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Technical Specification

**Universal Mobile Telecommunications System (UMTS);
UTRAN architecture for 3G Home Node B (HNB);
Stage 2
(3GPP TS 25.467 version 10.1.0 Release 10)**



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1 Scope

The present document specifies the UTRAN architecture for 3G Home NodeB (HNB).

It covers specification of the functions for UEs not supporting Closed Subscriber Groups (CSG) and UEs supporting CSGs. It also covers HNB specific requirements for O&M.

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.
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- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 25.468: "UTRAN Iuh Interface RUA signalling".
- [3] 3GPP TS 25.469: "UTRAN Iuh Interface HNBAP signalling".
- [4] 3GPP TS 25.401: "UTRAN overall description".
- [5] 3GPP TS 25.410: "UTRAN Iu Interface: general aspects and principles".
- [6] IETF RFC 4960 (September 2007): "Stream Control Transmission Protocol".
- [7] Broadband Forum TR-069 Amendment 2, *CPE WAN Management Protocol*, Broadband Forum Technical Report, 2007.
- [8] 3GPP TS 25.444: "Iuh data transport and transport signalling".
- [9] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".
- [10] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".
- [11] 3GPP TS 22.220: "Service requirements for Home NodeBs and Home eNodeBs".
- [12] 3GPP TS 25.419: "UTRAN Iu Interface: Service Area Broadcast Protocol SABP".
- [13] 3GPP TS 29.060: "GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".
- [14] 3GPP TS 29.274: "Tunnelling Protocol for Control Plane (GTPv2-C); Stage 3".
- [15] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".
- [16] 3GPP TS 33.320: "Security of Home Node B (HNB) / Home evolved Node B (HeNB)".
- [17] 3GPP TS 25.415: "UTRAN Iu Interface user plane protocols".
- [18] 3GPP TS 25.423: "UTRAN Iur interface Radio Network Subsystem Application Part (RNSAP) Signalling".
- [19] 3GPP TS 25.471: "UTRAN Iurh Interface RNSAP User Adaption (RNA) signalling".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

HNB, Home NodeB, 3G Home NodeB: as defined in TS 22.220 [11]. These terms, their derivations and abbreviations are used synonymously throughout this document.

CSG HNB: A HNB that is a CSG Cell broadcasting a CSG Indicator and a specific CSG identity.

Non CSG HNB: A HNB that does not broadcast either a CSG Indicator or a CSG Identity.

Hybrid HNB: A HNB that is a hybrid Cell not broadcasting a CSG Indicator but broadcasting a CSG identity.

Membership Verification: The process that checks whether a UE is a member or non-member of a hybrid cell

Access Control: The process that checks whether a UE is allowed to access and to be granted services in a closed cell

CSG ID Validation: The process that checks whether the CSG ID sent via relocation messages is the same as the one supported by the target RAN

Intra-HNB-GW – inter-HNB Relocation via RNSAP: this term is used synonymously with the following terms throughout this specification: **RNSAP Relocation, Enhanced Mobility.**

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

| | |
|--------|---|
| CSG | Closed Subscriber Group |
| DSL | Digital Subscriber Line |
| DSL-GW | DSL GateWayGNSSGlobal Navigation Satellite System |
| GPS | Global Positioning System |
| HMS | Home NodeB Management System |
| HNB | 3G Home NodeB |
| HNB-GW | 3G HNB Gateway |
| HW | Hard Ware |
| IP | Internet Protocol |
| L-GW | Local GateWay |
| LAC | Local Area Code |
| LIPA | Local IP Access |
| RAC | Routing Area Code |
| RGW | Residential GateWay |
| SAC | Service Area Code |
| SeGW | Security GateWay |
| SGW | Serving GateWay |
| SW | SoftWare |

4 Overall architecture

4.1 General

The overall UMTS architecture and UTRAN architectures are described in 25.401 [4] and 25.410 [5]. For clarity and ease of understanding, at appropriate places references to TR-069 [7] and associated methods are described briefly although they are beyond the scope of this specification.

The reference model shown in Figure 4.1-1 below contains the network elements that make up the HNB access network. There is one-to-many relationship between HNB-GW and HNB(s).

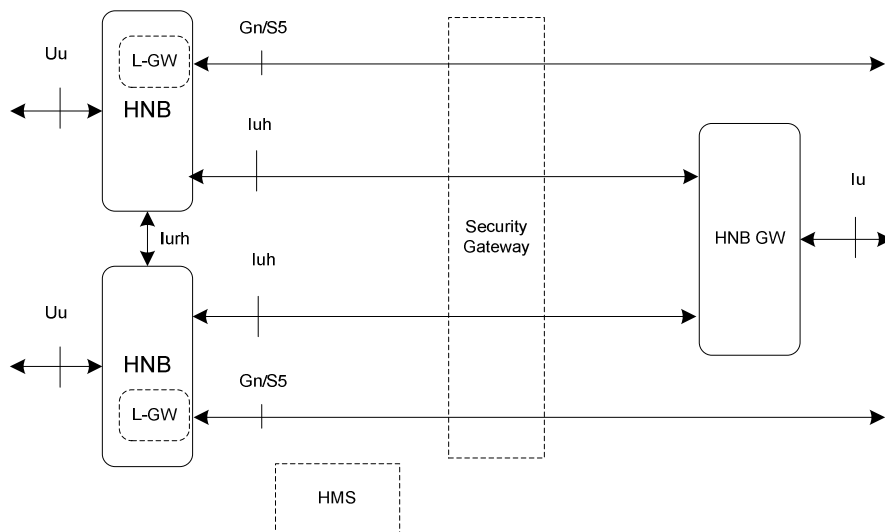


Figure 4.1-1. HNB access network reference model.

The HNB GW serves the purpose of a RNC presenting itself to the CN as a concentrator of HNB connections. The Iu interface between the CN and the HNB-GW serves the same purpose as the interface between the CN and a RNC. One HNB serves only one cell.

The Local Gateway (L-GW) may be present only when HNB operates in LIPA. When present, it is co-located with the HNB. This L-GW can then have a Gn/S5 interface towards the SGSN/SGW which does not use the HNB GW, and a Gi interface towards the residential/IP network.

The L-GW shall use the same IPSEC tunnel established by the HNB as specified in TS 33.320 [16].

The L-GW may be assigned the same inner IP address as the HNB, or a different IP address.

NOTE: If the L-GW and the HNB use the same IP address, they should be assigned distinct ranges of TEIDs in order to be able to discriminate downlink GTP-U packets.

NOTE: The Security gateway is a logically separated entity and may be implemented either as a separate physical element or integrated into, for example, a HNB-GW.

The HNB access network includes the functional entities as shown in Figure 4.1-1 and detailed below.

The HNB access network supports Iurh connectivity between HNBs.

This version of specification supports two different Iurh connectivity options:

- Direct Iurh interface connectivity between the two involved HNBs.
The HNB-GW is not involved at all in Iurh RNL signalling.
- Iurh interface connectivity between HNBs with the HNB-GW serving as an Iurh proxy.
The HNB-GW acting as an Iurh-proxy appears to a HNB as the peer HNB.

For this connectivity option the role of the HNB-GW is transparent with regards to RNSAP signalling. Conveying respective signalling messages via the HNB-GW is performed by routing based on information provided by the RNSAP User Adaptation (RNA) layer.

Iurh connectivity between one pair of HNBs shall either support direct Iurh connectivity or Iurh connectivity via the HNB-GW, not both at the same time.

There is no requirement for a HNB to support direct Iurh connectivity and Iurh connectivity via the HNB-GW at the same time in R10 timeframe.

4.1.1 HNB Management System (HMS)

- Based on TR-069 family of standards [7]
- Facilitates HNB-GW discovery
- Provisions configuration data to the HNB
- Performs Location verification of HNB and assigns appropriate serving elements (HMS, Security Gateway and HNB-GW).

4.1.2 Security Gateway (SeGW)

- Terminates Secure tunnelling for TR-069 [7] as well as Iuh
- Authentication of HNB
- Provides the HNB with access to the HMS and HNB-GW

4.1.3 HNB Gateway (HNB-GW)

- Terminates Iuh from HNB. Appears as an RNC to the existing Core network using existing Iu interface.
- Supports HNB registration and UE registration over Iuh.

4.1.4 HNB

- Customer Premise Equipment that offers the Uu Interface to the UE
- Provides RAN connectivity using the Iuh interface
- Supports RNC like functions, the details of which are captured in table 4.2-1 below
- Supports HNB registration and UE registration over Iuh.
- In case of LIPA support, the HNB supports the following additional functions:
 - transfer of the collocated L-GW IP address of the HNB over Iuh.
 - support of basic GGSN/P-GW functions in the collocated L-GW function by support of the Gi/SGi interface corresponding to LIPA,
 - Support of use of Correlation ID for correlation purposes between the collocated L-GW function and the HNB,

4.1.5 L-GW

- In Idle mode, support of first packet sending to SGSN/ SGW, buffering of subsequent downlink packets;
- Support of internal direct user plane path with the HNB.

The mobility of the LIPA PDN connection is not supported in this release of the specification. The LIPA connection is always released with handover as described in TS 23.060 [10]. The L-GW function within the HNB deactivates the LIPA connection.

4.2 Functional split

The UTRAN functions in the HNB are supported by RANAP, whereas the HNB specific functions are supported by the Home NodeB Application Protocol (HNBAP) between the HNB and the HNB GW. The HNB GW provides a concentration function for the control plane and may provide a concentration function for the user plane.

This sub-clause defines the functional split between the core network and the UMTS radio access network. The functional split is shown in table 4.2-1 and 4.2-2

Table 4.2-1. Functional split for UTRAN function in the HNB access.

| Function | HNB | HNB GW | CN |
|--|-----|---------------------|----|
| RAB management functions: | | | |
| RAB establishment, modification and release | X | X ^{Note 1} | X |
| RAB characteristics mapping I _u transmission bearers | X | X | |
| RAB characteristics mapping U _u bearers | X | | |
| RAB queuing, pre-emption and priority | X | | X |
| Radio Resource Management functions: | | | |
| Radio Resource admission control | X | | |
| Broadcast Information | X | X ^{Note 2} | X |
| Iu link Management functions: | | | |
| Iu signalling link management | X | X | X |
| ATM VC management | | X | X |
| AAL2 establish and release | | X | X |
| AAL5 management | | X | X |
| GTP-U Tunnels management | X | X | X |
| TCP Management | | X | X |
| Buffer Management | X | X | |
| Iu U-plane (RNL) Management: | | | |
| Iu U-plane frame protocol management | | | X |
| Iu U-plane frame protocol initialization | X | | |
| Mobility management functions: | | | |
| Location information reporting | X | | X |
| Handover and Relocation | | | |
| Inter RNC hard HO, Iur not used or not available | X | X | X |
| Serving RNS Relocation (intra/inter MSC) | X | X | X |
| Inter system hard HO (UMTS-GSM) | X | X | X |
| Inter system Change (UMTS-GSM) | X | | X |
| Paging Triggering | X | | X |
| Paging Optimization | | X | |
| GERAN System Information Retrieval | X | | X |
| Security Functions: | | | |
| Data confidentiality | | | |
| Radio interface ciphering | X | | |
| Ciphering key management | | | X |
| User identity confidentiality | X | | X |
| Data integrity | | | |
| Integrity checking | X | | |
| Integrity key management | | | X |
| Service and Network Access functions: | | | |
| CN Signalling data | X | | X |
| Data Volume Reporting | X | | |
| UE Tracing | X | | X |
| Location reporting | X | | X |
| Iu Co-ordination functions: | | | |
| Paging co-ordination | X | | X |
| NAS Node Selection Function | | X | |
| MOCN Rerouting Function | | X | X |
| <p>Note 1: This function could be needed for TNL address translation in the HNB GW when there is no user plane direct transport connection between HNB and CN</p> <p>Note 2: HNB GW is able to perform the filtering of SABP messages i.e. determines from the SAI list to which HNB the SABP message needs to be sent and then distributes the SABP messages to the appropriate HNBs. This is an optional function in HNB GW.</p> | | | |

Table 4.2-2. Functional split for HNB function in the HNB access.

| Function | HNB | HNB GW | CN |
|---|--------------------|--------|----|
| HNB Registration ^{Note 1} | | | |
| HNB Registration Function | X | X | |
| HNB-GW Discovery Function | X | | |
| HNB de-registration Function | X | X | |
| UE Registration for HNB ^{Note 1} | | | |
| UE Registration Function for HNB | X | X | |
| UE de-registration Function for HNB | X | X | |
| luh user-plane Management functions | | | |
| luh User plane transport bearer handling | X | X | |
| Functions for multiplexing CS user plane on the Uplink | X | X | |
| Traffic Offload Functions | | | |
| LIPA | X | | X |
| Enhanced Interference Management | | | |
| Mitigation of Interference from HNB to Macro | X | | |
| UE Access Control / Membership Verification | | | |
| IDLE mode | X ^{Note2} | X | X |
| Connected mode (inbound relocation to HNB cells) | | X | X |
| CSG ID validation | X | X | |
| CSG Subscription Expiry | X | X | X |
| Note 1: Protocol support for this group of functions is provided by the HNB Application Protocol. | | | |
| Note 2: Access control or membership verification at the HNB are optional. | | | |

5 UTRAN functions for HNB access

5.1 UE Registration

5.1.1 General

The UE Registration Function for HNB provides means for the HNB to convey UE identification data to the HNB-GW in order to perform access control or membership verification for the UE in the HNB GW. The UE Registration also informs the HNB-GW of the specific HNB where the UE is located.

The following sections illustrate the case when the HNB registers a specific UE with the HNB-GW. The registration is triggered when the UE attempts to access the HNB via an initial NAS message (e.g., Location Updating Request) and there is no context in the HNB allocated for that UE.

5.1.2 UE Registration: case of non CSG UEs or non CSG HNBs

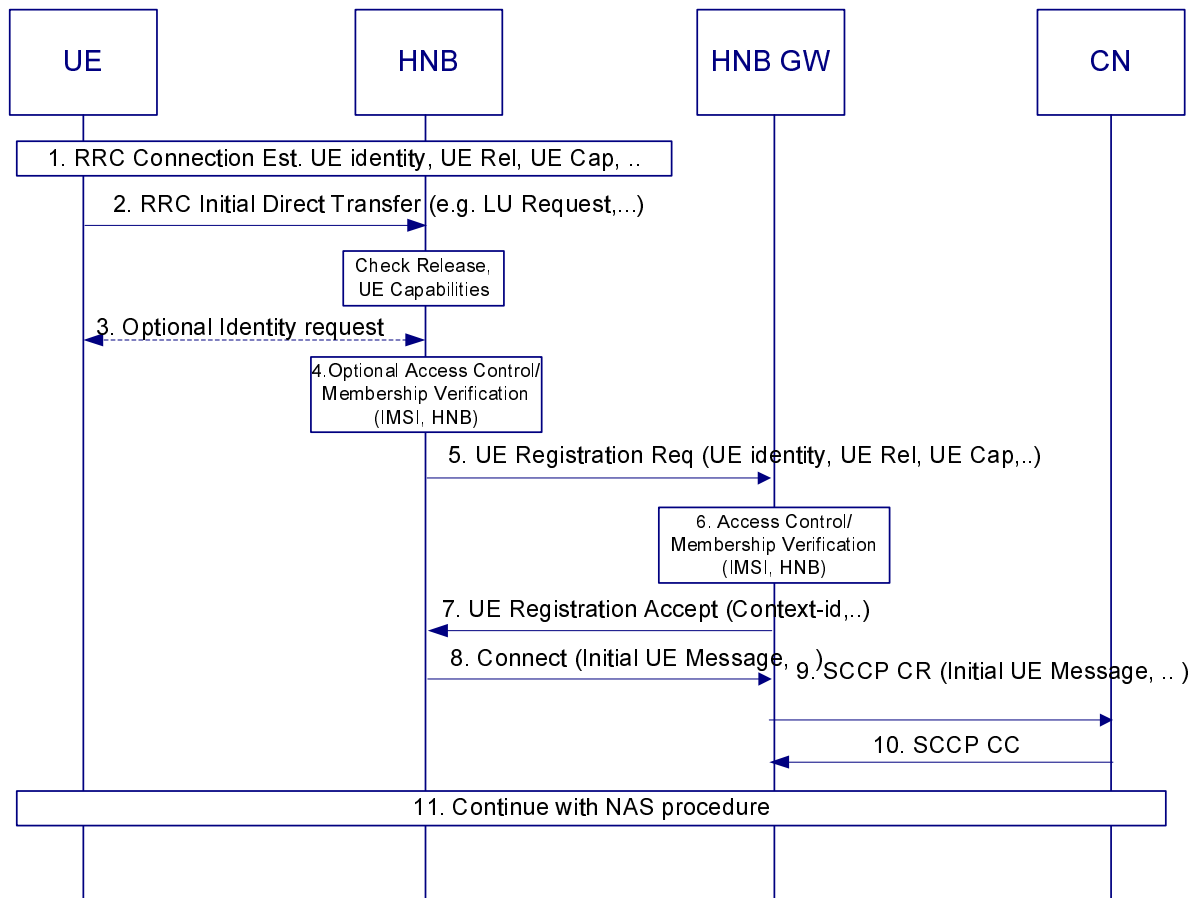


Figure 5.1.2-1. UE Registration for non CSG UEs or non CSG HNBs.

1. Upon camping on the HNB, the UE initiates an initial NAS procedure (e.g. LU Procedure) by establishing an RRC connection with the HNB. UE identity, UE capabilities and Establishment Cause, are reported to the HNB as part of the RRC Connection establishment procedure.
2. The UE then transmits a RRC Initial Direct Transfer message carrying the initial NAS message (e.g. Location Updating Request message) with some form of UE identity.
3. The HNB checks the UE capabilities provided in step 1, and if these indicate that CSG is not supported, or the HNB itself does not support CSG, and if the identity of the UE (provided during RRC Connection Establishment) is unknown at the HNB being accessed, i.e. no Context id exists for the UE, the HNB initiates UE registration towards the HNB-GW (step 5-7). Before starting the UE Registration procedure, the HNB triggers the Identification procedure (step 3) asking the UE for its IMSI, unless that identity has been provided during the RRC Connection Establishment or optionally if it is an emergency call. If the HNB has a context id for the UE, the UE registration procedure is not performed nor is the Identification procedure.
4. The HNB may optionally perform access control or membership verification based on the provided IMSI and the provided Allowed IMSI list. If the UE requests emergency services it shall always be admitted to the cell.
5. The HNB attempts to register the UE on the HNB-GW by transmitting the UE REGISTER REQUEST. The message contains at a minimum:
 - **UE Identity:** a unique identity for the UE provided in step 1 or 3.
 - **UE Capabilities:** derived from that provided in step 1.
 - **Registration Cause:** the indication about a UE registration for an emergency call.

