Technical Specification Group Services and System Aspects *TSGS#8(00)0448*
Meeting #9, Kapolei, Hawaii, USA, 25-28 September 2000

Source: **TSG SA WG2**
Title: **CRs on 03.60 v.7.4.0 and 23.060 v.3.4.0**
Agenda Item: **7.2.3**

The following Change Requests (CRs) have been approved by TSG SA WG2 and are requested to be approved by TSG SA plenary #9.
Note: the source of all these CRs is now S2, even if the name of the originating company(ies) is still reflected on the cover page of all the attached CRs.

CRs on 03.60 v.7.4.0

Spec	Rel	CR #	Cat	Title	S2 tdoc #
03.60	R98	A188	F	Removal of PDP type OSP:IHOSS in R99	S2-001535

CRs on 23.060 v.3.4.0

Spec	**Rel**	**CR #**	**Cat**	**Title**	**S2 tdoc #**
23.060	R99	147r3	F	Change of the Cell update procedure	S2-001409
23.060	R99	170	F	DTM: simultaneous LAU and RAU procedures on an SDCCH	S2-001362
23.060	R99	171r1	F	DTM: reuse of the GPRS Suspension procedure in cells with no DTM capabilities	S2-001523
23.060	R99	172r1	F	DTM: download of the IMSI from the SGSN to the BSC	S2-001524
23.060	R99	173	F	CS Paging procedure in UMTS	S2-001371
23.060	R99	174	F	Clarification on P-TMSI and P-TMSI signature at Detach	S2-001372
23.060	R99	175r1	F	Serving RNS Relocation Procedure	S2-001532
23.060	R99	176r1	F	DRX and MS network capabilities within UMTS	S2-001533
23.060	R99	177r1	F	Compatibility GTPv0/GTPv1 in case of SGSN change	S2-001531
23.060	R99	178r1	F	Correction on Iu Release Procedure	S2-001607
23.060	R99	178r1	F	Correction on Iu Release Procedure	S2-001654
23.060	R99	182r1	F	Removal of PDP type OSP:IHOSS in R99	S2-001536

3GPP TSG SA2 Meeting #14
Bristol, UK , 4-8 September 2000

***Document* S2-001535**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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3.60	CR	A188	Current Version:	7.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA #9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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 [X] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: Motorola **Date:** 2000-08-05

Subject: Removal of the PDP type OSP:IHOSS in Release 98

Work item: Release 99

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	X
D	Editorial modification			Release 99	
				Release 00	

Reason for change: The PDP type OSP:IHOSS has been removed completely from R98 at the SA#8 in 2.60. It is necessary now to remove it also from 3.60 in order to agree with 2.60.

Clauses affected: 12.4 and Annex B6

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:	23.060 CR 182
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:

help.doc

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

Deleted Section

~~12.4 Octet Stream Protocol Functionality~~

~~The Octet Stream Protocol (OSP) is used to carry an unstructured octet (character) stream between the MS and GGSN. It is used to provide a character pipe to allow an MS to communicate (via the GGSN) with an arbitrary Internet host, or other character-based service. PDP type shall be selected as OSP for this purpose. Unlike PDP types IP and X.25, OSP has no existence outside the PLMN. In the MS there is a character stream at the R reference point together with some optional control signals. In the GGSN there is a relay function, carrying the same character stream and control signals between OSP and a fixed-network protocol stack.~~

~~OSP has two modes of operation. In octet mode, it uses a Packet Assembly function to assemble a number of user octets into a single packet for more efficient transport by the underlying protocols. A complementary Packet Disassembly function performs the reverse operation in the peer OSP. In block mode, the Packet Assembly / Disassembly (PAD) function is bypassed. In this case, data is transferred between the OSP user and OSP in blocks of octets. Each block of octets is delivered as a single OSP PDU to the underlying protocol. The selection of octet or block mode is made independently for each OSP connection as an implementation or configuration decision before the connection is established, and remains fixed for the duration of the connection. An example of the use of the block mode is when OSP is used for interworking with a fixed network where the octets are also carried in packets. This avoids the use of back-to-back PADs. It could also be used in an embedded MT where the application transfers data in blocks of octets.~~

~~OSP uses the services of SNDCP between the MS and SGSN, and the services of GTP between the SGSN and GGSN. The quality of service is determined mainly by that provided by the underlying layers. However, the end-to-end delay may be affected by the presence of the PAD function. A reliable (acknowledged) service shall be provided by the layers below SNDCP and GTP.~~

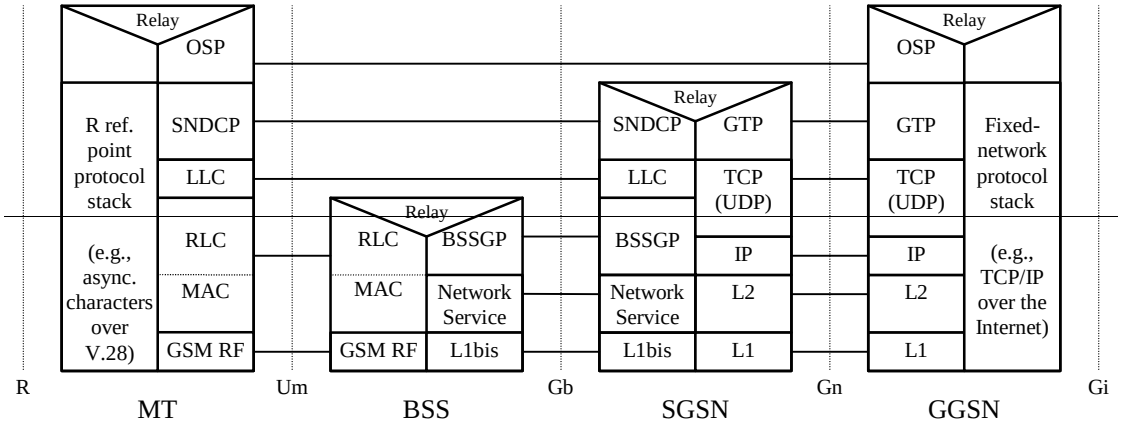
~~The main functions of OSP are:~~

- ~~transport of an unstructured octet stream;~~
- ~~packet assembly and disassembly to make efficient use of network resources; and~~
- ~~end-to-end flow control.~~

~~OSP may additionally provide:~~

- ~~transport of a "break" signal;~~
- ~~transport of control information blocks between the OSP users;~~
- ~~user control of packet assembly buffer forwarding; and~~
- ~~direct OSP user access to the underlying packet service, bypassing the PAD.~~

~~Figure 48 illustrates the OSP transmission plane.~~



~~Figure 48: Relationship of OSP to the Rest of the GPRS Protocol Architecture~~

~~12.4.1 PAD Function~~

~~In order to make efficient use of the network resources, particularly the radio resource, octets received from the OSP user are not forwarded immediately but are placed in a buffer. When some forwarding criterion is satisfied, the contents of the buffer are forwarded in the payload of an N-PDU to the SNDCP layer. At the receiving end, the payload of an N-PDU received from the SNDCP layer is placed in a buffer and the octets are delivered to the OSP user as an octet stream.~~

~~The PAD is used only when OSP operates in octet mode. It is not used when OSP operates in block mode.~~

~~12.4.1.1 Packet Assembler~~

~~The packet assembler shall be able to detect the following forwarding criteria. When any one criterion is satisfied, the contents of the buffer shall be forwarded in an N-PDU to the SNDCP layer, subject to any flow control condition.~~

~~12.4.1.1.1 Buffer Full~~

~~The buffer contents are forwarded when the number of octets in the buffer reaches the value of the maximum buffer size parameter.~~

~~12.4.1.1.2 Inactivity Timer Expiry~~

~~The inactivity timer shall be started whenever an octet is placed in the buffer. When the timer expires, the buffer contents shall be forwarded. The inactivity timer shall be stopped whenever a buffer is forwarded.~~

~~12.4.1.1.3 Maximum Buffer Delay Timer Expiry~~

~~A maximum buffer delay timer may be started when the first octet is placed in the (empty) buffer,. When the timer expires, the buffer contents shall be forwarded. This optional timer ensures that no octet is delayed in the buffer for longer than the specified time. The maximum buffer delay timer shall be stopped whenever a buffer is forwarded.~~

~~12.4.1.1.4 Special Character~~

~~Whenever an octet has been placed in the buffer, its least significant 7 bits shall be compared with a list of 7-bit special characters. If the bits match, the buffer shall be forwarded. The possible characters and combinations of characters shall be the same as specified for the X.3 PAD access to X.25.~~

~~12.4.1.1.5 Change in Flow Control State~~

~~The buffer may be forwarded when there is a need to signal a change in the ready to receive condition.~~

~~12.4.1.1.6 Immediate Forwarding Request~~

~~When the OSP receives an immediate forward request from its user, it shall immediately forward the buffer unless it is empty.~~

~~12.4.1.2 Packet Disassembler~~

~~The packet disassembler shall forward the contents of the N-PDU payload to the OSP user, subject to any local flow control condition.~~

~~12.4.2 Quality of Service~~

~~The QoS provided by the OSP layer is determined by that provided by the underlying protocol layers. However, the PAD functions introduce an additional variable delay into the transmission path. This delay can be limited at the risk of making less efficient use of network resources, in particular the radio resources.~~

Next Deleted Section

B.6 Connection Establishment Procedure

Establishing an IHOSS connection involves setting up two segments, the PLMN segment (using the OSP) between the MS and the GGSN, and the fixed-network segment between the GGSN and the Internet host. Establishing the PLMN segment shall be as described in subclause "PDP Context Activation Procedure". Figure B.2 illustrates the overall procedure.

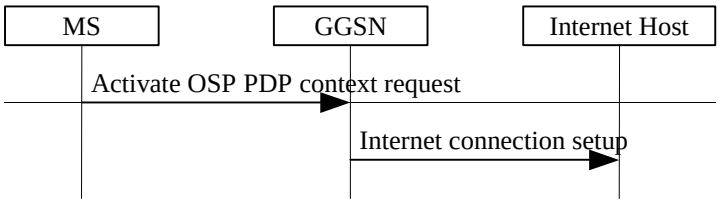


Figure B.2: IHOSS Connection Establishment

The MS requests that an OSP PDP context be activated by transmitting an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN with the following parameter values:

- NSAPI is selected by the MS.
- TI is selected by the MS.
- PDP Type shall have a two-part value. The first part shall identify the protocol as OSP, and the second part shall identify the service being used and thereby allow the SGSN to select a GGSN that can provide this service. For IHOSS PDP Type shall be set to OSP:IHOSS.
- PDP Address shall be empty.
- APN is selected by the MS, may be empty.
- QoS Requested is selected by the MS.
- PDP Configuration Options may contain an Internet host name, a port number, a protocol type, and possibly other parameters in order to enable the GGSN to set up a connection to the Internet host, or it may be empty.

The Activate PDP Context Accept message shall be returned to the MS only after the connection to the Internet host has been established.

The activation parameters shall be provided as either interactive commands or via a system-default value. The following sections describe how these parameters shall be derived for a number of different scenarios.

B.6.1 Fully User-Specified Establishment

The MS shall request an OSP:IHOSS connection, specifying the PAD parameters, the host name, the port, and the protocol (UDP or TCP) in PDP Configuration Options.

The SGSN shall select an appropriate GGSN for the outgoing connection.

The GGSN shall attempt to establish a connection with the specified host. Connection failure shall be signalled back to the MS and the session terminated. A successful connection establishment enables data transmission over the connection.

B.6.2 Default Internet Endpoint Parameters Establishment

The MS shall request an OSP:IHOSS connection, specifying only PAD parameters that deviate from the system defaults.

The SGSN shall connect to the GGSN indicated by the APN in the HLR subscription record.

The GGSN shall use the APN to further select the host name, the port number, and the protocol. The method used to select these parameters is manufacturer specific and outside of the scope of the specifications.

B.7 Connection Termination

Either the MS or the Internet host may request that a connection be cleared.

B.7.1 MS-initiated TCP IHOSS Connection Termination

The MS clears the connection by sending a Deactivate PDP Context Request message to the SGSN. This shall result in the TCP session closure procedures being executed by the GGSN. Once this is complete, the GGSN shall deallocate any resources allocated for this session.

B.7.2 MS-initiated UDP IHOSS Connection Termination

No further action is required by the GGSN towards the Internet endpoint, as the User Datagram Protocol is connectionless. The GGSN shall deallocate any resources allocated for this session.

B.7.3 Internet Host Initiated TCP IHOSS Connection Termination

When the GGSN receives a TCP clear request from the fixed network it shall follows the procedure described in subclause "PDP Context Deactivation Initiated by GGSN Procedure".

B.8 Quality of Service

The QoS profile shall be negotiated to the following QoS attribute values:

- precedence: as required;
- delay: as required, but consistent with PAD forwarding strategy;
- reliability: Class 1 for TCP. Class 3 for UDP;
- peak throughput: as required;
- mean throughput: as required.

B.9 Security

B.9.1 Authentication of the GPRS User

Identification and authentication of the subscriber by the GPRS network is carried out as described elsewhere in this document. The GPRS network shall not provide any identification of the GPRS subscriber to the Internet host. End-to-end security is provided at the application layer and is outside of the scope of this document.

B.9.2 Malicious Reconfiguration of the GPRS Device

An MS that can not hold protocol, host name, and port information, would render it impossible to gain unauthorised access and subvert the system by providing alternative protocol, host name, or port information. This information would have to be provided by the GGSN, which is potentially more physically secure than the embedded MT, and it would make "man in the middle" type security breaches considerably more complex.

B.10 Maintenance

Configuring the Internet endpoint by accepting a mandatory default endpoint from the GGSN enables a GPRS user to effect system reconfiguration without the requirement for a site visit for each GPRS MS. The association between the APN and the host name, port number and protocol in the GGSN would be updated to give a new host name and/or port number and/or protocol.

3GPP SA WG 2 Meeting #12
Berlin, Germany, 22-26 May 2000

***Document* S2-0001409**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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23.060	**CR**	**A147r3**	Current Version:	3.3.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: CN #8 *list expected approval meeting # here ↑*

for approval **X**
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: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [X]

Source: Ericsson/Siemens **Date:** 2000-05-18

Subject: Change of the Cell update procedure

Work item: GPRS

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

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

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

Reason for change:

The MS/SGSN shall restart the GMM READY timer at transmission/reception of any LLC frame, including an LLC frame without an information field transmitted in order to perform cell update.
NOTE FROM MCC: THIS CR SHOULD BE ADAPTED TO V.3.4.0
If the user is travelling around in an urban area, where the cell size is small, the READY timer will be restarted, even if there is no active user-data transmission. Thus, the MS and SGSN will remain in GMM ready state for considerably longer than is necessary, and the MS will continue to perform cell updates.

Frequent cell updates will lead to:
- increase of network load;
- waste of radio resources;
- significant increase of MS battery consumption, due to increased signalling and time spent in non-DRX mode.

In order to overcome this problem, it is proposed to introduce an optional cell update procedure where the READY timer will not be started if the LLC frame transmitted (by the MS)/received (by the SGSN) contains a cell update.

This proposed change is optional for both the network and the MS.

Clauses affected: 6.9.1.1, 8.4

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[X]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other The proposed solution introduces a "Cell Notification" (which is in fact an optimised Cell

comments:

Update Procedure) into MS and SGSN. The possibility to use the Cell Notification will be indicated by the network and shall be used by the MS when the MS does support it. The update will be triggered by the LLC NULL frame (introduced in 04.64) which is only allowed to be send by the MS if the network indicates the Cell Notification.

The feature is mandatory for R99 but a R99 network must be able to handle pre R99 MS which do not support Cell Notification.

Indication of the Cell Notification

A new, optional information element (optional on syntax level but on semantic level mandatory for R99) is introduced into the ATTACH ACCEPT and ROUTING AREA UPDATE ACCEPT message to indicate the ability of the network to support the Cell Notification.

If both the MS and SGSN support the Cell Notification, and the ATTACH ACCEPT message or ROUTING AREA UPDATE ACCEPT message contains a new value of the READY timer, the MS shall send any LLC frame except the LLC NULL frame in order to start the READY timer (LLC NULL frame can not be sent because it does not trigger the start of the READY timer).

Behaviour at Cell Notification (new cell is entered)

A LLC NULL frame is introduced at the LLC layer. If both the MS and SGSN support the Cell Notification, an MS shall transmit the LLC NULL frame in order to indicate a cell change to the network. The MS shall not start the READY timer as a result of transmitting the LLC NULL frame. Similarly, the SGSN shall not start the READY timer as a result of receiving LLC NULL frame.

Further:

An MS shall not transmit LLC NULL frame as a response to paging for PS services. If the MS does not support the Cell Notification but the SGSN indicates the ability to support them then the behaviour at cell update remains as currently specified.

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

6.9.1.1 Cell Update Procedure

A cell update takes place when the MS enters a new cell inside the current RA and the MS is in READY state. If the RA has changed, a routeing area update is executed instead of a cell update.

If the network does not support the Cell Notification (in fact an optimised Cell Update Procedure, see 24.008) ~~T~~the MS performs the cell update procedure by sending an uplink LLC frame of any type except the LLC NULL frame (see 04.64), containing the MS's identity, to the SGSN. If the network and the MS support the Cell Notification then the MS shall use the LLC NULL frame, containing the MS's identity, in order to perform a cell update. The support of Cell Notification is mandatory for MS and network but the network as well as the MS has to support the Cell Update Procedure, not using the LLC NULL frame, for backward compatibility reasons.

