI Signature, Update Type, CM) to the new 3G_SGSN. The SRNS shall add an identifier of the area where the message was received before passing the message to the 3G_SGSN.

235
236
237
238

3) The new 3G_SGSN sends SGSN Context Request (old RAI, old P-TMSI, New SGSN Address) to the old 2G_SGSN to get the MM and PDP contexts for the MS (The old RAI received from the MS is used to derive the old 2G_SGSN address). The old 2G_SGSN starts a timer for supervision of the MS's context and stops the transmission of N-PDUs to the MS.

- 239 4) The old 2G_SGSN responds with SGSN Context Response (MM Context, e.g. IMSI, PDP
240 Contexts, e.g. APN). Each PDP Context includes the GTP sequence number for the next
241 downlink N-PDU to be sent to the MS and the GTP sequence number for the next uplink
242 N-PDU to be tunnelled to the GGSN. Each PDP Context also includes the SNDCP Send
243 N-PDU Number for the next downlink N-PDU to be sent in acknowledged mode to the MS, the
244 SNDCP Receive N-PDU Number for the next uplink N-PDU to be received in acknowledged
245 mode from the MS. The new 3G_SGSN shall use the GTP sequence numbers for in-sequence
246 delivery over the Iu interface.
247 The new 3G_SGSN ~~uses the received SNDCP N-PDU sequence number for reliable data~~
248 ~~transmission (FFS)-converts the SNDCP numbers to RLC send and receive Ssequence~~
249 ~~Numbers (shifted left 4 times)-by adding the four most significant bits coded all 0.~~
- 250 5) Security functions may be executed.
- 251 6) The new 3G_SGSN request the SRNS to establish of a radio access bearer by sending RAB
252 Assignment Request (~~GTP SNDs, GTP SNUs, RLC SNDs, RLC SNU, RLC-UL and DL~~
253 ~~counters~~) to the SRNS. ~~The SRNS sends Radio Bearer Setup Request to the MS which -This~~
254 ~~message includes the next expected in-sequence last received UL N-PDU sequence number.~~
255 ~~The MS responds with Radio Bearer Setup Complete which includes the next expected in-~~
256 ~~sequence last received DL N-PDU sequence number.~~ The SRNS responds with RAB
257 Assignment Response.
258 ~~The SRNS shall discard all N-PDUs tunnelled from the 2G/3G_SGSN with N-PDU sequence~~
259 ~~numbers equal to or older than the DL N-PDU sequence number received from the MS. If this~~
260 ~~is not the case the N-PDU shall be transmitted to the MS. The MS shall discard all N-PDUs~~
261 ~~with sequence numbers equal to or older than the GTP-SNU UL N-PDU sequence number~~
262 ~~received from the SRNS. If this is not the case the N-PDU shall be transmitted to the SRNS.~~
- 263 7) The new 3G_SGSN sends a SGSN Context Acknowledge message to the old 2G_SGSN. This
264 informs the old 2G_SGSN that the new 3G_SGSN is ready to receive data packets belonging to
265 the activated PDP contexts. The old SGSN marks in its context that the MSC/VLR association
266 and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the
267 GGSNs, and the HLR to be updated if the MS initiates a routing area update procedure back to
268 the old SGSN before completing the ongoing routing area update procedure.
- 269 8) The old 2G_SGSN duplicates the buffered N-PDUs and starts tunnelling them to the new
270 3G_SGSN. ~~The 3G_SGSN shall ignore any SNDCP sequence numbers received with the~~
271 ~~tunnelled N-PDUs~~-Additional N-PDUs received from the GGSN before the timer described in
272 step 3 expires are also duplicated and tunnelled to the new 3G_SGSN. No N-PDUs shall be
273 forwarded to the new 3G_SGSN after expiry of the timer described in step 3.
- 274 9) The new 3G_SGSN sends a Update PDP Context Request (new SGSN Address, TID, QoS
275 Negotiated) to the GGSN (s) concerned. The GGSN (s) updates its PDP context fields and
276 returns Update PDP Context Response (TID).
- 277 10) The new 3G_SGSN informs the HLR of the change of SGSN by sending Update GPRS
278 Location (SGSN Number, SGSN Address, IMSI) to the HLR.
- 279 11) The HLR sends Cancel Location (IMSI, Cancellation Type) to the old 2G_SGSN. The old
280 2G_SGSN removes the MM and PDP contexts if the timer described in step 3 is not running.
281 When the timer is running the MM and PDP contexts are removed when the timer expires.
282 The old 2G_SGSN acknowledges with Cancel Location Ack (IMSI).
- 283 12) The HLR sends Insert Subscriber Data (IMSI, GPRS subscription data) to the new 3G_SGSN.
284 The 3G_SGSN constructs a MM context for the MS and returns an Insert Subscriber Data Ack
285 (IMSI) message to the HLR.
- 286 13) The HLR acknowledges the Update GPRS Location by sending Update Location Ack (IMSI)
287 to the new 3G_SGSN.
- 288 14) The new 3G_SGSN validate the MS's presence in the new RA. If due to roaming restrictions
289 the MS is not allowed to be attached in the 3G_SGSN, or if subscription checking fails, then
290 the new 3G_SGSN rejects the routing area update with an appropriate cause. If all checks are

291 successful then the new 3G_SGSN constructs MM and PDP contexts for the MS. A logical link
 292 is established between the new 3G_SGSN and the MS. The new 3G_SGSN responds to the MS
 293 with Routing Area Update Accept (P-TMSI, P-TMSI signature ~~Receive N PDU Number~~
 294 ~~(FFS)~~).

295 15) The MS acknowledges the new P-TMSI with a Routing Area Update Complete (~~P-TMSI,~~
 296 ~~Receive N PDU Number (FFS)~~).

297
 298 ~~The sequence applied for the intra SGSN RA update case is identical to the cell change within the~~
 299 ~~same RA case as shown in section 6.13.1.2 used with a different update type.~~

300 13.7 RNC for UMTS

301 RNC maintains RNC Context for CN-related information in PMM-CONNECTED state. RNC also
 302 contains RNC RAB contexts for activated RABs. Table 15. RNC Context shows the context fields for
 303 one MS.

304 **Table 15: RNC Context**

Field	Description
IMSI	IMSI is the main reference key.
Each RNC context contains one [FFS: zero or more?] or more RNC RAB contexts:	
NSAPI	Network layer Service Access Point Identifier.
TEID	Tunnel Endpoint Identifier
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
GTP_SND	GTP-U sequence number of the next downlink in-sequence N-PDU to be sent to the MS.
GTP_SNU	GTP-U sequence number of the next uplink in-sequence N-PDU to be sent to the GGSN.
RLC_SND	The next in-sequence RLC Sequence number to be sent to the MS
RLC_SNU	The next in-sequence RLC Sequence Number expected from the MS

305

CHANGE REQUEST		<small>Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.</small>	
23.060 CR 061r1		Current Version: 3.1.0	
<small>GSM (AA.BB) or 3G (AA.BBB) specification number ↑</small>		<small>↑ CR number as allocated by MCC support team</small>	
For submission to: TSG#6	for approval <input checked="" type="checkbox"/>	strategic <input checked="" type="checkbox"/>	<small>(for SMG use only)</small>
<small>list expected approval meeting # here ↑</small>	for information <input type="checkbox"/>	non-strategic <input type="checkbox"/>	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: Ericsson **Date:** 1999-12-01

Subject: Move of BSS Packet Flow Context Procedures

Work item: UMTS R99

Category:	F Correction <input checked="" type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked With an X)

Reason for change: In this CR, the BSS packet flow context procedures have been moved after the Create PDP Context Procedures to allow QoS negotiation with the GGSN to be taken into account when sending QoS profiles to the BSS. Also, the BSS packet flow procedures have been added to the Secondary PDP Context Activation Procedures.

Clauses affected: _____

Other specs Affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: _____ → List of CRs: _____ → List of CRs: _____ → List of CRs: _____ → List of CRs: _____
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Other comments: _____



help.doc

<----- double-click here for help and instructions on how to create a CR.

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1. Each step is explained in the following list.

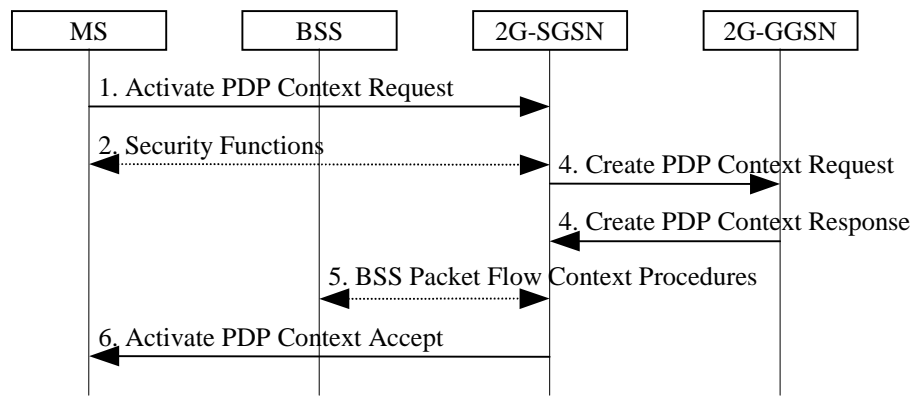


Figure 1: PDP Context Activation Procedure for GPRS

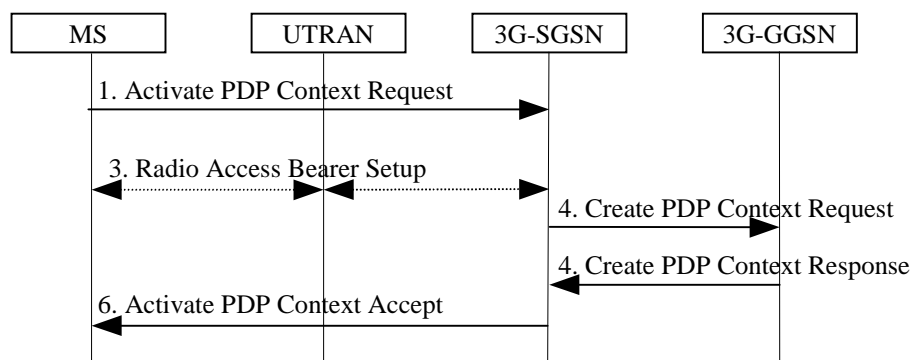


Figure 2: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) ~~For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".~~ For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.
- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

5) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

65) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

d) 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. All PDP contexts sharing the same PDP address are identified by one and the same TI but a unique NSAPI value.

The Secondary PDP Context Activation procedure associates a Traffic Flow Template (TFT) to the newly activated PDP context. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external 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. The procedure is illustrated in Figure 3. Each step is explained in the following list.

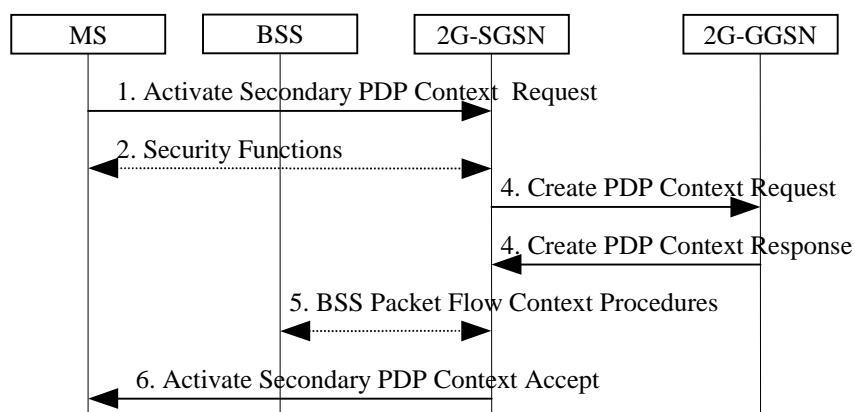


Figure 3: Secondary PDP Context Activation Procedure for GPRS

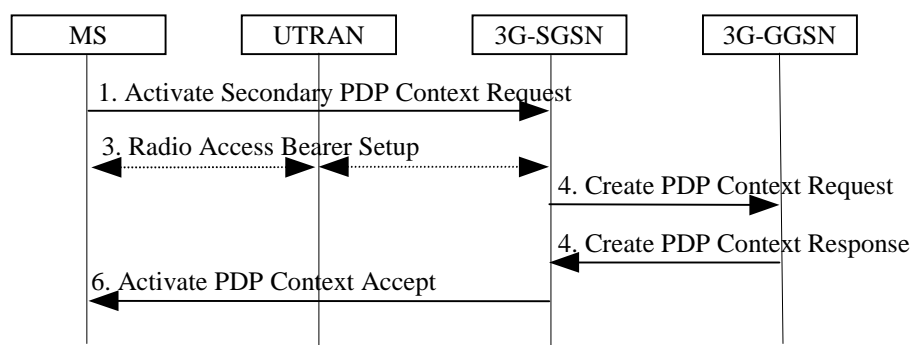


Figure 4: Secondary PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate Secondary PDP Context Request (NSAPI, TI, QoS Requested, TFT) message to the SGSN. 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 is the same TI used by the already-activated PDP context(s) for that PDP address, and NSAPI contains a value not used by any other activated PDP context.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.
- 4) The SGSN validates the Activate Secondary PDP Context Request using the 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TID, TFT) message to the affected GGSN. The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TID, BB Protocol, Reordering Required, QoS Negotiated, Cause) message to the SGSN.

5) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

64) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.

9.2.2.3 Anonymous Access PDP Context Activation Procedure

The MS can anonymously initiate PDP Context Activation in IDLE, STANDBY, and READY states. An existing MM context in the SGSN is neither required nor used in this case. Only dynamic PDP addressing is applicable.

The Anonymous Access PDP Context Activation procedure is illustrated in Figure 5. Each step is explained in the following list.

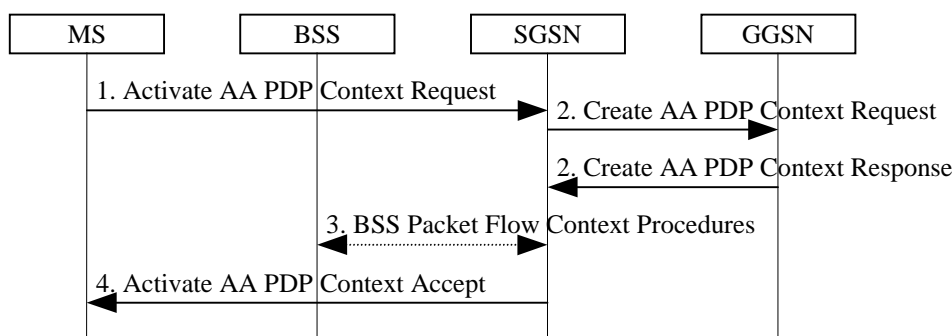


Figure 5: Anonymous Access PDP Context Activation Procedure

1) The MS sends an Activate AA PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use a Random TLLI at the RLC/MAC layer for identification purposes. The MS shall use PDP Address to indicate that it requires the use of a dynamic PDP address. The MS shall use Access Point Name to select a reference point to a certain external network that provides anonymous services. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.

2) BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

23) The SGSN may restrict the requested QoS value given its capabilities and the current load. The SGSN assigns an Auxiliary TLLI and creates an AA-TID for the PDP-Context. The SGSN sends a Create AA PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, AA-TID, Selection Mode, PDP Configuration Options) message to the GGSN indicated by Access Point Name in the Activate AA PDP Context Request message. Selection Mode indicates how the APN was selected. The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the server(s) that provide services for anonymous MSs, and to start charging. The GGSN may use Access Point Name to find an external network that provides anonymous services. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then allocates a dynamic PDP Address and returns a Create AA PDP Context Response (AA-TID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The GGSN shall check the source and destination address in all subsequent anonymous MO

PDP PDUs received from the SGSN. If the GGSN detects a not allowed address in an MO PDP PDU, then the PDP PDU shall be discarded and the MM and PDP contexts shall be deleted in the GGSN, SGSN, and MS, as defined in subclause "Anonymous Access PDP Context Deactivation Initiated by GGSN Procedure".

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create AA PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

3) BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

4) The SGSN inserts the NSAPI along with the PDP address received from the GGSN in its PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated and returns an Activate AA PDP Context Accept (A-TLLI, PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route anonymous PDP PDUs between the GGSN and the MS and to start charging.

After an SGSN has successfully updated the GGSN, the MM and PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the AA PDP Context Activation procedure fails or if the SGSN returns an Activate AA PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same GGSN up to a maximum number of attempts.

Other
comments:



9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1. Each step is explained in the following list.

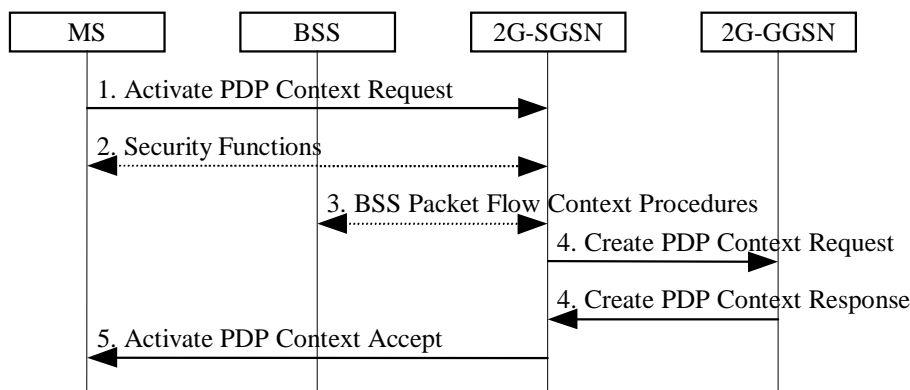


Figure 1: PDP Context Activation Procedure for GPRS

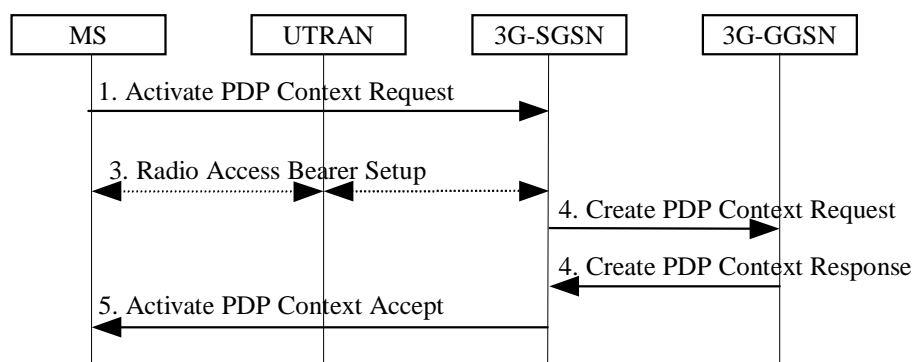


Figure 2: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options, Charging Characteristics) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode. Charging Characteristics indicates which kind of charging the PDP context is liable for. The SGSN shall copy Charging Characteristics from the Subscribed Charging Characteristics in the Packet Domain Subscription Data.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

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13 Information Storage

This clause describes information storage structures required for the packet domain, and the recovery and restoration procedures needed to maintain service if inconsistencies in databases occur and at lost or invalid database information.