NOTE: The UE Identity provided in the HNBAP UE REGISTER REQUEST message is unauthenticated.

6. The HNB-GW checks the UE capabilities and the Registration Cause. If the UE capabilities indicate that CSG is not supported or if the HNB does not support CSG, the HNB-GW shall perform access control or membership verification for the particular UE attempting to utilize the specific HNB. If the UE requests emergency services it shall always be admitted to the cell.
7. If the HNB-GW accepts the UE registration attempt it shall allocate a context-id for the UE and respond with an HNBAP UE REGISTER ACCEPT message, including the context-id, to the HNB. For non-CSG UEs, the HNB-GW may also include the CSG Membership Status in the HNBAP UE REGISTER ACCEPT message. If the HNB-GW chooses not to accept the incoming UE registration request then the HNB-GW shall respond with an HNBAP UE REGISTER REJECT message.
8. The HNB then sends an RUA CONNECT message containing the RANAP Initial UE message. If a L-GW collocated with the HNB is operating LIPA the RANAP Initial UE message will include the L-GW IP address.
9. The reception of the RUA CONNECT message at the HNB-GW triggers the setup of an SCCP connection by the HNB-GW towards the CN. The HNB-GW then forwards the RANAP Initial UE Message to the CN.
10. The CN responds with an SCCP Connection Confirm message.
- 10a. The HNB-GW shall additionally utilize a CN assisted method if available (e.g. using IMSI provided in the COMMON ID message), to alleviate the security risks associated with spoofing of IMSI and can subsequently trigger a UE deregistration upon detection of such an event.
11. The UE continues with the NAS procedure (e.g. Location Updating procedure) towards the CN, via the HNB and the HNB-GW.

5.1.3 UE Registration: case of CSG UEs and CSG or Hybrid HNBs

This call flow assumes that the Core Network is able to perform access control on the basis of Closed Subscriber Groups.

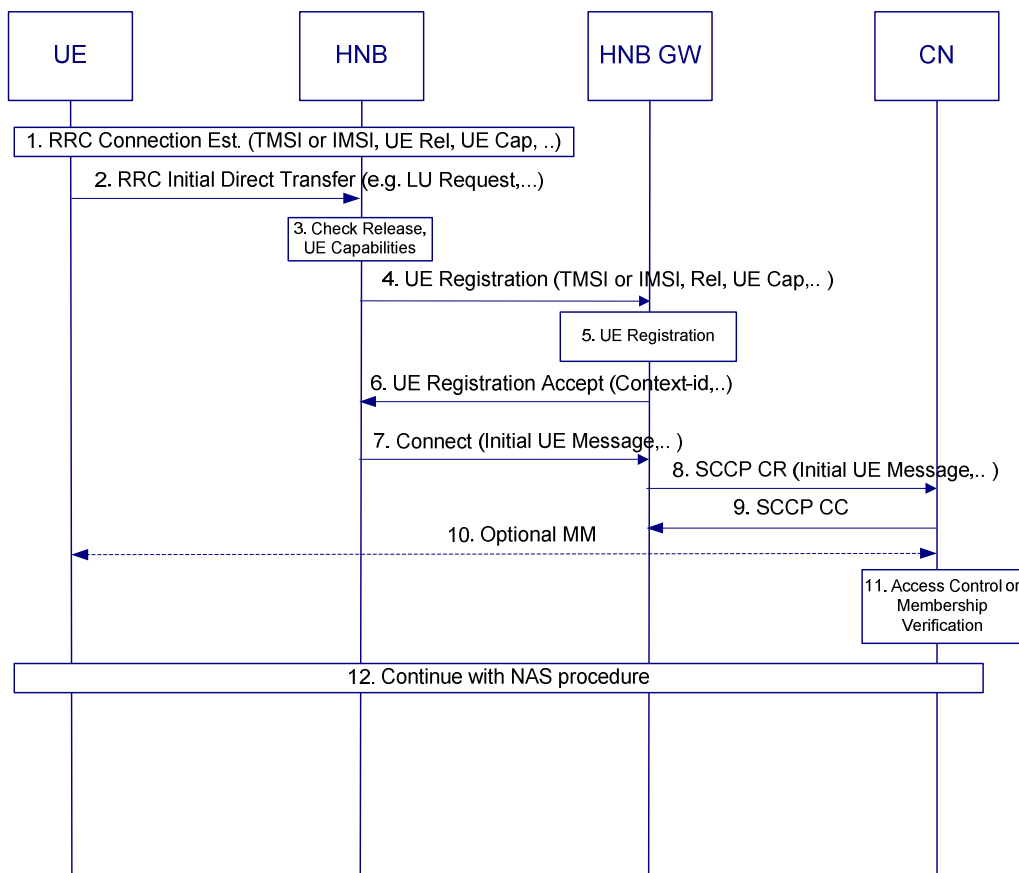


Figure 5.1.3-1. UE Registration for CSG UEs and CSG or Hybrid HNBs.

1. Upon camping on the HNB, the UE initiates an initial NAS procedure (e.g. LU Procedure) by establishing an RRC connection with the HNB. UE identity and UE capabilities are reported to the HNB as part of the RRC Connection establishment procedure.
2. The UE then transmits a RRC Initial Direct Transfer message carrying the initial NAS message (e.g. Location Updating Request message) with some form of identity (e.g. IMSI or TMSI, ..).
3. The HNB checks the UE capabilities provided in step 1, and if these indicate that CSG is supported and if the identity of the UE (provided during RRC Connection Establishment) is unknown at the HNB being accessed, i.e. no Context id exist for the UE, the HNB initiates UE registration towards the HNB-GW (steps 4-6). If the HNB has a context id for the UE, UE registration procedure is not performed. No Identification procedure is triggered, independent of the identity reported by the UE during the RRC Connection Establishment.
4. The HNB attempts to register the UE on the HNB-GW by transmitting the UE REGISTER REQUEST. The message contains:
 - **UE Identity:** a unique identifier for the UE and provided in step 1.
 - **UE capabilities:** derived from that provided in step 1.
 - **Registration Cause:** the indication about a UE registration for an emergency call.

NOTE: The UE IMSI/TMSI provided in the UE REGISTER message is unauthenticated.

5. The HNB-GW checks UE capabilities and if these indicate that CSG is supported and if the HNB supports CSG, the HNB-GW may accept the UE registration and allocate a context-id for the UE.
6. The HNB-GW responds with a UE REGISTER ACCEPT message back to the HNB including a context-id allocated to the UE
7. The HNB then sends a RUA CONNECT message containing the RANAP Initial UE message. The RANAP Initial UE message may contain the Cell Access Mode. If a L-GW collocated with the HNB is operating LIPA the RANAP Initial UE message will include the L-GW IP address.
8. The reception of the RUA CONNECT message at the HNB-GW triggers the setup of an SCCP connection by the HNB-GW towards the CN. The HNB-GW then forwards the Initial UE Message including the CSG id of the HNB.
9. The CN responds with an SCCP Connection Confirm message.
10. The CN may optionally perform Mobility Management procedures, e.g. Authentication procedure.
11. The CN performs access control (in case of CSG cells) or membership verification (in case of Hybrid cells) of the UE.
12. After being granted access the UE then continues with the NAS procedure (e.g. Location Updating procedure) towards the CN, via the HNB and the HNB-GW. During such procedures the CN may send to the HNB the UE membership status for the accessed cell in the COMMON ID message.

5.1.4 HNB-GW triggered UE Registration

The following section describes the mechanism, which is used to manage UE registration and associated context IDs for the scenarios based on HNB-GW triggered setup of UE-associated Signaling Connection.

In this mechanism, the RUA Connect message is used for transporting the first RANAP message resulting in network triggered setup of UE-associated Signaling Connection (e.g. RANAP Relocation Request).

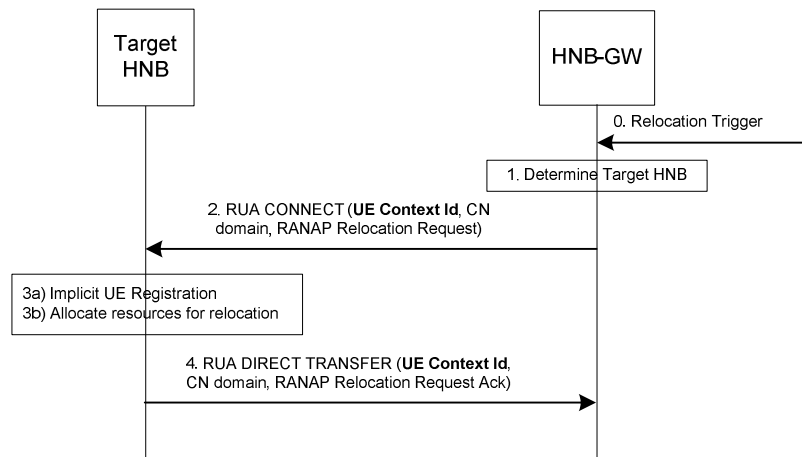


Figure 5.4.1-1. HNB-GW Triggered UE Registration

The above call flow assumes that the HNB-GW receives a trigger for inbound relocation for a UE (e.g. RANAP Relocation Request message from the CN) as shown in step 0.

1. The HNB-GW receives a RANAP message and determines the target HNB
2. The HNB-GW sends the RANAP message encapsulated in the RUA Connect message to the target HNB. The RUA Connect Message may contain the *CSG Membership Status IE*
3. The HNB-GW and the target HNB perform an implicit registration (i.e. HNB-GW establishes a UE specific Context Identifier to be used between the HNB and the HNB-GW) for the incoming UE session. The HNB also allocates the appropriate resource for handling the request in the RANAP message.
4. The RANAP reply message from the HNB to the HNB-GW is encapsulated in the RUA *Direct Transfer* message.

5.1.5 UE Registration: case of Open Access HNBs

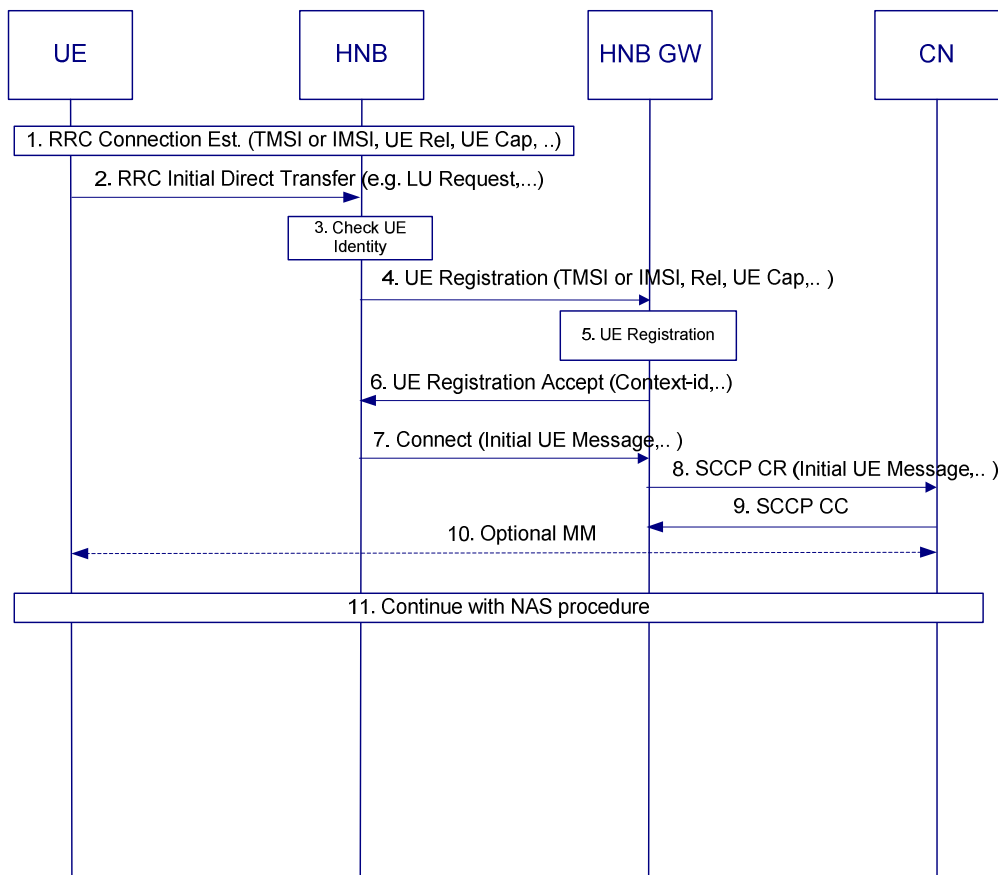


Figure 5.1.3-1. UE Registration to open access HNBs.

1. Upon camping on the HNB, the UE initiates an initial NAS procedure (e.g. LU Procedure) by establishing an RRC connection with the HNB. UE identity and UE capabilities are reported to the HNB as part of the RRC Connection establishment procedure.
2. The UE then transmits a RRC Initial Direct Transfer message carrying the initial NAS message (e.g. Location Updating Request message) with some form of identity (e.g. IMSI or TMSI).
3. If the identity of the UE (provided during RRC Connection Establishment) is unknown at the HNB being accessed, i.e. no Context id exist for the UE, the HNB initiates UE registration towards the HNB-GW (steps 4-6). If the HNB has a context id for the UE, UE registration procedure is not performed. No Identification procedure is triggered, independent of the identity reported by the UE during the RRC Connection Establishment.
4. The HNB attempts to register the UE on the HNB-GW by transmitting the UE REGISTER REQUEST. The message contains:
 - **UE Identity:** a unique identifier for the UE and provided in step 1.
 - **UE capabilities:** derived from that provided in step 1.
 - **Registration Cause:** the indication about a UE registration for an emergency call.

NOTE: The UE IMSI/TMSI provided in the UE REGISTER message is unauthenticated.

5. The HNB-GW may accept the UE registration and allocate a context-id for the UE.
6. The HNB-GW responds with a UE REGISTER ACCEPT message back to the HNB including a context-id allocated to the UE
7. The HNB then sends a RUA CONNECT message containing the RANAP Initial UE message.

8. The reception of the RUA CONNECT message at the HNB-GW triggers the setup of an SCCP connection by the HNB-GW towards the CN. The HNB-GW then forwards the Initial UE Message to the Core Network.
9. The CN responds with an SCCP Connection Confirm message.
10. The CN may optionally perform Mobility Management procedures, e.g. Authentication procedure.
11. After being granted access the UE then continues with the NAS procedure (e.g. Location Updating procedure) towards the CN, via the HNB and the HNB-GW.

5.2 HNB Registration

5.2.1 General

The following section illustrates the case when the HNB registers with the HNB-GW. The HNB registration procedure serves the following purposes:

- It informs the HNB-GW that a HNB is now available at a particular IP address.

5.2.2 HNB Registration procedure

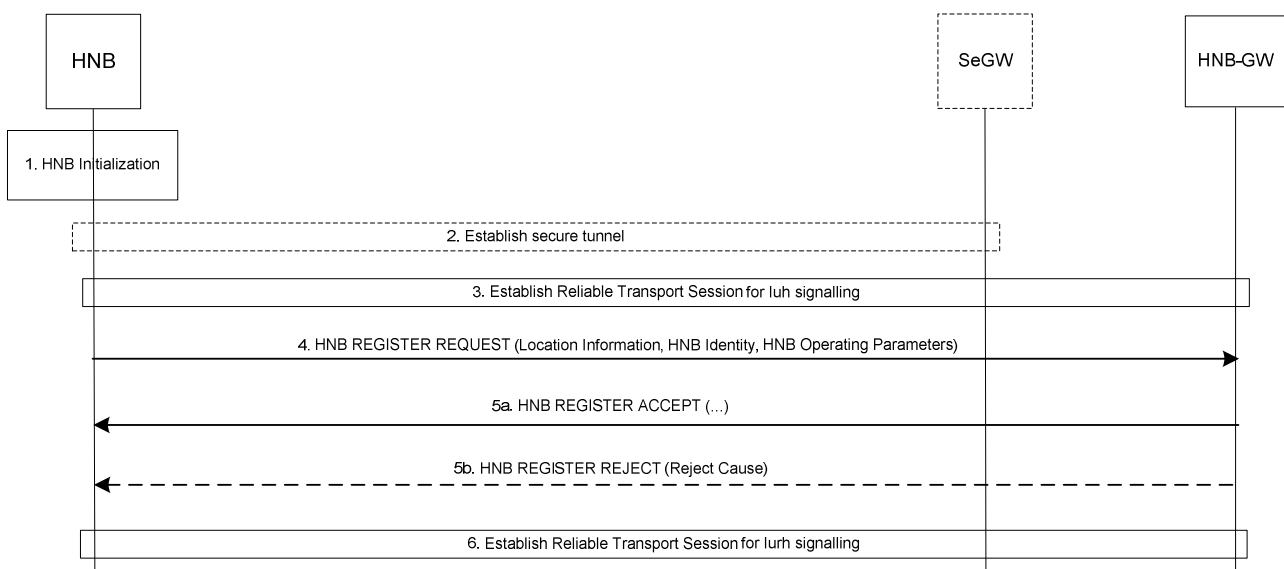


Figure 5.2.2-1. HNB Registration procedure.

1. HNB initialization is performed to obtain HNB configuration from the HNB Management System (HMS). Similarly, HNB-GW discovery is performed to obtain the initial serving HNB-GW information.

2. The HNB establishes a secure tunnel to the SeGW of the serving HNB-GW.

NOTE: This step may be omitted if the secure tunnel happens to be the same tunnel that is already established to contact the HMS.