In the direction towards the SGSN, the BSS shall add the Cell Global Identity including RAC and LAC to all BSSGP frames, see GSM 08.18. A cell update is any correctly received and valid LLC PDU carried inside a BSSGP PDU containing a new identifier of the cell.

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

Next Section to Modify

8.4 Paging for GPRS Downlink Transfer

An MS in STANDBY state is paged by the SGSN before a downlink transfer to that MS. The paging procedure shall move the MM state to READY to allow the SGSN to forward downlink data to the radio resource. Therefore, any uplink data from the MS that moves the MM context at the SGSN to READY state is a valid response to paging.

The SGSN supervises the paging procedure with a timer. If the SGSN receives no response from the MS to the Paging Request message, it shall repeat the paging. The repetition strategy is implementation dependent.

The MS shall accept pages also in READY state if no radio resource is assigned. This supports recovery from inconsistent MM states in MS and SGSN.

The GPRS Paging procedure is illustrated in **Error! Reference source not found.**. Each step is explained in the following list.

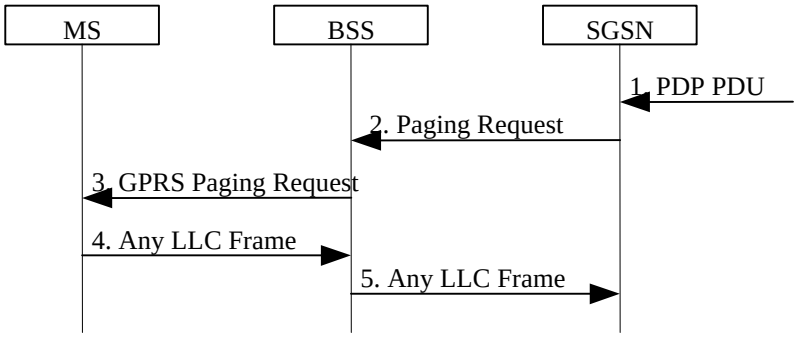

Figure 1: GPRS Paging Procedure

1) The SGSN receives a downlink PDP PDU for an MS in STANDBY state. Downlink signalling to a STANDBY state MS initiates paging as well.

2) The SGSN sends a BSSGP Paging Request (IMSI, P-TMSI, Area, Channel Needed, QoS, DRX Parameters) message to the BSS serving the MS. IMSI is needed by the BSS in order to calculate the MS paging group. P-TMSI is the identifier by which the MS is paged. Area indicates the routeing area in which the MS is paged. Channel Needed indicates GPRS paging. QoS is the negotiated QoS for the PDP context that initiates the paging procedure, and indicates the priority of this Paging Request relative to other Paging Request messages buffered in the BSS. 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.

3) The BSS pages the MS with one Paging Request (P-TMSI, Channel Needed) message in each cell belonging to the addressed routeing area. This is described in GSM 03.64.

4) Upon receipt of a GPRS Paging Request message, the MS shall respond with either any single valid LLC frame (e.g., a Receive Ready or Information frame) that implicitly is interpreted as a page response message by the SGSN. The MS shall not use the LLC NULL frame as a page response. When responding, the MS changes MM state to READY. The response is preceded by the Packet Channel Request and Packet Immediate Assignment procedures as described in GSM 03.64.

5) Upon reception of the LLC frame, the BSS adds the Cell Global Identity including the RAC and LAC of the cell and sends the LLC frame to the SGSN. The SGSN shall then consider the LLC frame to be an implicit paging response message and stop the paging response timer.

No further changes.

TSG SA2
Bristol, UK
4 – 8 September 2000

Document S2-001362
Agenda item
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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23.060	**CR**	**170**	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG SA #9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [ ]

Source: Vodafone **Date:** 27 July 2000

Subject: **DTM: simultaneous LAU and RAU procedures on an SDCCH**

Work item: BSS co-ordination of Radio Resources allocation for class A GPRS services - GSM Radio Access (R99)

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:
When a DTM class A MS in idle mode crosses a LA boundary (and, thus, RA boundary) in a cell where the network is operating in NMO II or III, the MS requests an SDCCH (or TCH in signalling mode) to perform the LAU procedure.

LAU and RAU procedures can be performed simultaneously, enabling a very reliable and efficient way to perform the RAU, instead of setting up two or three TBFs for that purpose.

Clauses affected: 6.9.1

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:
In the current work on DTM, there is nothing that prevents this modification.

The LAU procedure shall always be started first.

help.doc

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

6.9.1 Location Management Procedures (GSM Only)

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.

The MS detects that a new cell has been entered by comparing the cell's identity with the cell identity stored in the MS's MM context. The MS detects that a new RA has been entered by periodically comparing the RAI stored in its MM context with that received from the new cell. The MS shall consider hysteresis in signal strength measurements.

When the MS camps on a new cell, possibly in a new RA, this indicates one of three possible scenarios:

- a cell update is required;
- a routeing area update is required; or
- a combined routeing area and location area update is required.

In all three scenarios the MS stores the cell identity in its MM context.

If the MS enters a new PLMN, the MS shall either perform a routeing area update, or enter IDLE state.

In network mode of operation II and III, whenever an MS determines that it shall perform both an LA update and an RA update,

- if the MS is in class A mode of operation, it shall initiate the LA update and then initiate the RA update;
- if the MS is not in class A mode of operation, it shall perform the LA update first.

Routeing Area Update Request messages shall be sent unciphered, since in the inter SGSN routeing area update case the new SGSN shall be able to process the request.

S2-001523

TSG SA2
Bristol, UK
4 - 8 September 2000

Document ***Revision of S2-001363***
Agenda item
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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23.060	CR	171 r1	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG SA #9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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

Source: Vodafone **Date:** 4 August 2000

Subject: **DTM: reuse of the GPRS Suspension procedure in cells with no DTM capabilities**

Work item: BSS co-ordination of Radio Resources allocation for class A GPRS services - GSM Radio Access (R99)

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

When

- a DTM MS in dedicated mode or dual transfer mode is handed over to a cell that does not support DTM or
- a DTM MS ~~in packet transfer mode~~ is paged for circuit switched services in a cell that does not support DTM,

the GPRS activity in the cell needs to be suspended until the cause ceases: either the call is cleared or the MS is handed over to a cell that supports DTM. In the second of these two cases, there is no CHANNEL RELEASE message from the network to the MS and the Resume procedure is initiated by the MS, initiating a RA Update procedure.

Clauses affected: 16.1.2

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:

help.doc

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

16.2.1 Suspension of GPRS Services

The MS shall request the network for suspension of GPRS services when the MS or the network limitations make it unable to communicate on GPRS channels in one or more of the following scenarios:

- ~~W~~when a GPRS-attached MS enters dedicated mode and the support of Class A mode of operation is not posssible~~either the MS or the network does not support class A or the class A capabilities of the MS and the network are not the same~~ (e.g. the MS only supports DTM —see GSM 03.64— and the network only supports independent CS and PS)

- ~~or~~ when an MS in CS/PS mode of operation in UMTS during a CS connection reverts to class-B mode of operation in GSM

- when an MS in class A mode of operation is handed over to a cell where the support of Class A mode of operation is not possible (e.g. a DTM mobile station entering a cell not supporting DTM)~~that does not support class A mode of operation or the class A capabilities of the MS and the network are not the same~~ ~~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 **Error! Reference source not found.**.

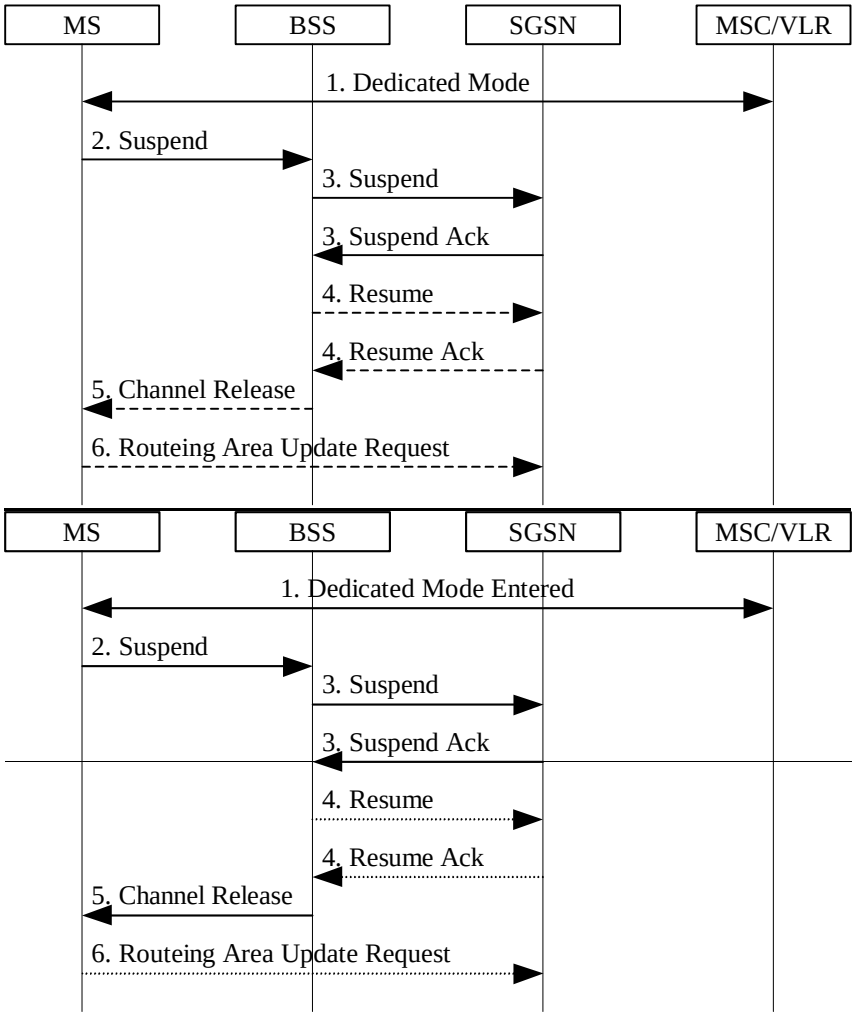

Figure 1: Suspend and Resume Procedure

1) The MS enters dedicated mode, ~~or~~ performs handover from UMTS to GSM (where the MS reverts to GSM class-B mode of operation) during CS connection or performs handover from a cell supporting class DTM to a cell not supporting DTM.

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 may determines that the ~~circuit-switched radio channel shall be released~~conditions for the GPRS suspension have disappeared. 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) If the circuit switched radio channel is to be released, ~~T~~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) The MS shall resume GPRS services by sending a Routeing Area Update Request message to the SGSN, as described in subclause "Routeing Area Update Procedure":

   - ~~I~~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, ~~or~~
   - if an MS in GSM class-B mode of operation during CS connection performs handover to CS/PS mode of operation in UMTS or
   - if the MS locally determines that the conditions for the GPRS suspension have disappeared~~, then the MS shall resume GPRS services by sending a Routeing Area Update Request message to the SGSN, as described in subclause "Routeing 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 Routeing Area Update Request procedure as described in step 6.

Document ***S2-001524***

Revision of S2-001364

Agenda item

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

TSG SA2
Bristol, UK
4 – 8 September 2000

CHANGE REQUEST

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23.060	**CR**	**172 r1**	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG SA #9	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic		

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

Source:	Vodafone	**Date:** 24 August 2000
Subject:	**DTM: download of the IMSI from the SGSN to the BSC**	
Work item:	BSS co-ordination of Radio Resources allocation for class A GPRS services - GSM Radio Access (R99)	

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

The IMSI of a DTM MS needs to be known by the BSC when the MS leaves packet idle mode and enters packet transfer mode, so that pages from the MSC can be related to the MS and the MS is *paged* on the PACCH.

The RA-Capability and the RA-Capability-Update procedures are reused in order to reduce the impact on the SGSN.

Clauses affected: 6.1.4.1.1

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:

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6.14.1.1 MS Radio Access Capability (GSM Only)

The MS radio access capability information element contains the GSM radio capabilities of the MS (e.g., multislot capability, power class), and more generally all the information that should be known by the BSS in order to handle radio resources for that MS.

The MS radio access capability is a container for a multiplicity of radio access technology-dependent information, i.e., within the MS radio access capability there are independent sub-fields for various technologies such as GSM 900 and GSM 1800. The coding shall allow a BSS to extract only the sub-fields relevant to it without interpreting the other sub-fields. This ensures that the MS radio access capability does not need to be interpreted by the NSS, and the full MS radio access capability is always sent by the MS to the SGSN, and thereafter provided to the BSS irrespective of the actual BSS capabilities.

The SGSN shall provide the MS radio access capability as an information element on the Gb interface. It is the responsibility of the SGSN to provide the BSS with the most recent MS radio access capability received from the MS. The MS radio access capability information element can be included in a downlink transfer request, or be sent in a specific message that updates the MS radio access capability information in the BSS. The BSS may at any time request the MS radio access capability for a given MS to be transmitted from the SGSN to the BSS.

Together with the MS radio access capability, the SGSN shall provide the IMSI of the MS when this is known. For a BSS supporting DTM, tThe IMSI is stored at the BSS and used for radio resource co-ordination; e.g. for a DTM MS.

A specific optimisation allows the BSS to receive a reduced MS radio access capability at initial access directly from the MS. This enables the BSS not to wait for the full MS radio access capability to be provided by the SGSN, and is therefore quicker for the initial MS-originated transmission. The reduced MS radio access capability can be carried in several RR messages depending on the access method, e.g., in the initial random access message, or in the first uplink radio block. Details are provided in 3G TS 24.008 and GSM 04.60.

At inter system change (UMTS to GSM) the MS radio access capability shall be sent to the SGSN in the Routeing Area Update Request message., as specified in 3G TS 24.008. The SGSN then provides the BSS with the GSM radio capabilities.

3GPP TSG SA2 Meeting #14
Bristol, UK, 4-8 September 2000

***Document* S2-001371**
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23.060	CR	173	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA #9	for approval	X	strategic		(for SMG use only)
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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 [X] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: Ericsson **Date:**

Subject: CS paging procedure in UMTS

Work item: Release 99

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: The paging procedure when initiated by MSC/VLR is not described for the UMTS case. This CR clarifies which messages and parameters that are applicable in the CS paging procedure.
One example that is not described elsewhere and clarified in this CR is the 'CN Domain Indicator' which must be set to "CS" by SGSN, to get the correct handling in MS.

Clauses affected:

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:

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6.3.4 CS Paging (UMTS Only)

When an MS is both IMSI- and GPRS-attached in a network that operates in mode I, then the MSC/VLR executes paging for circuit-switched services via the SGSN. ~~Paging is defined in~~
The paging procedure is supervised in the MSC by a paging timer.

The CS Paging procedure is illustrated in Figure 1. Each step is explained in the following list.

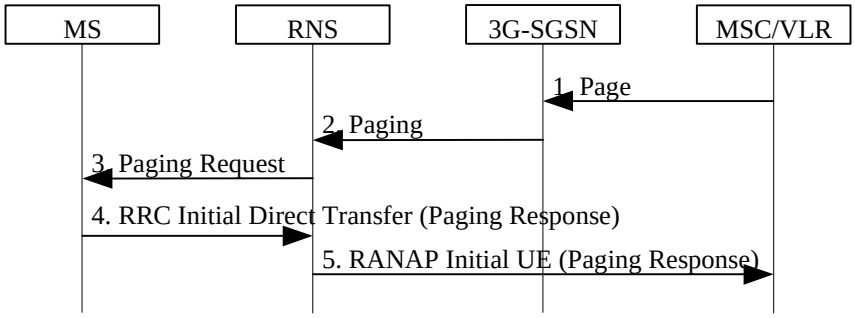

Figure 1: CS Paging Procedure

1) The SGSN receives a Page (IMSI, VLR TMSI, Location Information) message from the MSC. If VLR TMSI is omitted the IMSI is used instead of the TMSI as a paging address at the radio interface. If location information is not included, then SGSN shall page the MS in all the cells served by the VLR and the SGSN, unless the SGSN has reliable information about the location of the MS.

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

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

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

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

6.3.4.1 Network Operation Modes for UMTS

3GPP/SMG Meeting TSG-SA2 #14
Bristol, England, 4-8 September 2000

Document S2-001372

CHANGE REQUEST

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23.060	CR	174	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

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

Source:	Ericsson
Date:	2000-08-29
Subject:	Clarification on P-TMSI and PTMSI Signature at detach
Work item:	GSM-UMTS Interworking

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

Reason for change:	Alignment with 24.008 of the P-TMSI handling in the MS initiated Detach Procedure.
Clauses affected:	6.6.1

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:	

6.6.1 MS-Initiated Detach Procedure

The MS-Initiated Detach procedure when initiated by the MS is illustrated in Figure 1~~Figure 22~~.

