**3GPP Joint Meeting on GSM-UTRAN handover and SRNS relocation**

***Document WHS-99018***

**Sophia Antipolis, 23 Aug 1999**

# 3G CHANGE REQUEST

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

**23.121** **CR** Current Version: 3.0.0

*3G specification number ↑* *↑ CR number as allocated by 3G support team*

For submision to TSG SA#5 *list TSG meeting no. here ↑*

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

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

**Proposed change affects:** *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [X]

**Source:** Nokia **Date:** 20 Aug, 1999

**Subject:** SRNC relocation in relation with SGSN change

**3G Work item:**

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

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

**Reason for change:**

The SRNC relocation described in section 4.3.12.2.3 proposes to introduce a new procedure: the network initiated Routing Area Update. However, this new procedure is not really needed as a normal Routing area update could be initiated from the UE instead (see Tdoc. WHS-99018).

Furthermore, SRNC relocation signaling between the target RNC and target SGSN is updated to be in accordance with the signaling already agreed in RAN WG3.

**Clauses affected:** 4.3.12.2.3; 4.3.1; 4.3.3 and 4.3.6.2

**Other specs affected:**

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

**Other comments:**

help.doc

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

#### 4.3.12.2.3 SRNS relocation (UE connected to a single CN node, 3G_SGSN) followed by Location Registration in new Location Area

This example shows SRNS relocation when source RNC and target RNC are connected to different 3G_SGSN. Figure 33 and Figure 35 illustrate the situation before respective after the SRNS relocation and location registration. Figure 37 illustrates the signalling sequence where each step is explained in the following list.

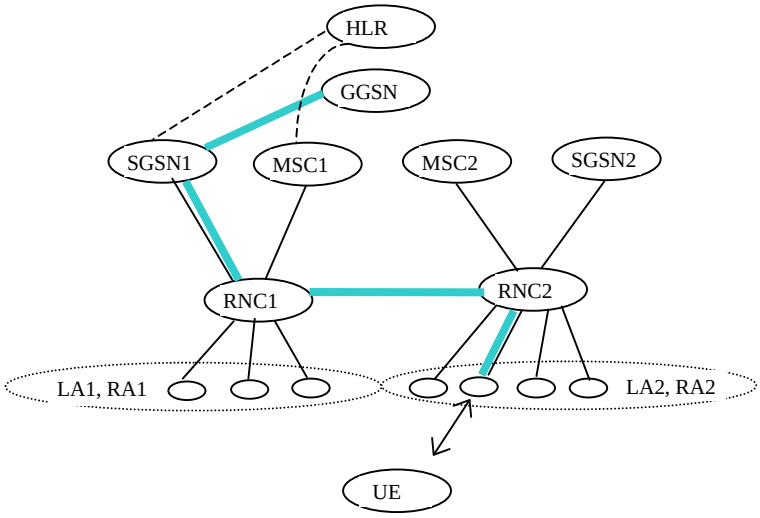


**Figure 33 Before the SRNS relocation and location registration**

Before the SRNS relocation and location registration the UE is registered in SGSN1 and in MSC1. The UE is in state MM connected towards the SGSN1 and in state MM idle towards the MSC1. The RNC1 is acting as SRNC and the RNC2 is acting as DRNC.