3. The HNB sets up an SCTP transport session to the registered port on the serving HNB-GW for Iurh.

4. The HNB then attempts to register with the serving HNB-GW using an HNB REGISTER REQUEST message. The message contains:

- a. **HNB Location Information:** The HNB provides location information via use of one or more of the following mechanisms:
 - i. detected macro-cell coverage information (e.g. GERAN or UTRAN cell information)

- ii. geographical co-ordinates (e.g. via use of GPS, etc)
 - iii. Internet connectivity information (e.g. IP address), provided, the resulting location information is at least as accurate as location determination based on macro-cell coverage information, whether or not there is macro cell-coverage available at the location of the HNB (e.g. as determined by point i above).
- b. **HNB Identity**: the HNB has a globally unique and permanent identity.
 - c. **HNB Operating Parameters**: Such as the selected LAC, RAC, SAC, PLMN Id, Cell Id, etc.
 - d. **HNB operating mode** (optional): HNB CSG-id or access mode (open, closed or hybrid).
 - e. **HNB own IP address** (if Iurh connectivity is supported by the HNB).
- 5a. The HNB-GW may use the information from the HNB REGISTER REQUEST message to check whether the HNB registration can be accepted (e.g. to check whether a particular HNB is allowed to operate in a given location, etc). If the HNB-GW accepts the registration attempt it shall respond with a HNB REGISTER ACCEPT message. If the HNB-GW has capability to de-multiplex, the HNB-GW may include a mux port in the HNB REGISTER ACCEPT message. The HNB shall include the provided RNC-ID in RANAP and RRC messages that contain an RNC-ID. If available, the HNB-GW provides its IP address in order to allow the HNB to establish Iurh-connectivity via the HNB-GW.
- 5b. Alternatively, the HNB-GW may reject the registration request (e.g. due to network congestion, blacklisted HNB, unauthorized HNB location, etc). In this case, the HNB-GW shall respond with an HNB REGISTER REJECT indicating the reject cause.
6. If the HNB-GW had provided in the HNB REGISTER ACCEPT message the HNB own IP address for Iurh support, the HNB shall, if supported, set up an SCTP transport session to the port registered for Iurh.

NOTE: The HNB shall start broadcasting only after successful registration with the HNB-GW.

5.3 HNB-GW Discovery Function

5.3.1 General

The HNB-GW Discovery Function provides the means to determine the address of the Serving HNB-GW for a particular HNB. The HNB will use the Serving HNB GW address to register with the Serving HNB-GW.

5.4 HNB de-registration Function

5.4.1 General

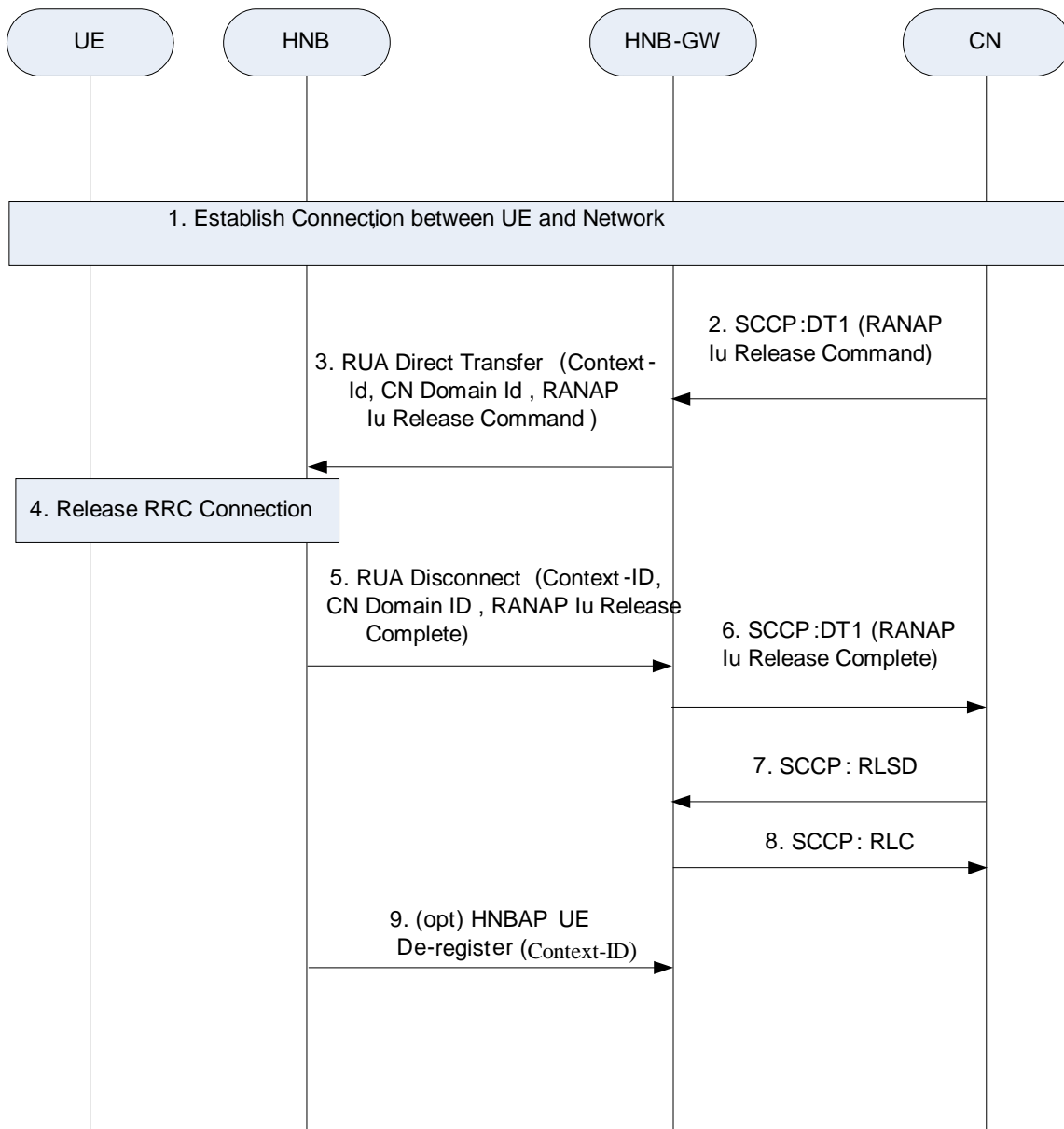
The HNB de-registration Function provides the means to terminate the HNB operation. The HNB de-registration can be initiated by either the HNB or the HNB-GW.

5.5 Iuh Disconnect

5.5.1 General

The following section illustrates the scenario where an UE-associated signaling connection is released across the Iuh. In this scenario the HNB is responsible for initiating the release of the UE-associated signaling connection via the RUA disconnect message. The HNB-GW is then responsible for co-ordinating the release of the UE-associated signaling connection with the corresponding Iu connection, which will be triggered by the CN.

5.5.2 Iuh Disconnect procedure



1. Establish connection between UE and network. Procedure in Section 5.1.
2. CN sends a RANAP Release Iu connection command message to the HNB-GW
3. HNB-GW forwards this message to the relevant HNB
4. HNB triggers the release of the RRC connection to the UE. In this case a single Iu connection had been established for the UE
5. HNB sends a Disconnect message to the HNB-GW to indicate that this is the end of this particular UE-associated signaling connection and includes the RANAP Release Iu Connection Complete message.
6. HNB-GW forwards the RANAP message onto the CN.
7. CN triggers the release of the associated SCCP connection
8. HNB-GW confirms that the SCCP connection is released
9. Optionally the HNB can de-register the UE context from the HNB-GW.

5.6 Paging Optimization Function

5.6.1 General

The paging optimization function provides the means to decrease the impact of a paging load over Iuh (for example, via the use of knowledge about the UE Registration or its CSG Id List in the PAGING message).

5.7 HNB to HNB Mobility

5.7.1 General

The following sub-sections describe the mechanism for handling the intra HNB-GW mobility signaling via Iurh.

5.7.2 Connected mode mobility from one HNB to another HNB (Intra HNB-GW, Intra CSG)

5.7.2.1 C-Plane Handling

RNSAP Relocation utilises existing protocol functions specified for Enhanced Relocation between non-CSG cells within TS 25.413 [9] and TS 25.423 [18].

Additional information from the Source-HNB to the Target-HNB is provided within the RANAP Enhanced Relocation Information and the RANAP Relocation Information as specified in section 5.10.

Figure 5.7.2.1-1 below depicts the case where the UE is involved in the RNSAP Relocation and the HNBs are directly Iurh-connected. In case of UE not being involved, an Iurh signalling connection (i.e. RNA signalling resources) already exists between the involved HNBs which can be utilised for RNSAP signalling. In case of Iurh-connectivity via the HNB-GW, RNA signalling terminates at the HNB-GW, whereas RNSAP signalling is still performed peer-to-peer.

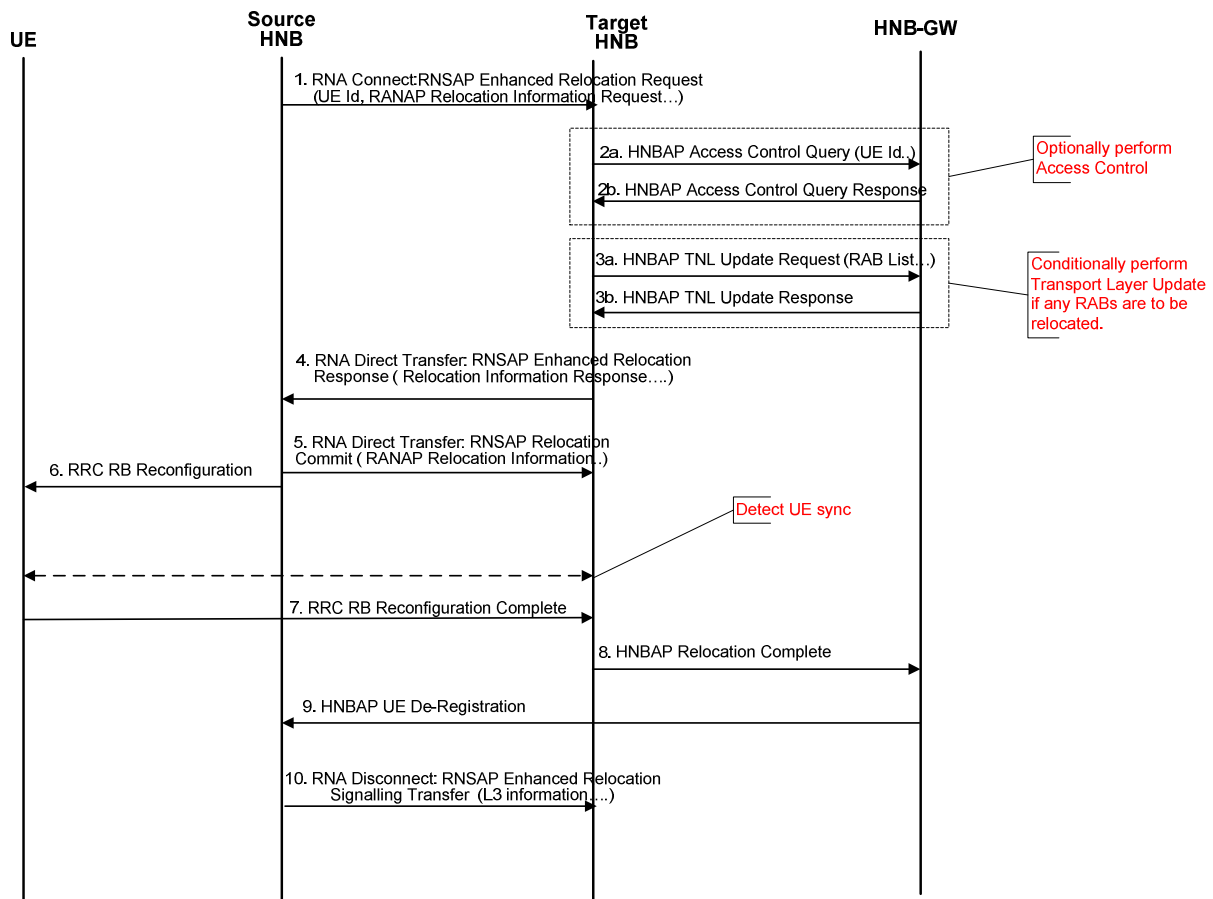


Figure 5.7.2.1-1. HNB to HNB Handover via luh interface – UE involved.

1. Source HNB sends RNA Connect (or RNA Direct Transfer if already in SHO) containing RNSAP Enhanced Relocation Request message to the identified target HNB to prepare the Target for a relocation.
2. Target HNB optionally queries the HNB-GW to perform access control for the UE that is being handed over.

Note: This step is optional as the target HNB may need to query the HNB-GW if non CSG UEs are supported

3. The target HNB updates the transport network layer information for any RABs that are to be relocated to it by sending a HNBAP TNL Update Request message to the HNB-GW, the HNB-GW responds with a HNBAP TNL Update Response.
4. Target HNB sends RNA Direct Transfer containing RNSAP Enhanced Relocation Response back to the source HNB to indicate that it has successfully prepared the relocation.
5. Source HNB sends RNA Direct Transfer containing RNSAP Relocation Commit, to commit the relocation preparation on the target HNB, this message will include information to aid the relocation procedure, these are described in section 5.10.
6. Source HNB reconfigures the UE to commence the handover procedure.
7. At some point later Layer 1 synchronisation is achieved between the UE and the target HNB. UE then completes the RRC reconfiguration procedure by sending an RRC Radio Bearer Reconfiguration Complete message to the target HNB.
8. Target HNB indicates to the HNB-GW that the UE has successfully relocated via the HNBAP UE Relocation Complete. The HNB-GW also switches the Uplane to the target HNB.
9. The HNB-GW sends the HNBAP UE DEREGISTER to the Source-HNB indicating Successful RNSAP Relocation with an appropriate cause value.

10. Source HNB sends an RNA Disconnect containing RNSAP Enhanced Relocation Signalling Transfer message to the target HNB to transfer any L3 information that the source HNB may have received during the relocation procedure and locally releases any resources it has for the UE.

Note: In the case of GW based HO, the RNA messages are routed via the HNB-GW.

5.7.2.2 User Plane Handling

In order to keep the CN unaware of any Intra-GW mobility for RABs operating in support mode (see TS 25.415 [17]), which would normally need an Iu-UP initialization procedure during relocation, the respective userplane configuration (RFCIs, etc.) has to be transferred to the Target-HNB without actually carrying out the Iu-UP Initialisation procedure towards its peer node. Special handling of related control and user data frame sequence numbers has to be applied.

In order to avoid problems with Iu-UP version interworking, the Target-HNB shall support at least the same versions of Iu UP and rate parameters used by the Source-HNB.

In order to allow seamless Iu-UP operation from a CN perspective

- the Source-HNB shall
 - provide the Target-HNB within RANAP ENHANCED RELOCATION INFORMATION REQUEST message
 - with CS IuUP control information needed to allocate IuUP instances for those RABs operated in support mode.
 - with the latest CS Iu-UP user-data frame-numbers for UL and DL for all CS RABs operated in support mode for which user data frame numbering is based on time together with the time-difference between UL and DL packets as received/sent on the source side.
 - provide the Target-HNB within RANAP RELOCATION INFORMATION message (encapsulated within the RNSAP message RELOCATION COMMIT)
 - with CS IuUP control information needed to allocate IuUP instances for those RABs operated in support mode, if the IuUP configuration of the RABs have changed.
 - with the latest CS Iu-UP control-data frame-numbers for UL and DL for all CS RABs operated in support mode.
 - with the latest CS Iu-UP user-data frame-numbers for UL and DL for all CS RABs operated in support mode for which user data frame numbering is based on time together with the time-difference between UL and DL packets as received/sent on the source side.
 - for those CS RABs which user-data frame-numbering is based on sent Iu UP PDU with the last sent DL and last received and forwarded UL user-data frame number.
 - provide the Target-HNB with the latest PS Iu-UP user-data frame-numbers for UL and DL for all applicable PS RABs.
 - when triggering the execution of the RNSAP Relocation (exact sequence of actions is implementation specific)
 - may start to forward user plane packets towards the Target-HNB for those RABs for which it has decided to perform data forwarding.
 - after having sent the RNSAP message RELOCATION COMMIT
 - not initiate any Iu-UP procedure and ignore incoming Iu-UP control frames.
- the Target-HNB shall
 - after having received the RANAP ENHANCED RELOCATION INFORMATION REQUEST message
 - use the information provided by the Source-HNB to establish Iu-UP instances for receiving user Iu-UP frames from the Source-HNB and may use the information of the last CS Iu-UP UL/DL user-data frame number as received from the source together with received DL user-data frames to re-install the timing

and frame-numbering for UL/DL user-data frames once the first DL user data packet is received from the Source-HNB.

- use the information provided by the Source-HNB to establish Iu-UP instances.
- for each CS RAB operated in support mode, use the information of the last CS Iu-UP UL/DL user-data frame number as received from the source together with received DL user-data frames to re-install the timing and frame-numbering for UL/DL user-data frames once the first DL user data packet is received
- not initiate any Iu-UP procedure and ignore incoming Iu-UP control frames.
- after having received the HNBAP: TNL UPDATE RESPONSE message from the HNB-GW
 - use the information provided by the Source-HNB to establish Iu-UP instances for receiving user Iu-UP frames from the HNB-GW and use the information of the last CS Iu-UP UL/DL user-data frame number as received from the source together with received DL user-data frames to re-install the timing and frame-numbering for UL/DL user-data frames once the first DL user data packet is received from the HNB-GW.
 - not initiate any Iu-UP procedure and ignore incoming Iu-UP control frames.
- after having received the RNSAP message RELOCATION COMMIT
 - use the information of the last CS Iu-UP UL control-data frame number as received from the Source-HNB for the next to be sent UL control-data frame.
 - ignore any loss of DL control frames and start respective error handling after the first received DL control frame.
 - use the information of the last CS Iu-UP UL/DL user-data frame number as received from the source together with received DL user-data frames to re-adjust the timing and frame-numbering for UL/DL user-data frames, if necessary.
 - start Iu-UP procedures as necessary (e.g. downlink rate control (due to e.g. local congestion), Iu Time Alignment)
- the HNB-GW shall
 - after receipt of the HNBAP:RELOCATION COMPLETE message
 - switch the UP completely towards the Target-HNB.

5.7.3 Soft Handover Initiation

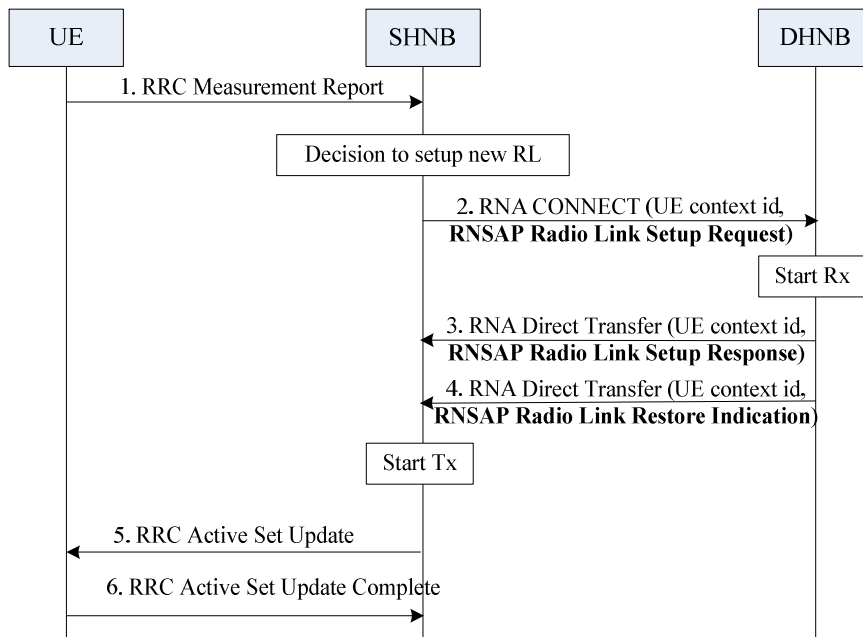


Figure 5.7.3-1. Soft Handover Initiation HNB to HNB.