13.1 HLR

IMSI is the prime key to the packet domain subscription data stored in the HLR. There may be several sets of packet domain subscription data per IMSI. This is illustrated in Figure 3.

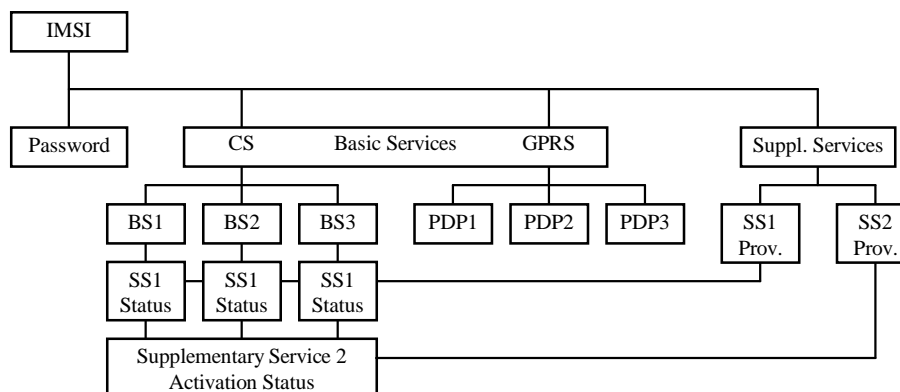


Figure 3: Packet Domain Subscription Data

As Figure 3 indicates, the packet domain subscription data is at the same level as basic services. Each PDP subscription is seen as a basic service. Supplementary services are provisioned as part of the overall subscription. Activation of SSs is either at the basic service level (SS1) or at the overall subscription level (SS2).

Table 1 shows the packet domain subscription data contained in the HLR.

Table 1: HLR Packet Domain Subscription Data

Field	Description	GPRS	UMTS
IMSI	IMSI is the main reference key.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
<u>Subscribed Charging Characteristics</u>	<u>The charging characteristics of the MS, e. g. normal subscription, prepaid subscription, flat rate subscription, and/or hot billing subscription.</u>	<u>X</u>	<u>X</u>
SGSN Number	The SS7 number of the SGSN currently serving this MS.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
MS PS Purged for	Indicates that the MM and PDP contexts of the MS are deleted from the SGSN.	X	X
MNRG	Indicates that the MS is not reachable through an SGSN, and that the MS is marked as not reachable at the SGSN and possibly at the GGSN.	X	X
GGSN-list	The GSN number and optional IP address pair related to the GGSN that shall be contacted when activity from the MS is detected and MNRG is set. The GSN number shall be either the number of the GGSN or the protocol-converting GSN as described in the subclauses "MAP-based GGSN - HLR Signalling" and "GTP and MAP-based GGSN - HLR Signalling".	X	X
Each IMSI contains zero or more of the following PDP context subscription records:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address. This field shall be empty if dynamic addressing is allowed.	X	X
Access Point Name	A label according to DNS naming conventions describing the access point to the external packet data network.	X	X
QoS Profile Subscribed	The quality of service profile subscribed. QoS Profile Subscribed is the default level if a particular QoS profile is not requested.	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

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 2 shows the context fields for one MS.

Table 2: SGSN MM and PDP Contexts

Field	Description	GPRS	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
Subscribed Charging Characteristics	The charging characteristics of the MS, e. g. normal subscription, prepaid subscription, flat rate subscription, and/or hot billing subscription.	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	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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
TFT [FFS]	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 downlink N-PDU to be sent	X	

	to the MS.		
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.	X	
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. Table 3 shows the context fields for one MS.

Table 3: SGSN MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
AA-TID	Anonymous Access Tunnel Identifier.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN currently used.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
GGSN Address in Use	The IP address of the GGSN currently used.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.
SND	GTP sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 4 shows the PDP context fields for one PDP Address.

Table 4: GGSN PDP Context

Field	Description	GPRS	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
<u>Charging Characteristics</u>	<u>The charging characteristics of the PDP context, e. g. normal, prepaid, flat rate, and/or hot billing.</u>	<u>X</u>	<u>X</u>
Reordering Required [FFS]	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.	X	X

If a PDP context is enabled for network-requested PDP context activation, then IMSI, PDP Type, PDP Address, SGSN Address and MNRG contain valid information also when the PDP context is inactive and when the MS is GPRS-detached.

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15 Operational Aspects

15.1 Charging

Charging information for the packet domain is collected for each MS by SGSNs and GGSNs that are serving the MS. The operator can control whether charging shall be collected in the SGSN and the GGSN on an individual MS basis by appropriately setting the Subscribed Charging Characteristics in the HLR subscription profile.

The information that the operator uses to generate a bill to a subscriber is operator-specific. Billing aspects, e.g., a regular fee for a fixed period, are outside the scope of the present document.

Every packet domain operator collects and processes their own charging information.

The SGSN collects charging information for each MS related with the radio network usage while the GGSN collects charging information for each MS related with the external data network usage. Both GSNs also collect charging information on usage of the network resources.

15.1.1 Charging Information

Charging information is collected for the PS subscriber.

As a minimum, the SGSN shall collect the following charging information for MSs which are liable for charging:

- usage of the radio interface: the charging information shall describe the amount of data transmitted in MO and MT directions categorised with QoS and user protocols;
- usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the packet data protocol addresses;
- usage of the general packet domain resources: the charging information shall describe the usage of other packet domain-related resources and the MS's network activity (e.g., mobility management); and
- location of MS: HPLMN, VPLMN, plus optional higher-accuracy location information.

As a minimum, the GGSN shall collect the following charging information for MSs which are liable for charging:

- destination and source: the charging information shall describe the destination and source addresses with a level of accuracy as defined by the packet domain operator;
- usage of the external data networks: the charging information shall describe the amount of data sent and received to and from the external data network; and
- usage of the packet data protocol addresses: the charging information shall describe how long the MS has used the PDP addresses.

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in ~~Figure 1~~ **Figure 4**. Each step is explained in the following list.

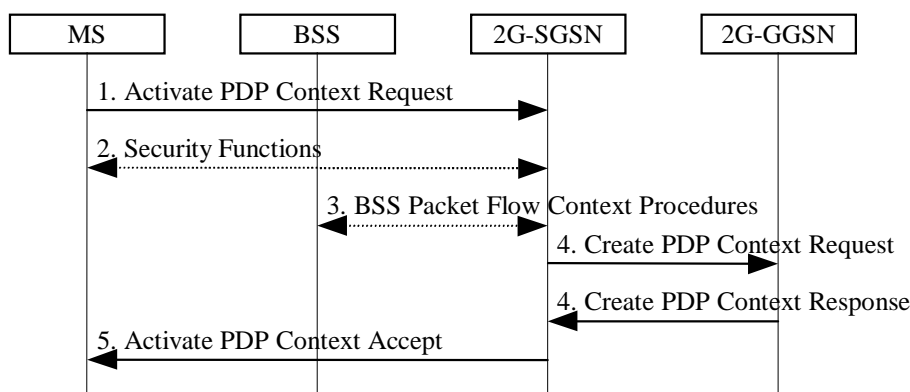


Figure 1: PDP Context Activation Procedure for GPRS

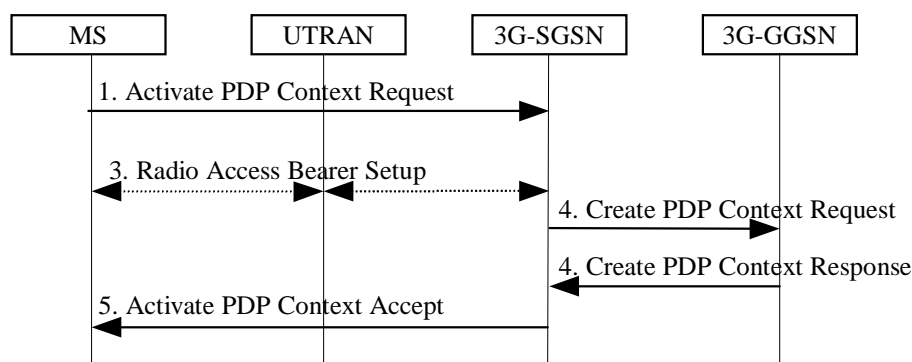


Figure 32: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options, Trace Reference, Trace Type, Trace Id, Initial OMC Identity, OMC Identity) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode. Trace Reference is allocated at trace activation and identifies a record or a collection of records for a particular trace. Trace Type indicates which kind of trace the MS is subject to. OMC Identity identifies the address where the trace record(s) should be sent. The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information. The Trace Id indicates the identity of the entity, which initiated the trace. The SGSN shall include Trace Reference, Trace Type, and OMC Identity in the message if GGSN trace is activated. The SGSN shall copy Trace Reference, Trace Type, and OMC Identity from the trace request sent by the HLR.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, BB Protocol, Reordering Required, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. Reordering Required indicates whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

< next modified section >

9.2.3 Modification Procedures

An MS or GGSN can request, or an SGSN can decide, possibly triggered by the HLR as explained in subclause "Insert Subscriber Data Procedure", to modify parameters that were negotiated during an activation procedure for one or several PDP contexts. The following parameters can be modified:

- QoS Negotiated;
- Radio Priority;
- Packet Flow Id; and
- PDP Address (in case of the GGSN-initiated modification procedure).

The SGSN can request the modification of parameters by sending a Modify PDP Context Request message to the MS.

A GGSN can request the modification of parameters by sending an Update PDP Context Request message to the SGSN.

An MS can request the modification of parameters by sending a Modify PDP Context Request message to the SGSN.

A trace may be activated while a PDP context is active. To enable trace activation in the GGSN, the SGSN shall send Update PDP Context Request to the GGSN. If PDP context modification is performed only to activate a trace, the SGSN shall not send Modify PDP Context Request to the MS.

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in ~~Figure 4~~ Figure 3. Each step is explained in the following list.

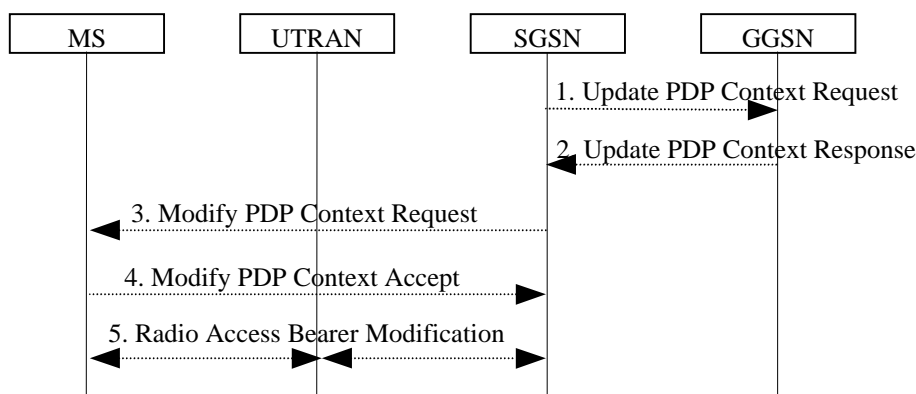


Figure 43: SGSN-Initiated PDP Context Modification Procedure

- 1) The SGSN may send an Update PDP Context Request (TID, QoS Negotiated, Trace Reference, Trace Type, Trigger Id, Initial OMC Identity, OMC Identity) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator. Trace Reference is allocated at trace activation and identifies a record or a collection of records for a particular trace. Trace Type indicates which kind of trace the MS is subject to. OMC Identity identifies the address where the trace record(s) should be sent. The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information. The Trace Id indicates the identity, which initiated the trace. The SGSN shall include Trace Reference, Trace Type, and OMC Identity in the message if

GGSN trace is activated while the PDP context is active. The SGSN shall copy Trace Reference, Trace Type, Trace Id, and OMC Identity from the trace request sent by the HLR.

- 2) The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TID, QoS Negotiated, Cause) message.
- 3) The SGSN may selects Radio Priority and Packet Flow Id based on QoS Negotiated, and may sends a Modify PDP Context Request (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.
- 4) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 5) The radio access bearer modification procedure may be executed.

< next modified section >

12.7.3.5.1 BSS Packet Flow Context Creation Procedure

On receiving a request to transmit an uplink or downlink LLC PDU for which no BSS packet flow context exists in the BSS, the BSS may request the download of the BSS packet flow context from the SGSN.

The SGSN may at any time request the creation of a BSS packet flow context, e.g., due to the activation of a PDP context.

The BSS Packet Flow Context Creation procedure is illustrated in Figure 6~~Figure 4~~. Each step is explained in the following list.

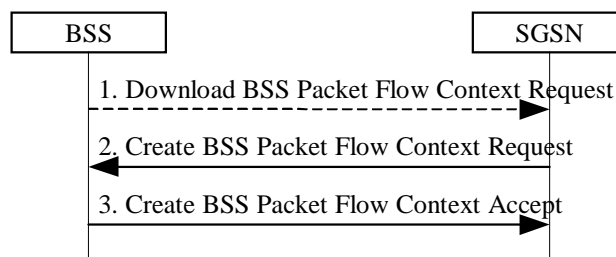


Figure 64: BSS Packet Flow Context Creation Procedure

- 1) The BSS receives a request to transfer an uplink or downlink user data LLC PDU for which it currently does not have a BSS packet flow context. In the uplink case, TLLI, Radio Priority, and Packet Flow Id are received from the MS as defined in GSM 04.60. In the downlink case, TLLI and Packet Flow Id are received from the SGSN as defined in GSM 08.18. If Packet Flow Id does not indicate best-effort service nor SMS, then the BSS sends a Download BSS Packet Flow Context Request (RAI, TLLI, Packet Flow Id) message to the SGSN. Until the BSS receives the BSS packet flow context, the BSS shall handle uplink and downlink transfers according to a default aggregate BSS QoS profile. For uplink transfers, the default profile is specific to the radio priority level.
- 2) The SGSN sends a Create BSS Packet Flow Context Request (IMSI, TLLI, Packet Flow Id, Aggregate BSS QoS Profile Requested, BSS Packet Flow Timer, Trace Reference, Trace Type, Trace Id, Initial OMC Identity, OMC Identity) message to the associated BSS. The SGSN shall include Trace Reference, Trace Type, Trace Id, Initial OMC Identity, and OMC Identity in the message if BSS trace is activated. The SGSN shall copy Trace Reference, Trace Type, Trace Id, Initial OMC Identity and OMC Identity from the trace request sent by the HLR.
- 3) The BSS may restrict the requested aggregate BSS QoS profile given its capabilities and the current load. The BSS creates a BSS packet flow context and inserts the parameters in its BSS context. The BSS returns a Create BSS Packet Flow Context Accept (IMSI, Packet Flow Id, Aggregate BSS QoS Profile Negotiated) message to the SGSN. The BSS uses the negotiated aggregate BSS QoS profile when allocating radio resources and other resources such as buffer capacity.

12.7.3.5.2 SGSN-Initiated BSS Packet Flow Context Modification Procedure

The SGSN may at any time request the modification of the contents of an existing BSS packet flow context, e.g., due to the activation, modification, or deactivation of a PDP context or due to the activation of a trace.

The SGSN-Initiated BSS Packet Flow Context Modification procedure is illustrated in Figure 8~~Figure 5~~. Each step is explained in the following list.

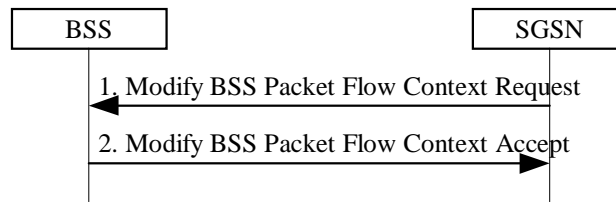


Figure 85: SGSN-Initiated BSS Packet Flow Context Modification Procedure

- 1) The SGSN sends a Modify BSS Packet Flow Context Request (IMSI, TLLI, Packet Flow Id, Aggregate BSS QoS Profile Requested, BSS Packet Flow Timer, Trace Reference, Trace Type, Trace Id, Initial OMC Identity, OMC Identity) message to the BSS. The SGSN shall include Trace Reference, Trace Type, Trace Id, Initial OMC Identity, and OMC Identity in the message if BSS trace is activated while the PDP context is active. The SGSN shall copy Trace Reference, Trace Type, Trace Id, Initial OMC Identity, and OMC Identity from the trace request sent by the HLR.
- 2) The BSS may restrict the requested aggregate BSS QoS profile given its capabilities and the current load. The BSS inserts the modified parameters in its BSS context. The BSS returns a Modify BSS Packet Flow Context Accept (IMSI, Packet Flow Id, Aggregate BSS QoS Profile Negotiated) message to the SGSN.

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13 Information Storage

This clause describes information storage structures required for the packet domain, and the recovery and restoration procedures needed to maintain service if inconsistencies in databases occur and at lost or invalid database information.

13.1 HLR

IMSI is the prime key to the packet domain subscription data stored in the HLR. There may be several sets of packet domain subscription data per IMSI. This is illustrated in Figure 10~~Figure 6~~.