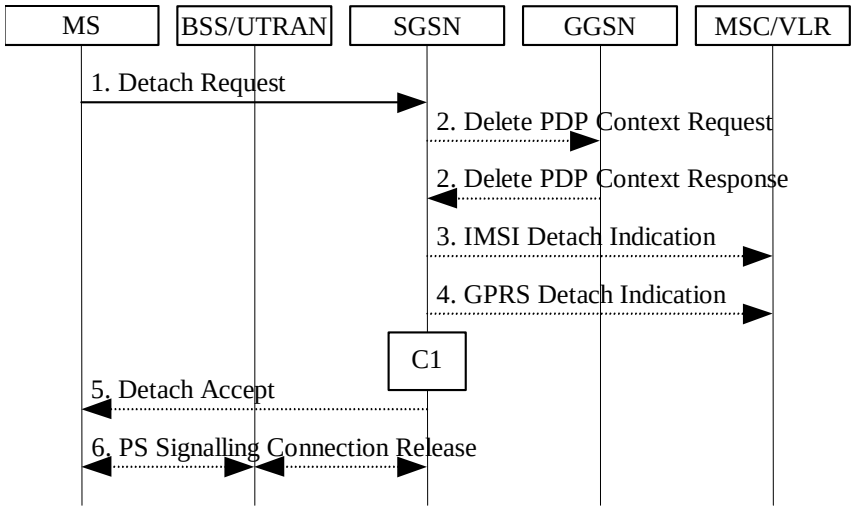

Figure 1~~22~~: MS-Initiated Combined GPRS / IMSI Detach Procedure

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., GPRS Detach only, IMSI Detach only or combined GPRS and IMSI Detach. Switch Off indicates whether the detach is due to a switch off situation or not. ~~For UMTS, t~~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 GPRS 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 IMSI detach, the SGSN sends an IMSI Detach Indication (IMSI) message to the VLR.

4) If the MS wants to remain IMSI-attached and is doing a GPRS detach, the SGSN sends a GPRS Detach Indication (IMSI) message to the VLR. The VLR removes the association with the SGSN and handles paging and location update without going via the SGSN.

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 GPRS detached, then the 3G-SGSN releases the PS signalling connection.

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedure in 3G TS 23.078:

C1) CAMEL-GPRS-Detach.

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Bristol, England, 4-8 September 2000

***Document* S2-001532**
e.g. for 3GPP use the format TP-99xxx
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23.060	CR	175r1	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG SA #9	for approval	X	strategic		(for SMG use only)
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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: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio	X	Core Network	X

Source: Ericsson **Date:** 2000-09-07

Subject: Serving RNS Relocation Procedure

Work item: Release 99

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

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

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

Reason for change: Clarification on when uplink and downlink data transfer shall be suspended within the procedures

Clauses affected: 6.9.2.2

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:

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6.9.2.2 Serving RNS Relocation Procedures

6.9.2.2.1 Serving SRNS Relocation Procedure

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

The Serving SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, from a "standing still position". In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra SGSN SRNS Relocation procedure is performed. If the routeing area is changed, then this procedure is followed by an Intra SGSN Routeing Area Update procedure. 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 HLR about the new MS location.

Figure 1 shows SRNS relocation when source SRNC and target RNC are connected to different SGSNs. Figure 2 shows the situation after SRNS Relocation procedure and Routeing Area Update procedure have been completed. In the case described in Figure 1and Figure 2 the MS is in state MM-IDLE.

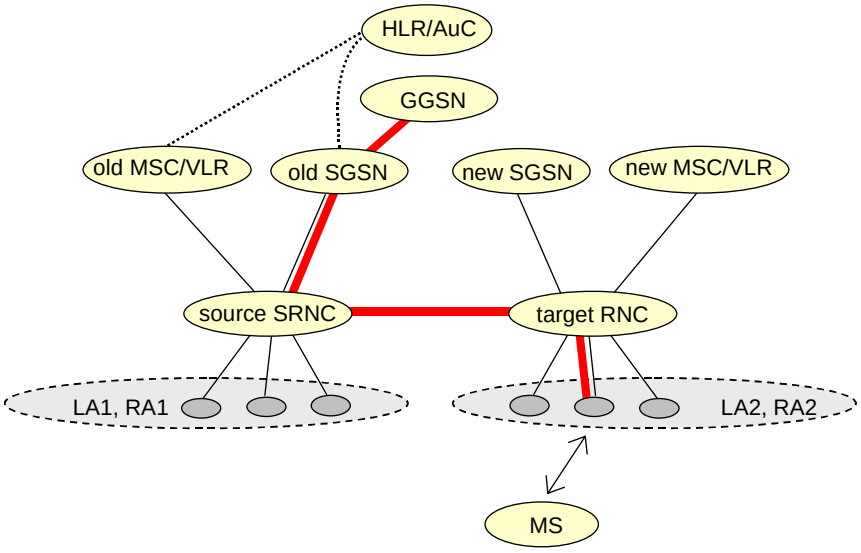


Figure 1: Before SRNS Relocation and Routeing Area Update

Before the Serving SRNS Relocation procedure and RA update, the MS is registered in the old SGSN. The source RNC is acting as serving RNC (SRNC).

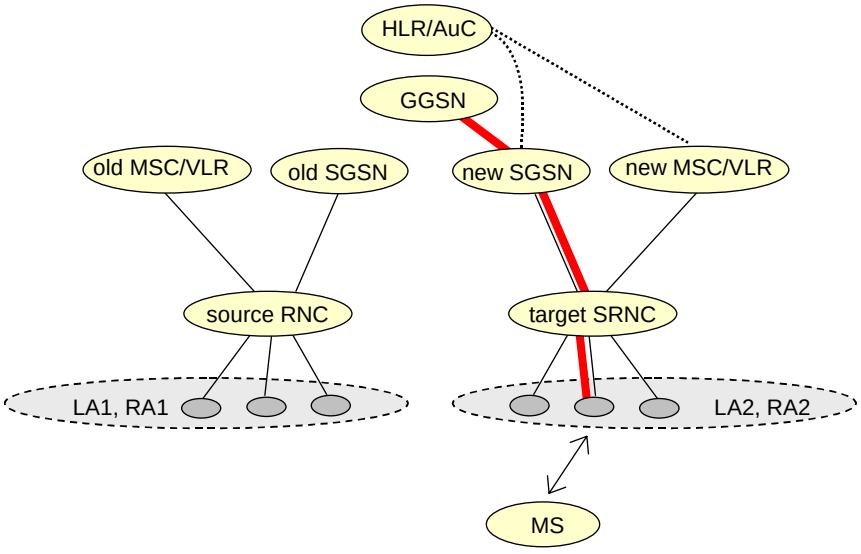


Figure 2: After SRNS Relocation and Routeing Area Update

After the Serving SRNS Relocation procedure and RA update, the MS is registered in the new SGSN The MS is in state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as serving RNC.

The Serving SRNS Relocation procedure is illustrated in Figure 3. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

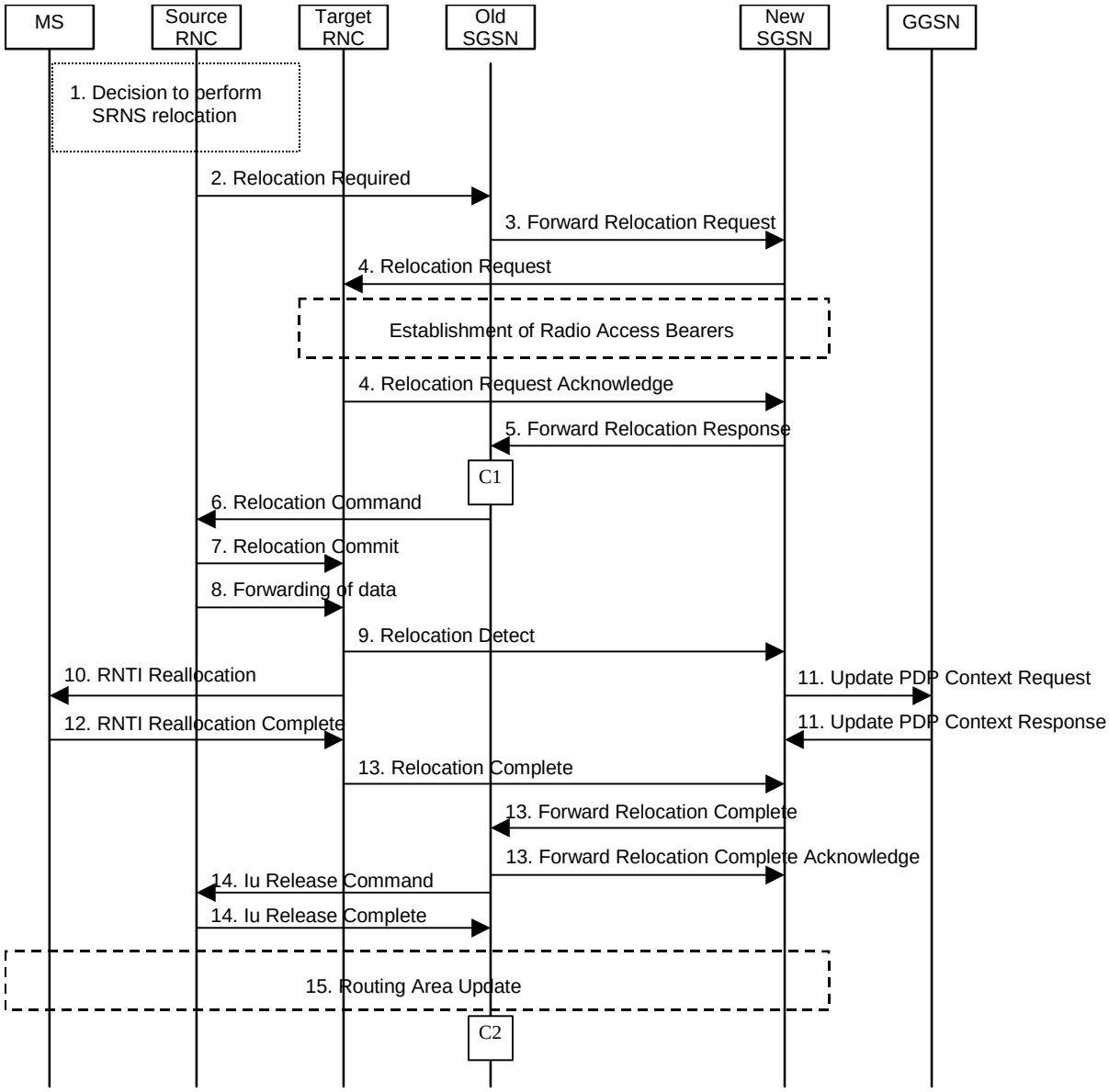


Figure 3: Serving SRNS Relocation Procedure

1) The source SRNC decides to perform/initiate an SRNS relocation.

2) The source SRNC initiates the relocation preparation procedure by sending a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to target RNC transparent container) to the old SGSN. The source SRNC shall set the Relocation Type to "UE not involved". The Source to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality and RRC protocol context information (including UE Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request message (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN transparent container, RANAP Cause) to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see the Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to target RNC transparent container, RABs to be setup) to the target RNC. For each RAB requested to be established, the RABs to be setup information elements shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data. After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge message (RABs setup, RABs failed to setup) to the new SGSN. The target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and RAB Setup Information) is sent from new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the downstream packets not yet acknowledged by the MS, i.e. the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The RAB Setup Information, one information element for each RAB, contain the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command message (RABs to be released, and RABs subject to data forwarding) to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit message (SRNS Contexts) to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

   If PDCP does not support lossless relocation, the acknowledged mode SRNS relocation procedures shall be performed as in unacknowledged mode. Hence PDCP sequence numbers shall not be transferred from old RNC to target RNC.

   Before sending the Relocation Commit uplink and downlink data transfer in the source SRNC shall be suspended for RABs which requires loss-less relocation.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a RNTI Reallocation message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

The target SRNC resets and restarts the RLC connections, and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

11) Upon reception of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier).

12) When the MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

13) When the target SRNC receives the RNTI Reallocation Complete message, i.e. the new SRNC—ID + S-RNTI are successfully exchanged with the UE by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect and upon reception of Relocation Complete, the CN shall switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN shall signal to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

14) Upon receiving the Relocation Complete message or if it is an inter SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

15) After the MS has finished the RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS Only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED mode.

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.2 Combined Hard Handover and SRNS Relocation Procedure

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

The Combined Hard Handover and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a hard handover decided by the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra SGSN SRNS Relocation procedure is performed. If the routeing area is changed, then this procedure is followed by an Intra SGSN Routeing Area Update procedure. 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 HLR about the new MS location.

If the target RNC is connected to a different SGSN than the source SRNC, an Inter SGSN SRNS Relocation procedure is performed. This procedure is followed by an Inter SGSN Routeing Area Update procedure.

Figure 4 shows the situation before a Combined Hard Handover and SRNS Relocation procedure when source and target RNC are connected to different SGSNs. Figure 5 shows the situation after the Combined Hard Handover and SRNS Relocation procedure and RA update procedure have been completed. In the case described in Figure 4 and Figure 5 the MS is in MM IDLE state.

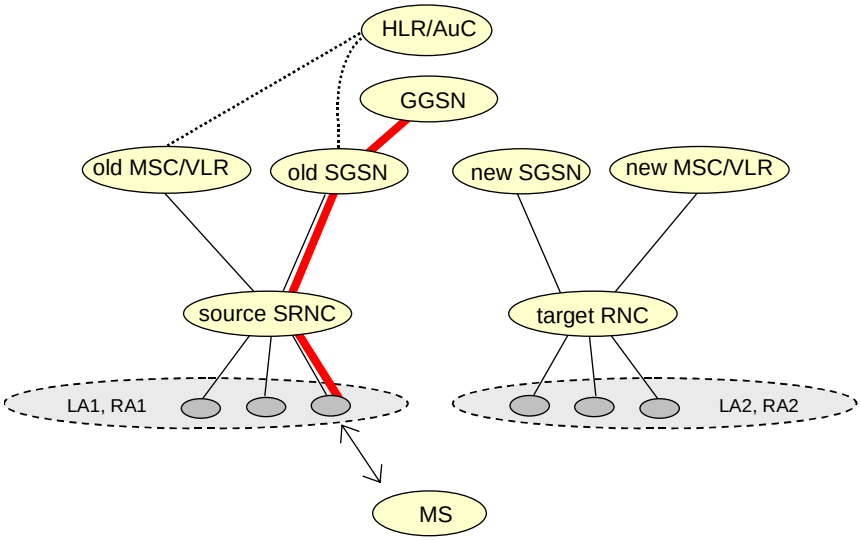


Figure 4: Before Combined Hard Handover and SRNS Relocation and Routeing Area Update

Before the SRNS Relocation and Routeing Area Update the MS is registered in the old SGSN and in the old MSC/VLR. The source RNC is acting as serving RNC.

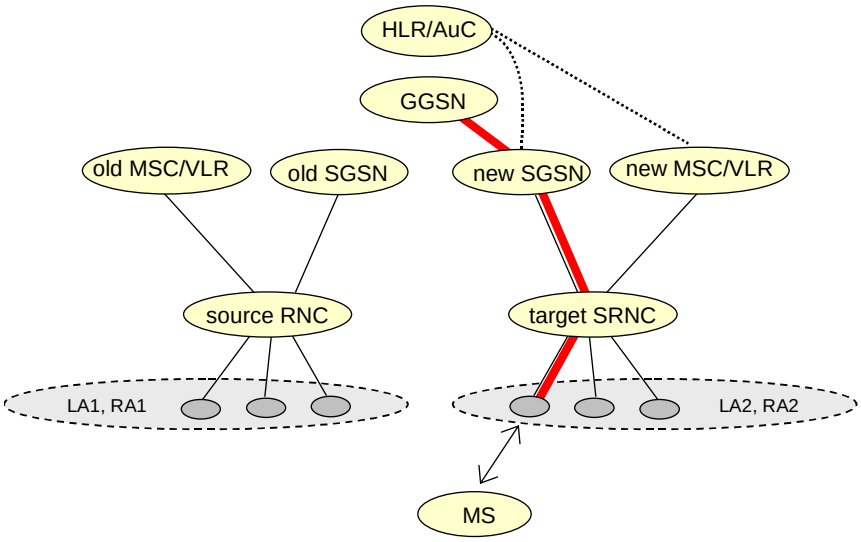


Figure 5: After Combined Hard Handover and SRNS Relocation and Routeing Area Update

After the SRNS relocation and RA update, the MS is registered in the new SGSN and in the new MSC/VLR. The MS is in state PMM-CONNECTED towards the new SGSN and in MM IDLE state towards the new MSC/VLR. The target RNC is acting as serving RNC.

The Combined Hard Handover and SRNS Relocation procedure for the PS domain is illustrated in Figure 6. The sequence is valid for both intra SGSN SRNS relocation and inter SGSN SRNS relocation.

