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Technical Report

**Universal Mobile Telecommunications System (UMTS);
UTRAN Functions, Examples on Signalling Procedures
(3GPP TR 25.931 version 3.1.0 Release 1999)**

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Contents

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1 Scope

The present 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.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

[1]   25.990: "Vocabulary".

[2]   25.401: "UTRAN Overall Description".

[3]   25.413: "UTRAN Iu Interface RANAP Signalling".

[4]   25.423: "UTRAN Iur Interface RNSAP Signalling".

[5]   25.433: "UTRAN Iub Interface NBAP Signalling".

[6]   25.832: "Manifestations of Handover and SRNS Relocation".

[7]   25.301: "Radio Interface Protocol Architecture".

[8]   25.331: "RRC Protocol Specification".

[9]   25.419: "UTRAN Iu Interface: Service Area Broadcast Protocol SABP".

[10]   25.324: "Radio Interface for Broadcast/Multicast Services".

[11]   25.925: "Radio Interface for Broadcast/Multicast Services".

[12]   23.041: "Technical realisation of Cell Broadcast Service (CBS)".

[13]   25.425: "UTRAN Iur Interface User Plane Protocols for Common Transport Channel Data Streams"

[14]   25.435: "UTRAN Iub Interface User Plane Protocols for Common Transport Channel Data Streams"

[15]   25.427: " UTRAN Iub/Iur Interface User Plane Protocol for DCH Data Streams "

3 Definitions, abbreviations and notation

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [1], [2] and [4] apply.

3.2 Abbreviations

For the purposes of the present document the following abbreviations apply:

NOTE: More extensive abbreviations on UMTS are provided in [1].

AAL2	ATM Adaptation Layer type 2
ACK	Acknowledgement
AICH	Acquisition Indicator CHannel
ALCAP	Access Link Control Application Part
AM	Acknowledged Mode
AS	Access Stratum
ATM	Asynchronous Transfer Mode
BCCH	Broadcast Control Channel
BCFE	Broadcast Control Functional Entity
BER	Bit Error Rate
BLER	Block Error Rate
BMC	Broadcast/Multicast Control
BSS	Base Station Sub-system
BSSMAP	Base Station System Management Application Part
CCCH	Common Control Channel
CCPCH	Common Control Physical CHannel
CFN	Connection Frame Number
CM	Connection Management
CN	Core Network
CPCH	Common Packet CHannel
CPICH	Common Pilot Channel
CRNC	Controlling RNC
C-RNTI	Cell RNTI
CS	Circuit Switched
DCA	Dynamic Channel Allocation
DCCH	Dedicated Control Channel
DCFE	Dedicated Control Functional Entity
DCH	Dedicated Channel
DC-SAP	Dedicated Control SAP
DL	Downlink
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DRAC	Dynamic Resource Allocation Control
DRNC	Drift RNC
DRNS	Drift RNS
DRX	Discontinuous Reception
DSCH	Downlink Shared Channel
DTCH	Dedicated Traffic Channel
EP	Elementary Procedure
FACH	Forward Access Channel
FAUSCH	Fast Uplink Signalling Channel
FDD	Frequency Division Duplex
FFS	For Further Study
FN	Frame Number
FP	Frame Protocol
ID	Identifier
IE	Information element
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
ISCP	Interference on Signal Code Power
L1	Layer 1
L2	Layer 2
L3	Layer 3
LAI	Location Area Identity
MAC	Medium Access Control

MCC	Mobile Country Code
MM	Mobility Management
MNC	Mobile Network Code
MS	Mobile Station
MSC	Mobile services Switching Center
NAS	Non Access Stratum
NBAP	Node B Application Protocol
Nt-SAP	Notification SAP
NW	Network
O	Optional
ODMA	Opportunity Driven Multiple Access
PCCH	Paging Control Channel
PCH	Paging Channel
PDCP	Packet Data Convergence Protocol
PDSCH	Physical Downlink Shared Channel
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
PNFE	Paging and Notification Control Functional Entity
PRACH	Physical Random Access CHannel
PS	Packet Switched
PSCH	Physical Synchronisation Channel
P-TMSI	Packet Temporary Mobile Subscriber Identity
PUSCH	Physical Uplink Shared Channel
QoS	Quality of Service
RAB	Radio Access Bearer
RACH	Random Access CHannel
RAI	Routing Area Identity
RANAP	Radio Access Network Application Part
RB	Radio Bearer
RFE	Routing Functional Entity
RL	Radio Link
RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNSAP	Radio Network Subsystem Application Part
RNTI	Radio Network Temporary Identifier
RRC	Radio Resource Control
RSCP	Received Signal Code Power
RSSI	Received Signal Strength Indicator
SAI	Service Area Identifier
SAP	Service Access Point
SCCP	Signalling Connection Control Part
SCFE	Shared Control Function Entity
SF	Spreading Factor
SFN	System Frame Number
SGSN	Serving GPRS Support Node
SHCCH	Shared Control Channel
SIR	Signal to Interference Ratio
SRNC	Serving RNC
SRNS	Serving RNS
S-RNTI	SRNC - RNTI
SSDT	Site Selection Diversity Transmission
TDD	Time Division Duplex
TEID	Tunnel Endpoint Identifier
TF	Transport Format
TFCI	Transport Format Combination Indicator
TFCS	Transport Format Combination Set
TFS	Transport Format Set
TME	Transfer Mode Entity
TMSI	Temporary Mobile Subscriber Identity
Tr	Transparent
Tx	Transmission

UARFCN	UMTS Absolute Radio Frequency Channel Number
UE	User Equipment
UL	Uplink
UM	Unacknowledged Mode
UMTS	Universal Mobile Telecommunication System
UNACK	Unacknowledgement
URA	UTRAN Registration Area
U-RNTI	UTRAN-RNTI
USCH	Uplink Shared Channel
UTRAN	UMTS Terrestrial Radio Access Network

3.3   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 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 1;

- The Setup and Release of Iub/Iur and Iu Data Transport Bearer with the ALCAP protocol is represented as shown in Figure 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 1
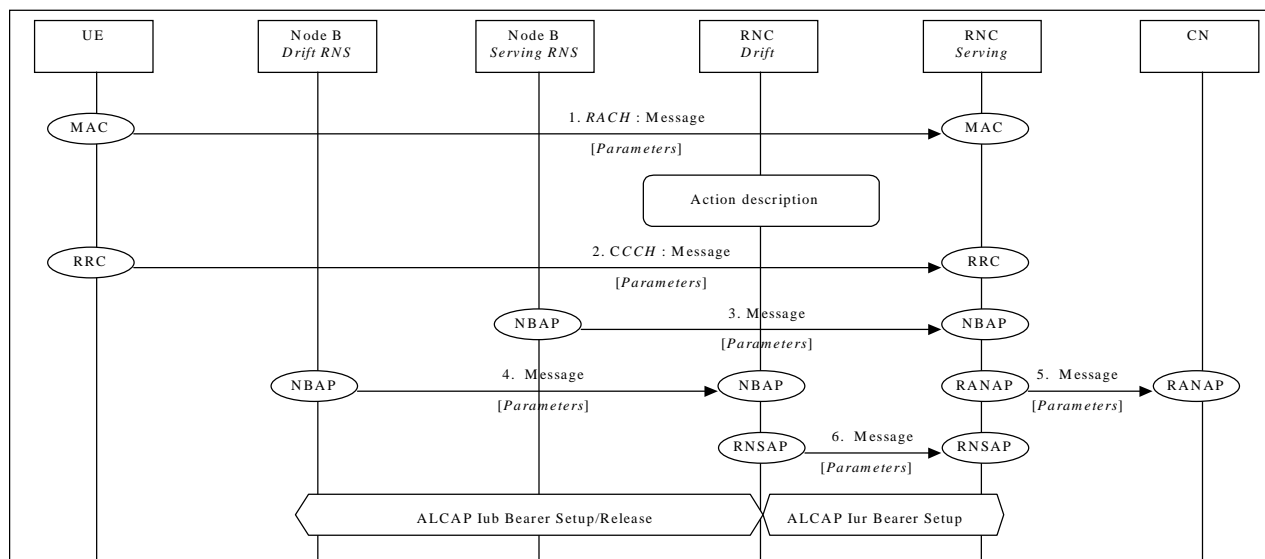
Figure 1: Example of signalling procedure notation

4   UTRAN and UE protocol Architecture

4.1   Protocol Architecture

For a detailed description of the Protocol Architecture and the Radio Protocol Architecture for the UTRAN and the UE refer to [2] and [7] respectively.

4.2   RANAP Procedures & Messages

For a detailed description of RANAP procedures and messages refer to [3]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 1

Message Name	UTRAN Procedure	Direction
Direct Transfer	Uplink Direct Transfer Downlink Direct Transfer	RNC ⇒ CN CN ⇒ RNC
Initial UE Message	NAS Signalling Connection Establishment	RNC ⇒ CN
Iu Release Command	RRC Connection Release Hard HO with switching in the CN SRNS Relocation UTRAN ⇒ GSM/BSS handover	CN ⇒ RNC CN ⇒ RNC CN ⇒ RNC CN ⇒ RNC
Iu Release Complete	RRC Connection Release Hard HO with switching in the CN SRNS Relocation UTRAN ⇒ GSM/BSS handover	RNC ⇒ CN RNC ⇒ CN RNC ⇒ CN RNC ⇒ CN
Paging	Paging for a UE in RRC Idle Mode Paging for a UE in RRC Connected Mode	CN ⇒ RNC CN ⇒ RNC
Radio Access Bearer Assignment Request	Radio Access Bearer Establishment Radio Access Bearer Release Radio Access Bearer Modification	CN ⇒ RNC CN ⇒ RNC CN ⇒ RNC
Radio Access Bearer Assignment Response	Radio Access Bearer Establishment Radio Access Bearer Release Radio Access Bearer Modification	RNC ⇒ CN RNC ⇒ CN RNC ⇒ CN
Relocation Command	Hard HO with switching in the CN SRNS Relocation UTRAN ⇒ GSM/BSS handover	CN ⇒ RNC CN ⇒ RNC CN ⇒ RNC
Relocation Complete	Hard HO with switching in the CN SRNS Relocation GSM/BSS handover ⇒ UTRAN	RNC ⇒ CN RNC ⇒ CN RNC ⇒ CN
Relocation Detect	Hard HO with switching in the CN GSM/BSS handover ⇒ UTRAN	RNC ⇒ CN RNC ⇒ CN
Relocation Failure	SRNS Relocation	RNC ⇒ CN
Relocation Request	Hard HO with switching in the CN SRNS Relocation GSM/BSS handover ⇒ UTRAN	CN ⇒ RNC CN ⇒ RNC CN ⇒ RNC
Relocation Request Acknowledge	Hard HO with switching in the CN SRNS Relocation GSM/BSS handover ⇒ UTRAN	RNC ⇒ CN RNC ⇒ CN RNC ⇒ CN
Relocation Required	Hard HO with switching in the CN SRNS Relocation UTRAN ⇒ GSM/BSS handover	RNC ⇒ CN RNC ⇒ CN RNC ⇒ CN

4.3   SABP Procedures & Messages

For a detailed description of SABP procedures and messages refer to [9]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 2

Message Name	UTRAN Procedure	Direction
Write-replace	Service Area Broadcast	CN ⇒ RNC
Write-replace Complete	Service Area Broadcast	RNC ⇒ CN
Write-Replace Failure	Service Area Broadcast	RNC ⇒ CN

4.4 RNSAP Procedures & Messages

For a detailed description of RNSAP procedures and messages refer to [4]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 3

Message Name	UTRAN Procedure	Direction
Common Transport Channel Resources Release	Cell Update	SRNC ⇒ DRNC
Common Transport Channel Resources Initialisation Request	Cell Update	SRNC ⇒ DRNC
Common Transport Channel Resources Initialisation Response	Cell Update	DRNC ⇒ SRNC
DL Power Control Request	Downlink Power Control	SRNC ⇒ DRNC
Downlink Signalling Transfer Request	RRC Connection Re-establishment URA Update	SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Addition Request	RRC Connection Release Soft Handover Hard Handover	SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Addition Response	RRC Connection Release Soft Handover Hard Handover	DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC
Radio Link Deletion Request	RRC Connection Re-establishment Soft Handover Hard Handover	SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Deletion Response	RRC Connection Re-establishment Soft Handover Hard Handover	DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC
Radio Link Failure Indication	Hard Handover	DRNC ⇒ SRNC
Radio Link Reconfiguration Request	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration	SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Reconfiguration Commit	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration Radio Access Bearer Modification	SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Reconfiguration Prepare	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration Radio Access Bearer Modification	SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Reconfiguration Ready	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration Radio Access Bearer Modification	DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC
Radio Link Reconfiguration Response	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration	DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC
Radio Link Setup Request	RRC Connection Re-establishment Hard Handover USCH/DSCH Configuration and Capacity Allocation [TDD]	SRNC ⇒ DRNC SRNC ⇒ DRNC SRNC ⇒ DRNC
Radio Link Setup Response	RRC Connection Re-establishment Hard Handover USCH/DSCH Configuration and Capacity Allocation [TDD]	DRNC ⇒ SRNC DRNC ⇒ SRNC DRNC ⇒ SRNC
Relocation Commit	SRNS Relocation URA Update	Source RNC ⇒ Target RNC
Uplink Signalling Transfer Indication	RRC Connection Re-establishment URA Update	DRNC ⇒ SRNC DRNC ⇒ SRNC

4.5 NBAP Procedures & Messages

For a detailed description of NBAP procedures and messages refer to [5]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 4

Message Name	UTRAN Procedure	Direction
DL Power Control Request	Downlink Power Control	RNC ⇒ Node B
Paging	Paging	RNC ⇒ Node B
Physical Shared Channel Reconfiguration Request	USCH/DSCH Configuration and Capacity Allocation [TDD]	RNC ⇒ Node B
Physical Shared Channel Reconfiguration Request	USCH/DSCH Configuration and Capacity Allocation [TDD]	Node B ⇒ RNC
Radio Link Addition Request	Hard Handover Soft Handover	RNC ⇒ Node B RNC ⇒ Node B
Radio Link Addition Response	Hard Handover Soft Handover	RNC ⇒ Node B RNC ⇒ Node B
Radio Link Deletion	RRC Connection Release RRC Connection Re-establishment Hard Handover Soft Handover	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Deletion Response	RRC Connection Release RRC Connection Re-establishment Hard Handover Soft Handover	Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC
Radio Link Failure Indication	Hard Handover	Node B ⇒ RNC
Radio Link Reconfiguration Commit	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration Radio Access Bearer Modification	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Reconfiguration Prepare	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration Radio Access Bearer Modification	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Reconfiguration Ready	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration Radio Access Bearer Modification	Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC
Radio Link Reconfiguration Request	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Reconfiguration Response	Radio Access Bearer Establishment Radio Access Bearer Release Physical Channel Reconfiguration Transport Channel Reconfiguration	Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC
Radio Link Setup Request	RRC Connection Establishment RRC Connection Re-establishment Hard Handover Soft Handover USCH/DSCH Configuration and Capacity Allocation [TDD]	RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B RNC ⇒ Node B
Radio Link Setup Response	RRC Connection Establishment RRC Connection Re-establishment Hard Handover Soft Handover USCH/DSCH Configuration and Capacity Allocation [TDD]	Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC Node B ⇒ RNC
System Information Broadcast Request	System Information Broadcasting Service Area Broadcast	RNC ⇒ Node B RNC ⇒ Node B
System Information Broadcast Response	System Information Broadcasting Service Area Broadcast	Node B ⇒ RNC Node B ⇒ RNC

4.6   ALCAP

ALCAP is a generic name to indicate the protocol(s) used to establish data transport bearers on the Iu, Iur and Iub interfaces. Q.2630.1 (Q AAL2) is one of the selected protocols to be used as ALCAP.

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.

4.6.1   Q2630.1 (Q.AAL 2)

The following figure is showing an example of use of Q.2630.1 in the UTRAN context, for the different interfaces.
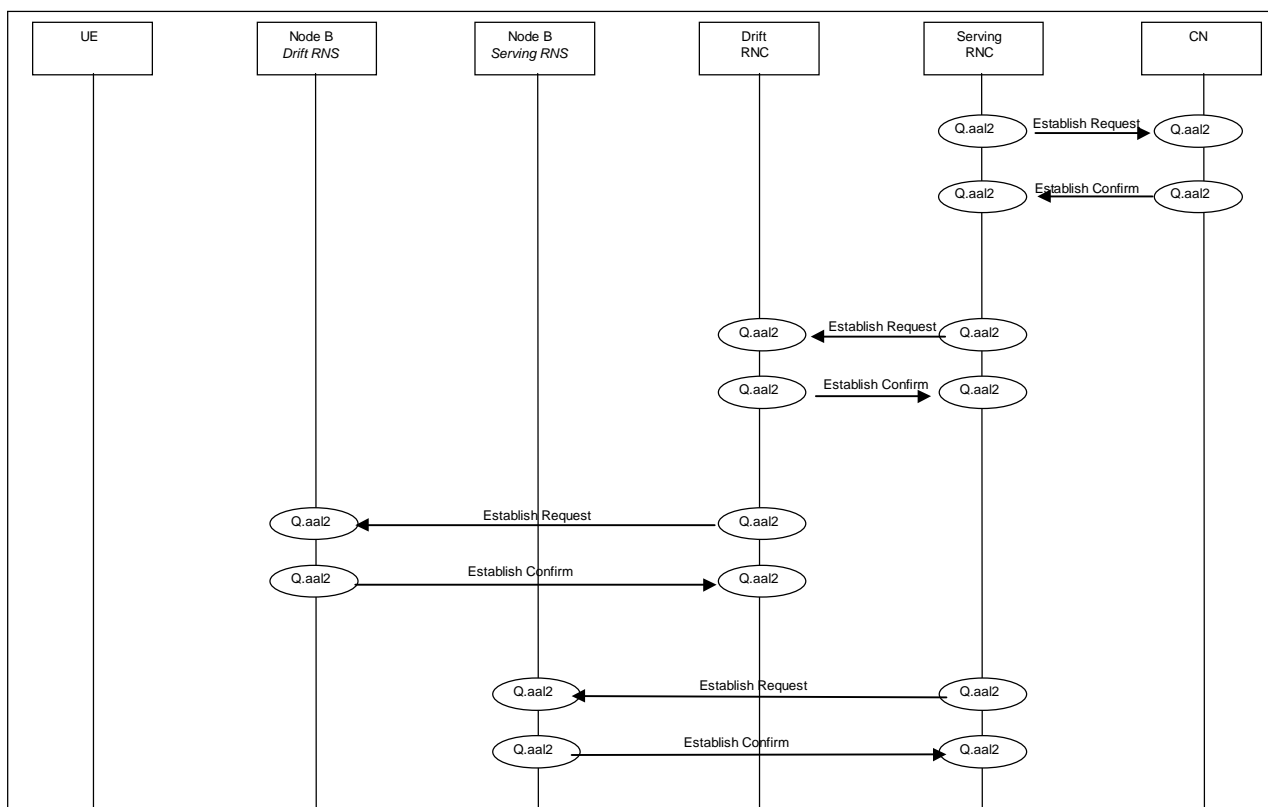

Figure 2: Example on Q.2630.1

4.7   RRC Procedures & Messages

For a detailed description of RRC procedures and messages refer to [8]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 5

Message Name	UTRAN Procedure	Direction
Active Set Update	Soft Handover	RNC ⇒ UE
Active Set Update Complete	Soft Handover	UE ⇒ RNC
Cell Update	Cell Update	UE ⇒ RNC
Cell Update Confirm	Cell Update	RNC ⇒ UE
Direct Transfer	NAS Signalling Conn. Establishment	UE ⇔ RNC
Downlink Direct Transfer	Downlink Direct Transfer	RNC ⇒ UE
Initial Direct Transfer	NAS Signalling Connection Establishment	UE ⇒ RNC
Measurement Control	Downlink Power Control	RNC ⇒ UE
Measurement Report	Downlink Power Control	UE ⇒ RNC
Paging Type 1	Paging for a UE in RRC Idle Mode and RRC connected mode (CELL_PCH and URA_PCH states)Paging for a UE in RRC Connected Mode	RNC ⇒ UE
Paging Type 2	Paging for a UE in RRC Connected Mode (CELL_DCH and CELL_FACH states)	RNC ⇒ UE
Physical Channel Reconfiguration	Physical Channel Reconfiguration Hard Handover	RNC ⇒ UE RNC ⇒ UE
Physical Channel Reconfiguration Allocation	USCH/DSCH Configuration and Capacity Allocation [TDD]	RNC ⇒ UE
Physical Channel Reconfiguration Complete	Physical Channel Reconfiguration Hard Handover	UE ⇒ RNC UE ⇒ RNC
PUSCH Capacity Request	USCH/DSCH Configuration and Capacity Allocation [TDD]	UE ⇒ RNC
RB Reconfiguration	USCH/DSCH Configuration and Capacity Allocation [TDD]	RNC ⇒ UE
RB Reconfiguration Complete	USCH/DSCH Configuration and Capacity Allocation [TDD]	UE ⇒ RNC
RB Release	Radio Access Bearer Release	RNC ⇒ UE
RB Release Complete	Radio Access Bearer Release	UE ⇒ RNC
RB Setup	Radio Access Bearer Establishment	RNC ⇒ UE
RB Setup Complete	Radio Access Bearer Establishment	UE ⇒ RNC
RNTI Reallocation Complete	Cell Update URA Update	UE ⇒ RNC UE ⇒ RNC
RRC Connection Re-establishment	RRC Connection Re-establishment	RNC ⇒ UE
RRC Connection Re-establishment Complete	RRC Connection Re-establishment	UE ⇒ RNC
RRC Connection Re-establishment Request	RRC Connection Re-stablishment	UE ⇒ RNC
RRC Connection Release	RRC Connection Release	RNC ⇒ UE
RRC Connection Release Complete	RRC Connection Release	UE ⇒ RNC
RRC Connection Request	RRC Connection Establishment.	UE ⇒ RNC
RRC Connection Setup	RRC Connection Establishment	RNC ⇒ UE
RRC Connection Setup Complete	RRC Connection Establishment	UE ⇒ RNC
System Information	System Information Broadcasting	Node B ⇒ UE
Transport Channel Reconfiguration	Physical Channel Reconfiguration	RNC ⇒ UE
Transport Channel Reconfiguration Complete	Physical Channel Reconfiguration	UE ⇒ RNC
UE Capability Information	NAS Signalling Conn. Establishment.	UE ⇒ RNC
Uplink Direct Transfer	Uplink Direct Transfer	UE ⇒ RNC
URA Update	Cell Update	UE ⇒ RNC
URA Update Confirm	Cell Update	RNC ⇒ UE

4.8 BMC Procedures & Messages

For a detailed description of BMC procedures and messages refer to [11] and [12]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 6

Message Name	UTRAN Procedure	Direction
CBS Message	Service Area Broadcast	Node B ⇒ UE

4.9 DCH Frame Protocol Messages

For a detailed description of DCH Frame protocol messages refer to [15]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 7

Message Name	UTRAN Procedure	Direction
Downlink Synchronisation	RRC Connection Establishment Radio Access Bearer Establishment Soft Handover	SRNC ⇒ Node B SRNC ⇒ Node B SRNC ⇒ Node B
Uplink Synchronisation	RRC Connection Establishment Radio Access Bearer Establishment Soft Handover	Node B ⇒ SRNC Node B ⇒ SRNC Node B ⇒ SRNC

4.10 DSCH Frame Protocol Messages

For a detailed description of DSCH Frame protocol messages refer to [13]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 8

Message Name	UTRAN Procedure	Direction
DSCH Capacity Allocation	USCH/DSCH Configuration and Capacity Allocation [TDD]	DRNC ⇒ SRNC
DSCH Capacity Request	USCH/DSCH Configuration and Capacity Allocation [TDD]	SRNC ⇒ DRNC

4.11 USCH Frame Protocol Messages

For a detailed description of DSCH Frame protocol messages refer to [14]. Only Messages mentioned in the present document are shown. For each message is also given the list of example procedures where the message is used, as provided by this document.

Table 9

Message Name	UTRAN Procedure	Direction
Dynamic PUSCH Assign	USCH/DSCH Configuration and Capacity Allocation [TDD]	RNC ⇒ Node B

5 UTRAN Signalling 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.

The list of parameters is not be complete, but should only be seen as help for the understanding of the examples.

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

This clause presents some signalling procedures not related to a specific UE.

6.1 System Information Broadcasting

This example shows an example of System Information broadcasting.
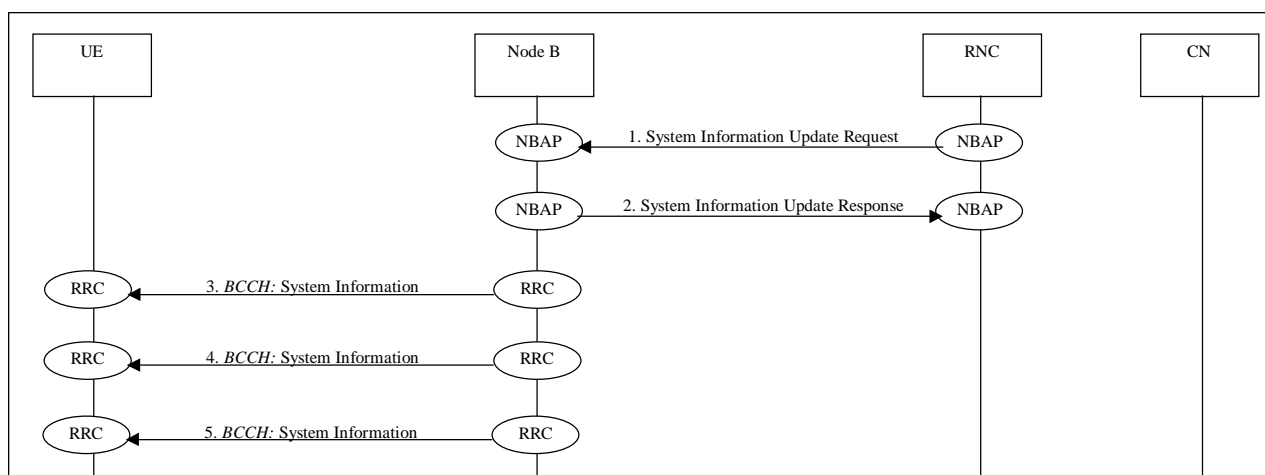
Figure 3: System Information Broadcasting

1. The RNC forwards the request to the pertinent node(s) B for via NBAP message **System Information Update Request**.
   Parameters: Master/Segment Information Block(s) (System information to be broadcasted), BCCH modification time.
2. The Node B confirm the ability to broadcast the information sending **System Information Update Response** message to the RNC via NBAP. (If the Node B can not Broadcast the information as requested, System Information Update Failure is return to the RNC).
3./4./5. The information is broadcasted on the air interface by RRC message **System Information**.
   Parameters: Master/Segment Information Block(s) (System information).