1. Serving HNB receives a RRC measurement report indicating that Soft handover is possible and the HNB decides to setup a RL to the DHNB.
2. The SHNB send a RNA Connect containing RNSAP Radio Link Setup Request to the DHNB to set up a radio link at the DHNB.
3. The DHNB starts receiving from the UE and sends a Radio Link Setup Response message.
4. When the radio link is established on the DHNB, the DHNB sends a RNSAP Radio Link Restore Indication.
5. The SHNB send a RRC Active Set Update to the UE
6. The SHNB receives a RRC Active Set Update Complete from the UE.

5.7.4 Mobility Access Control

5.7.4.1 Limitations

For intra-CSG mobility access control is only needed for non-CSG UEs.

The current version of the specification allows RNSAP relocation via Iurh only for the following scenarios:

- Intra-CSG Closed access cell to closed access cell mobility
- Intra-CSG Hybrid access cell to hybrid access cell
- Open access cell to Open access cell.

5.8 HNB Configuration Transfer

The HNB Configuration Transfer function provides the means to inform the HNB-GW to provide HNBs with address information of neighbour HNBs in order to enable the establishment of Iurh connectivity. The neighbour list is maintained in the HNB via interaction with the HMS. The HNB will use the IP addresses received from the HNB-GW to connect to neighbour HNBs over Iurh.. The procedure for HNB Configuration Transfer is shown in Figure 5.8-1.

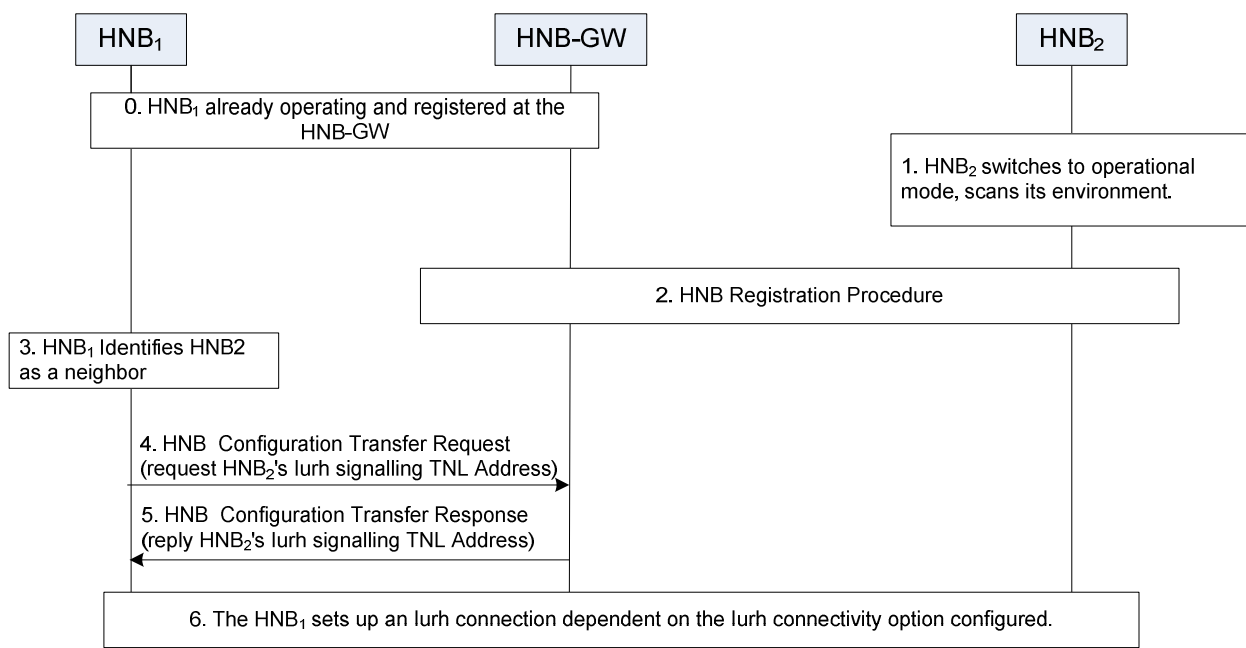


Figure 5.8-1 HNB Configuration Transfer

0. HNB₁ has already switched to operational mode, has registered at the HNB-GW and is connected to HNBs within its reach.
1. HNB₂ switches to operational mode.
2. HNB₂ registers at the HNB-GW successfully and provides its local IP address.
3. HNB₁ identifies a change in its neighbour list, from e.g. detecting HNB₂ or via HMS.
4. HNB₁ requests the IP addresses of the Target HNB(s) by sending HNBAP HNB Configuration Transfer Request to the HNB-GW.
5. The HNB-GW responds with a HNB Configuration Transfer Response message to the source HNB with the target HNB lurch local IP address, remote IP address and other information for each neighbour HNB requested.

5.9 lurch Setup

5.9.1 General

The purpose of this procedure is to setup an lurch connection between two HNBs, and ensure that they have the necessary information for operation.

5.9.2 Iurh Setup for direct Iurh connectivity

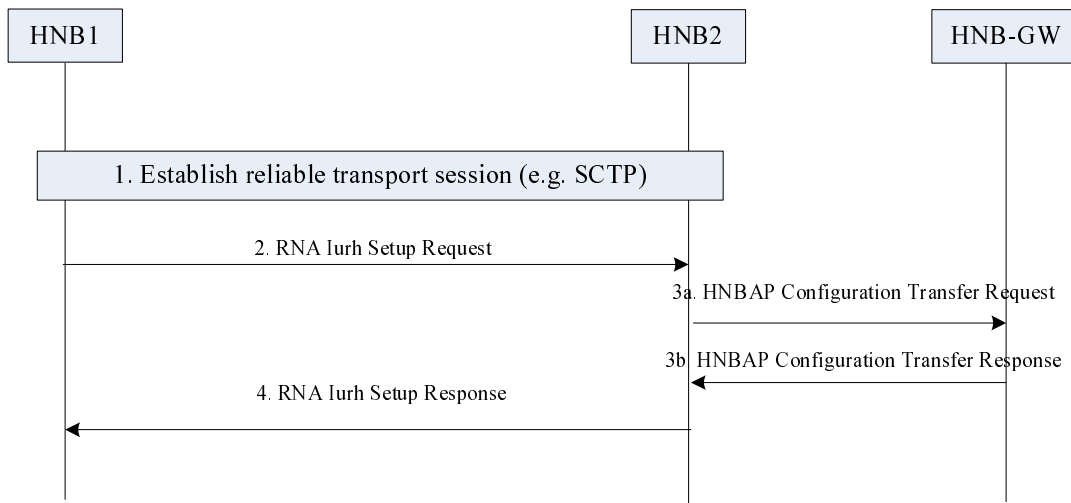


Figure 5.9.2-1 Procedure for Iurh Setup-direct Iurh connectivity

The purpose of this procedure is to establish Iurh connectivity between two HNBs and ensure that the application level information is available to the two HNBs to interoperate correctly.

1. The HNB sets up an SCTP transport session if required.
2. HNB₁ sends an RNA:IURH SETUP REQUEST to HNB₂.
3. If HNB₂ does not have configuration information on HNB₁, it triggers a request for the configuration information on HNB₁ from the HNB-GW.
4. HNB₂ responds to HNB₁.

5.9.3 Iurh Setup for Iurh connectivity via the HNB-GW

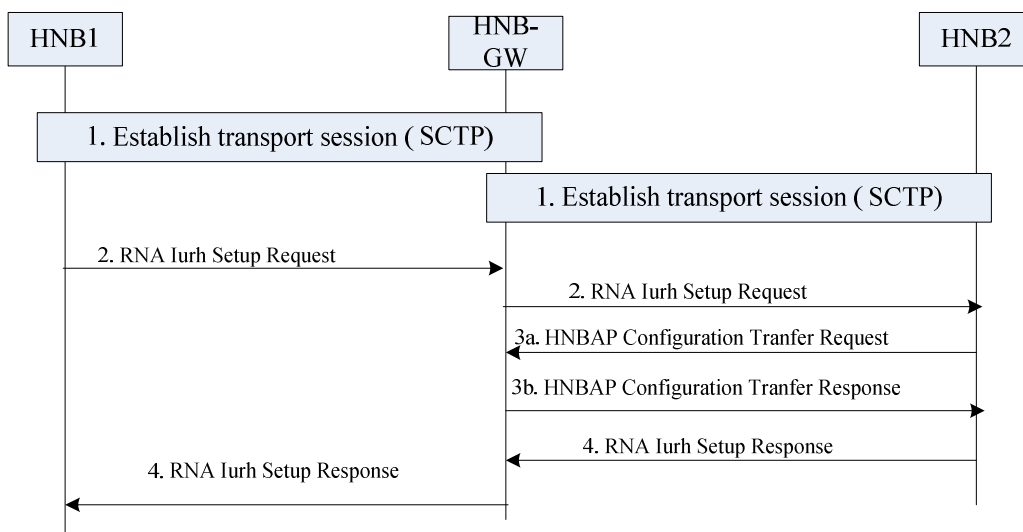


Figure 5.9.3-1 Procedure for Iurh Setup-Iurh connectivity via the HNB-GW

The purpose of this procedure is to establish Iurh connectivity between two HNBs via the HNB-GW and ensure that the application level information is available to the two HNBs to interoperate correctly.

1. HNB₁ and HNB₂ have set up an SCTP transport session towards the HNB-GW at HNB Registration if they both support RNSAP Relocation.
2. HNB₁ provides within the RNA:IURH SETUP REQUEST message information which enables the HNB-GW to route the message to the HNB₂ and to enable the HNB₂ to reply via the HNB-GW.
3. If HNB₂ does not have configuration information on HNB₁, it triggers a request for the configuration information on HNB₁ from the HNB-GW.
4. HNB₂ responds with a RNA:IURH SETUP RESPONSE to HNB₂ via the GW.

5.10 Handling of Source information transfer to Target

In order to maintain the continuity of UE support during handover, information must be transferred from the Source to the Target HNB. RAB related information to ensure that continuity of User Plane and RAB establishment and other non-RAB related information is transferred in the RELOCATION COMMIT message.

5.10.1 RAB Related Parameters

5.10.1.1 User Plane

During RNSAP Relocation preparation phase, information is provided to the Target-HNB in order to allow forwarding of user data. For each CS RAB operated in support mode (see TS 25.415 [17] for the definition of 'support mode') IuUP protocol data is provided to establish a respective IuUP instance at the Target-HNB in a way that the CN is unaware of the RNSAP Relocation.

During the RNSAP Relocation execution phase, for each CS RAB operated in support mode, final counters of IuUP user data and control data frames are provided.

The behaviour of all involved nodes (Source-HNB, Target-HNB, HNB-GW) is fully specified in section 5.7.2.2.

5.10.1.2 Other parameters

During Relocation Commit the following information is transferred from the Source to Target HNB to maintain valid data volume reports.

RAB Data Volume Information, The unsuccessful data report transferred to the target to be accumulated at the target for the final Data Volume report on RAB release.

5.10.2 Non-RAB Related Parameters

During Relocation Commit the following information is transferred from the Source- to Target-HNB to continue non-RAB related functionality triggered at the Source-HNB:

- Location Reporting parameters are transferred to the target HNB to ensure continuity of Location Reporting.
- Trace Information parameters are transferred to the target HNB to ensure continuity of Trace operations.
- The Service Area ID of the source cell is transferred to the target to enable the Target HNB to detect a change of service area and report this in the Location Reporting procedures.

5.8 CS user plane multiplexing

If the HNB-GW had signalled on the HNB REGISTER ACCEPT a mux port and if the HNB has capability to support CS user plane multiplexing, the HNB may send the multiplexed packets to the mux port at the HNB-GW.

The HNB, for the same UE, shall not send multiplexed packets over multiple ports. i.e, once the HNB chooses to multiplex CS user plane packets for a given UE on the uplink, it shall send those multiplexed packets only to the assigned mux port on the HNB-GW. For those UEs whose CS user plane packets are not being multiplexed, the HNB shall send packets only to the port number assigned via RAB assignment request.

When the HNB-GW receives multiplexed packet, it shall de-multiplex before sending them to the CN.

5.9 Inbound Mobility to HNB

5.9.1 General

The following sub-sections describe the mechanism for handling the inbound mobility to HNB. This mechanism is also applicable to the handover between HNBs under the same HNB-GW.

5.9.2 Connected Mode Inbound Mobility for CSG UEs to CSG HNBs or to Hybrid Cells

The following figure and accompanying steps describe the inbound mobility procedure for Rel-9 CSG UEs, when the Source RAN supplies to the Core Network a CSG id associated with the target HNB. The following is assumed:

- UE is Rel-9 CSG capable and SIB-reading capable.
- UE is able to provide in the RRC measurement report the cell identity and the CSG-Id (if requested) of the target HNB.
- The Source RAN is able to determine the Cell Access Mode of the target HNB.

NOTE: It is assumed that the network knows whether the target cell is a hybrid cell, e.g. by PSC range for hybrid cells.

- Core network is Release-9 CSG capable and is able to perform access control or membership verification for relocated CSG UE.
- The HNB-GW is able to route the incoming relocation to the appropriate target HNB using the target cell identity provided in RANAP RELOCATION REQUEST (i.e. Target Cell Id is unique for a HNB in a given HNB-GW)

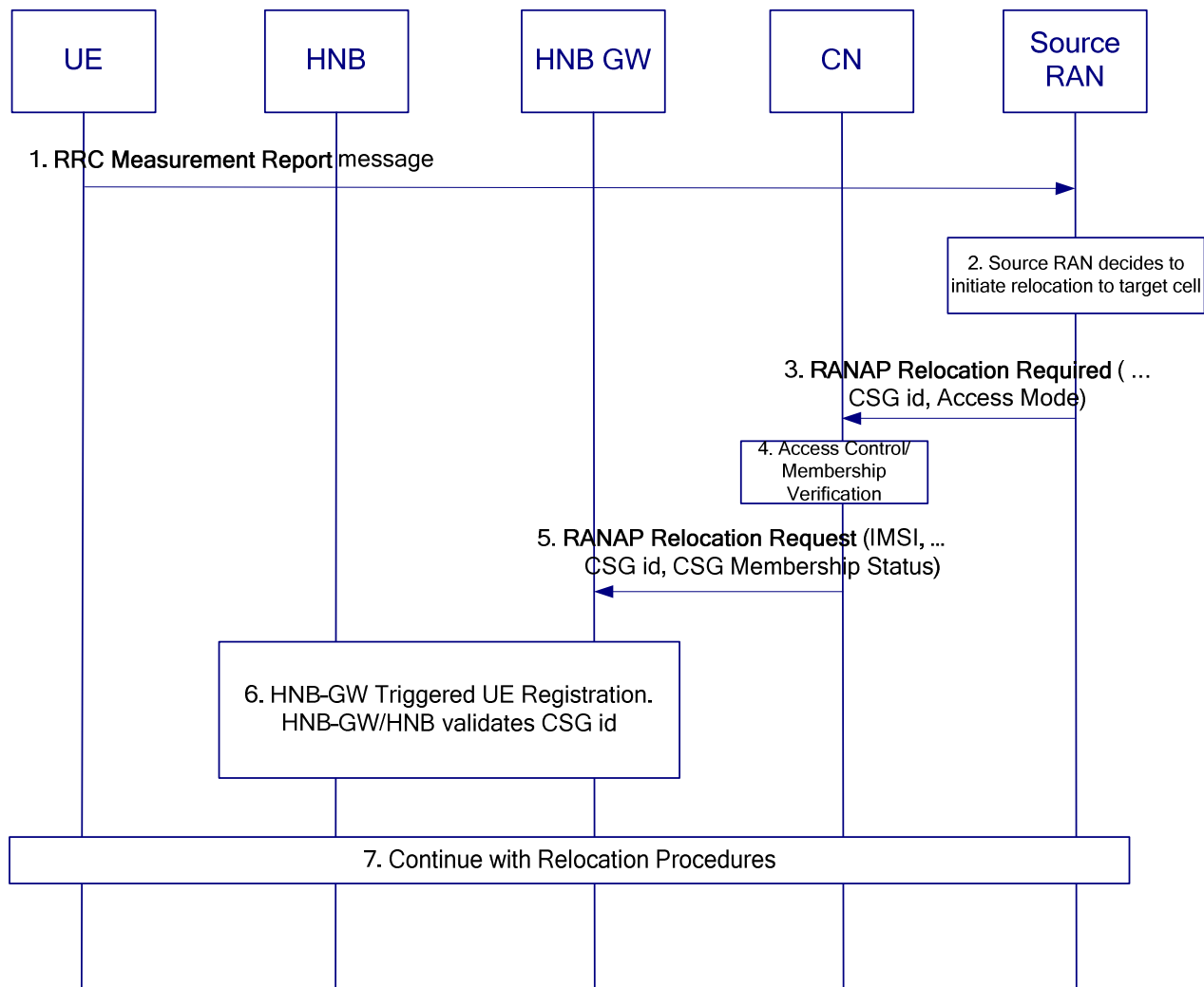


Figure 5.9.2-1: Connected Mode inbound mobility for CSG UEs to CSG HNB or Hybrid Cell

1. The UE is triggered to send an RRC Measurement Report by the rules set by the UTRAN. The Measurement Report includes the Cell Identity, CSG id (if requested) of the target HNB.
2. The Source RAN node makes a decision to relocate the UE session.
3. The source RAN triggers relocation of the UE session by sending the RANAP RELOCATION REQUIRED message to the Core Network. The target RNC-Id, CSG id, Target Cell Id and – for relocation to a hybrid cell – Cell Access Mode information along with relocation information are included by the source RAN in the RANAP RELOCATION REQUIRED message.
4. If the target cell is a CSG HNB, the Core Network performs access control on the basis of the CSG ID associated with the target cell, as reported to the Core Network (TS 25.413 [9]). Otherwise (if the target is a Hybrid Cell), the Core Network performs membership verification and fills the *CSG Membership Status* IE in step 5 to reflect the UE's membership to the target cell.
5. The HNB-GW receives a RANAP RELOCATION REQUEST message from the Core Network, including the CSG id, Target Cell Id and – for relocation to a hybrid cell – CSG Membership Status.
6. The steps for HNB-GW Triggered UE Registration are executed between the HNB-GW and the HNB. The HNB-GW/HNB validates the CSG id received in the RANAP RELOCATION REQUEST message.
7. The remainder of the relocation procedure continues normally as documented in TS 25.413 [9], TS 23.060 [10]

Note: Steps 2 to 7, as appropriate, are repeated for the second CN domain when present with the following exceptions. The relocation of the 2nd domain shall not trigger an additional registration. The 2nd RANAP Relocation Request shall

be carried as RUA Direct Transfer. There is only one Context Id assigned to the UE regardless of the number of domains relocated from the source RAN.