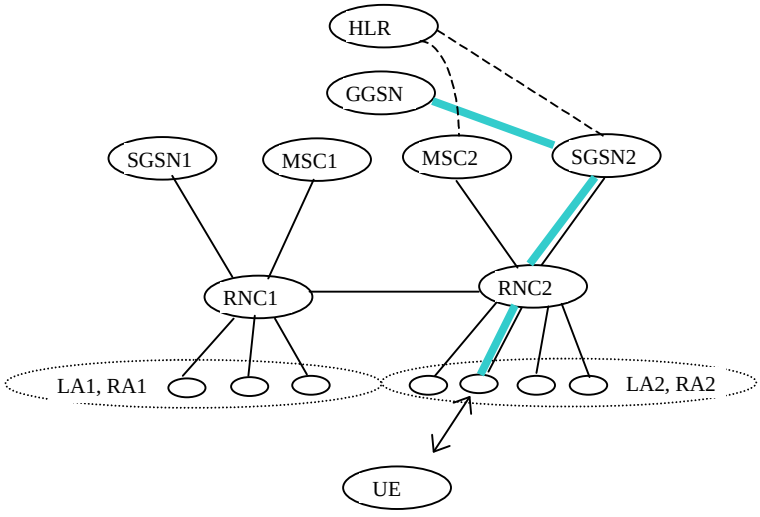


**Figure 35 After the SRNS relocation and location registration**

After the SRNS relocation and location registration the UE is registered in MSC2 and in SGSN2. The UE is in state MM connected towards the SGSN2 and in state MM idle towards the MSC2. The RNC2 is acting as SRNC.

At SRNS relocation:

The source and target SGSN exchange CN level information (CN classmark, list of established PDP contexts)

The source and target SRNC exchange UTRAN level information (UTRAN classmark,…) and information used to ensure that no user packet is lost nor duplicated during the SRNS relocation procedure