6.2 Service Area Broadcast

This example shows an example of broadcasting of Cell Information. UTRAN transports this broadcast information transparently.

Figure 4: Service Area Broadcast
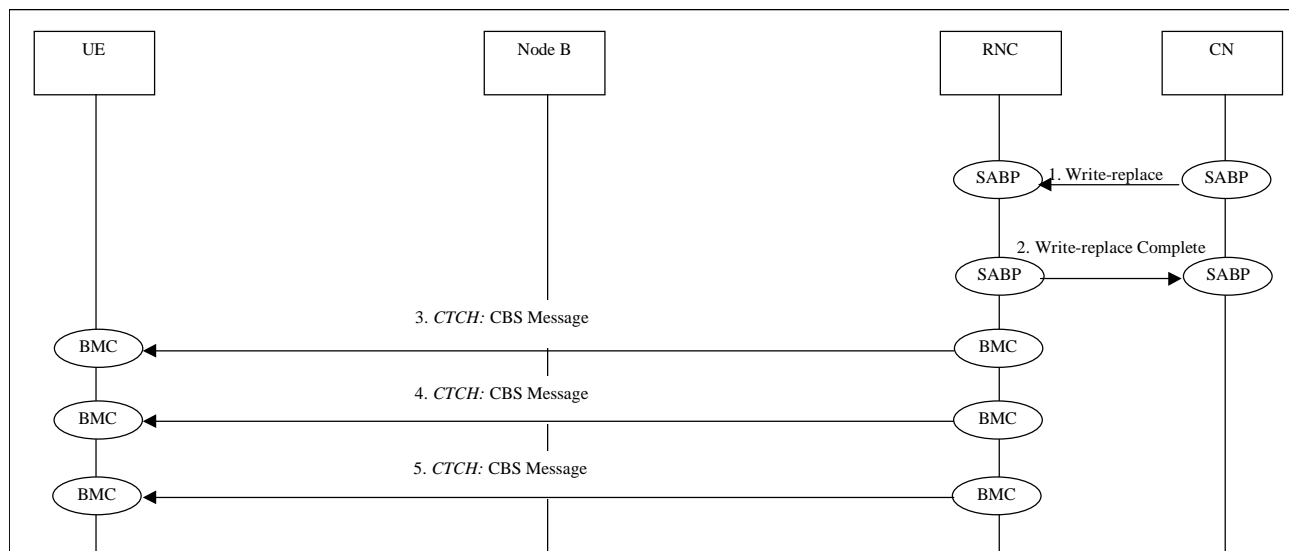
1. The CN asks the RNC for an information Broadcast via SABP message **Write-replace**.
   Parameters: Broadcast-Message-Content, Service-Area-List.
2. The RNC confirm the ability to broadcast the information sending **Write-Replace Complete** message to the CN via SABP. (If the RNC can not Broadcast the information as requested, Write-replace Failure message is return to the CN).
3./4./5. The information is broadcasted on the air interface by BMC message **CBS Message**. carried over CTCH channel.
   Parameters: Message ID, CB Data.

Note that the Node B is transparent to this messaging because (as mentioned in [10],[11] and [12]) the BMC protocol is terminated in RNC (see also [7]).

7 Procedures related to a specific UE

This clause presents a number of signalling procedures related to a specific UE.

7.1 Paging

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

7.1.1 Paging for a UE in RRC Idle Mode and RRC connected mode (CELL_PCH and URA_PCH states)

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.
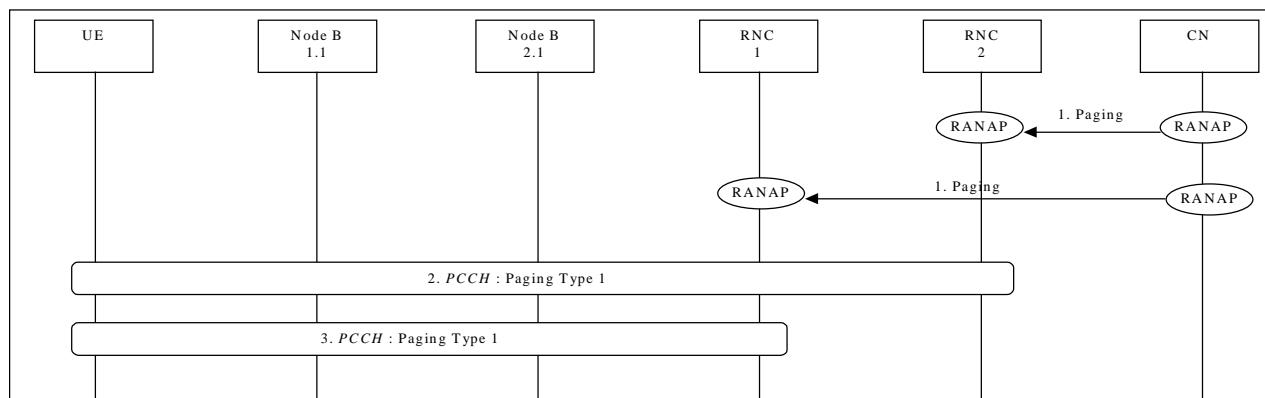
Figure 5: Paging for a UE in RRC Idle Mode

1. CN initiates the paging of a UE over a LA spanning two RNCs (i.e. RNC1 and RNC2) via RANAP message **Paging**.
   Parameters: CN Domain Indicator, Permanent NAS UE Identity, Temporary UE Identity, Paging Cause.
2. Paging of UE performed by cell1 using **Paging Type 1** message.
3. Paging of UE performed by cell2 using **Paging Type 1** message.

The UE detects page message from RNC1 (as example) and the procedure for NAS signalling connection establishment follows. NAS message transfer can now be performed.

This procedure described for RRC idle mode, applies also to the RRC connected mode in the case of CELL_PCH and URA_PCH states.

7.1.2 Paging for a UE in RRC Connected Mode (CELL_DCH and CELL_FACH states)

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 (CELL_DCH and CELL_FACH states) when the UTRAN coordinates the paging request with the existing RRC connection using DCCH.
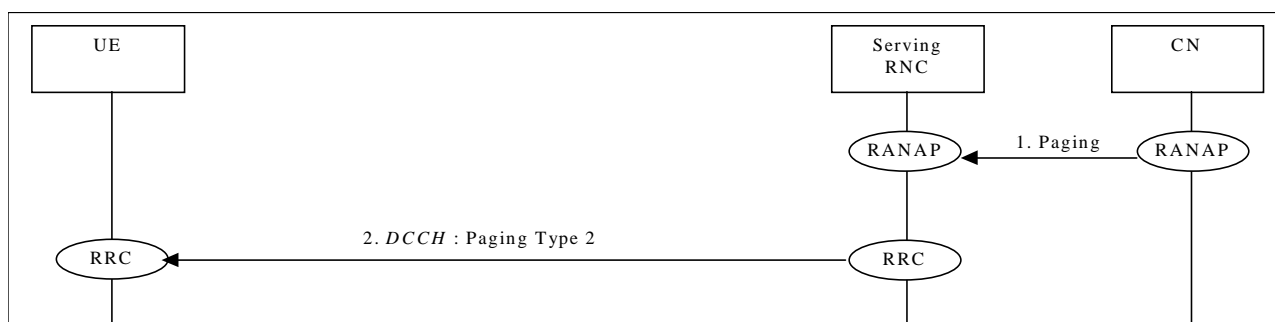

Figure 6: Paging for a UE in RRC Connected Mode (CELL_DCH and CELL_FACH states)

1. CN initiates the paging of a UE via RANAP message **Paging**.
   Parameters: CN Domain Indicator, Permanent NAS UE Identity, Temporary UE Identity, Paging Cause.
2. SRNC sends RRC message **Paging Type 2**.

7.2   NAS Signalling Connection Establishment

This example shows establishment of a NAS Signalling Connection.

This establishment could be request by the terminal by itself (for example to initiate a service) or could be stimulated by a paging from the CN.
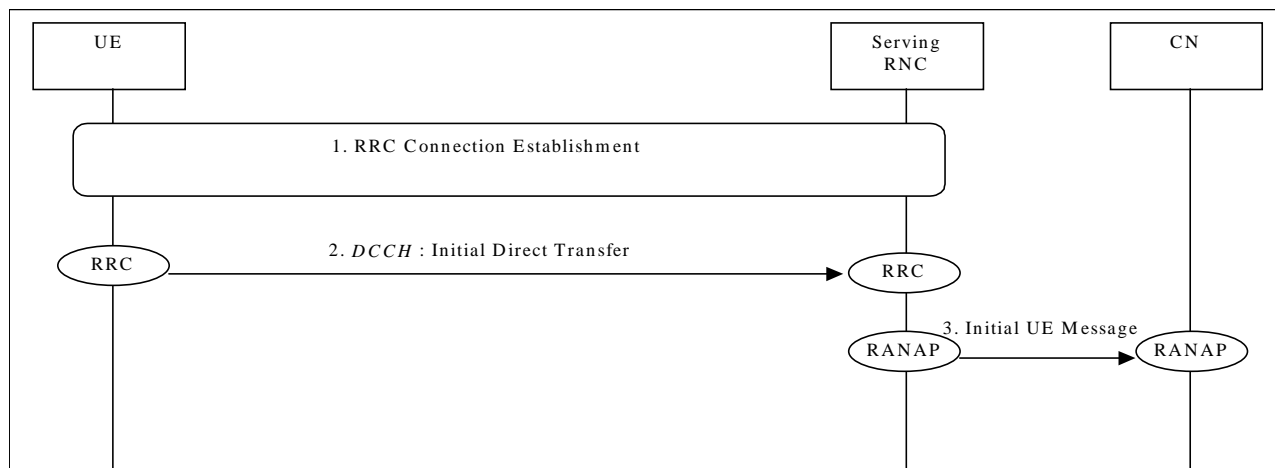
Figure 7: NAS Signalling Connection Establishment

1. RRC Connection is established (see 7.3.1 or 7.3.2).
2. UE sends RRC **Initial 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).
3. SRNC initiates signalling connection to CN, and sends the RANAP message **Initial UE Message**.
   Parameters: NAS PDU (could for a GSM based CN be e.g. CM Service Request, Location Update Request etc.), CN domain indicator (indicating the CN domain towards which this message is sent).

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

7.3   RRC Connection Establishment

The following examples show establishment of a RRC connection either in dedicated transport channel (DCH) state or in common transport channel (RACH/FACH) state.

7.3.1   DCH Establishment

This example shows establishment of an RRC connection in dedicated transport channel (DCH) state.

Figure 8: RRC Connection Establishment - DCH Establishment

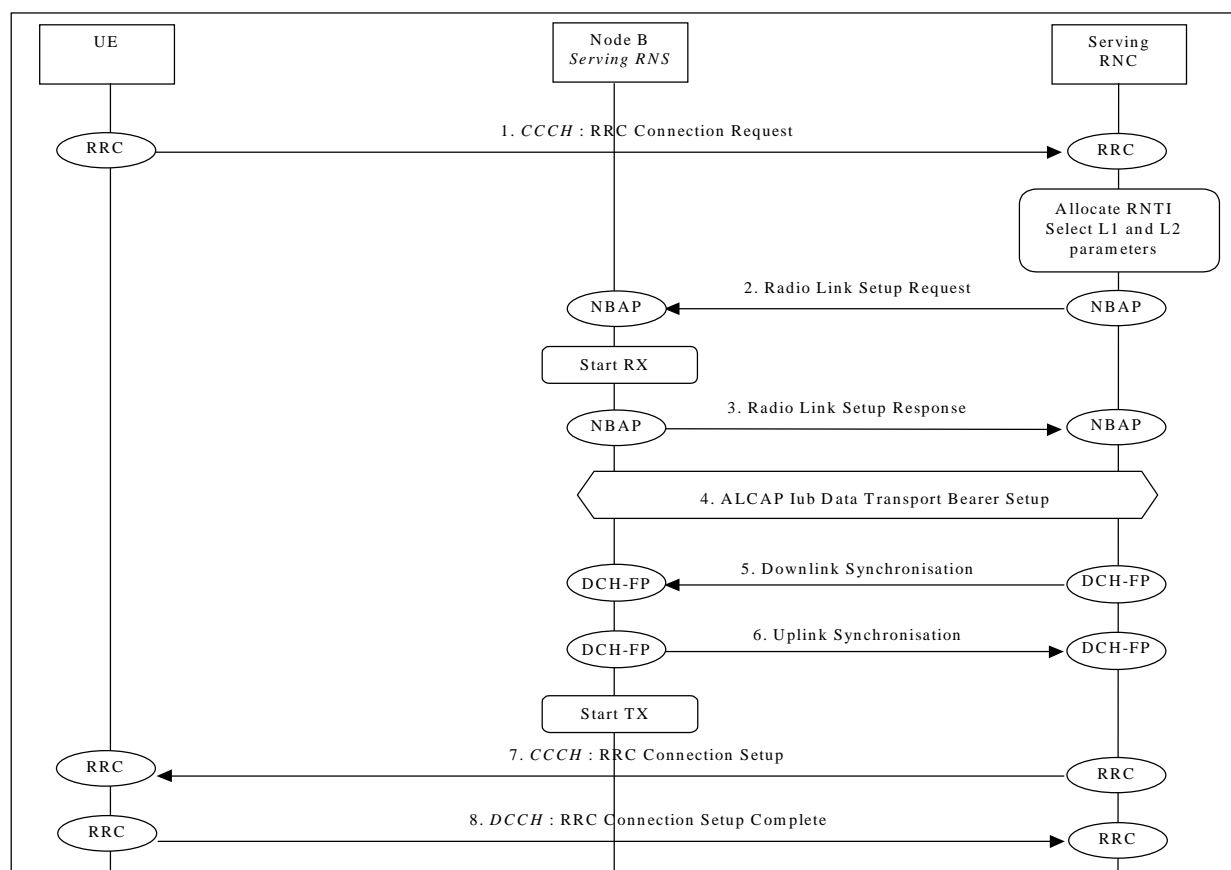1. The UE initiates set-up of an RRC connection by sending RRC message **Connection Request** on CCCH.
   Parameters: Initial UE Identity, Establishment cause, Initial UE Capability.
2. The SRNC decides to use a DCH for this RRC connection, allocates RNTI and radio resources for the RRC connection. When 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), Power control information.
3. Node B allocates resources, starts PHY reception, and responses with NBAP message **Radio Link Setup Response**.
   Parameters: Signalling link termination, 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./6. The Node B and SRNC establish synchronism for the Iub and Iur Data Transport Bearer by means of exchange of the appropriate DCH Frame Protocol frames **Downlink Synchronisation** and **Uplink Synchronisation**. Then Node B starts DL transmission.
7. Message **RRC Connection Setup** is sent on CCCH from SRNC to UE.
   Parameters: Initial UE Identity, RNTI, Capability update Requirement, Transport Format Set, Transport Format Combination Set, frequency, DL scrambling code (FDD only), Time Slots (TDD only), User Codes (TDD only), Power control information.
8. Message **RRC Connection Setup Complete** is sent on DCCH from UE to SRNC.
   Parameters: Integrity information, ciphering information.

7.3.2   RACH/FACH Establishment

An Example of procedure for establishment of an RRC connection in common transport channel (RACH/FACH) state is specified in subclause 8.2.1 of [5]. A prerequisite for this example is that the necessary Iub Data Transport bearer for the RACH/FACH is established prior to this procedure.

7.4　　RRC Connection Release

The following examples show RRC connection release either of a dedicated channel (DCH) or of a common transport channel (RACH/FACH).

7.4.1　　DCH Release

This example shows RRC Connection release of a dedicated channel, in the case of macrodiversity on two nodes B, the first one connected to the Serving RNC, the second one to the Drift RNC.
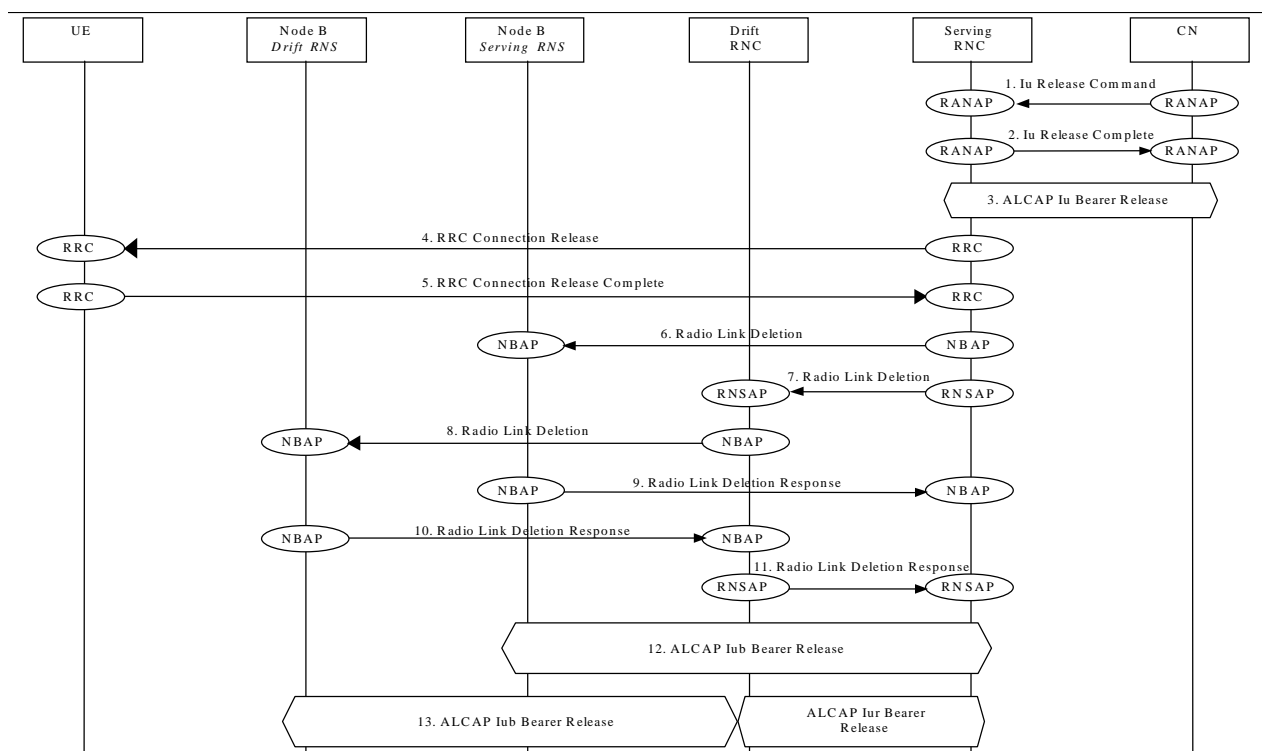

Figure 9: RRC Connection release of a dedicated channel

1.　The CN initiates the release of a dedicated Channel by sending the message **Iu Release Command** to the SRNC. Parameters: Cause.
2.　The SRNC confirms the release by sending a **Iu Release Complete** message to the CN. Parameters: Data volume Report (if data volume reporting to PS is required).
3.　The SRNC initiates release of Iu Data Transport bearer using ALCAP protocol.
4.　Message **RRC Connection Release** from SRNC to UE to initiate the RRC connection release. Parameters: Cause.
5.　Message **RRC Connection Release Complete** from UE to SRNC to confirm the RRC connection release.
6.　The SRNC initiates the release of the link by sending the **Radio Link Deletion** to the Node B (SRNC).
7.　The SRNC initiates the release of the link by sending the **Radio Link Deletion** to the Drift RNC.
8.　The Drift RNC initiates the release of the link by sending the **Radio Link Deletion** to the Node B (Drift RNC).
9.　The Node B (SRNC) confirms the release of the link by sending the **Radio Link Deletion Response** to the SRNC.
10.　The Node B (Drift RNC) confirms the release of the link by sending the **Radio Link Deletion Response** to the Drift RNC.
11.　The Drift RNC confirms the release of the link by sending the Radio Link Deletion Response to the SRNC.
12.　The Node B (SRNC) initiates release of Iub Data Transport bearer using ALCAP protocol.
13.　The Node B (Drift RNC) initiates release of Iub Data Transport bearer using ALCAP protocol.
14.　The Drift RNC initiates release of Iur Data Transport bearer using ALCAP protocol.

7.4.2　　Common Transport Channel Release

This example shows RRC Connection release of a common transport channel.
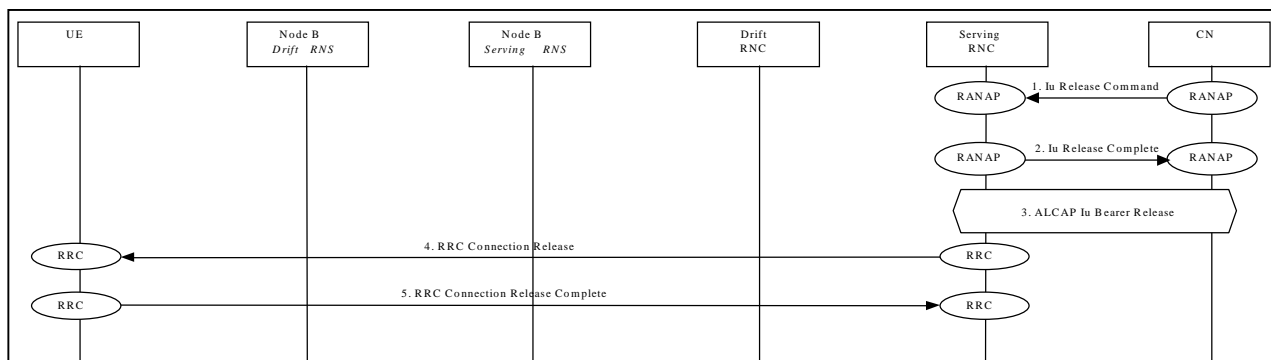
Figure 10: RRC Connection release of a common transport channel

1. The CN initiates the release of a dedicated Channel by sending the message **Iu Release Command** to the SRNC.
   Parameters: Cause.
2. The SRNC confirms the release by sending a **Iu Release Complete** message to the CN.
   Parameters: Data volume Report (if data volume reporting to PS is required).
3. The SRNC initiates release of Iu Data Transport bearer using ALCAP protocol.
4. Message **RRC Connection Release** from SRNC to UE to initiate the RRC connection release.
   Parameters: Cause.
5. Message **RRC Connection Release Complete** from UE to SRNC to confirm the RRC connection release.

7.5   RRC Connection Re-establishment

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

7.5.1   DCH Re-establishment

7.5.1.1   RRC connection Re-establishment (Anchor approach) – DCH Re-establishment

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

Figure 11: RRC connection Re-establishment (Anchor approach) – DCH Re-establishment

1. The UE initiates the re-establishment of the RRC connection with the new cell by sending **RRC Connection Re-establishment Request** message on CCCH.
2. The new RNC delivers this message transparently as **Uplink Signalling Transfer Indication** message to the serving RNC, the RNSAP delivers it to the RRC.
3. The serving RNC allocates radio resources for the RRC connection on Iur, and sends the RNSAP message **Radio Link Setup Request** to the target RNC.
4. The target RNC sends the NBAP message **Radio Link Setup Request** to the target Node B.
5. Node B allocates resources, and responses with NBAP message **Radio Link Setup Response**.
6. Target RNC responses with RNSAP message **Radio Link Setup Response**.

7. Serving RNC initiates set-up 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 the DCH. The request for set-up of Iur / Iub Data Transport bearer is acknowledged by target RNC / Node B.

8./9./10./11./12./13. The SRNC initiates release of Iur/Iub Data Transport bearer using ALCAP protocol and also release of Iur/Iub Radio resource using RNSAP / NBAP protocols.

14. The RRC in the serving RNC prepare a RRC Connection Re-establishment message and the RNSAP sends it in the transparent message **Downlink Signalling Transfer Request** to the new CRNC.

15. The New CRNC delivers the **RRC Connection Re-establishment message** on CCCH.

16. Message **RRC Connection Re-establishment Complete** is sent on the new DCCH from the UE to the serving RNC.

7.5.1.2   RRC Connection Re-establishment with SRNC Relocation - DCH Re-establishment

This subclause shows an example for the RRC Connection Re-establishment procedure, in dedicated transport channel (DCH) state.