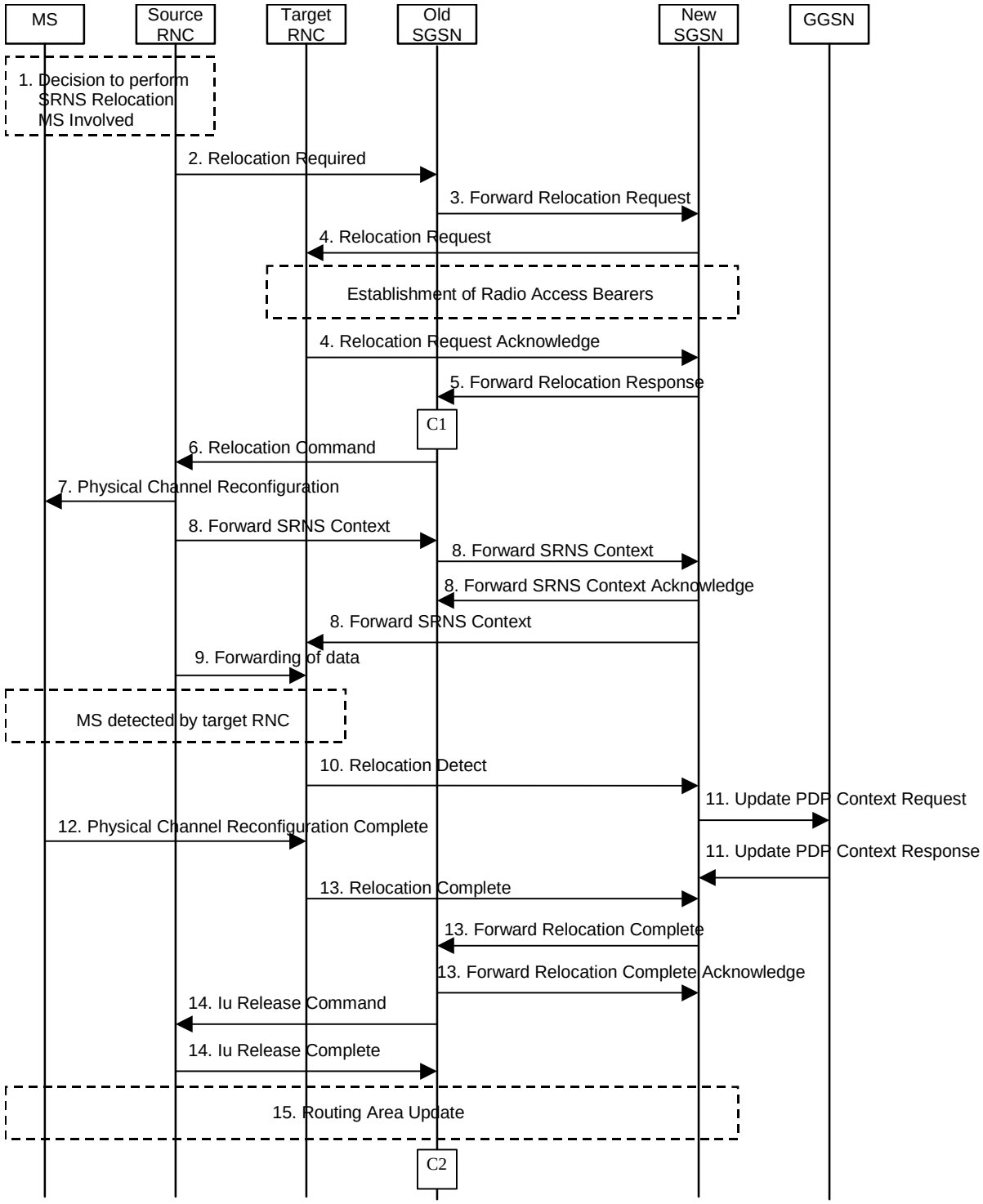


Figure 6: Combined Hard Handover and SRNS Relocation Procedure

1) Based on measurement results and knowledge of the UTRAN topology, the source SRNC decides to initiate a combined hard handover and SRNS relocation.

2) The source SRNC initiates the relocation preparation procedure by sending a Relocation Required (Relocation Type, Cause, Source ID, Target ID, Source RNC To Target RNC Transparent Container) message to the old SGSN. The source SRNC shall set Relocation Type to "UE Involved". Source To Target RNC Transparent Container includes the necessary information for relocation co-ordination, security functionality and RRC protocol context information (including UE Capabilities).

3) The old SGSN determines from the Target ID if the SRNS relocation is intra-SGSN SRNS relocation or inter-SGSN SRNS relocation. In case of inter-SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) message to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN (see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)"). The Forward Relocation Request message is applicable only in case of inter-SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC To Target RNC Transparent Container, RABs To Be Setup) message to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data.

   After all the necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (Target RNC To Source RNC Transparent Container, RABs Setup, RABs Failed To Setup) message to the new SGSN. The transparent container contains all radio-related information that the MS needs for the handover, i.e., a complete RRC message (e.g., Physical Channel Reconfiguration) to be sent transparently via CN and source SRNC to the MS. The target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response (Cause, UTRAN Transparent Container, RANAP Cause, Target RNC Information) message is sent from the new SGSN to the old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the downstream packets not yet acknowledged by the MS, i.e., the relocation resource allocation procedure is terminated successfully. UTRAN transparent container and RANAP Cause are information from the target RNC to be forwarded to the source RNC. The Target RNC Information, one information element for each RAB to be setup, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. The Forward Relocation Response message is applicable only in case of inter-SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (Target RNC To Source RNC Transparent Container, RABs To Be Released, RABs Subject To Data Forwarding) message to the source SRNC. The old SGSN decides the RABs to be subject for data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

   7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, then the source SRNC shall trigger the execution of relocation of SRNS by sending to the MS the RRC message provided in the Target RNC to source RNC transparent container, e.g., a Physical Channel Reconfiguration (UE Information Elements, CN Information Elements) message. UE Information Elements include among others new SRNC identity and S-RNTI. CN Information Elements contain among others Location Area Identification and Routeing Area Identification.
   Before the RRC message is sent (e,g, Physical Channel Reconfiguration) uplink and downlink data transfer in the source SRNC shall be suspended for RABs which requires loss-less relocation.

8) The source SRNC continues the execution of relocation of SRNS by sending a Forward SRNS Context (RAB Contexts) message to the target RNC via the old and the new SGSN, which is acknowledge by a Forward SRNS Context Acknowledge message. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC when handover is made with switching in CN. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence numbers is not used.

The target SRNC resets and restarts the RLC connections, and exchanges the PDCP sequence numbers (PDCP-SNU, PDCP-SND) between the target SRNC and the MS. PDCP-SND is the PDCP sequence number for the next expected in-sequence downlink packet to be received in acknowledged mode in the MS per radio bearer, which requires lossless relocation. PDCP-SND confirms all mobile terminated packets successfully transferred before the start of the relocation procedure. If PDCP-SND confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. PDCP-SNU confirms all mobile originated packets successfully transferred before the start of the relocation procedure. If PDCP-SNU confirms reception of packets that were received in the source SRNC, then these packets shall be discarded by the MS.

9) After having sent the Forward SRNS Context message, source SRNC begins the forwarding of data for the RABs to be subject for data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

10) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE Involved", the relocation execution trigger may be received from the Uu interface; i.e., when target RNC detects the MS on the lower layers. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

11) Upon reception of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request (New SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) message to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the MS has reconfigured it self, it sends e.g., a Physical Channel Reconfiguration Complete message to the target SRNC. From now on the exchange of packets with the MS can start.

13) When the target SRNC receives the Physical Channel Reconfiguration Complete message or the Radio Bearer Release Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the UE by the radio protocols, the target SRNC shall initiate Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter-SGSN SRNS relocation, then the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

14) Upon receiving the Relocation Complete message or if it is an inter-SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete message.

15) After the MS has finished the reconfiguration procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS Only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update.

6.9.2.2.3 Combined Cell / URA Update and SRNS Relocation Procedure

This procedure is only performed for an MS in PMM-CONNECTED state, where the Iur carries control signalling but no user data.

The Combined Cell / URA Update and SRNS Relocation procedure is used to move the UTRAN to CN connection point at the UTRAN side from the source SRNC to the target RNC, while performing a cell re-selection in the UTRAN. In the procedure, the Iu links are relocated. If the target RNC is connected to the same SGSN as the source SRNC, an Intra SGSN SRNS Relocation procedure is performed. If the routeing area is changed, the this procedure is followed by an Intra SGSN Routeing Area Update procedure. 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 HLR about the new MS location.

Before the Combined Cell / URA Update and SRNS Relocation and the Routeing Area Update the MS is registered in the old SGSN. The source RNC is acting as serving RNC.

After the Combined Cell / URA Update and SRNS Relocation and the Routeing Area Update, the MS is registered in the new SGSN The MS is in state PMM-CONNECTED towards the new SGSN, and the target RNC is acting as serving RNC.

The Combined Cell / URA Update and SRNS Relocation procedure for the PS domain is illustrated in Figure 7. The sequence is valid for both intra-SGSN SRNS relocation and inter-SGSN SRNS relocation.

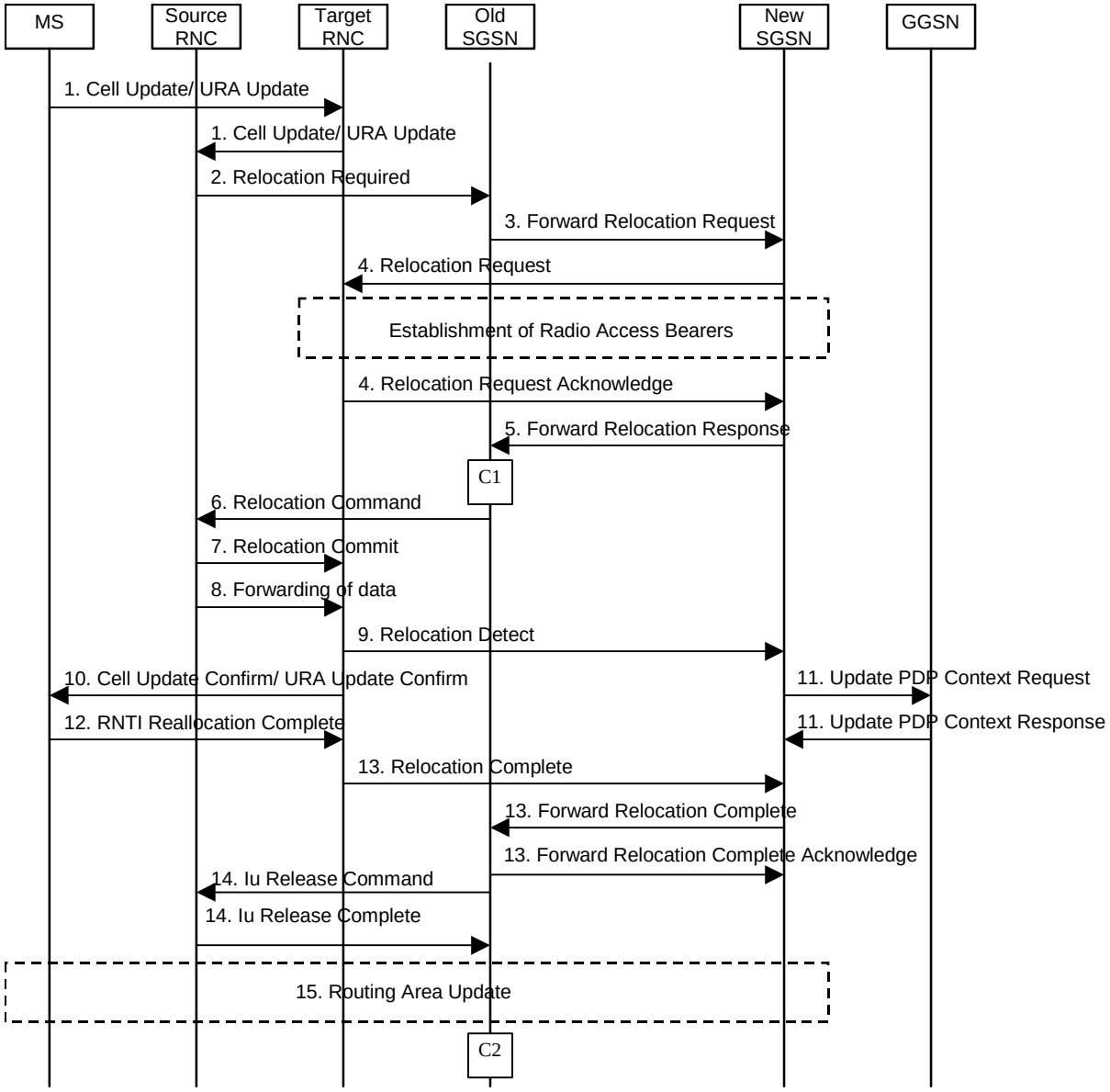


Figure 7: Combined Cell / URA Update and SRNS Relocation Procedure

1) The MS sends a Cell Update / URA Update message to the UTRAN, after having made cell re-selection. Upon reception of the message, the target RNC forwards the received message towards the source SRNC via Iur. Source SRNC decides to perform a combined cell / URA update and SRNS relocation towards the target RNC.

2) The source SRNC initiates the relocation preparation procedure by sending a Relocation Required message (Relocation Type, Cause, Source ID, Target ID, Source RNC to Target RNC Transparent Container) to the old SGSN. The source SRNC shall set Relocation Type to "UE not involved". Source RNC to Target RNC Transparent Container includes the necessary information for Relocation co-ordination, security functionality, and RRC protocol context information (including UE Capabilities).

3) The old SGSN determines from the Target ID if the SRNS Relocation is intra SGSN SRNS relocation or inter SGSN SRNS relocation. In case of inter SGSN SRNS relocation the old SGSN initiates the relocation resource allocation procedure by sending a Forward Relocation Request (IMSI, Tunnel Endpoint Identifier Signalling, MM Context, PDP Context, Target Identification, UTRAN Transparent Container, RANAP Cause) message to the new SGSN. At the same time a timer is started on the MM and PDP contexts in the old SGSN, see Routeing Area Update procedure in subclause "Location Management Procedures (UMTS Only)". The Forward Relocation Request message is applicable only in case of inter SGSN SRNS relocation.

4) The new SGSN sends a Relocation Request message (Permanent NAS UE Identity, Cause, CN Domain Indicator, Source RNC to Target RNC Transparent Container, RABs To Be Setup) to the target RNC. For each RAB requested to be established, RABs To Be Setup shall contain information such as RAB ID, RAB parameters, Transport Layer Address, and Iu Transport Association. The RAB ID information element contains the NSAPI value, and the RAB parameters information element gives the QoS profile. The Transport Layer Address is the SGSN Address for user data, and the Iu Transport Association corresponds to Tunnel Endpoint Identifier Data.

   After all necessary resources for accepted RABs including the Iu user plane are successfully allocated, the target RNC shall send the Relocation Request Acknowledge (RABs setup, RABs failed to setup) message to the new SGSN. The target RNC will for each RAB to be setup (defined by an IP Address and a Tunnel Endpoint Identifier) receive both forwarded downstream PDUs from the source SRNC as well as downstream PDUs from the new SGSN.

5) When resources for the transmission of user data between target RNC and new SGSN have been allocated and the new SGSN is ready for relocation of SRNS, the Forward Relocation Response message (Cause, RANAP Cause, and Target RNC Information) is sent from new SGSN to old SGSN. This message indicates that the target RNC is ready to receive from source SRNC the downstream packets not yet acknowledged by MS, i.e., the relocation resource allocation procedure is terminated successfully. RANAP Cause is information from the target RNC to be forwarded to the source RNC. The RAB Setup Information, one information element for each RAB, contains the RNC Tunnel Endpoint Identifier and RNC IP address for data forwarding from source SRNC to target RNC. If the target RNC or the new SGSN failed to allocate resources the RAB Setup Information element contains only NSAPI indicating that the source RNC shall release the resources associated with the NSAPI. The Forward Relocation Response message is applicable only in case of inter SGSN SRNS relocation.

6) The old SGSN continues the relocation of SRNS by sending a Relocation Command (RABs to be released, and RABs subject to data forwarding) message to the source SRNC. The old SGSN decides the RABs subject to data forwarding based on QoS, and those RABs shall be contained in RABs subject to data forwarding. For each RAB subject to data forwarding, the information element shall contain RAB ID, Transport Layer Address, and Iu Transport Association. The Transport Layer Address and Iu Transport Association is used for forwarding of DL N-PDU from source RNC to target RNC.

7) Upon reception of the Relocation Command message from the PS domain, the source RNC shall start the data-forwarding timer. When the relocation preparation procedure is terminated successfully and when the source SRNC is ready, the source SRNC shall trigger the execution of relocation of SRNS by sending a Relocation Commit (SRNS Contexts) message to the target RNC. The purpose of this procedure is to transfer SRNS contexts from the source RNC to the target RNC. SRNS contexts are sent for each concerned RAB and contain the sequence numbers of the GTP-PDUs next to be transmitted in the uplink and downlink directions and the next PDCP sequence numbers that would have been used to send and receive data from the MS. For connections using RLC unacknowledged mode PDCP sequence number is not used.

   Before sending the Relocation Commit uplink and downlink data transfer in the source SRNC shall be suspended for RABs which requires loss-less relocation.

8) After having sent the Relocation Commit message, source SRNC begins the forwarding of data for the RABs subject to data forwarding. The data forwarding at SRNS relocation shall be carried out through the Iu interface, meaning that the data exchanged between source SRNC and target RNC are duplicated in the source SRNC and routed at IP layer towards the target RNC.

9) The target RNC shall send a Relocation Detect message to the new SGSN when the relocation execution trigger is received. For SRNS relocation type "UE not involved", the relocation execution trigger is the reception of the Relocation Commit message from the Iur interface. When the Relocation Detect message is sent, the target RNC shall start SRNC operation.