5.9.3 Connected Mode Inbound Mobility for non-CSG UEs to CSG HNBs or to Hybrid Cells

The following figure and accompanying steps describe the inbound mobility procedure for non-CSG UEs, when the Source RAN is able to identify the target HNB. The following is assumed:

- UE is non-CSG capable not able to read SIBs for CSG inbound mobility purposes.
- The HNB-GW is able to perform access control or membership verification for the UE.
- The HNB-GW is able to route the incoming relocation to the appropriate target HNB.

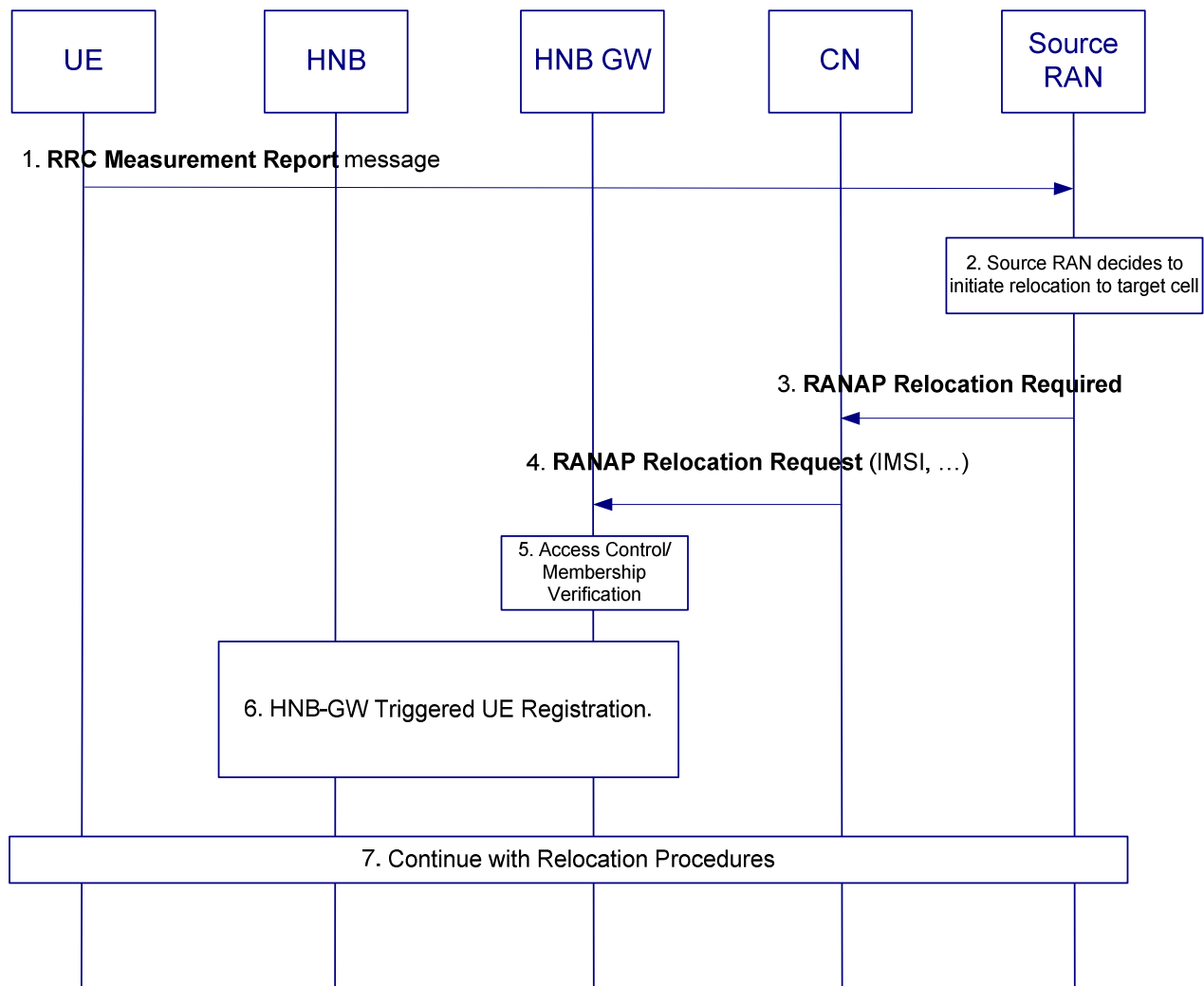


Figure 5.9.3-1: Connected Mode inbound mobility for non-CSG UEs to CSG HNB or Hybrid Cell

1. The UE is triggered to send an RRC Measurement Report by the rules set by the UTRAN.
2. The Source RAN node makes a decision to relocate the UE session.
3. The source RAN triggers relocation of the UE session by sending the RANAP RELOCATION REQUIRED message to the Core Network. The target RNC-Id and Target Cell Id are included by the source RAN in the RANAP RELOCATION REQUIRED message. The source RAN shall not include target CSG ID and the Cell Access Mode in the RELOCATION REQUIRED message.

4. The Core Network shall not perform any access control or membership verification for the UE and it shall not include target CSG ID and CSG Membership Status in the RELOCATION REQUEST message.
5. The HNB-GW receives a RANAP RELOCATION REQUEST message not including the target CSG ID and the CSG Membership Status. The HNB GW shall perform access control (in case of CSG cells) or membership verification (in case of Hybrid cells) for the UE. If the relocation is towards a hybrid cell the HNB GW may include the CSG Membership Status in the RUA Connect message.
6. The steps for HNB-GW Triggered UE Registration are executed between the HNB-GW and the HNB.
7. The remainder of the relocation procedure continues normally as documented in TS 25.413 [9], TS 23.060 [10]

Note: Steps 2 to 7, as appropriate, are repeated for the second CN domain when present with the following exceptions. The relocation of the 2nd domain shall not trigger an additional registration. The 2nd RANAP Relocation Request shall be carried as RUA Direct Transfer. There is only one Context Id assigned to the UE regardless of the number of domains relocated from the source RAN.

5.9.4 Connected Mode Inbound Mobility to open access HNBs

The following figure and accompanying steps describe the inbound mobility procedure when the Source RAN is able to identify the target HNB. The following is assumed:

- The HNB-GW is able to route the incoming relocation to the appropriate target HNB.

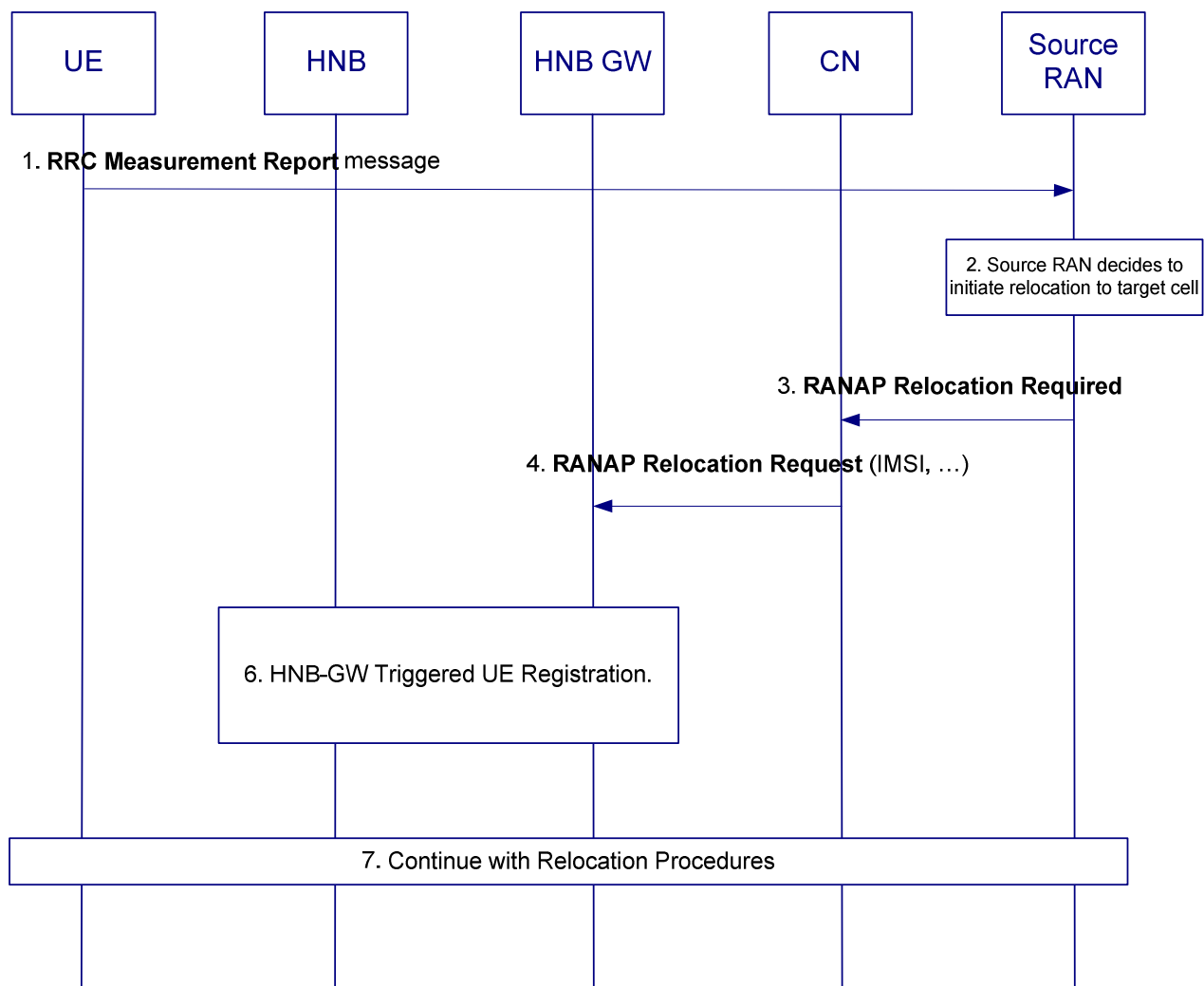


Figure 5.9.4-1: Connected Mode inbound mobility to open access HNBs

1. The UE is triggered to send an RRC Measurement Report by the rules set by the UTRAN.

2. The Source RAN node makes a decision to relocate the UE session.
3. The source RAN triggers relocation of the UE session by sending the RANAP RELOCATION REQUIRED message to the Core Network. The target RNC-Id and Target Cell Id are included by the source RAN in the RANAP RELOCATION REQUIRED message. The source RAN shall not include target CSG ID and the Cell Access Mode in the RELOCATION REQUIRED message.
4. The Core Network shall not perform any access control or membership verification for the UE and it shall not include target CSG ID and CSG Membership Status in the RELOCATION REQUEST message.
5. The HNB-GW receives a RANAP RELOCATION REQUEST message not including the target CSG ID and the CSG Membership Status.
6. The steps for HNB-GW Triggered UE Registration are executed between the HNB-GW and the HNB.
7. The remainder of the relocation procedure continues normally as documented in TS 25.413 [9], TS 23.060 [10]

Note: Steps 2 to 7, as appropriate, are repeated for the second CN domain when present with the following exceptions. The relocation of the 2nd domain shall not trigger an additional registration. The 2nd RANAP Relocation Request shall be carried as RUA Direct Transfer. There is only one Context Id assigned to the UE regardless of the number of domains relocated from the source RAN.

5.10 CSG Subscription Expiry

Case of CSG UEs:

If the CN has signalled CSG membership update to the HNB:

- If the UE is served by a CSG cell, and is no longer a member of the CSG cell, the HNB may initiate a handover to another cell. If the UE is not handed over, or handover is not initiated, the HNB should request the release of Iu connection (s) with an appropriate cause. The CN initiates Iu release after a configurable time, if the UE is not handed over or released by the CSG cell (TS 23.060 [10]).
- If the UE is served by a Hybrid cell, the HNB may use the new membership information to perform differentiated treatment for member and non-member UEs.

Case of non-CSG UEs:

If the HNB GW has signalled CSG membership update to the HNB:

- If the UE is served by a CSG cell, and is no longer a member of the CSG cell, the HNB may initiate a handover to another cell. If the UE is not handed over, or handover is not initiated, the HNB should request the release of Iu connection (s) with an appropriate cause. The HNB-GW shall initiate UE De-Registration after a configurable time, if the UE is not handed over or released by the serving HNB.
- If the UE is served by a Hybrid cell, the HNB may use the new membership information to perform differentiated treatment for member and non-member UEs.

6 Requirements for O&M

6.1 O&M for HNB

6.1.1 Provisioning Procedure for HNB

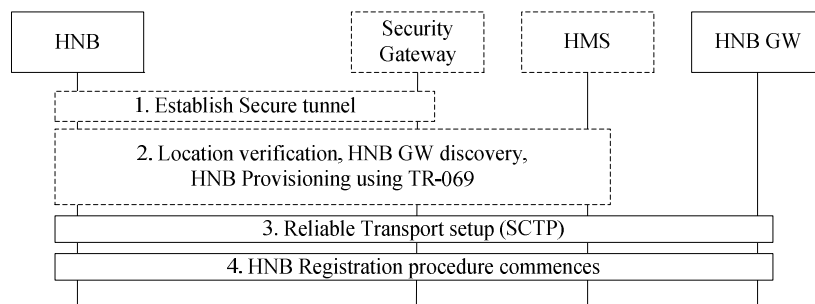


Figure 6.1.1-1. Provisioning procedure for HNB.

1. A secure tunnel is established from the HNB to the Security gateway.
2. Location verification shall be performed by the HMS based on information sent by the HNB (e.g. macro neighbour cell scans, global navigational satellite system type of information etc.). HMS determines the serving elements and provides the HNB GW, HMS and Security Gateway to the HNB. The HMS also provisions configuration parameters to the HNB only after successful location verification in the HMS.

NOTE: Steps 3 & 4 are shown only for completeness. Security Gateway and HMS are shown to highlight the general architecture.

NOTE: In the event information required for verifying location are not available (for example, no macro neighbour cells, no GNSS, no DSL line ID etc. available), HNB GW discovery may be based on specific operator and/or regulatory policies.

6.1.2 Location Verification

6.1.2.1 General

During location verification, the HNB reports its location information to the HMS. The HMS in turn examines the provided information and verifies the HNB's location. There are 3 possible types of information for this purpose:

1. Macrocell Information
2. GNSS location information
3. Broadband connection information, provided that the resulting location information is at least as accurate as location determination based on macro-cell coverage information, whether or not there is macro-cell coverage available at the location of the HNB (e.g. as determined by point 1. above).

NOTE: Not all of this information is mandatory. In fact, the type of reported information is based on factors such as the physical environment in which the HNB is installed and/or possible variations in the HNB's HW and SW implementation.

6.1.2.2 Macro-cell Information

6.1.2.2.1 General

The HNB is expected to have a radio environment measurement capability. This includes capturing the following type of information from the surrounding environment.

- a) UTRAN cell information
 - RF level information
 - Broadcast information
- b) GSM cell information
 - RF level information
 - Broadcast information

6.1.2.2.2 UTRAN Cell Information

The information in the following table is reported by the HNB to the HMS for each UTRAN cell detected.

Table 6.1.2.2.2-1. UTRAN Cell Information.

| Information | | Description / Note | Presence | 3GPP Reference |
|-----------------------|---------------|-----------------------------|----------|---|
| RF information | UARFCNDL | UARFCN (DL) | M | 25.104, sec.5.4 32.642 sec. 6.3.11 |
| | CPICHRSCP | RSCP of CPICH | M | |
| | PSC | Primary Scrambling Code | M | 32.642 sec. 6.3.11 |
| Broadcast information | PLMN Type | « GSM-MAP » or « ANSI-41 » | M | 25.331, sec.10.3.1.12 |
| | MCC | Mobile Country Code | M | 24.008 32.642 sec. 6.3.10 |
| | MNC | Mobile Network Code | M | 24.008 32.642 sec. 6.3.10 |
| | LAC | Location Area Code | M | 24.008, sec.10.5.1.3 32.642 sec. 6.3.10 |
| | RAC | Routing Area Code | M | 24.008, sec.10.5.1.12.3 25.413, sec.9.2.3.7 32.642 sec. 6.3.10 |
| | CellID | Cell ID | M | 25.331, sec.10.3.2.2 |
| | CSG Cell Info | <detail per Rel.8 RRC spec> | O | Applicable to Rel.8 compliant cell only. |

6.1.2.2.3 GSM Cell Information

The information in the following table is reported by the HNB to the HMS for each GSM cell detected.

Table 6.1.2.2.3. GSM Cell Information.

| Information | | Description / Note | Presence | 3GPP Reference |
|-----------------------|----------|---------------------------|----------|-------------------|
| RF information | ARFCN | Channel number | M | 32.652 sec. 6.3.5 |
| | BCCHRSSI | RSSI of the BCCH carrier. | M | 32.652 sec. 6.3.5 |
| | BSIC | Base Station ID Code | M | 32.652 sec. 6.3.5 |
| Broadcast Information | MCC | Mobile Country Code | M | 32.652 sec. 6.3.5 |
| | MNC | Mobile Network Code | M | 32.652 sec. 6.3.5 |
| | LAC | Location Area Code | M | 32.652 sec. 6.3.5 |
| | RAC | Routing Area Code | M | 32.652 sec. 6.3.5 |
| | CellID | Cell ID | M | 32.652 sec. 6.3.5 |

6.1.2.3 GNSS Location Information

This information consists of, at minimum, latitude and longitude detected by the GNSS receiver (e.g. GPS receiver), if the HNB implementation includes this functionality.