It is assumed that a signalling link is available on the Iur, but no DCH is established on this interface.
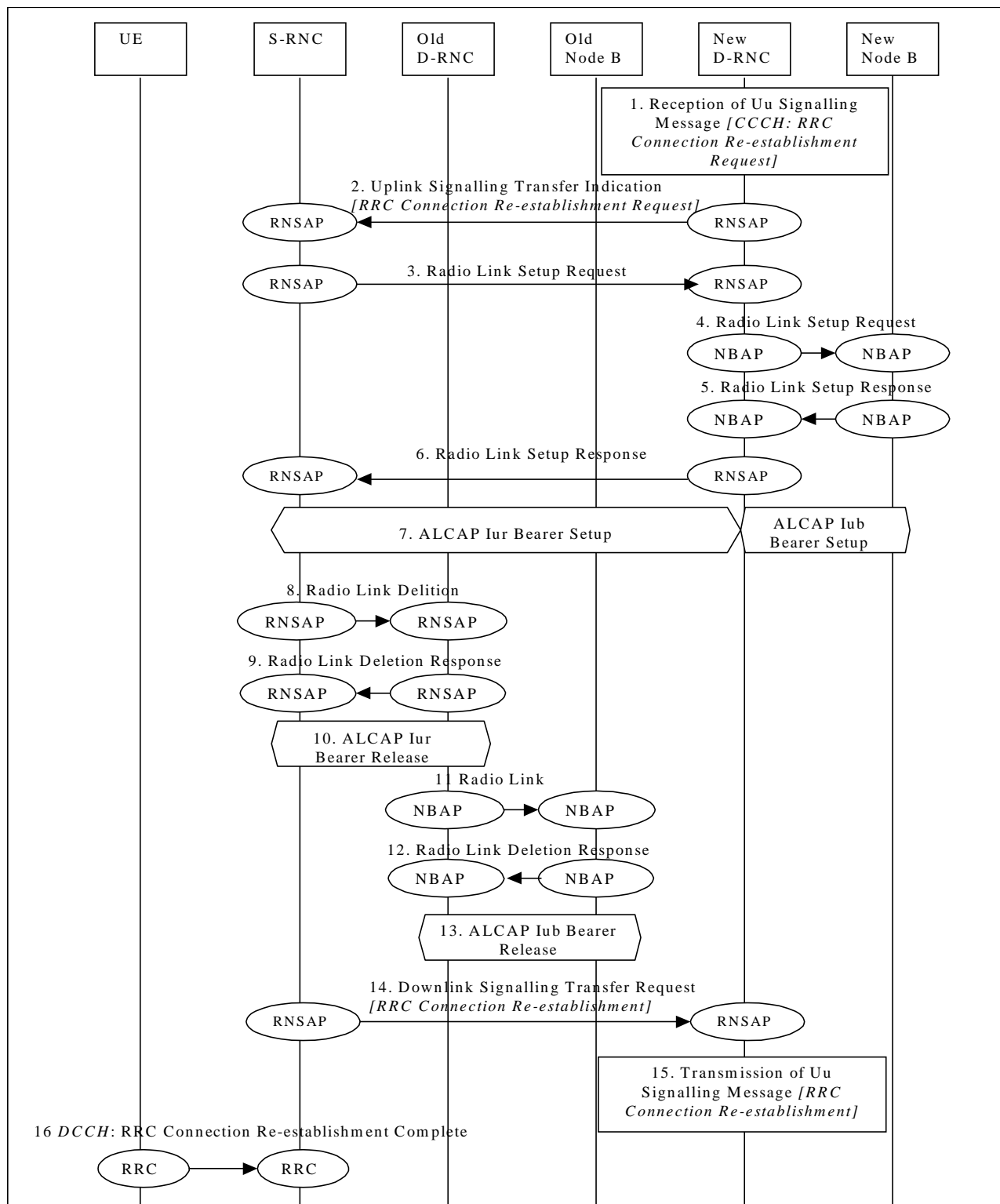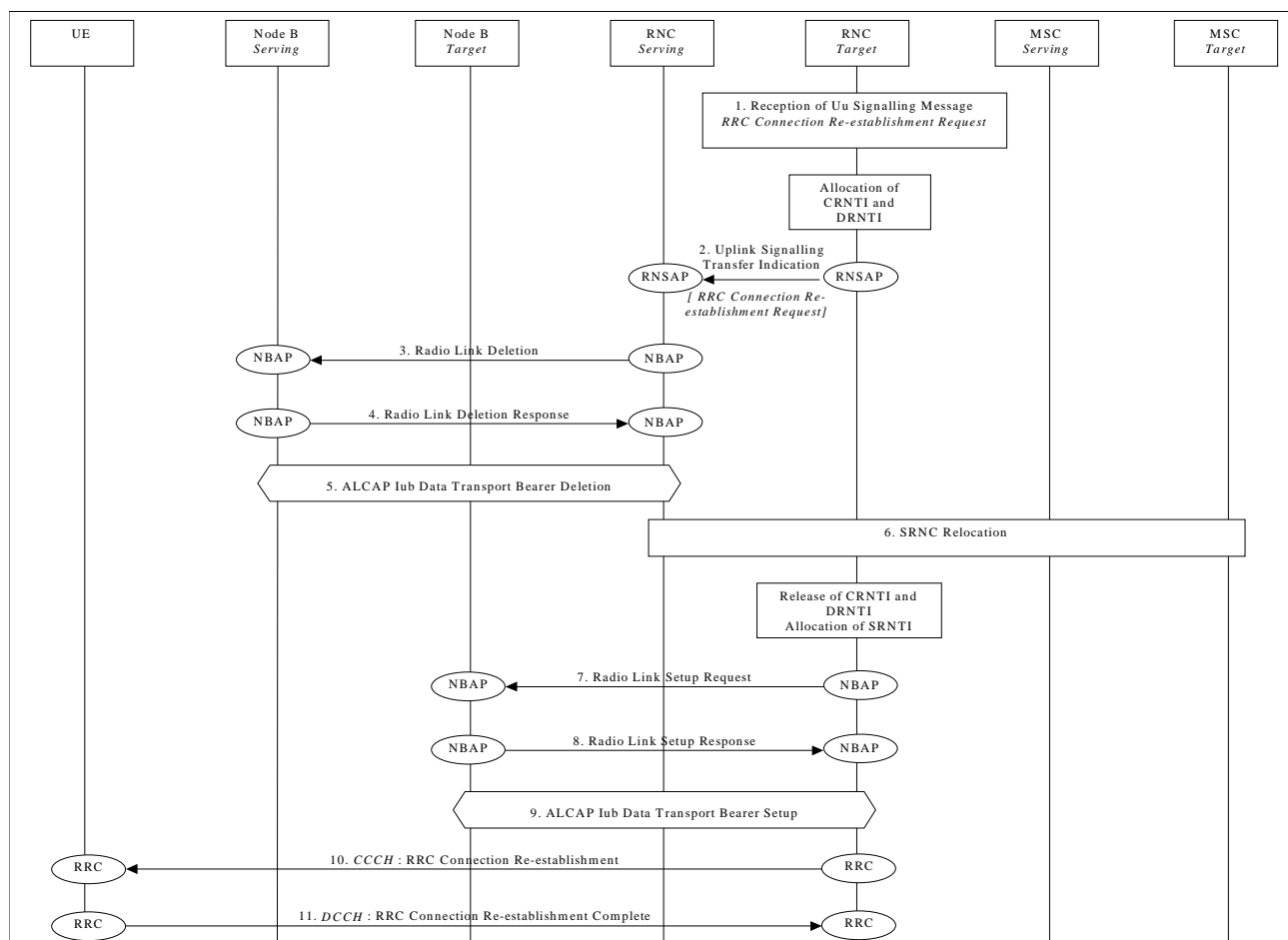

Figure 12: RRC Connection Re-establishment with SRNC Relocation - DCH Re-establishment

1. The UE initiates the re-establishment of the RRC connection with the new cell by sending **RRC Connection Re-establishment Request** message on CCCH. The message is received by the Target RNC.
2. The target RNC delivers the received message transparently as **Uplink Signalling Transfer Indication** message to the serving RNC.
3. The Serving RNC sends NBAP message **Radio Link Deletion** to Node B.
    Parameters: Cell id, Transport layer addressing information.
4. Node B deallocates radio resources. Successful outcome is reported in NBAP message **Radio Link Deletion Response**.

5. The SRNC initiates release of Iub Data Transport bearer using ALCAP protocol.
6. SRNC relocation procedure is triggered by the reception of the message **RRC Connection Re-establishment Request** embedded in the RNSAP **Uplink Signalling Transfer Indication** message (relocation is performed in parallel with Radio Link release).
7. The target RNC (new SRNC) allocates RNTI and radio resources for the RRC connection, and sends the NBAP message **Radio Link Setup Request** to the target 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), Power control information.
8. Target Node B allocates resources, starts PHY reception, and responses with NBAP message **Radio Link Setup Response**.
   Parameters: Signalling link termination, Transport layer addressing information for the Iub Data Transport Bearer.
9. Target RNC (new 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.
10. Message **RRC Connection Re-establishment** is sent on CCCH from target RNC (new SRNC) to UE.
    Parameters: Old RNTI, New RNTI, Transport Format Set, Transport Format Combination Set, frequency, DL scrambling code (FDD only), Time Slots (TDD only), User Codes (TDD only)
11. Message **RRC Connection Re-establishment Complete** is sent on the new DCCH from the UE to the Target RNC (new SRNC).

   NOTE: SRNC Relocation execution is performed asynchronously respect to the RL deletion procedure (step 3/4).

7.6 Radio Access Bearer Establishment

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

7.6.1 DCH - DCH Establishment - Synchronised

This example shows establishment of a radio access bearer (DCH) in dedicated transport channel (DCH) RRC state.

[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.].
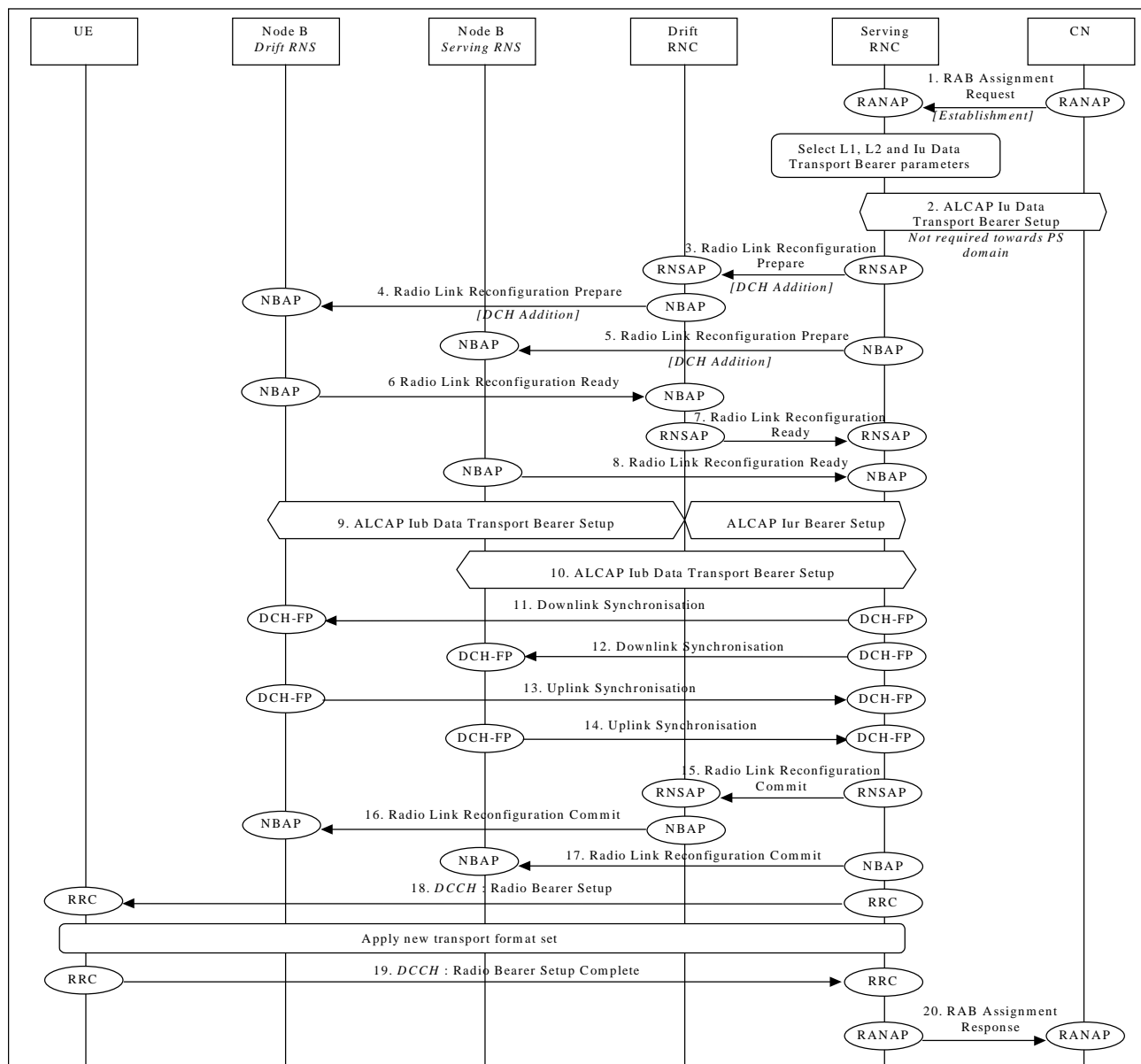
Figure 13: Radio Access Bearer Establishment - DCH - DCH Establishment - Synchronised

1. CN initiates establishment of the radio access bearer with RANAP message **Radio Access Bearer Assignment Request**.
    Parameters: Radio Access Bearer parameters, User Plane Mode, Transport Address, Iu Transport Association.
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 (this step is not required towards PS domain).
3. SRNC requests DRNC to prepare establishment of DCH to carry the radio access bearer (**Radio Link Reconfiguration Prepare**).
    Parameters: Transport Format Set, Transport Format Combination Set, Power control information, instructions for DCH mapping on Iub Data Transport Bearers.
4. DRNC requests its Node B to prepare establishment of DCH to carry the radio access bearer (**Radio Link Reconfiguration Prepare**).
    Parameters: Transport Format Set, Transport Format Combination Set, Power control information.
5. SRNC requests its Node B to prepare establishment of DCH to carry the radio access bearer (**Radio Link Reconfiguration Prepare**).
    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 Ready**).

Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

7. DRNC notifies SRNC that the preparation is ready (**Radio Link Reconfiguration Ready**).
    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 preparation is ready (**Radio Link Reconfiguration Ready**).
    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.

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./12./13./14. The Nodes B and SRNC establish synchronism for the Iub and Iur Data Transport Bearer by means of exchange of the appropriate DCH Frame Protocol frames **Downlink Synchronisation** and **Uplink Synchronisation**.

15. RNSAP message **Radio Link Reconfiguration Commit** is sent from SRNC to DRNC.
    Parameters:

16. NBAP message **Radio Link Reconfiguration Commit** is sent from DRNC to Node B.
    Parameters:

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

18. RRC message **Radio Access Bearer Setup** is sent by SRNC to UE.
    Parameters: Transport Format Set, Transport Format Combination Set, Time Slots (TDD only), User Codes (TDD only).

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

20. SRNC sends RANAP message **Radio Access Bearer Assignment Response** to CN.

7.6.2   DCH - DCH Establishment - Unsynchronised (PS Core Network)

This example shows the establishment of a radio access bearer (DCH) in dedicated transport channel (DCH) RRC state. 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.
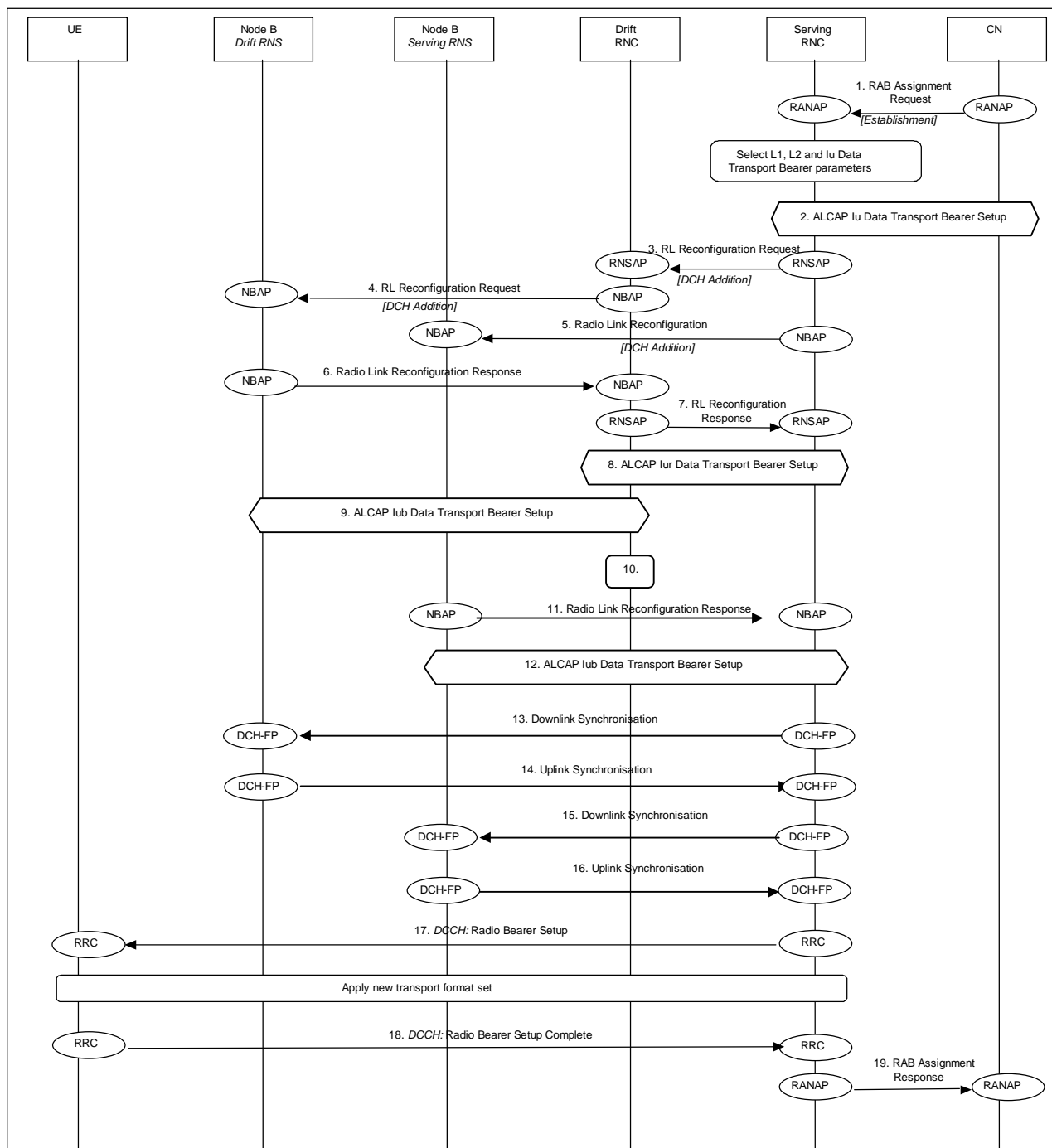
Figure 14: Radio Access Bearer Establishment - DCH - DCH Establishment – Unsynchronised

1. CN initiates establishment of the radio access bearer with RANAP **Radio Access Bearer Assignment Request** message.
   Parameters: radio access bearer parameters, User Plane Mode, Transport Address, Iu Transport Association.
2. SRNC performs mapping of the radio access bearer QoS parameters to AAL2 link characteristics and initiates set-up of Iu Data Transport bearer using ALCAP protocol.
   Parameters: Served User Generated Reference, AAL2 link characteristics …
3. SRNC decided that there are no need for a synchronous RL reconfiguration, and requests DRNC to setup a new DCH sending the **RL Reconfiguration Request** message. The modification shall be done immediately without waiting for the command message.
   Parameters: Bearer ID, , 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 sending the **RL Reconfiguration Request** message.
   Parameters: Bearer ID, 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 sending the **RL Reconfiguration Request** message.
   Parameters: Bearer ID, Transport Format Set, Transport Format Combination Set, Power control information.

6. Node B allocates resources and notifies DRNC that the setup is done sending the **RL Reconfiguration Response** message.
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

7. DRNC notifies SRNC that the setup is done sending the **RL Reconfiguration Response** message.
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

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

9. 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.

10. DRNC performs bridging of Iub and Iur Data Transport bearers.

11. Node B allocates resources and notifies SRNC that the setup is sending the **RL Reconfiguration Response**.
    Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

12. 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.

13./14./15./16. The Nodes B and SRNC establish synchronism for the Iub and Iur Data Transport Bearer by means of exchange of the appropriate DCH Frame Protocol frames **Downlink Synchronisation** and **Uplink Synchronisation**.

17. RRC message **Radio Bearer Setup** is sent by SRNC to UE.
    Parameters: Transport Format Set, Transport Format Combination Set.

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

19. SRNC sends RANAP message Radio Access Bearer Assignment Response to CN.
    Parameters: Transport Address (Always for PS domain; for CS domain only if modified), Iu Transport Association (Always for PS domain; for CS domain only if modified).

7.6.3 RACH/FACH - DCH Establishment

This example shows the establishment of a radio access bearer (DCH) in common transport channel (RACH/FACH) RRC State.
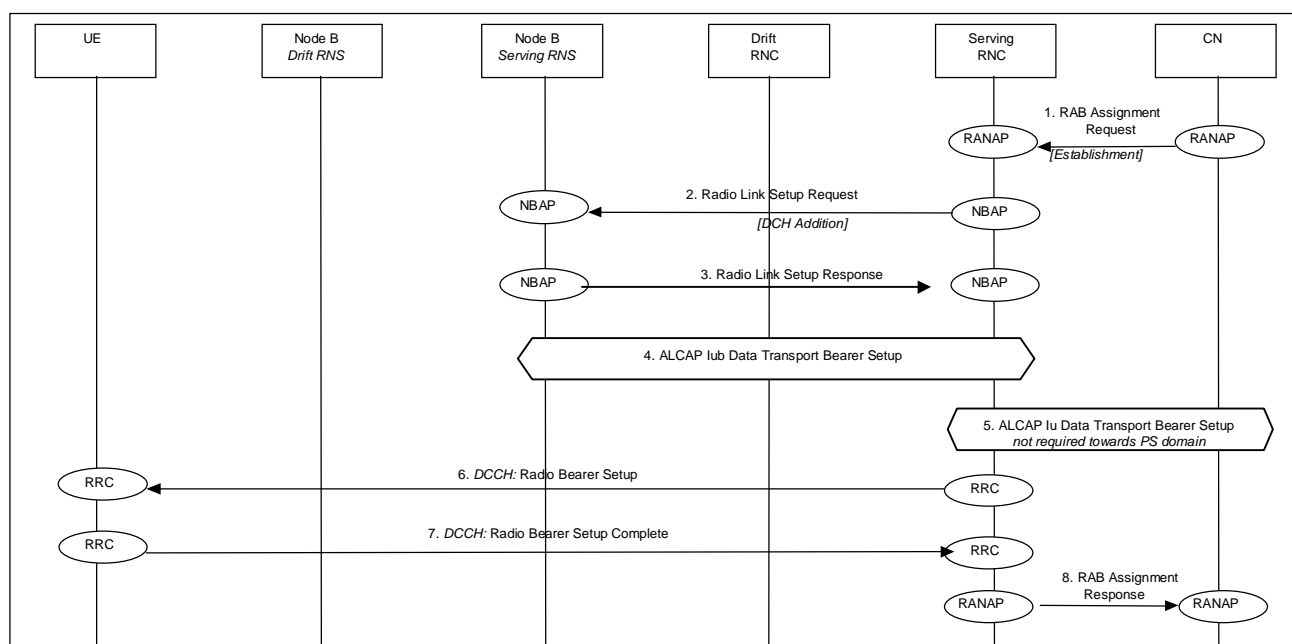

Figure 15: Radio Access Bearer Establishment – RACH/FACH - DCH Establishment – Unsynchronised

1. CN initiates establishment of the radio access bearer with RANAP **Radio Access Bearer Assignment Request** message.
   Parameters: radio access bearer parameters, User Plane Mode, Transport Address, Iu Transport Association.
2. DRNC requests its Node B to establish of a new DCH in the existing Radio Link sending the **Radio Link Setup Request** message.
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information.
3. Node B allocates resources and notifies SRNC that the setup is sending the **Radio Link Setup Response**.
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
4. 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.
5. SRNC performs mapping of the radio access bearer QoS parameters to AAL2 link characteristics and initiates set-up of Iu Data Transport bearer using ALCAP protocol (this step is not required towards PS domain)
6. RRC message **Radio Bearer** Setup is sent by SRNC to UE.
   Parameters: Transport Format Set, Transport Format Combination Set.
7. UE sends RRC message **Radio Bearer Setup Complete** to SRNC.
8. SRNC sends RANAP message **Radio Access Bearer Assignment Response** to CN.

7.6.4 RACH/FACH - RACH/FACH Establishment

This example shows the establishment of a radio access bearer (RACH/FACH) in common transport channel (RACH/FACH) RRC state.
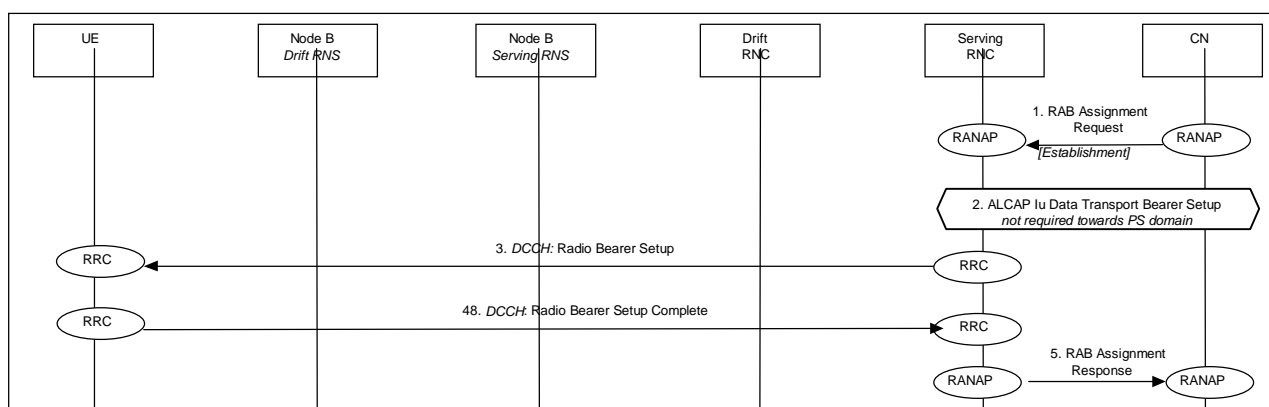

Figure 16: Radio Access Bearer Establishment – RACH/FACH – RACH/FACH Establishment – Unsynchronised

1. CN initiates establishment of the radio access bearer with RANAP **Radio Access Bearer Assignment Request** message.
   Parameters: radio access bearer parameters, User Plane Mode, Transport Address, Iu Transport Association.
2. SRNC performs mapping of the radio access bearer QoS parameters to AAL2 link characteristics and initiates set-up of Iu Data Transport bearer using ALCAP protocol (this step is not required towards PS domain).
3. RRC message **Radio Bearer** Setup is sent by SRNC to UE.
   Parameters: Transport Format Set, Transport Format Combination Set.
4. UE sends RRC message **Radio Bearer Setup Complete** to SRNC.
5. SRNC sends RANAP message **Radio Access Bearer Assignment Response** to CN.

7.7 Radio Access Bearer Release

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

7.7.1 DCH - DCH Release - Synchronised

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.

[FDD - The UE communicates via two Nodes B. One Node B is controlled by SRNC, one Node B is controlled by DRNC.]