10) After having sent the Relocation Detect message, target SRNC responds to the MS by sending a Cell Update Confirm / URA Update Confirm message. Both messages contain UE information elements and CN information elements. The UE information elements include among others new SRNC identity and S-RNTI. The CN information elements contain among others Location Area Identification and Routeing Area Identification. The procedure shall be co-ordinated in all Iu signalling connections existing for the MS.

11) Upon reception of the Relocation Detect message, the CN may switch the user plane from source RNC to target SRNC. If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN sends Update PDP Context Request messages (new SGSN Address, SGSN Tunnel Endpoint Identifier, QoS Negotiated) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (GGSN Tunnel Endpoint Identifier) message.

12) When the MS has reconfigured itself, it sends the RNTI Reallocation Complete message to the target SRNC.

13) When the target SRNC receives the RNTI Reallocation Complete message, i.e. the new SRNC-ID + S-RNTI are successfully exchanged with the UE by the radio protocols, the target SRNC shall initiate the Relocation Complete procedure by sending the Relocation Complete message to the new SGSN. The purpose of the Relocation Complete procedure is to indicate by the target SRNC the completion of the relocation of the SRNS to the CN. If the user plane has not been switched at Relocation Detect, the CN shall upon reception of Relocation Complete switch the user plane from source RNC to target SRNC, If the SRNS Relocation is an inter SGSN SRNS relocation, the new SGSN signals to the old SGSN the completion of the SRNS relocation procedure by sending a Forward Relocation Complete message.

14) Upon receiving the Relocation Complete message or if it is an inter SGSN SRNS relocation; the Forward Relocation Complete message, the old SGSN sends an Iu Release Command message to the source RNC. When the RNC data-forwarding timer has expired the source RNC responds with an Iu Release Complete.

15) After the MS has finished the Cell / URA update and RNTI reallocation procedure and if the new Routeing Area Identification is different from the old one, the MS initiates the Routeing Area Update procedure. See subclause "Location Management Procedures (UMTS Only)". Note that it is only a subset of the RA update procedure that is performed, since the MS is in PMM-CONNECTED state.

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update.

3GPP-SA2 Meeting #14
Bristol, England, 04-08 September 2000

Document S2-001533
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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**	**176r1**	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSGSA#9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic		

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: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [X]

Source: Ericsson **Date:** 2000-09-07

Subject: DRX and MS network capabilities within UMTS

Work item: GSM/UMTS interworking

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

F	Correction	[X]	**Release:**	Phase 2	[ ]
A	Corresponds to a correction in an earlier release	[ ]		Release 96	[ ]
B	Addition of feature	[ ]		Release 97	[ ]
C	Functional modification of feature	[ ]		Release 98	[ ]
D	Editorial modification	[ ]		Release 99	[X]
				Release 00	[ ]

Reason for change:
In N1 the Tdoc N1-000722 introduced MS network capability into RAU request as mandatory to avoid compatibility problem when roaming 3G->2G->3G. Hence this CR aligns the description in stage 2 with this correction.

23.060 is missing a description on DRX for UMTS at the same level of detail as for the description for GSM. Furthermore, it is mandatory to include DRX parameters in RAU request when changing access system from GSM to UMTS, as agreed in Tdoc N1-000988, to resolve the roaming compatibility problem.

Clauses affected: 2, 6.5.3, 6.9.1.2.2, 6.9.1.3.2, 6.9.2.1, 6.14.2, 8.2.3, 8.2.3.1, 8.2.3.2, 13.2

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:

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.), or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[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] 3G TS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".

[4] 3G TS 23.003: "Numbering, addressing and identification".

[5] 3G TS 23.007: "Restoration procedures".

[5b] 3G TS 23.016: "Subscriber Data Management; Stage 2".

[6] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[7] GSM 03.22: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

[7b] 3G TS 23.122: "Non Access Stratum functions related to Mobile Station (MS) in idle mode".

[8] 3G TS 23.040: "Technical realisation of the Short Message Service (SMS); Point-to-Point (PP)".

[8b] 3G TS 23.078: "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] 3G TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[13] 3G TS 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 – Serving GPRS Support Node (MS - 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 (SNDCP)".

[16b] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[17] 3G TS 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] 3G TS 29.002: "Mobile Application Part (MAP) specification".

[24] 3G TS 29.016: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface network service specification".

[25] 3G TS 29.018: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface layer 3 specification".

[26] 3G TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[27] 3G TS 29.061: "General Packet Radio Service (GPRS); Interworking between the Public Land Mobile Network (PLMN) supporting GPRS and Packet Data Networks (PDN)".

[27b] 3G TS 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".

[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".

[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".

[49] TIA/EIA-136 (1999): "TDMA Cellular / PCS"; Arlington: Telecommunications Industry Association.

[50] 3G TS 25.301: "Radio Interface Protocol Architecture".

[51] 3G TS 25.303: "UE Functions and Interlayer Procedures in Connected Mode".

[51b] 3G TS 25.304: "UE Procedures in Idle Mode and Procedures for Call Reselection in Connected Mode".

[52] 3G TS 25.331: "RRC Protocol Specification".

[53] 3G TS 25.401: "UTRAN Overall Description".

[54] 3G TS 23.121: "Architectural Requirements for Release 1999".

[55] 3G TS 25.322: "RLC Protocol Specification".

[56] 3G TS 25.412: "UTRAN Iu Interface Signalling Transport".

[56b] 3G TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[57] 3G TS 25.323: "Packet Data Convergence Protocol (PDCP) protocol".

[58] 3G TS 23.107: "Quality of Service, Concept and Architecture".

[59] ITU-T Recommendation I.361: "B-ISDN ATM Layer Specification".

[60] 3G TS 25.321: "Medium Access Control (MAC) Protocol Specification".

[61] 3G TS 33.102: "Security Architecture".

[62] 3G TS 22.002: "Circuit Bearer Services Supported by a PLMN".

[63] 3G TS 25.411: "UTRAN Iu interface Layer 1".

[64] 3G TS 25.414: "UTRAN Iu interface data transport & transport signalling".

[65] 3G TS 23.171: "Functional stage 2 description of location services in UMTS".

[66] Void.

[67] ITU-T Recommendation I.363.5: "B-ISDN ATM Adaptation Layer Specification: Type 5 AAL".

[68] IETF RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[69] IETF RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[70] 3G TS 32.015: "GSM call and event data for the packet switched domain".

6.5.3 Combined GPRS / IMSI Attach Procedure

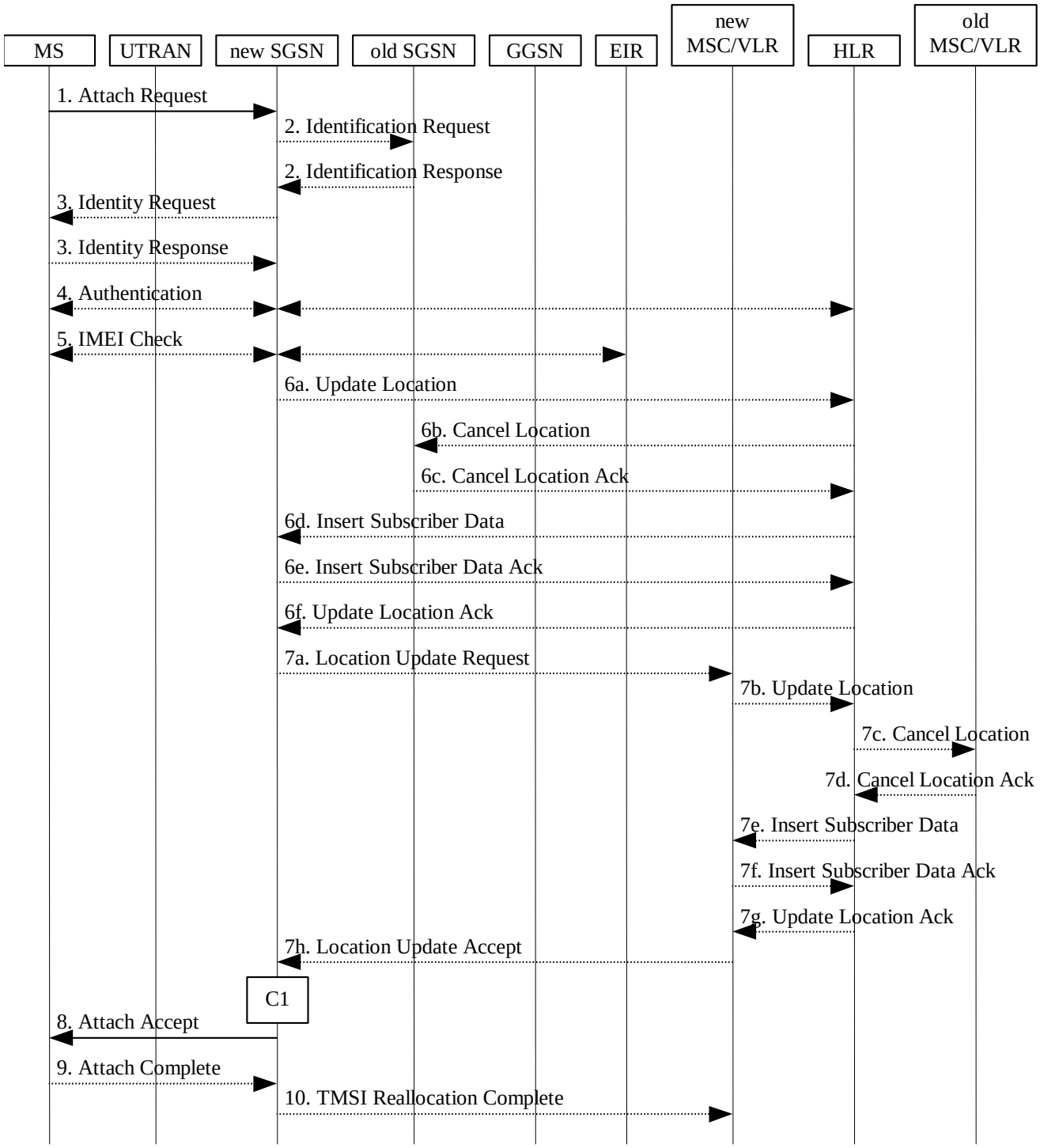


Figure 21: Combined GPRS / IMSI Attach Procedure

1) For GPRS, the MS initiates the attach procedure by the transmission of an Attach Request (IMSI or P-TMSI and old RAI, Classmark, CKSN, Attach Type, DRX Parameters, old P-TMSI Signature) message to the SGSN. IMSI shall be included if the MS does not have a valid P-TMSI available. If the MS has a valid P-TMSI, then P-TMSI and the old RAI associated with P-TMSI shall be included. Classmark contains the MS's GPRS multislot capabilities and supported GPRS ciphering algorithms in addition to the existing classmark parameters defined in GSM 04.08. Attach Type indicates which type of attach 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.

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

2) If the MS identifies itself with P-TMSI and the SGSN has changed since detach, the new SGSN sends an Identification Request (P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to request the IMSI. The old SGSN responds with Identification Response (IMSI, Authentication Triplets (for GPRS) or Authentication Vectors (for UMTS)). 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 6d). This operation marks the MS as GPRS-attached in the VLR.

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

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

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

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

   e) If the LA update is inter-MSC, the HLR sends Insert Subscriber Data (IMSI, 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) by returning an Attach Complete message to the SGSN.

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

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

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedure in 3G TS 23.078:

C1) CAMEL-GPRS-Attach-Request.

6.9.1.2.2 Inter SGSN Routeing Area Update

The Inter SGSN Routeing Area Update procedure is illustrated in Figure 32.

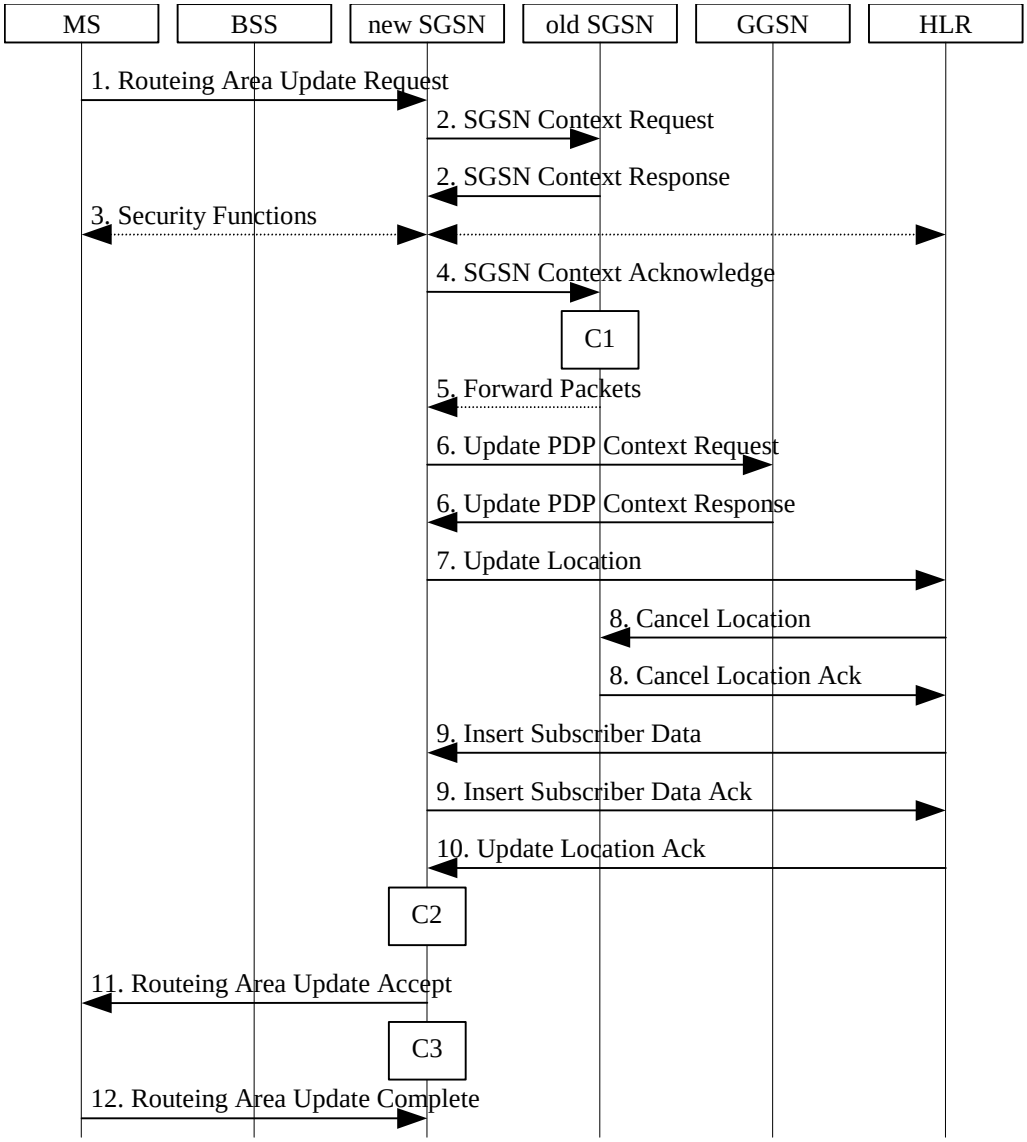


Figure 32: Inter SGSN Routeing Area Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark and DRX parameters) 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. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

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 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 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, 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 by returning a Routeing Area Update Complete (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.

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.

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update-Session.

C3) CAMEL-GPRS-Routeing-Area-Update-Context.

6.9.1.3.2 Combined Inter SGSN RA / LA Update

The Combined RA / LA Update (inter SGSN) procedure is illustrated in Figure 34.