6.1.2.4 Broadband Connection Information

This information consists of the information associated with the broadband connection (e.g. DSL) the HNB is connected with: 1) public IP address assigned to the RGW (e.g. DSL-GW/router), and 2) line identifier to which the RGW is connected with (e.g. DSL line ID) as seen on the broadband service provider. These are applicable only when this information is available to the HNB, and only when the resulting location information is at least as accurate as location determination based on macro-cell coverage information, whether or not there is macro-cell coverage available at the location of the HNB (e.g. as determined by clause 6.1.2.2 above).

6.1.3 HNB-GW Discovery

During the HNB-GW Discovery procedure, the HMS provides the HNB with 3 identities as shown in the following table. The information may be either IP address or FQDN to be resolved by DNS.

Table 6.1.3. HNB-GW Discovery Information.

| Parameter | Description / Note | Presence | 3GPP Reference |
|-------------------|---------------------------------|----------|----------------|
| Serving HMS ID | One or more IDs may be provided | M | |
| Serving SeGW ID | One or more IDs may be provided | M | |
| Serving HNB-GW ID | One or more IDs may be provided | M | |

6.1.4 HNB Provisioning

6.1.4.1 General

During the HNB Provisioning procedure, the HMS transfers the HNB configuration information to the HNB. This includes 3 types of parameters:

1. CN level parameters
2. RAN level parameters
3. RF level parameters

NOTE: The HNB may have auto-configuration capabilities, such that the HMS sends a list/range of values to the HNB, which selects (and returns to HMS) a single value, also based on the information collected measuring the radio environment. The HMS may also provide control parameters of the auto-configuration process.

6.1.4.2 CN Level Parameters

Table 6.1.4.2. CN Level Parameters.

| Parameter | Description / Note | Presence | 3GPP Reference |
|--|--|---------------|---|
| PLMN Type | 'GSM-MAP' or 'ANSI-41' | M | 25.331, sec.10.3.1.12 |
| MCC | Mobile Country Code | M | 24.008 32.642 sec. 6.3.8 |
| MNC | Mobile Network Code | M | 24.008 32.642 sec. 6.3.8 |
| LAC | Location Area Code (one or more LACs may be provided) | M (Note 1) | 24.008, sec.10.5.1.3 32.642 sec. 6.3.9 |
| SAC | Service Area Code | M | 25.413, sec.9.2.3.9 32.642 sec. 6.3.9 |
| T3212 | Periodic LAU timer (CS domain) | M | 24.008, sec.10.5.1.12.2 |
| ATT | Attach-detach allowed (CS domain) | M | 24.008, sec.10.5.1.12.2 |
| RAC | Routing area code (PS domain) (one or more RACs may be provided) | M (Note 1) | 24.008, sec.10.5.1.12.3 25.413, sec.9.2.3.7 32.642 sec. 6.3.9 |
| NMO | Network Mode of Operation (Gs i/f) | M | 24.008, sec.10.5.1.12.3 |
| Equivalent PLMN ID | List of one or more equivalent PLMN ID (MCC + MNC) | O (Note 2) | 24.008, sec.10.5.1.13 |
| Allowed IMSI list | For access control or membership verification purposes. | O (Note 3) | 24.008, sec.10.5.1.4 |
| CSG Cell Info | CSG Capability Indication, CSG Id, in case the Cell is CSG capable <any further detail per Rel.8 RRC spec> | M | Applicable to Rel.8 compliant cell only. |
| HNB Location Information | Location information (Geographical coordinates, Uncertainty code) | O | 25.413, sec.9.2.3.11 |
| SAI for broadcast | Service Area for broadcast | M | 25.419, sec. 9.2.11 |
| NOTE 1: May be a list/range of values in case the HNB has auto-configuration capabilities. | | | |
| NOTE 2: This information is operator-dependent based on its circumstance. | | | |
| NOTE 3: ACL is an optional function at HNB. This information is provided if this function is enabled in the HNB. | | | |

6.1.4.3 RAN Level Parameters

Table 6.1.4.3-1. RAN Level Parameters.

| Parameter | | Description | Presence | 3GPP Reference |
|---|---|--|---------------|---|
| RNCID for HNB | | RNC ID used by HNB | M | 32.642 sec. 6.3.8 |
| Cell ID | | 28-bit 'Cell ID' in SIB3 | M | 25.331, sec.10.3.2.2 |
| HSPA related | HSflag | Whether HSDPA/HSUPA is used or not | O | 32.642-820 32.642 sec. 6.3.9 |
| HCS related | UseOfHCS HCSPrio QHCS | | M | 25.331, sec.10.3.7.47, 10.3.7.12 32.642 sec. 6.3.9 |
| Cell selection / reselection related | Quality measure QqualMin QqualMin-offset QrxlevMin QrxlevMin-offset Sintrasearch Sintersearch SsearchRAT SsearchHCS Treselections UETxPwrMaxRACH QHyst1 | CPICH Ec/NO or RSCP if Ec/NO is used if RSCP is used | O (Note*1) | 25.331, sec.10.3.2.3, 10.3.2.4 32.642 sec. 6.3.9 25.304 |
| Intra Freq Measurement Related | Filter coefficient Measurement quantity for freq quality estimate Hysteresis for event 1x Threshold for event 1x TimetoTrigger for event 1x Weighting factor for event 1x Reporting Range Triggering Condition | Filter coefficient CPICH Ec/No, CPICH RSCP, or pathloss 'x' in 1x includes applicable events from 1A to 1J | O (Note*1) | 25.331 sec.10.3.7.38, 10.3.7.39 |
| Inter-Freq Measurement Related | Filter coefficient Measurement quantity for freq quality estimate Hysteresis for event 2x Threshold for event 2x TimetoTrigger for event 2x Weighting factor for event 2x | Filter coefficient CPICH Ec/No, CPICH RSCP 'x' in 2x includes applicable events from 2A to 2F | O (Note*1) | 25.331 sec.10.3.7.18, 10.3.7.19 |
| Inter-RAT Measurement Related | Filter coefficient BSIC verification required Hysteresis for event 3x Threshold for event 3x TimetoTrigger for event 3x Weighting factor for event 3x | Filter coefficient 'required' / 'not required' 'x' in 3x includes applicable events from 3A to 3D | O (Note*1) | 25.331 sec.10.3.7.29, 10.3.7.30 |
| RRC related | N30x, N31x T30x, T31x, T320 | RRC constants RRC timers | O (Note*1) | 25.331, sec.10.3.3.43, 10.3.3.44 |
| Neighbour list (UTRA Intra-Freq cell info list) | RNCID C-Id LAC RAC PSC | Defined for each intra-freq cells C-Id is either 12 or 16 bits depending on RNCID length. | O (Note*2) | 32.642 sec. 6.3.10 25.401 sec. 6.1 25.413 sec. 9.2.1.28 |
| Neighbour list (UTRA Inter-Freq cell info list) | RNCID C-Id LAC RAC UARFCN (DL) PSC | Defined for each inter-freq cells C-Id is either 12 or 16 bits depending on RNCID length | O (Note*2) | 32.642 sec. 6.3.10 25.401 sec. 6.1 25.413 sec. 9.2.1.28 |
| Neighbour list (GERAN cell info list) | CellID BSIC BandIndicator BCCHARFCN | Defined for each inter-RAT cells (assume GSM cell only). | O (Note*2) | 32.652 sec. 6.3.5 |

Note (*1): Marked as optional based on the operator preference on the extent of provisioning that the HMS performs to the HNB vs. the level of autonomy that HNB has for auto-configuration. In case this IE is absent, default value is assumed (additional implication is that HNB has a set of default parameter values).

Note (*2): Marked as optional due to several implications: 1) there may be no suitable neighbour cell available based on the RF scanning procedure described earlier, 2) based on operator deployment policy (e.g. dedicated RF channel for HNB layer vs. macro layer), and 3) operator preference on the extent of provisioning that the HMS performs to the HNB vs. the level of autonomy that HNB has for auto-configuration. Regarding 3) above, this may include capabilities such as the HMS to add or remove neighbour cells initially detected by the HNB during the radio environment scanning process, and the HNB to extend the received Neighbour list based on auto-configuration capabilities.

6.1.4.4 RF Level Parameters

Table 6.1.4.4. RF Level Parameters.

| Parameter | Description / Note | Presence | 3GPP Reference |
|--|--|---------------|--|
| UARFCN (DL) | Frequency channel number (one or more UARFCNs may be provided) | O (note 1) | 25.101, sec.5.4, 25.104, sec.5.4, 32.642, sec.6.3.11 |
| PSC | Primary scrambling code (one or more PSCs may be provided) | O (note 1) | 32.642, sec.6.3.11 |
| MaxHNBTxPower | Maximum allowed Tx power of the HNB. | O (note 1) | 25.104, sec.6.2, 32.642, sec.6.3.9 |
| MaxULTxPower | The parameter defines the maximum transmission power level a UE can use on PRACH. | O (note 1) | 25.101, sec.6.2, 32.642, sec.6.3.9 |
| P-CPICHPower | Transmission power of Primary CPICH (DL config). This may be either a specific value or a range (min / max) of values. | O (note 1) | 32.642, sec.6.3.11 |
| P-SCHPower | Primary SCH power offset (DL config) | O (note 1) | 32.642, sec.6.3.11 |
| S-SCHPower | Secondary SCH power offset (DL config) | O (note 1) | 32.642, sec.6.3.11 |
| BCHPower | BCH power offset (DL config) | O (note 1) | 32.642, sec.6.3.11 |
| AICHPower | AICH power offset (DL config, BCCH info) | O (note 1) | 25.331, sec.10.3.6.3, 32.642, sec.6.3.11 |
| PICHPower | PICH power offset (DL config, BCCH info) | O (note 1) | 25.331, sec.10.3.6.50, 32.642, sec.6.3.9 |
| PCHPower | PCH power offset (DL config, BCCH info) | O (note 1) | 32.642, sec.6.3.9 |
| FACHPower | FACH power offset (DL config, BCCH info) | O (note 1) | 32.642, sec.6.3.9 |
| NOTE 1: Marked as optional based on the operator preference on the extent of provisioning that the HMS performs to the HNB vs. the level of autonomy that HNB has for auto-configuration. In case this IE is absent, it is assumed that the HNB will derive the suitable value based on its auto-configuration capability. In case this IE is a list/range of values, the HNB will choose a single value based on its auto-configuration capability. UARFCN UL may be automatically determined by the HNB upon UARFCN DL (basing on standard duplex configuration and country-specific spectrum allocation). | | | |

6.2 O&M for HNB GW

No requirements have been identified.

7 Iuh interface protocol structure

7.1 General

Figure 7.2-1 shows the Control Plane and the User Plane protocol structures over the Iuh interface. For the control plane, the HNBAP protocol provides the signalling service between the HNB and the HNB-GW required to fulfil the functions described in TS 25.469 [3].

RUA provides the signalling service between the HNB and the HNB-GW that is required to fulfil the functions described in TS 25.468 [2].

The payload protocol identifier (PPI) field in SCTP (IETF RFC 4960 [6]) is set to the value 19 assigned by IANA for use with the RUA protocol. In addition, the value 20 is assigned for the PPI for HNBAP. The value 31 is assigned for the PPI for SABP. The multiplexing protocol as specified in TS 25.444 [8] provides the means to multiplex CS user plane on the uplink.

The destination port number field in SCTP (IETF RFC 4960 [6]) is set to the value 29169 assigned by IANA for setup of the common SCTP association in HNBAP, RUA and SABP.

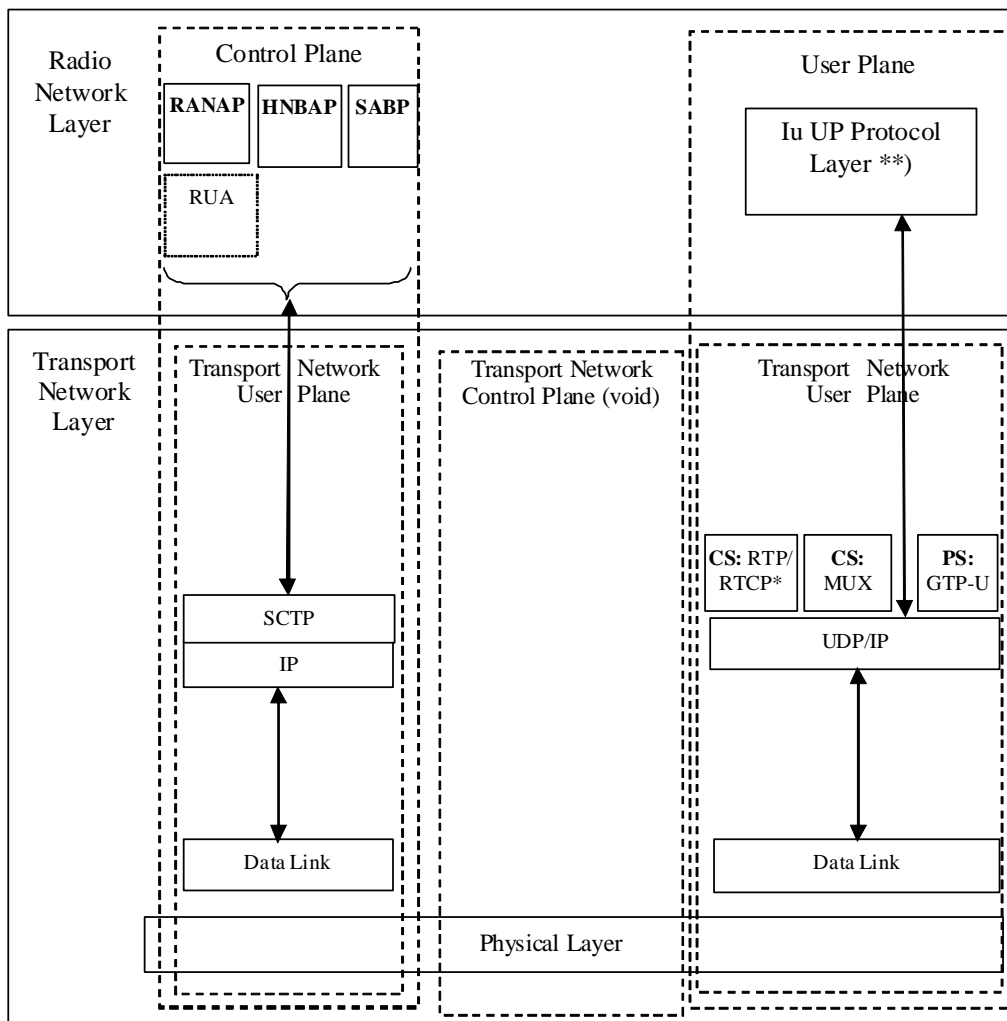
For Iurh there shall be an SCTP association for each direct Iurh interface between HNBs. For operation via the HNB-GW there shall be a single SCTP association common to all Iurh interface instances. This association shall be separate from the Iuh SCTP association established between the HNB and the HNB-GW.

The payload protocol identifier (PPI) field in IETF RFC 4960 [6] is set to the value 42 registered by IANA for the use with the RNA protocol.

The destination port number field in IETF RFC 4960 [6] is set to the value 25471 assigned by IANA for setup of the SCTP association in RNA.

7.2 Iuh

Figure 7.2-1 shows the protocol structure for Iuh, following the structure described in TS 25.410 [5].



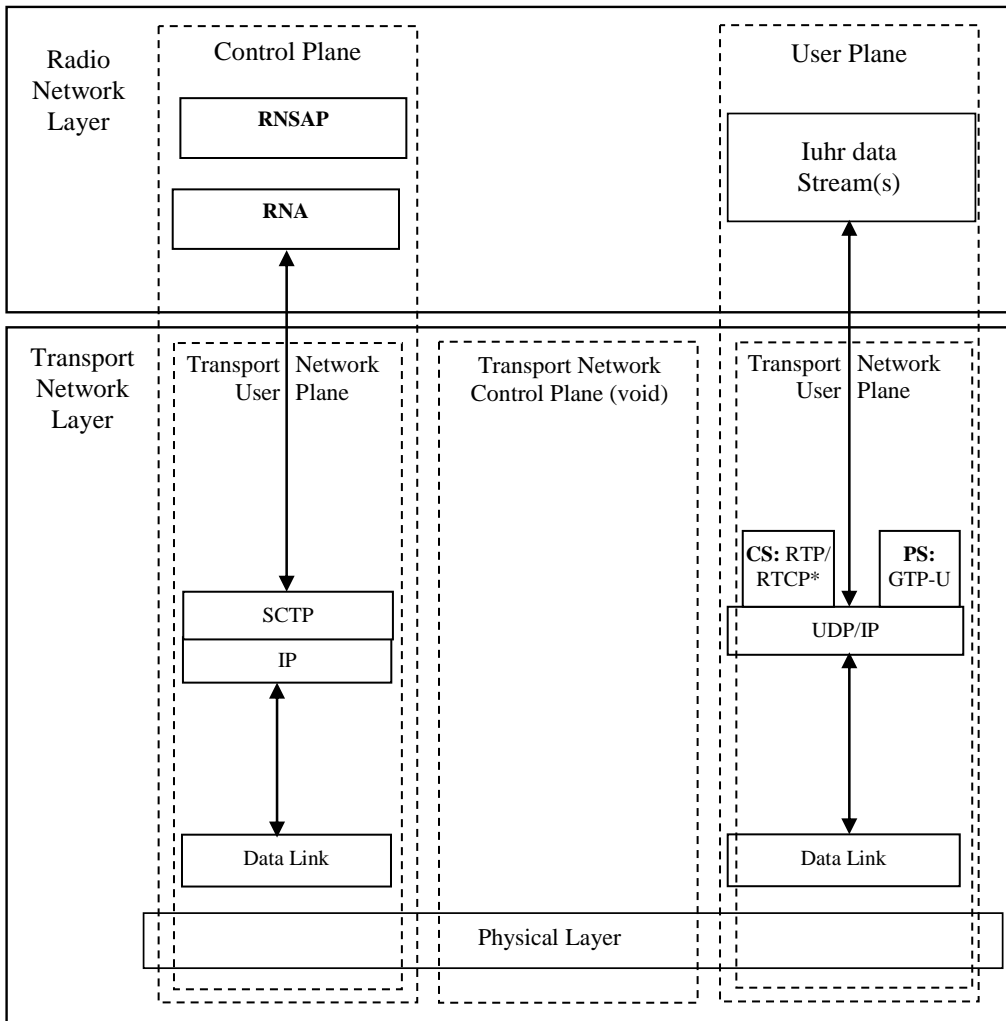
*) RTCP is optional.

