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Agenda:

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Title: **I3.01 v0.0.2**
RAN Functions, Examples on Signalling Procedures

Editor general notes to this version:

- The correct first pages common for 3GPP were introduced (first page, copyright,etc)

- Revision marks are referred to the modification introeduced to the document AFTER the TSG-RAN WG3 first meeting – Bon February 99, based on the minor comments receved in line with the decision of the previous meeting, (i.e. comments to the first draft merged version are identified)
  In this version the revision marsk referre to version 0.0.0 were accepted.

- *The graphical look of the parts included from the TTC/ARIB document still to be aligned by the editor to the rest of the document (the content is aligned- hopefully)*

TR I3.01 V<0.0.2> (<1999-02>)

3rd Generation Partnership Project (3GPP);
Technical Specification Group (TSG) RAN;

RAN Functions, Examples on Signalling Procedures

3GPP

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Contents

1. Intellectual Property Rights

2. Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project, Technical Specification Group RAN.

The contents of this TS may be subject to continuing work within the 3GPP and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released with an identifying change of release date and an increase in version number as follows:

    Version m.t.e

    where:

        m indicates [major version number]

        x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

        y the third digit is incremented when editorial only changes have been incorporated into the specification.

3. Scope

This document describes the UTRAN functions by means of signalling procedure examples (Message Sequence Charts). The signalling procedure examples show the interaction between the UE, the different UTRAN nodes and the CN to perform system functions. This gives an overall understanding of how the UTRAN works in example scenarios

4. References

References may be made to:

    a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply;

    b) all versions up to and including the identified version (identified by "up to and including" before the version identity);

    c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

    d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1]	UMTS 23.01	General UMTS Architecture
[2]	UMTS 23.10	UMTS Access Stratum - Services and Functions
[3]	UMTS 23.30	
[4]	ETSI SMG2	UMTS-L23 Working Assumptions on Radio Access Bearers
[5]	UMTS XX.XX	UTRAN Architecture Description
[6]	UMTS ZZ.XX	Description of I_u Interface
[7]	UMTS ZZ.01	Description of I_{ur} Interface
[8]	UMTS ZZ.13	Description of I_{ub} Interface
[9]	UMTS	Manifestations of Handover and Streamlining
[10]	UMTS YY.01	MS-UTRAN Radio Interface Protocol Architecture
[11]	UMTS YY.02	Layer 1: General Requirements and Services
[12]	UMTS YY.03	Description of UE States and Procedures in Connected Mode
[13]	UMTS YY.04	Description of Procedures in Idle Mode
[14]	UMTS YY.31	Description of RRC protocol
[15]	UMTS YY.22	Description of RLC protocol
[16]	UMTS YY.21	Description of MAC protocol

5. Definitions, abbreviations and notation

5.1 Definitions

Refer to [5].

5.2 Abbreviations

For the purposes of this specification the following abbreviations apply.

ALCAP	Access Link Control Application Part
AS	Access Stratum
BSSMAP	Base Station System Management Application Part
CCH	Common Channel
CN	Core Network
CRNC	Controlling RNC
DCH	Dedicated Channel
DRNS	Drift RNS
L1	Layer 1
MAC	Medium Access Control
MSC	Message Sequence Chart
NAS	Non Access Stratum
NBAP	Node B Application Protocol
PCH	Paging Channel
RAB	Radio Access Bearer
RACH	Random Access Channel
RANAP	Radio Access Network Application Part
RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNSAP	Radio Network Subsystem Application Part
RRC	Radio Resource Control
SRNS	Serving RNS
UE	User Equipment
UMTS	Universal Mobile Telecommunication System
UTRAN	UMTS Terrestrial Radio Access Network

5.3 Notation for the signalling procedures

Complex signalling procedures may involve several protocols in different nodes.
In order to facilitate the understanding of these procedures, the following rules in the drawing of Message Sequence Chart (MSC) are applied:

- Messages are always exchanged between nodes, i.e. the sender and the receiver of a message are nodes and not single protocol entities;
- The protocol entity inside a node that is sending/receiving a message is represented by means of an ellipse, containing the protocol entity name;
- Each message is numbered, so that a numbered list with explanations can be added below the figure;
- Message parameters may be specified as shown in Figure 1Figure 1 only when required for a clear understanding of the procedures;
- Explicit signalling is represented by means of continuos arrows.
- Inband signalling is represented by means of dotted arrows.
- A description of the relevant actions may be included as shown in Figure 1Figure 1.
- The Setup and Release of Iub/Iur and Iu Data Transport Bearer with the ALCAP protocol is represented as shown in Figure 1Figure 1.
- The transport channel used by the MAC protocol or the logical channel used by the RLC and RRC protocols may be indicated before the message name as shown in Figure 1Figure 1.
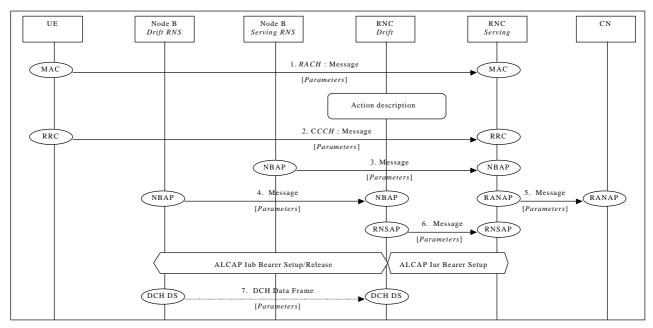

Figure 1: Example of signalling procedure notation

6. UTRAN AND UE PROTOCOL ARCHITECTURE

The complete UTRAN and UE protocol architecture for the control plane (including the transport layers) is shown in Figure 2Figure 3 (idle mode) and Figure 3Figure 5 (connected mode). For a detailed description of the UTRAN Protocol Architecture and of the Radio Protocol Architecture refer to [5] and [10] respectively.
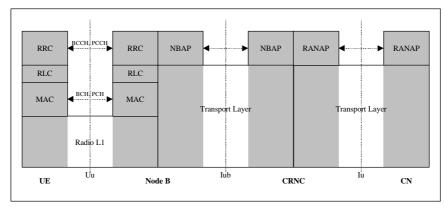
Figure 23: UTRAN and UE control plane protocol architecture (idle mode)
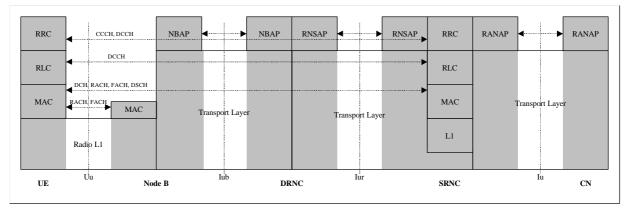
Figure 35: UTRAN and UE control plane protocol architecture (connected mode)

Editor note: this figure still to be modified in order to cope with the agreed decision to show ONLY the protocol used -TSG RAN WG3 meeting #1 (Bonn, February 99)

6.1 RANAP Procedures & Messages

For a detailed description of RANAP procedures and messages refer to [6].

Message Name	UTRAN Procedure	Direction
Initial UE Message	NAS Signalling Connection Establish.	Source ~~S~~RNC ⇒ CN
RAB Assignment Request	RAB Establishment RAB Release Inter-RNS HO with switching in the CN	CN ⇒ Source ~~S~~RNC CN ⇒ Source ~~S~~RNC CN ⇒ Source ~~S~~RNC
RAB Assignment Complete	RAB Establishment RAB Release	Source ~~S~~RNC ⇒ CN Source ~~S~~RNC ⇒ CN Source
~~Hard~~ Handover Required	Inter-RNS HO with switching in the CN UTRAN ⇒ GSM/BSS handover	Source ~~S~~RNC ⇒ CN Source ~~S~~RNC ⇒ CN
~~Hard~~ Handover Request	GSM/BSS ⇒ UTRAN handover Inter-RNS HO with switching in the CN	CN ⇒ SRNC Source RNC ⇒ CN
~~Hard~~ Handover Command	Inter-RNS HO with switching in the CN UTRAN ⇒ GSM/BSS handover	CN ⇒ Source RNC CN ⇒ Source RNC
~~Hard~~ Handover ~~Proceeding 1~~Request Acknowledge	Inter-RNS HO with switching in the CN GSM/BSS ⇒ UTRAN handover	Target RNC ⇒ CN Target RNC ⇒ CN
Hard Handover Proceeding 2	UTRAN -> GSM/BSS handover via MAP/E interface	CN ⇒ Source RNC
~~Hard~~ Handover Detect	Inter-RNS HO with switching in the CN	Target RNC ⇒ CN
~~Hard~~ Handover Complete	Inter-RNS HO with switching in the CN GSM/BSS ⇒ UTRAN handover	Target RNC ⇒ CN Source RNC ⇒ CN
~~Hard~~ Handover Failure	Inter-RNS HO with switching in the CN	RNC ⇒ CN CN ⇒ CN
~~SRNC~~ Relocation Required	SRNC Relocation	Source RNC ⇒ CN
~~SRNC~~ Relocation Request	SRNC Relocation	CN ⇒ Target RNC
~~SRNC~~ Relocation Proceeding 1	SRNC Relocation	Target RNC ⇒ CN
~~SRNC~~ Relocation Proceeding 2	SRNC Relocation	CN ⇒ Source RNC
~~SRNC~~ Relocation Complete	SRNC Relocation	Target RNC ⇒ CN
~~SRNC~~ Relocation Failure	SRNC Relocation	RNC ⇒ CN
Iu Release Command	Inter-RNS HO with switching in the CN SRNC Relocation UTRAN ⇒ GSM/BSS handover	CN ⇒ Source RNC CN ⇒ Source RNC CN ⇒ Source RNC
Iu Release Complete	Inter-RNS HO with switching in the CN SRNC Relocation UTRAN ⇒ GSM/BSS handover	Source RNC ⇒ CN Source RNC ⇒ CN Source RNC ⇒ CN
Paging	Paging	CN ⇒ SRNC

6.2 RNSAP Procedures & Messages

For a detailed description of RNSAP procedures and messages refer to [7].

Message Name	UTRAN Procedure	Direction
Radio Link Reconfiguration Prepare	RAB Establishment RAB Release	SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Reconfiguration Ready	RAB Establishment RAB Release	DRNC ⇒ SRNC DRNC ⇒ SRNC
Radio Link Reconfiguration	RAB Establishment RAB Release	SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Reconfiguration Response	RAB Establishment RAB Release	DRNC ⇒ SRNC DRNC ⇒ SRNC
Radio Link Reconfiguration ~~Command~~Commit	RAB Establishment RAB Release	SRNC ⇒ DRNC SRNC ⇒ DRNC

Radio Link Addition ~~Request~~	Soft Handover	SRNC ⇒ DRNC
Radio Link Addition ~~Proceed~~Response	Soft Handover	DRNC ⇒ SRNC
Radio Link Deletion ~~Request~~	Soft Handover	SRNC ⇒ DRNC
Radio Link Deletion ~~Proceed~~Response	Soft Handover	DRNC ⇒ SRNC
SRNC Relocation Commit	SRNC Relocation	Source RNC ⇒ Target RNC

6.3 NBAP Procedures & Messages

For a detailed description of NBAP procedures and messages refer to [8].

Message Name	UTRAN Procedure	Direction
Radio Link Setup ~~Request~~	RRC Connection Establishment Hard Handover Soft Handover	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Setup ~~Proceed~~Respose	RRC Connection Establishment Hard Handover Soft Handover	Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC
Radio Link Addition ~~Request~~	Soft Handover	RNC ⇒ Node B
Radio Link Addition ~~Proceed~~Response	Soft Handover	RNC ⇒ Node B
Radio Link Deletion ~~Request~~	RRC Connection Release Hard Handover Soft Handover	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Deletion ~~Proceed~~Response	RRC Connection Release Hard Handover Soft Handover	Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC
Radio Link Reconfiguration Prepare	RAB Establishment RAB Release	RNC ⇒ Node B RNC ⇒ Node B
Radio Link Reconfiguration ~~Response~~Ready	RAB Establishment RAB Release	Node B ⇒ RNC Node B ⇒ RNC
Radio Link Reconfiguration ~~Command~~Commit	RAB Establishment RAB Release	RNC ⇒ Node B RNC ⇒ Node B
Paging	Paging	RNC ⇒ Node B

6.4 ALCAP

ALCAP is a generic name to indicate the protocol(s) used to establish data transport bearers on the Iu, Iur and Iub interfaces.
The protocol(s) to be used by ALCAP is FFS.
The following should be noted:

- data transport bearers may be dynamically established using ALCAP or preconfigured;
- transport bearers may be established before or after allocation of radio resources.

6.5 RRC Procedures & Messages

For a detailed description of RRC procedures and messages refer to [14].

Message Name	UTRAN Procedure	Direction	Logical Channel
UE Capability Information	NAS Signalling Conn. Est.	UE ⇒ SRNC	DCCH
Direct Transfer	NAS Signalling Conn. Est.	UE ⇔ SRNC	DCCH
RRC Connection Request	RRC Connection Est.	UE ⇒ SRNC	CCCH
RRC Connection Setup	RRC Connection Est.	SRNC ⇒ UE	CCCH
RAB Setup	RAB Establishment	SRNC ⇒ UE	DCCH

RAB Setup Complete	RAB Establishment	UE $\Rightarrow$ SRNC	DCCH
RAB Release	RAB Release	SRNC $\Rightarrow$ UE	DCCH
RAB Release Ccomplete	RAB Release	UE $\Rightarrow$ SRNC	DCCH
Handover Command	Hard Handover	SRNC $\Rightarrow$ UE	DCCH
Handover Complete	Hard Handover	UE $\Rightarrow$ SRNC	DCCH
Active Set Update	Soft Handover	SRNC $\Rightarrow$ UE	DCCH
Active Set Update Complete	Soft Handover	UE $\Rightarrow$ SRNC	DCCH
Paging	Paging for a UE in RRC Connected Mode	SRNC $\Rightarrow$ UE	DCCH

6.6 RLC Procedures & Messages

For a detailed description of RLC procedures and messages refer to [15].