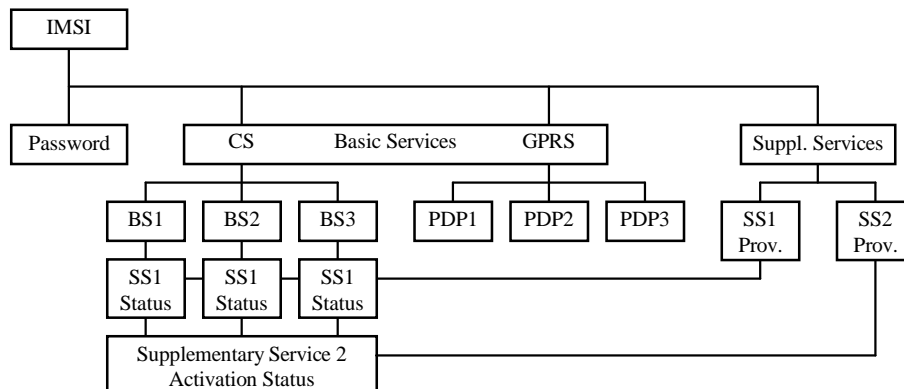


Figure 106: Packet Domain Subscription Data

As Figure 10 Figure 6 indicates, the packet domain subscription data is at the same level as basic services. Each PDP subscription is seen as a basic service. Supplementary services are provisioned as part of the overall subscription. Activation of SSs is either at the basic service level (SS1) or at the overall subscription level (SS2).

Table 1 shows the packet domain subscription data contained in the HLR.

Table 1: HLR Packet Domain Subscription Data

Field	Description	GPRS	UMTS
IMSI	IMSI is the main reference key.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
Trace Reference	The trace reference is allocated at trace activation and identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates which kind of trace the MS is subject to, e. g. MSC/BSS trace, HLR trace, and/or SGSN/GGSN/BSS trace.	X	X
Trace Id	The Trace Id indicates the identity of the entity, which initiated the trace.	X	X
Initial OMC Identity	The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information.	X	X
OMC Identity	The address where the trace record(s) should be sent.	X	X
Trace Activated in SGSN	Indicates that the trace is activated in the SGSN.	X	X
Trace Activated in GGSN	Indicates that the trace is activated in the GGSN.	X	X
SGSN Number	The SS7 number of the SGSN currently serving this MS.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
SMS Parameters	SMS-related parameters, e.g., operator-determined barring.	X	X
MS PS Purged for	Indicates that the MM and PDP contexts of the MS are deleted from the SGSN.	X	X
MNRG	Indicates that the MS is not reachable through an SGSN, and that the MS is marked as not reachable at the SGSN and possibly at the GGSN.	X	X
GGSN-list	The GSN number and optional IP address pair related to the GGSN that shall be contacted when activity from the MS is detected and MNRG is set. The GSN number shall be either the number of the GGSN or the protocol-converting GSN as described in the subclauses "MAP-based GGSN - HLR Signalling" and "GTP and MAP-based GGSN - HLR Signalling".	X	X
Each IMSI contains zero or more of the following PDP context subscription records:			
PDP Context Identifier	Index of the PDP context.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address. This field shall be empty if dynamic addressing is allowed.	X	X
Access Point Name	A label according to DNS naming conventions describing the access point to the external packet data network.	X	X
QoS Profile Subscribed	The quality of service profile subscribed. QoS Profile Subscribed is the default level if a particular QoS profile is not requested.	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

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 2 shows the context fields for one MS.

Table 2: SGSN MM and PDP Contexts

Field	Description	GPRS	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
Trace Reference	A trace reference is allocated at trace activation and identifies a record or a collection of records for a particular trace.	X	X
Trace Type	Indicates which kind of trace the MS is subject to.	X	X
Trace Id	The Trace Id indicates the identity of the entity, which initiated the trace.	X	X
Initial OMC Identity	The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information.	X	X
OMC Identity	The address where the trace record(s) should be sent.	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	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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

TFT [FFS]	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 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	
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
<u>Trace Reference</u>	<u>A trace reference is allocated at trace activation and identifies a record or a collection of records for a particular trace.</u>	<u>X</u>	<u>X</u>
<u>Trace Type</u>	<u>Indicates which kind of trace the MS is subject to.</u>	<u>X</u>	<u>X</u>
<u>Trace Id</u>	<u>The Trace Id indicates the identity of the entity, which initiated the trace.</u>	<u>X</u>	<u>X</u>
<u>Initial OMC Identity</u>	<u>The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information.</u>	<u>X</u>	<u>X</u>
<u>OMC Identity</u>	<u>The address where the trace record(s) should be sent.</u>	<u>X</u>	<u>X</u>
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. Table 3 shows the context fields for one MS.

Table 3: SGSN MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
AA-TID	Anonymous Access Tunnel Identifier.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN currently used.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
GGSN Address in Use	The IP address of the GGSN currently used.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.
SND	GTP sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 4 shows the PDP context fields for one PDP Address.

Table 4: GGSN PDP Context

Field	Description	GPRS	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Trace Reference	<u>A trace reference is allocated at trace activation and identifies a record or a collection of records for a particular trace.</u>	<u>X</u>	<u>X</u>
Trace Type	<u>Indicates which kind of trace the MS is subject to.</u>	<u>X</u>	<u>X</u>
Trace Id	<u>The Trace Id indicates the identity of the entity, which initiated the trace.</u>	<u>X</u>	<u>X</u>
Initial OMC Identity	<u>The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information.</u>	<u>X</u>	<u>X</u>
OMC Identity	The address where the trace record(s) should be sent.	X	X
Reordering Required [FFS]	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.	X	X

If a PDP context is enabled for network-requested PDP context activation, then IMSI, PDP Type, PDP Address, SGSN Address and MNRG contain valid information also when the PDP context is inactive and when the MS is GPRS-detached.

< next modified section >

13.6 BSS for GPRS

Table 5 shows the BSS context fields for one MS.

Table 5: BSS Context

Field	Description
IMSI	IMSI is the main reference key.
TLLI	Temporary Logical Link Identity.
Each BSS context contains one or more BSS Packet Flow contexts:	
Packet Flow Id	Packet flow identifier.
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for this packet flow.
BSS Packet Flow Timer	BSS packet flow context inactivity timer.
Trace Reference	<u>A trace reference is allocated at trace activation and identifies a record or a collection of records for a particular trace.</u>
Trace Type	<u>Indicates which kind of trace the MS is subject to.</u>
Trace Id	<u>The Trace Id indicates the identity of the entity, which initiated the trace.</u>
Initial OMC Identity	<u>The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information.</u>
OMC Identity	<u>The address where the trace record(s) should be sent.</u>

The BSS may store BSS contexts also in the anonymous access case. Table 6 shows the BSS context fields for one MS.

Table 6: BSS Context for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
Packet Flow Id	Packet flow identifier.
Aggregate BSS QoS Profile Negotiated	The aggregate BSS quality of service profile negotiated for this packet flow.
BSS Packet Flow Timer	BSS packet flow context inactivity timer.

13.7 RNC for UMTS

RNC maintains RNC Context for CN-related information in PMM-CONNECTED state. RNC also contains RNC RAB contexts for activated RABs. ~~Table 7: RNC Context~~ ~~Table 7: RNC Context~~ shows the context fields for one MS.

Table 7: RNC Context

Field	Description
IMSI	IMSI is the main reference key.
Each RNC context contains one [FFS: zero or more?] or more RNC RAB contexts:	
NSAPI	Network layer Service Access Point Identifier.
TEID	Tunnel Endpoint Identifier
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.
Trace Reference	<u>A trace reference is allocated at trace activation and identifies a record or a collection of records for a particular trace.</u>
Trace Type	<u>Indicates which kind of trace the MS is subject to.</u>
Trace Id	<u>The Trace Id indicates the identity of the entity, which initiated the trace.</u>
Initial OMC Identity	<u>The Initial OMC Identity identifies the original OMC that the local OMC should sent the trace information.</u>
OMC Identity	<u>The address where the trace record(s) should be sent.</u>

<h2 style="margin: 0;">CHANGE REQUEST</h2>		<small>Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.</small>	
23.060	CR	068r1	Current Version: 3.1.0
<small>GSM (AA.BB) or 3G (AA.BBB) specification number ↑</small>		<small>↑ CR number as allocated by MCC support team</small>	
For submission to: SA#6	for approval <input checked="" type="checkbox"/>	strategic <input type="checkbox"/>	<small>(for SMG use only)</small>
<small>list expected approval meeting # here ↑</small>	for information <input type="checkbox"/>	non-strategic <input type="checkbox"/>	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: Motorola **Date:** 30 Nov., 1999

Subject: BSS QoS involvement improvements

Work item: Enhanced QoS support in GPRS

Category:	F Correction <input checked="" type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: Some improvement have been proposed during the ongoing stage-3 work on enhanced QoS support in GPRS:

- A Packet Flow Id has been reserved for GMM and SM signalling.
- The Creation procedure is also used for SGSN-initiated Modification.

This CR reflects the corresponding stage-2 changes.

Clauses affected: 12.7.3.4 and 12.7.3.5.

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	GSM 08.18 A089.
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Other comments:



<----- double-click here for help and instructions on how to create a CR.

12.7.3.4 Flow Control Between SGSN and BSS over the Gb Interface

The flow control mechanism controls the loading of the BSS LLC PDU queues per BVCI and per MS between the SGSN and the BSS in the downlink direction. No flow control is performed in the uplink direction. Buffers and link capacity shall be dimensioned to avoid loss of uplink data.

The downlink flow control mechanism is based on the following principles:

- In the SGSN, queues for LLC PDUs are provided per BVCI. These queues may be split further, e.g., per MS or per ~~packet flow~~~~QoS delay class or precedence class~~. The SGSN shall pass LLC PDUs to LLC via BSSGP to the BSS as long as the allowed BSSGP throughput is not exceeded. The allowed BSSGP throughput is given per BVCI and for a single MS on that BVCI. The SGSN schedules the BSSGP downlink traffic of all MSs of a BVCI according to both throughput parameters and to the QoS profile related to each LLC PDU. The scheduling algorithm is implementation dependent.
- In the BSS, queues per BVCI are provided at the BSSGP level. These queues may be split further, e.g., per MS or per ~~packet flow~~~~QoS delay class or precedence class~~. Depending on the queuing conditions and the available radio resource capacity in the cell the BSS indicates the allowed BSSGP throughput per BVCI and the default allowed BSSGP throughput for each individual MS of that BVCI by BSSGP flow control messages to the SGSN. Additionally, the BSS may change the allowed BSSGP throughput for an individual MS by a BSSGP flow control message.

12.7.3.5 BSS Context

The SGSN can provide a BSS with information related to ongoing user data transmission. The information related to one MS is stored in a BSS context. The BSS may contain BSS contexts for several MSs. A BSS context contains a number of BSS packet flow contexts. Each BSS packet flow context is identified by a packet flow identifier assigned by the SGSN. A BSS packet flow context is shared by one or more activated PDP contexts with identical or similar negotiated QoS profiles. The data transmission related to PDP contexts that share the same BSS packet flow context constitute one packet flow.

~~Three~~~~no~~ packet flows are pre-defined, and identified by ~~three~~~~no~~ reserved packet flow identifier values. The BSS shall not negotiate BSS packet flow contexts for these pre-defined packet flows with the SGSN. One pre-defined packet flow is used for best-effort service, ~~and~~ one is used for SMS, ~~and one is used for signalling~~. The SGSN can assign the ~~best-effort or SMS~~ packet flow identifier to any PDP context, ~~and the BSS shall~~ ~~in the SMS~~ ~~is~~ case, ~~the BSS shall~~ handle the packet flow for ~~the~~ PDP context with the same QoS that it handles SMS with.

The combined BSS QoS profile for the PDP contexts that share the same packet flow is called the aggregate BSS QoS profile. The aggregate BSS QoS profile is considered to be a single parameter with multiple data transfer attributes as defined in subclause "Quality of Service Profile". It defines the QoS that must be provided by the BSS for a given packet flow between the MS and the SGSN, i.e., for the Um and Gb interfaces combined. The aggregate BSS QoS profile is negotiated between the SGSN and the BSS.

A BSS packet flow timer indicates the maximum time that the BSS may store the BSS packet flow context. The BSS packet flow timer shall not exceed the value of the READY timer for this MS. The BSS packet flow timer is started when the BSS packet flow context is stored in the BSS and when an LLC frame is received from the MS. When the BSS packet flow timer expires the BSS shall delete the BSS packet flow context.

When a PDP context is activated, modified, or deactivated, the SGSN may create, modify, or delete BSS packet flow contexts.

12.7.3.5.1 BSS Packet Flow Context Creation Procedure

On receiving a request to transmit an uplink or downlink LLC PDU for which no BSS packet flow context exists in the BSS, the BSS may request the download of the BSS packet flow context from the SGSN.

The SGSN may at any time request the creation of a BSS packet flow context, e.g., due to the activation of a PDP context.

The BSS Packet Flow Context Creation procedure is illustrated in Figure 1. Each step is explained in the following list.

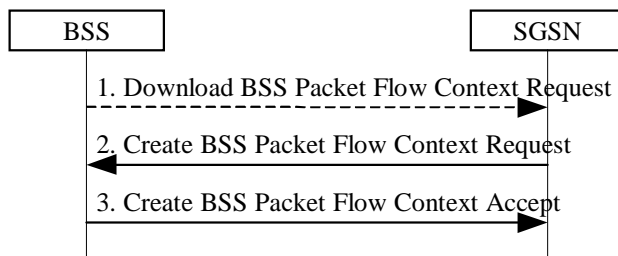


Figure 1: BSS Packet Flow Context Creation Procedure

- 1) The BSS receives a request to transfer an uplink or downlink user data LLC PDU for which it currently does not have a BSS packet flow context. In the uplink case, TLLI, Radio Priority, and Packet Flow Id are received from the MS as defined in GSM 04.60. In the downlink case, TLLI and Packet Flow Id are received from the SGSN as defined in GSM 08.18. If Packet Flow Id does not indicate best-effort service nor SMS, then the BSS sends a Download BSS Packet Flow Context Request (RAI, TLLI, Packet Flow Id) message to the SGSN. Until the BSS receives the BSS packet flow context, the BSS shall handle uplink and downlink transfers according to a default aggregate BSS QoS profile. For uplink transfers, the default profile is specific to the radio priority level.
- 2) The SGSN sends a Create BSS Packet Flow Context Request (IMSI, TLLI, Packet Flow Id, Aggregate BSS QoS Profile Requested, BSS Packet Flow Timer) message to the associated BSS.
- 3) The BSS may restrict the requested aggregate BSS QoS profile given its capabilities and the current load. The BSS creates a BSS packet flow context and inserts the parameters in its BSS context. The BSS returns a Create BSS Packet Flow Context Accept (IMSI, Packet Flow Id, Aggregate BSS QoS Profile Negotiated) message to the SGSN. The BSS uses the negotiated aggregate BSS QoS profile when allocating radio resources and other resources such as buffer capacity.

12.7.3.5.2 SGSN-Initiated BSS Packet Flow Context Modification Procedure

The SGSN may at any time request the modification of the contents of an existing BSS packet flow context, e.g., due to the activation, modification, or deactivation of a PDP context. The BSS Packet Flow Context Creation procedure shall be used in this case, and the BSS shall instead of creating a BSS packet flow context overwrite the existing parameters with the modified parameters.

The SGSN may at any time request the modification of the contents of an existing BSS packet flow context, e.g., due to the activation, modification, or deactivation of a PDP context.

The SGSN-Initiated BSS Packet Flow Context Modification procedure is illustrated in Figure 83. Each step is explained in the following list.

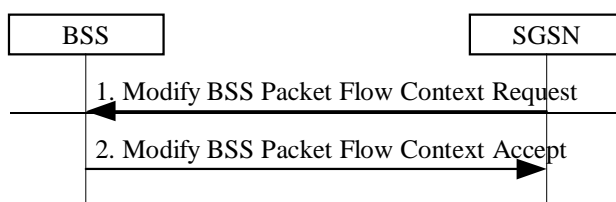


Figure 83: SGSN-Initiated BSS Packet Flow Context Modification Procedure

- 1) The SGSN sends a Modify BSS Packet Flow Context Request (IMSI, TLLI, Packet Flow Id, Aggregate BSS QoS Profile Requested, BSS Packet Flow Timer) message to the BSS.
- 2) The BSS may restrict the requested aggregate BSS QoS profile given its capabilities and the current load. The BSS inserts the modified parameters in its BSS context. The BSS returns a Modify BSS Packet Flow Context Accept (IMSI, Packet Flow Id, Aggregate BSS QoS Profile Negotiated) message to the SGSN.

12.7.3.5.3 BSS-Initiated BSS Packet Flow Context Modification Procedure

The BSS can at any time request modification of the contents of an existing BSS packet flow context, e.g., due to a change in the resource availability at the BSS.

The BSS-Initiated BSS Packet Flow Context Modification procedure is illustrated in Figure 3. Each step is explained in the following list.

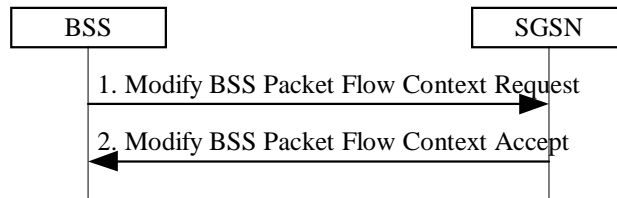


Figure 3: BSS-Initiated BSS Packet Flow Context Modification Procedure

- 1) The BSS sends a Modify BSS Packet Flow Context Request (IMSI, Packet Flow Id, Aggregate BSS QoS Profile Requested) message to the SGSN.
- 2) The SGSN may restrict the requested aggregate BSS QoS profile given its capabilities and the current load. The SGSN returns a Modify BSS Packet Flow Context Accept (IMSI, TLLI, Packet Flow Id, Aggregate BSS QoS Profile Negotiated, BSS Packet Flow Timer) message to the BSS. The BSS inserts the modified parameters in its BSS context.

12.7.3.5.4 BSS Packet Flow Context Deletion Procedures

The BSS can, due to e.g., memory restrictions, at any time delete a BSS packet flow context without notifying the SGSN.

The SGSN may request the deletion of a BSS packet flow context with the SGSN-Initiated BSS Packet Flow Context Deletion procedure, as illustrated in Figure 4. Each step is explained in the following list.