**) Iu UP is terminated in CN and HNB only (i.e. not in the HNB GW)

Figure 7.2-1. Iuh-Interface Protocol Stack.

7.3 Iurh

Figure 7.3-1 shows the protocol structure for Iurh, following the structure described in TS 25.410 [5].



* RTCP is optional

Figure 7.3-1. Iurh-Interface Protocol Stack.

7.3.1 Iurh-Interface Control Plane Protocol Stack

Figure 7.3.1-1 shows the control plane protocol stack for the direct Iurh-connectivity option.

Note: The option that Iurh signalling traffic may be routed on IP level via the HNB-GW is depicted by the optional protocol entity boxes within the routing function.

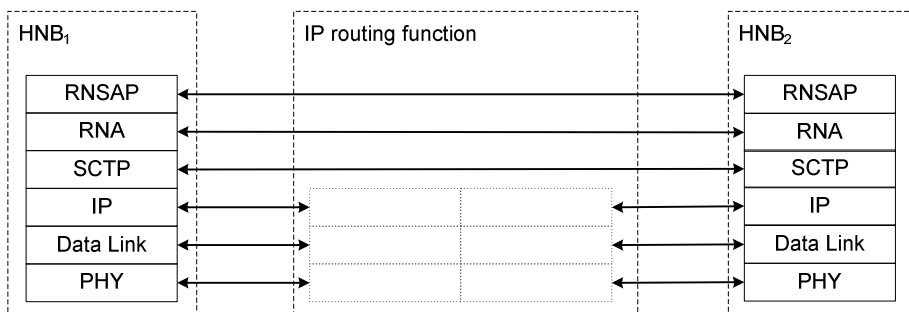


Figure 7.3.1-1. Iurh-Interface Protocol Stack for direct Iurh-connectivity.

Figure 7.3.1-2 shows the control plane protocol stack for the Iurh connectivity via the HNB-GW.

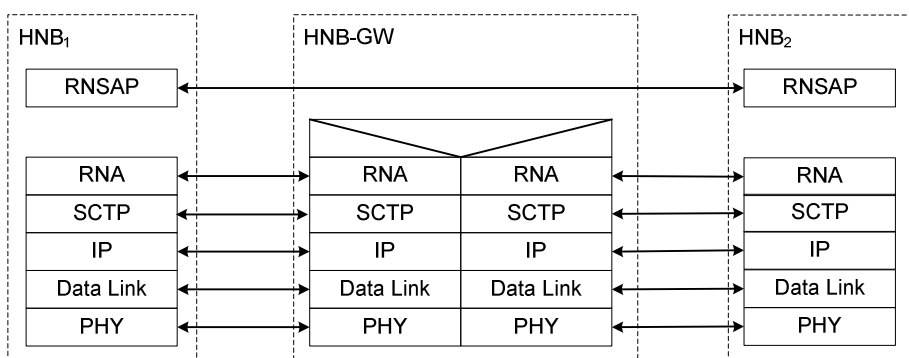


Figure 7.3.1-2. Iurh-Interface Protocol Stack for Iurh-connectivity via the HNB-GW.

7.3.2 Usage of the services provided by RNSAP User Adaptation Layer (RNA)

RNA supports the transport of any RNSAP signalling messages between HNBs.

RNA provides a connection-oriented data transfer service and a connectionless data transfer service.

A signalling connection established by means of RNA is denoted by a single Context Id, which is unique within both involved nodes (see TS 25.471 [19] for further details).

RNA supports direct Iurh-connectivity and Iurh-connectivity via the HNB-GW.

8 Enhanced Interference Management

8.1 General

There is a type of interference which may be considered: 1) Interference from HNB to Macro.

Scenarios are listed in Table 8.1.

Table 8.1. Interference scenarios.

| Scenario | Aggressor | Victim | Type of interference |
|----------|------------|----------|---|
| 1 | HNBUE (UL) | Macro NB | Interference from HNB to Macro |
| 2 | HNB (DL) | Macro UE | *applicable to co-channel deployment scenario |

8.2 Mitigation of interference from HNB to Macro

8.2.1 Interference from HNB UE(UL) to Macro NB

The scenario involves:-

1. Adaptively limiting the HNB UE's maximum UL Tx Power in connected mode possibly using HNB UE measurement and calculating the path loss between HNB UE and Macro NB.

8.2.2 Interference from HNB(DL) to Macro UE

The scenario involves:-

1. Redirecting unauthorized UE to another carrier possibly based on uplink access attempts by unauthorised UE.

2. Adjusting HNB's DL CPICH Tx Power adaptively either temporarily or over long term possibly based on uplink access attempts by unauthorised UE.

Annex A (informative): Implementation of CN functions within the HNB-GW for support of inter-HNB intra-HNB-GW SRNS Relocation

A.1 Scope

The implementation option described in this Annex will not be evolved or maintained/corrected by 3GPP in the current Release or future Releases of the 3GPP specifications. The mechanism in section 5.7 is the mechanism that shall be maintained, and for which evolution within 3GPP is applicable.

A.2 General

This Section describes an implementation variant where CN functions of SRNS Relocation are implemented within the HNB-GW in order to hide intra-HNB-GW inter-HNB active mode mobility from the CN.

From a HNB perspective the HNB-GW appears as a CN node (one node per CN domain) providing all necessary protocol functions for SRNS Relocation (Hard Handover), from a CN node perspective, the HNB-GW appears as an RNC serving the inter-HNB relocations as intra-RNC mobility.

The following sub-sections describe the respective mechanisms. The RANAP messages are exchanged over the Iuh interface from the Source-HNB to the HNB-GW and from the HNB-GW to the Target-HNB using appropriate RUA encapsulation.

In this implementation the Iu UP protocol is still terminated in the CN and HNB (Figure 7.2-1), but there is an Iu UP Interworking function (A.10) residing in the HNB-GW. This implementation variant supports SRNS Relocation between HNBs supporting the same RFC combinations if the HNB supports only Iu UP v1; and SRNS Relocation between all HNBs supporting Iu UP v2.

A.3 Mobility procedure

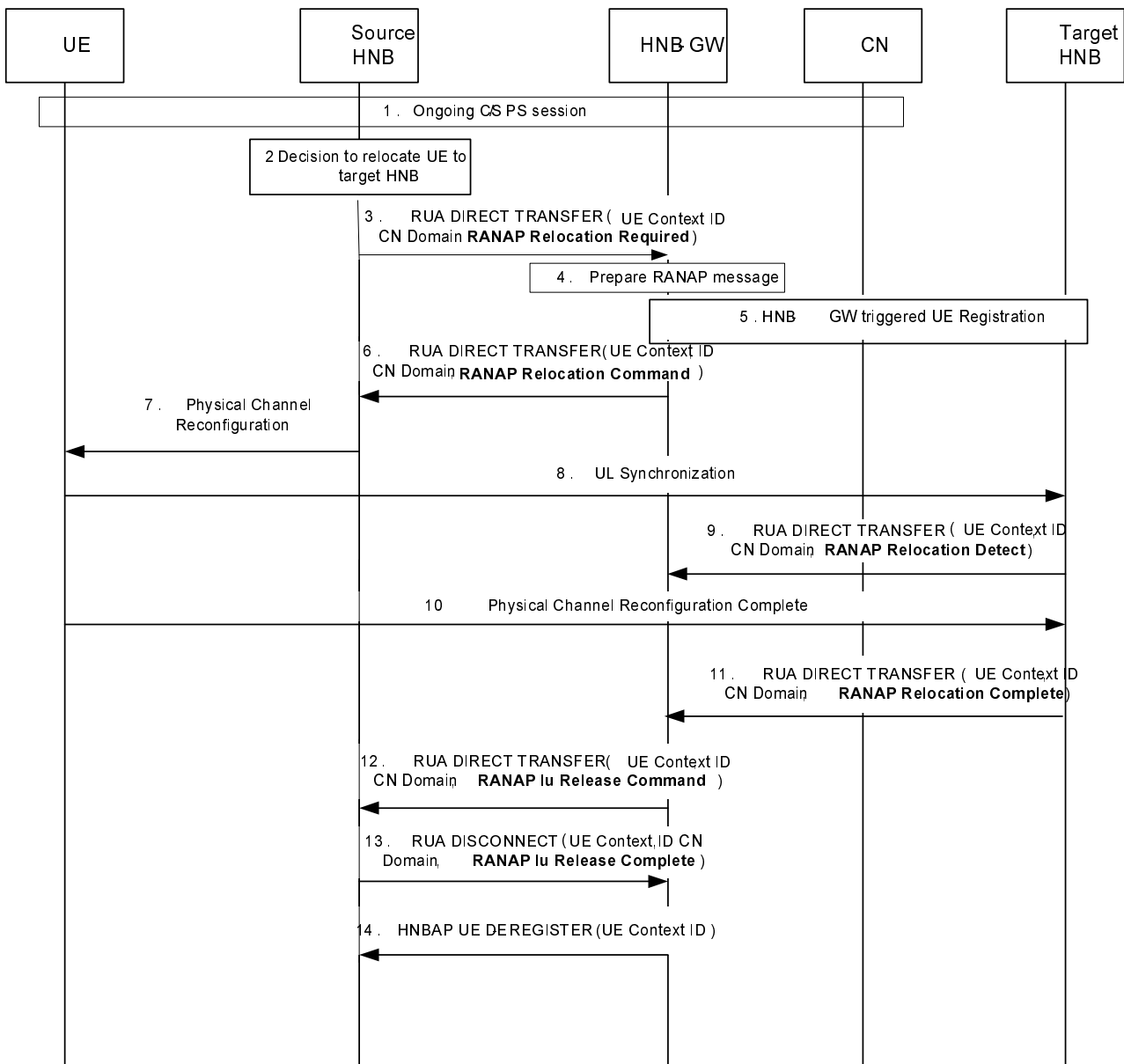


Figure A.3-1: Inter-HNB Inter-HNB-GW SRNS Relocation – Implementation of CN functions for SRNS Relocation within the HNB-GW.

1. The UE has established an active CS/PS session to the CN via the source HNB and HNB-GW.
2. At some point, the source HNB makes a decision to relocate the UE session.
3. The source HNB triggers relocation of the UE session by sending the RANAP *Relocation Required* message encapsulated in the RUA *Direct Transfer* message to the HNB-GW. The target RNC-Id and target Cell-Identity information along with relocation information are included by the source HNB in the RANAP *Relocation Required* message.
4. The HNB GW constructs the RANAP RELOCATION REQUEST using the stored RAB Parameters and parameters received from source HNB. The RANAP message also includes the HNB-GW UL TNL information for each RAB to be setup at the target HNB.
5. Steps for HNB-GW Triggered UE Registration are executed between the HNB-GW and the HNB. The IuhUPIF function handles the CS user plane establishment in the HNB GW. The RANAP message from the target HNB includes the target HNB DL TNL information for each RAB to be setup. In case the target HNB decides to use the alternative RAB parameters and indicates the same in the RANAP RELOCATION ACKNOWLEDGE message, the HNB-GW rejects the relocation towards the target HNB and redirects original relocation request

towards the CN node as in section 5.9.

In this phase, HNB GW may begin bi-casting DL traffic to the source and target HNB.

6. The HNB-GW constructs the appropriate RANAP *Relocation Command* message and routes the RANAP message encapsulated in the RUA *Direct Transfer* message to the source HNB.
 - 7-11. the rest of the relocation procedure continues as shown in the corresponding steps in the above figure. When the relocation is detected in HNB GW, the HNB GW switches the user plane from the source HNB to the target HNB.
 12. The HNB-GW upon getting an indication that the UE has been successfully relocated to the target HNB triggers the Iu release procedure towards the source HNB by sending a RUA encapsulated RANAP *Iu Release Command* message.
 13. The source HNB acknowledges the Iu release procedure to the HNB-GW by sending a RUA encapsulated RANAP *Iu Release Complete* message.
- Note: Steps 2 to 13, as appropriate, are repeated for the second CN domain when present with the following exception. There is only one Context Id allocated to the UE regardless of the number of signaling domains relocated.
14. The HNB-GW deregisters the UE from the source HNB. The source HNB releases the resources assigned to the UE and deletes all stored context information associated with the UE.

A.4 Iuh Control Plane Aspects

The HNB GW processes and forwards some of the connection-oriented RANAP messages, related to RAB Management, Data Volume Reporting, UE Tracing, Location Reporting, Security and Iu UP Initialisation.

A.5 Iuh user plane aspects

The HNB-GW processes and forwards all the user plane packets between the HNB and the CN and performs the switching of the user plane between the source and the target HNB.

A.6 RAB management Functions

The establishment, modification or release of a RAB is performed between the HNB and the CN as specified in TS 25.413 [9]. However, the HNB GW stores the RAB parameters of each established RAB as signalled via respective on the RANAP messages during RAB establishment, modification and SRNS Relocation.

A.7 Data Volume Reporting

The data volume reporting function is used to report the volume of unsuccessfully transmitted DL data of PS RABs to the CN. If the CN has initiated the data volume report then in order to continue data volume reporting after the finalisation of the SRNS Relocation, the HNB GW includes the Data Volume Reporting Indication in the RANAP RELOCATION REQUEST message towards the target HNB. The HNB-GW accumulates data volume reports from the different HNBs involved in subsequent inter-HNB intra-HNB-GW SRNS Relocations and reports the final value to the SGSN at RAB release.

A.8 UE Tracing

This feature allows tracing of various events related to the UE and its activities. The HNB GW stores the Trace related RANAP parameters exchanged in the RANAP signalling messages. In order to continue UE tracing in the target HNB during and after SRNS Relocation, the HNB GW sends the stored RANAP CN INVOKE TRACE encapsulated in the RUA DIRECT TRANSFER message towards the target HNB after step 5 (section 5.11.2).

A.9 Location reporting function

The positioning function performs the determination of the geographical position for an UE. The location reporting function transfers the positioning information between the UTRAN and the CN triggered by the RANAP Location Reporting Control from the CN. If the RANAP Location Reporting Control procedure is initiated with 'Request Type' indicated as 'to report upon change of Service area', the HNB GW sends the Location Report if there is a change in SA due to SRNS Relocation. Also, the HNB GW sends the stored RANAP LOCATION REPORTING CONTROL encapsulated in the RUA DIRECT TRANSFER message towards the target HNB after step 5 (section 5.11.2) if Location Reporting Control procedure continues after relocation.

A.10 Security Functions

The radio interface is ciphered/integrity protected upon request of the Core Network. The ciphering/ integrity protection is done within UTRAN at the HNB. However, the HNB GW stores the ciphering and integrity protection related RANAP parameters exchanged in the UE dedicated RANAP signalling messages. The HNB GW includes the stored ciphering/integrity protection information in the Relocation Request message to the target HNB.

A.11 Iuh Framing Protocol Interworking Function (IuhUPIF)

A.11.1 Introduction

The CS user plane traffic on the Iuh interface (between HNB and HNB GW) carried using the Iu UP framing protocol as defined in the TS 25.415 [17] UTRAN Iu interface user plane protocols. The HNB Iu UP entity follows the procedures and principles defined in the Iu UP framing protocol specification (25.415 [17] UTRAN Iu interface user plane protocols). Most of the Iu UP PDUs will be transferred by the HNB GW without any processing. However, the HNB GW will perform certain functionalities that could be implemented by an IuhUPIF (Iuh user plane interworking function) in the HNB GW as described below.

The IuhUPIF is the functional entity responsible for aligning or mapping control procedures (including RFCIs, frame numbers etc) on the separate UP interfaces. The IuhUPIF determines if the two UP configurations (at the HNB and CN) are identical and thus the UP PDUs may be passed transparently. If the IuhUPIF determines that the two UP configurations are not identical it applies the necessary mapping.

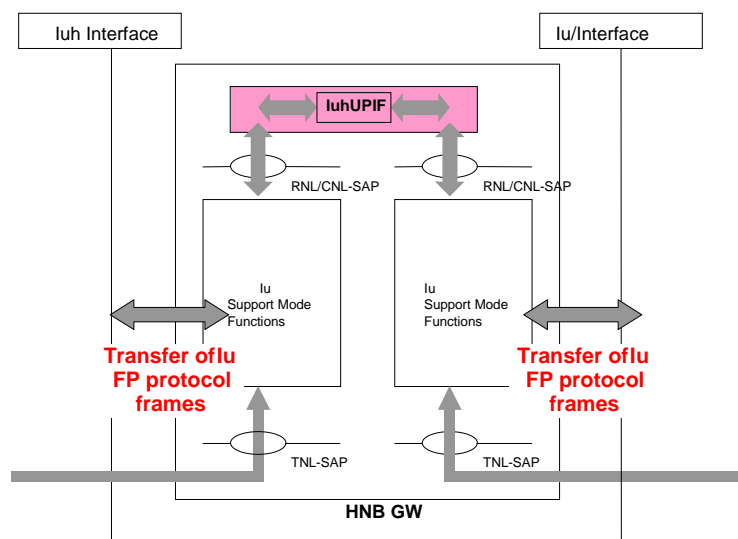


Figure A.11.1-1. The Iuh Framing Protocol Interworking Function.

A.11.2 CS User Plane handling during the Initial CS RAB setup

During the CS RAB setup, the HNB allocates the RAB Subflows combination indicator for the SDU formats (SDU formats are sent to the HNB in the RANAP RAB ASSIGNMENT message). The allocation is then sent in the Iu Framing Initialisation PDU by the HNB in the user plane. For further details see 25.413 [9] and 25.415 [17].

Upon reception of the RFCI values in the Iu UP Initialisation Frame (Iu UP PDU type 14 from the HNB) during the call establishment, the HNB GW stores 'UL RFCI vector'. The first subflow of the initialisation corresponds to the Initial Rate control i.e. indicate the highest rate for the first speech mode to be used in the direction of the Initialisation acknowledgement frame. The HNB GW forwards the Iu UP Initialisation frame towards the CN according to TS 25.415 [17] without any change to the received Iu UP PDU from the HNB. Upon reception of the Iu UP ACK/NACK PDU, the HNB GW forwards it towards the HNB.