Message Name	**UTRAN Procedure**	**Direction**	**Logical Channel**
Link Establishment	RRC Connection Establishment	UE $\Rightarrow$ SRNC	DCCH
Link Establishment Ack.	RRC Connection Establishment	SRNC $\Rightarrow$ UE	DCCH

6.7 MAC Procedures & Messages

For a detailed description of MAC procedures and messages refer to [16].

Message Name	**UTRAN Procedure**	**Direction**	**Transport Chan**

7. UTRAN Signaling Procedures

The signalling procedures shown in the following sections do not represent the complete set of possibilities, nor do they mandate this kind of operation. The standard will specify a set of elementary procedures for each interface, which may be combined in different ways in an implementation. Therefore these sequences are merely examples of a typical implementation.
Furthermore the list of parameters may not be complete, but should only be seen as examples of possible information carried by the messages.
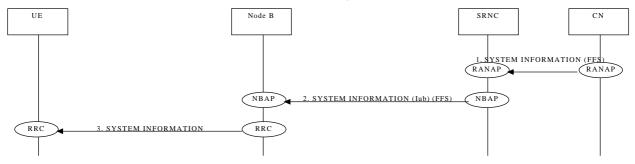
NOTE: the use of Radio Bearer Setup or Radio Bearer Assignement is FFS. This note is valid for all the document

7.1 Procedures not related to a specific UE (global procedures)

This section presents a number of signaling procedures not related to a specific UE. The protocol stack involved during these procedures is the one shown in Figure 2Figure 3.

7.1.1 System Information Broadcasting

This example shows an example of System Information broadcasting. The procedure shown is for RNC Idle mode.

7.1.2 *Editor Note: The procedure is derived from the TTC/ARIB document, and the need of further refinement was idetified at the TSG RAN WG3 meeting #1 (Bonn, February 99)*Cell Broadcast

This example shows an example of broadcasting of User Information.

7.2 Procedures related to a specific UE

This section presents a number of signaling procedures related to a specific UE. The protocol stack involved during these procedures is the one shown in Figure 3Figure 5, with the exception of Paging for a UE in RRC Idle Mode that makes use of the protocol stack shown in Figure 2Figure 3.

7.2.1 Paging

This section presents two examples of Paging procedures for both the cases of a UE in RRC Idle Mode and RRC Connected Mode.

7.2.1.1 Paging for a UE in RRC Idle Mode

This example shows how paging is performed for a UE in RRC Idle Mode. The UE may be paged for a CS or PS service. Since the UE is in RRC Idle Mode, the location is only known at CN level and therefore paging is distributed over a defined geographical area (e.g. LA).

Note: Example below illustrates scenario where LA spans across 2 RNCs.

Figure 47: Paging for a UE in RRC Idle Mode

1. CN initiates the paging of a UE over a LA spanning two RNCs (i.e. RNC1 and RNC2) via RANAP message **Paging**.
    Parameters: UE identifier, Paging Type.
2. RNC1 and RNC2 forward **Paging** message via NBAP to corresponding Nodes B (for example Node B 1.1, Node B 2.1).
    Parameters: UE identifier.
3. Paging of UE performed by cell1
4. Paging of UE performed by cell2
5. UE detects page message from RNC1 and the procedure for NAS signalling connection establishment is followed (see Section 7.2.2)

NAS message transfer over established signalling connection can now be performed.

7.2.1.2 Paging for a UE in RRC Connected Mode

This can occur in case of two core network domains, with the mobility management independent of each other. Two possible solutions exists:
*   The UTRAN coordinates the paging request with the existing RRC connection.
*   The UE coordinates the paging request with the existing RRC connection.

The following example shows how paging is performed for a UE in RRC Connected Mode when the UTRAN coordinates the paging request with the existing RRC connection using DCCH.

Figure 58: Paging for a UE in RRC Connected Mode when the UTRAN coordinates the paging request with the existing RRC connection using DCCH

1. CN initiates the paging of a UE via RANAP message **Paging**.
    Parameters: UE identifier, Paging Type.
2. *SRNC sends RRC message* **Paging** .
    Parameters: Paging Type.

7.2.2 NAS Signalling Connection Establishment

The following examples show establishment of a Signalling Connection either by the UE or by the CN.

7.2.2.1 UE Initiated Signalling Connection Establishment

This example shows establishment of a UE originated NAS Signalling Connection Establishment.

Figure 69: NAS Signalling Connection Establishment

1. RRC Connection is established (see 7.2.3.1 or 7.2.3.2).
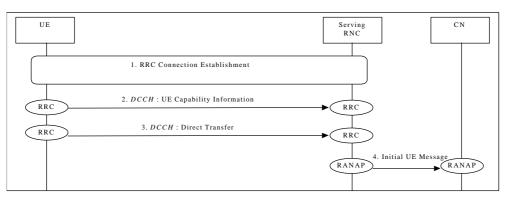2. *UE sends RRC message **UE Capability Information** to SRNC.*
   Parameters: UE Radio Capability (e.g. maximum number of simultaneous radio links, maximum TX power capability, supported radio access types).
   Note: To speed up the transfer of the initial NAS message the RRC message **UE Capability Information** could be transferred after the initial NAS message (step 3). This issue is FFS.
3. *UE sends RRC **Direct Transfer** to SRNC.*
   Parameters: Initial NAS Message (could for a GSM based CN be e.g. CM Service Request, Location Update Request etc.) CN node indicator (it indicates the correct CN node into which the NAS message shall be forwarded).
4. SRNC initiates signalling connection to CN, and sends the RANAP message **Initial UE Message**.
   Parameters: Initial NAS Message (could for a GSM based CN be e.g. CM Service Request, Location Update Request etc.).

   The NAS signalling connection between UE and CN can now be used for NAS message transfer.
•

7.2.2.2 CN Initiated Signalling Connection Establishment

This example shows establishment of a CN originated NAS Signalling Connection Establishment.

7.2.3 RRC Connection Establishment

The following examples show establishment of a RRC connection either on a dedicated channel (DCH) or on a common channel (CCH).

7.2.3.1 DCH Establishment

This example shows establishment of an RRC connection on a dedicated channel (DCH).
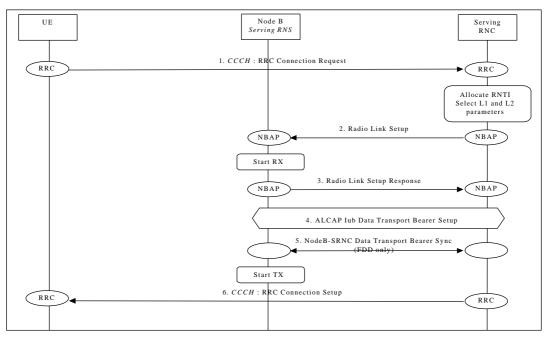
Figure 710: RRC Connection Establishment - DCH Establishment

1. The UE initiates set-up of an RRC connection by sending RRC message **Connection Request** on CCCH.
    Parameters: UE identification, reason for RRC connection.
    Note: Type of UE identification and Layer 1 Node B Acknowledge on RACH (CCCH) are FFS.
2. The SRNC decides to use a DCH for this RRC connection, allocates RNTI and radio resources for the RRC
    connection. When a DCH is to be set-up, NBAP message **Radio Link Setup Request** is sent to Node B.
    *Parameters: Cell id, Transport Format Set, Transport Format Combination Set, frequency, UL scrambling code(FDD
    only), Time Slots (TDD only), User Codes (TDD only),DL channelisation code, Power control information.*
3. Node B allocates resources, starts PHY reception, and responses with NBAP message **Radio Link Setup
    ProceedResponse**.
    *Parameters: Signalling link termination, , DL channelisation code (FDD only), Transport layer addressing information
    (AAL2 address, AAL2 Binding Identity) for the Iub Data Transport Bearer.*
4. SRNC initiates set-up of Iub Data Transport bearer using ALCAP protocol. This request contains the AAL2 Binding
    Identity to bind the Iub Data Transport Bearer to the DCH. The request for set-up of Iub Data Transport bearer is
    acknowledged by Node B.
5. Node B and SRNC establish synchronism for the Iub Data Transport Bearer. Then Node B starts DL transmission.
    (FDD only)
6. Message **RRC Connection Setup** is sent on CCCH from SRNC to UE.
    *Parameters: UE identification, RNTI, Transport Format Set, Transport Format Combination Set, frequency, DL scrambling
    code (FDD only), Time Slots (TDD only), User Codes (TDD only), DL channelisation code(FDD only), Power control
    information..*

*Editor Note: Synchronization at DCH Establishment is an open study item identified at TSG RAN WG3 meeting #1 (Bonn,
February 99) (SIG/1)*

7.2.3.2 CCH Establishment

This example shows establishment of an RRC connection on a common channel (CCH). A prerequisite for this example is
that the necessary Iub Data Transport bearer for the CCH is established prior to this procedure.
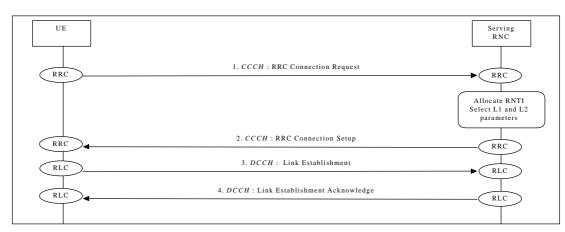
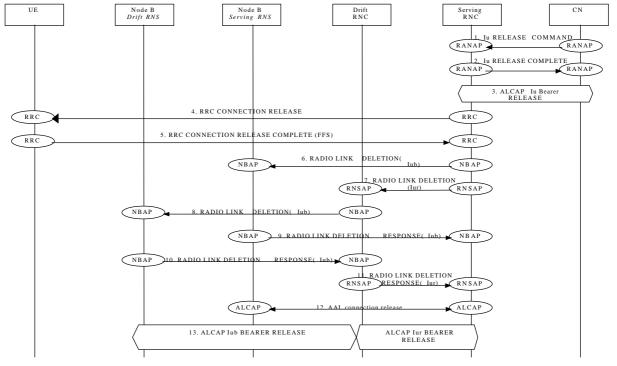**Figure 8̶1̶1̶: RRC Connection Establishment - CCH Establishment**

1. The UE initiates set-up of an RRC connection by sending **RRC Connection Request** message on CCCH.
   Parameters: UE identification, reason for RRC connection.
   Note: Type of UE identification and Layer 1 Node B Acknowledge on RACH (CCCH) are FFS.
2. The SRNC decides to use a CCH for this RRC connection, allocates RNTI and radio resources for the RRC connection. **RRC Connection Setup** message is sent on CCCH from SRNC to UE.
   Parameters: UE identification, RNTI, other parameters are FFS
3. UE initiates establishment of RLC link on DCCH (**Link Establishment**).
4. RLC link establishment is acknowledged by SRNC (**Link Establishment Acknowledge**).

7.2.4 RRC Connection Release

The following examples show RRC connection release either of a dedicated channel (DCH) or of a common channel (CCH).
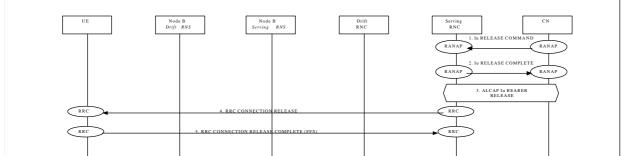
7.2.4.1 DCH Release

This example shows RRC Connection release of a dedicated channel.

7.2.4.2 CCH Release

This example shows RRC Connection release of a common channel.

7.2.5 RRC Connection Re-establishment

The following examples show re-establishment of a RRC connection either on a dedicated channel (DCH) or on a common channel (CCH).

7.2.5.1 DCH Re-establishment

This example shows re-establishment of a RRC connection on a dedicated channel (DCH).

7.2.5.2 CCH Re-establishment

This example shows re-establishment of a RRC connection on a common channel (CCH).

7.2.6 Radio Access Bearer Establishment

The following examples show establishment of a radio access bearer on a dedicated channel (DCH) or on a common channel (CCH) when the RRC connection already support a radio access bearer either on a dedicated channel (DCH) or on a common channel (CCH).