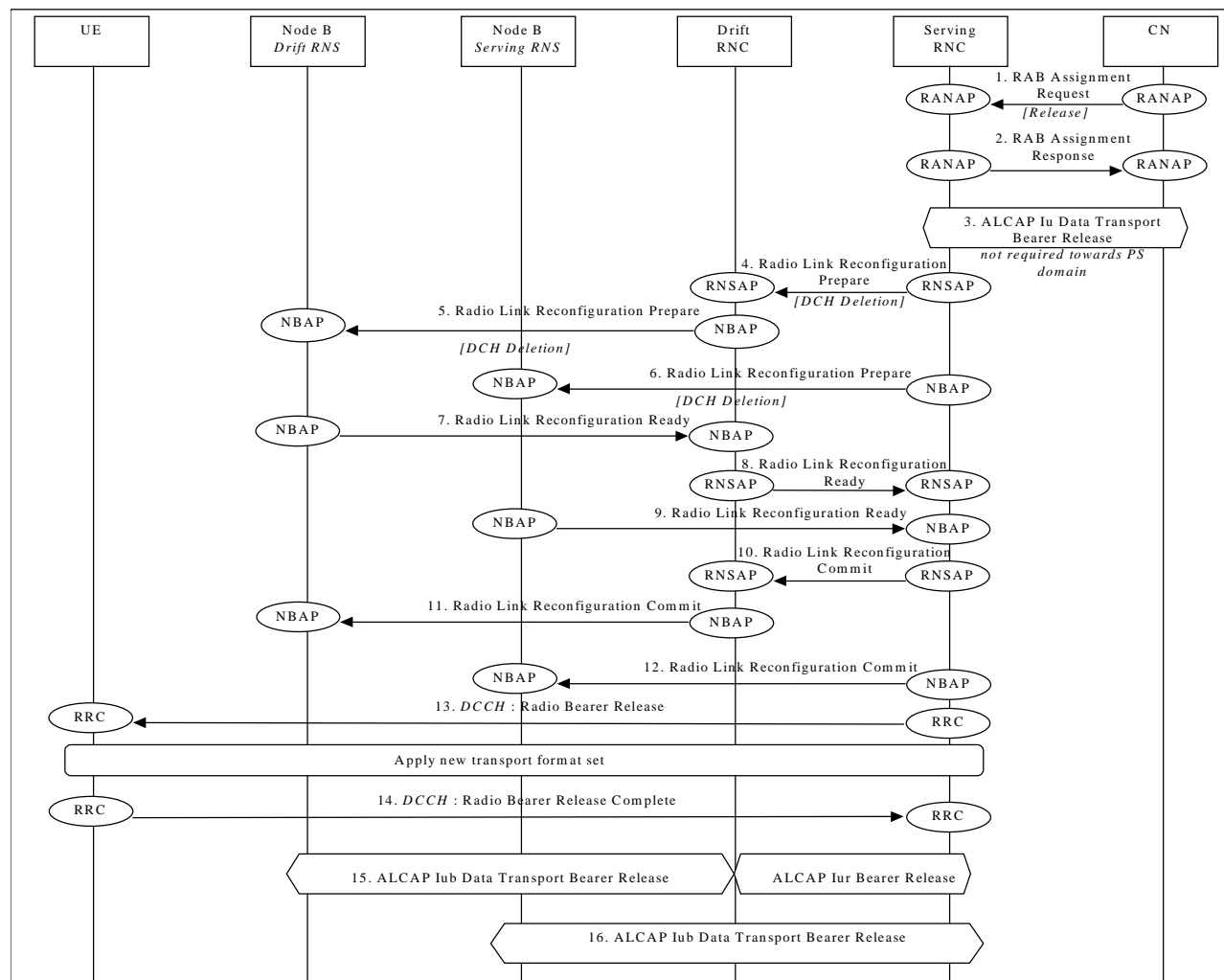[TDD – The Nodes B shown in the figure are mutually exclusive in TDD mode.]

Figure 17: Radio Access Bearer Release - DCH - DCH Release - Synchronised

1. CN initiates release of the radio access bearer with RANAP message **Radio Access Bearer Assignment Request**.
2. SRNC acknowledges the release of radio access bearer (**Radio Access Bearer Assignment Response**).
3. SRNC initiates release of the Iu Data Transport bearer between the CN and the SRNC using the ALCAP protocol (this step is not required towards PS domain).
4. SRNC requests DRNC to prepare release of DCH carrying the radio access bearer (**Radio Link Reconfiguration Prepare**).
   Parameters: Transport Format Combination Set, UL scrambling code.
5. DRNC requests its Node B to prepare release of DCH carrying the radio access bearer (**Radio Link Reconfiguration Prepare**).
   Parameters: Transport Format Combination Set, UL scrambling code.
6. SRNC requests its Node B to prepare release of DCH carrying the radio access bearer (**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 Ready**).
8. DRNC notifies SRNC that release preparation is ready (**Radio Link Reconfiguration ready**).
9. Node B notifies SRNC that release preparation is ready (**Radio Link Reconfiguration Ready**).
10. RNSAP message **Radio Link Reconfiguration Commit** is sent from SRNC to DRNC.
11. NBAP message **Radio Link Reconfiguration Commit** is sent from DRNC to Node B.
12. NBAP message **Radio Link Reconfiguration Commit** is sent from SRNC to Node B.

13. RRC message **Radio Bearer Release** is sent by SRNC to UE.
    Parameters: Transport Format Set, Transport Format Combination Set, Time Slots (TDD only), User Codes (TDD only).
14. UE sends RRC message **Radio Bearer Release Complete** to SRNC.
15. Not used resources in DRNC and Node B (Drift RNS) are released. DRNC initiates release of Iur and Iub (Drift RNS) Data Transport bearer using ALCAP protocol
    16. Not used resources in SRNC and Node B (Serving RNS, if any) are released. SRNC initiates release of Iub (Serving RNS) Data Transport bearer using ALCAP protocol.

7.7.2 DCH - DCH Release - Unsynchronised

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.

Figure 18: 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 Bearer Release is sent by SRNC to UE.
3. UE sends RRC message Radio 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 (this step is not required towards PS domain).
6. SRNC requests DRNC to release of DCH carrying the radio access bearer.
   Parameters: DCH ID,, TFCS.
7. DRNC requests its Node B to release of DCH carrying the radio access bearer.
   Parameters: DCH ID, TFCS.
8. SRNC requests its Node B to prepare release of DCH carrying the radio access bearer.
   Parameters: DCH ID, 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.
13. SRNC initiates release of Iub Data Transport bearer using ALCAP protocol. Note: the release of the Iub link may be done before step 10.

7.7.4 RACH/FACH - RACH/FACH Release

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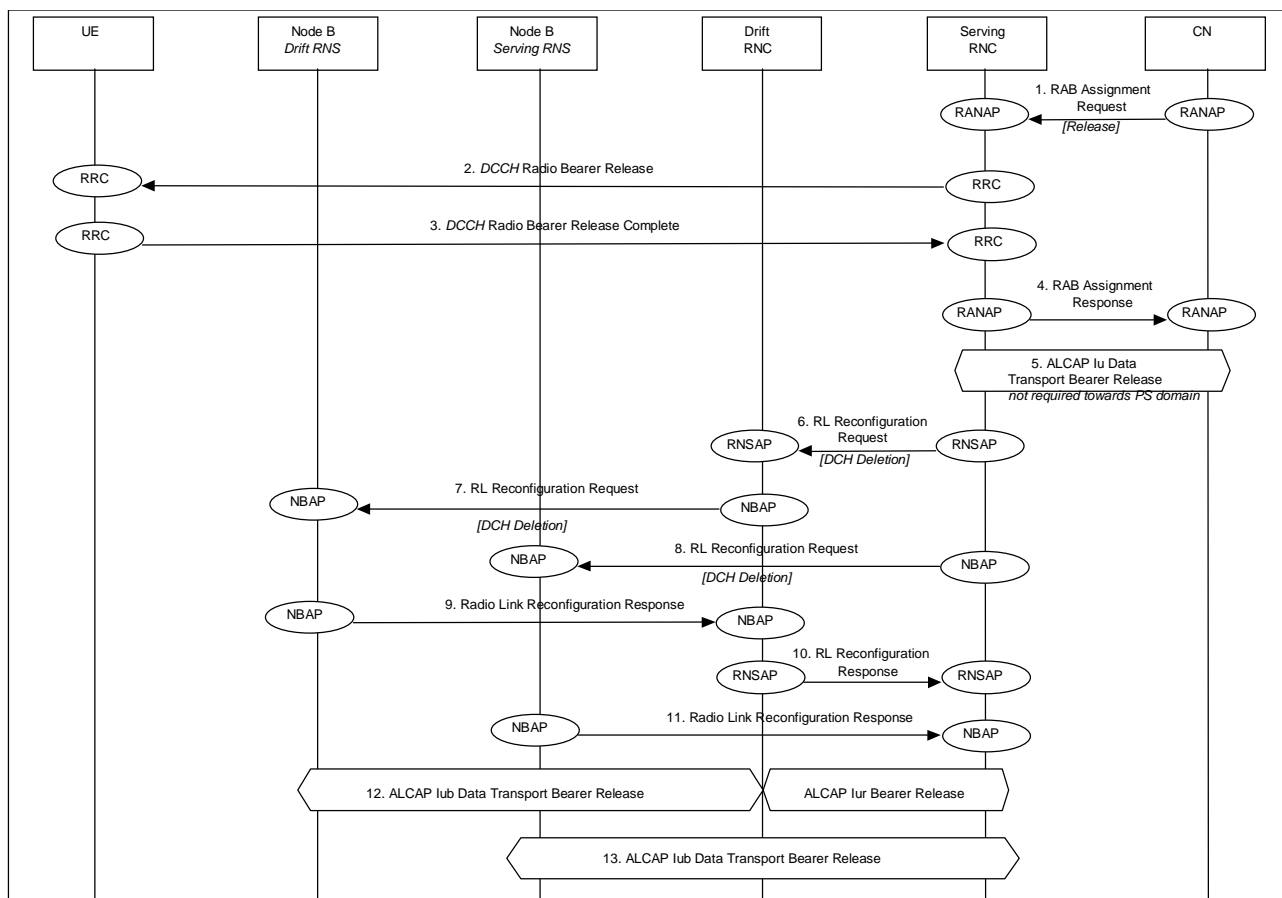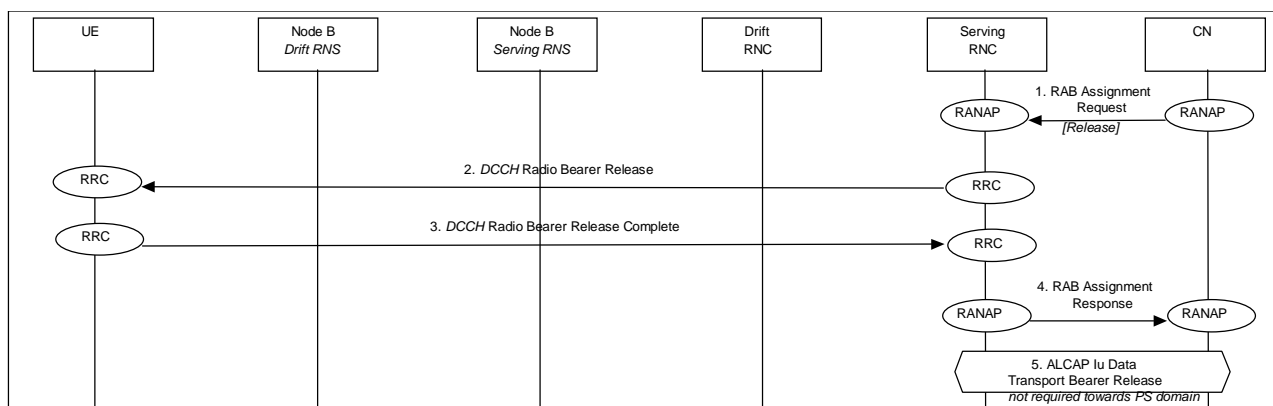

Figure 19: Radio Access Bearer Release - RACH/FACH - RACH/FACH Release

1. CN initiates release of the radio access bearer with RANAP **Radio Access Bearer Assignment Request** message.
2. RRC message **Radio Bearer Release** is sent by SRNC to UE.
3. UE sends RRC message **Radio 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 (this step is not required towards PS domain).

7.8 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 transport channel (RACH/FACH).The procedure starts from a radio access bearer assignment because does not exist a special message to modify a radio access bearer, instead an "assignment" message is used.

7.8.1 DCCH on DCH - Synchronised

This example shows modification of a radio access bearer established on a dedicated channel (DCH) with UE in macrodiversity between two RNCs. A NSAP synchronised procedure is used and a successful case is shown. For an unsuccessful case it's important to note that a failure message can be sent in any point of the Message Sequence Chart (MSC); in particular could be in RRC reconfiguration response (# 16).
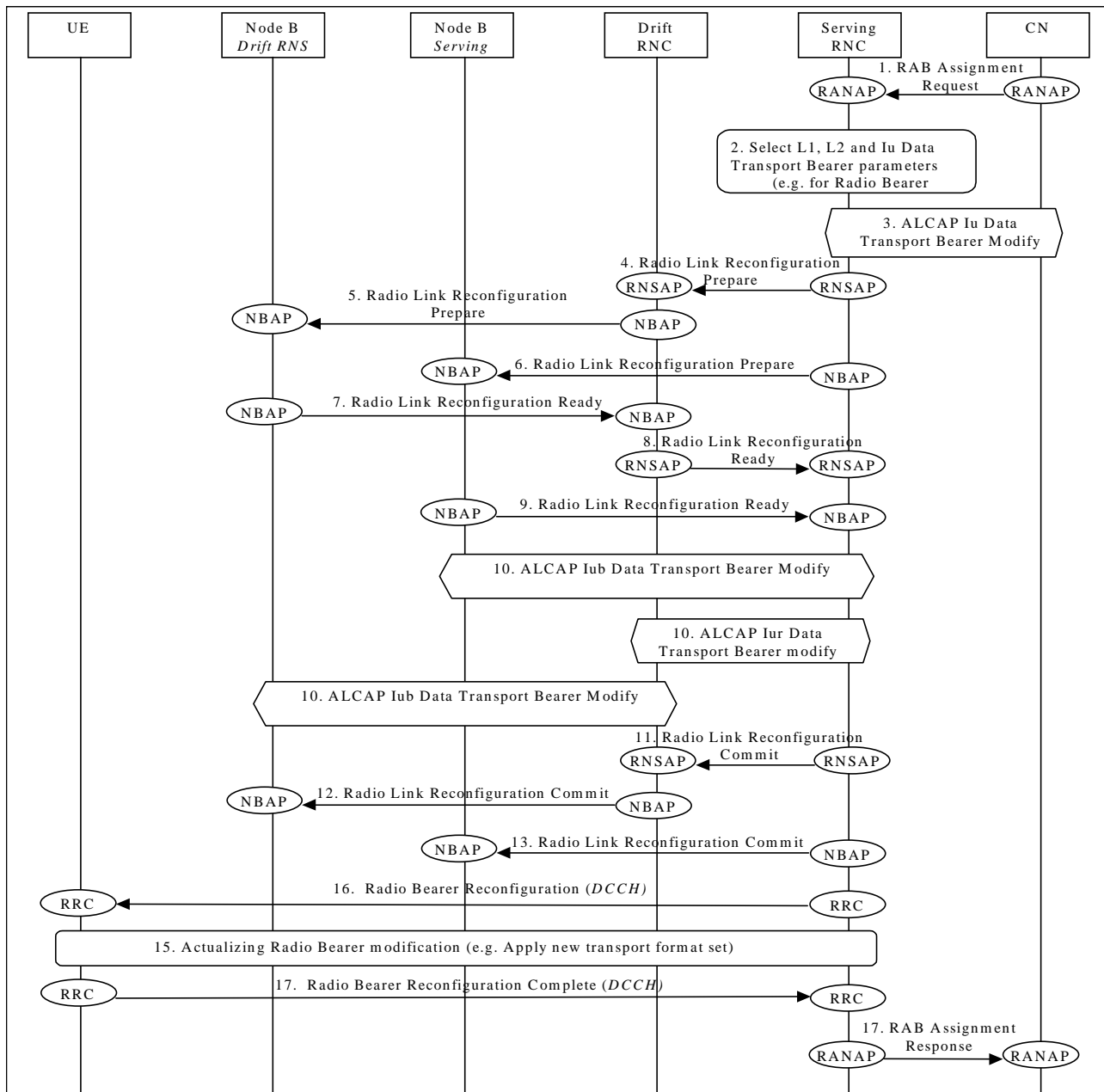
Figure 20: Radio Access Bearer Modification - DCH Modification - Synchronised

1. CN initiates modification of the radio access bearer with RANAP message **Radio Access Bearer Assignment Request.**
   Parameters: parameters to be modified at lower level e.g. Maximum Bit Rate.
2. Interworking functions. SRNC chooses which parameters (lower level) ought to be modified and what kind of procedure has to start up (i.e Radio Bearer Reconfiguration for RRC).
3. SRNC starts an Iu Data Transport Bearer Modification between the CN and the SRNC using the ALCAP protocol with AAL2 bindings carried by radio access bearer assignment message (this step is not required towards PS domain). This has to be done before Radio Reconfiguration itself because the transport channel must be ready when the radio channel will be ready.
4. SRNC requests DRNC to prepare modification of DCH carrying the radio access bearer (**Radio Link Reconfiguration Prepare**).
   Parameters: Transport Format Combination Set, UL scrambling code, etc.
5. DRNC requests its Node B to prepare modification of DCH related to the radio access bearer (**Radio Link Reconfiguration Prepare**).
6. SRNC requests its Node B to prepare modification of DCH carrying the radio access bearer (**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 (drift) notifies DRNC that modification preparation is ready (**Radio Link Reconfiguration Ready**).

8. DRNC notifies SRNC that modification preparation is ready (**Radio Link Reconfiguration ready**).

9. Node B (serving) notifies SRNC that modification preparation is ready (**Radio Link Reconfiguration Ready**). Note: here a **Radio Link Reconfiguration Failure** could occur.

10. SRNC initiates modify of Iub (Serving RNS) Data Transport bearer. The same does DRNC with its own Iub. SRNC initiates modify of Iur (Serving RNS) Data Transport bearer. In the case that ALCAP is implemented by Q.AAL2 (Q.2361.1) it implies the release of the existing bearer and the establishment of a new one.

11. RNSAP message **Radio Link Reconfiguration Commit** is sent from SRNC to DRNC.

12. NBAP message **Radio Link Reconfiguration Commit** is sent from DRNC to Node B (drift).

13. NBAP message **Radio Link Reconfiguration Commit** is sent from SRNC to Node B (serving).

14. RRC message **Radio Bearer Reconfiguration** is sent by controlling RNC (here SRNC) to UE.

15. Both UE and Nodes B actualise modification of DCH (i.e. applying a new transport format).

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

17. SRNC acknowledges the modification of radio access bearer (**Radio Access Bearer Assignment Response**) towards CN.

A radio access bearer modification procedure (via radio access bearer assignment message) is shown with mapping to Radio Bearer reconfiguration. Note that this is not possible if we want to change what transport channel or logical channel you use, because RB reconfiguration does not permit a change in type of channel (see [8]).

7.8.2 DCCH on RACH/FACH

This example shows reconfiguration of a radio access bearer using a common transport channel (RAH/FACH). The difference with respect to the previous example is that here there is no macrodiversity because with a physical common channel (e.g. PRACH) it's impossible to be on macrodiversity
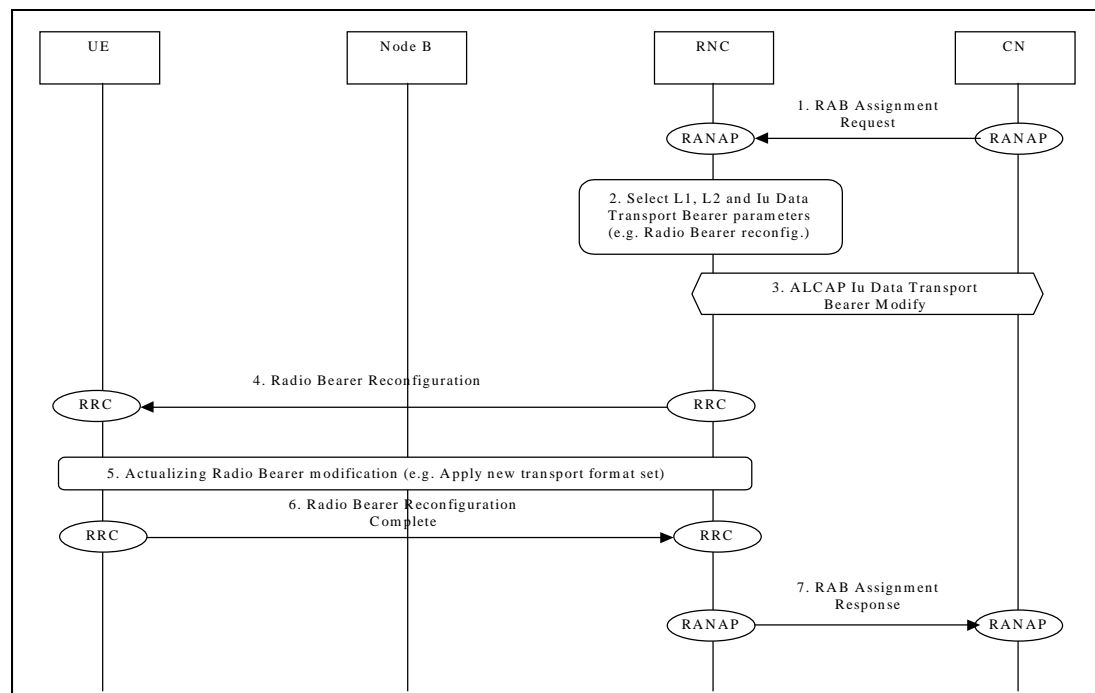
Figure 21: Radio Access Bearer Modification – RACH/FACH Modification

1. CN initiates modification of the radio access bearer with RANAP message **Radio Access Bearer Assignment Request**

2. Interworking functions. SRNC chooses which parameters (lower level) ought to be modified and what kind of procedure has to start up (i.e Radio Bearer Reconfiguration for RRC).

3. RNC starts an Iu Data Transport Bearer Modification between the CN and the RNC using the ALCAP protocol with AAL2 bindings carried by radio access bearer assignment message (this step is not required towards PS domain). This has to be done before Radio Reconfiguration itself because the transport channel must be ready when the radio channel will be ready.

4. RRC message **Radio Bearer Reconfiguration** is sent by controlling RNC (here RNC) to UE. UE actualises modification of common transport channel (e.g. applying a new transport format).
5. Both UE and Nodes B actualise modification of DCH (i.e. applying a new transport format).
6. UE sends RRC message **Radio Bearer Reconfiguration Complete** to RNC.
7. RNC acknowledges the modification of radio access bearer (**Radio Access Bearer Assignment Response**) towards CN.

A radio access bearer modification procedure (via radio access bearer assignment message) is mapped with Radio Bearer reconfiguration. Note that this is not possible if we want to change what transport channel or logical channel you use, because Radio Bearer reconfiguration does not permit a change in type of channel (see [8]).

7.9 Physical Channel Reconfiguration

7.9.1 Physical Channel Reconfiguration (DCH)

The following example shows an example for the Physical Channel Reconfiguration in dedicated channel (DCH) RRC state.

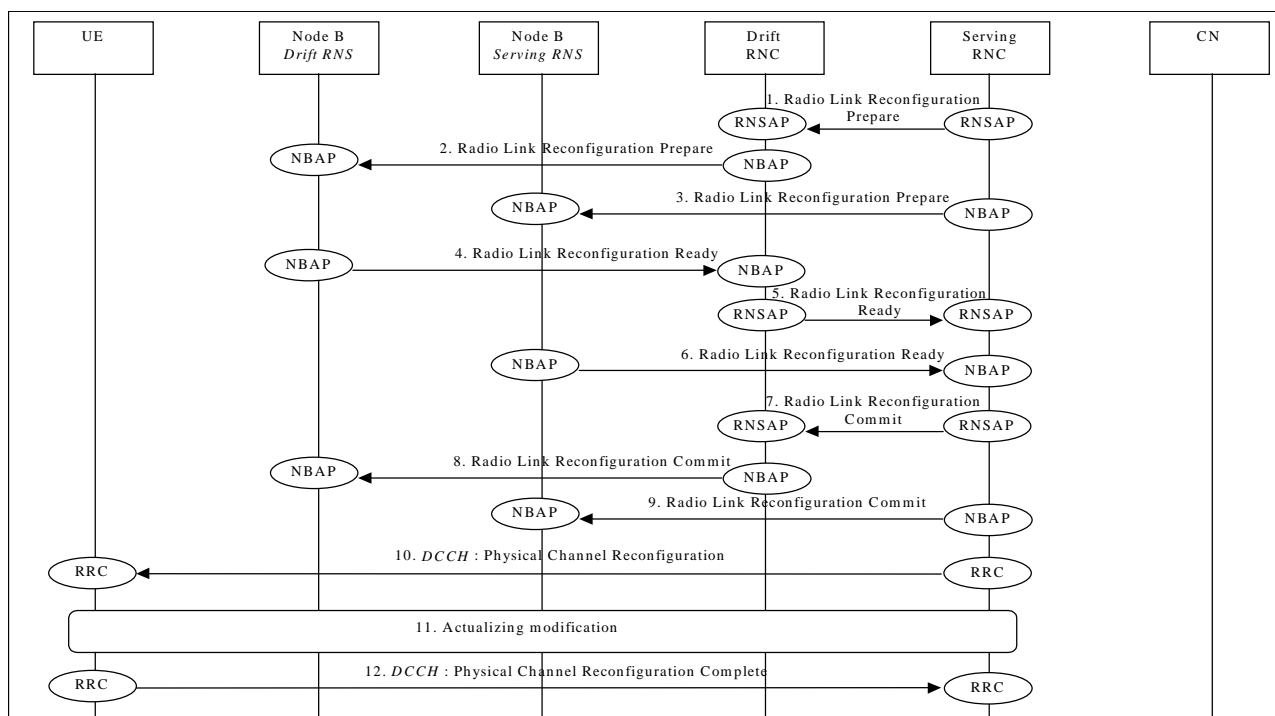This procedure can be used, for example, to change the UL scrambling code of a UE.

Figure 22: Physical Channel Reconfiguration (DCH)

1. SRNC decided that there is a need for a Physical Channel Reconfiguration and requests DRNC to prepare reconfiguration of DCH (**Radio Link Reconfiguration Prepare**).
   Parameters: UL scrambling code (FDD only), Power control information.
2. DRNC requests its Node B to prepare reconfiguration of physical channel (**Radio Link Reconfiguration Prepare**).
   Parameters: Power control information, UL scrambling code (FDD only), Time Slots (TDD only), User Codes (TDD only).
3. SRNC requests its Node B to prepare reconfiguration of physical channel (**Radio Link Reconfiguration Prepare**).
   Parameters: Power control information, UL scrambling code (FDD only), Time Slots (TDD only), User Codes (TDD only).
4. Node B allocates resources and notifies DRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**).
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

5. DRNC notifies SRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**). Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iur Data Transport Bearer.

6. Node B allocates resources and notifies SRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**). Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

7. RNSAP message **Radio Link Reconfiguration Commit** is sent from SRNC to DRNC. Parameters: CFN.

8. NBAP message **Radio Link Reconfiguration Commit** is sent from DRNC to Node B. Parameters: CFN.

9. NBAP message **Radio Link Reconfiguration Commit** is sent from SRNC to Node B. Parameters: CFN.

10. RRC message **Physical Channel Reconfiguration** is sent by SRNC to UE. Parameters: UL scrambling code (FDD only), Time Slots (TDD only), User Codes (TDD only), CFN.