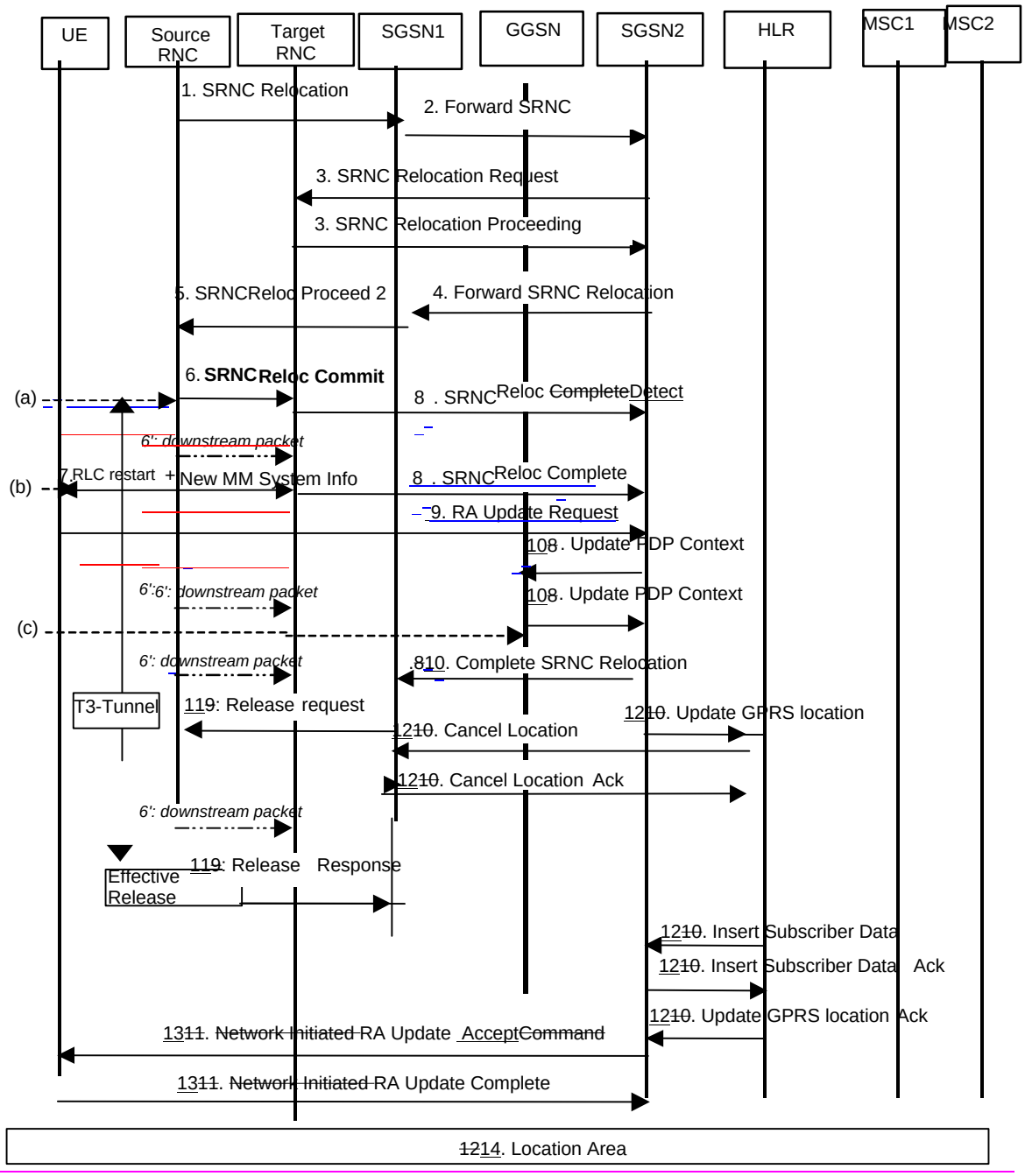


**Figure 37 Interface information transfer for SRNS relocation update when changing SGSN area resulting in a change of registered location and followed by location registration in new Location Area.**

**"Resource reservation" Phase**

During this phase, the transmission of packets between GGSN and UE through the source SRNC goes on.

1) UTRAN (source SRNC) makes the decision to perform the Serving RNC relocation procedure. This includes decision on into which RNC (Target RNC) the Serving RNC functionality is to be relocated. The source SRNC sends SRNC Relocation required messages to the SGSN1. This message includes parameters such as target RNC identifier and an information field that shall be passed transparently to the target RNC.

2) Upon reception of SRNC Relocation required message the SGSN1 determines from the received information that the SRNC relocation will (in this case) result in change of SGSN.
The SGSN will then send a Forward SRNC relocation request to the applicable SGSN, SGSN2, including the information received from the Source SRNC and necessary information for the change of SGSN (e.g. MM context, PDP context). The PDP context information contains the list of the PDP context (including

PDP type, requested / negotiated QoS) currently established by the UE along with the address of the associated GGSN. It does not contain any information linked with packet transmission (sequence numbers) because such information is under the responsibility of the UTRAN

3) The SGSN2 sends a SRNC Relocation Request message to the target RNC. This message includes information for building up the SRNC context, transparently sent from Source SRNC (e.g. UE id., no of connected CN nodes, UE capability information), and directives for setting up Iu user plane transport bearers.
When the Iu user plane transport bearers have been established, and target RNC completed its preparation phase, SRNC Relocation Proceeding 1 message is sent to the SGSN2.

4) When the traffic resources between target RNC and SGSN2 has been allocated and the SGSN2 is ready for the SRNC move, then the Forward SRNC Relocation Response is sent from SGSN2 to SGSN1. This message indicates that necessary resources have been allocated for the SRNC relocation: SGSN2 / target RNC are ready to receive from source SRNC the downstream packets not yet acknowledged by UE. *The Forward SRNC Relocation Response message* contains the IP address(es) (possibly one address per PDP context) on which SGSN2 is willing to receive these packets.

5) When the Forward SRNC Relocation Response has been received in the SGSN1, the SGSN1 indicates the completion of preparation phase at the CN PS domain side for the SRNC relocation by sending the SRNC Relocation Proceeding 2 message to the Source RNC. . This message contains the IP address(es) (possibly one address per PDP context) on which to send the downstream packets not yet acknowledged by UE.

**"Actual hand-over of Serving RNC" Phase**

6) When the source RNC has received the SRNC Relocation Proceeding 2 message, the source RNC sends a SRNC Relocation Commit message to the target RNC(list of (SNU, UP_RLC_ack, SND)). SND is the GTP sequence number for the next downlink packet received from the GGSN. SNU is the GTP sequence number for the next uplink packet to be tunnelled to the GGSN. UP_RLC_Ack contains the acknowledgements for upstream PDU received by the source SRNC on each RLC connection used by the UE (i.e. the Receive State Variable V(R) for all RLC SAPI in acknowledged mode). The source SRNC starts a timer T3-TUNNEL , stops the exchange of the packets with the UE (point (a)), and starts tunnelling the buffered downstream packets towards the target SRNC. The target RNC executes switch for all bearers at the earliest suitable time instance.