7.2.6.1 DCH - DCH Establishment - Synchronized

This example shows establishment of a radio access bearer on a dedicated channel (DCH) when the RRC connection already uses a dedicated channel (DCH).
[FDD-The UE communicates via two Nodes B. One Node B is controlled by SRNC, one Node B is controlled by DRNC]
[TDD – The Nodes B shown in the figure are mutually exclusive in TDD mode.].
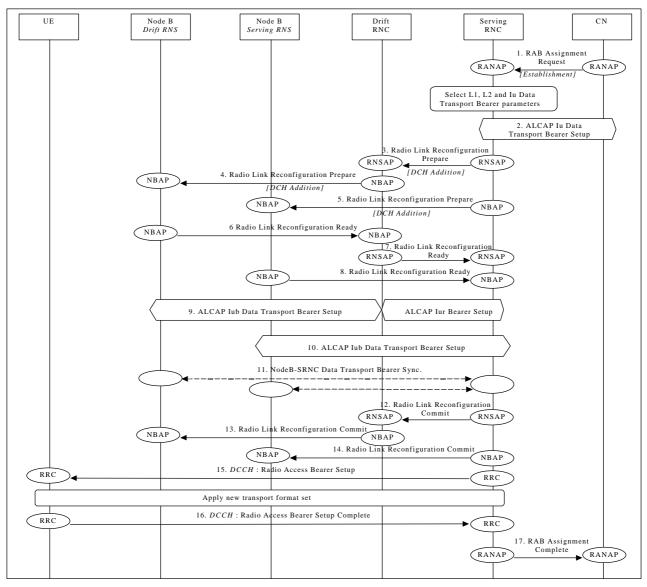
Figure 912: Radio Access Bearer Establishment - DCH - DCH Establishment - Synchronized

1. CN initiates establishment of the radio access bearer with RANAP message **RAB Assignment Request**.
    Parameters: RAB QoS parameters, Transport layer addressing information (AAL2 address, AAL2 Binding Identity) for Iu Data Transport Bearer SRNC decides the requirements on L1, L2 and Iu Data Transport Bearer.
2. SRNC initiates set-up of Iu Data Transport bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iu Data Transport Bearer to the Radio Access Bearer.
3. SRNC requests DRNC to prepare establishment of DCH to carry the RAB (**Radio Link Reconfiguration RequestPrepare**).
    Parameters: Transport Format Set, Transport Format Combination Set, Power control information, instructions for DCH mapping on Iub Data Transport Bearers.
    This step is applicableonly when more Nodes B are involved.
4. DRNC requests its Node B to prepare establishment of DCH to carry the RAB (**Radio Link Reconfiguration PrepareRequest**).
    Parameters: Transport Format Set, Transport Format Combination Set, Power control information, , DL channelisation code.
    This step is applicableonly when more Nodes B are involved.
5. SRNC requests its Node B to prepare establishment of DCH to carry the RAB (**Radio Link Reconfiguration PrepareRequest**).
    Parameters: Transport Format Set, Transport Format Combination Set, Power control information, Time Slots (TDD only), User Codes (TDD only).
6. Node B allocates resources and notifies DRNC that the preparation is ready (**Radio Link Reconfiguration ProceedReady**).
    Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
    This step is applicableonly when more Nodes B are involved.

7. DRNC notifies SRNC that the preparation is ready (**Radio Link Reconfiguration ~~Ready~~Proceed**).
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
   This step is applicableonly when more Nodes B are involved.

8. Node B allocates resources and notifies SRNC that the preparation is ready (**Radio Link Reconfiguration ~~Ready~~Proceed**).
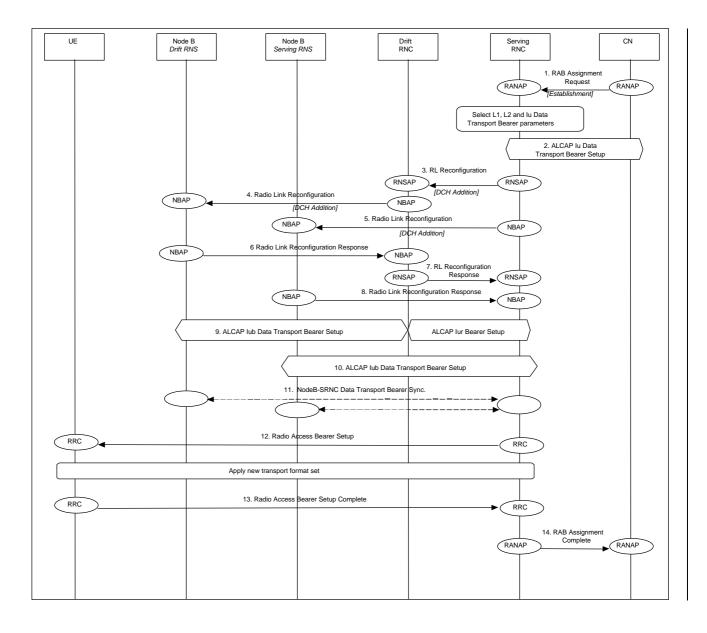   *Parameters: DL channelisation code Per Cell (FDD only), Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.*
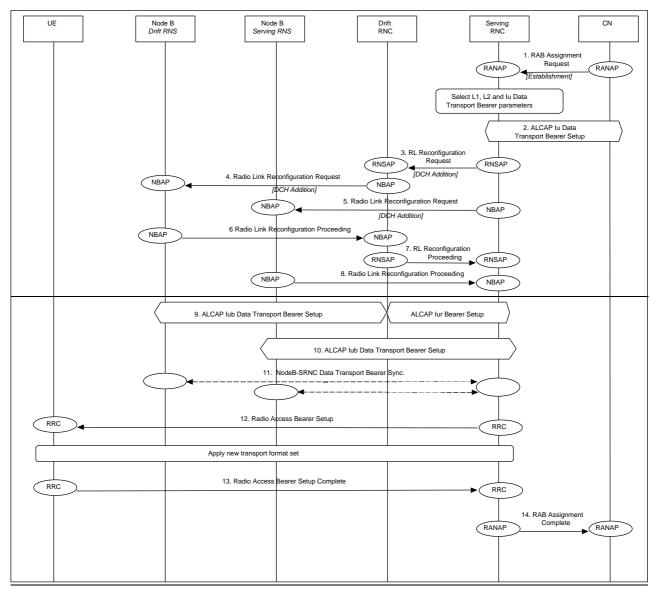
9. SRNC initiates setup of Iur/Iub Data Transport Bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur/Iub Data Transport Bearer to DCH.
   This step is applicableonly when more Nodes B are involved.

10. SRNC initiates setup of Iub Data Transport Bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer to DCH.

11. The Nodes B and SRNC establish synchronism for the Iub and Iur Data Transport Bearer.
    This step is applicableonly for the FDD case..

12. RNSAP message **Radio Link Reconfiguration ~~Command~~ Commit** is sent from SRNC to DRNC.
    Parameters:
    This step is applicableonly when more Nodes B are involved.

13. NBAP message **Radio Link Reconfiguration Commit ~~Command~~** is sent from DRNC to Node B.
    Parameters:
    This step is applicableonly when more Nodes B are involved.

14. NBAP message **Radio Link Reconfiguration Commit ~~Command~~** is sent from SRNC to Node B.
    Parameters:

15. RRC message **Radio Access Bearer Setup** is sent by SRNC to UE.
    Parameters: Transport Format Set, Transport Format Combination Set, DL channelisation code per cell(FDD only), Time Slots (TDD only), User Codes (TDD only).

16. UE sends RRC message **Radio Access Bearer Setup Complete** to SRNC.

17. SRNC sends RANAP message **RAB Assignment Complete** to CN.

7.2.6.2 DCH - DCH Establishment - Unsynchronized

This example shows an establishment of a radio access bearer on a dedicated channel (DCH) when the RRC connection already uses a dedicated channel (DCH). The UE communicates via two Nodes B. One Node B is controlled by SRNC, one Node B is controlled by DRNC. The reconfiguration time does not require to be synchronised among Node-Bs, SRNC and UE.

UE | Node B *Drift RNS* | Node B *Serving RNS* | Drift RNC | Serving RNC | CN

RANAP — 1. RAB Assignment Request *[Establishment]* — RANAP

Select L1, L2 and Iu Data Transport Bearer parameters

2. ALCAP Iu Data Transport Bearer Setup

RNSAP — 3. RL Reconfiguration Request *[DCH Addition]* — RNSAP

NBAP — 4. Radio Link Reconfiguration Request *[DCH Addition]* — NBAP

NBAP — 5. Radio Link Reconfiguration Request *[DCH Addition]* — NBAP

NBAP — 6 Radio Link Reconfiguration Proceeding — NBAP

RNSAP — 7. RL Reconfiguration Proceeding — RNSAP

NBAP — 8. Radio Link Reconfiguration Proceeding — NBAP

9. ALCAP Iub Data Transport Bearer Setup | ALCAP Iur Bearer Setup

10. ALCAP Iub Data Transport Bearer Setup

11. NodeB-SRNC Data Transport Bearer Sync.

RRC — 12. Radio Access Bearer Setup — RRC

Apply new transport format set

RRC — 13. Radio Access Bearer Setup Complete — RRC

RANAP — 14. RAB Assignment Complete — RANAP

Radio Access Bearer Establishment - DCH - DCH Establishment - Unsynchronised

1. CN **initiates establishment of the radio access bearer with RANAP Radio Access Bearer Assignment Request message.**
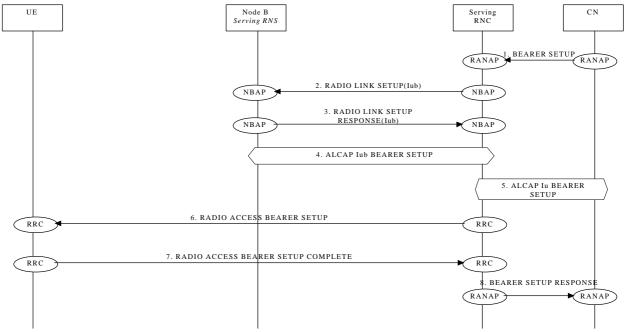   **Parameters: RAB QoS parameters**
2. **SRNC initiates set-up of Iu Data Transport bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iu Data Transport Bearer to the Radio Access Bearer.**
3. **SRNC decided that there are no need for a synchronous RL reconfiguration, and requests DRNC to setup a new DCH. It include in the message that the modification shall be done immediately without waiting for the command message.**
    Parameters: Bearer ID, Mode= Unsynchronised, Transport Format Set, Transport Format Combination Set, Power control information
4. **DRNC requests its Node B to establish of a new DCH in the existing Radio Link.**
    Parameters: Bearer ID, Mode= Unsynchronised, Transport Format Set, Transport Format Combination Set, Power control information.
5. **SRNC requests its Node B setup a new DCH in the existing Radio Link.**
    Parameters: Bearer ID, Mode= Unsynchronised, Transport Format Set, Transport Format Combination Set, Power control information
6. **Node B allocates resources and notifies DRNC that the setup is done.**
    Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
7. **DRNC notifies SRNC that the setup is done.**
    Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
8. **Node B allocates resources and notifies SRNC that the setup is done.**
    Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
9. **SRNC initiates setup of Iur/Iub Data Transport Bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur/Iub Data Transport Bearer to DCH. The setup of the Iub link in the drift RNC may occur before step 7 (and be the triggering cause of message 7) – FFS.**

10. **SRNC initiates setup of Iub Data Transport Bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer to DCH.**
11. **The Nodes B and SRNC establish frame synchronism for the Iub and Iur Data Transport Bearer.**
12. **RRC message Radio Access Bearer Setup is sent by SRNC to UE.**
    Parameters: Transport Format Set, Transport Format Combination Set.
13. **UE sends RRC message Radio Access Bearer Setup Complete to SRNC.**
14. **SRNC sends RANAP message Radio Access Bearer Assignment Complete to CN.**
15. **Parameters: Binding ID**
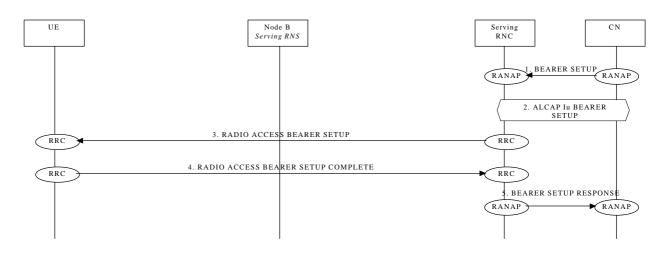
7.2.6.3 CCH - DCH Establishment

This example shows establishment of a radio access bearer on a dedicated channel (DCH) when the RRC connection

already uses a common channel (CCH).

7.2.6.4 CCH - CCH Establishment

This example shows establishment of a radio access bearer on a common channel (CCH) when the RRC connection already uses a common channel (CCH).

7.2.7 Radio Access Bearer Release

The following examples show release of a radio access bearer either on a dedicated channel (DCH) or on a common channel (CCH) when the RRC connection already uses a dedicated channel (DCH) or a common channel (CCH).

7.2.7.1 DCH - DCH Release - Synchronized

This example shows release of a radio access bearer on a dedicated channel (DCH) when the RRCconnection still uses a dedicated channel (DCH) after the release.
[FDD - The UE communicates via two Nodes B. One Node B is controlled by SRNC, one Node B is controlled by DRNC.]
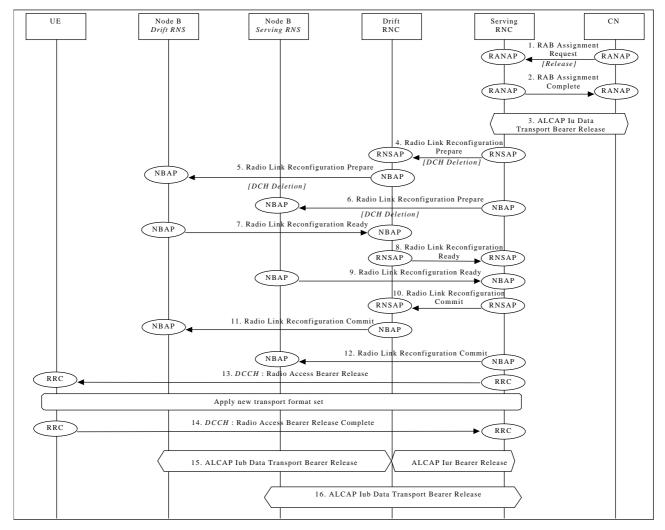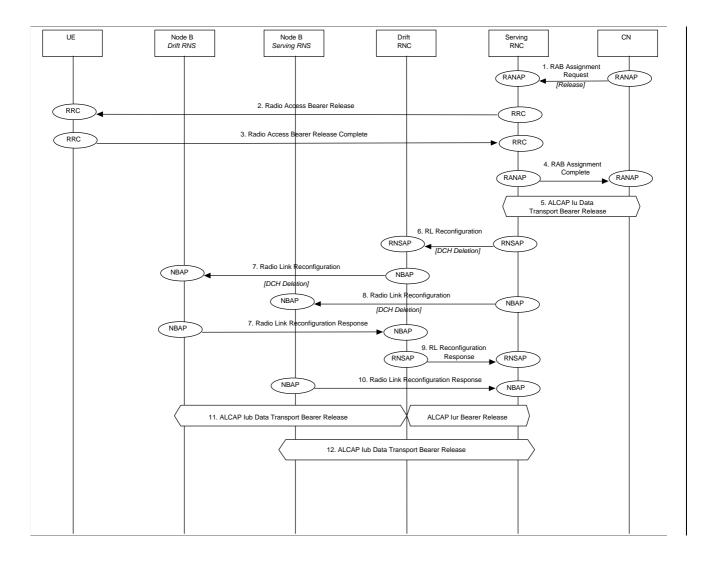[TDD – The Nodes B shown in the figure are mutually exclusive in TDD mode.]