11. Both UE and Nodes B actualise modification of the physical channel.

12. UE sends RRC message **Physical Channel Reconfiguration Complete** to SRNC.

7.9.2 Physical Channel Reconfiguration (CRNC Controlled)

This procedure shall be used to reconfigure the Physical Channel in the CRNC; in case of FDD it corresponds to the Down Link Code Reconfiguration Procedure, while in TDD it allows to change either TS or User Code.
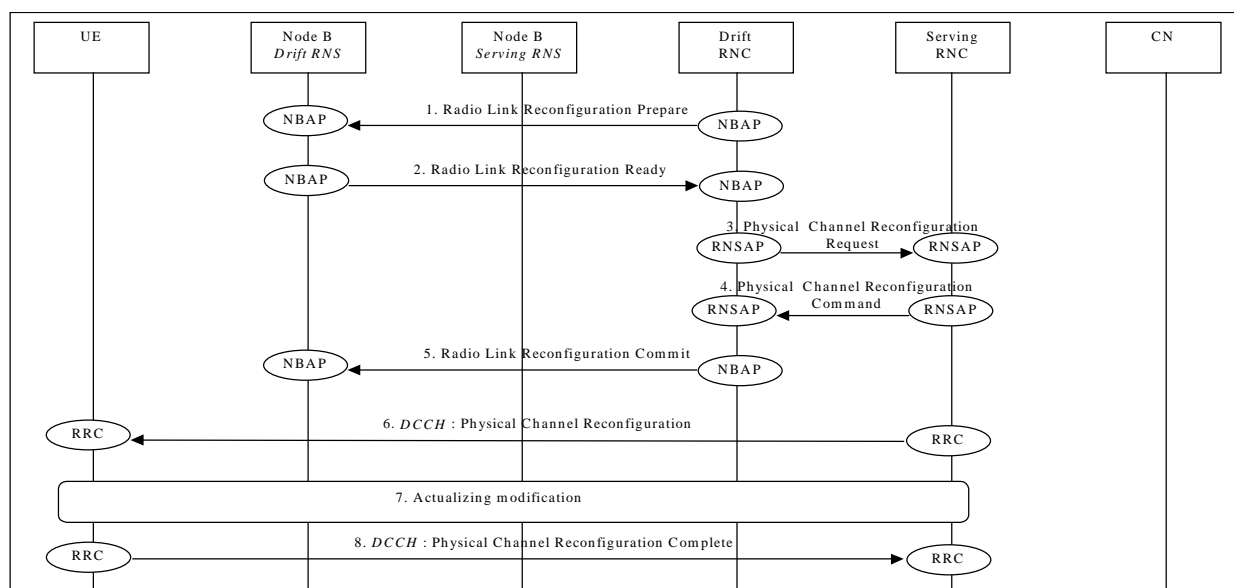

Figure 23: Physical Channel Reconfiguration (CRNC Controlled)

1. DRNC requests its Node B to reconfigure the physical channel (**Radio Link Reconfiguration Prepare**). Parameters: Power control information, Time Slots (TDD only), User Codes (TDD only).

2. Node B allocates resources and notifies DRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**). Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

3. DRNC decides that a Physical Channel Reconfiguration is needed and sends the RNSAP message **Physical Channel Reconfiguration Request** to the SRNC.

4. SRNC determines the CFN in which to perform the physical channel reconfiguration and sends the message **Physical Channel Reconfiguration Command.**

5. NBAP message **Radio Link Reconfiguration Commit** is sent from DRNC to Node B. Parameters: CFN.

6. RRC message **Physical Channel Reconfiguration** is sent by SRNC to UE. Parameters: Time Slots (TDD only), User Codes (TDD only), CFN.

7. Both UE and Nodes B actualise modification of the physical channel.

8. After the reconfiguration, the UE sends RRC message **Physical Channel Reconfiguration Complete** to SRNC.

7.10 Soft Handover (FDD)

This subclause 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).

Soft Handover applies only to FDD mode.

7.10.1 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.

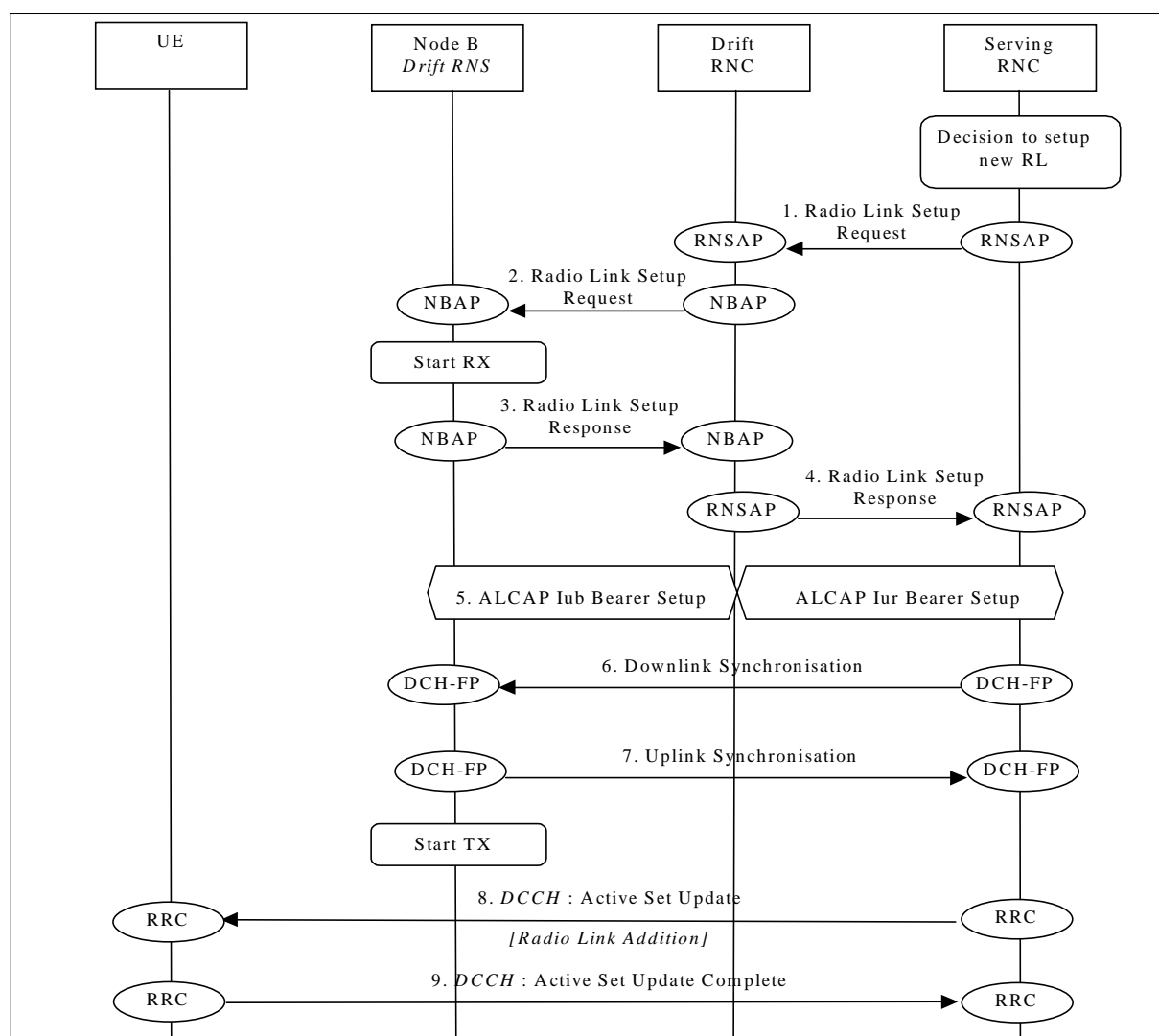**Figure 24: Soft Handover - Radio Link Addition (Branch Addition)**

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 Setup 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.

    Then Node B start the UL reception.

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

4. DRNC sends RNSAP message **Radio Link Setup Response** to SRNC.
    Parameters: 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./7. Node B and SRNC establish synchronism for the Data Transport Bearer(s) by means of exchange of the appropriate DCH Frame Protocol frames **Downlink Synchronisation** and **Uplink Synchronisation**, relative already existing radio link(s). Then Node B starts DL transmission.

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

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

7.10.2 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.
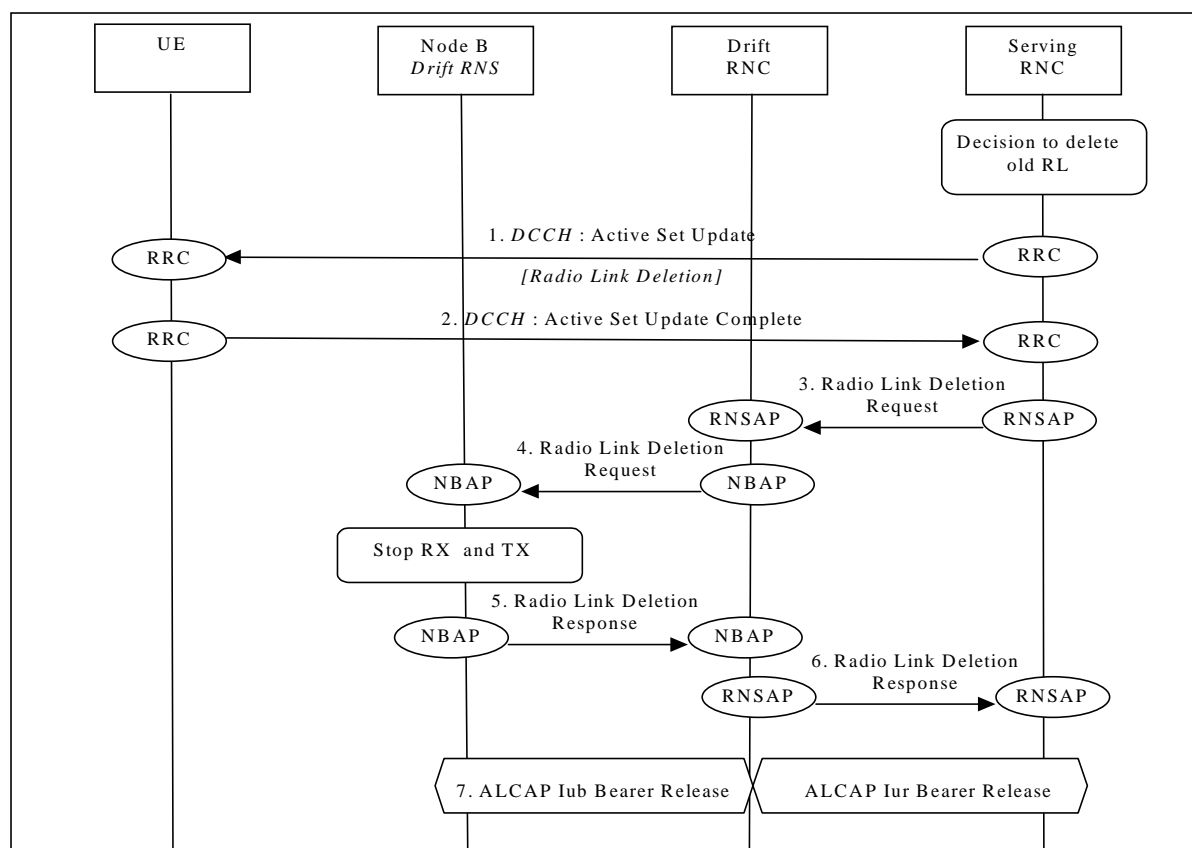
Figure 25: Soft Handover - Radio Link Deletion (Branch Deletion)

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 Request**.
   Parameters: Cell id, Transport layer addressing information.
4. DRNC sends NBAP message **Radio Link Deletion Request** 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 Response**.
6. DRNC sends RNSAP message **Radio Link Deletion Response** to SRNC.
7. SRNC initiates release of Iur/Iub Data Transport Bearer using ALCAP protocol.

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

This example shows simultaneous deletion 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 procedure is needed when the maximum number of branches allowed for the macrodiversity set has already been reached.
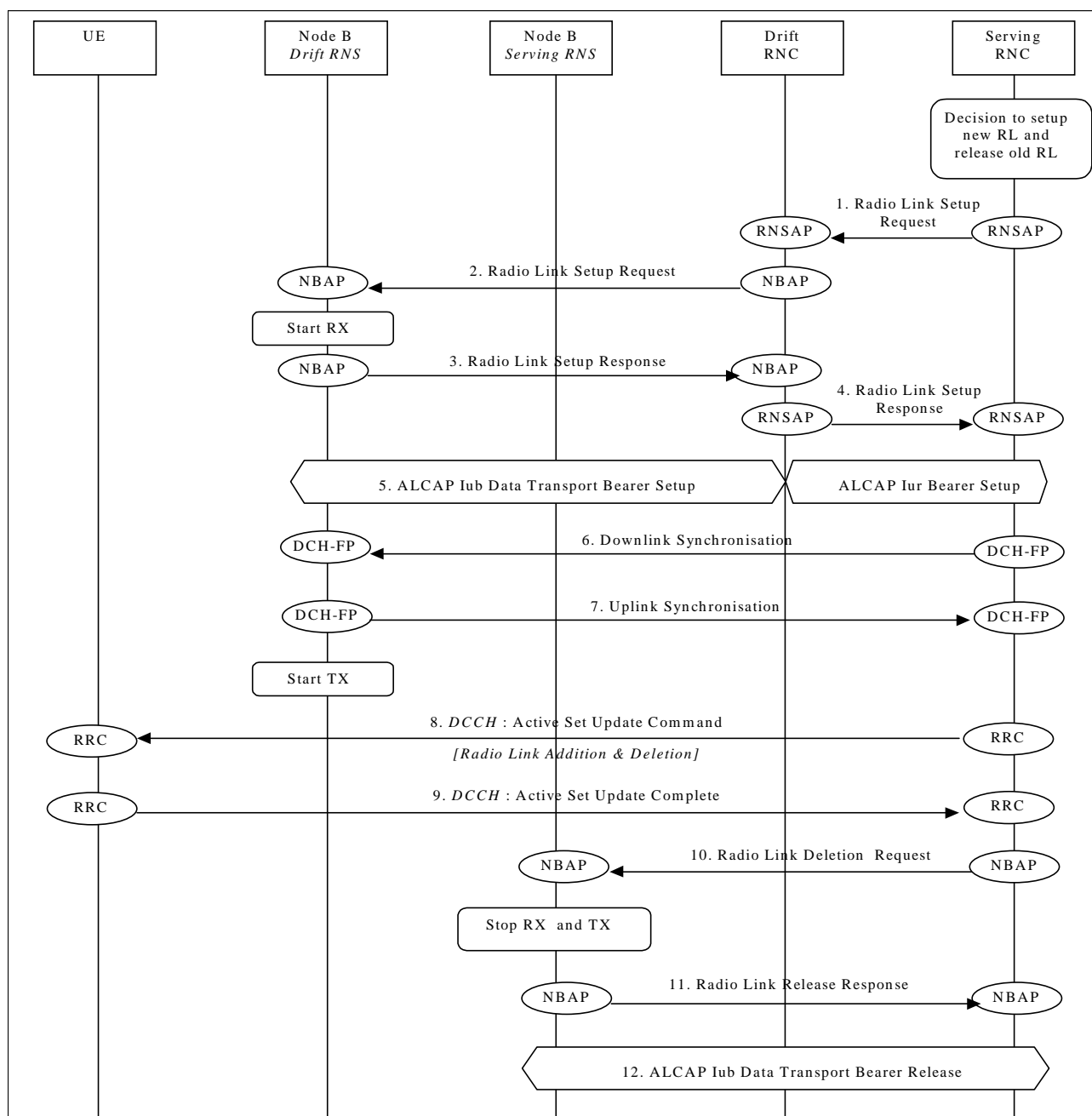
Figure 26: Soft Handover - Radio link Addition & Deletion (Branch Addition & Deletion - simultaneously)

1. ⇒ 7. See description 1. ⇒ 7. in subclause 7.10.1.

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

9. UE deactivates DL reception via old branch, activates DL reception via new branch and acknowledges with RRC message **Active Set Update Complete**.

10. ⇒ 12. See description 3. ⇒ 7. in subclause 7.10.2.

7.11 Hard Handover

This subclause presents some examples of hard handover procedures. These procedures are for both dedicated and common channels and may be applied in the following cases:

- intra-frequency Hard Handover (TDD mode);

- inter-frequency Hard Handover (FDD and TDD mode).

7.11.1 Backward Hard Handover

This subclause shows some examples of hard handover in the case of network initiated backward handovers.

7.11.1.1 Hard Handover via Iur (DCH State)

This subclause shows an example of Hard Handover via Iur, when the mobile is in DCH state, for both successful and unsuccessful cases.
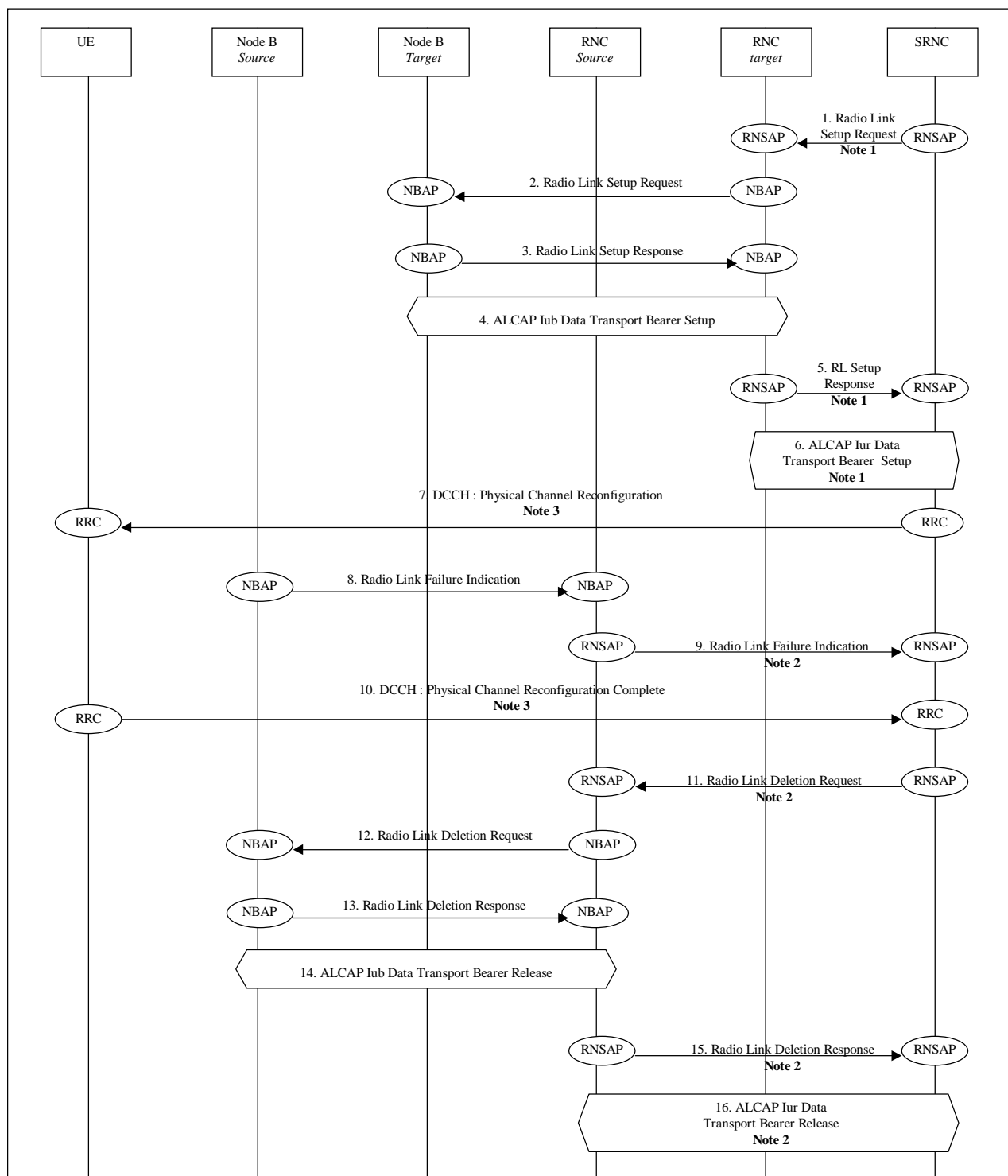
Figure 27: Hard Handover via Iur (DCH on Iur) – successful case

1. SRNC sends **Radio Link Setup Request** message to the target RNC.
   Parameters: target RNC identifier, s-RNTI, Cell id, Transport Format Set, Transport Format Combination Set.
   (Note 1).
2. The target RNC allocates RNTI and radio resources for the RRC connection and the Radio Link(s) (if possible),
   and sends the NBAP message **Radio Link Setup Request** to the target 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), Power control information etc.
3. Node B allocates resources, starts PHY reception, and responds with NBAP message **Radio Link Setup Response**.
   Parameters: Signalling link termination, Transport layer addressing information for the Iub Data Transport Bearer.

4. Target RNC 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. When the Target RNC has completed preparation phase, **Radio Link Setup Response** is sent to the SRNC (*Note 1*).

6. SRNC initiates set-up of Iur Data Transport bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur Data Transport Bearer to the DCH. The request for set-up of Iur Data Transport bearer is acknowledged by Target RNC (*Note 1*).

7. SRNC sends a RRC message **Physical Channel Reconfiguration** to the UE.

8. When the UE switches from the old RL to the new RL, the source Node B detects a failure on its RL and sends a NBAP message **Radio Link Failure Indication** to the source RNC.

9. The source RNC sends a RNSAP message **Radio Link Failure Indication** to the SRNC (*Note 2*).

10. When the RRC connection is established with the target RNC and necessary radio resources have been allocated, the UE sends RRC message **Physical Channel Reconfiguration Complete** to the SRNC.

11. The SRNC sends a RNSAP message **Radio Link Deletion Request** to the source RNC (*Note 2*).

12. The source RNC sends NBAP message **Radio Link Deletion Request** to the source Node B. Parameters: Cell id, Transport layer addressing information.

13. The source Node B de-allocates radio resources. Successful outcome is reported in NBAP message **Radio Link Deletion Response**.

14. The source RNC initiates release of Iub Data Transport bearer using ALCAP protocol.

15. When the source RNC has completed the release the RNSAP message Radio Link Deletion Response is sent to the SRNC (*Note 2*).

16. SRNC initiates release of Iur Data Transport bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur Data Transport Bearer to the DCH. The request for release of Iur Data Transport bearer is acknowledged by the Source RNC (*Note 2*).

NOTE 1: This message is not necessary when the target RNC is the SRNC.

NOTE 2: This message is not necessary when the source RNC is the SRNC.

NOTE 3: The messages used are only one example of the various messages which can be used to trigger a handover, to confirm it or to indicate the handover failure. The different possibilities are specified in the RRC specification (25.331), subclause 8.3.5.2.
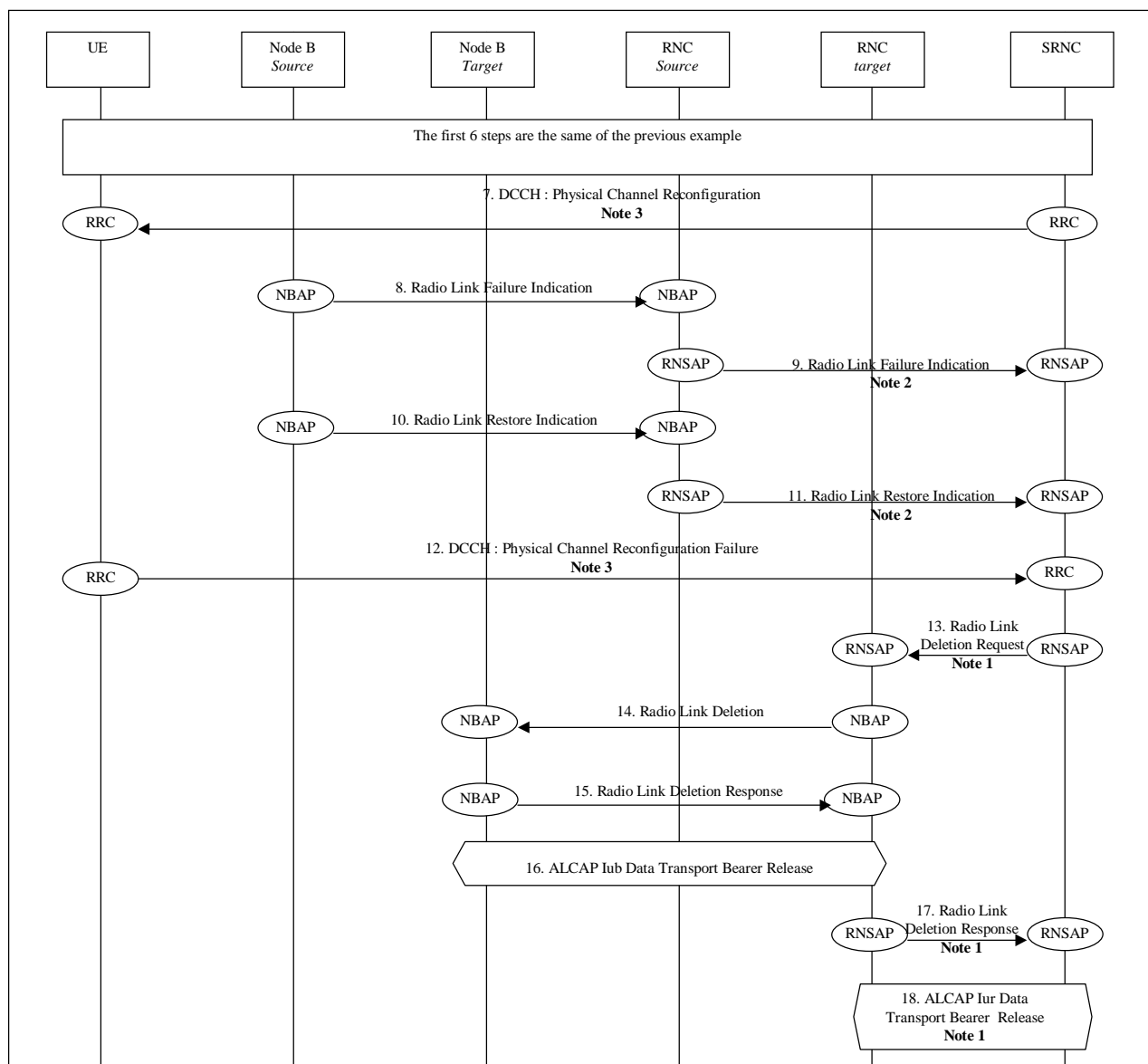
Figure 28: Hard Handover via Iur (DCH on Iur) – unsuccessful case.

The first 6 steps are the same of the previous example.