7) The target RNC starts acting as SRNC. The target SRNC :

- Restarts the RLC connections. This includes the exchange between the target SRNC and the UE of the UP_RLC_Ack and DOWN_RLC_ACK. DOWN_RLC_ACK confirms all mobile-terminated packets successfully transferred before the start of the relocation procedure. If DOWN_RLC_ACK confirms reception of packets that were forwarded from the source SRNC, then these packets shall be discarded by the target SRNC. UP_RLC Ack confirms all mobile-originated packets successfully transferred before the start of the relocation procedure. From now on the exchange of the packets with the UE can restart (point (b)).

- Sends New MM System Information to the UE indicating e.g. relevant Routing Area and Location Area. A new RAI triggers a routing area update procedure. Additional RRC information may then also be sent to the UE, e.g. new RNTI identity. This may trigger a location update procedure (see 12)

8) Immediately after a successful switch at RNC, target RNC (=SRNC) sends SRNC Relocation ~~Complete~~ Detect message to the SGSN2. After sending out the New MM System Information, the target RNC sends SRNC Relocation Complete message to the SGSN2.

9) The UE sends a Routing area update request (old RAI; old P-TMSI; old PTMSI signature, Update type) to SGSN2 when the New MM System Information included a new RAI.

~~9)~~10) Upon reception of ~~this message~~RAU request, the SGSN2 updates the GGSN(s) with a Update PDP Context Request including the new SGSN address. The GGSN(s) then update the PDP context and return Update PDP Context Response. The SGSN sends a Complete SRNC Relocation towards the SGSN1.

~~9)~~11) At reception of the Complete SRNC Relocation, SGSN1 will send a release indication towards the Source RNC. All resources allocated to this UE by the source RNC are released only when this message has been received and timer T3-TUNNEL has expired. Before timer T3-TUNNEL expires, all downstream packets received from the GGSN are sent towards the target SRNC..

~~10)~~12) The SGSN2 informs the HLR of the change of SGSN by sending Update GPRS location (IMSI, new SGSN address etc.) to the HLR. The HLR cancels the context in the old SGSN, SGSN1, by sending Cancel Location (IMSI). The SGSN1 removes the context and acknowledges with Cancel Location Ack. The HLR sends Insert subscriber data (IMSI, subscription data) to the SGSN2. The SGSN2 acknowledges with Insert Subscriber Data Ack. The HLR acknowledges the Update GPRS location by sending Update GPRS Location Ack to the SGSN2.

~~11)~~13) At reception of Insert subscriber data from HLR, the SGSN2 will send a Routing Area Update Accept message ~~initiate the update of MM information stored in the UE. This is done by sending Network Initiated Routing Area Update Command~~ to the UE. This message will include new RAI, and possible also new P-TMSI. When the UE has made necessary updates it answers with ~~Network Initiated~~ Routing Area Update Complete.

~~12)~~14) When receiving new MM system information indicating a new Location Area, the UE will, in this case, initiate a Location Area update procedure towards the MSC2. This implies that the Location Area update will be performed in parallel to the above indicated activities related to the SGSN side of the Core Network.

It has to be noted that the sequence chart of Figure 19 may be further refined.

UE-GGSN Communication path during the SRNS relocation procedure

Before point (a), in Figure 37, the connection is established between UE and GGSN via Source SRNC and SGSN1.