Figure 1013: Radio Access Bearer Release - DCH - DCH Release - Synchronized
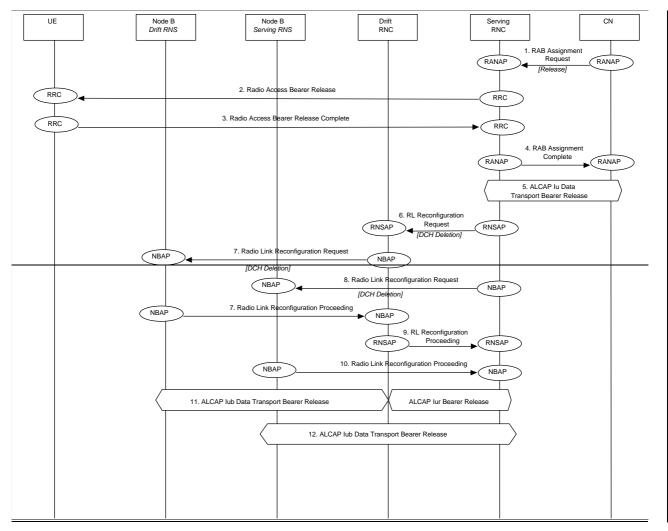
1. CN initiates release of the radio access bearer with RANAP message **RAB Assignment Request**.
2. SRNC acknowledges the release of radio access bearer (**RAB Assignment Complete**).
3. SRNC initiates release of the Iu Data Transport bearer between the CN and the SRNC using the ALCAP protocol.
4. SRNC requests DRNC to prepare release of DCH carrying the RAB (**Radio Link Reconfiguration Request**).
    Parameters: Transport Format Combination Set, UL scrambling code.
    This step is applicableonly when more Nodes B are involved.
5. DRNC requests its Node B to prepare release of DCH carrying the RAB (**Radio Link Reconfiguration Prepare**).
    Parameters: Transport Format Combination Set, UL scrambling code, DL channelisation code.
    This step is applicableonly when more Nodes B are involved.
6. SRNC requests its Node B to prepare release of DCH carrying the RAB (**Radio Link Reconfiguration Prepare**).
    Parameters: Transport Format Combination Set, UL scrambling code (FDD only), Time Slots (TDD only), User Codes (TDD only).
7. Node B notifies DRNC that release preparation is ready (**Radio Link Reconfiguration ResponseReady**).
    This step is applicableonly when more Nodes B are involved.
8. DRNC notifies SRNC that release preparation is ready (**Radio Link Reconfiguration Proceed**).
    This step is applicableonly when more Nodes B are involved.
9. Node B notifies SRNC that release preparation is ready (**Radio Link Reconfiguration ResponseReady**).
    Parameters: DL channelisation code per cell (FDD only).

10. RNSAP message **Radio Link Reconfiguration** ~~Command~~ **Commit** is sent from SRNC to DRNC.
This step is applicableonly when more Nodes B are involved.

11. NBAP message **Radio Link Reconfiguration** ~~Command~~ **Commit** is sent from DRNC to Node B.
This step is applicableonly when more Nodes B are involved.

12. NBAP message **Radio Link Reconfiguration** ~~Command~~ **Commit** is sent from SRNC to Node B.
Parameters:

13. RRC message **Radio Access Bearer Release** is sent by SRNC to UE.
Parameters: Transport Format Set, Transport Format Combination Set, DL channelisation code per cell. (FDD only), Time Slots (TDD only), User Codes (TDD only).

14. UE sends RRC message **Radio Access Bearer Release Complete** to SRNC.

15. Not used resources in ~~SRNC,~~ DRNC and NodeB <u>(Drift RNS)</u> are released. DRNC initiates release of Iur <u>and Iub (Drift RNS)</u> Data Transport bearer using ALCAP protocol
This step is applicableonly when more Nodes B are involved.

16. <u>Not used resources in SRNC and NodeB (Serving RNS, if any) are released. SRNC initiates release of Iub (Serving RNS) Data Transport bearer using ALCAP protocol.</u>

7.2.7.2 DCH - DCH Release - Synchronized

This example shows release of a radio access bearer on a dedicated channel (DCH) when the RRC connection still uses a dedicated channel (DCH) after the release. The UE communicates via two Nodes B. One Node B is controlled the SRNC, one Node B is controlled by DRNC. The reconfiguration does not require to be synchronised among Node-Bs, SRNC and UE.

UE	Node B *Drift RNS*	Node B *Serving RNS*	Drift RNC	Serving RNC	CN

1. RAB Assignment Request
RANAP ← RANAP
[Release]

2. Radio Access Bearer Release
RRC ← RRC

3. Radio Access Bearer Release Complete
RRC → RRC

4. RAB Assignment Complete
RANAP → RANAP

5. ALCAP Iu Data Transport Bearer Release

6. RL Reconfiguration
RNSAP ← RNSAP
[DCH Deletion]

7. Radio Link Reconfiguration
NBAP ← NBAP
[DCH Deletion]

8. Radio Link Reconfiguration
NBAP ← NBAP
[DCH Deletion]

7. Radio Link Reconfiguration Response
NBAP → NBAP

9. RL Reconfiguration Response
RNSAP → RNSAP

10. Radio Link Reconfiguration Response
NBAP → NBAP

11. ALCAP Iub Data Transport Bearer Release | ALCAP Iur Bearer Release

12. ALCAP Iub Data Transport Bearer Release

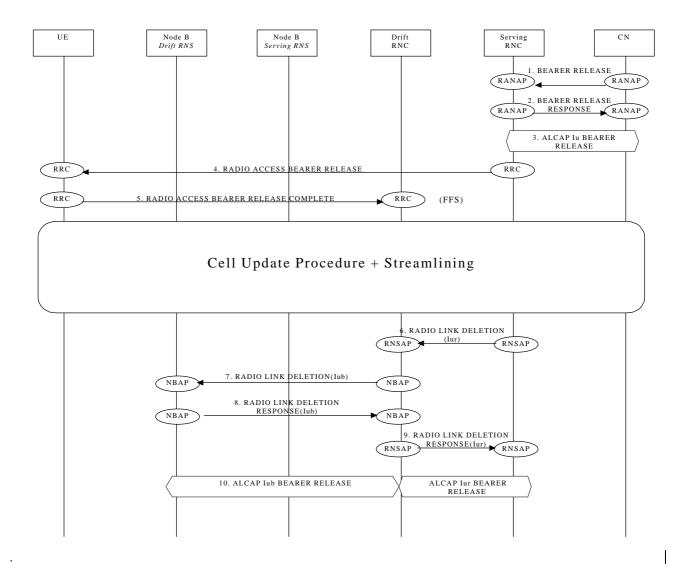**Radio Access Bearer Release - DCH - DCH Release - Unsynchronised**

1. CN initiates release of the radio access bearer with RANAP Radio Access Bearer Assignment Request message.
2. RRC message Radio Access Bearer Release is sent by SRNC to UE.
3. UE sends RRC message Radio Access Bearer Release Complete to SRNC.
4. SRNC acknowledges the release of radio access bearer to CN
5. SRNC initiates release of the Iu Data Transport bearer between the CN and the SRNC using the ALCAP protocol.
6. SRNC requests DRNC to release of DCH carrying the RAB.
   Parameters: Bearer ID, Unsynchronised, TFCS
7. DRNC requests its Node B to release of DCH carrying the RAB.
   Parameters: Bearer ID, Unsynchronised, TFCS
8. SRNC requests its Node B to prepare release of DCH carrying the RAB.
   Parameters: Bearer ID, Unsynchronised, TFCS
9. Node B acknowledges DRNC.
10. DRNC acknowledges SRNC.
11. Node B acknowledges SRNC
12. SRNC initiates release of Iur Data Transport bearer using ALCAP protocol. Note: the release of the Iur link may be done before step 10.

7.2.7.3 DCH - CCH Release

This example shows release of a radio access bearer on a Dedicated channel (DCH) when the RRC connection still uses a Common channel (CCH) after the release (DCH to RACH/FACH).
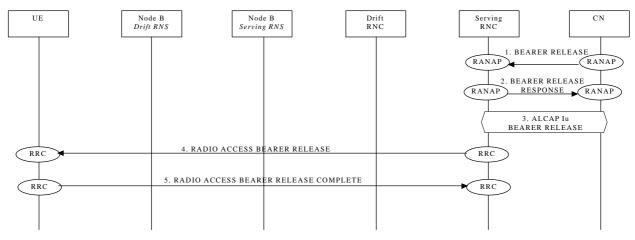
NOTE: This procedure is FFS

.

7.2.7.4 CCH - CCH Release

This example shows release of a radio access bearer on a common channel (CCH) when the RRC connection still uses a common channel (CCH) after the release (RACH/FACH to RACH/FACH.

7.2.8 Radio Access Bearer Re-establishment

The following examples show re-establishment of a radio access bearer either on a dedicated channel (DCH) or on a common channel (CCH) when the RRC connection already uses a dedicated channel (DCH) or a common channel (CCH).

7.2.8.1 DCH - DCH Re-establishment

This example shows re-establishment of a radio access bearer on a dedicated channel (CCH) when the RRC connection already uses a dedicated channel (DCH).

7.2.8.2 CCH - DCH Re-establishment

This example shows re-establishment of a radio access bearer on a dedicated channel (CCH) when the RRC connection already uses a common channel (CCH).
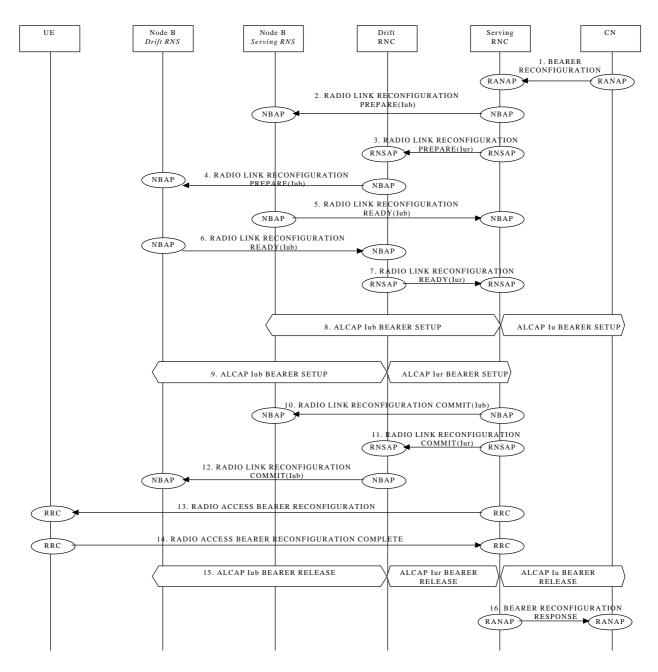
7.2.8.3 CCH - CCH Re-establishment

This example shows re-establishment of a radio access bearer on a common channel (CCH) when the RRC connection already uses a common channel (CCH).

7.2.9 Radio Access Bearer Modification

The following examples show modification of a radio access bearer established either on a dedicated channel (DCH) or on a common channel (CCH).
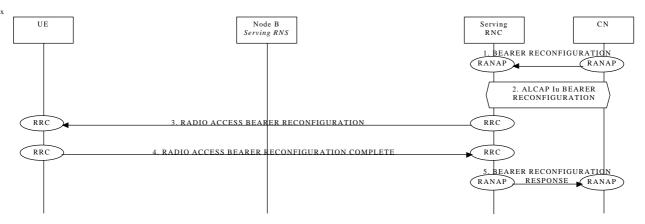
7.2.9.1 DCH to DCH Modification

This example shows modification of a radio access bearer on a dedicated channel (DCH)
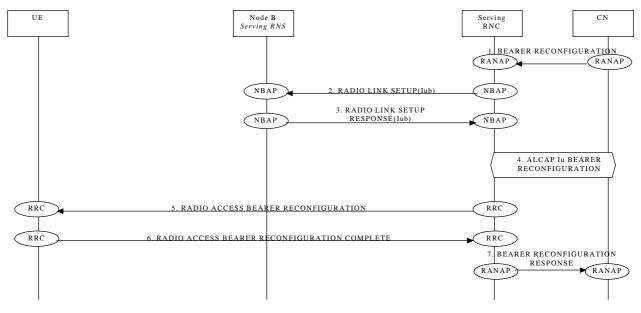
7.2.9.2 CCH TO CCH Reconfiguration

This example shows reconfiguration of a radio access bearer on a common channel (RAH/FACH to RACH/FACH) .