7. SRNC sends a RRC message **Physical Channel Reconfiguration** to the UE.
8. When the UE switch from the old RL to the new RL, the source Node B detect a failure on its RL and send a NBAP message **Radio Link Failure Indication** to the source RNC.
9. The SRNC sends a RNSAP message message **Radio Link Failure Indication** to the source RNC. *See note 2.*
10. UE cannot access the target cell and switch back to the new. The source Node B detects a RL restoration and send a NBAP message **Radio Link Restoration Indication** to the source RNC.
11. The SRNC sends a RNSAP message message **Radio Link Restoration Indication** to the source RNC. *See note 2.*
12. When the RRC connection is re-established with the source RNC the UE sends RRC message **Physical Channel Reconfiguration Failure** to the SRNC.
13. The SRNC sends a RNSAP message **Radio Link Deletion Request** to the target RNC. *See note 1.*
14. The target RNC sends NBAP message **Radio Link Deletion Request** to the target Node B. Parameters: Cell id, Transport layer addressing information.
15. The target Node B de-allocates radio resources. Successful outcome is reported in NBAP message **Radio Link Deletion Response**.
16. The target RNC initiates release of Iub Data Transport bearer using ALCAP protocol.
17. When the target RNC has completed the release the RNSAP message **Radio Link Deletion Response** is sent to the SRNC. *See note 1.*

18. SRNC initiates release of Iur Data Transport bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur Data Transport Bearer to the DCH. The Target RNC acknowledges the request for release of Iur Data Transport bearer. *See note 1.*

NOTE 1: This message is not necessary when the target RNC is the SRNC.

NOTE 2: This message is not necessary when the source RNC is the SRNC.

NOTE 3: The messages used are only one example of the various messages which can be used to trigger a handover, to confirm it or to indicate the handover failure. The different possibilities are specified in the RRC specification (25.331), subclause 8.3.5.2.

7.11.1.2 Hard Handover with switching in the CN (UE connected to two CN nodes, DCH state)

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.
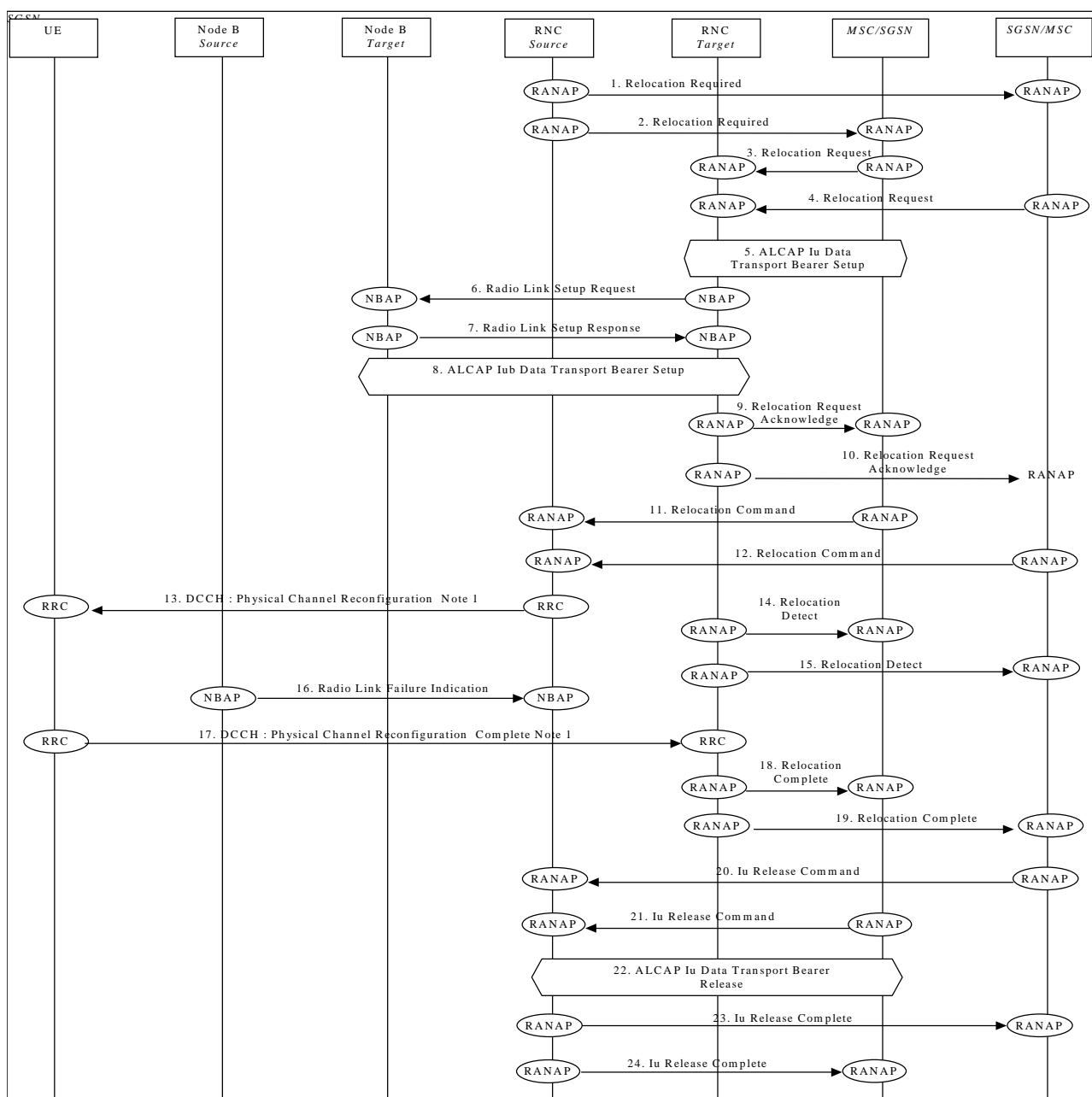

Figure 29: Hard Handover with switching in the CN (UE connected to two CN nodes, DCH state)

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 **Relocation 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 **Relocation 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 CN is aware of preparation , CN node conveys a **Relocation Request** message to the target RNC to allocate resources.
            Parameters: bearer ID's requested to be rerouted towards the CN node, from which the **Relocation 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.   Target RNC and CN node establish the new Iu transport bearers for each Radio Access Bearer related to the CN node.

6./7./8.   The target RNC allocates RNTI and radio resources for the RRC connection and the Radio Link, then sends the NBAP message **Radio Link Setup Request** to the target 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), Power control information etc.
            Node B allocates resources, starts PHY reception, and responds with NBAP message **Radio Link Setup Response**. Target RNC 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.

9./10.   When RNC has completed preparation phase, **Relocation Request Acknowledge** is sent to the CN elements.
            Parameters: transparent field to the CN that is to be transmitted to the Source RNS.

11./12.   When CN is ready for the change of SRNC, CN node sends a **Relocation Command** to the RNC. Message contains the transparent field provided by Target RNC.
            Parameters: information provided in the Information field from the target RNC.

13.   Source RNC sends a RRC message **Physical Channel Reconfiguration** to the UE.

14./15.   When target RNC has detected the UE, Relocation Detect message is sent to the CN nodesTarget 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 B16. When the UE switch from the old RL to the new RL, the source Node B detect a failure on its RL and send a NBAP message **Radio Link Failure Indication** to the source RNC.

17.   When the RRC connection is established with the target RNC and necessary radio resources have been allocated the UE sends RRC message **Physical Channel Reconfiguration Complete** to the target RNC.

18./19   After a successful switch and resource allocation at target RNC, RNC sends **Relocation Complete** messages to the involved CN nodes.
            At any phase, before the **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 unexceptional thing occurs a **Relocation Failure** message may be sent instead of any message numbered 3-10 and 13-14 described in this above.

20./21.   The CN node initiates the release of the Iu connections to the source RNC by sending RANAP message **Iu Release Command**.

22.   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.

23./24.   SRNC confirm the IU release to the CN nodes sending the message **Iu Release Complete.**

NOTE 1:   The messages used are only one example of the various messages which can be used to trigger a handover, to confirm it or to indicate the handover failure. The different possibilities are specified in the RRC specification (25.331), subclause 8.3.5.2.

7.11.2   Forward Hard Handover

This subclauses shows some examples of hard handover in the case of mobile initiated forward handovers.

Some examples of Cell Update procedures are shown, 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. The UE is in CELL_PCH or CELL_FACH.

7.11.2.1   Cell Update with SRNS relocation

This example shows Inter-RNS Cell Update with switching in the CN (therefore with SRNS relocation) and RNTI reallocation.
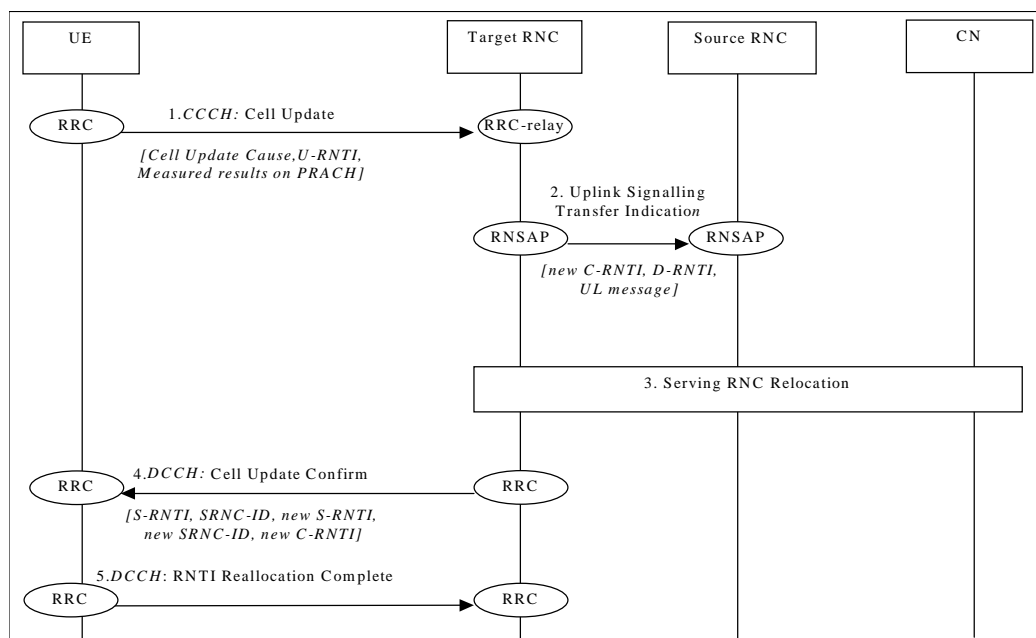

Figure 30: Cell Update with SRNS Relocation

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, target RNC allocates a C-RNTI for the UE.
2. Controlling target RNC forward the received message (on CCCH) via **Uplink Signalling Transfer Indication** RNSAP message towards the SRNC. Message includes, besides target RNC-ID, also the allocated C-RNTI, which is to be used as UE identification within the C-RNC, and the D-RNTI. Upon reception of the RNSAP message SRNC decides to perform SRNS Relocation towards the target RNC.
3. Serving RNC relocation procedure is executed as defined in subclause 'SRNS Relocation Relocation (UE connected to a single CN node)'. After completing SRNS Relocation, target RNC allocates new S-RNTI for the UE, UE becoming the new serving RNC.
4. Target 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.
5.   UE acknowledges the RNTI reallocation by sending the RRC message **RNTI Reallocation Confirm**

7.11.2.2   Cell Update via Iur without SRNS relocation

This example shows an Inter RNS cell update in DRNS without SRNS relocation when no Iur RACH/FACH transport bearer exists. In this example target DRNS, source DRNS and serving RNS are all located separately from each other. Other scenarios can be easily derived from this most comprehensive signalling procedure.
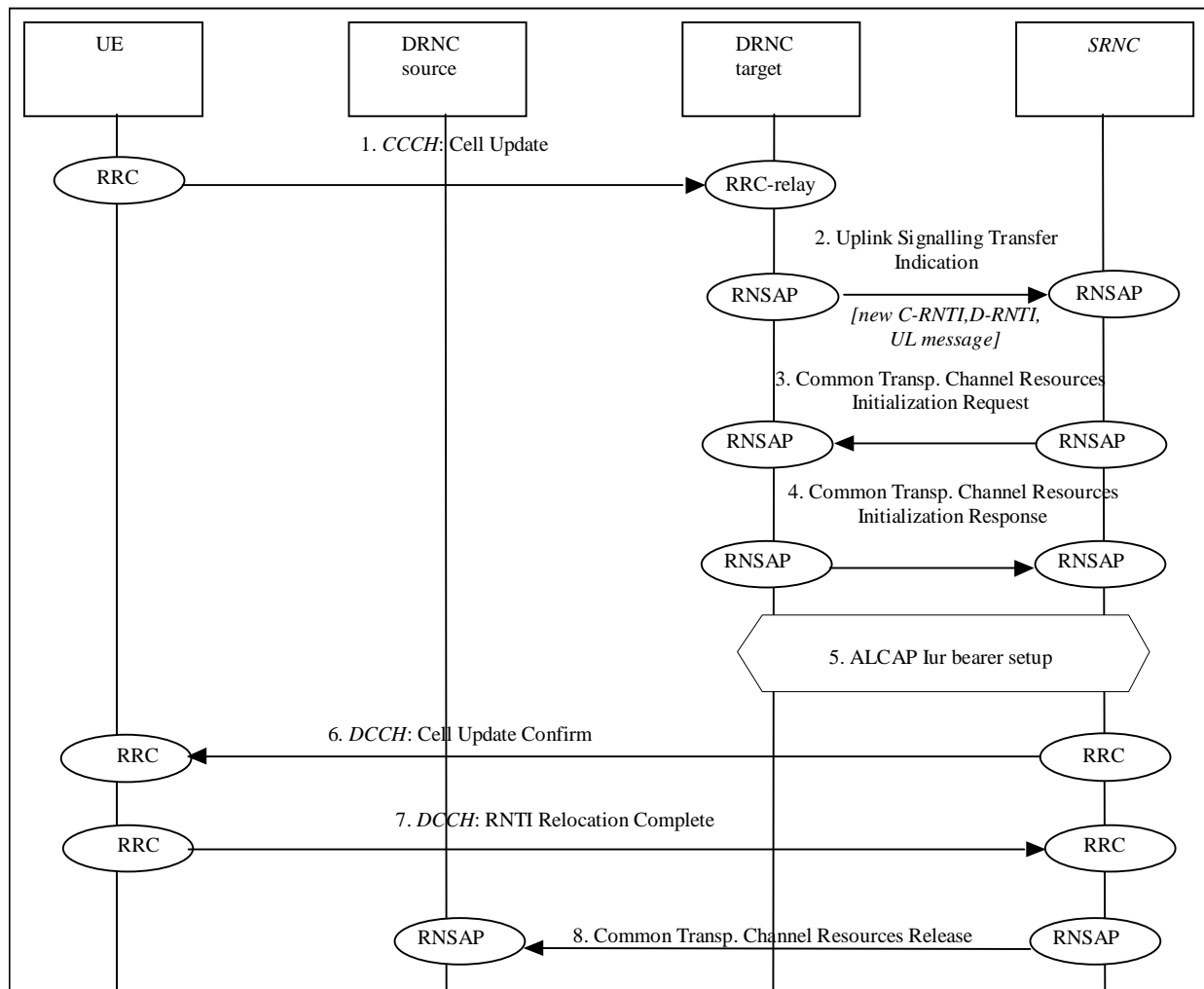
Figure 31: Cell Update via Iur without SRNS Relocation

1. UE sends an RRC message **Cell Update** to the UTRAN (Target DRNC), after having made cell re-selection.
2. Upon reception of a CCCH message from a UE, the target DRNC decodes the SRNC-ID and the S-RNTI. The UE is not registered in the target DRNC, thus the target DRNC allocates C-RNTI and D-RNTI for the UE. The target DRNC forwards the received uplink CCCH message towards the SRNC in the RNSAP **Uplink Signalling Transfer Indication** message. The Uplink Signalling Transfer message includes also the cell-ID of the cell from which the CCCH message was received, the D-RNC ID and the allocated C-RNTI and D-RNTI.
3. Upon reception of the Uplink Signalling Transfer message the SRNC decides not to perform an SRNS Relocation towards the target RNC. The SRNC initialises the UE context in the target RNC with the **RNSAP Common Transport Channel Resources Initialisation Request** message. The message includes the D-RNTI and the cell identity previously received in the Uplink Signalling Transfer indication message, as well as a request for transport layer address and binding identity if there exists no appropriate Iur transport bearer to be used for the UE.
4. The target DRNC sends the transport layer address, binding identity and optionally PHY parameters (FACH code,) to the SRNC with the RNSAP **Common Transport Channel Resources Initialisation Response** message
5. If there does not already exist an appropriate Iur transport bearer to be used for the UE, a transport bearer is established from the SRNC
6. The SRNC sends RRC **Cell Update Confirm** to the UE. The message is sent in the Iur user plane. It will be sent by the target DRNC to the UE on the FACH coupled to the RACH. Subsequent FACH data may be sent on a different FACH if so decided by the target DRNC.
7. UE acknowledges the RNTI reallocation by sending the RRC message **RNTI Reallocation Confirm**.
8. The SRNC releases the UE context in the source DRNC by sending a **Common Transport Channel Resources Release** message. The source DRNC releases the D-RNTI.

7.11.2.3 Cell Update via Iur without SRNS relocation (with C-RNTI reallocation)

This example is similar to the previous one (7.11.2.2) with minor changes. It shows a cell update in DRNS without SRNS relocation when an Iur RACH/FACH transport bearer exists and the UE is already known in the DRNS. The DRNC decides to allocate a new C-RNTI for the UE but not a new D-RNTI because D-RNC does not change. Therefore the two columns DRNC of picture 31 merge themselves to represent this case.

7.11.2.4 Cell Update via Iur with USCH/DSCH, without SRNS relocation

This example shows an inter-RNS cell update without SRNS relocation, when the UE is in Cell_FACH state and has been allocated DSCH and USCH (TDD) before the Cell Update and when no Iur RACH/FACH transport bearer exists. In this example target RNS, source RNS and serving RNS are all located separately from each other. The procedure includes an implicit release of the USCH and DSCH, which includes release of the Radio Link in the old cell. A potential restoration of USCH and DSCH after the cell update, triggered by the SRNC, is not shown.
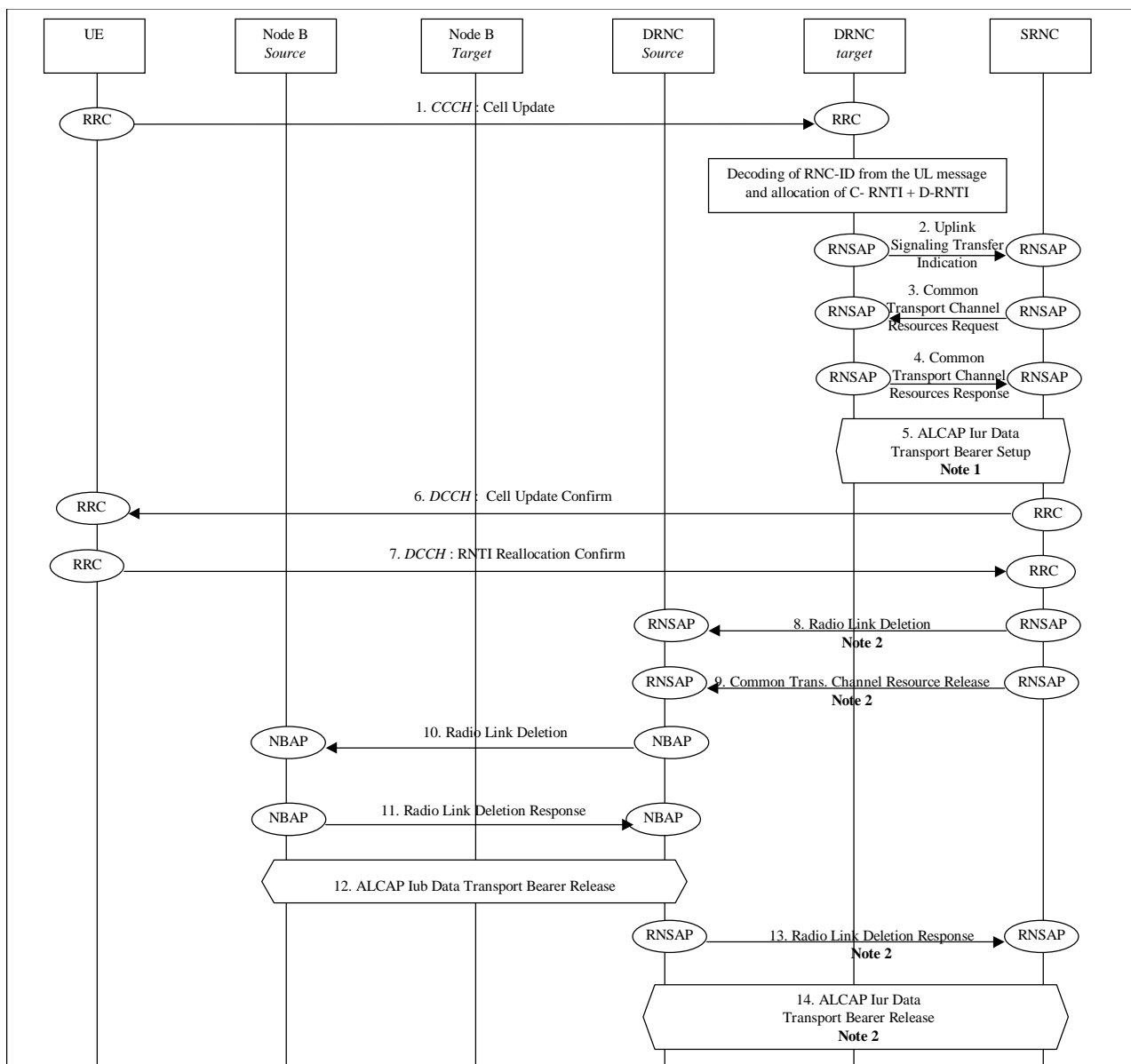

Figure 32: Backward Cell Update via Iur (Cell_FACH State with USCH/DSCH) – successful case.

Note 1: These messages are not necessary if the Target RNC and the SRNC are identical.
Note 2: These messages are not necessary if the Source RNC and the SRNC are identical.

1. When the UE decides that a cell update is necessary, it sends an RRC message **Cell Update** to the Target RNC. This is a *CCCH* message carried on the *RACH* in the new cell. Upon reception of a CCCH message from a UE, the

target DRNC decodes the SRNC ID and the S-RNTI. Supposing that the UE is not registered in the target DRNC (RNC ID and SRNTI unknown), the target DRNC allocates a C-RNTI and a D-RNTI for the UE.

2. The Target RNC forwards the **Cell Update** to the SRNC via an RNSAP **Uplink Signaling Transfer** message. (*Note 1*). The Uplink Signalling Transfer message includes also the cell-ID of the cell from which the CCCH message was received, the D-RNTI and the allocated C-RNTI. Upon reception of the Uplink Signalling Transfer message the SRNC decides not to perform a SRNS Relocation towards the target RNC.

3. The SRNC initialises the UE context in the target RNC with the **RNSAP Common Transport Channel Resource Request** message. The message includes the D-RNTI and the cell identity previously received in the Uplink Signalling Transfer indication message, as well as a request for transport layer address and binding identity if there exists no appropriate Iur transport bearer to be used for the UE. (*Note 1*)

4. The Target RNC responds with an RNSAP message **Common Transport Channel Resources Response** including the transport layer address, binding identity and optionally PHY parameters (FACH code, ..) (*Note 1*).

5. If there does not already exist an appropriate Iur transport bearer to be used for the UE, a transport bearer is established from the SRNC (*Note 1*).

6. The SRNC sends an RRC message **Cell Update Confirm** within the *DCCH* on *FACH* to the UE. The message is sent in the Iur user plane. It will be sent by the target DRNC to the UE on the FACH coupled to the RACH. Subsequent FACH data may be sent on a different FACH if so decided by the target DRNC.

7. UE acknowledges the RNTI reallocation by sending the RRC message **RNTI Reallocation Confirm**.

8. The SRNC releases the UE context in the source DRNC by sending a **Common Transport Channel Resource Release** message. The source DRNC releases the D-RNTI (*Note 2*).

9. The SRNC sends an RNSAP message **Radio Link Deletion** to the source RNC(*Note 2*).

10. The source RNC sends NBAP message **Radio Link Deletion** to the source Node B. Parameters: Cell id, Transport layer addressing information.

11. The source Node B deletes the previous Radio link and the Communication Context. Successful outcome is reported in NBAP message **Radio Link Deletion Response**.

12. The source RNC initiates release of the corresponding Iub Data Transport bearers using ALCAP protocol.

13. When the source RNC has completed the release, the RNSAP message **Radio Link Deletion Response** is sent to the SRNC (*Note 2*).

14. SRNC initiates release of Iur Data Transport bearer using ALCAP protocol. The request for release of Iur Data Transport bearer is acknowledged by the Source RNC *(Note 2)*.

7.12 URA Update

This subclause 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.

7.12.1 Inter-RNS URA Update with SRNS Relocation

This example shows Inter-RNS URA Update with switching in the CN (SRNS relocation).
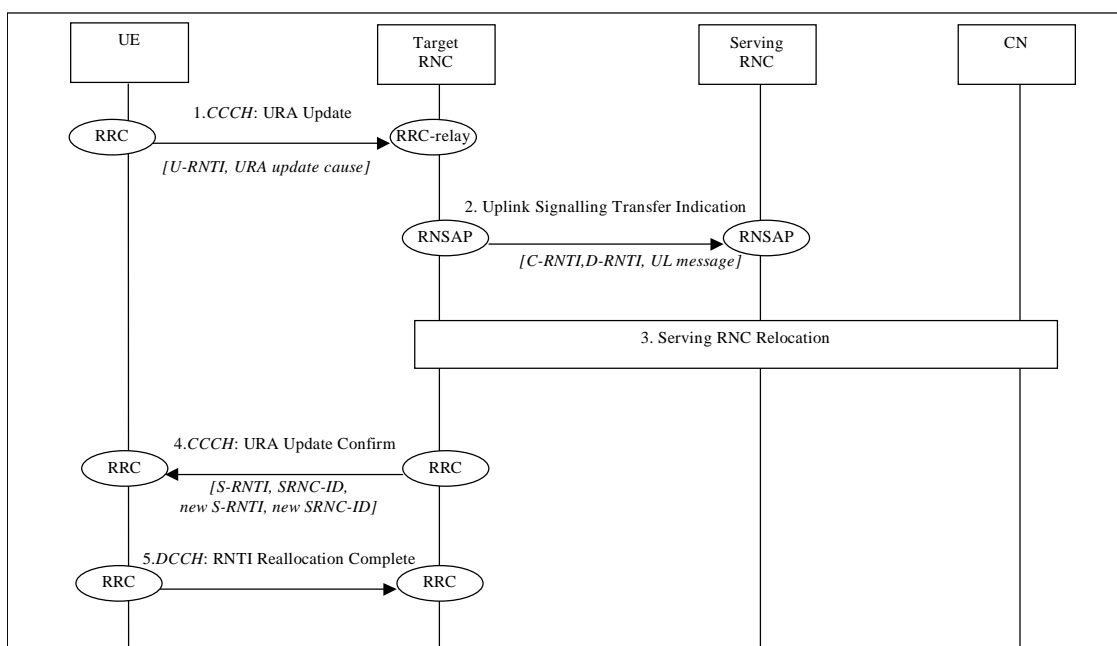
Figure 33: Inter RNS URA Update with switching in CN.