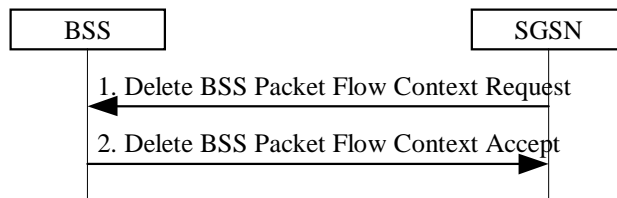


Figure 4: SGSN-Initiated BSS Packet Flow Context Deletion Procedure

- 1) The SGSN sends a Delete BSS Packet Flow Context Request (IMSI, Packet Flow Id) message to the BSS. The BSS deletes the corresponding BSS packet flow context from its BSS context.
- 2) The BSS returns a Delete BSS Packet Flow Context Accept (TLLI, Packet Flow Id) message to the SGSN.

5.4.5 GPRS Mobile Stations

A GPRS MS can operate in one of three modes of operation. The mode of operation depends on the services that the MS is attached to, i.e., only GPRS or both GPRS and other GSM services, and upon the MS's capabilities to operate GPRS and other GSM services simultaneously.

- Class-A mode of operation: The MS is attached to both GPRS and other GSM services, and the MS supports simultaneous operation of GPRS and other GSM services.
- Class-B mode of operation: The MS is attached to both GPRS and other GSM services, but the MS can only operate one set of services at a time. ~~In network operation mode III (see subclause "Paging Co-ordination"), an MS that is capable of monitoring only one paging channel at a time cannot operate in class B mode of operation. In this case, such an MS shall revert to class C mode of operation.~~
- Class-C mode of operation: The MS is exclusively attached to GPRS services.

The three modes of operation are defined in GSM 02.60.

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

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

23.060 CR 070_{r1}

Current Version: **3.1.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑

↑ CR number as allocated by MCC support team

For submission to: **TSG SA #6**
list expected approval meeting # here
↑

for approval
for information

strategic
non-strategic (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG

The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: Nokia, Ericsson, Siemens AG

Date: 19.11.99

Subject: Usage of TI in the secondary PDP context activation procedure

Work item: ????

Category:	F Correction	<input checked="" type="checkbox"/>	Release:	Phase 2	<input type="checkbox"/>
<i>(only one category shall be marked with an X)</i>	A Corresponds to a correction in an earlier release	<input type="checkbox"/>		Release 96	<input type="checkbox"/>
	B Addition of feature	<input type="checkbox"/>		Release 97	<input type="checkbox"/>
	C Functional modification of feature	<input type="checkbox"/>		Release 98	<input type="checkbox"/>
	D Editorial modification	<input type="checkbox"/>		Release 99	<input checked="" type="checkbox"/>
				Release 00	<input type="checkbox"/>

Reason for change:

In the current definition of the secondary PDP context activation procedure, the secondary context has the same TI value as the primary context, but a different NSAPI. With this definition a PDP context is only uniquely identified by the TI and the NSAPI value. In consequence to this definition, most of the existing SM messages need the NSAPI as additional parameter. In the general L3 message definition given in 24.007 and 24.008 the TI is the general mechanism to uniquely identify a "instance" within a L3 entity. The concept of the TI as the unique identifier within an L3 entity allows the receiver to determine for which instance the message is related without checking the message contents itself. This concept also allows a general error handling in order to detect whether a message received is related to an existing L3 instance or not.

Because there is no dependency between the primary and the secondary PDP context (the secondary context could be active while the primary is deactivated already again), the linkage between the secondary and the primary context needs only to be indicated during the activation of the secondary context.

As there is no need to couple the TI and the NSAPI this CR proposes to assign a new TI value upon each secondary PDP context activation instead of using the TI of the primary context in combination with a new NSAPI.

Clauses affected: 9.2.2.1.1

<u>Other specs affected:</u>	Other 3G core specifications	<input checked="" type="checkbox"/>	→ List of CRs:	CR 24.008-033
	Other GSM core specifications	<input type="checkbox"/>	→ List of CRs:	
	MS test specifications	<input type="checkbox"/>	→ List of CRs:	
	BSS test specifications	<input type="checkbox"/>	→ List of CRs:	
	O&M specifications	<input type="checkbox"/>	→ List of CRs:	

**Other
comments:**

This CR is agreed on the condition that the TI number space is extended in 24.008, as agreed by TSG CN1 in 24.007 CR 001r1.

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 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 subclause "PDP Context Activation, Modification, and Deactivation Functions". All PDP contexts of a subscriber are associated with the same MM context for the IMSI of that subscriber.

9.2 PDP Context Activation, Modification, and Deactivation Functions

A PS-attached MS can initiate these functions at any time in order to activate, modify, or deactivate a PDP context in the MS, the SGSN, and the GGSN. A GGSN may request the activation of a PDP context to a PS-attached subscriber. A GGSN may initiate the deactivation of a PDP context.

NOTE: If the MS is in PMM-IDLE state, it needs to perform a service request procedure to enter the PMM-CONNECTED state before initiating these procedure.

Upon receiving an Activate PDP Context Request message or an Activate Secondary PDP Context Request message, the SGSN shall initiate procedures to set up PDP contexts. The first procedure includes subscription checking, APN selection, and host configuration, while the the latter procedure excludes these functions and reuses PDP context parameters including the PDP address but except the QoS parameters. **Once activated, all PDP contexts are managed equally.** At least one PDP context shall be activated for a PDP address before a Secondary PDP Context Activation procedure may be initiated.

Upon receiving a Deactivate PDP Context Request message, the SGSN shall initiate procedures to deactivate the PDP context. When the last PDP context associated with a PDP address is deactivated, then N-PDU transfer for this PDP address is disabled.

An MS does not have to receive the (De-)Activate PDP Context Accept message before issuing another (De-)Activate PDP Context Request. However, only one request can be outstanding for every NSAPI.

First modified section

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. ~~All PDP contexts sharing the same PDP address are identified by one and the same TI but a unique NSAPI value.~~

~~Each PDP context sharing the same PDP address is identified by a unique TI.~~

The Secondary PDP Context Activation procedure associates a Traffic Flow Template (TFT) to the newly activated PDP context. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external 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. The procedure is illustrated in Figure 1. Each step is explained in the following list.

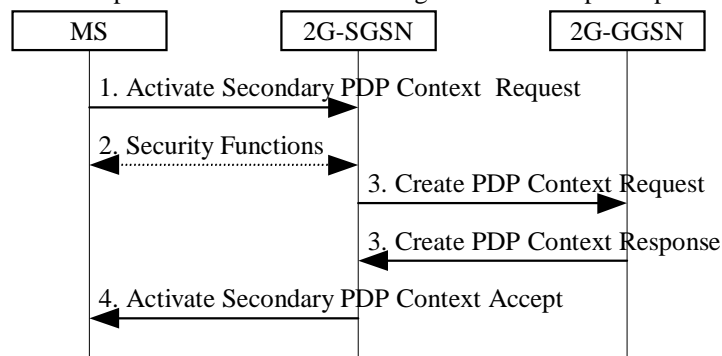


Figure 1: Secondary PDP Context Activation Procedure for GPRS

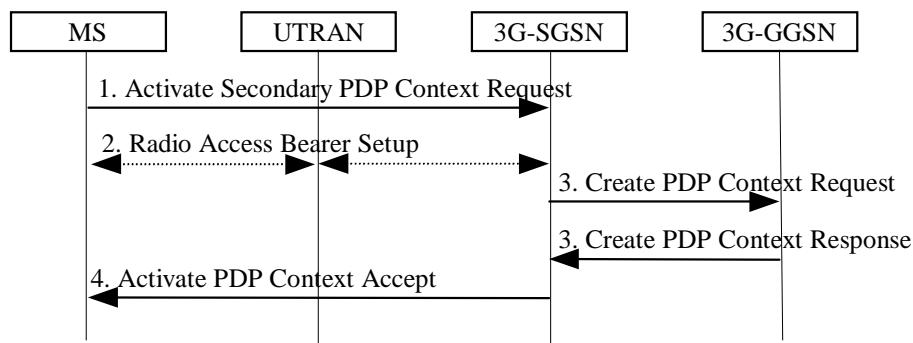


Figure 2: Secondary PDP Context Activation Procedure for UMTS

1) The MS sends an Activate Secondary PDP Context Request ([Linked TI](#), NSAPI, TI, QoS Requested, TFT) message to the SGSN. [Linked TI indicates the TI value assigned to one of the already activated PDP contexts.](#) 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 is the same TI used by the already activated PDP context\(s\) for that PDP address, and TI and NSAPI contains a-values](#) not used by any other activated PDP context.

2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

For UMTS, , the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TID, TFT) message to the affected GGSN. The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TID, BB Protocol, Reordering Required, QoS Negotiated, Cause) message to the SGSN.

4) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, [NSAPI](#), QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.

9.2.3 Modification Procedures

An MS or GGSN can request, or an SGSN can decide, possibly triggered by the HLR as explained in subclause "Insert Subscriber Data Procedure", to modify parameters that were negotiated during an activation procedure for one or several PDP contexts. The following parameters can be modified:

- QoS Negotiated;
- Radio Priority;
- Packet Flow Id; and
- PDP Address (in case of the GGSN-initiated modification procedure).

The SGSN can request the modification of parameters by sending a Modify PDP Context Request message to the MS.

A GGSN can request the modification of parameters by sending an Update PDP Context Request message to the SGSN.

An MS can request the modification of parameters by sending a Modify PDP Context Request message to the SGSN.

9.2.3.1 SGSN-Initiated PDP Context Modification Procedure

The SGSN-Initiated PDP Context Modification procedure is illustrated in Figure 3. Each step is explained in the following list.

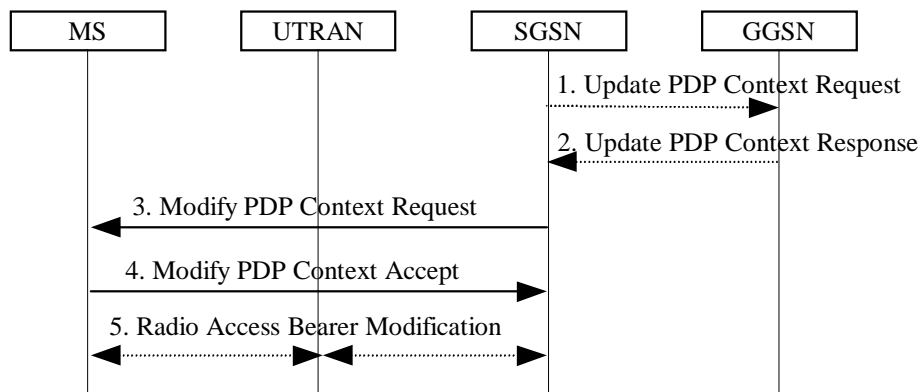


Figure 3: SGSN-Initiated PDP Context Modification Procedure

- 1) The SGSN may send an Update PDP Context Request (TID, QoS Negotiated) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.
- 2) The GGSN may restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TID, QoS Negotiated) message.
- 3) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, ~~NSAPI~~, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.
- 4) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 5) The radio access bearer modification procedure may be executed.

9.2.3.2 GGSN-Initiated PDP Context Modification Procedure

The GGSN-Initiated PDP Context Modification procedure is illustrated in Figure 4. Each step is explained in the following list.

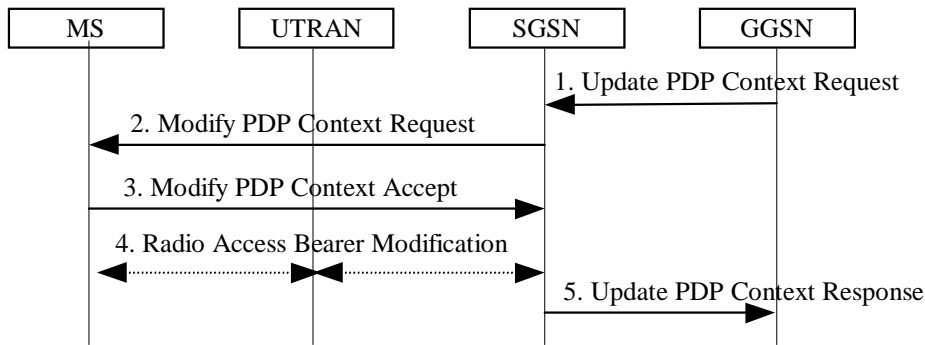


Figure 4: GGSN-Initiated PDP Context Modification Procedure

- 1) The GGSN sends an Update PDP Context Request (TID, PDP Address, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile. PDP Address is optional.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, the current QoS profile, and the subscribed QoS profile. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and sends a Modify PDP Context Request (TI, ~~NSAPI~~, PDP Address, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. PDP Address is optional.
- 3) The MS acknowledges by returning a Modify PDP Context Accept message. If the MS does not accept the new QoS Negotiated it shall instead de-activate the PDP context with the PDP Context Deactivation Initiated by MS procedure.
- 4) For UMTS, the radio access bearer modification procedure may be executed.
- 5) Upon receipt of the Modify PDP Context Accept message, or upon completion of the RAB modification procedure, the SGSN returns an Update PDP Context Response (TID, QoS Negotiated) message to the GGSN. If the SGSN receives a Deactivate PDP Context Request message, it shall instead follow the PDP Context Deactivation Initiated by MS procedure.

9.2.3.3 MS-Initiated PDP Context Modification Procedure

The MS-Initiated PDP Context Modification procedure is illustrated in Figure 5. Each step is explained in the following list.

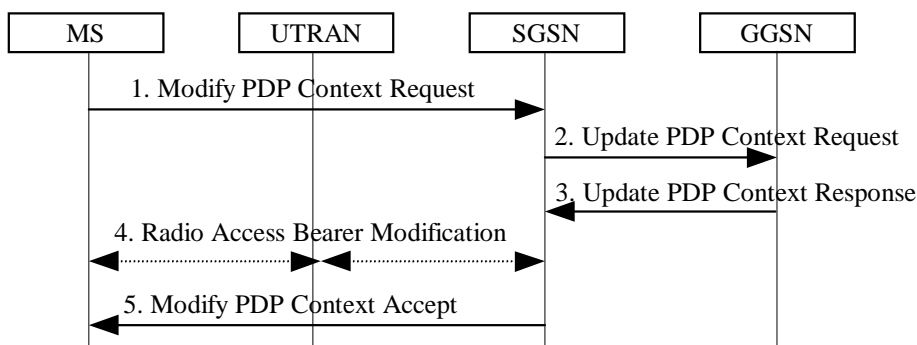


Figure 5: MS-Initiated PDP Context Modification Procedure

- 1) The MS sends a Modify PDP Context Request (TI, ~~NSAPI~~, QoS Requested) message to the SGSN. QoS Requested indicates the desired QoS profile.
- 2) The SGSN may restrict the desired QoS profile given its capabilities, the current load, and the subscribed QoS profile. The SGSN sends an Update PDP Context Request (TID, QoS Negotiated) message to the GGSN. If QoS Negotiated received from the SGSN is incompatible with the PDP context being modified (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Update PDP Context Request. The compatible QoS profiles are configured by the GGSN operator.
- 3) The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN stores QoS Negotiated and returns an Update PDP Context Response (TID, QoS Negotiated) message.

- 4) For UMTS, the radio access bearer modification procedure may be executed.
- 5) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns a Modify PDP Context Accept (TI, ~~NSAPI~~, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS.

NOTE: If the SGSN does not accept QoS Requested, then steps 2 and 3 of this procedure are skipped, and the existing QoS Negotiated is returned to the MS in step 4.

9.2.4 Deactivation Procedures

9.2.4.1 PDP Context Deactivation Initiated by MS Procedure

The PDP Context Deactivation Initiated by MS procedure is illustrated in Figure 6. Each step is explained in the following list.

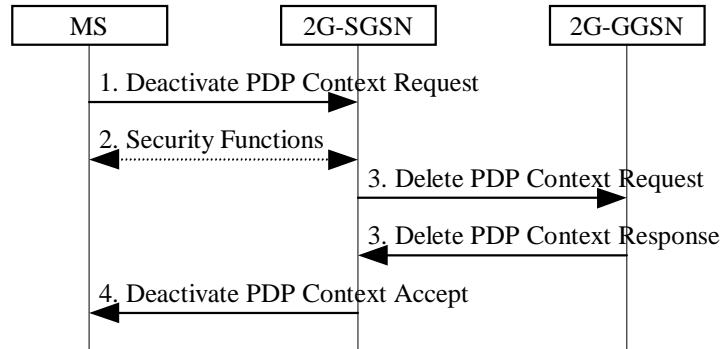


Figure 6: PDP Context Deactivation Initiated by MS Procedure for GPRS

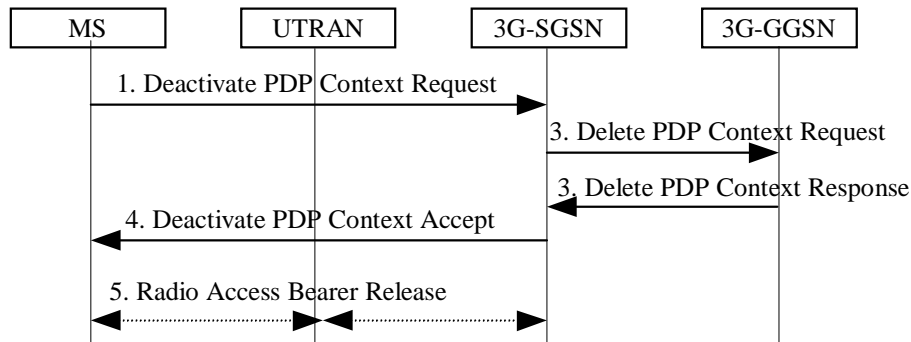


Figure 7: PDP Context Deactivation Initiated by MS Procedure for UMTS

- 1) The MS sends a Deactivate PDP Context Request (TI, ~~NSAPI~~ Teardown Ind) message to the SGSN.
- 2) For GPRS security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) The SGSN sends a Delete PDP Context Request (TID, Teardown Ind) message to the GGSN. If ~~the Teardown Ind NSAPI~~ was ~~not~~ included by the MS in the Deactivate PDP Context Request message, then the SGSN deactivates all PDP contexts associated with this ~~TI and~~ PDP address by including Teardown Ind in the Delete PDP Context Request message. The GGSN removes the PDP context(s) and returns a Delete PDP Context Response (TID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network.
- 4) The SGSN returns a Deactivate PDP Context Accept (TI, ~~NSAPI~~) message to the MS.
- 5) For UMTS, the radio access bearer release procedure is executed.