… [no change to the rest of the chapter]

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## 4.3.1 Location Management and Mobility Management concept overview

… [no change to the beginning of the chapter]

**Figure 11: Overview of the UE registration and connection principles within UMTS for the integrated CN architecture case when the CN consists of both a CS service domain and an PS service domain with an UMSC as the main serving node.**

The main PS service states are PS-DETACHED, PS-IDLE and PS-CONNECTED. The main CS service states are CS-DETACHED, CS-IDLE and CS-CONNECTED. For the respective service domain there are specific related MM system information controlling the Mobility Management functionality of the UE

The aim of UTRAN is to offer one unified set of radio bearers which may be used for bursty packet traffic and for traditional telephony traffic. This leads to the conclusion that only one logical control channel structure will be used for all kind of traffic. The radio resource handling is UTRAN internal functionality and the CN does not define the type of radio resource allocated.

The Radio Resource Control (RRC) has two modes, RRC Connected mode and RRC Idle mode. The RRC mode describes which identity is used to identify the UE. In RRC Idle mode the UE is identified by a CN associated identity. In RRC Connected mode the UE is assigned a Radio Network Temporary Identity to be used as UE identity on common transport channels. When the UE is allocated dedicated transport channels, it uses the inherent addressing provided by these transport channels.

In PS-CONNECTED state the UE is in RRC Connected mode. In CS-CONNECTED state the UE is in RRC Connected mode.

For the mobility functionality, four different area concepts are used. Location Areas and Routing Areas are used in the Core Network. UTRAN Registration Areas and Cell Areas are used in UTRAN. Location Areas are related to CS services. Routing Areas are related to PS services.

One Location Area is handled by one CN node. For an UE that is registered in a Location Area, this implies that the UE is registered in the specific CN node handling this specific Location Area. One Routing Area is handled by one CN node. For an UE that is registered in a Routing Area, this implies that the UE is registered in the specific CN node handling this specific Routing Area. Location Area is used by the 3G_MSC/VLR for paging the UE. Routing Area is used by the 3G_SGSN for paging the UE. UTRAN Registration Areas and Cell Areas are only visible in UTRAN and used in RRC-Connected mode.

For the relations between Location Area (LA) and Routing Area (RA) it shall be possible for the operator to have a LA and a RA equal (i.e. same cells), a RA as a part of a LA, a LA as a part of RA, and LA and RA independent. In case of a LA and RA consisting of both UMTS cells and GSM cells the GSM defined relations will apply.

In RRC Idle mode it is the broadcasted MM system information (e.g. information about the present Location Area and present Routing Area) that determines when the UE initiates a location registration procedure towards the CN. An UE in state CS-IDLE will in RRC Idle mode, initiate Location Area update towards the CN when crossing LA border. An UE in state PS-IDLE will in RRC Idle mode initiate Routing Area update towards the CN when crossing RA border.

In RRC Connected mode, the UE receives the MM system information on the established RRC connection. (I.e. the broadcasted MM system information is not used by the UE in the RRC connected mode.) An UE in state CS-IDLE will, in RRC Connected mode, initiate Location Area update towards the CN when receiving information indicating a new Location Area. An UE in state PS-IDLE will, in RRC Connected mode, initiate Routing Area update towards the CN when receiving information indicating a new Routing Area. An UE in state CS-CONNECTED will, in RRC Connected mode, not initiate Location Area update towards the CN. An UE in state PS- CONNECTED will, in RRC Connected mode, not initiate Routing Area update towards the CN.

In CS-DETACHED mode the UE will not initiate any Location Area update and this independent of the RRC mode. In PS-DETACHED mode the UE will not initiate any Routing Area update and this independent of the RRC mode, except during SRNS relocation when RAI in MM system information changes.

In additional to normal location registration when changing registration area, the UE may (network options) perform CS periodic registration when in CS-IDLE state and PS periodic registration when in PS-IDLE state. The respective periodic registration may be on/off on Location Area respective Routing Area level.

On the Mobility Management level, IMSI and CS related TMSI are used as UE identities in the CS service domain, and IMSI and PS related TMSI are used as UE identities in the PS service domain. The IMSI is the common UE identity for the two CN service domains.

A signalling connection between the UE and the CN refers to a logical connection consisting of an RRC connection between UE and UTRAN and an Iu signalling connection (“one RANAP instance”) between the UTRAN and the CN node. The CS service domain related signalling and PS service domain related signalling uses one common RRC connection and two Iu signalling connections (“two RANAP instances”), i.e. one Iu signalling connection for the CS service domain and one Iu signalling connection for the PS service domain.