This procedure is FFS. It is not yet clear if the Bearer should be effectively reconfigured of should be removed and setted up again
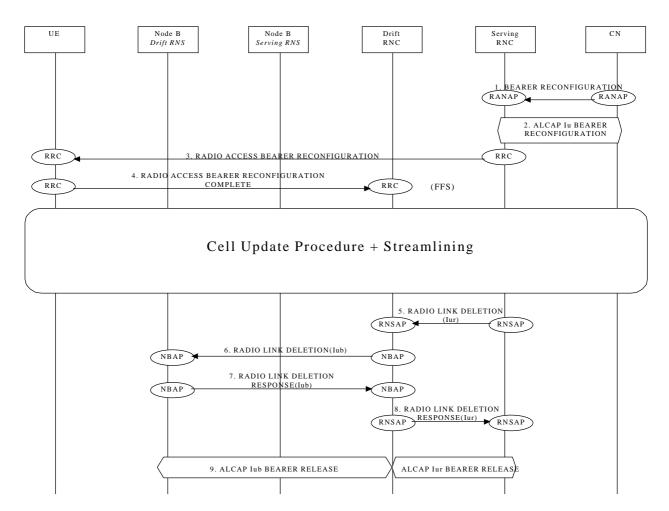
7.2.9.3 CCH TO DCH Reconfiguration

This example shows reconfiguration of a radio access bearer on a common channel (RACH/FACH to DCH)
This procedure is FFS. It is not yet clear if the Bearer should be effectively reconfigured of should be removed and setted up again
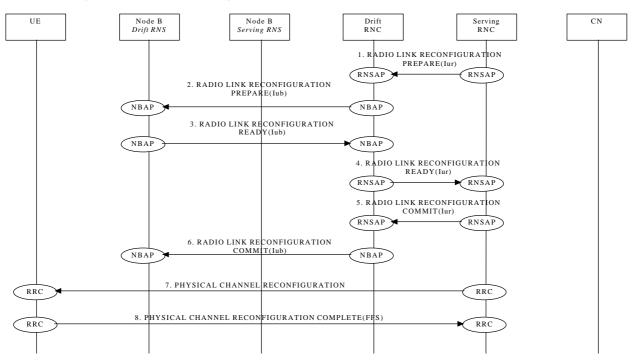
7.2.9.4 DCH TO CCH RECONFIGURATION

This example shows reconfiguration of a radio access bearer on a dedicated channel (DCH to RACH/FACH).

This procedure is FFS.

7.2.10 Physical Channel Reconfiguration

The following example show the reconfiguration from one channel type to another(DCH to DCH)

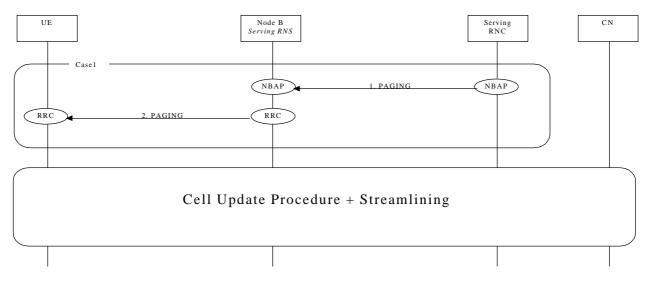## 7.2.11 Channel Type Switching

The following examples show switching from one channel type to another.
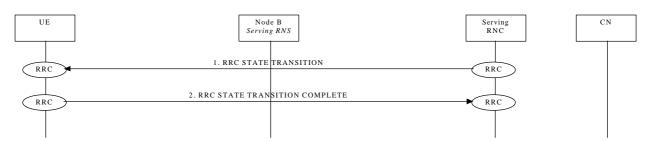
7.2.11.1 RACH/PCH to RACH/FACH

This example shows channel switching from RACH/PCH to RACH/FACH (URA connected to CELL Connected).
NOTE: The first and the second transition are included when the procedure is intitiated by UTRAN
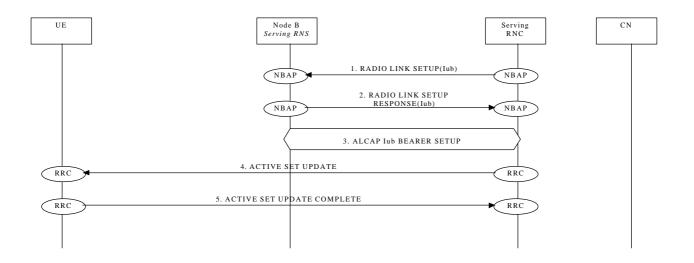
7.2.11.2 RACH/FACH to RACH/PCH

This example shows channel switching from RACH/FACH to RACH/PCH (Cell Connected to URA connected).

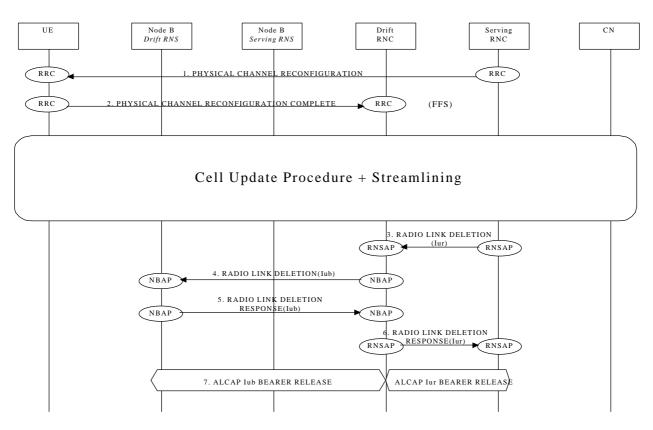NOTE: The first transition is included when the procedure is intitiated by UTRAN

7.2.11.3 RACH/FACH to DCH

This example shows channel switching from RACH/FACH to DCH

~~7.2.10.4~~7.2.11.4 DCH to RACH/FACH

This example shows channel switching from DCH to RACH/FACH

UE	Node B *Drift RNS*	Node B *Serving RNS*	Drift RNC	Serving RNC	CN

RRC — RRC 1. PHYSICAL CHANNEL RECONFIGURATION

RRC — RRC 2. PHYSICAL CHANNEL RECONFIGURATION COMPLETE (FFS)

Cell Update Procedure + Streamlining

RNSAP — RNSAP 3. RADIO LINK DELETION (Iur)

NBAP — NBAP 4. RADIO LINK DELETION(Iub)

NBAP — NBAP 5. RADIO LINK DELETION RESPONSE(Iub)

RNSAP — RNSAP 6. RADIO LINK DELETION RESPONSE(Iur)

7. ALCAP Iub BEARER RELEASE   ALCAP Iur BEARER RELEASE

7.2.12 Soft Handover

This section presents some examples of soft handover procedures. The following cases are considered:
- Radio Link Addition (Branch Addition);
- Radio link Deletion (Branch Deletion);
- Radio link Addition & Deletion (Branch Addition & Deletion - simultaneously).

Note that Soft Handover applies only to FDD mode.

7.2.12.1 Radio Link Addition (Branch Addition)

This example shows establishment of a radio link via a Node B controlled by another RNC than the serving RNC. This is the first radio link to be established via this RNS, thus macro-diversity combining/splitting with already existing radio links within DRNS is not possible.
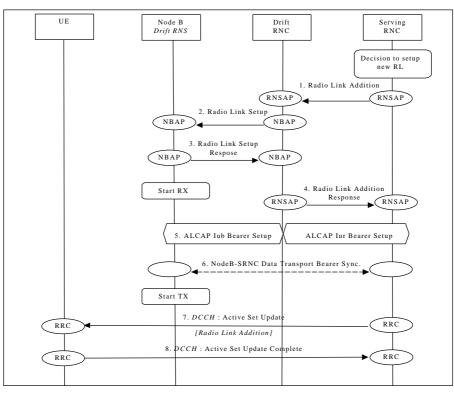
Figure 1114: Soft Handover - Radio Link Addition (Branch Addition)

1. SRNC decides to setup a radio link via a new cell controlled by another RNC. SRNC requests DRNC for radio resources by sending RNSAP message **Radio Link Addition Request**. If this is the first radio link via the DRNC for this UE, a new Iur signalling connection is established. This Iur signalling connection will be used for all RNSAP signalling related to this UE.
Parameters: Cell id, Transport Format Set per DCH, Transport Format Combination Set, frequency, UL scrambling code.

2. If requested resources are available, DRNC sends NBAP message **Radio Link Setup Request** to Node B.
Parameters: Cell id, Transport Format Set per DCH, Transport Format Combination Set, frequency, UL scrambling code, DL channelisation code.

3. Node B allocates requested resources. Successful outcome is reported in NBAP message **Radio Link Setup CompleteResponse**.
Parameters: Signalling link termination, Transport layer addressing information (AAL2 address, AAL2 Binding Identitie(s)) for Data Transport Bearer(s).
Then Node B starts the UL reception.

4. DRNC sends RNSAP message **Radio Link Addition Proceed Response** to SRNC.
Parameters: DL channelisation code, Transport layer addressing information (AAL2 address, AAL2 Binding Identity) for Data Transport Bearer(s), Neighbouring cell information.

5. SRNC initiates setup of Iur/Iub Data Transport Bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer to DCH.
This may be repeated for each Iur/Iub Data Transport Bearer to be setup.

6. Node B and SRNC establish synchronism for the Data Transport Bearer(s), relative already existing radio link(s). Then Node B starts DL transmission.

7. SRNC sends RRC message **Active Set Update** (*Radio Link Addition*) to UE on DCCH.
Parameters: Update type, Cell id, DL scrambling code, DL channelisation code, Power control information, Ncell information.

8. UE acknowledges with RRC message **Active Set Update Complete**.

7.2.12.2 Radio link Deletion (Branch Deletion)

This example shows deletion of a radio link belonging to a Node B controlled by another RNC than the serving RNC.
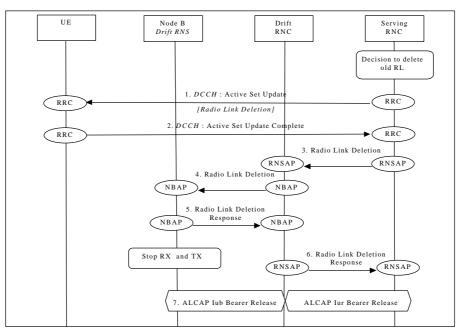
Figure 12<s>15</s>: Soft Handover - Radio Link Deletion (Branch Deletion)

1. SRNC decides to remove a radio link via an old cell controlled by another RNC. SRNC sends RRC message **Active Set Update** (*Radio Link Deletion*) to UE on DCCH.
   Parameters: Update *type, Cell id.*
2. UE deactivates DL reception via old branch, and acknowledges with RRC message **Active Set Update Complete**.
3. SRNC requests DRNC to deallocate radio resources by sending RNSAP message **Radio Link Deletion <s>Request</s>**.
   Parameters: Cell id, Transport layer addressing information.
4. DRNC sends NBAP message **Radio Link Deletion <s>Request</s>** to Node B.
   Parameters: Cell id, Transport layer addressing information.
5. Node B deallocates radio resources. Successful outcome is reported in NBAP message **Radio Link Deletion <s>Proceed</s>Response**.
6. DRNC sends RNSAP message **Radio Link Deletion <s>Proceed</s> Response** to SRNC.
7. SRNC initiates release of Iur/Iub Data Transport Bearer using ALCAP protocol.

7.2.12.3 Radio link Addition & Deletion (Branch Addition & Deletion - simultaneously)

This example shows simultaneous deletion of of a radio link belonging to a Node B controlled by the serving RNC and the establishment of a radio link via a Node B controlled by another RNC than the serving RNC. This is the first radio link to be established via this RNS, thus macro-diversity combining/splitting with already existing radio links within DRNS is not possible.
This procedures is needed when the maximum number of branches allowed for the macrodiversity set has already been reached.
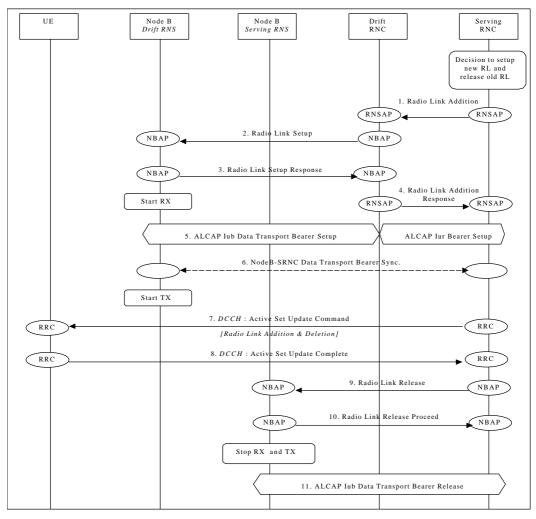
Figure 1316: Soft Handover - Radio link Addition & Deletion (Branch Addition & Deletion - simultaneously)

1. ⇒   6. See description 1. ⇒ 6. in Section 7.2.12.1.
7. SRNC sends RRC message **Active Set Update** (*Radio Link Addition & Deletion*) to UE on DCCH.
    Parameters:Update type, Cell id, DL scrambling code, DL channelisation code, Power control information, Ncell information.
8. UE disactivates DL reception via old branch, activates DL reception via new branch and acknowledges with RRC message **Active Set Update Complete**.
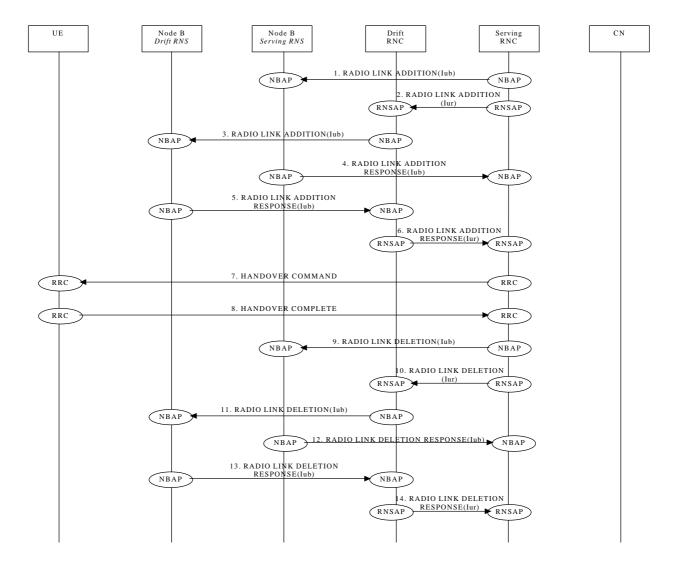9. ⇒   11. See description 3. ⇒ 7. in Section 7.2.12.2

7.2.13 Hard Handover

This section presents some examples of hard handover procedures. These procedures may be applied in the following cases:
*   intra-frequency Hard Handover (TDD mode);
*   inter-frequency Hard Handover (FDD and TDD mode).