At GPRS detach, all PDP contexts for the MS are implicitly deactivated.

If the SGSN receives a Deactivate PDP Context Request (TI) message for a PDP context that is currently being activated, then the SGSN shall stop the PDP Context Activation procedure without responding to the MS, and continue with the PDP Context Deactivation initiated by MS procedure.

9.2.4.2 PDP Context Deactivation Initiated by SGSN Procedure

The PDP Context Deactivation Initiated by SGSN procedure is illustrated in Figure 8. Each step is explained in the following list.

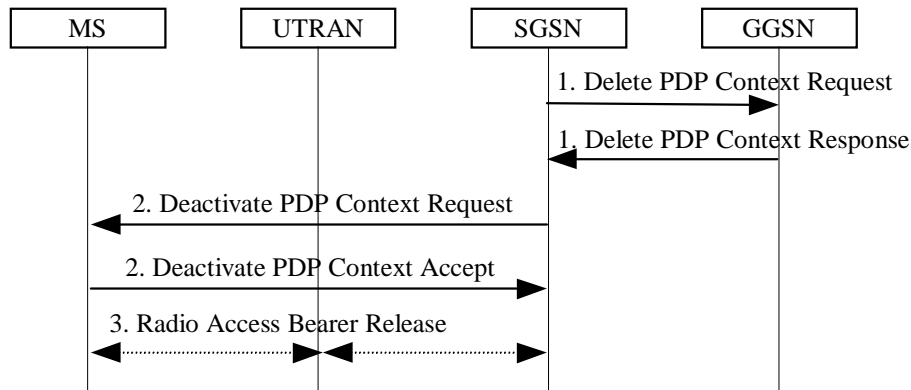


Figure 8: PDP Context Deactivation Initiated by SGSN Procedure

- 1) The SGSN sends a Delete PDP Context Request (TID, Teardown Ind) message to the GGSN. If Teardown Ind is included by the SGSN, then the GGSN deactivates all PDP contexts associated with this PDP address. The GGSN removes the PDP context and returns a Delete PDP Context Response (TID) message to the SGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the GGSN before sending the Deactivate PDP Context Request message.
- 2) The SGSN sends a Deactivate PDP Context Request (TI, ~~NSAPI~~ Teardown Ind) message to the MS. If ~~the Teardown Ind NSAPI~~ is ~~not~~ included, then all PDP contexts associated with this ~~TI and~~ PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, ~~Teardown Ind NSAPI~~) message to the SGSN. ~~NSAPI Teardown Ind~~ is included if received from the SGSN.
- 3) For UMTS, the radio access bearer release procedure is executed.

9.2.4.3 PDP Context Deactivation Initiated by GGSN Procedure

The PDP Context Deactivation Initiated by GGSN procedure is illustrated in Figure 9. Each step is explained in the following list.

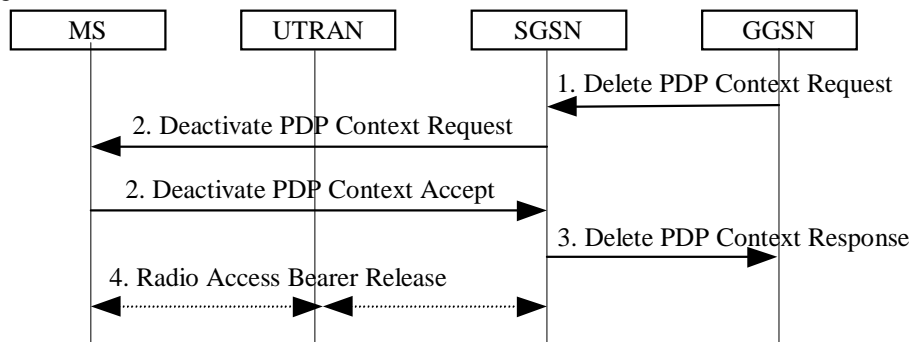


Figure 9: PDP Context Deactivation Initiated by GGSN Procedure

- 1) The GGSN sends a Delete PDP Context Request (TID, Teardown Ind) message to the SGSN. Teardown Ind indicates whether or not all PDP contexts associated with this PDP address shall be deactivated.
- 2) The SGSN sends a Deactivate PDP Context Request (TI, ~~NSAPI~~ Teardown Ind) message to the MS. If ~~the Teardown Ind NSAPI~~ was ~~not~~ included by the SGSN, then all PDP contexts associated with this ~~TI and~~ PDP address are deactivated. The MS removes the PDP context(s) and returns a Deactivate PDP Context Accept (TI, ~~Teardown Ind NSAPI~~) message to the SGSN. ~~NSAPI Teardown Ind~~ is included if received from the SGSN.

- 3) The SGSN returns a Delete PDP Context Response (TID, Teardown Ind) message to the GGSN. If the MS was using a dynamic PDP address allocated by the GGSN, and if the context being deactivated is the last PDP context associated with this PDP address, then the GGSN releases this PDP address and makes it available for subsequent activation by other MSs. The Delete PDP Context messages are sent over the backbone network. The SGSN may not wait for the response from the MS before sending the Delete PDP Context Response message.
- 3) For UMTS, the radio access bearer release procedure is executed.

CHANGE REQUEST		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.	
23.060	CR	071	Current Version: 3.1.0
GSM (AA.BB) or 3G (AA.BBB) specification number ↑		↑ CR number as allocated by MCC support team	
For submission to: <input style="width: 100px;" type="text"/> <i>list expected approval meeting # here ↑</i>	for approval for information	<input checked="" type="checkbox"/> <input type="checkbox"/>	strategic <input type="checkbox"/> non-strategic <input type="checkbox"/> (for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: **Date:**

Subject:

Work item:

Category:	F Correction <input type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input checked="" type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change:

Clauses affected:

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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Other comments:



<----- double-click here for help and instructions on how to create a CR.

5.3.4 Logical Link Management Functions for GPRS

~~[The UMTS signalling connection could also be considered as a logical link. Should it be describe here?]~~

Logical link management functions are concerned with the maintenance of a communication channel between an individual MS and the PLMN across the radio interface. These functions involve the co-ordination of link state information between the MS and the PLMN as well as the supervision of data transfer activity over the logical link.

Refer to GSM 04.64 [15] for further information.

5.3.4.1 Logical Link Establishment Function

Logical link establishment is performed when the MS attaches to the PS services.

5.3.4.2 Logical Link Maintenance Functions

Logical link maintenance functions supervise the logical link status and control link state changes.

5.3.4.3 Logical Link Release Function

The logical link release function is used to de-allocate resources associated with the logical link connection.

5.4.1 Packet Domain Core Network Nodes

A GPRS Support Node (GSN) contains functionality required to support GPRS and/or to support UMTS packet domain functionality. In one PLMN, there may be more than one GSN.

The Gateway GPRS Support Node (GGSN) is the node that is accessed by the packet data network due to evaluation of the PDP address. It contains routing information for attached GPRS users. The routing information is used to tunnel N-PDUs to the MS's current point of attachment, i.e., the Serving GPRS Support Node. The GGSN may request location information from the HLR via the optional Gc interface. The GGSN is the first point of PDN interconnection with a GSM PLMN supporting GPRS (i.e., the Gi reference point is supported by the GGSN). GGSN functionality is common for GPRS and for the UMTS packet domain.

The Serving GPRS Support Node (SGSN) is the node that is serving the MS. The SGSN supports GPRS (i.e., the Gb interface is supported by the SGSN) and/or UMTS (i.e., the Iu interface is supported by the SGSN). At GPRS attach, the SGSN establishes a mobility management context containing information pertaining to e.g., mobility and security for the MS. At PDP Context Activation, the SGSN establishes a PDP context, to be used for routing purposes, with the GGSN that the subscriber will be using.

The SGSN and GGSN functionalities may be combined in the same physical node, or they may reside in different physical nodes. SGSN and GGSN contain IP or other (operator's selection, e.g., ATM-SVC routing functionality, and they may be interconnected with IP routers. When SGSN and GGSN are in different PLMNs, they are interconnected via the Gp interface. The Gp interface provides the functionality of the Gn interface, plus security functionality required for inter-PLMN communication. The security functionality is based on mutual agreements between operators.

The SGSN may send location information to the MSC/VLR via the optional Gs interface. The ~~IPPS: 2G-}SGSN~~ may receive paging requests from the MSC/VLR via the Gs interface.

5.6.2 User Plane for UMTS

5.6.2.1 MS – GGSN

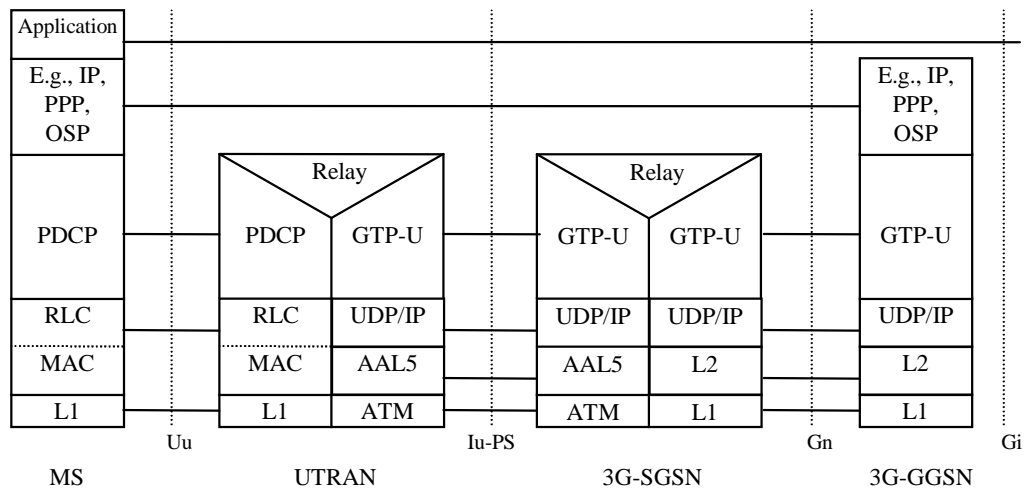


Figure 1: User Plane for UMTS

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, OSP, 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 UMTS 25.323.

NOTE: Unlike in GPRS, user data compression is not supported in UMTS, 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.

- GPRS Tunnelling Protocol for the user plane (GTP-U): This protocol tunnels user data between UTRAN and the 3G-SGSN, and between the GSNs in the backbone network. All PDP PDUs shall be encapsulated by GTP. GTP is specified in UMTS 29.060.
- UDP/IP: These are the backbone network protocols used for routing user data and control signalling.
- 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 UMTS 25.322.
- Asynchronous Transfer Mode (ATM): Information to transmit is divided into the cell of the fixed size (53octet), and multiplexing is done and transmitted. ATM is specified in ITU-T Recommendation I.361 "B-ISDN ATM Layer Specification".
- Medium Access Control (MAC): The Medium Access Control function controls the access signalling (request and grant) procedures for the radio channel. MAC is specified in UMTS 25.321.

[Add text for ATM and MAC.]

5.6.2.2 GSN – GSN

This user plane is the same as for GPRS, see subclause "GSN – GSN" above.

CHANGE REQUEST		<small>Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.</small>	
23.060 CR 074		Current Version: 3.1.0	
<small>GSM (AA.BB) or 3G (AA.BBB) specification number ↑</small>		<small>↑ CR number as allocated by MCC support team</small>	
For submission to: TSG#6	for approval <input checked="" type="checkbox"/>	strategic <input checked="" type="checkbox"/>	<small>(for SMG use only)</small>
<small>list expected approval meeting # here ↑</small>	for information <input type="checkbox"/>	non-strategic <input type="checkbox"/>	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: NTT COMMUNICATIONWARE **Date:** 1999-11-29

Subject: UTRAN Registration Area Identity and Cell Identity

Work item: UMTS R99

Category:	F Correction	<input type="checkbox"/>	Release:	Phase 2	<input type="checkbox"/>
<small>(only one category shall be marked with an X)</small>	A Corresponds to a correction in an earlier release	<input type="checkbox"/>		Release 96	<input type="checkbox"/>
	B Addition of feature	<input type="checkbox"/>		Release 97	<input type="checkbox"/>
	C Functional modification of feature	<input type="checkbox"/>		Release 98	<input type="checkbox"/>
	D Editorial modification	<input checked="" type="checkbox"/>		Release 99	<input checked="" type="checkbox"/>
				Release 00	<input type="checkbox"/>

Reason for change: This CR proposes the modification of the description of UTRAN Registration Area Identity (URA Id) and Cell Identity. CI and CGI are only for GPRS. The descriptions of URA Id and Cell identifier for UMTS should be referred to UTRAN Specifications (TS 25.401 and TS 25.331) in detail.

Clauses affected: 14.6, 14.7, 14.8

Other specs affected:	Other 3G core specifications	<input type="checkbox"/>	→ List of CRs:	
	Other GSM core specifications	<input type="checkbox"/>	→ List of CRs:	
	MS test specifications	<input type="checkbox"/>	→ List of CRs:	
	BSS test specifications	<input type="checkbox"/>	→ List of CRs:	
	O&M specifications	<input type="checkbox"/>	→ List of CRs:	

Other comments:



<----- double-click here for help and instructions on how to create a CR.

14.6 Routing Area Identity

Routing Area Identity (RAI), defined by an operator, identifies one or several cells. In GPRS, RAI is broadcast as system information. In UMTS, RAI is broadcast to MSs in RRC Idle mode, and is notified to MSs in RRC Connected mode on established RRC connections as MM system information.

The location of an MS in STANDBY or PMM-IDLE state is known in the SGSN on an RA level. Cells that do not support packet-domain services within an LA are grouped into a null RA. The MS is paged for packet services in the RA where the MS is located when mobile-terminated traffic arrives in the SGSN. The MS is paged for circuit-switched services by the SGSN in the last known RA plus in the null RA.

NOTE: Cells not supporting GPRS and served by a BSC without a Gb interface should not be included in the same location area as cells not supporting GPRS and served by a BSC with a Gb interface.

A Routing Area is a subset of one, and only one, Location Area (LA), meaning that an RA cannot span more than one LA. An RA is served by only one SGSN.

The following rules apply for the Routing Area Identity:

- RAC is only unique when presented together with LAI.
- CI is only unique when presented together with LAI or RAI. (GPRS only)
- LAI = MCC + MNC + LAC
- RAI = MCC + MNC + LAC + RAC
- CGI = LAI + CI (GPRS only)

14.7 UTRAN Registration Area Identity for UMTS

~~Gives the identity of the UTRAN Registration Area.~~ UTRAN Registration Area Identity (URA Id) which identifies a UTRAN Registration Area (UTRAN) is defined in UMTS 25.331. It can be used to indicate to the MS which URA it shall use in case of overlapping URAs.

~~[This definition does not seem useful, more text is needed.]~~

14.8 Cell Identity

~~In GPRS,~~ Cell Identity (CI) identifies one cell. CI is defined in UMTS 23.003.

~~In UMTS, the cell identifier (C-Id) which is used to uniquely identify a cell within an RNS is defined in UMTS 25.401. The C-Id together with the identifier of the controlling RNC (CRNC Id) constitutes the UTRAN Cell Identity (UC Id), and is used to uniquely identify the cell within UTRAN. UC Id and C-Id is used to identify a cell on the UTRAN Iub, Iur, and Iu interfaces.~~

~~— UC Id = RNC Id + C Id~~

14.9 GSN Addresses

14.9.1 GSN Address

Each SGSN and GGSN shall have an IP address, either of type IPv4 or IPv6, for inter-communication over the backbone network. The IP addresses of GSNs and other backbone nodes of all PLMNs build a private address space that is not accessible from the public Internet. For the GGSN and the SGSN, this IP address may also correspond to one or more DNS-type logical GSN names.

14.9.2 GSN Number

Each SGSN shall have an SGSN number for communication with e.g., HLR and EIR.

Each GGSN that supports the optional SS7-based Gc interface shall have a GGSN number for communication with HLRs.

14.10 RNC Addresses

~~[The Cell Identity subclause above uses CRNC-Id which needs to be defined here.]~~

14.10.1 RNC Address

Each RNC shall have one or more IP addresses, either of type IPv4 or IPv6, for inter-communication over the Iu interface.

14.10.2 RNC Number

Each RNC shall have an RNC number for inter-communication over the Iu interface.

14.11 Access Point Name

In the backbone, Access Point Name is a reference to the GGSN to be used. In addition, Access Point Name may, in the GGSN, identify the external network and optionally a service to be offered. Access Point Name is composed of two parts as defined in UMTS 23.003:

- The APN Network Identifier is mandatory and is a label (for example "corporation" or "service") or a set of labels separated by dots which is a fully qualified domain name according to the DNS naming conventions (for example "company.com" or "service.company.com"). In order to guarantee the uniqueness of the APN, the packet-domain PLMN should allocate, to an ISP or corporation, an APN Network Identifier identical to their domain name in the public Internet. The APN Network Identifier shall not end with ".gprs". An APN Network Identifier that consists of 3 or more labels and that starts with a Reserved Service Label, or an APN Network Identifier that consists of a Reserved Service Label alone, shall indicate that for this APN the GGSN supports additional services such as external PDN address allocation or Mobile IP support. Reserved Service Labels, e.g., "dhcp" or "MIPv4FA", and the corresponding services that they stand for, e.g., external PDN address allocation via DHCP, or Mobile IP Foreign Agent support, are to be agreed among operators.
- The APN Operator Identifier is optional. It is a fully qualified domain name according to the DNS naming conventions, and consists of three labels. The APN Operator Identifier shall end in ".gprs". For example, it may be "MNCyyy.MCCzzz.gprs". The exact format is defined in UMTS 29.060.

The APN stored in the HLR shall not contain the APN Operator Identifier. A wild card may be stored in the HLR instead of the APN. This wild card indicates that the user may select an APN that is not stored in the HLR. The use of the wild card is described in annex A.