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, the target RNC becomes a controlling RNC and it allocates a new C-RNTI and a new D-RNTI for the UE.

2. The target RNC forwards the received uplink CCCH message towards the SRNC by RNSAP **Uplink Signalling Transfer Indication** message to the old Source/Controller RNC. Message includes, besides target RNC-ID, also the allocated C-RNTI, which is to be used as UE identification within the C-RNC, and the D-RNTI. Upon reception of the RNSAP message SRNC decides to perform SRNS Relocation towards the target RNC.

3. Serving RNC relocation procedure is executed as defined in subclause 'SRNS Relocation (UE connected to a single CN node)'. After having completed SRNS Relocation, target RNC allocates new S-RNTI for the UE becoming the new serving RNC. New SRNC also deletes the allocated C-RNTI, since it is not needed for an UE in URA_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.

5. UE acknowledges the RNTI reallocation by sending the RRC message **RNTI Reallocation Confirm** on DCCH.

7.12.2   Inter-RNS URA Update via Iur without SRNS relocation

This example shows an Inter RNS URA update in DRNS without SRNS relocation. In this example target RNS, source RNS and serving RNS are all located separately from each other. Other scenarios can be easily derived from this most comprehensive signalling procedure.

Please note that this example shows the case when no ciphering is requires; for this case no channels on Iur are required and therefore the message flow 5 (Cell Update Confirm) is sent on CCCH. In the case that ciphering is required, that message must be sent on the DCCH (ciphering is performed at MAC-d level) and the flow becomes similar to the one shown for the Cell Update in section "Cell Update via Iur without RNS relocation".
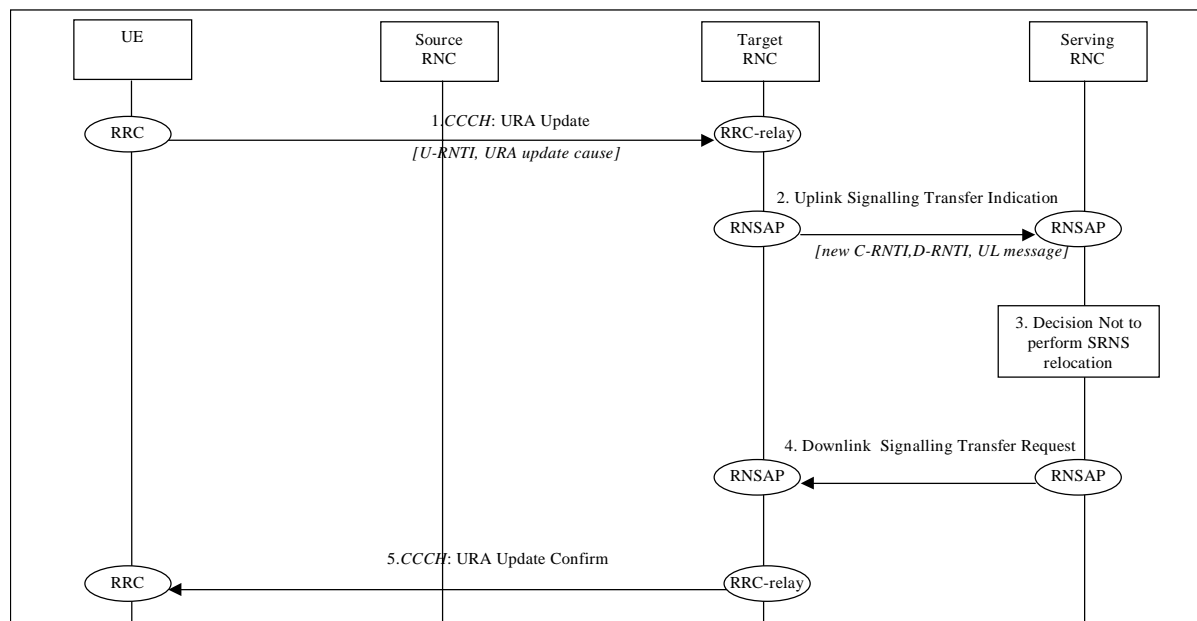
Figure 34: Inter-RNS URA Update via Iur without SRNS relocation

1. UE sends a RRC message **URA Update** to the UTRAN, after having made cell re-selection and URA has changed.
2. Upon reception of the message from a UE, Target RNC decodes the RNC ID and the S-RNTI. The UE is not registered in the target RNC (RNC ID and SRNTI unknown), thus RNC allocates C-RNTI and D-RNTI for the UE. The Target RNC forward the received Uu signalling message towards the SRNC by RNSAP **Uplink Signalling Transfer Indication** message. The message includes also the cell-ID from which the message was received and the allocated C-RNTI and D-RNTI.
3. Upon reception of the RNSAP message SRNC decides not to perform an SRNS relocation towards the target RNC. The target RNC become C-RNC while SRNC remains unchanged.
4. SRNC delivers to Target RNC information upon, eventually new, RNTIs via a **Downlink Signalling Transfer Request**, transporting a URA Update Confirm.
5. The **URA Update Confirm** is forwarded to the UE (via CCCH with new RNTIs) from the target RNC.

7.12.3 SRNS Relocation (UE connected to two CN nodes)

This example show SRNS Relocation, in situation in which the UE is connected to two CN nodes simultaneously (this means that RNC is connected to a SGSN and a MSC). It is assumed that:

- all cells in the active set are in one DRNC;

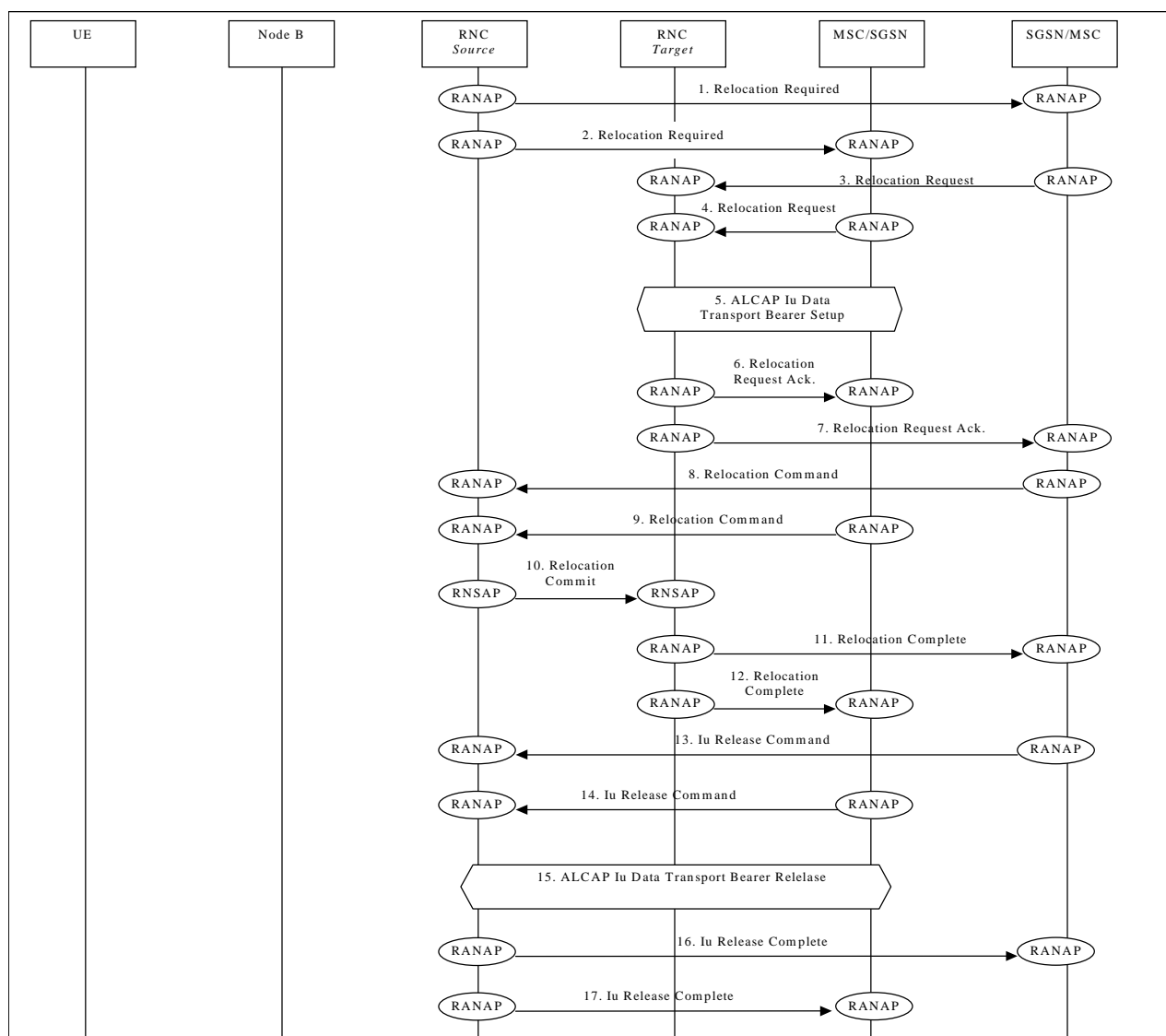- the CN performs hard switching of the user traffic.

Figure 35: SRNS 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 **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 data.
          Upon reception of **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 **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.
5.   The targets RNC and CN node establish the new Iu transport bearers for each Radio Access Bearer related to that CN node.
6./7.   When the source RNC and the target RNC have completed its preparation phase, **Relocation Request Acknowledge** message is sent to CN.
8./9.   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 SRNS Relocation by sending the **Relocation Command** message. To the source RNC and the target RNC.
10.   When the source RNC has received **Relocation Command** messages from all the CN nodes, the source RNC sends a **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.

11./12. Immediately after a successful switch at RNC, target RNC (=SRNC) sends **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.

13./14. 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**.

15 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.

16./17. SRNC confirm the IU release to the CN nodes sending the message **Iu Release Complete.**

At any phase, before the **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 **Relocation Failure** may be sent instead of any message numbered 3-11 described.

7.13 HO & Cell Reselection between UTRAN and GSM/BSS

This subclause presents some examples of handover procedure from UTRAN to GSM/BSS and vice versa.

The case of a UTRAN connected to UMTS CN connected to a 2G-MSC (i.e. via MAP/E interface) is shown. The case of an UTRAN connected a GSM CN trough an IWF (where RANAP is interworked with BSSMAP) is not shown, because is equivalent from the point of view of the UTRAN.

The case of HO between UTRAN and GPRS and viceversa are also considered.

7.13.1 UTRAN ⇒ GSM/BSS

This example shows how handover (Hard Handover) is performed from UTRAN to GSM/BSS between a UMTS CN and a 2G-MSC.

NOTE: Procedures between CN and MSC, and between MSC and BSC are out of the scope of WG3, and are only included for clarity.
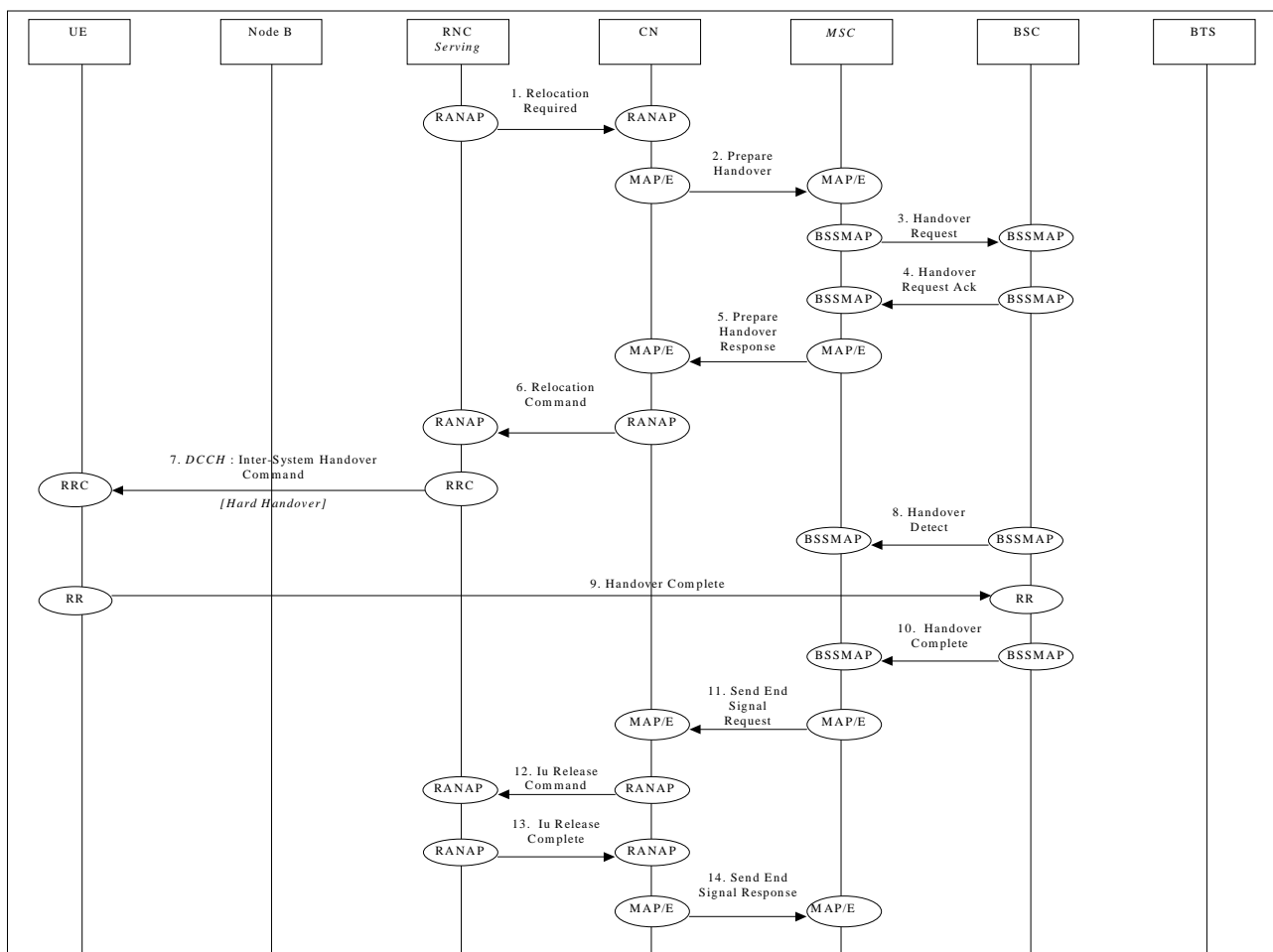
Figure 36: UTRAN ⇒ GSM/BSS handover

1. Upon detection of a trigger SRNC sends RANAP message **Relocation 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**).

   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 **Relocation Command** to the SRNC.
7. Via existing RRC connection, SRNC sends RRC message Inter-System Handover Command (Hard Handover) to the UE.
   Parameters: Handover type.

   Procedures related to synchronisation etc. to GSM BSS are not shown.

   Steps 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).

7.13.2 GSM/BSS ⇒ UTRAN

This example shows how handover (Hard Handover) is performed from GSM/BSS to UMTS between a UMTS CN and a 2G-MSC.

> NOTE: Procedures between CN and MSC, and between MSC and BSC are out of the scope of WG3, and are only included for clarity.
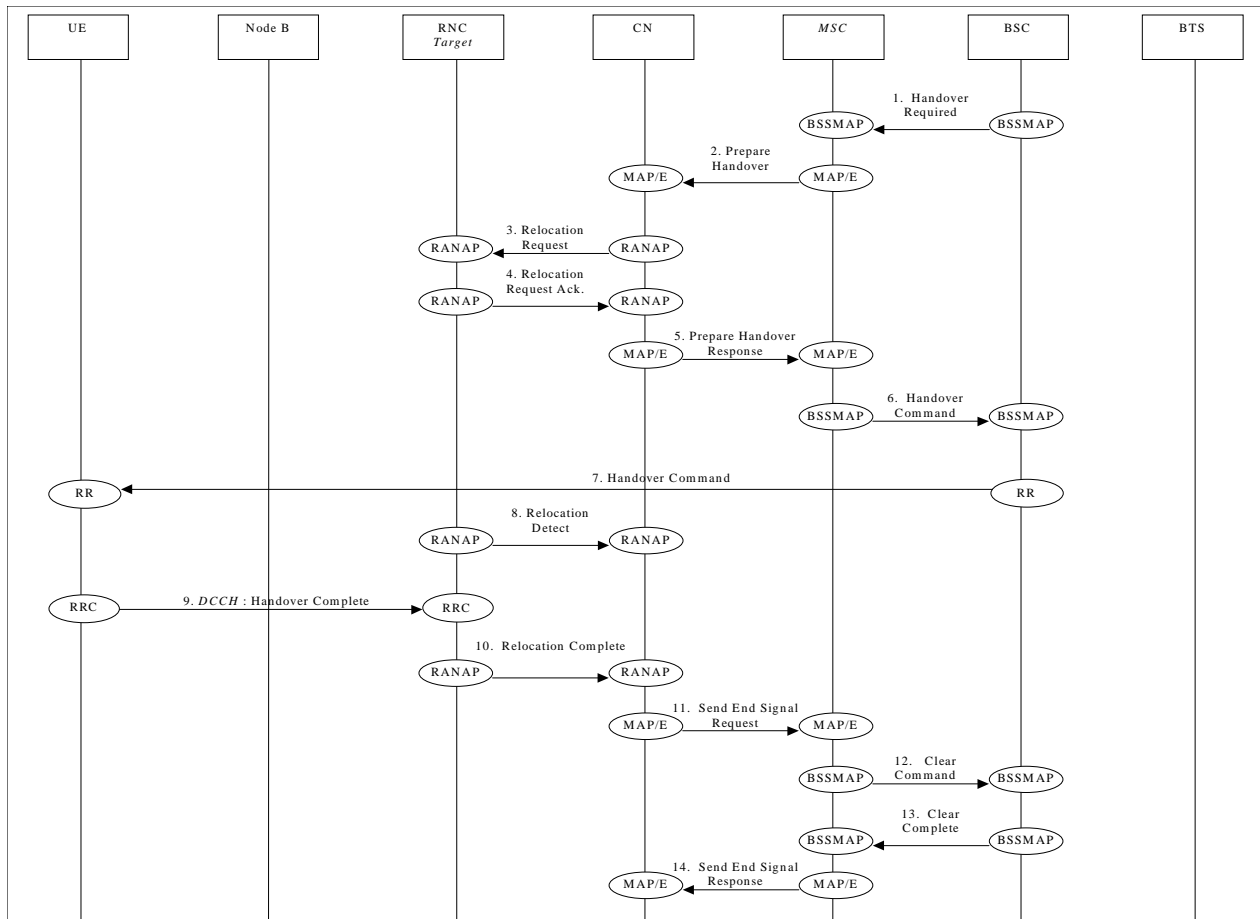

Figure 37: GSM/BSS ⇒ UTRAN handover

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 **Relocation Request** to the Target RNC.
4. Response **Relocation 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.

   Steps 6 & 7 follow normal GSM procedures and are shown only for clarity.

8. When target RNC has detected the UE, **Relocation Detect** message is sent to the CN node.
9. 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.
10. Once complete the target RNC sends RANAP message **Relocation Complete** to the CN.
11. CN sends MAP/E message **Send End Signal Request** to the MSC.
12. The MSC sends **Clear Command** message to the BSC.
13. 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).

7.13.3 GPRS ⇒ UMTS Cell Reselection

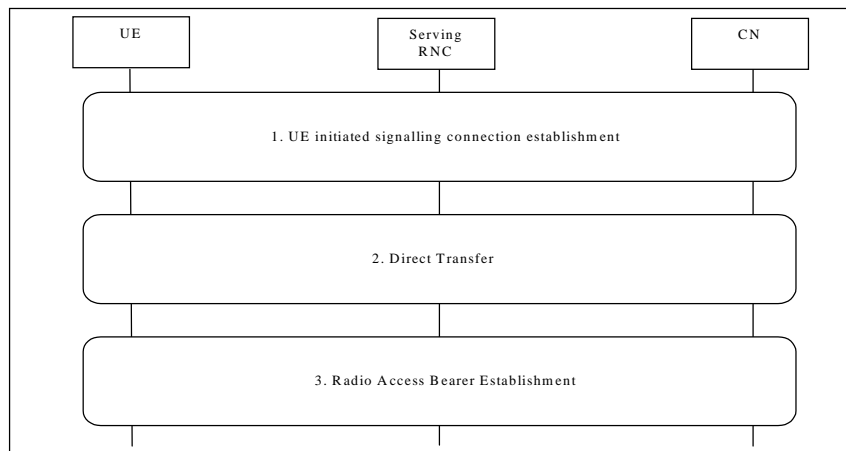This subclause shows UTRAN signalling procedures for GPRS to UTRAN Cell Reselection.

Figure 38

1. The UE selects a UTRAN cell, reads system information, and initiates establishment of a NAS signalling connection.
   See section UE Initiated Signalling Connection Establishment.
2. The NAS signalling connection between UE and CN can now be used for NAS message transfer (e.g. execution of security functions).
   See section Direct Transfer.
3. After necessary CN-GPRS preparations (e.g. UE context information retrieval), CN initiates establishment of radio access bearer(s).
   See section Radio Access Bearer Establishment.

7.13.4 UMTS ⇒ GPRS Cell Reselection, UE Initiated

This subclause shows UTRAN signalling procedures for UTRAN to GPRS cell reselection initiated by UE..
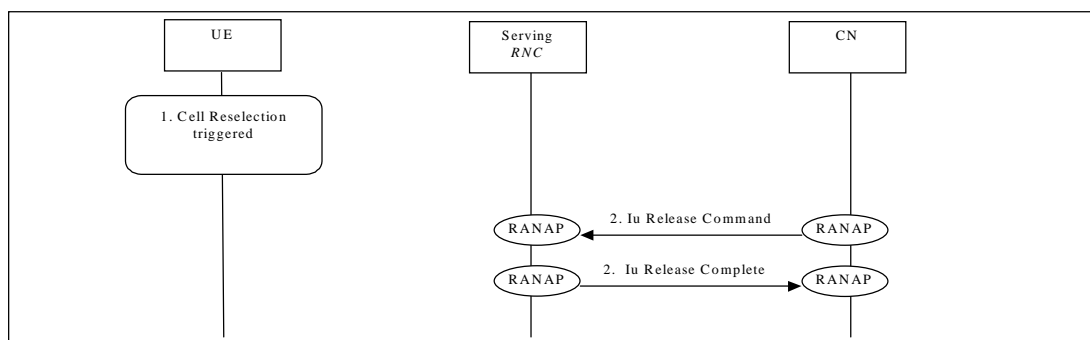

Figure: 39

1. The UE selects a GPRS cell, reads system information, and initiates establishment of UE-GPRS connection.
2. After necessary CN-GPRS preparations (e.g. UE context information retrieval), CN initiates release of Iu connection. SRNC releases the RRC connection.

7.13.5 UMTS ⇒ GPRS Cell Reselection, Network Initiated

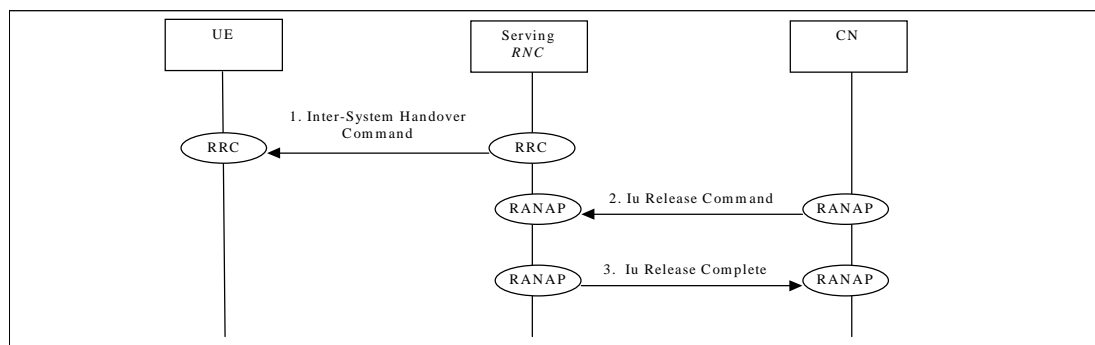This subclause shows UTRAN signalling procedures for UTRAN to GPRS Cell Reselection triggered by Serving RNC.

Note: This case can only supported if the RNC could generate GSM messages.

Figure: 40

1. Based on UE measurements, SRNC triggers the handover to a GPRS cell by sending a Inter-System Handover Command to the UE. UE initiates establishment of UE-GPRS connection.
2. After necessary CN-GPRS preparations (e.g. UE context information retrieval), CN initiates release of the RRC connection.
3. SRNC releases all resources reserved for the UE.

7.14 Transport Channel Reconfiguration(DCH to DCH)

7.14.1 Synchronised Transport Channel Reconfiguration

The procedure can be applied when the reconfiguration time requires being synchronised among Node-Bs, SRNC and UE.

Figure 41: Synchronised Transport Channel Reconfiguration

1. SRNC decided that there is a need for a synchronous Transport Channel Reconfiguration and requests DRNC to prepare reconfiguration of DCH **Radio Link Reconfiguration Prepare**).
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information, Time Slots (TDD only), User Codes (TDD only).
2. DRNC requests its Node B to prepare reconfiguration of DCH to carry the radio access bearer (**Radio Link Reconfiguration   Prepare**).
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information Time Slots (TDD only), User Codes (TDD only).
3. SRNC requests its Node B to prepare reconfiguration of DCH (**Radio Link Reconfiguration Prepare**).
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information, Time Slots (TDD only), User Codes (TDD only).
4. Node B allocates resources and notifies DRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**).
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
5. DRNC notifies SRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**).
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iur Data Transport Bearer.
6. Node B allocates resources and notifies SRNC that the reconfiguration is ready (**Radio Link Reconfiguration Ready**).
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.
7. SRNC initiates (if needed) establishment of new Iur/Iub Data Transport Bearers using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur/Iub Data Transport Bearer to DCH.
8. SRNC initiates (if needed) establishment of new Iub Data Transport Bearers using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer to DCH.
9. RNSAP message **Radio Link Reconfiguration Commit** is sent from SRNC to DRNC.
Parameters: CFN.
10. NBAP message **Radio Link Reconfiguration Commit** is sent from DRNC to Node B.

Parameters: CFN.

11. NBAP message **Radio Link Reconfiguration Commit** is sent from SRNC to Node B.

Parameters: CFN.