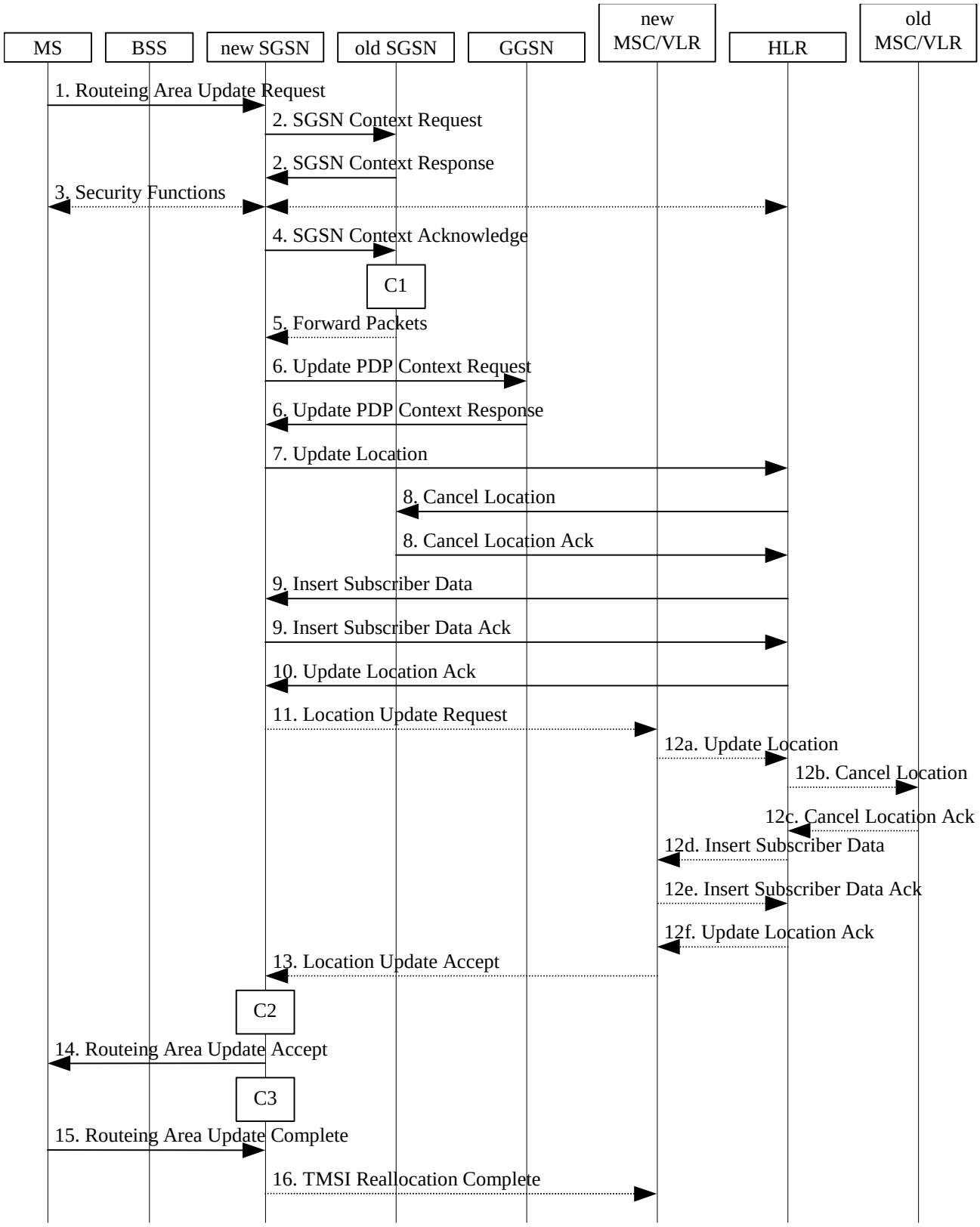


Figure 34: Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

1) The MS sends a Routeing Area Update Request (old RAI, old P-TMSI Signature, Update Type, Classmark and DRX parameters) 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. Classmark contains the MS GPRS multislot capabilities and supported GPRS ciphering algorithms as defined in TS 24.008. DRX Parameters indicates whether or not the MS uses discontinuous and the DRX cycle length.

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 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 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 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 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, 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 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 returning a Routeing Area Update Complete (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 TMSI Reallocation Complete 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.

For an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update-Session.

C3) CAMEL-GPRS-Routeing-Area-Update-Context.

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 GPRS-attached and IMSI-attached shall perform the Combined RA / LA Update procedures.

In UMTS, an 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 35.

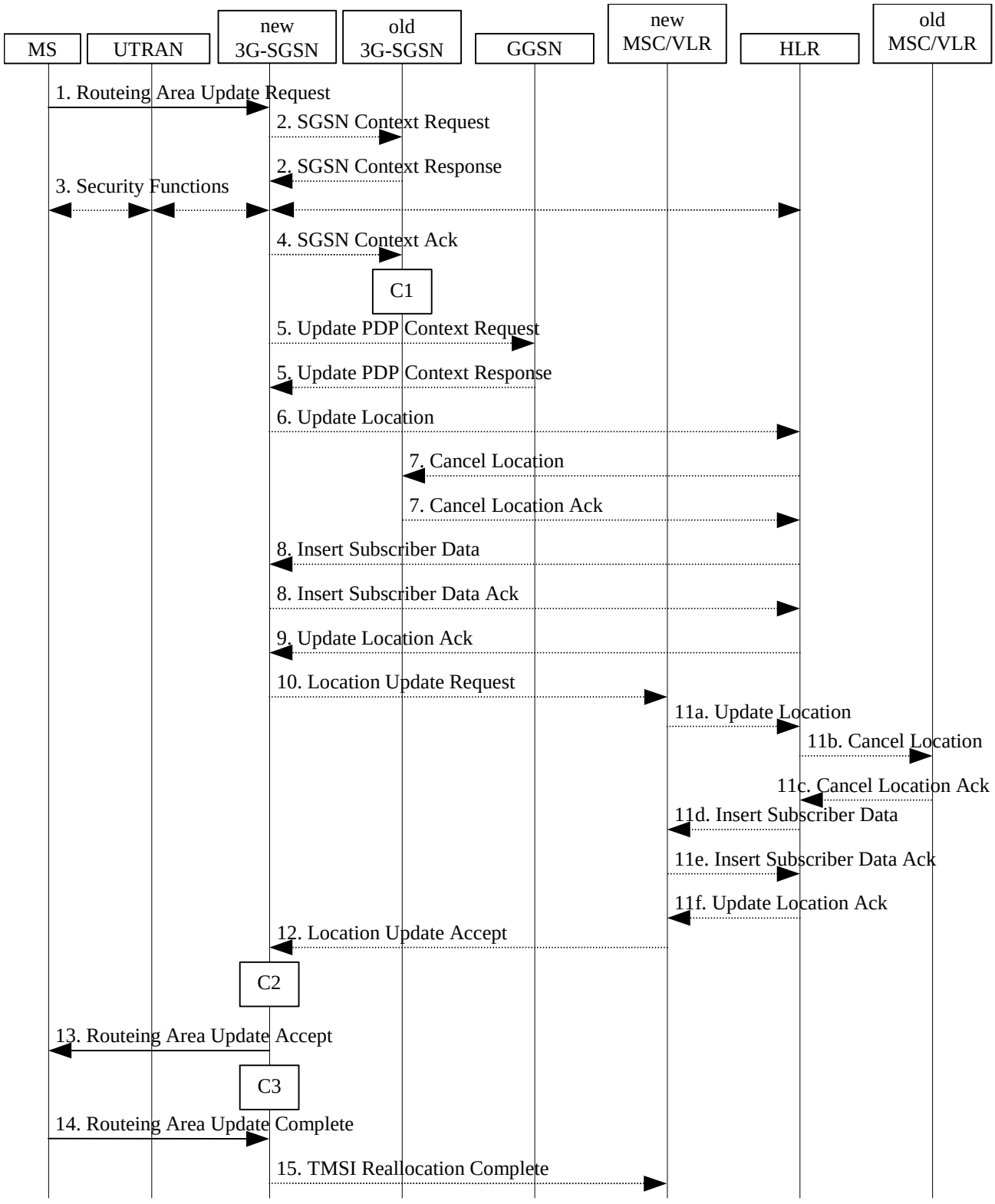


Figure 35: UMTS RA Update Procedure

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

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

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

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

2) If the RA update is an Inter-SGSN Routeing area update and if the MS was in PMM-IDLE state, the new SGSN sends SGSN Context Request message (old P-TMSI, old RAI, old P-TMSI Signature) to the old SGSN to get the MM and PDP contexts for the MS. The old SGSN validates the old P-TMSI Signature and responds with an appropriate error cause if it does not match the value stored in the old SGSN. This should initiate the security functions in the new SGSN. If the security functions authenticate the MS correctly, the new SGSN shall send an SGSN Context Request (IMSI, old RAI, MS Validated) message to the old SGSN. MS Validated indicates that the new SGSN has authenticated the MS. If the old P-TMSI Signature was valid or if the new SGSN indicates that it has authenticated the MS, the old SGSN 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 Routeing area update, the new SGSN sends an SGSN Context Acknowledge message to the old SGSN. The old SGSN marks in its context that the MSC/VLR association and the information in the GGSNs and the HLR are invalid. This triggers the MSC/VLR, the GGSNs, and the HLR to be updated if the MS initiates a routeing area update procedure back to the old SGSN before completing the ongoing routeing area update procedure.

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, Tunnel Endpoint Identifier,) to the GGSNs concerned. The GGSNs update their PDP context fields and return an Update PDP Context Response (Tunnel Endpoint Identifier). Note: If the RA update is an Inter-SGSN routeing area update initiated by an MS in PMM-CONNECTED state, then the Update PDP Context Request message is sent as described in subclause "Serving RNS Relocation Procedures".

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

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 routeing 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 Routeing Area Update Accept (P-TMSI, VLR TMSI, P-TMSI Signature).

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

15) The new SGSN sends a TMSI Reallocation Complete 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 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 routeing area update procedure fails a maximum allowable number of times, or if the SGSN returns a Routeing Area Update Reject (Cause) message, the MS shall enter PMM-DETACHED state.

If the Location Update Accept message indicates a reject, 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 an MS with GPRS-CSI defined, CAMEL interaction may be performed, see referenced procedures in 3G TS 23.078:

C1) CAMEL-GPRS-SGSN-Context-Acknowledge.

C2) CAMEL-GPRS-Routeing-Area-Update-Session.

C3) CAMEL-GPRS-Routeing-Area-Update-Context.

6.14.2 MS Network Capability

The MS network capability contains non radio-related capabilities, e.g., the GSM GPRS ciphering, UMTS authentication, and TI extension capabilities. In the coding of the information element certain capabilities may be grouped together in a single indicator. The SGSN stores the MS network capability which is used both locally by the SGSN and for transfer to the new SGSN at all types of inter SGSN RA update. To avoid interoperability problem when roaming between GSM and UMTS the MS network capability shall be included in the routeing area update request sent by the MS. At inter-SGSN RA update, the network shall use this MS Network Capability and ignore the same IE received in MM Context from the old SGSN.

8.2.3 Paging Initiated by CN

A CN node requests paging only for MSs in CMM-IDLE state or PMM-IDLE state. In the separate CN architecture, paging from a CN node is done independently from the state of the MS in the other CN service domain.

In this alternative with paging co-ordination in the UTRAN, the MS does not need to listen to the PCH (Paging Channel) in the RRC Connected mode, at least not when MS is allocated a dedicated channel.

For each paging request received from a CN node, the RNC determines whether the MS has an established RRC connection or not. In order to achieve this, the context that is prepared within the SRNC for MS in RRC Connected mode must contain the IMSI, which is the common MS identity for the two CN domains.

If no context is found for the MS, "normal PCH paging" is performed. The paging message is transferred on the paging channel, and it includes the MS paging identity received from the CN and a CN service domain type indication.

If a context is found, a "CN paging message" is transferred using the existing RRC connection. This message includes a CN service domain type indication.

8.2.3.1 PS Paging Initiated by 3G-SGSN without RRC Connection for CS

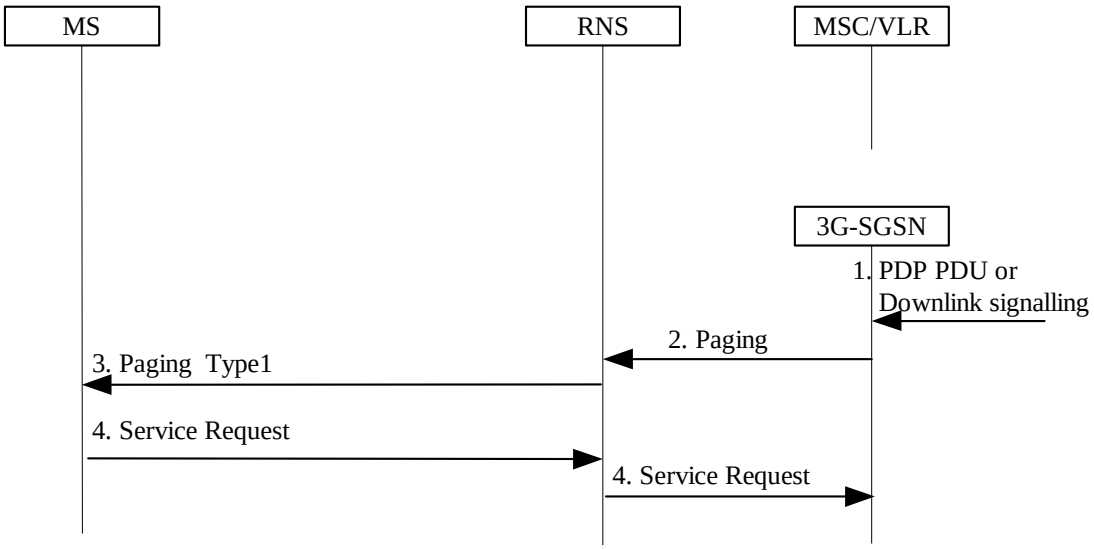


Figure 56: PS Paging Without RRC Connection for CS

1) The 3G-SGSN receives a PDP PDU or downlink signalling for an MS in PMM Idle state.

2) The 3G-SGSN sends a RANAP Paging (IMSI, P-TMSI, Area, CN Domain Indicator, DRX parameters) message to each RNS belonging to the routeing area in which the MS located. IMSI is needed by the RNS in order to calculate the MS paging group, and to identify the paged MS. If 3G-SGSN assigned the P-TMSI to the MS, P-TMSI is also included. Area indicates the routeing area in which the MS is paged. CN Domain Indicator indicates which domain (MSC or 3G-SGSN) initiated the paging message, and it represents "SGSN" in this case. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

3) The RNS controls whether the MS has an established RRC connection or not. In this case, MS has no RRC connection, so a "normal PCH paging" is performed. Paging Type 1(IMSI or P-TMSI, Paging originator, CN domain ID) is transferred on the Paging channel, IMSI or P-TMSI identifies the MS. Paging originator indicates whether this is core network originated paging or UTRAN originated paging, so it represents "CN" in this case. And CN domain ID indicates whether this paging message is for CS service or PS service, so it represents "PS" in this case.

4) The paging request triggers the Service Request procedures in the MS. The service request procedures are described in subclause "Service Request Procedure (UMTS Only)".

Optionally, 3G-SGSN may include "Non Searching Indication" in RANAP Paging message in this case. If a "Non Searching Indication" parameter is present, the RNC will not search the established RRC connection, and just initiate "normal PCH paging".

8.2.3.2 PS Paging Initiated by 3G-SGSN With RRC Connection for CS

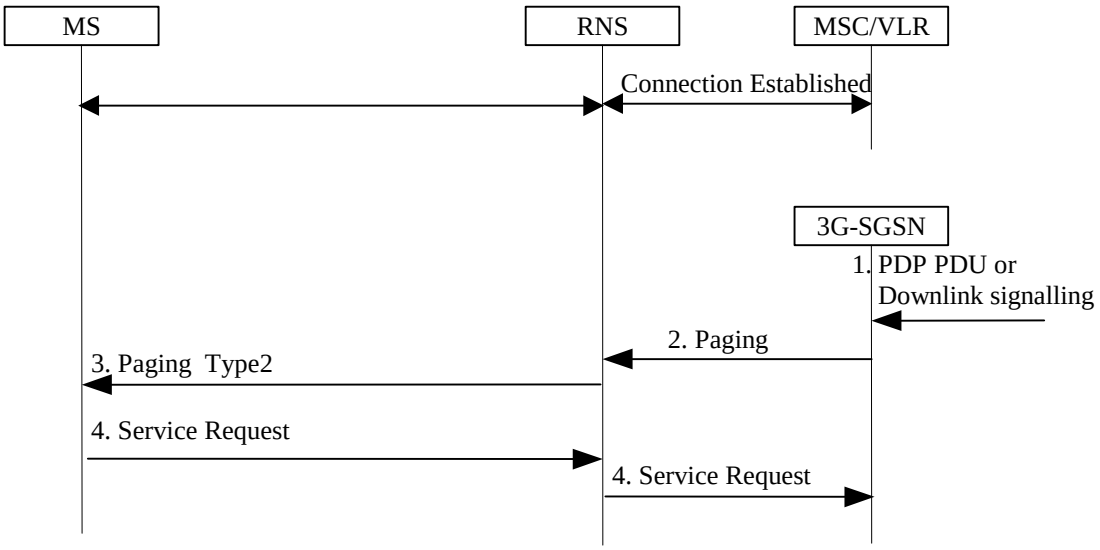


Figure 57: PS Paging With RRC Connection for CS

1) The 3G-SGSN receives a PDP PDU or downlink signalling for an MS in PMM Idle state.

2) The 3G-SGSN sends a RANAP Paging (IMSI, P-TMSI, Area, CN Domain Indicator, DRX parameters) message to each RNS belonging to the routeing area in which the MS is located. IMSI is needed by the RNS in order to calculate the MS paging group. If 3G-SGSN assigned the P-TMSI to the MS, P-TMSI is included, and it identifies the MS is paged. Area indicates the routeing area in which the MS is paged. CN Domain Indicator indicates to which domain (MSC or 3G-SGSN) the paging was initiated, and it represents "3G-SGSN" in this case. DRX Parameters indicates whether or not the MS uses discontinuous reception and the DRX cycle length.

3) The RNS controls whether the MS has an established RRC connection or not. In this case, MS has an established RRC connection for CS service, so RNS sends a RRC Paging Type 2(CN domain ID) message to the MS on established RRC connection. CN Domain ID indicates to which domain (CS or PS) the paging shall be directed, so it represents "PS" in this case.

4) The paging request triggers the Service Request procedures in the MS. The service request procedures are described in subclause "Service Request Procedure (UMTS Only)".