7.2.13.1 Intra-RNS Hard Handover

This example shows Intra-RNS Hard Handover.

7.2.13.1.1 Intra Node B Hard Handover

7.2.13.2 Inter-RNS Hard Handover

This section presents some examples of Inter-RNS Hard Handover.In the first sub-section the case of Inter-RNS Hard Handover via Iur interface is considered.
In the second sub-section two examples of Inter-RNS Hard Handover with switch in CN are presented.
In this second case the Iur interface is not used and the SRNC role is relocated to the new RNC, here denoted Target RNC.
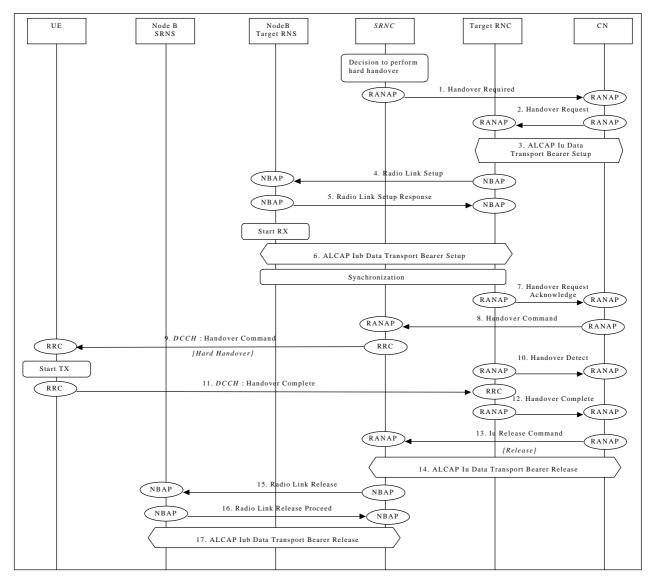This could be the case of an Inter-PLMN Handover.

7.2.13.2.1 Inter-RNS Hard Handover with switching in the CN

This section shows two examples of Inter-RNS Hard Handover with switch in CN. In the first case it is assumed that the UE is connected to a single CN node, while in the second case it is assumed that the UE is connected to two CN nodes simultaneously.
Note that CN scenarios are still under discussion in SMG12.

7.2.13.2.1.1 Inter-RNS Hard Handover with switching in the CN (UE connected to a single CN)

This example shows Inter-RNS Hard Handover with switch in CN, in a situation in which the UE is connected to a single CN node and will be using one node B directly under the target RNC after the hard handover.

Figure 14 17: Inter-RNS Hard Handover with switching in the CN (UE connected to a single CN node)

1. SRNS initiates the preparation of Inter-RNS Handover with switch in CN by sending RANAP message ~~Hard~~ **Handover Required** to CN. After reception of this message, CN will not initiate RANAP procedures such as RAB Assignment.
    Parameters: Target RNC identification
    Information sent transparently to Target RNC (UE identification, Cell Identity, UE Capability Information, UL scrambling code)

    The list of RANAP procedures not allowed to be initiated after CN reception of RANAP message ~~Hard~~ **Handover Required** is FFS. Whether it should be possible to specify a set of cell identities, i.e. setup more than one radio link at hard handover, is FFS.

2. CN requests Target RNC to prepare for Inter-RNS Hard Handover (~~Hard~~ **Handover Request**)

Parameters: RAB QoS parameters for each RAB, Transport Layer addressing information and binding information per RAB
Information sent transparently from SRNC via CN to Target RNC (UE identification, Cell Identity, UE Capability Information, UL scrambling code)

3. Target RNC initiates setup of Iu data transport bearer using ALCAP protocol. This request contains binding identity to bind the Iu data transport bearer to RAB.
   This may be repeated for each Iu data transport bearer to be setup.

4. Target RNC initiates setup of radio link in cell (**Radio Link Setup ~~Request~~**)
   Parameters: Cell identity, Transport Format Set per DCH, Transport Format Combination Set, frequency, UL scrambling code.

5. Node B allocates requested resources. Successful outcome is reported in NBAP message **Radio Link Setup ~~Proceed~~Response**.
   Parameters: DL channelisation code, Transport Layer addressing information and binding information for Iub data transport bearer(s).

6. Target RNC initiates setup of Iub data transport bearer using ALCAP protocol. This request contains Binding Identity to bind the Iub data transport bearer to the DCH.
   This may be repeated for each Iub data transport bearer to be setup.

7. RNC sends message **Hard Handover ~~Proceeding 1~~Request Acnowledge** to CN. At reception of this message in CN, CN suspends NAS message sending towards UE.
   Parameters: Information to be sent transparently via CN and SRNC to UE (RRC message Handover Command, including e.g. Transport Format Set per DCH, Transport Format Combination Set, frequency, DL channelisation code)

8. CN sends RANAP message **~~Hard~~ Handover Command** to SRNC.
   Parameters: e.g. Transport Format Set per DCH, Transport Format Combination Set, frequency, DL channelisation code.

9. SRNC sends RRC message **Handover Command** (*Hard Handover*) to UE.
   Parameters: Handover type.

10. Upon detection of PHY synchronisation, Target RNC starts acting as SRNC for the UE, and RANAP message **~~Hard~~ Handover Detect** is sent from Target RNC to CN. CN may use this message as trigger point for switch of Iu data transport bearers.

    The PHY synchronisation detection mechanism is FFS.

11. After completed handover, UE sends RRC message **Handover Complete** to Target RNC.

12. Target RNC sends RANAP **~~Hard~~ Handover Complete** to CN. This indicates for CN that activation of RANAP procedures and NAS signalling can be resumed.

13. CN initiates release of resources allocated by the former SRNC (**Iu Release Command**).

14. The former SRNC initiates release of Iu data transport bearer(s) using the ALCAP protocol.

15. The former SRNC requests release of radio link(s) (**Radio Link Deletion Request**).
    The request may be repeated if radio links of several Nodes B are to be deleted.

16. Node B acknowledges deletion of Radio Link, and stops RX/TX (**Radio Link Deletion Proceed**).

17. The former SRNC initiates release of Iub data transport bearer(s) using the ALCAP protocol.

7.2.13.2.1.2 Inter-RNS Hard Handover with switching in the CN (UE connected to two CN nodes)

This example shows Inter-RNS Hard Handover with switch in CN, in a situation in which the UE is connected to two CN nodes simultaneously node and will be using one node B directly under the target RNC after the hard handover.
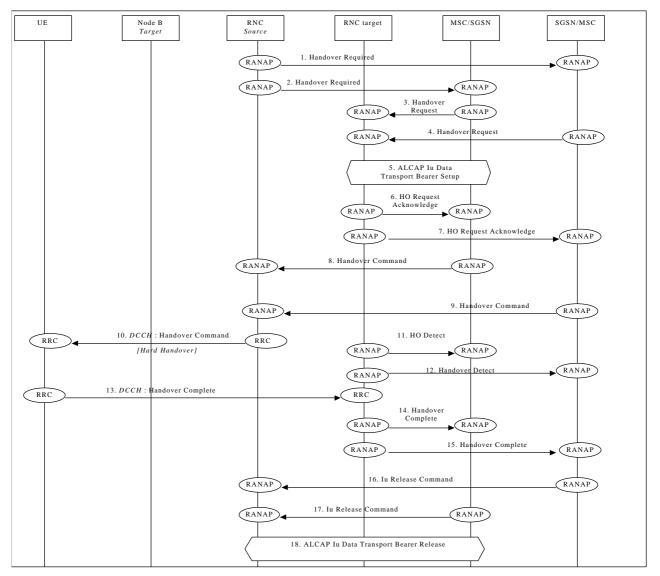*Editor note: the text needs to be aligned with the current content of the figure.*

Figure 1518: Inter-RNS Hard Handover with switching in the CN (UE connected to two CN nodes)

Serving RNC makes the decision to perform the Hard Handover via CN. Serving RNC also decides into which RNC (Target RNC) the Serving RNC functionality is to be relocated.

1./2.   SRNC sends ~~Hard~~ **Handover Required** messages to both CN nodes.
         Parameters: target RNC identifier, Information field transparent to the CN node and to be transmitted to the target RNC.
         Upon reception of ~~Hard~~ **Handover Required** message CN element prepares itself for the switch and may also suspend data traffic between UE and itself for some bearers.

3./4.   When preparation is completed CN node conveys a ~~Hard~~ **Handover Request** message to the target RNC.
         Parameters: bearer ID's requested to be rerouted towards the CN node, from which the ~~Hard~~ Handover Request originated.
         CN indicates in the message whether it prefers point to multipoint type of connections within CN or hard switch in CN. In this example the latter is assumed.

         Target RNC allocates necessary resources within the UTRAN to support the radio links to be used after completion of the Hard Handover procedure.

5./6.   Target RNC and CN node establish the new Iu transport bearers for each Radio Access Bearer related to the CN node. When RNC has completed preparation phase, ~~Hard~~ **Handover** ~~Proceeding 1~~**Request Acknowledge** is sent to the CN element.
         Parameters: transparent field to the CN which is to be transmitted to the Source RNS.

7./8.   When CN is ready for the change of SRNC, CN node sends a ~~Hard~~ **Handover Command** to the source RNC. Message contains the transparent field provided by Target RNC.
         Parameters: information provided in the Information field from the target RNC.

9.   Source RNC sends a RRC message **Handover Command** (*Hard Handover*) to the UE.

Parameters: Handover type.

10./11. When target RNC has detected the UE, ~~Hard~~ Handover Detect message is sent to the CN nodes.
Target RNC switches also the connection towards the new Iu, when UE is detected. After the switch UL traffic
from node-B's is routed via the newly established MDC to the new MAC/RLC entities and finally to the correct Iu
transport bearer.
DL data arriving from the new Iu link is routed to newly established RLC entities, to the MAC and to the MD-
splitter and Nodes B.

12. When the RRC connection is established with the target RNC and necessary radio resources have been
allocated the UE sends RRC message **Handover complete** to the target RNC.

13./14. After a succesful switch and resource allocation at target RNC, RNC sends ~~Hard~~ Handover Complete messages
to the involved CN nodes.

At any phase, before the ~~Hard~~ Handover Complete message is sent, the old communication link between the CN
and UE is all the time existing and working and the procedure execution can be stopped and original
configuration easily restored. If any such unexpectional thing occurs a ~~Hard~~ Handover Failure message may be
sent instead of any message numbered 3-10 and 13-14 described in this above.

15./16. The CN nodes initiates the release of the Iu connections to the source RNC by sending RANAP message **Iu
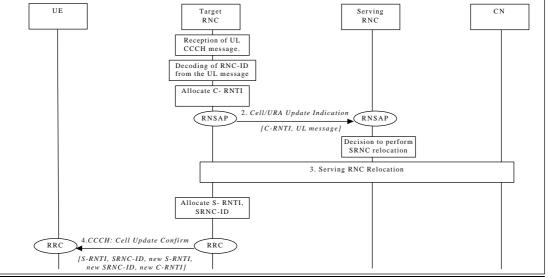Release Command**.
Upon reception of the release requests from the CN nodes the old SRNC executes all necessary procedures to
release all visible UTRAN resources that were related to the RRC connection in question.

7.2.14 Cell Update

This section presents some examples of Cell Update procedures, i.e. those procedures that update the position of the UE
when a RRC connection exists and the position of the UE is known on cell level in the UTRAN.

7.2.14.1 Inter-RNS Cell Update with switching in the CN

This example shows Inter-RNS Cell Update with switching in the CN.

Inter RNS Cell Update with switching in CN.

1. UE sends a RRC message Cell Update to the UTRAN, after having made cell re-selection. Upon reception of a
CCCH message from a UE, controlling RNC allocates a C-RNTI for the UE.
2. Controlling RNC forward the received uplink CCCH message towards the SRNC by RNSAP *Cell/URA Update
Indication* message. C-RNC includes the allocated C-RNTI to the RNSAP message, which is used as a UE
identification within the C-RNC. Upon reception of the RNSAP message SRNC decides to perform a SRNC
relocation towards the target RNC.
3. Serving RNC relocation procedure is executed as defined in Chapter SRNC Relocation (UE connected to a single
CN node). After completing SRNC relocation, target RNC allocates new S-RNTI for the UE.
4. Serving RNC responds to UE by RRC Cell Update Confirm, including old S-RNTI and SRNC ID as UE identifiers.
Message contains also the new S-RNTI, SRNC-ID and C-RNTI.