CHANGE REQUEST		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.	
23.060 CR 075r2		Current Version: 3.1.0	
GSM (AA.BB) or 3G (AA.BBB) specification number ↑		↑ CR number as allocated by MCC support team	
For submission to: TSG#6 <i>list expected approval meeting # here ↑</i>	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	strategic <input checked="" type="checkbox"/> non-strategic <input type="checkbox"/>	<i>(for SMG use only)</i>

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: NTT COMMUNICATIONWARE **Date:** 1999-11-29

Subject: necessity of cell identity and cell identity age in 3G-SGSN MM context

Work item: UMTS R99

Category:	F Correction <input checked="" type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: This CR proposes the necessity of cell identity and cell identity age in 3G-SGSN MM context. In UMTS, since the cell structure within a RAN is to be kept invisible to the Core Network, cell can not be used for the indication of areas smaller than Location Area over Iu. Therefore, the concept of Service Area Identity (SAI) which consists of MCC, MNC, LAC and SAC introduced and was agreed at R3. 3G-SGSN can know SAI when the initial UE message is received or location report procedure is executed. In 3G-SGSN, SAC parameter and the age is necessary for e.g. CAMEL. Therefore, this CR proposes SAC and SAC age information in 3G-SGSN MM context.

Clauses affected: 13.2, 14.9

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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Other comments:



<----- double-click here for help and instructions on how to create a CR.

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 1 shows the context fields for one MS.

Table 1: SGSN MM and PDP Contexts

Field	Description	GPRS	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	{FFS}
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	{FFS}
Service Area Code	Last known service area code when initial UE message was received or Location report procedure was executed		X
Service Area Code Age	Time elapsed since the last service area code was received at 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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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
TFT [FFS]	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 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	
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

14.8 Cell Identity

Cell Identity (CI) identifies one cell. CI is defined in UMTS 23.003.

In UMTS, the cell identifier (C-Id) is used to uniquely identify a cell within an RNS. The C-Id together with the identifier of the controlling RNC (CRNC-Id) constitutes the UTRAN Cell Identity (UC-Id), and is used to uniquely identify the cell within UTRAN. UC-Id and C-Id is used to identify a cell on the UTRAN Iub, Iur, and Iu interfaces.

- UC-Id = RNC-Id + C-Id

14.9 Service Area Identity

The Service Area Identifier (SAI) is used to uniquely identify an area consisting of one or more cells belonging to the same Location Area. Such an area is called a Service Area and can be used for indicating the location of a MS to the CN.

The Service Area Code (SAC) together with the PLMN-Id and the LAC will constitute the Service Area Identifier.

$$\text{SAI} = \text{MCC} + \text{MNC} + \text{LAC} + \text{SAC}$$

14.109 GSN Addresses

14.109.1 GSN Address

14.109.2 GSN Number

14.110 RNC Addresses

14.110.1 RNC Address

14.110.2 RNC Number

14.124 Access Point Name

CHANGE REQUEST		<small>Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.</small>	
23.060 CR 076		Current Version: 3.1.0	
<small>GSM (AA.BB) or 3G (AA.BBB) specification number ↑</small>		<small>↑ CR number as allocated by MCC support team</small>	
For submission to: TSG#6	for approval <input checked="" type="checkbox"/>	strategic <input checked="" type="checkbox"/>	<small>(for SMG use only)</small>
<small>list expected approval meeting # here ↑</small>	for information <input type="checkbox"/>	non-strategic <input type="checkbox"/>	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: NTT COMMUNICATIONWARE **Date:** 1999-11-29

Subject: Deletion of TFT in 3G-SGSN PDP context

Work item: UMTS R99

Category:	F Correction	<input checked="" type="checkbox"/>	Release:	Phase 2	<input type="checkbox"/>
<small>(only one category shall be marked with an X)</small>	A Corresponds to a correction in an earlier release	<input type="checkbox"/>		Release 96	<input type="checkbox"/>
	B Addition of feature	<input type="checkbox"/>		Release 97	<input type="checkbox"/>
	C Functional modification of feature	<input type="checkbox"/>		Release 98	<input type="checkbox"/>
	D Editorial modification	<input type="checkbox"/>		Release 99	<input checked="" type="checkbox"/>
				Release 00	<input type="checkbox"/>

Reason for change: TFT is necessary for edge nodes, e.g. MS and GGSN, and is not necessary for SGSN. This CR proposes the deletion of TFT in 3G-SGSN PDP context.

Clauses affected: 13.2

Other specs affected:	Other 3G core specifications	<input type="checkbox"/>	→ List of CRs:	
	Other GSM core specifications	<input type="checkbox"/>	→ List of CRs:	
	MS test specifications	<input type="checkbox"/>	→ List of CRs:	
	BSS test specifications	<input type="checkbox"/>	→ List of CRs:	
	O&M specifications	<input type="checkbox"/>	→ List of CRs:	

Other comments:



<----- double-click here for help and instructions on how to create a CR.

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 1 shows the context fields for one MS.

Table 1: SGSN MM and PDP Contexts

Field	Description	GPRS	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	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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
TFT [FFS]	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 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	

SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

CHANGE REQUEST		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.	
23.060 CR 077		Current Version: 3.1.0	
GSM (AA.BB) or 3G (AA.BBB) specification number ↑		↑ CR number as allocated by MCC support team	
For submission to: TSG#6 <small>list expected approval meeting # here ↑</small>	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	strategic <input checked="" type="checkbox"/> non-strategic <input type="checkbox"/>	(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: NTT COMMUNICATIONWARE **Date:** 1999-11-29

Subject: The number of RNC RAB contexts in a RNC context

Work item: UMTS R99

Category:	F Correction <input checked="" type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: In the case of no Radio Access Bearer, there is no RNC RAB contexts in a RNC context. This CR proposes that each RNC context contains zero or more RNC RAB contexts.

Clauses affected: 13.7

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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Other comments:



<----- double-click here for help and instructions on how to create a CR.

13.7 RNC for UMTS

RNC maintains RNC Context for CN-related information in PMM-CONNECTED state. RNC also contains RNC RAB contexts for activated RABs. Table 1: RNC Context shows the context fields for one MS.

Table 1: RNC Context

Field	Description
IMSI	IMSI is the main reference key.
Each RNC context contains one [FFS: zero or more?] or more RNC RAB contexts:	
NSAPI	Network layer Service Access Point Identifier.
TEID	Tunnel Endpoint Identifier
GGSN Address in Use	The IP address of the SGSN currently used.
QoS Profile Negotiated	The quality of service profile negotiated for this RAB.

CHANGE REQUEST		Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.	
23.060 CR 078r1		Current Version: 3.1.0	
GSM (AA.BB) or 3G (AA.BBB) specification number ↑		↑ CR number as allocated by MCC support team	
For submission to: TSG#6 <small>list expected approval meeting # here ↑</small>	for approval <input checked="" type="checkbox"/>	strategic <input checked="" type="checkbox"/>	<small>(for SMG use only)</small>
	For information <input type="checkbox"/>	non-strategic <input type="checkbox"/>	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: NTT COMMUNICATIONWARE **Date:** 1999-11-29

Subject: The usage of reordering required parameter

Work item: UMTS R99

Category:	F Correction <input type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input checked="" type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change:

In release 99 system, delivery order attribute in QoS profile is used as the same meaning of reordering required parameter in release 97/98. Therefore, SGSN, GGSN and RNC shall reorder out of sequence T-PDUs based on this requested attribute, so that the reordering required parameter is unnecessary in the create PDP context activation procedure. The reordering required field in SGSN and GGSN PDP context is also unnecessary.

In UMTS, RNC and GGSN shall reorder out of sequence T-PDUs when in sequence delivery is required for PDP context. Furthermore, this is optional at the SGSN in UMTS based on N2 agreement (see N2-99F92).

This CR proposes the deletion of reordering required parameter in create PDP context accept message, and the deletion of this parameter field in SGSN and GGSN PDP context.

Clauses affected:

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: → List of CRs: → List of CRs: → List of CRs:	
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Other comments:



help.doc

<----- double-click here for help and instructions on how to create a CR.

9.2.2 Activation Procedures

9.2.2.1 PDP Context Activation Procedure

The PDP Context Activation procedure is illustrated in Figure 1. Each step is explained in the following list.

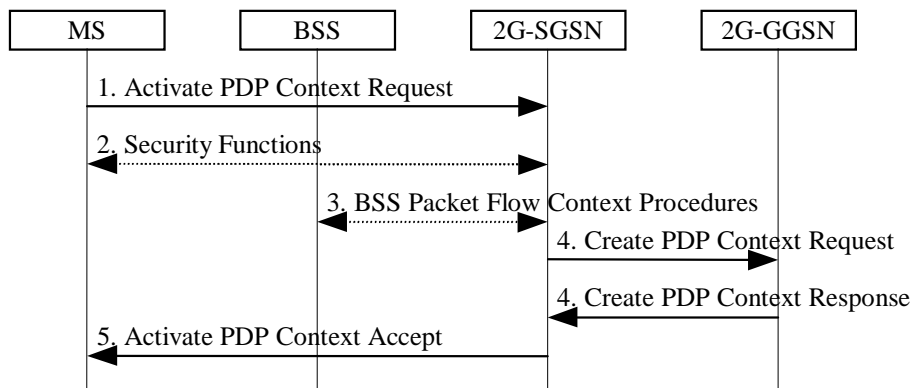


Figure 1: PDP Context Activation Procedure for GPRS

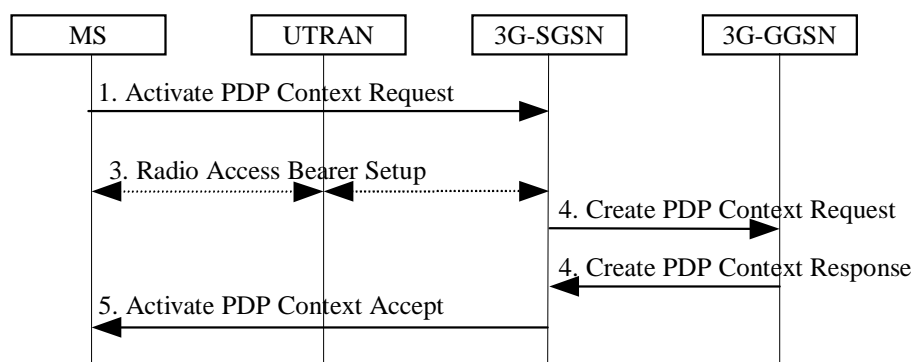


Figure 2: PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN. The MS shall use PDP Address to indicate whether it requires the use of a static PDP address or whether it requires the use of a dynamic PDP address. The MS shall leave PDP Address empty to request a dynamic PDP address. The MS may use Access Point Name to select a reference point to a certain external network and/or to select a service. Access Point Name is a logical name referring to the external packet data network and/or to a service that the subscriber wishes to connect to. QoS Requested indicates the desired QoS profile. PDP Configuration Options may be used to request optional PDP parameters from the GGSN (see GSM 09.60). PDP Configuration Options is sent transparently through the SGSN.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".
- 3) For GPRS, BSS packet flow context procedures may be executed. These procedures are defined in subclause "BSS Context".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 4) The SGSN validates the Activate PDP Context Request using PDP Type (optional), PDP Address (optional), and Access Point Name (optional) provided by the MS and the PDP context subscription records. The validation criteria, the APN selection criteria, and the mapping from APN to a GGSN are described in annex A.

If no GGSN address can be derived or if the SGSN has determined that the Activate PDP Context Request is not valid according to the rules described in annex A, then the SGSN rejects the PDP context activation request.

If a GGSN address can be derived, the SGSN creates a TID for the requested PDP context by combining the IMSI stored in the MM context with the NSAPI received from the MS. If the MS requests a dynamic address, then the SGSN lets a GGSN allocate the dynamic address. The SGSN may restrict the requested QoS attributes given its capabilities, the current load, and the subscribed QoS profile.

[TEID is studied under N2. The impact should be clarified in 23.060.]

The SGSN sends a Create PDP Context Request (PDP Type, PDP Address, Access Point Name, QoS Negotiated, TID, MSISDN, Selection Mode, PDP Configuration Options) message to the affected GGSN. Access Point Name shall be the APN Network Identifier of the APN selected according to the procedure described in annex A. PDP Address shall be empty if a dynamic address is requested. The GGSN may use Access Point Name to find an external network and optionally to activate a service for this APN. Selection Mode indicates whether a subscribed APN was selected, or whether a non-subscribed APN sent by MS or a non-subscribed APN chosen by SGSN was selected. Selection Mode is set according to annex A. The GGSN may use Selection Mode when deciding whether to accept or reject the PDP context activation. For example, if an APN requires subscription, then the GGSN is configured to accept only the PDP context activation that requests a subscribed APN as indicated by the SGSN with Selection Mode.

The GGSN creates a new entry in its PDP context table and generates a Charging Id. The new entry allows the GGSN to route PDP PDUs between the SGSN and the external PDP network, and to start charging. The GGSN may further restrict QoS Negotiated given its capabilities and the current load. The GGSN then returns a Create PDP Context Response (TID, PDP Address, BB Protocol, ~~Reordering Required~~, PDP Configuration Options, QoS Negotiated, Charging Id, Cause) message to the SGSN. PDP Address is included if the GGSN allocated a PDP address. If the GGSN has been configured by the operator to use External PDN Address Allocation for the requested APN, then PDP Address shall be set to 0.0.0.0, indicating that the PDP address shall be negotiated by the MS with the external PDN after completion of the PDP Context Activation procedure. The GGSN shall relay, modify, and monitor these negotiations as long as the PDP context is in ACTIVE state and use the GGSN-Initiated PDP Context Modification procedure to transfer the currently-used PDP address to the SGSN and the MS. BB Protocol indicates whether TCP or UDP shall be used to transport user data on the backbone network between the SGSN and GGSN. ~~Reordering Required~~ indicates whether the SGSN shall reorder N PDUs before delivering the N PDUs to the MS. PDP Configuration Options contain optional PDP parameters that the GGSN may transfer to the MS. These optional PDP parameters may be requested by the MS in the Activate PDP Context Request message, or may be sent unsolicited by the GGSN. PDP Configuration Options is sent transparently through the SGSN. The Create PDP Context messages are sent over the backbone network.

If QoS Negotiated received from the SGSN is incompatible with the PDP context being activated (e.g., the reliability class is insufficient to support the PDP type), then the GGSN rejects the Create PDP Context Request message. The compatible QoS profiles are configured by the GGSN operator.

- 5) The SGSN inserts the NSAPI along with the GGSN address in its PDP context. If the MS has requested a dynamic address, the PDP address received from the GGSN is inserted in the PDP context. The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate PDP Context Accept (PDP Type, PDP Address, TI, QoS Negotiated, Radio Priority, Packet Flow Id, PDP Configuration Options) message to the MS. The SGSN is now able to route PDP PDUs between the GGSN and the MS, and to start charging.

For each PDP Address a different quality of service (QoS) profile may be requested. For example, some PDP addresses may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are reflected in the QoS profile. The QoS profile is defined in subclause "Quality of Service Profile". If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the QoS profile as close as possible to the requested QoS profile. The MS either accepts the negotiated QoS profile, or deactivates the PDP context.

After an SGSN has successfully updated the GGSN, the PDP contexts associated with an MS is distributed as shown in clause "Information Storage".

If the PDP Context Activation Procedure fails or if the SGSN returns an Activate PDP Context Reject (Cause, PDP Configuration Options) message, then the MS may attempt another activation to the same APN up to a maximum number of attempts.

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. All PDP contexts sharing the same PDP address are identified by one and the same TI but a unique NSAPI value.

The Secondary PDP Context Activation procedure associates a Traffic Flow Template (TFT) to the newly activated PDP context. The TFT contains attributes that specify an IP header filter that is used to direct data packets received from the interconnected external 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. The procedure is illustrated in Figure 3. Each step is explained in the following list.

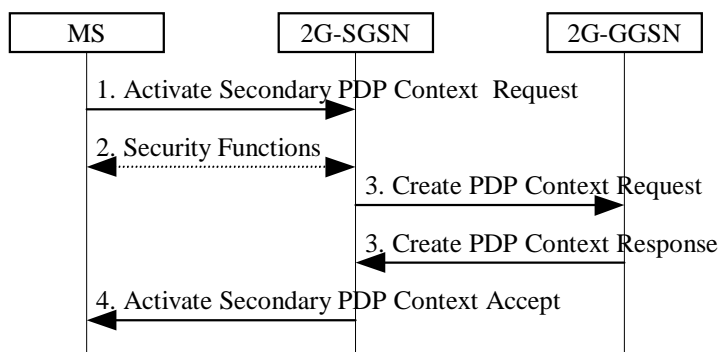


Figure 3: Secondary PDP Context Activation Procedure for GPRS

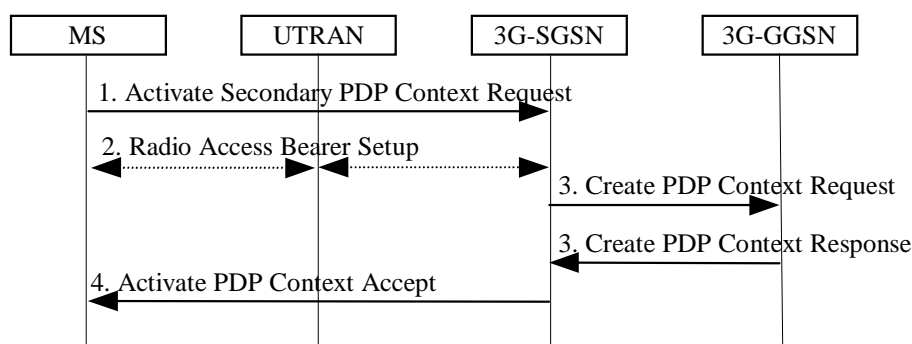


Figure 4: Secondary PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate Secondary PDP Context Request (NSAPI, TI, QoS Requested, TFT) message to the SGSN. 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 is the same TI used by the already-activated PDP context(s) for that PDP address, and NSAPI contains a value not used by any other activated PDP context.

- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

For UMTS, the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 3) The SGSN validates the Activate Secondary PDP Context Request using the 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TID, TFT) message to the affected GGSN. The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TID, BB Protocol, ~~Reordering Required~~, QoS Negotiated, Cause) message to the SGSN.