8.2.2b Discontinuous Reception

An MS can set the DRX cycle length that is specific to the PS domain. 3G TS 25.304 [51b] describes how the MS shall select which DRX cycle length to use with respect to DRX cycle length requirements set by UTRAN, CN PS domain and CN CS domain.

The DRX parameter information shall be indicated by the MS in the attach procedure and when changing from GSM to UMTS also in the routeing area update procedure. The SGSN shall then in each page request send these parameter to the RNC that uses this information, and the IMSI, to calculate the correct paging group.

At inter-SGSN RA update, the network shall use the DRX IE received from the MS in the routeing area update request message and ignore the same IE received in MM Context from the old SGSN.

13.2 SGSN

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

Table 6: SGSN MM and PDP Contexts

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

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

3GPP SA WG2 Meeting #

***Document* S2-001531**

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

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	177r1	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: *list expected approval meeting # here ↑*		for approval	X	strategic		*(for SMG use only)*
		for information		non-strategic		

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: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: Siemens **Date:** 10.August.2000

Subject: Compatibility GTPv0/GTPv1 in case of SGSN change

Work item: GPRS

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

			Release:	
F	Correction	X	Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Reason for change:

Issue

Configuration A:

GGSN	Release 99
SGSN_1	Release 99
SGSN_2	Release 97/98

As a result, betwseen GGSN and SGSN_1 GTP v1 is used; between SGSN_1 and SGSN_2 as well as between SGSN_2 and GGSN GTP v0 is used.

Assuming the following scenarios:

Scenario_1
An MS moves from SGSN_1 to SGSN_2.

The old SGSN_1 must response with PDP context data toward the new SGSN_2 using GTPv0. The old SGSN_1 must fill the Flow Label field of the PDP context IE which is used by the new SGSN_2 to point to the GGSN context. No Flow Labels but TEIDs are used between SGSN_1 and GGSN, therefore SGSN_1 can not deliver the proper Flow Labels to SGSN_2.

Scenario_2
An MS moves from SGSN_2 to SGSN_1.

The old SGSN_2 will response with PDP context data toward the new SGSN_1 using GTPv0, therefore delivering the Flow Label with the PDP context IE. The SGSN_1 shall use GTP v1 and therefore TEIDs are used between SGSN_1 and GGSN. When sending the “Update PDP Context Request” to GGSN; no TEID can be put into the header; when receiving this message, GGSN can not detect the

associated PDP context, as the IMSI is not contained in the GTP v1 message "Update PDP Context Request".

Proposed solution configuration A

For scenario_1:

a) The GGSN must be able to change from GTPv1 to GTPv0 for an open PDP context to support the Update PDP Context procedure according to scenario_1.

b) The old SGSN_1 delivers the lower two octets of the Up link TEID control plane used between SGSN_1 and GGSN as Flow Label to the new SGSN_2 in the PDP context IE with the message "SGSN Context Response" in GTPv0.

c) The new SGSN_2 uses this Flow Label for the update towards the GGSN

d) The GGSN has to detect the concerned PDP context on receiving the Update PDP Context Request. As a preparation of the GTP v1 to GTP v0 handover, the GGSN may construct the TEID in such a way that the lower two octets can be used as Flow Label also. But this is not mandatory and in the sole responsibility of the GGSN. The GGSN does not have to rely on the Flow Label for detecting the proper PDP context.

For scenario_2:

e) The GGSN must be able to change from GTPv0 to GTPv1 for an open PDP context to support the Update PDP Context procedure according to scenario_2.

f) The new SGSN_1 ignores the delivered Flow Label and sends an "Update PDP Context Request" with aTEID set to all zeros in the Header and additional IE containing the IMSI.

g) The GGSN has to detect the concerned PDP context on receiving the Update PDP Context Request and to switch the PDP context to the use of TEID. GGSN can identifiy the PDP context unambiguously by IMSI and NSAPI, both contained in the message.

Configuration B:

GGSN	Release 97/98
SGSN_1	Release 99
SGSN_2	Release 99

An MS moves from SGSN_1 to SGSN_2.

Towards the GGSN GTPv0 is used. Towards GGSN Flow Labels are used but between the SGSNs TEIDs are used. The old SGSN_1 must response with PDP context data toward the new SGSN_2 using GTPv1.
No Flow Labels but TEIDs are used between SGSN_1 and SGSN_2, therefore SGSN_1 can not deliver the proper Flow Labels to GGSN.

Proposed solution configuration B

1. An SGSN must be able to support GTPv0 towards GGSN and GTPv1 towards SGSN

2. The Flow Label is sent in the lower two octets of TEID, the upper two octets shall be set to all zeros

Clauses affected:	11.1.1			
Other specs Affected:	Other 3G core specifications	**29.060**	→ 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:				

help.doc

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

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 GSM 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 GSM MEs or UMTS MEs is defined in 3G TS 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.

A GGSN ~~must~~shall be able to fall back to GTP v0 during an Update PDP Context procedure. That is, the GGSN ~~must~~shall accept an Update PDP Context Request of GTP v0 even if the established GTP tunnel is of GTP v1.

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. Furthermore it fills the Uplink Flow Label Signalling field in the PDP Context information element of the SGSN Context Response message with the lower two octets of the Uplink TEID Control Plane. 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 [58] 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, ignore the delivered Uplink Flow Label Signalling, and use GTP v1 to send the Update PDP Context Request message to the GGSN. The Update PDP Context Request message shall be sent with a header containing a TEID set to all zeros and with an additional IE containing the IMSI for the PDP context.

A GGSN ~~must~~shall be able to change to GTP v1 during an Update PDP Context procedure. That is, the GGSN ~~must~~shall accept an Update PDP Context Request of GTP v1 with a TEID set to all zeros and containing the IMSI in addition to the NSAPI, even if the established GTP tunnel is of GTP v0.

In case of a SGSN change between SGSN that support GTP v1 with a GTP v0 tunnel between old SGSN and GGSN, the respective up link Flow Label signalling shall be inserted in the two lower octets of the TEID field; the upper two octets shall be set to all zeros.

3GPP-SA2 Meeting #14
Bristol/U.K. 4-8 September 2000

Document ***S2-001654***
Revision of S2-001607
Revision of S2-001458
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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**	**178r1**	Current Version:	3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: SA#9 *list expected approval meeting # here ↑*

for approval [X] 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: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [X]

Source: NTT Communicationware **Date:** 04-09-2000

Subject: Correction on Iu Release Procedure

Work item: GSM-UMTS Interworking

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

F	Correction	[X]	**Release:**	Phase 2 [ ]
A	Corresponds to a correction in an earlier release	[ ]		Release 96 [ ]
B	Addition of feature	[ ]		Release 97 [ ]
C	Functional modification of feature	[ ]		Release 98 [ ]
D	Editorial modification	[ ]		Release 99 [X]
				Release 00 [ ]

Reason for change: This CR proposes alignment causes in Iu release procedure with TS 25.413v3.2.0.

Clauses affected: 12.8.3

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:

help.doc

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

12.8.3 Iu Release Procedure

This procedure is used to release the Iu interface. This procedure also triggers the release of all the Iu connections and changes the 3G-SGSN PMM state to PMM-IDLE. Both RNC-initiated and SGSN-initiated Iu release procedures are showed in Figure 1~~Figure 87~~.

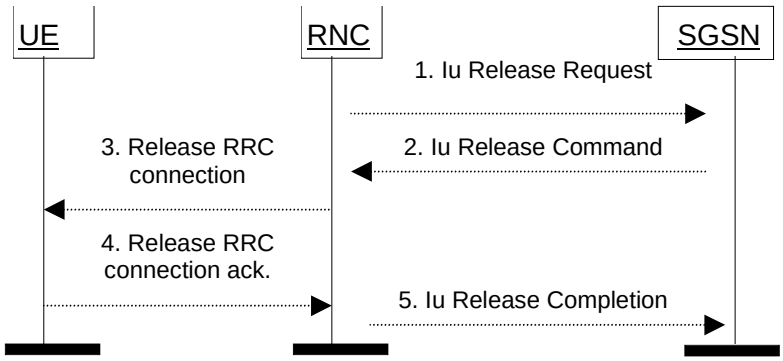


Figure 1~~87~~: Iu Release Procedure

NOTE 1: Message 1 is only sent when the RNC-initiated Iu release procedure is considered.

NOTE 2: Message 1 is not sent but message 2 is sent when the SGSN-initiated Iu release procedure is considered.

1) The RNC notices that the RRC connection has been released or detects a need to release the radio resources. It sends an Iu Release Request (Cause) message to the SGSN. Cause indicates the reason for the release (e.g. O&M Intervention, Unspecified Failure, User Inactivity, Repeated Integrity Checking Failure, or Release due to UE generated signalling connection release~~Equipment Failure, Implicit Release, or Resource Optimisation~~). ~~Implicit Release means that the periodic URA update timer expired. Resource Optimisation~~User Inactivity means that RNC decided to release an MS with only a non real-time bearer established to optimise the radio usage after the RRC-Connection-Release timer expired.

2) The SGSN releases the Iu by sending the Iu Release Command (Cause) message to the RNC. This message may be triggered either by an Iu Release Request message, or by another SGSN event (e.g., authentication failure or detach). It is optional for the SGSN to send the Iu Release Command message after an Iu Release Request message with Cause set to ~~Resource Optimisation~~User Inactivity is received from the RNC.

3) If the RRC connection is not already released (Cause = ~~Resource Optimisation~~User Inactivity), then the RNC sends a Release RRC Connection message to the MS. ~~[Cause "Detach" or "Authentication failure are FFS].~~

4) The MS returns a Release RRC Connection Acknowledge message to the RNC.

5) The RNC confirms the Iu release by returning an Iu Release Completion message to the SGSN.

If the RNC does not receive the Release RRC Connection Acknowledge message and if Cause is different from Authentication Failure or Detach, then it should send a failure message to the SGSN, and the SGSN should stay in the MM-CONNECTED state.

After Iu release, the MS and SGSN shall modify PDP context(s) that use streaming or conversational traffic class according to the rules in subclause "RNC-Initiated PDP Context Modification Procedure".

*** Quotation From 25.413v3.2.0 ***

8.4 Iu Release Request

8.4.1 General

The purpose of the Iu Release Request procedure is to enable UTRAN to request the CN to release the Iu connection for a particular UE due to some UTRAN generated reason (e.g. "O&M Intervention", "Unspecified Failure", "User Inactivity", "Repeated Integrity Checking Failure" , "Release due to UE generated signalling connection release"). The procedure uses connection oriented signalling.

8.4.2 Successful Operation

Figure 23: Iu Release Request procedure. Successful Operation

The RNS controlling the Iu connection(s) of that particular UE shall initiate the procedure by generating an IU RELEASE REQUEST message towards the CN. If two Iu connections exist for that particular UE, RNC shall sent an IU RELEASE REQUEST message to both CN domains. The procedure may be initiated for instance when the contact with a particular UE is lost or due to user inactivity.

The IU RELEASE REQUEST message shall indicate the cause value for the requested Iu connection release. It is up to the CN to decide how to react to the request.

Interactions with Iu Release:

If the CN decides to release the Iu connection, the CN shall initiate the Iu Release procedure.

8.4.3 Abnormal Conditions

8.5 Iu Release

8.5.1 General

The purpose of the Iu Release procedure is to enable the CN to release the Iu connection and all UTRAN resources related only to that Iu connection to be released. The procedure uses connection oriented mode signalling.

The Iu Release procedure can be initiated for at least the following reasons:

- Completion of transaction between UE and CN.
- UTRAN generated reasons, e.g. reception of IU RELEASE REQUEST.
- Completion of successful relocation of SRNS.
- Cancellation of relocation after successful completion of the Relocation Resource Allocation procedure.

8.5.2 Successful Operation

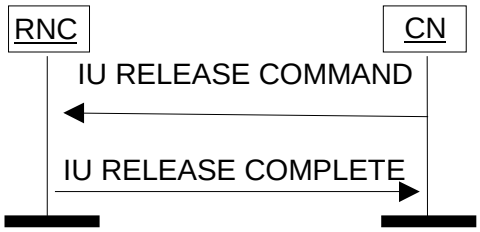


Figure 34: Iu Release procedure

The procedure is initiated by the CN by sending an IU RELEASE COMMAND message to the UTRAN.

After the IU RELEASE COMMAND has been sent, the CN shall not send further RANAP connection oriented messages on this particular connection.

The IU RELEASE COMMAND message shall include a *Cause* IE, indicating the reason for the release (e.g. "Successful Relocation", "Normal Release", "Release due to UTRAN Generated Reason", "Relocation Cancelled").

When the RNC receives the IU RELEASE COMMAND:

1. Clearing of the related UTRAN resources is initiated. However, the UTRAN shall not clear resources related to other Iu signalling connections the UE might have. The Iu transport bearers for RABs subject to data forwarding and other UTRAN resources used for the GTP-PDU forwarding process, are released by the RNC only when the timer $T_{DATAfwd}$ expires.

2. The RNC returns any assigned Iu user plane resources to idle. Then the RNC sends an IU RELEASE COMPLETE message to the CN. (The RNC does not need to wait for the release of UTRAN radio resources to be completed before returning the IU RELEASE COMPLETE message.) When an IU RELEASE COMPLETE message is sent, the procedure is terminated in the UTRAN.

Reception of an IU RELEASE COMPLETE message terminates the procedure in the CN.

8.5.3 Abnormal Conditions

If the Iu Release procedure is not initiated towards the source RNC from the CN before the expiry of timer $T_{RELOCoverall}$, the source RNC should initiate the Iu Release Request procedure towards the CN with a cause value "$T_{relocoverall}$ expiry".

9.2.1.4 Cause

The purpose of the cause information element is to indicate the reason for a particular event for the RANAP protocol.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **Cause**				
>Radio Network Layer Cause			INTEGER (RAB pre-empted(1), Trelocoverall Expiry(2), Trelocprep Expiry(3), Treloccomplete Expiry(4), Tqueing Expiry(5), Relocation Triggered(6), Unable to Establish During Relocation(8), Unknown Target RNC(9), Relocation Cancelled(10), Successful Relocation(11), Requested Ciphering and/or Integrity Protection Algorithms not Supported(12), Change of Ciphering and/or Integrity Protection is not supported(13), Failure in the Radio Interface Procedure(14), Release due to UTRAN Generated Reason(15), User Inactivity(16), Time Critical Relocation(17), Requested Traffic Class not Available(18), Invalid RAB Parameters Value(19), Requested Maximum Bit Rate not Available(20),	Value range is 1 – 64.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **Cause**				
			Requested Maximum Bit Rate for DL not Available(33), Requested Maximum Bit Rate for UL not Available(34), Requested Guaranteed Bit Rate not Available(21), Requested Guaranteed Bit Rate for DL not Available(35), Requested Guaranteed Bit Rate for UL not Available(36), Requested Transfer Delay not Achievable(22), Invalid RAB Parameters Combination(23), Condition Violation for SDU Parameters(24), Condition Violation for Traffic Handling Priority(25), Condition Violation for Guaranteed Bit Rate(26), User Plane Versions not Supported(27), Iu UP Failure(28), TRELOCalloc Expiry (7), Relocation Failure in Target CN/RNC or Target System (29), Invalid RAB ID(30), No remaining RAB(31), Interaction with other procedure(32),	

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **Cause**				
			Repeated Integrity Checking Failure(37), Requested Report Type not supported(38), Request superseded(39), Release due to UE generated signalling connection release(40) …)	

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **Cause**				
>Transport Layer Cause			INTEGER (Logical Error: Unknown Iu Transport Association(65), …)	Value range is 65 – 80.
>NAS Cause			INTEGER (User Restriction Start Indication(81), User Restriction End Indication(82), Normal Release(83), …)	Value range is 81 – 96.
>Protocol Cause			INTEGER (Transfer Syntax Error(97), Semantic Error (98), Message not compatible with receiver state (99), Abstract Syntax Error (Reject) (100), Abstract Syntax Error (Ignore and Notify) (101), …)	Value range is 97 – 112.
>Miscellaneous Cause			INTEGER (O&M Intervention(113), No Resource Available(114), Unspecified Failure(115), Network Optimisation(116), …)	Value range is 113 – 128.
>Non-standard Cause			INTEGER (…)	Value range is 129 – 256.

3GPP TSG SA2 Meeting #14
Bristol, UK , 4-8 September 2000

Document ~~S2-001517~~ **001536**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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	182r1	Current Version:	3.3.4

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA #9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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

Source: Motorola **Date:** 2000-08-06

Subject: Removal of the PDP type OSP:IHOSS in Release 99

Work item: Release 99

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

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: The PDP type OSP:IHOSS has been removed completely from R98 and R99 at the SA#8 in 22.060. It is necessary now to remove it also from 23.060 in order to agree with 22.060.