It is ffs. whether a Cell Update Complete is needed to confirm the successful reception of Cell Update Confirm. The decision
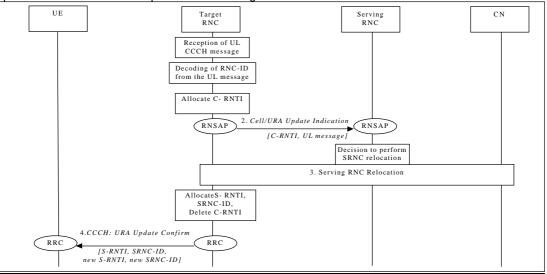is to be made by 3GPP RAN WG2.

7.2.15 URA Update

This section presents some examples of URA Update procedures, i.e. those procedures that update the UTRAN registration area of a UE when a RRC connection exists and the position of the UE is known on URA level in the UTRAN.

7.2.15.1 Inter-RNS URA Update with switching in the CN

This example shows Inter-RNS URA Update with switching in the CN.

Inter RNS URA Update with switching in CN.

1.   UE sends a RRC message URA Update to the UTRAN, after having made cell re-selection. Upon reception of a CCCH message from an unknown UE, controlling RNC allocates a new C-RNTI for the UE.
2.   Controlling RNC forwards the received uplink CCCH message towards the SRNC by RNSAP *Cell/URA Update Indication* message. C-RNC includes the allocated C-RNTI, which is to be used as a UE identification within the C-RNC, to the RNSAP message. Upon reception of the RNSAP message SRNC decides to perform a SRNC relocation towards the target RNC.
3.   Serving RNC relocation procedure is executed as defined in Chapter 'SRNC Relocation (UE connected to a single CN node)'. After having completed SRNC relocation, target RNC allocates new S-RNTI for the UE. New SRNC also deletes the allocated C-RNTI, since it is not needed for an UE in RACH/PCH state.
4.   Serving RNC acknowledges the message by RRC URA Update Confirm, including old S-RNTI and SRNC ID as UE identifiers. Message contains also the new S-RNTI and RNC-ID.

It is ffs. whether a URA Update Complete is needed to confirm the successful reception of URA Update Confirm. The decision is to be made by 3GPP RAN WG2.

7.2.16 SRNS Relocation

This section shows two examples of SRNS Relocation.In the first case it is assumed that the UE is connected to a single CN node, while in the second case it is assumed that the UE is connected to two CN nodes simultaneously.

Note that CN scenarios are still under discussion in SMG12.

7.2.16.1 SRNC Relocation (UE connected to a single CN node)

This example shows SRNS Relocation, in a situation in which the UE is connected to a single CN node.

7.2.16.2 SRNC Relocation (UE connected to two CN nodes)

Editor note: the text description need to be aligned to the figure contents.
This example shows SRNS Relocation, in situation in which the UE is connected to two CN nodes simultaneously. It is assumed that:

- all cells in the active set are in one DRNC;
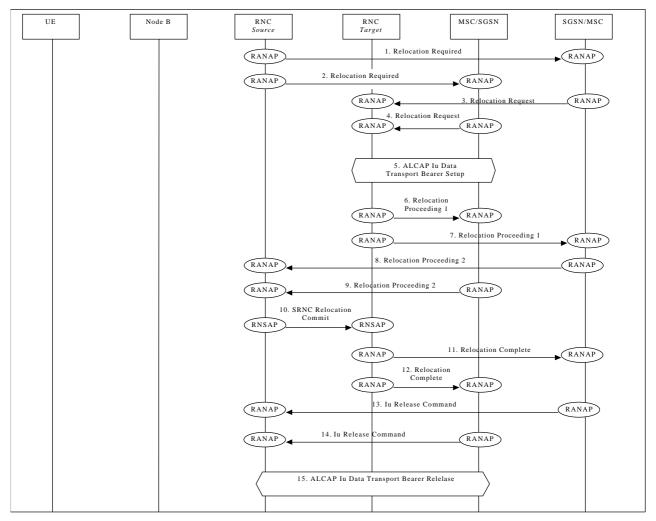- the CN performs hard switching of the user traffic.

Figure 1619: SRNC Relocation (UE connected to two CN nodes)

Note that the SRNC makes the decision to perform the Serving RNC relocation procedure. The Serving RNC also decides into which RNC (Target RNC) the Serving RNC functionality is to be relocated.

1./2.   The source SRNC sends ~~SRNC~~ **Relocation Required** messages to both CN nodes.
Parameters: target RNC identifier, Information field that the CN node(s) shall pass transparently to the target RNC. This transparent field contains the UE identifier, number of CN nodes and other TBD data.
Upon reception of ~~SRNC~~ **Relocation Required** message the CN element prepares itself for the switch and may also suspend user data traffic and/or signalling between UE and itself for some bearers.

3./4.   When preparation is completed the CN node conveys a ~~SRNC~~ **Relocation Request** message to the target RNC.
Parameters: indication of which bearers should be routed towards this CN node, transparent information field sent by the source RNC, UE identifier.

The target RNC uses the UE identifier to link the requests from multiple CN nodes to each other and to the resources (e.g. Iub links) that the UE is currently using.
FFS: The target RNC allocates necessary Iur branches to be used after the SRNC relocation switch will be made.

5./6.   The target RNC and CN node establish the new Iu transport bearers for each Radio Access Bearer related to that CN node.
When the RNC has completed its preparation phase, **Relocation Proceeding 1** message is sent to CN.

7./8.   When the CN node is ready for the SRNC move, the CN node indicates the completion of preparation phase at the CN side for the SRNC relocation by sending the ~~SRNC~~ **Relocation Proceeding 2** message. To the source RNC.

9.   When the source RNC has received ~~SRNC~~ **Relocation Proceeding 2** messages from all the CN nodes, the source RNC sends a **~~SRNC~~ Relocation Commit** message to the target RNC. The target RNC executes both the DL and UL switch for all bearers at the earliest suitable time instance.
         After the switch UL traffic from node-B's is routed via the newly established Macro Diversity Combiner to the new MAC/RLC entities and finally to the correct Iu transport bearer. UL data transmission to the old Iur transport bearer is ceased.
         DL data arriving from the new Iu link is routed to newly established RLC entities, to the MAC and to the Macro Diversity Splitter and Nodes B. The DL data received from the old Iur is discarded.

10./11. Immediately after a succesfull switch at RNC, target RNC (=SRNC) sends ~~SRNC~~ **Relocation Complete** messages to the involved CN nodes.
         Upon reception of messages 9 and 10, the CN switches from the old Iu transport bearers to the new ones.

12./13. After a successful switch at the CN node, the CN node initiates the release of the Iu connection to the source RNC by sending the RANAP message **Iu Release Command**.

         Upon reception of the release requests from the CN nodes the old SRNC executes all necessary procedures to release all visible UTRAN resources that were related to the RRC connection in question.

At any phase, before the **SRNC Relocation Complete** message is sent, the old communication link between the CN and UE is all the time existing and working and the procedure execution can be stopped and original configuration easily restored. If any such abnormal thing occurs a **SRNC Relocation Failure** may be sent instead of any message numbered 3-11 described.

Note: The whole described procedure is FFS

7.2.17 HO between UTRAN and GSM/BSS

This section presents some examples of handover procedure from UTRAN to GSM/BSS and vice versa. Both the case of a UTRAN connected to a GSM CN trough an IWF (where RANAP is interworked with BSSMAP) and the case a UMTS CN connected to a 2G-MSC (i.e. via MAP/E interface) are considered.
The role of IWF is FFS.

7.2.17.1 UTRAN ⇒ GSM/BSS via IWF

This example shows handover procedure from UTRAN to GSM/BSS via IWF.

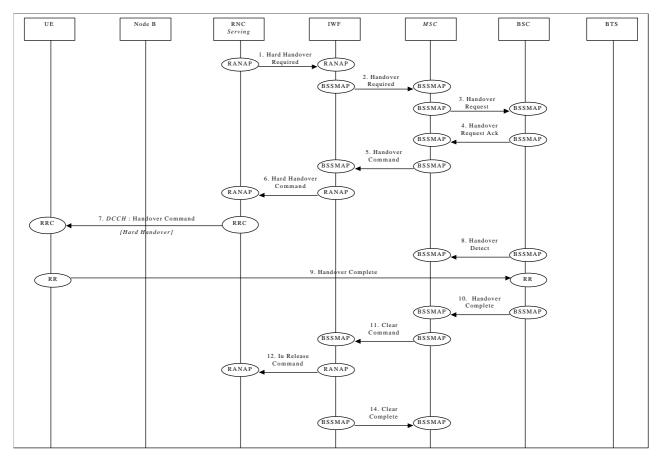*Editor's Note: Interactions between the Node B/RNC and BSC/BTS will be added in a later phase.*

Figure 1720: UTRAN ⇒ GSM/BSS handover via IWF

1. Upon detection of a trigger SRNC sends RANAP message ~~Hard~~ **Handover Required** to IWF.
2. IWF forwards this request to the GSM MSC (**Handover Required**).

Steps 3&4 follow the normal GSM procedures and are shown only for clarity.

5. GSM MSC responds to the initial request from IWF by sending BSSMAPmessage **Handover Command** to the IWF.
6. IWF forwards this request to the SRNC (~~Hard~~ **Handover Command**).
7. Serving RNC sends a RRC message **Handover Command** (*Hard Handover*) to the UE.
    Parameters: Handover type.

Steps 8&10 follow the normal GSM procedures and are shown only for clarity.
11. GSM MSC sends **Clear Command** to IWF to release previously allocated bearer resources.
12. IWF forwards this request to the SRNC (**Iu Release Command**)
Previously allocated bearer resources are released within UMTS (using RANAP and ALCAP protocols [ALCAP not shown]).
13. IWF forwards this confirmation to the GSM MSC (**Clear Complete**).

7.2.17.2 UTRAN ⇒ GSM/BSS via MAP/E interface

This example shows how handover (Hard Handover) is performed from UTRAN to GSM/BSS via MAP/E interface between a UMTS CN and a 2G-MSC.
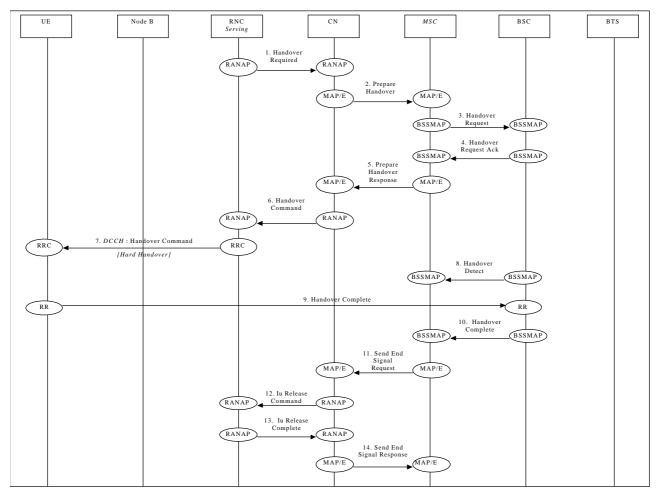
Editor's Note: Interactions between the Node B/RNC and BSC/BTS will be added in a later phase.

Figure 1821: UTRAN $\Rightarrow$ GSM/BSS handover via MAP/E interface

1. Upon detection of a trigger SRNC sends RANAP message ~~Hard~~ **Handover Required** to the CN.
2. The UMTS CN will forward this request to the GSM MSC (indicated in the received message) over the MAP/E interface (MAP message **Prepare Handover**).

Note: Steps 3&4 follow the normal GSM procedures and are shown only for clarity.

5. Once initial procedures are complete in GSM MSC/BSS the MSC returns MAP/E message **Prepare Handover**.
6. CN responds to the initial request from SRNC by sending RANAP message ~~Hard~~ **Handover** ~~Proceeding 2~~**Command** to the SRNC.
7. Via existing RRC connection, SRNC sends RRC message **Handover Command** (*Hard Handover*) to the UE.
   Parameters: Handover type.

Note: Procedures related to synchronisation etc. to GSM BSS are not shown.
Note: Step 8&10 follow normal GSM procedures and are shown only for clarity.

11. Detection of the UE within the GSM coverage results in the MSC sending MAP/E message **Send End Signal Request** to the CN.
12. CN initiates release of resources allocated by the former SRNC (**Iu Release Command**).
13. Previously allocated bearer resources are released within UMTS (e.g. using RANAP and ALCAP protocols [ALCAP not shown]) (**Iu Release Complete**).
14. Procedure is concluded from UMTS point of view by CN sending MAP/E message **Send End Signal Response** (this message is not sent until the end of the call).

7.2.17.3 GSM/BSS $\Rightarrow$ UTRAN via IWF

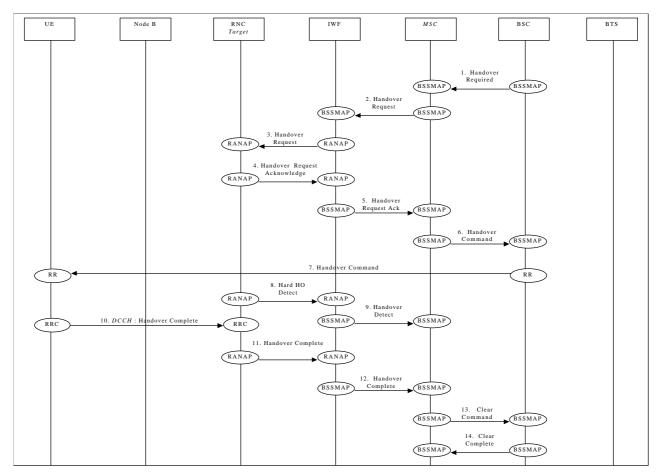This example shows handover procedure from GSM/BSS to UTRAN.