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### 4.3.3 MM functionality in different UE service states

Below are the main UE service states and related MM functionality described. For the determination on when LA or RA is changed, see chapter on “Handling of MM system information”.

CS service states and related MM functionality:

CS-DETACHED: The UE is not reachable by the network for CS services. The UE does not initiate LA updates at LA changes and no periodic CS service updates.

CS-IDLE: The UE is reachable by paging for CS services. The UE initiates LA updates at LA changes. The UE may initiate periodic CS service updates and this depending on the CS periodic update state of the present LA.

CS-CONNECTED: The UE has a signalling connection for CS services established between the UE and the CN. The UE does not initiate LA update (even not when the present LA changes) and no periodic CS service updates.

PS service states and related MM functionality:

PS-DETACHED: The UE is not reachable by the network for PS services. The UE does not initiate RA updates at RA changes and no periodic PS service updates.

PS-IDLE: The UE is reachable by paging for PS services. The UE initiates RA updates at RA changes. The UE may initiate periodic PS service updates and this depending on the PS periodic update state of the present RA.

PS-CONNECTED: The UE has a signalling connection for PS services established between the UE and the CN. The UE does not initiate RA update ~~(even not when the present RA changes)~~ at RA changes, except during SRNS relocation when RAI in MM system information changes. ~~and n~~No periodic PS service updates.

There may also be a NULL state. In the UE, this state corresponds to power off or maybe a “no SIM” condition. In the CN, the NULL state correspond to CS-DETACHED and PS-DETACHED

For each state transition there can be several events that triggers the transition. Some of them are described below. Note that some of these may coincide, e.g. moving from CS-IDLE to CS-DETACHED and moving from PS-IDLE to PS-DETACHED.

**Moving from CS-IDLE to CS-CONNECTED:**

The state transition from CS-IDLE to CS-CONNECTED is performed when a signalling connection is established between UE and CN for CS services. In GSM this state transition is triggered by the message CM_SERVICE_REQUEST or PAGE_RESPONSE.

**Moving from CS-CONNECTED to CS-IDLE:**

The state transition from CS-CONNECTED to CS-IDLE is performed when the signalling connection for CS services is released, e.g. at call release and no other CS service is ongoing. A radio link failure may also trigger this state transition.

**Moving from CS-IDLE to CS-DETACHED:**

The transition from CS-IDLE to CS-DETACHED may be triggered by some action from the user of the UE but an expiring timer in the network could also trigger it. The UE is marked as CS_DETACHED in the CN and then as a consequence no CS service establishment is possible.

**Moving from PS-IDLE to PS-CONNECTED:**

The state transition from PS-IDLE to PS-CONNECTED is performed when a signalling connection is established between UE and CN for PS services.

Moving from PS-CONNECTED to PS-IDLE:

The state transition from PS-CONNECTED to PS-IDLE is performed when the signalling connection for PS services is released, e.g. at release of a PS service and no other PS service is ongoing. A radio link failure may also trigger this state transition.

Moving from PS-IDLE to PS-DETACHED:

The transition from PS-IDLE to PS-DETACHED may be triggered by some action from the user of the UE but an expiring timer in the network could also trigger it. The UE is marked as PS_DETACHED in the CN and then as a consequence no PS service establishment is possible.

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#### 4.3.6.2 Routing area update

Routing area update is initiated by the UE to inform the PS service domain of the core network that the UE has entered a new routing area. In case the new routing area is in an area served by another CN node, the routing area update also triggers the registration of the subscriber in the new CN node and a location update for PS services towards the HLR.

Routing area update is only initiated by the UE when the UE is in state PS-IDLE except during SRNS relocation when RAI in MM system information changes, and this independently of the CS state. If the UE is PS-IDLE but RRC connected, which means that the UE is in CS-CONNECTED state, routing area update is initiated by the UE when it enters a new routing area (see also the chapter “Handling of MM system information”).