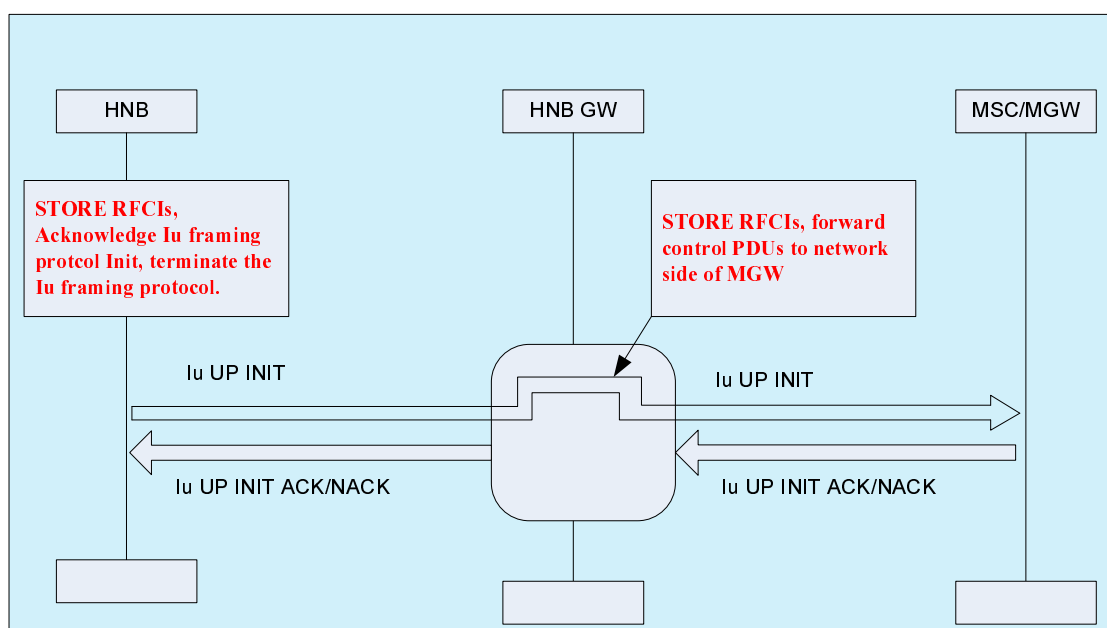


Figure A.11.2-1. IU UP Handling during the Initial call setup.

A.11.3 CS User Plane handling after the finalisation of SRNS Relocation

During the SRNS Relocation, as part of the RANAP Relocation Resource Allocation procedure, the target HNB performs the user plane initialisation. The (Target) HNB allocates the RAB Subflows combination indicator(s) for the each SDU formats (SDU formats are sent to the HNB in the RANAP RELOCATION REQUEST message). The allocation is then sent in the Iu Framing Initialisation PDU by the HNB in the user plane. For further details see 25.413 [9] and 25.415 [17].

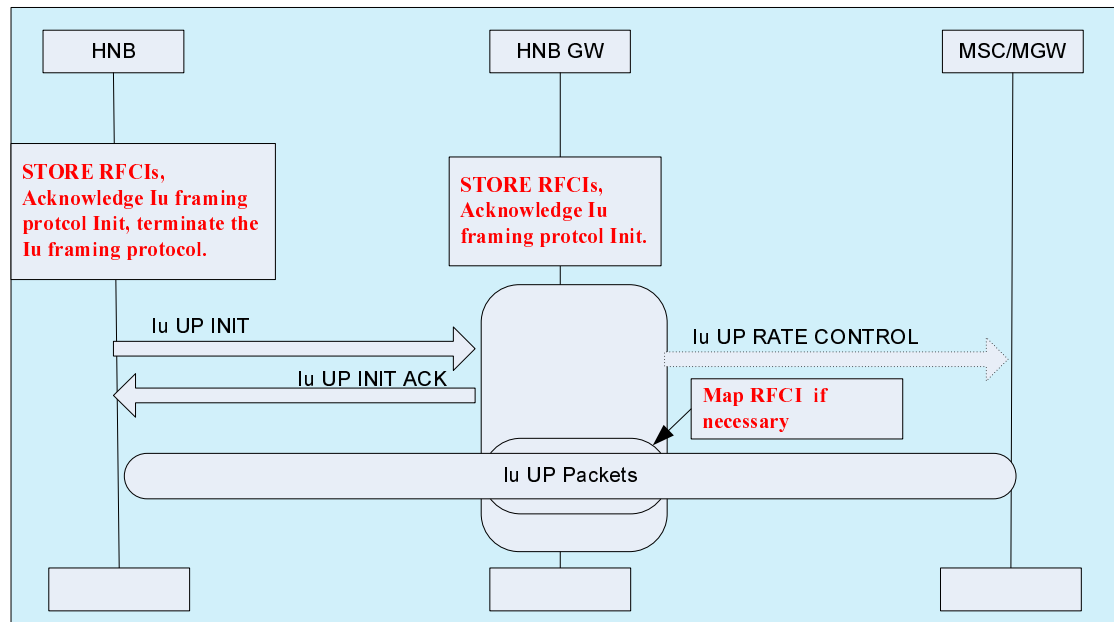


Figure A.11.3-1. IU UP Handling after SRNS Relocation.

At reception of an IU UP Initialisation Frame (Iu UP PDU type 14) from the Target HNB, the HNB GW stores received RFCI indexes (per data rate) in the form of ordered sequence (received in the initialisation PDU) as 'UL RFCI Vector' and send the Initialisation acknowledgment to the target HNB. The HNB GW does not perform the forwarding of the IuUP initialisation on the Iu interface. The HNB GW checks whether the received RFCI allocations match the stored RFCI allocation for the same bearer established with the source HNB. The HNB GW performs the following functions:

- RFCI Mapping function: If the allocated RFCI index (s) does not match with the existing RFCI index(s) for the corresponding data rates, then the HNB GW performs the RFCI Mapping function. That is, for every subsequent Iu UP frame upon the relocation, the HNB GW maps the RFCI indices of the incoming side (from the HNB) to the corresponding RFCI indicates to the outgoing side (towards the MSC that is already stored in the HNB GW) and vice versa.
- In case Iu UP version 1, if the maximum rate indicated by the target HNB in the Iu UP INIT is different from the current used maximum rate then the HNB GW initiates a Rate Control PDU indicating the new maximum rate to the MSC.

A.11.4 FQC

The HNB GW (IuhUP IF) does not handle the FQC included in the UP frames. The value included in the Iu UP frame is passed to the peer not without any modification.

A.11.5 Frame number

The frame number indicated by the peer node (i.e. Iu or Iuh) on the receiving side is forwarded unmodified to lower layer on the sending side.

A.11.6 Time alignment Procedure:

When a HNB GW (IuhUP IF) entity receives a time Alignment Command over the Iu or Iuh interface, it is relayed unmodified to the other peer node.

A.11.7 Rate Control Procedure

When an HNB GW (IuhUP IF) entity receives a Rate Control over the Iu or Iuh interface, it forwards to the other peer node) with "RFCI Mapping" where appropriate.

A.11.8 Payload

When a HNB GW (IuhUP IF) entity receives the payload SDUs, the received SDUs is forwarded unmodified to the either side (HNB or HNB GW) with "RFCI Mapping" where appropriate.

A.11.9 Iu UP Re-Initialisation

When an HNB GW (IuhUP IF) entity receives a Iu UP Initialisation from the CN, it stores the 'DL RFCI Vector' and then forward it to the HNB without any modification in the RFCIs. Upon reception of the Iu UP ACK/NACK PDU, the HNB GW forwards it towards the CN.

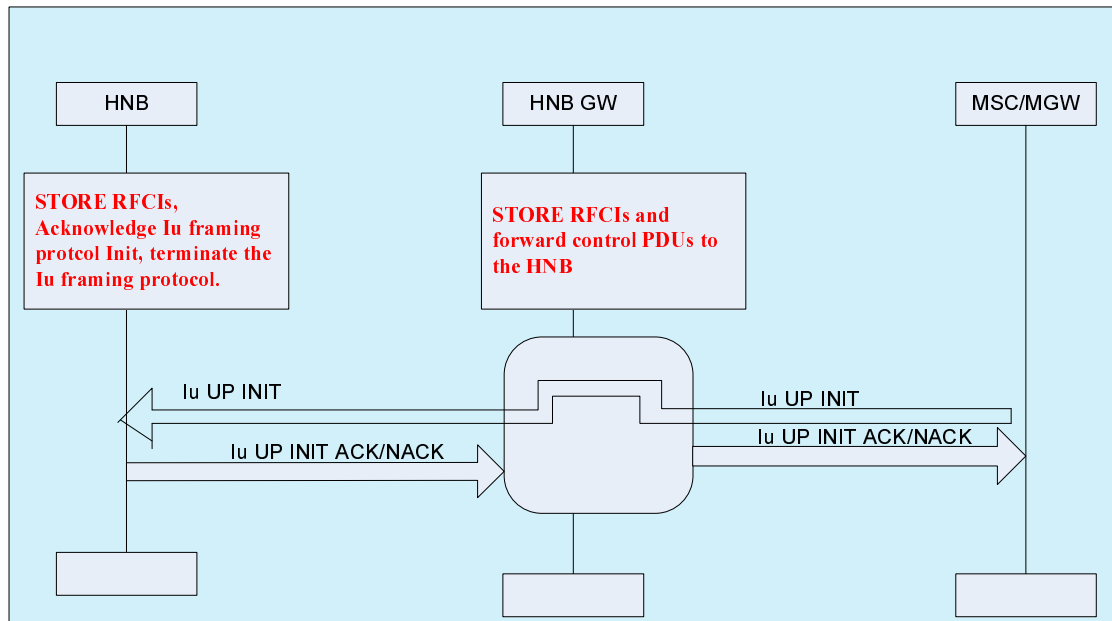


Figure A.11.9-1. IU UP Re- Initialisation.

Annex B (Informative): Deployment Architecture

B.1 Direct Iurh connectivity between HNBs

The reference model shown in Figure B.1-1 below illustrates an HNB access network with direct Iurh connectivity.

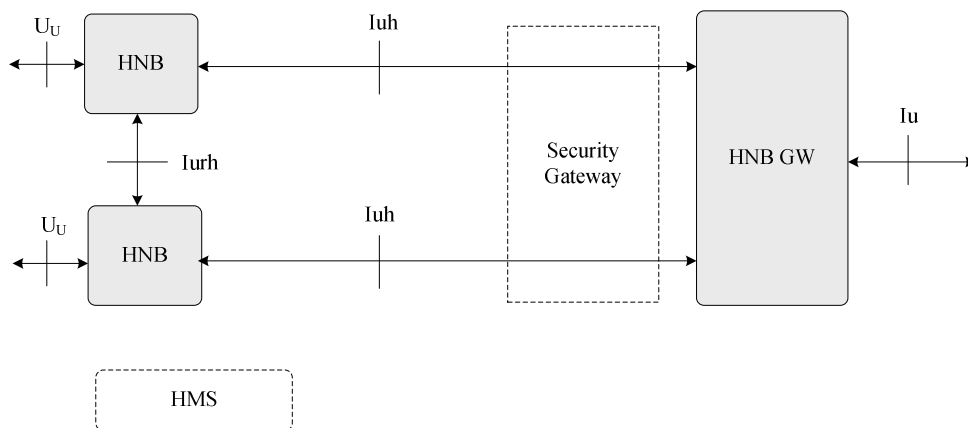


Figure B.1-1. HNB access network deploying direct Iurh connectivity.

An alternative HNB access network configuration deploying the Iurh interface transported via the Security Gateway is shown in Figure B.1-2. Note: If the Security Gateway and the HNB-GW are co-located then the co-located node should support IP routing.

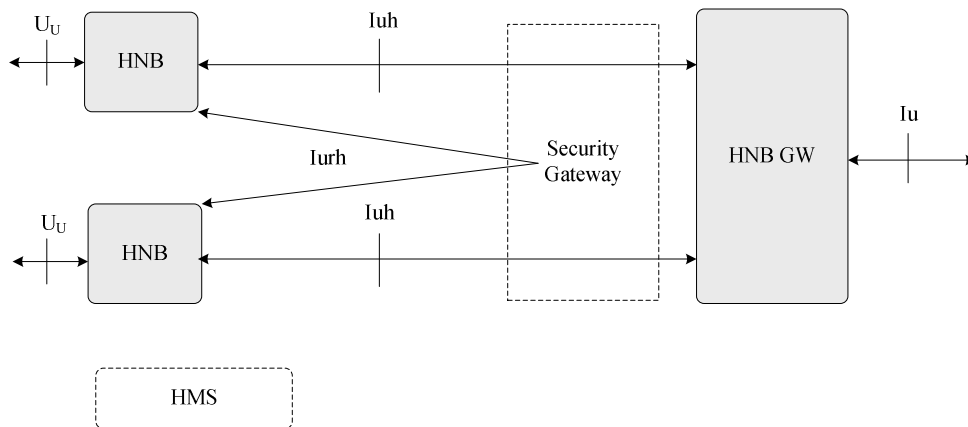


Figure B.1-2. HNB access network deploying Iurh connectivity via a Security Gateway.

An alternative arrangement with the Iurhr interface transported via the Security Gateway and the HNB-GW is shown in Figure B.1-3. The HNB-GW provides transport routing functionality.

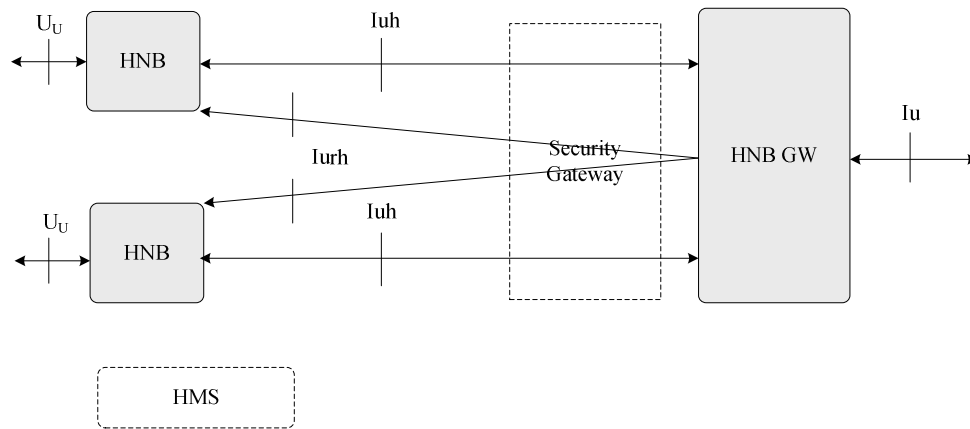


Figure B.1-3. HNB access network deploying lurch connectivity via the HNB-GW.

Annex C (informative): Change History

| TSG # | TSG Doc. | CR | Rev | Subject/Comment | New |
|---------|-----------|------|-----|--|--------|
| 09/2009 | | | | Rel-9 version is created based on v.8.3.0 | 9.0.0 |
| 45 | RP-090999 | 0044 | 3 | Support for paging optimization with CSG membership changes | 9.0.0 |
| 45 | RP-090999 | 0048 | 1 | Enhancements to handle HNB to HNB mobility | 9.0.0 |
| 45 | RP-090999 | 0049 | 1 | Access Mode and Membership notification for UEs accessing CSG-Hybrid cells | 9.0.0 |
| 10/2009 | | | | Editorial changes: 5.x.2 -> 5.7.2 and adding numbering to Figure 5.7.2-1 | 9.0.1 |
| 46 | RP-091191 | 0039 | 4 | CS Mux on Uplink | 9.1.0 |
| 46 | RP-091195 | 0053 | 2 | Enhanced Interference Management Mechanisms for HNB | 9.1.0 |
| 46 | RP-091191 | 0057 | | Introducing changes for supporting ETWS in Home Node B (Rel9) | 9.1.0 |
| 46 | RP-091184 | 0059 | 1 | Add assigned SCTP Port Number for RUA and HNBAP | |
| 46 | RP-091191 | 0061 | | Addition of use of COMMON ID message to convey Hybrid cell membership information. | 9.1.0 |
| 46 | RP-091184 | 0067 | | Clean up of 25.467 | 9.1.0 |
| 46 | RP-091191 | 0070 | 1 | Mitigating IMSI spoofing in non-CSG UE registration | 9.1.0 |
| 46 | RP-091191 | 0071 | 1 | UE registration in case of HNB-GW access control | 9.1.0 |
| 46 | RP-091191 | 0072 | 1 | Inbound Mobility to CSG and Hybrid Cells | 9.1.0 |
| 47 | RP-100219 | 0073 | | Clarification of HNB Definition | 9.2.0 |
| 47 | RP-100219 | 0075 | | Corrections on the non-CSG UEs registration and luh Disconnect Procedure | 9.2.0 |
| 47 | RP-100365 | 0076 | 3 | Removal of incomplete material for intra-GW Handover | 9.2.0 |
| 47 | RP-100222 | 0083 | 2 | Removal of FFS in Rel-9 stage 2 specification | 9.2.0 |
| 47 | RP-100222 | 0085 | 7 | CSG expiry Handling | 9.2.0 |
| 47 | RP-100222 | 0086 | 2 | PSC Split Clarification | 9.2.0 |
| 47 | RP-100222 | 0087 | 3 | Clarifications on UE registration and mobility procedures | 9.2.0 |
| 48 | RP-100595 | 0092 | 2 | Support of HNB GW functionalities | 9.3.0 |
| 48 | RP-100595 | 0094 | | Location information correction for Stage 2 | 9.3.0 |
| 50 | RP-101271 | 0111 | | PPI value for SABP in luh | 9.4.0 |
| 50 | RP-101271 | 0113 | | Clarification on Inbound Mobility to HNB | 9.4.0 |
| 12/2010 | | | | Rel-10 version is created based on version 9.4.0 | 10.0.0 |
| 50 | RP-101407 | 0101 | 5 | Introduction of the Implementation Variant where CN functions for the enhancement of inter-HNB intra-HNB-GW SRNS Relocation are implemented within the HNB-GW. | 10.0.0 |
| 50 | RP-101272 | 0112 | 2 | Clarification of use of RNC-Id | 10.0.0 |
| 50 | RP-101188 | 0114 | 4 | Introduction of HNB to HNB mobility procedure using direct interface | 10.0.0 |
| 50 | RP-101389 | 0117 | 2 | Introduction of LIPA Functions for UMTS | 10.0.0 |
| SP-49 | SP-100629 | | | Clarification on the use of References (TS 21.801 CR#0030) | 10.1.0 |
| 51 | RP-110231 | 0125 | | Correction on UE De-Registration for Enhanced H2H Mobility | 10.1.0 |
| 51 | RP-110227 | 0126 | | Completion of LIPA feature | 10.1.0 |
| 51 | RP-110231 | 0131 | 2 | Correction to definition of HNB enhanced mobility | 10.1.0 |

History

| Document history | | |
|-------------------------|------------|-------------|
| V10.1.0 | April 2011 | Publication |
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