- 4) The SGSN selects Radio Priority and Packet Flow Id based on QoS Negotiated, and returns an Activate Secondary PDP Context Accept (TI, NSAPI, QoS Negotiated, Radio Priority, Packet Flow Id) message to the MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.

[skip]

9.4 Relay Function

The relay function of a network node transfers the PDP PDUs received from the incoming link to the appropriate outgoing link. At the RNC, the SGSN, and the GGSN the relay function stores all valid PDP PDUs until they are forwarded to the next network node or until the maximum holding time of the PDP PDUs is reached. The PDP PDUs are discarded when buffering is longer than their maximum holding time. This maximum holding time is implementation dependent and can be influenced by the PDP type, the QoS of the PDP PDU, the resource load status, and by buffer conditions. The discarding protects resources from useless transfer attempts, especially the radio resource. Impacts on user protocol operation by too short holding time shall be avoided.

In GPRS, the SGSN and GGSN relay functions add sequence numbers to PDP PDUs received from SNDCP and from the Gi reference point, respectively. In UMTS, the RNC and GGSN relay functions add sequence numbers to PDP PDUs received from PDCP and from the Gi reference point, respectively. The SGSN relay function may perform re-sequencing of PDP PDUs before passing the PDP PDUs to SNDCP for GPRS based on the delivery order attribute in QoS profile. The SGSN relay function may optionally perform re-sequencing of PDP PDUs before passing the PDP PDUs to Iu GTP-U for downlink packet and before passing the PDP PDUs to Gn GTP-U for UMTS based on the delivery order attribute in QoS profile. The GGSN relay function may perform re-sequencing of PDP PDUs before passing the PDP PDUs to the Gi reference point based on the delivery order attribute in QoS profile. The RNC may perform re-sequencing of PDP PDUs before passing the PDP PDUs to PDCP based on the delivery order attribute in QoS profile.

12.6.2 Functions

The PPP peers at the MS and GGSN handle the PPP protocol as specified in RFC 1661. PPP requires in-sequence packet delivery by the underlying protocols. Concerning GTP, this shall be achieved by delivery order attribute in QoS profile enabling Reordering Required upon GTP tunnel establishment. For GPRS, concerning SNDCP, out-of-sequence packets, that may be present if LLC operates in unacknowledged mode, shall be discarded. SNDCP for GPRS, and PDCP for UMTS, shall not use TCP/IP header compression because PPP may not carry IP packets at all, or because PPP may carry IP packets with already compressed TCP/IP headers. These PPP options are negotiated during the RFC 1661 Network Control Protocol establishment phase.

[skip]

13.2 SGSN

SGSN maintains MM context and PDP context information for MSs in the STANDBY, READY, PMM-IDLE, and PMM-CONNECTED states. Table 1 shows the context fields for one MS.

Table 1: SGSN MM and PDP Contexts

Field	Description	GPRS	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	[FFS]
Cell Identity Age	Time elapsed since the last LLC PDU was received from the MS at the SGSN.	X	[FFS]
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 for UMTS.		X
Kc	Currently used ciphering key.	X	
CKSN	Ciphering key sequence number of Kc.	X	
Ciphering algorithm	Selected ciphering algorithm.	X	
CK	Currently used ciphering key.		X
IK	Currently used integrity key.		X
KSI	Key Set Identifier.		X
Radio Access Classmark	MS radio access capabilities.	X	
SGSN Classmark	MS network capabilities.	X	X
DRX Parameters	Discontinuous reception parameters.	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
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	
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., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 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	Tunnel Endpoint Identifier.	X	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
TFT [FFS]	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 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	

SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.	X	X
RNC Address in Use	The IP address of the RNC currently used.		X

In case of anonymous access (GPRS only) the SGSN maintains the MM context and PDP context information for MSs in READY state. Table 2 shows the context fields for one MS.

Table 2: SGSN MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
AA-TID	Anonymous Access Tunnel Identifier.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN currently used.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
GGSN Address in Use	The IP address of the GGSN currently used.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next downlink N-PDU to be sent to the MS.
Receive N-PDU Number	SNDCP sequence number of the next uplink N-PDU expected from the MS.
SND	GTP sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the SGSN shall reorder N-PDUs before delivering the N-PDUs to the MS.

13.3 GGSN

GGSN maintains activated PDP contexts. Table 3 shows the PDP context fields for one PDP Address.

Table 3: GGSN PDP Context

Field	Description	GPRS	UMTS
IMSI	International Mobile Subscriber Identity.	X	X
NSAPI	Network layer Service Access Point Identifier.	X	X
MSISDN	The basic MSISDN of the MS.	X	X
PDP Type	PDP type, e.g., X.25, PPP, or IP.	X	X
PDP Address	PDP address, e.g., an X.121 address.	X	X
Dynamic Address	Indicates whether PDP Address is static or dynamic.	X	X
APN in Use	The APN Network Identifier currently used.	X	X
TFT	Traffic flow template.	X	X
QoS Profile Negotiated	The quality of service profile negotiated.	X	X
SGSN Address	The IP address of the SGSN currently serving this MS.	X	X
MNRG	Indicates whether the MS is marked as not reachable for PS at the HLR.	X	X
Recovery	Indicates if the SGSN is performing database recovery.	X	X
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.	X	X
SNU	GTP-U sequence number of the next uplink N-PDU to be received from the SGSN.	X	X
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.	X	X
Reordering Required [FFS]	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.	X	X

If a PDP context is enabled for network-requested PDP context activation, then IMSI, PDP Type, PDP Address, SGSN Address and MNRG contain valid information also when the PDP context is inactive and when the MS is GPRS-detached.

In case of anonymous access (GPRS only) the GGSN maintains activated PDP contexts. Table 4 shows the PDP context fields for one MS.

Table 4: GGSN PDP Context for Anonymous Access

Field	Description
AA-TID	Anonymous Access Tunnel Identifier.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
APN in Use	The APN Network Identifier currently used.
QoS Profile Negotiated	The quality of service profile negotiated.
SGSN Address	The IP address of the SGSN serving this MS.
SND	GTP-U sequence number of the next downlink N-PDU to be sent to the MS.
SNU	GTP-U sequence number of the next uplink N-PDU to be sent to the GGSN.
Charging Id	Charging identifier, identifies charging records generated by SGSN and GGSN.
Reordering Required	Specifies whether the GGSN shall reorder N-PDUs received from the SGSN.

A GGSN that supports anonymous access shall have a list of server addresses that are allowed to be accessed by anonymous MSs. The method to maintain the list of the servers is outside the scope of the present document.

CHANGE REQUEST		<small>Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.</small>	
23.060	CR	079r1	Current Version: 3.1.0
<small>GSM (AA.BB) or 3G (AA.BBB) specification number ↑</small>		<small>↑ CR number as allocated by MCC support team</small>	
For submission to: TSG#6	for approval <input checked="" type="checkbox"/>	strategic <input checked="" type="checkbox"/>	<small>(for SMG use only)</small>
<small>list expected approval meeting # here ↑</small>	for information <input type="checkbox"/>	Non-strategic <input type="checkbox"/>	

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: **NTT COMMUNICATIONWARE, Vodafone** **Date:** **1999-1-1-29**

Subject: **Information storage in USIM**

Work item: **UMTS R99**

Category:	F Correction <input type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input checked="" type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: **This CR proposes the addition of the description about information storage in case of USIM**

Clauses affected:

Other specs affected:	Other 3G core specifications <input type="checkbox"/> → List of CRs: Other GSM core specifications <input type="checkbox"/> → List of CRs: MS test specifications <input type="checkbox"/> → List of CRs: BSS test specifications <input type="checkbox"/> → List of CRs: O&M specifications <input type="checkbox"/> → List of CRs:	
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Other comments:



<----- double-click here for help and instructions on how to create a CR.

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 1 shows the MS context fields.

Table 1: MS MM and PDP Contexts

Field	<u>GSIM</u> <u>/USI</u> <u>M</u>	Description	GPRS	UMTS
IMSI	<u>G, U</u> V	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	<u>G, U</u> V	Packet Temporary Mobile Subscriber Identity.	X	X
P-TMSI Signature	<u>G, U</u> V	A signature used for identification checking purposes.	X	X
Routeing Area	<u>G, U</u> V	Current routeing area.	X	X
Cell Identity		Current cell.	X	
Kc	<u>G</u> V	Currently used GPRS ciphering key.	X	
CKSN/ <u>KSI</u>	<u>G, U</u> V	Ciphering key sequence number of Kc. Key set identifier for <u>IK Next, CK Next and Kc.</u>	X	<u>X</u>
Ciphering algorithm		Selected ciphering algorithm.	X	X
CK	V	Currently used ciphering key.		X
CK Next	V <u>U</u>	UMTS Ciphering key to be used after next security mode command for the next authentication.		X
IK	V	Currently used integrity key.		X
IK Next	<u>U</u> V	Integrity key to be used after next security mode command for the next authentication.		X
<u>KSI</u>	V	Key Set Identifier.		X
Classmark		MS classmark.	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., X.25, PPP, or IP.	X	X
PDP Address		PDP address, e.g., an X.121 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

The information marked with a "U" in Table 1 shall be stored in the USIM.

The information marked with an "G~~V~~" in Table 1:

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

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

~~[USIM is probably PS aware, and these paragraphs may need to be changed accordingly.]~~

If the GSIM is not packet domain service-aware, then the P-TMSI, P-TMSI Signature, Routeing Area, Kc, ~~CK, IK,~~ and CKSN, ~~and KSI~~ 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, then 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 PS attach. IMSI, P-TMSI, P-TMSI Signature, Routeing Area, Kc, ~~CK, IK, and CKSN~~, and ~~KSI~~ may be stored in the ME after the PS attach has been successfully performed.

When using a USIM, then 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.

For anonymous access (GPRS only) each GPRS MS maintains MM and PDP context information in READY state. The information may be contained in the ME and the TE. Table 2 shows the MS context fields.

Table 2: MS MM and PDP Contexts for Anonymous Access

Field	Description
A-TLLI	Auxiliary Temporary Logical Link Identity.
Routeing Area	Current routeing area.
Cell Identity	Current cell.
PDP Type	PDP type, e.g., X.25, PPP, or IP.
PDP Address	PDP address, e.g., an X.121 address.
NSAPI	Network layer Service Access Point Identifier.
TI	Transaction Identifier.
APN Requested	The APN requested.
QoS Profile Requested	The quality of service profile requested.
QoS Profile Negotiated	The quality of service profile negotiated.
Radio Priority	The RLC/MAC radio priority level for uplink user data transmission.
Packet Flow Id	Packet flow identifier.
Send N-PDU Number	SNDCP sequence number of the next uplink N-PDU to be sent to the SGSN.
Receive N-PDU Number	SNDCP sequence number of the next downlink N-PDU expected from the SGSN.

<h2 style="margin: 0;">CHANGE REQUEST</h2>		<small>Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.</small>
23.060	CR 081	Current Version: 3.1.0
<small>GSM (AA.BB) or 3G (AA.BBB) specification number ↑</small>	<small>↑ CR number as allocated by MCC support team</small>	
For submission to: SA#6 <small>list expected approval meeting # here ↑</small>	for approval <input checked="" type="checkbox"/> for information <input type="checkbox"/>	strategic <input type="checkbox"/> non-strategic <input type="checkbox"/> <small>(for SMG use only)</small>

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: <ftp://ftp.3gpp.org/Information/CR-Form-v2.doc>

Proposed change affects: (U)SIM ME UTRAN / Radio Core Network
(at least one should be marked with an X)

Source: Motorola, Vodafone **Date:** 30 Nov., 1999

Subject: CS paging response

Work item: _____

Category:	F Correction <input checked="" type="checkbox"/> A Corresponds to a correction in an earlier release <input type="checkbox"/> B Addition of feature <input type="checkbox"/> C Functional modification of feature <input type="checkbox"/> D Editorial modification <input type="checkbox"/>	Release:	Phase 2 <input type="checkbox"/> Release 96 <input type="checkbox"/> Release 97 <input type="checkbox"/> Release 98 <input type="checkbox"/> Release 99 <input checked="" type="checkbox"/> Release 00 <input type="checkbox"/>
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(only one category shall be marked with an X)

Reason for change: The statement that a GPRS class-B MS can delay the response to an incoming CS page request in order to allow an ongoing GPRS communication to terminate, is enclosed in square brackets which indicates that it is for further study. Since the statement has not been challenged, and since it seems to be a reasonable MS optimization, it is proposed that the square brackets be removed.

Clauses affected: 16.2.2.

Other specs affected:	Other 3G core specifications <input type="checkbox"/> Other GSM core specifications <input type="checkbox"/> MS test specifications <input type="checkbox"/> BSS test specifications <input type="checkbox"/> O&M specifications <input type="checkbox"/>	→ List of CRs: → List of CRs: GSM 03.60 A180 (R97) and GSM 03.60 A181 (R98). → List of CRs: → List of CRs: → List of CRs:
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Other comments: _____



<----- double-click here for help and instructions on how to create a CR.

16.2.2 GPRS and Dedicated Mode Priority Handling

An MS in class-B mode of operation that communicates on GPRS radio channels when a dedicated channel is needed, shall immediately abort the GPRS communication and trigger the Suspend and Resume procedure.

{Response to circuit-switched paging, }non-emergency MO circuit-switched calls, MO SMS, and MO supplementary services are exceptions to the above rule. In these cases, it is an implementation choice whether to immediately abort GPRS communication or to delay the dedicated mode establishment.

5.6.3.2 MS – SGSN for UMTS

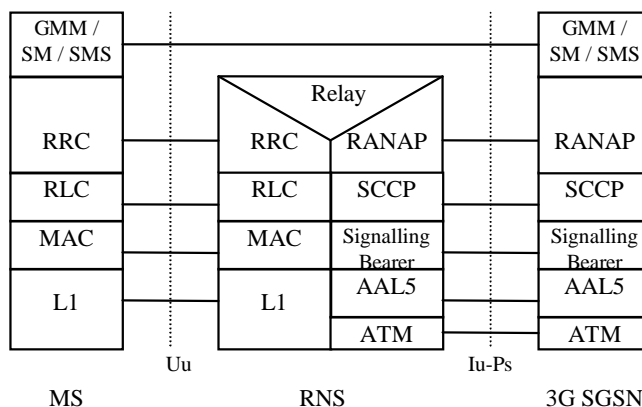


Figure 1: Control Plane MS - 3G-SGSN

Legend:

- UMTS Mobility Management and Session Management (GMM/SM): GMM supports mobility management functionality such as attach, detach, security, and routing area update, as described in clause "Mobility Management Functionality". SM supports PDP context activation and PDP context deactivation, as described in subclause "PDP Context Activation, Modification, and Deactivation Functions".
- SMS supports the mobile-originated and mobile-terminated short message service described in UMTS 23.040.
- Radio Access Network Application Protocol (RANAP): This protocol encapsulates and carries higher-layer signalling, handles signalling between the 3G-SGSN and UTRAN, and manages the GTP connections on the Iu interface. RANAP is specified in UMTS 25.413. The layers below RANAP are defined in UMTS 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 UMTS 25.322.

16 Interactions with Other ~~GSM~~ Services

This clause describes the interaction between ~~GPRS~~ packet-domain services and the following other ~~GSM~~ services:

- point-to-point Short Message Service (SMS);
- circuit-switched services; and
- supplementary services.

16.1 Point-to-point Short Message Service

~~[Not yet updated for UMTS, but SMS in UMTS packet should be very similar to GPRS SMS.]~~

16.1.1 Point-to-point Short Message Service for GPRS

It shall be possible for a GPRS-attached MS to send and receive short messages over GPRS radio channels. An MS that is GPRS-attached and not IMSI-attached shall transfer SMSs over GPRS channels. MSs that are both GPRS-attached and IMSI-attached shall transfer SMSs over GPRS channels or over non-GPRS control channels (if non-GPRS control channels are used, then paging for MT SMS may go through the SGSN).

The following two subclauses define the operation of mobile-terminated and mobile-originated SMS routing and transfer over GPRS radio channels. More detailed definitions are contained in GSM 03.40 [8].

16.1.1.1 Mobile-terminated SMS Transfer

Figure 2 and the description below show an example of a successful delivery of a SM to an MS over a GPRS radio channel.

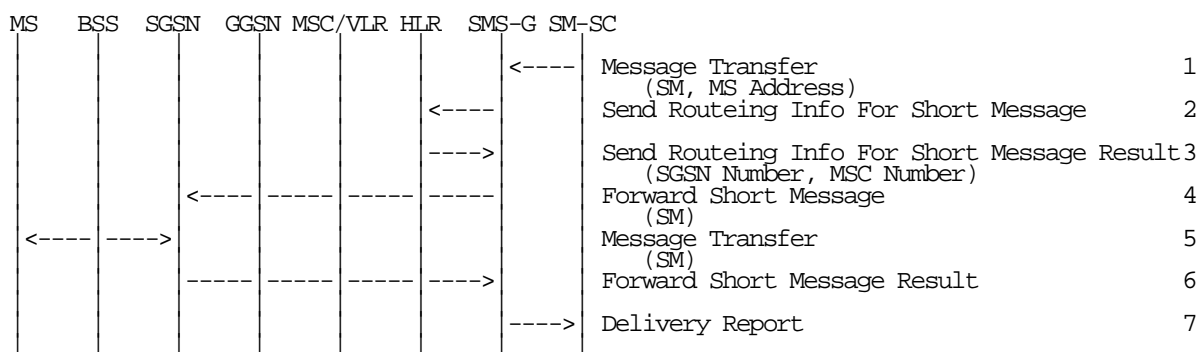


Figure 2: MT SMS Transfer, Successful

- 1) The short message service centre determines it shall send a SM to an MS. SM-SC forwards the SM to a SMS gateway MSC (SMS-GMSC).
- 2) SMS-GMSC examines the destination MS Address, and sends a Send Routeing Info For Short Message message to the relevant HLR.
- 3) HLR returns a Send Routeing Info For Short Message Result message to the SMS-GMSC. The result may contain the MS's current SGSN Number, the MSC Number, or both. If the result does not contain an SGSN Number (i.e., the HLR knows that the MS is not reachable via an SGSN), and if the result does contain an MSC Number, then non-GPRS SMS delivery procedures are followed. If the result contains an SGSN Number, the SMS transfer proceeds according to the following events.