Clauses affected: 5.6.2, 12.5, Annex B

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	CR 181 23.060
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:

help.doc

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

MODIFIED SECTION

5.6.2 User Plane (UMTS Only)

5.6.2.1 MS – GGSN

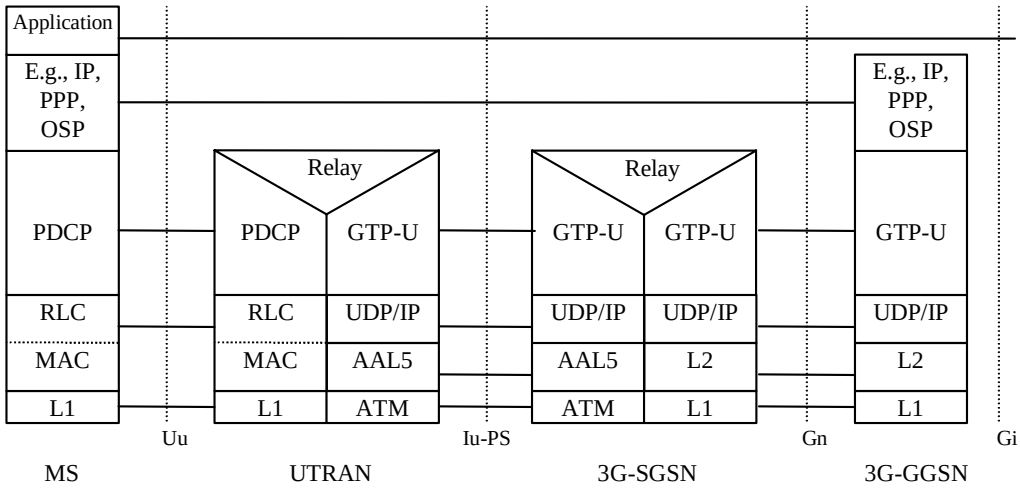


Figure 1: User Plane for UMTS

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 3G TS 25.323.

NOTE: Unlike in GSM, 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 3G TS 29.060.

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

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

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

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

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

5.6.2.2 GSN – GSN

This user plane is the same as for GSM, see subclause "GSN – GSN" above.

DELETED SECTION

12.5 Octet Stream Protocol Functionality

The Octet Stream Protocol (OSP) is used to carry an unstructured octet (character) stream between the MS and GGSN. It is used to provide a character pipe to allow an MS to communicate (via the GGSN) with an arbitrary Internet host, or other character-based service. PDP type shall be selected as OSP for this purpose. Unlike PDP type IP, OSP has no existence outside the PLMN. In the MS there is a character stream at the R reference point together with some optional control signals. In the GGSN there is a relay function, carrying the same character stream and control signals between OSP and a fixed-network protocol stack.

OSP has two modes of operation. In octet mode, it uses a Packet Assembly function to assemble a number of user octets into a single packet for more efficient transport by the underlying protocols. A complementary Packet Disassembly function performs the reverse operation in the peer OSP. In block mode, the Packet Assembly / Disassembly (PAD) function is bypassed. In this case, data is transferred between the OSP user and OSP in blocks of octets. Each block of octets is delivered as a single OSP PDU to the underlying protocol. The selection of octet or block mode is made independently for each OSP connection as an implementation or configuration decision before the connection is established, and remains fixed for the duration of the connection. An example of the use of the block mode is when OSP is used for interworking with a fixed network where the octets are also carried in packets. This avoids the use of back-to-back PADs. It could also be used in an embedded MT where the application transfers data in blocks of octets.

The quality of service is determined mainly by that provided by the underlying layers. However, the end-to-end delay may be affected by the presence of the PAD function. A reliable (acknowledged) service shall be provided by the layers below SNDCP.

The main functions of OSP are:

- transport of an unstructured octet stream;
- packet assembly and disassembly to make efficient use of network resources; and
- end-to-end flow control.

OSP may additionally provide:

- transport of a "break" signal;
- transport of control information blocks between the OSP users;
- user control of packet assembly buffer forwarding; and
- direct OSP user access to the underlying packet service, bypassing the PAD.

Figure 2 illustrates the OSP user plane for GPRS, and Figure 3 for UMTS.

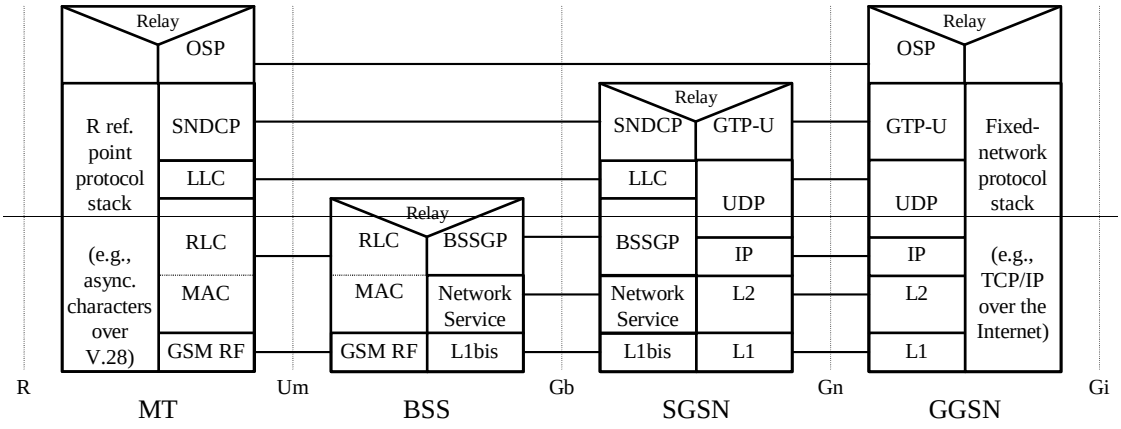
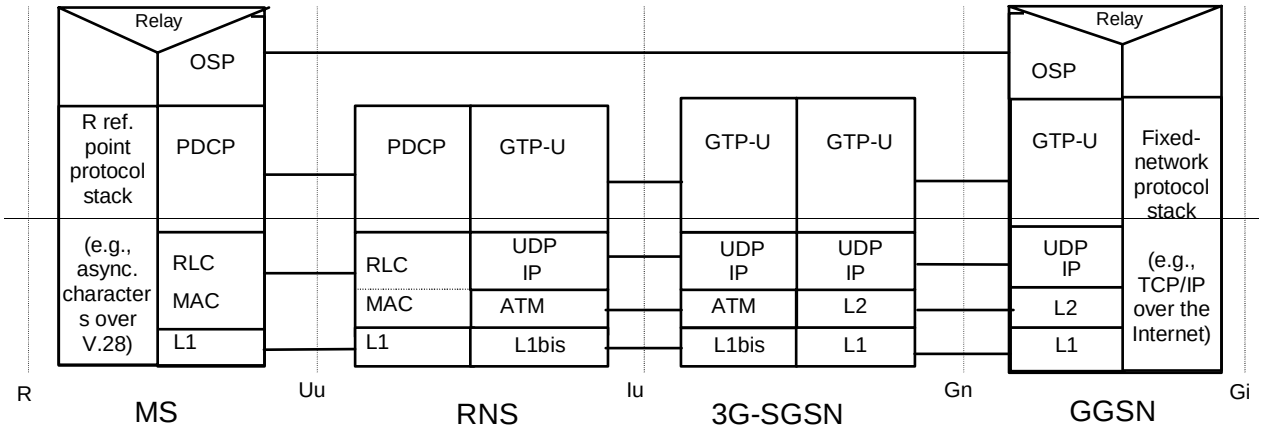


Figure 2: GPRS User Plane for PDP Type OSP



~~Figure 3: UMTS User Plane for PDP Type OSP~~

~~12.5.1 PAD Function~~

~~In order to make efficient use of the network resources, particularly the radio resource, octets received from the OSP user are not forwarded immediately but are placed in a buffer. When some forwarding criterion is satisfied, the contents of the buffer are forwarded in the payload of an N-PDU to the underlying layer. At the receiving end, the payload of an N-PDU received from the underlying layer is placed in a buffer and the octets are delivered to the OSP user as an octet stream.~~

~~The PAD is used only when OSP operates in octet mode. It is not used when OSP operates in block mode.~~

~~12.5.1.1 Packet Assembler~~

~~The packet assembler shall be able to detect the following forwarding criteria. When any one criterion is satisfied, the contents of the buffer shall be forwarded in an N-PDU to the underlying layer, subject to any flow control condition.~~

~~12.5.1.1.1 Buffer Full~~

~~The buffer contents are forwarded when the number of octets in the buffer reaches the value of the maximum buffer size parameter.~~

~~12.5.1.1.2 Inactivity Timer Expiry~~

~~The inactivity timer shall be started whenever an octet is placed in the buffer. When the timer expires, the buffer contents shall be forwarded. The inactivity timer shall be stopped whenever a buffer is forwarded.~~

~~12.5.1.1.3 Maximum Buffer Delay Timer Expiry~~

~~A maximum buffer delay timer may be started when the first octet is placed in the (empty) buffer,. When the timer expires, the buffer contents shall be forwarded. This optional timer ensures that no octet is delayed in the buffer for longer than the specified time. The maximum buffer delay timer shall be stopped whenever a buffer is forwarded.~~

~~12.5.1.1.4 Special Character~~

~~Whenever an octet has been placed in the buffer, its least significant 7 bits shall be compared with a list of 7-bit special characters. If the bits match, the buffer shall be forwarded. The possible characters and combinations of characters shall be the same as specified for the X.3 [33] PAD access to X.25.~~

~~12.5.1.1.5 Change in Flow Control State~~

~~The buffer may be forwarded when there is a need to signal a change in the ready to receive condition.~~

12.5.1.1.6 Immediate Forwarding Request

When the OSP receives an immediate forward request from its user, it shall immediately forward the buffer unless it is empty.

12.5.1.2 Packet Disassembler

The packet disassembler shall forward the contents of the N-PDU payload to the OSP user, subject to any local flow control condition.

12.5.2 Quality of Service

The QoS provided by the OSP layer is determined by that provided by the underlying protocol layers. However, the PAD functions introduce an additional variable delay into the transmission path. This delay can be limited at the risk of making less efficient use of network resources, in particular the radio resources.

NEXT DELETED SECTION

Annex B (normative): Internet-Hosted Octet Stream Service

[Not yet updated for UMTS.]

The GPRS Internet-Hosted Octet Stream Service (IHOSS) is a connection-oriented service that can transport an unstructured octet (character) stream between a GPRS MS and an Internet host. The service uses the Octet Stream Protocol (OSP) PDP type to provide a "character pipe" between the MS and the GGSN. In the GGSN there is an interworking function which provides a relay function between the OSP and the Internet host.

Figure B.1 shows the scope of IHOSS and OSP.

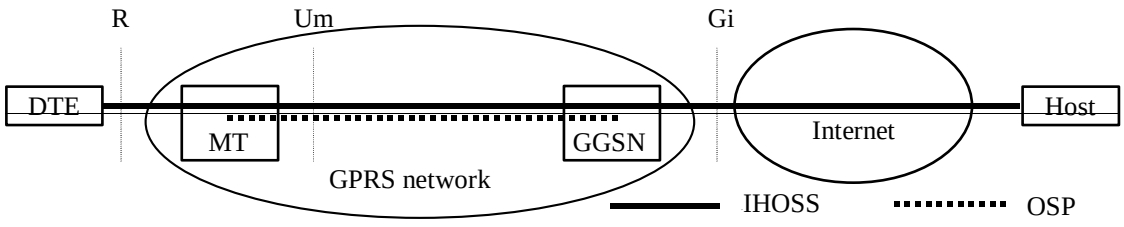


Figure B.1: Scope of IHOSS and OSP

IHOSS is analogous to a virtual serial cable between the MS and the Internet host.

This service is intended to provide a very simple connection for early implementation and for simple low-cost devices later on in the life cycle of GPRS.

B.1 Direction of Connection Setup

This service shall be mobile-originated only.

B.2 Bearer

The IHOSS shall use the unstructured Octet Stream Protocol as its bearer service.

The MT end of the IHOSS connection shall use the octet mode interface to the OSP as a Packet Assembler / Disassembler function is necessary.

The GGSN end of the IHOSS connection shall use the block mode interface to the OSP to remove the need for two back-to-back PAD functions.

B.3 Setup Data

The following data items are required before an octet stream can be initiated.

B.3.1 Protocol Type – TCP or UDP

This refers to the protocol used over IP on the GGSN to Internet host segment of the connection. The options available are TCP or UDP.

If no protocol is specified for a given context, TCP shall be used.

B.3.2 Host Name

This refers to the Internet host to which the connection is made. It shall be a fully formed domain name extended host name.

There shall be no default host name. If no host name is specified, the context activation shall fail.

B.3.3 Port Number

This refers to the TCP or UDP port on the host name, which forms the endpoint of the Internet side of the connection.

If no port number is specified for a given context, a default value of 23 decimal shall be used.

B.3.4 PAD Parameters

The Packet Assembler / Disassembler parameters determine how to fill the outgoing packets. If the user requires interactive terminal style behaviour then the PAD shall be able to act in this way. If the user requires a streaming data link then a different setup is necessary.

The default values for the PAD parameters are defined in GSM 07.60.

B.4 Flow Control

The service shall use the flow control features provided by the OSP to provide simple start / stop flow control.

B.5 Break Signal

The OSP break signals are mapped onto the appropriate break signals at the R and Gi interfaces.

B.6 Connection Establishment Procedure

Establishing an IHOSS connection involves setting up two segments, the PLMN segment (using the OSP) between the MS and the GGSN, and the fixed-network segment between the GGSN and the Internet host. Establishing the PLMN segment shall be as described in subclause "PDP Context Activation Procedure". Figure B.2 illustrates the overall procedure.

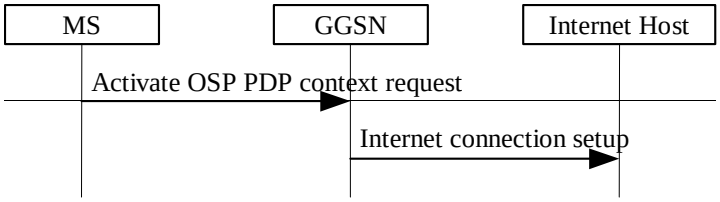


Figure B.2: IHOSS Connection Establishment

The MS requests that an OSP PDP context be activated by transmitting an Activate PDP Context Request (NSAPI, TI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) message to the SGSN with the following parameter values:

- NSAPI is selected by the MS.
- TI is selected by the MS.
- PDP Type shall have a two-part value. The first part shall identify the protocol as OSP, and the second part shall identify the service being used and thereby allow the SGSN to select a GGSN that can provide this service. For IHOSS PDP Type shall be set to OSP:IHOSS.
- PDP Address shall be empty.
- APN is selected by the MS, may be empty.
- QoS Requested is selected by the MS.
- PDP Configuration Options may contain an Internet host name, a port number, a protocol type, and possibly other parameters in order to enable the GGSN to set up a connection to the Internet host, or it may be empty.

The Activate PDP Context Accept message shall be returned to the MS only after the connection to the Internet host has been established.

The activation parameters shall be provided as either interactive commands or via a system-default value. The following subclauses describe how these parameters shall be derived for a number of different scenarios.

B.6.1 Fully User-Specified Establishment

The MS shall request an OSP:IHOSS connection, specifying the PAD parameters, the host name, the port, and the protocol (UDP or TCP) in PDP Configuration Options.

The SGSN shall select an appropriate GGSN for the outgoing connection.

The GGSN shall attempt to establish a connection with the specified host. Connection failure shall be signalled back to the MS and the session terminated. A successful connection establishment enables data transmission over the connection.

B.6.2 Default Internet Endpoint Parameters Establishment

The MS shall request an OSP:IHOSS connection, specifying only PAD parameters that deviate from the system defaults.

The SGSN shall connect to the GGSN indicated by the APN in the HLR subscription record.

The GGSN shall use the APN to further select the host name, the port number, and the protocol. The method used to select these parameters is manufacturer specific and outside of the scope of the specifications.

B.7 Connection Termination

Either the MS or the Internet host may request that a connection be cleared.

B.7.1 MS-initiated TCP IHOSS Connection Termination

The MS clears the connection by sending a Deactivate PDP Context Request message to the SGSN. This shall result in the TCP session closure procedures being executed by the GGSN. Once this is complete, the GGSN shall deallocate any resources allocated for this session.

B.7.2 MS-initiated UDP IHOSS Connection Termination

No further action is required by the GGSN towards the Internet endpoint, as the User Datagram Protocol is connectionless. The GGSN shall deallocate any resources allocated for this session.

B.7.3 Internet Host Initiated TCP IHOSS Connection Termination

When the GGSN receives a TCP clear request from the fixed network it shall follows the procedure described in subclause "PDP Context Deactivation Initiated by GGSN Procedure".

B.8 Security

B.8.1 Authentication of the GPRS User

Identification and authentication of the subscriber by the GPRS network is carried out as described elsewhere in this document. The GPRS network shall not provide any identification of the GPRS subscriber to the Internet host. End-to-end security is provided at the application layer and is outside of the scope of this document.

B.8.2 Malicious Reconfiguration of the GPRS Device

An MS that can not hold protocol, host name, and port information, would render it impossible to gain unauthorised access and subvert the system by providing alternative protocol, host name, or port information. This information would have to be provided by the GGSN, which is potentially more physically secure than the embedded MT, and it would make "man in the middle" type security breaches considerably more complex.

B.9 Maintenance

Configuring the Internet endpoint by accepting a mandatory default endpoint from the GGSN enables a GPRS user to effect system reconfiguration without the requirement for a site visit for each GPRS MS. The association between the APN and the host name, port number and protocol in the GGSN would be updated to give a new host name and/or port number and/or protocol.