Editor's Note: Interactions between the Node B/RNC and BSC/BTS will be added in a later phase.

Figure 19~~22~~: GSM/BSS ⇒ UTRAN handover via IWF

1. The BSC sends **Handover Required** message to the GSM MSC.
2. GSM MSC sends BSSMAP message **Handover Request** to IWF.
3. IWF forwards this request to the target RNC (~~Hard~~ **Handover Request**).
4. RANAP response **Hard Handover ~~Proceeding 1~~Request Acknowledge** is returned to the IWF by the target RNC.
5. IWF forwards this message to the GSM MSC (**Handover Request Ack.**).

Note: Step 6&7 follow normal GSM procedures and are shown only for clarity.

8. When target RNC has detected the UE, **Handover Detect** message is sent to the IWF.
9. The IWF forwards the **Handover Detect** message to the MSC.
10. When the RRC connection is established with the target RNC and necessary radio resources have been allocated, the UE sends RRC message **Handover complete** to the target RNC.
11. Once complete the target RNC sends RANAP message **~~Hard~~ Handover Complete** to the IWF.
12. IWF forwards this message to the GSM MSC (**Handover Complete**).

Steps 14&15 are normal GSM procedures and are shown only for clarity.

7.2.17.4 GSM/BSS ⇒ UTRAN via MAP/E interface

This example shows how handover (Hard Handover) is performed from GSM/BSS to UMTS via MAP/E interface between a UMTS CN and a 2G-MSC.
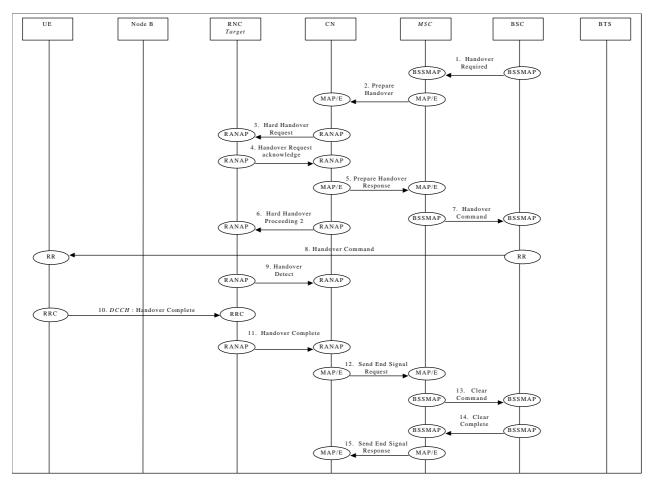
Editor's Note: Interactions between the Node B/RNC and BSC/BTS will be added in a later phase.

Figure 20~~23~~: GSM/BSS $\Rightarrow$ UTRAN handover via MAP/E interface

1. The BSC sends **Handover Required** message to the GSM MSC.
2. The MSC sends MAP/E message **Prepare Handover** to the UMTS CN.
3. The CN sends RANAP message ~~Hard~~ **Handover Request** to the Target RNC.
4. Response **Hard Handover ~~Proceeding 1~~Request Acknowledge** is returned to the CN by the target RNC via RANAP.
5. MAP/E message **Prepare Handover Response** is sent by the UMTS CN to the MSC.
6. The CN sends RANAP message **Hard Handover Proceeding 2** to the Target RNC and the RNC activates reserved resources for the new connection.

Note: Step 7&8 follow normal GSM procedures and are shown only for clarity.

9. When target RNC has detected the UE, ~~Hard~~ **Handover Detect** message is sent to the CN node.
10. When the RRC connection is established with the target RNC and necessary radio resources have been allocated the UE sends RRC message **Handover complete** to the target RNC.
11. Once complete the target RNC sends RANAP message ~~Hard~~ **Handover Complete** to the CN.
12. CN sends MAP/E message **Send End Signal Request** to the MSC.
13. The MSC sends **Clear Command** message to the BSC.
14. The BSC responds with **Clear Complete** message to the GSM
15. The MSC sends MAP/E message **Send End Signal Response** to the UMTS CN to conclude the procedure (this message is not sent until the end of the call).

7.2.18 Load Indication

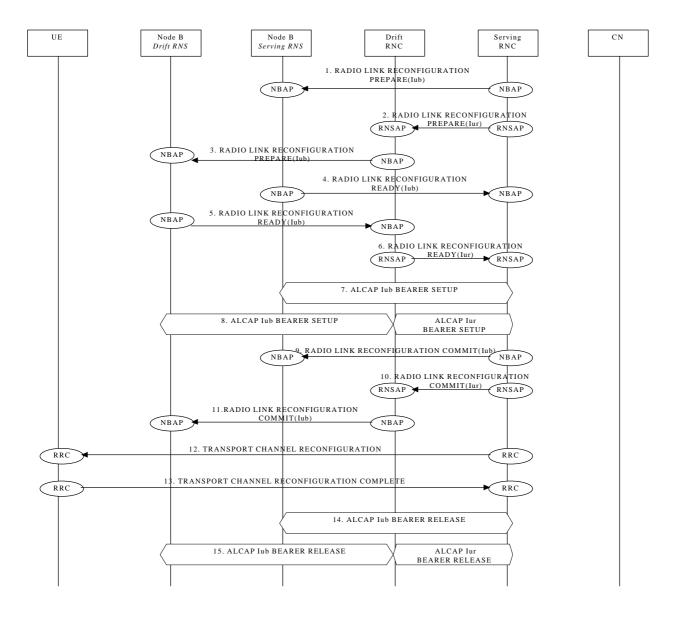This section shows examples of load indication reporting.

7.2.19 Ciphering

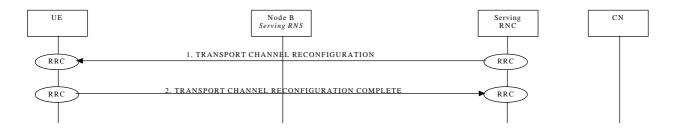This example shows ciphering procedure.
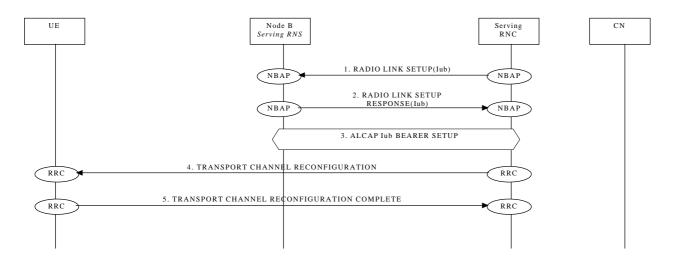
7.2.20 Transport CH Reconfiguration

NOTE: The set of procedures described in section 7.2.20 is FFS

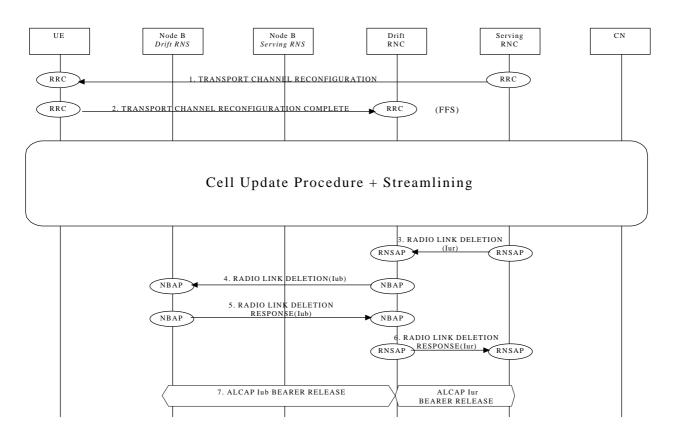## 7.2.20.1 Transport CH Reconfiguration (Dedicated CH to Dedicated CH)

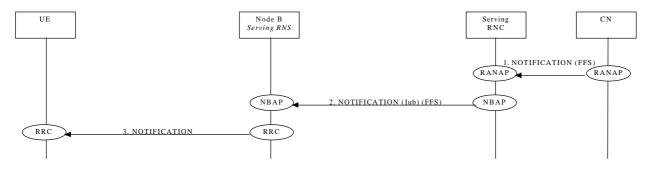## 7.2.20.2 Transport CH Reconfiguration (RACH/FACH to RACH/FACH)

UE	Node B *Serving RNS*	Serving RNC	CN

RRC ← 1. TRANSPORT CHANNEL RECONFIGURATION RRC

RRC → 2. TRANSPORT CHANNEL RECONFIGURATION COMPLETE RRC

7.2.20.3 Transport CH Reconfiguration (RACH/FACH to Dedicated CH)

UE	Node B *Serving RNS*	Serving RNC	CN

NBAP ← 1. RADIO LINK SETUP(Iub) ← NBAP

NBAP → 2. RADIO LINK SETUP RESPONSE(Iub) → NBAP

3. ALCAP Iub BEARER SETUP

RRC ← 4. TRANSPORT CHANNEL RECONFIGURATION ← RRC

RRC → 5. TRANSPORT CHANNEL RECONFIGURATION COMPLETE → RRC

7.2.20.4 Transport CH Reconfiguration (Dedicated CH to RACH/FACH)

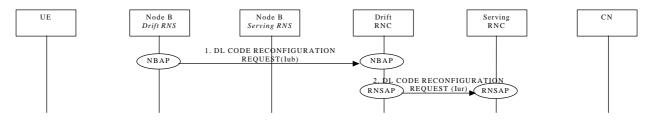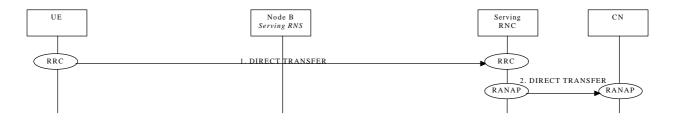## 7.2.21 Notification

NOTE: The whole procedure is FFS.

7.2.22 DL Code Reconfiguration Request

NOTE: The whole procedure is FFS.
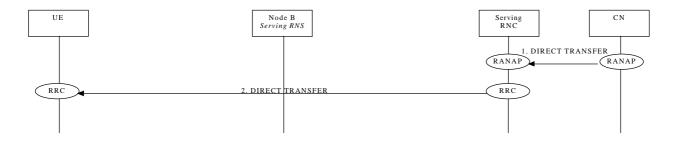
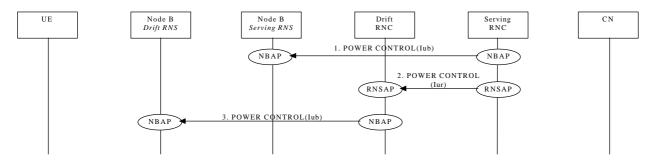## 7.2.23 Direct Transfer

7.2.23.1 Uplink Direct Transfer

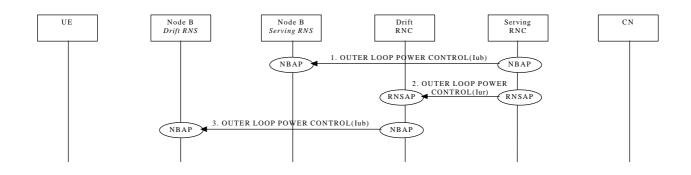## 7.2.23.2 Downlink Direct Transfer

7.2.24   Downlink Power Control

NOTE: The whole procedure is FFS.

7.2.25 Outer-Loop Power Control

UE	Node B *Drift RNS*	Node B *Serving RNS*	Drift RNC	Serving RNC	CN

1. OUTER LOOP POWER CONTROL(Iub)   NBAP ← NBAP

2. OUTER LOOP POWER CONTROL(Iur)   RNSAP ← RNSAP

3. OUTER LOOP POWER CONTROL(Iub)   NBAP ← NBAP

Document history		
Date	**Version**	**Comment**
March 1<u>st</u> 1999	<u>0.0.2</u>	<u>The correct first pages common for 3GPP were introduced (first page, copyright,etc)</u> <u>Revision marks are referred to the modification intreoduced to the document AFTER the TSG-RAN WG3 first meeting – Bon February 99, based on the minor comments receved in line with the decision of the previous meeting, (i.e. comments to the first draft merged version are identified)</u> <u>In this version the revision marsk referre to version 0.0.0 were accepted</u>
February 15<u>th</u> 1999	<u>0.0.1</u>	This version includes also the modification agreed at the TSG-RAN WG3 first meeting based on new contributions <u>Notes</u> • <u>The general information dealing with references and copyrights are not updated to the 3GPP ones (To be introduced when available)</u> • <u>The graphical look of the parts included from the TTC/ARIB document still to be aligned by the editor to the rest of the document (the content is supposed to be aligned)</u>
February 4<u>th</u> 1999	0.0.0	First draft version based on merge of the corresponding ETSI and TTC/ARIB document as agreed at the TSG-RAN WG3 first meeting – Bon February 99. (Revision marks are referred to the ETSI one). This version includes also the modification agreed at the TSG-RAN WG3 first meeting based on new contributions (except document 54 and 55, from which is expected an electronic version with the agreed modifications from the authors) Notes • The general information dealing with references and copyrights are not updated to the 3GPP ones (To be introduced when available) • Alignement of names of messages respect to the Iur and Iub ETSI/ARIB merged interfaces is not complete. (To be introduced/checked later when the correspondant documents will be available in order to limit misalignement) • The graphical look of the parts included from the TTC/ARIB document still to be aligned by the editor to the rest of the document (the content is supposed to be aligned)
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This document is written in Microsoft Word version 97.		