NOTE: SMS delivery via the SGSN is normally more radio resource efficient than SMS delivery via the MSC/VLR. The preferred delivery path is selected by SMS-GMSC operator-specific action.

- 4) SMS-GMSC forwards the SM to the SGSN.
- 5) SGSN transfers the SM to the MS on the RP, CP, LLC layers, as defined in GSM 04.11 and GSM 04.64.
- 6) SGSN returns a Forward Short Message Result message to the SMS-GMSC indicating successful delivery of the SM.
- 7) SMS-GMSC returns a Delivery Report to the SM-SC indicating successful delivery of the SM.

16.1.1.1 Unsuccessful Mobile-terminated SMS Transfer

The SGSN may not be able to deliver the SM to the MS. This may for example happen when the MS is not attached to GPRS, or when the radio channel conditions are bad.

When the SGSN cannot deliver the SM to the MS, the SGSN sets the Mobile station Not Reachable for GPRS flag (MNRG), and returns a failure report to the SMS-GMSC. Based on the routeing information received from the HLR, the SMS-GMSC shall do one of the following:

- If an MSC/VLR is available for the MS, the SM is forwarded to the MS via the MSC/VLR. A successful delivery report shall be returned to the SM-SC.
- If an MSC/VLR is not available for the MS, the Message Waiting Indication information in the HLR shall be updated and an unsuccessful delivery report shall be returned to the SM-SC.

Figure 3 illustrates one possible traffic scenario when neither the SGSN nor the MSC is able to deliver the SM.

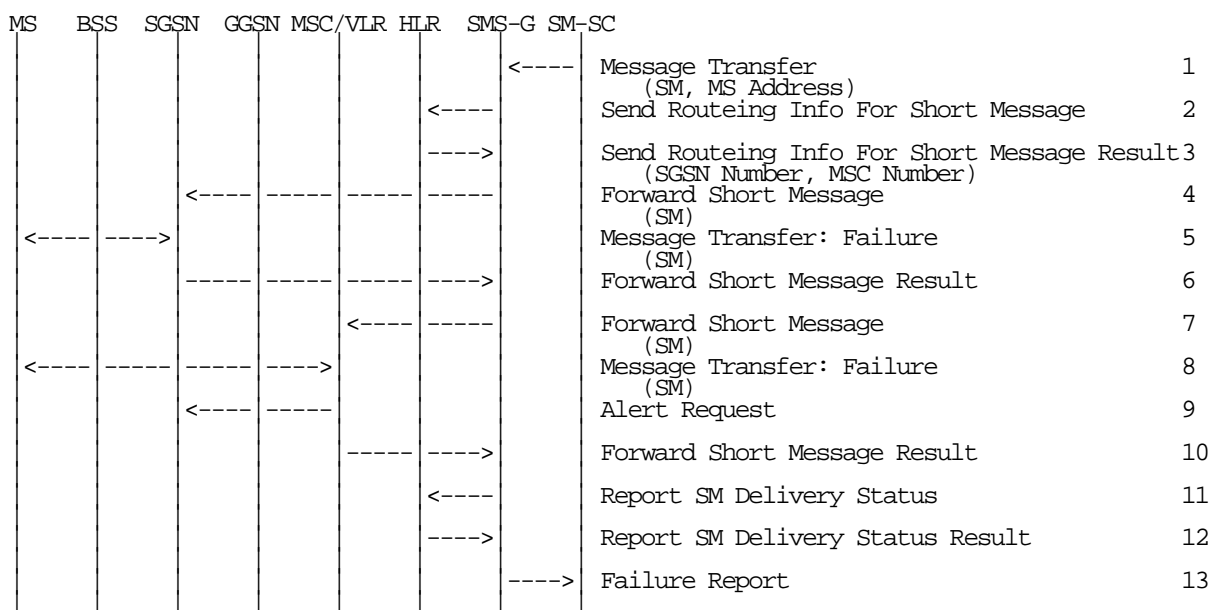


Figure 3: MT SMS Transfer, Unsuccessful

- 1) The short message service centre determines it shall send a SM to an MS. SM-SC forwards the SM to a SMS-GMSC.
- 2) SMS-GMSC examines the destination MS Address, and sends a Send Routing Info For Short Message message to the relevant HLR.
- 3) HLR returns a Send Routing Info For Short Message Result message to the SMS-GMSC. The Result contains an SGSN Number and an MSC Number.
- 4) SMS-GMSC forwards the SM to the SGSN.
- 5) SGSN attempts to transfer the SM to the MS, but fails.
- 6) SGSN sets MNRG and returns a Forward Short Message Result message to SMS-GMSC indicating unsuccessful delivery of the SM.
- 7) SMS-GMSC selects an alternative route for the SMS, and forwards the SM to the MSC/VLR.
- 8) MSC/VLR attempts to transfer the SM to the MS, but fails.
- 9) The MSC/VLR requests the setting of the NGAF at the SGSN.
- 10) VLR sets MNRF and returns a Forward Short Message Result message to the SMS-GMSC indicating unsuccessful delivery of the SM.
- 11) SMS-GMSC sends a Report SM Delivery message to the HLR.
- 12) HLR updates its Message Waiting Indication fields and returns a Report SM Delivery Result message to the SMS-GMSC.
- 13) SMS-GMSC returns a Failure Report to the SM-SC indicating unsuccessful delivery of the SM.

Error! Reference source not found. shows that the SGSN sends a Ready for SM (MS Reachable) message to the HLR when the MS becomes reachable and MNRG is set in the SGSN. The SGSN indicates also to the MSC/VLR when the MS becomes reachable and NGAF is set in the SGSN. If the MNRF is set at the MSC/VLR, the MSC/VLR sends a Ready for SM (MS Reachable) message to the HLR. Reception of a Ready for SM message or Update Location message when MNRG is set in the HLR shall trigger the SMS alert procedure as defined in GSM 03.40.

MNRG remains set in the SGSN independently of whether the MSC/VLR was successful in delivering the SM or not. This means that the SGSN in certain cases sends a Ready for SM message to the HLR when an MS becomes reachable via the SGSN, even if no SM is waiting. This causes a small amount of duplicate signalling between SGSN and HLR only.

16.1.1.2 Mobile-originated SMS Transfer

Figure 4 and the description below explain the steps involved in sending a SM from an MS over a GPRS radio channel.

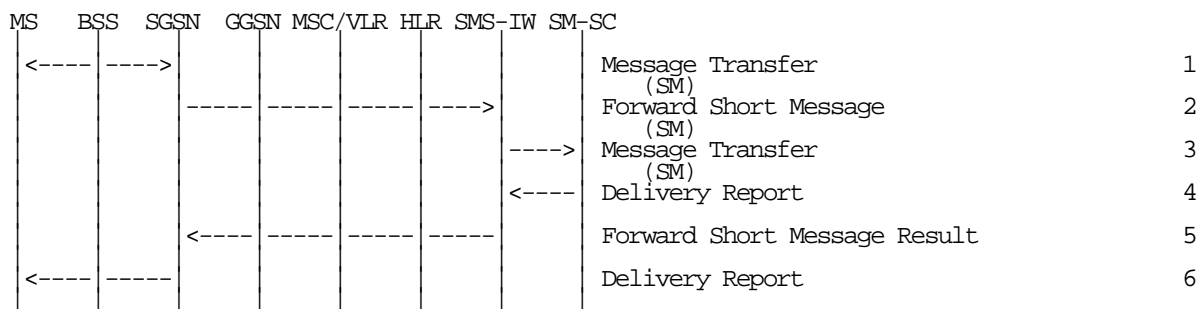


Figure 4: MO SMS Transfer, Successful

- 1) The MS has a SM to send, and transfers the SM to the SGSN via RP, CP, and LLC.
- 2) SGSN checks the MS subscription data, and determines that the MS is allowed to originate the SMS. SGSN forwards the SM to a SMS interworking MSC (SMS-IW MSC).
- 3) SMS-IW MSC passes the SM to the addressed SM-SC.
- 4) SM-SC returns a Delivery Report to the SMS-IW MSC indicating successful delivery of the SM.
- 5) SMS-IW MSC returns a Forward Short Message Result message to the SGSN indicating successful delivery of the SM.
- 6) SGSN returns a Delivery Report to the MS indicating successful delivery of the SM.

16.1.2 Point-to-point Short Message Service for UMTS

SMS shall be supported via the control plane in the UMTS packet domain. The UMTS SMS service is described in UMTS 23.040.

16.2 Circuit-switched Services for GPRS

The ability for a GPRS user to access circuit-switched services depends on the subscription held, the network capabilities, and the MS capabilities. Interaction between GPRS and circuit-switched services is described in subclause "Interactions Between SGSN and MSC/VLR".

16.2.1 Suspension of GPRS Services

When a GPRS-attached MS enters dedicated mode, and when the MS limitations make it unable to communicate on GPRS channels, the MS shall request the network for suspension of GPRS services. The Suspend and Resume procedure is illustrated in Figure 5. Each step is explained in the following list.

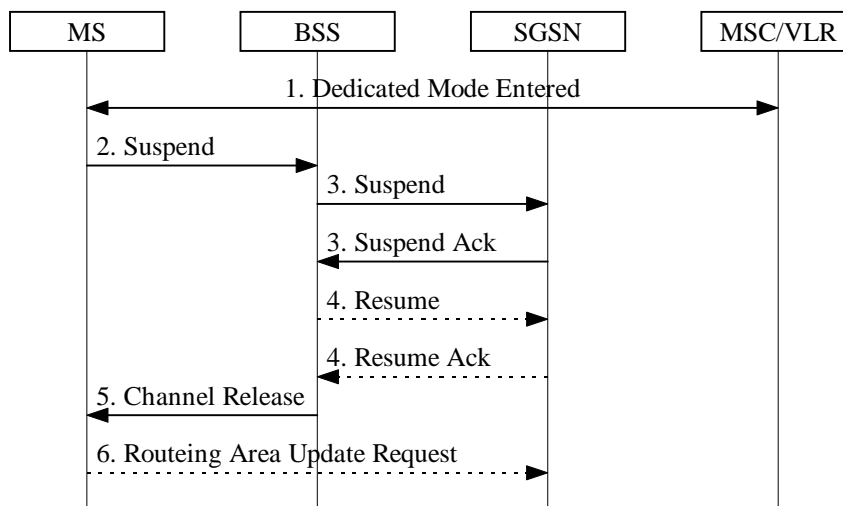


Figure 5: Suspend and Resume Procedure

- 1) The MS enters dedicated mode.
- 2) The MS sends an RR Suspend (TLLI, RAI) message to the BSS. The BSS may terminate any ongoing GPRS traffic for this TLLI.
- 3) The BSS sends a Suspend (TLLI, RAI) message to the SGSN, and the SGSN acknowledges by returning Suspend Ack. The BSS shall store TLLI and RAI in order to be able to request the SGSN to resume GPRS services when the MS leaves dedicated mode.
- 4) Eventually, the BSS determines that the circuit-switched radio channel shall be released. If the BSS is able to request the SGSN to resume GPRS services, the BSS shall send a Resume (TLLI, RAI) message to the SGSN. The SGSN acknowledges the successful outcome of the resume by returning Resume Ack.
- 5) The BSS sends an RR Channel Release (Resume) message to the MS. Resume indicates whether the BSS has successfully requested the SGSN to resume GPRS services for the MS, i.e., whether Resume Ack was received in the BSS before the RR Channel Release message was transmitted. The MS leaves dedicated mode.
- 6) If the BSS did not successfully request the SGSN to resume GPRS services, or if the RR Channel Release message was not received before the MS left dedicated mode, then the MS shall resume GPRS services by sending a Routing Area Update Request message to the SGSN, as described in subclause "Routing Area Update Procedure".

The full handling of suspended MSs in the BSS and the SGSN is implementation dependent. Typically, the SGSN should not page suspended MSs.

If the MS performs an inter-BSC handover while suspended, then TLLI and RAI should be transferred as BSC-to-BSC information in the Handover Required and Handover Request messages, see GSM 08.08. This allows the new BSC to initiate the Resume request procedure to the SGSN. In the case where the BSC-to-BSC information was not transferred or not understood, then the MS doesn't receive an indication that resumption has been successful, and the MS shall resume GPRS services by initiating a Routing Area Update Request procedure as described in step 6.

16.2.2 GPRS and Dedicated Mode Priority Handling

An MS in class-B mode of operation that communicates on GPRS radio channels when a dedicated channel is needed, shall immediately abort the GPRS communication and trigger the Suspend and Resume procedure.

[Response to circuit-switched paging,]non-emergency MO circuit-switched calls, MO SMS, and MO supplementary services are exceptions to the above rule. In these cases, it is an implementation choice whether to immediately abort GPRS communication or to delay the dedicated mode establishment.

16.3 Supplementary Services

No supplementary services are defined for the packet domain. Supplementary services may be available in the interworked-with networks (e.g., the X.25 Call Redirection user facility), but this is outside the scope of this specification.

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 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 subclause "PDP Context Activation, Modification, and Deactivation Functions". All PDP contexts of a subscriber are associated with the same MM context for the IMSI of that subscriber.

9.2 PDP Context Activation, Modification, and Deactivation Functions

A PS-attached MS can initiate these functions at any time in order to activate, modify, or deactivate a PDP context in the MS, the SGSN, and the GGSN. A GGSN may request the activation of a PDP context to a PS-attached subscriber. A GGSN may initiate the deactivation of a PDP context.

NOTE: If the MS is in PMM-IDLE state, it needs to perform a service request procedure to enter the PMM-CONNECTED state before initiating these procedure.

Upon receiving an Activate PDP Context Request message or an Activate Secondary PDP Context Request message, the SGSN shall initiate procedures to set up PDP contexts. The first procedure includes subscription checking, APN selection, and host configuration, while the the latter procedure excludes these functions and reuses PDP context parameters including the PDP address but except the QoS parameters. **Once activated, all PDP contexts that share the same PDP address and APN shall be managed equally.** At least one PDP context shall be activated for a PDP address before a Secondary PDP Context Activation procedure may be initiated. If Routing Area Update procedures are executed during which the MS changes from a R99 system to a R97 or R98 system, only one active PDP context per PDP address and APN shall be preserved. It is selected taking it's QoS profile and NSAPI value into account.

Upon receiving a Deactivate PDP Context Request message, the SGSN shall initiate procedures to deactivate the PDP context. When the last PDP context associated with a PDP address is deactivated, then N-PDU transfer for this PDP address is disabled.

An MS does not have to receive the (De-)Activate PDP Context Accept message before issuing another (De-)Activate PDP Context Request. However, only one request can be outstanding for every TI/NSAPI.

First modified section

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.

Each PDP context sharing the same PDP address and APN shall be is-identified by it's own a-unique TI and it's own unique NSAPI.

The Secondary PDP Context Activation procedure may be executed without providing associates 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 a TFT associated, else 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 external 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 1Figure-60](#). Each step is explained in the following list.

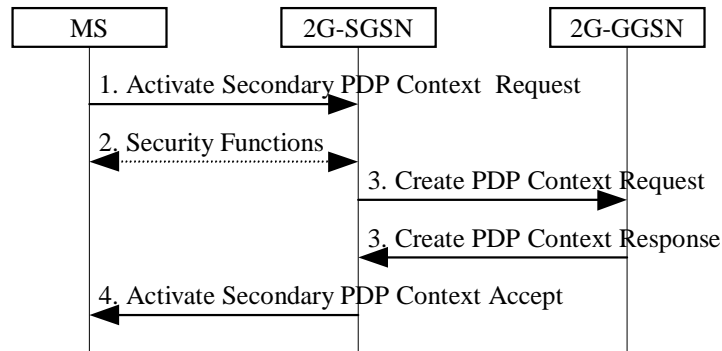


Figure 160: Secondary PDP Context Activation Procedure for GPRS

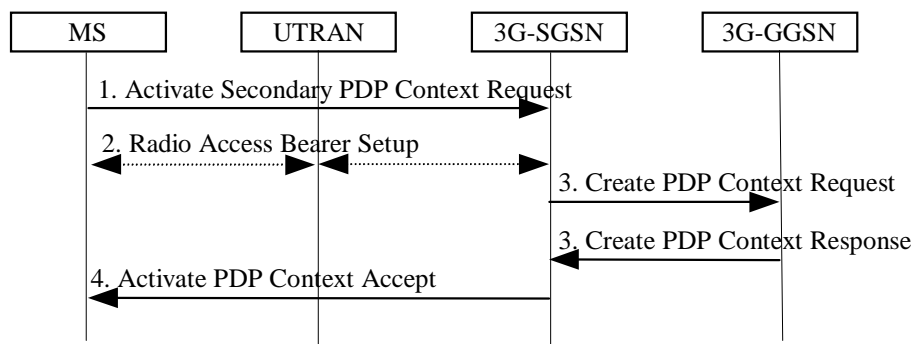


Figure 364: Secondary PDP Context Activation Procedure for UMTS

- 1) The MS sends an Activate Secondary PDP Context Request (Linked TI, NSAPI, TI, QoS Requested, TFT) message to the SGSN. Linked TI indicates the TI value assigned [to any ~~to~~](#) 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 contains ~~-~~values not used by any other activated PDP context.
- 2) For GPRS, security functions may be executed. These procedures are defined in subclause "Security Function".

For UMTS, , the RAB setup procedure is performed. The 3G-SGSN sends a Radio Access Bearer Setup Request message to the UTRAN. The UTRAN then initiates the radio access bearer setup procedure.

- 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 and GGSN may restrict and negotiate the requested QoS as specified in subclause "PDP Context Activation Procedure". The SGSN sends a Create PDP Context Request (QoS Negotiated, TID, TFT) message to the affected GGSN. [TFT parameter is included in this message only when this is included in the Activate Secondary PDP Context Request message](#). The GGSN uses the same external 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 external PDP network. The GGSN returns a Create PDP Context Response (TID, BB Protocol, Reordering Required, QoS Negotiated, Cause) message to the SGSN.

- 4) 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) message to the MS. 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, then the MS may attempt another activation with a different TFT, depending on the cause.