12. RRC message **Transport Channel Reconfiguration** is sent by SRNC to UE.

13. UE sends RRC message **Transport Channel Reconfiguration Complete** to SRNC.

14. Not used resources in DRNC and Node B (Drift RNS) are released. DRNC initiates release of Iur and Iub (Drift RNS) Data Transport bearer using ALCAP protocol.

15. Not used resources in SRNC and Node B (Serving RNS) are released. SRNC initiates release of Iub (Serving RNS) Data Transport bearer using ALCAP protocol.

7.14.1 Unsynchronised Transport Channel Reconfiguration

The procedure can be applied when the reconfiguration time does not require being synchronised among Node-Bs, SRNC and UE.
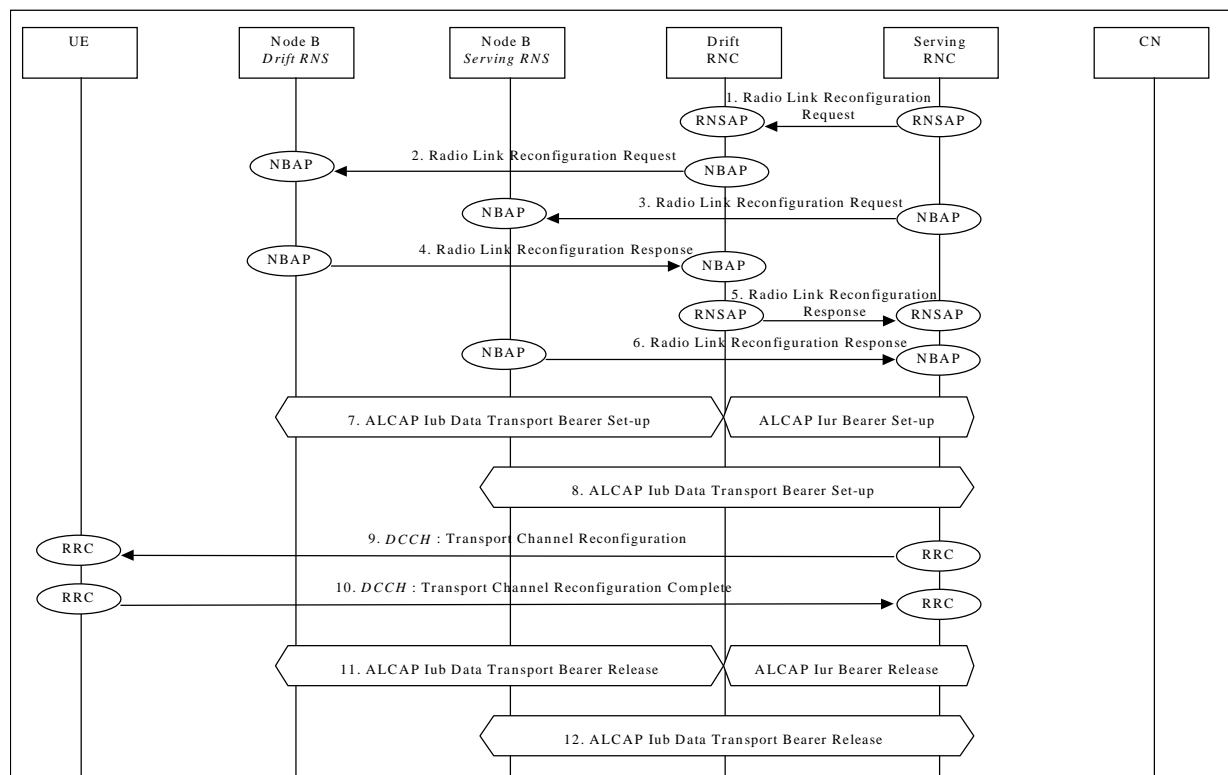

Figure 42: Unsynchronised Transport Channel Reconfiguration

1. SRNC decided that there are no need for a synchronised Transport Channel Reconfiguration, and requests DRNC to reconfigure the DCH. It includes in the message **Radio Link Reconfiguration Request** that the modification shall be done immediately without waiting for the commit message.
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information, Time Slots (TDD only), User Codes (TDD only).

2. DRNC requests its Node B to reconfigure the DCH in the existing Radio Link (**Radio Link Reconfiguration Request**).
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information, Time Slots (TDD only), User Codes (TDD only).

3. SRNC requests its Node B to reconfigure the DCH in the existing Radio Link (**Radio Link Reconfiguration Request**).
   Parameters: Transport Format Set, Transport Format Combination Set, Power control information, Time Slots (TDD only), User Codes (TDD only).

4. Node B of the DRNC allocates resources and notifies DRNC that the reconfiguration is done (**Radio Link Reconfiguration Response**).
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

5. DRNC notifies SRNC that the reconfiguration is done (**Radio Link Reconfiguration Response**). Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iur Data Transport Bearer.

6. Node B of the SRNC allocates resources and notifies DRNC that the reconfiguration is done (**Radio Link Reconfiguration Response**).
Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Id) for Iub Data Transport Bearer.

7. SRNC initiates (if needed) establishment of new Iur/Iub Data Transport Bearers using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iur/Iub Data Transport Bearer to DCH.

8. SRNC initiates (if needed) establishment of new Iub Data Transport Bearers using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer to DCH.

9. RRC message **Transport Channel Reconfiguration** is sent by SRNC to UE.

10. UE sends RRC message **Transport Channel Reconfiguration Complete** to SRNC.

11. Not used resources in-DRNC and Node B (Drift RNS) are released. DRNC initiates release of Iur and Iub (Drift RNS) Data Transport bearer using ALCAP protocol

12. Not used resources in SRNC and Node B (Serving RNS) are released. SRNC initiates release of Iub (Serving RNS) Data Transport bearer using ALCAP protocol.

7.15   Direct Transfer

7.15.1   Uplink Direct Transfer

This example applies to the transportation of a NAS message through UTRAN. This flow applies when the terminal is in connected mode.
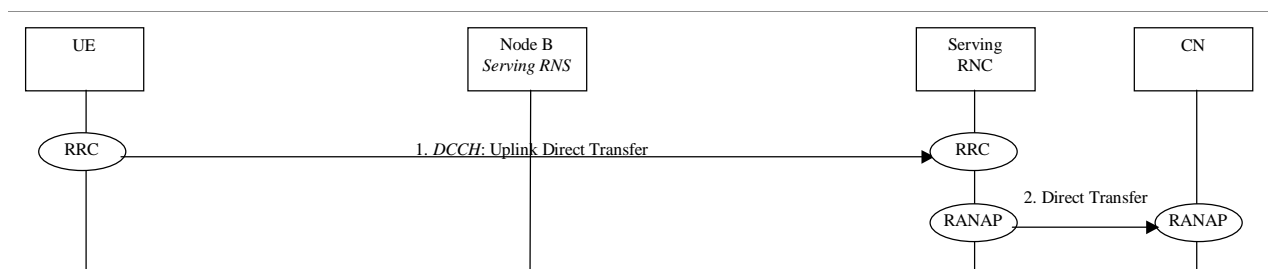

Figure 43: Uplink Direct Transfer

1. UE sends RRC **Uplink Direct Transfer Message** to SRNC.
Parameters: NAS Message.

2. SRNC sends the RANAP message **Direct Transfer** to the CN.
Parameters: NAS PDU.

The NAS message is transported transparently by the UTRAN.

7.15.2   Downlink Direct Transfer

This example applies to the transportation of a NAS message through UTRAN.
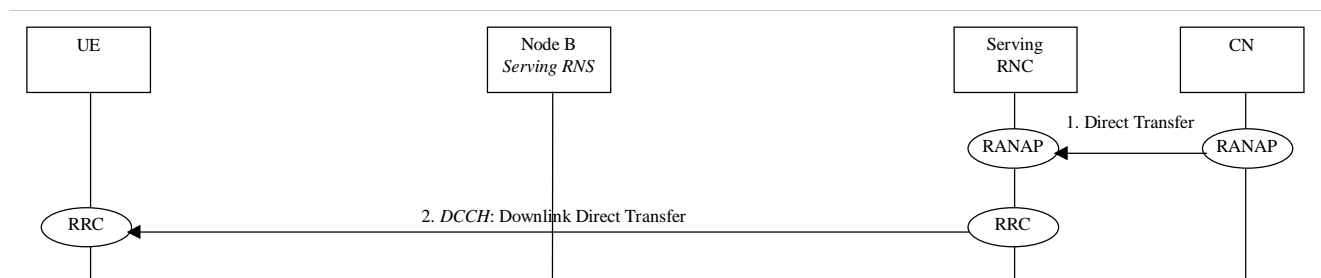

Figure 44: Downlink Direct Transfer

1. CN sends the RANAP message **Direct Transfer** to the SRNC.
    Parameters: NAS PDU, CN domain Identity.
2. SRNC sends RRC **Downlink Direct Transfer Message** to UE.
    Parameters: NAS Message.

The NAS message is transported transparently by the UTRAN.
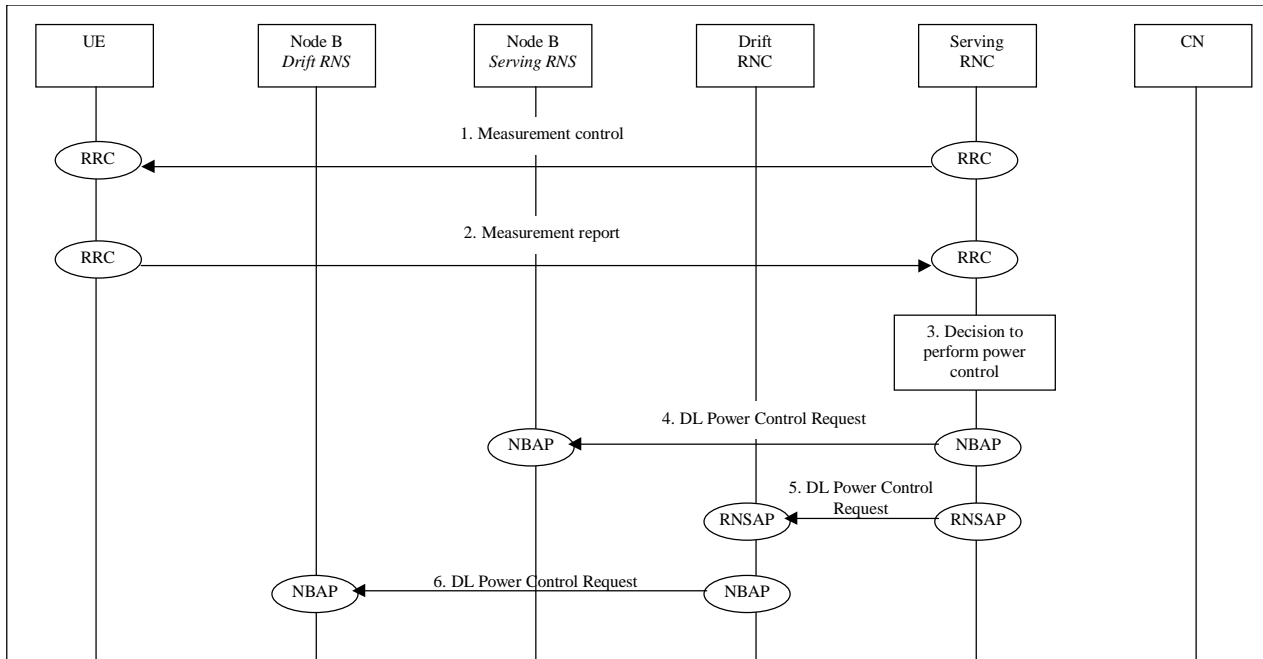
7.16 Downlink Power Control [FDD]

Figure 45: Downlink Power Control

1. SRNC send to UE a RRC **Measurement Control** message to setup a quality measure.
    Parameters: Measurement ID number, Measurement type, Measurement command; This message is optional in the described flow.
2. UE after having performed the measure, send towards CRNC the report in Measurement Report.
3. CRNC decides to request NodeBs lower level (L1) to change power in DL
4. SRNC sends the NBAP message **DL Power Control Request** to the controlled Node B
    Parameters: RL ID, RL Reference power,Max Adjustment Step, Adjustment Period, Adjustment Ratio.
5. SRNC sends the RNSAP message **DL Power Control Request** to the DRNC
    Parameters: RL ID, RL Reference power, Max Adjustment Step, Adjustment Period, Adjustment Ratio.
6. DRNC sends the NBAP message **DL Power Control Request** to the controlled Node B
    Parameters: RL ID, RL Reference power, Max Adjustment Step, Adjustment Period, Adjustment Ratio.

7.17 USCH/DSCH Configuration and Capacity Allocation [TDD]

This subclause shows an example of USCH/DSCH configuration and capacity allocation.

It is assumed that no RL has been already established for the considered RRC connection on the serving cell (i.e. the UE is in cell_FACH state without USCH/DSCH) and that only standalone USCH/DSCH are going to be configured. In case the UE is in cell_DCH state or in cell_FACH state with USCH/DSCH, the Radio Link Reconfiguration procedure is used in steps 1-4-5-6 instead of the Radio Link Setup procedure.
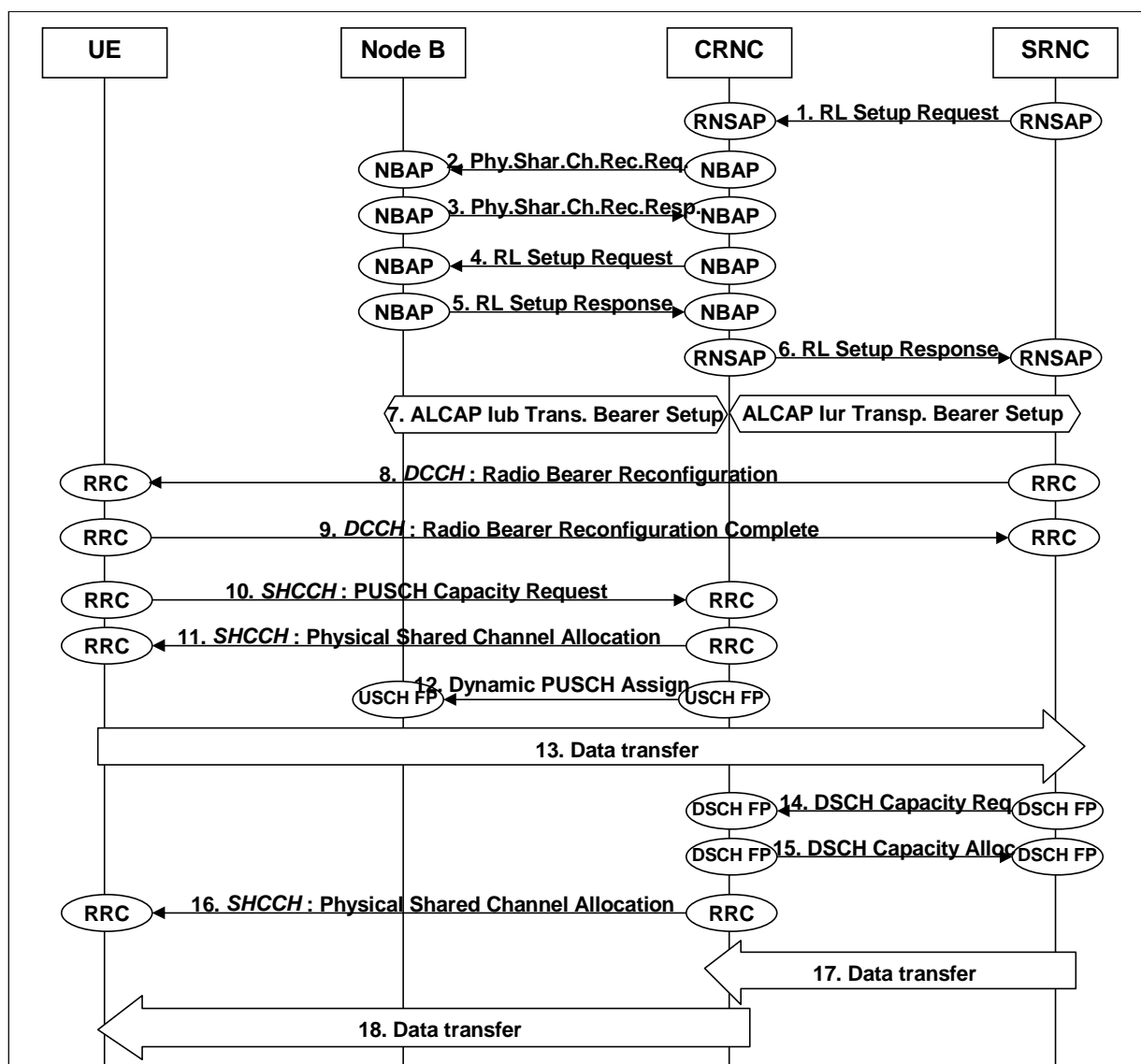
USCH/DSCH Configuration and Capacity Allocation

1. In case no RL has already been established on the RNC controlling the serving cell, the SRNC sends a Radio Link Setup Request message to the target RNC.
    Parameters: target RNC identifier, s-RNTI, Cell id, Transport Format Set (for DSCHs and USCHs), Transport Format Combination Set.
2. If necessary, the CRNC sends to the Node B a Physical Shared Channel Reconfiguration Request message in order to add, modify or delete any PDSCH Sets and PUSCH Sets in the Common Transport Channel data base.
    Parameters: PDSCH Info (to add, modify or delete), PUSCH Info (to add, modify or delete).
3. The Node B updates the PDSCH and PUSCH Sets in the Common Transport Channel data base and makes them available to all the current and future DSCH and USCH transport channels. Then it responds with Physical Shared Channel Reconfiguration Response message.
4. The RNC sends the NBAP message Radio Link Setup Request to the target Node-B.
    Parameters: Cell id, Transport Format Set (for DSCHs and USCHs), Transport Format Combination Set, Power control information, etc.
5. Node B configures resources for USCHs and DSCHs and responds with NBAP message Radio Link Setup Response.
    Parameters: Signaling link termination, Transport layer addressing information for the Iub Data Transport Bearer.
6. When the Target RNC has completed preparation phase, Radio Link Setup Response is sent to the SRNC.
7. Target RNC initiates set-up of Iub Data Transport bearer using ALCAP protocol while the SRNC initiates set-up of Iur Data Transport bearer. These requests contain the AAL2 Binding Identity to bind the Iub/Iur Data Transport Bearers to the DSCHs/USCHs. The request for set-up of Iub Data Transport bearer is acknowledged by Node B, while the request for set-up of Iur Data Transport bearer is acknowledged by Target RNC.

8. The SRNC sends a Radio Bearer Reconfiguration message to establish the requested USCHs and DSCHs.
   Parameters: Radio Bearer information.

9. The UE replies with a Radio Bearer Reconfiguration Complete message.

10. As soon as the RRC in the UE detects the necessity to sends UL data on one USCH, it sends a PUSCH Capacity Request message to obtain allocation of PUSCH resources from the CRNC.
    Parameters: C-RNTI, Radio Bearer ID, RLC buffer info.

11. The CRNC determines which PUSCH Set to allocate to the USCH and sends a Physical Shared Channel Allocation message to the UE.
    Parameters: C-RNTI, Allocation Period info (Activation CFN, Duration), PUSCH info.

12. The CRNC signals the allocation of PUSCH resources for a given UE to the Node B by means of a Dynamic PUSCH Assignment control frame.
    Parameters: PUSCH Set Id, Activation CFN, Duration.

13. At the scheduled CFN the UE may start transmitting UL data on the USCH for the assigned allocation period. UL data are forwarded by the CRNC to the SRNC.

14. As soon as the SRNC detects the necessity to sends DL data on one DSCH, it sends a DSCH Capacity Request control frame to the CRNC.
    Parameters: Common Transport Channel Priority Indicator, User buffer size.

15. The CRNC determines the amount of data (credits) that can be transmitted on the DSCH and reports this information back to the SRNC by means of DSCH Capacity Allocation message.
    Parameters: Common Transport Channel Priority Indicator, Max MACc-sh SDU Length, Credits, Interval, Repetition Period.

16. The CRNC determines which PDSCH Set to allocate to the DSCH and sends a Physical Shared Channel Allocation message to the UE.
    Parameters: C-RNTI, Allocation Period info (Activation CFN, Duration), PDSCH info.

17. The SRNC starts sending DL data to the CRNC.

18. The CRNC schedules the DL transmission of DL data on DSCH according to the allocation of PDSCH resources.

# 7.18 Channel and Mobile State Switching on Iur

7.18.1 General Description

This subclause shows an example of switching of a mobile protocol state to another, which Iur is used, thus involving RNSAP procedure.

7.18.2 Switching from Cell_FACH to Cell_DCH State

The following examples show switching of protocol state from Cell_FACH to Cell_DCH providing UE with information on RACH/FACH flows and involving DRNC and Iur.

The resulting sequence is the following:
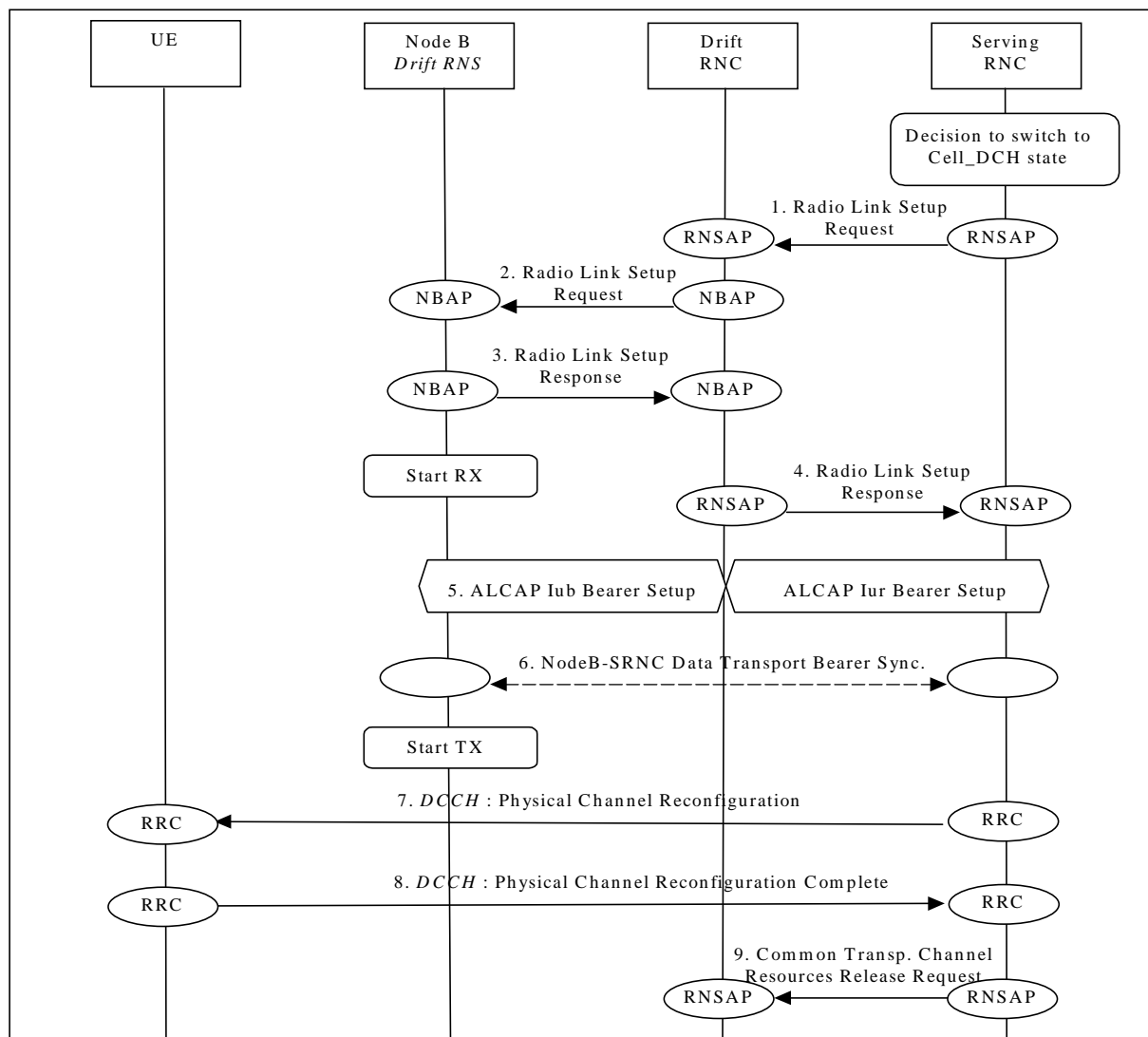
1. SRNC decides to switch to CELL_DCH state, setting up a new radio link via a new cell controlled by DRNC.

   SRNC requests DRNC for radio resources by sending RNSAP message **Radio Link Setup 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. 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.

3. Successful outcome is reported in NBAP message **Radio Link Setup Response**.
   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 Setup Response** to SRNC.
   Parameters: Transport layer addressing information (AAL2 address, AAL2 Binding Identity) for Data Transport Bearer(s), Neighbouring cell information.

5. SRNC initiates setup of Iur, while DRNC is in charge to setup Iub, Data Transport Bearer using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer to DCH.
   Note: there is not a time relation between set up of Iur and Iub. Both must be carried out before next step.

6. Node B and SRNC establish synchronism for the Data Transport Bearer by means of exchange of the appropriate DCH Frame Protocol frames via **Downlink Synchronisation** and **Uplink Synchronisation**, relative to already

existing radio link(s).

Then Node B starts DL transmission.

7. SRNC sends RRC message **Physical Channel Reconfiguration** to UE on DCCH.
    Parameters: Update type, Cell id, DL scrambling code, Power control information, Ncell information.
8. After the reconfiguration, the UE sends RRC message **Physical Channel Reconfiguration Complete** to SRNC.
9. The SRNC releases the UE context for CELL_FACH state in the source DRNC by sending a **Common Transport Channel Resources Release** message.

## 7.18.3   Switching from Cell_DCH to Cell_FACH State

In the this scenario the SRNC needs to get the C-RNTI from DRNC to be able to indicate to the UE a new C-RNTI and which cell it is valid in (given by the Primary Scrambling Code).

The SRNC also needs to get either:

1. information in the RACH and/or FACH to be used (if the DRNC selects RACH and/or FACH in a different way than the UE would do based on broadcast information) including User Plane flow control information for the Iur FACH FP.

2. User Plane flow control information for the FACH (Secondary CCPCH) that the UE selects if no Secondary CCPCH information is provide to the UE in the RRC Physical Channel Reconfiguration message

If receiving the C-ID the DRNC shall allocate a C-RNTI and provide it together with the Primary CPICH information to the SRNC. Further more, if the DRNC would like to select another RACH and/or FACH than the UE would select based on the broadcast information the DRNC also provides information on the DRNC Selected RACH and/or FACH (alternative 1). If the DRNC does not select any FACH the DRNC shall provide the user plane flow control information (alternative 2).

The above solution would result in the following sequence:
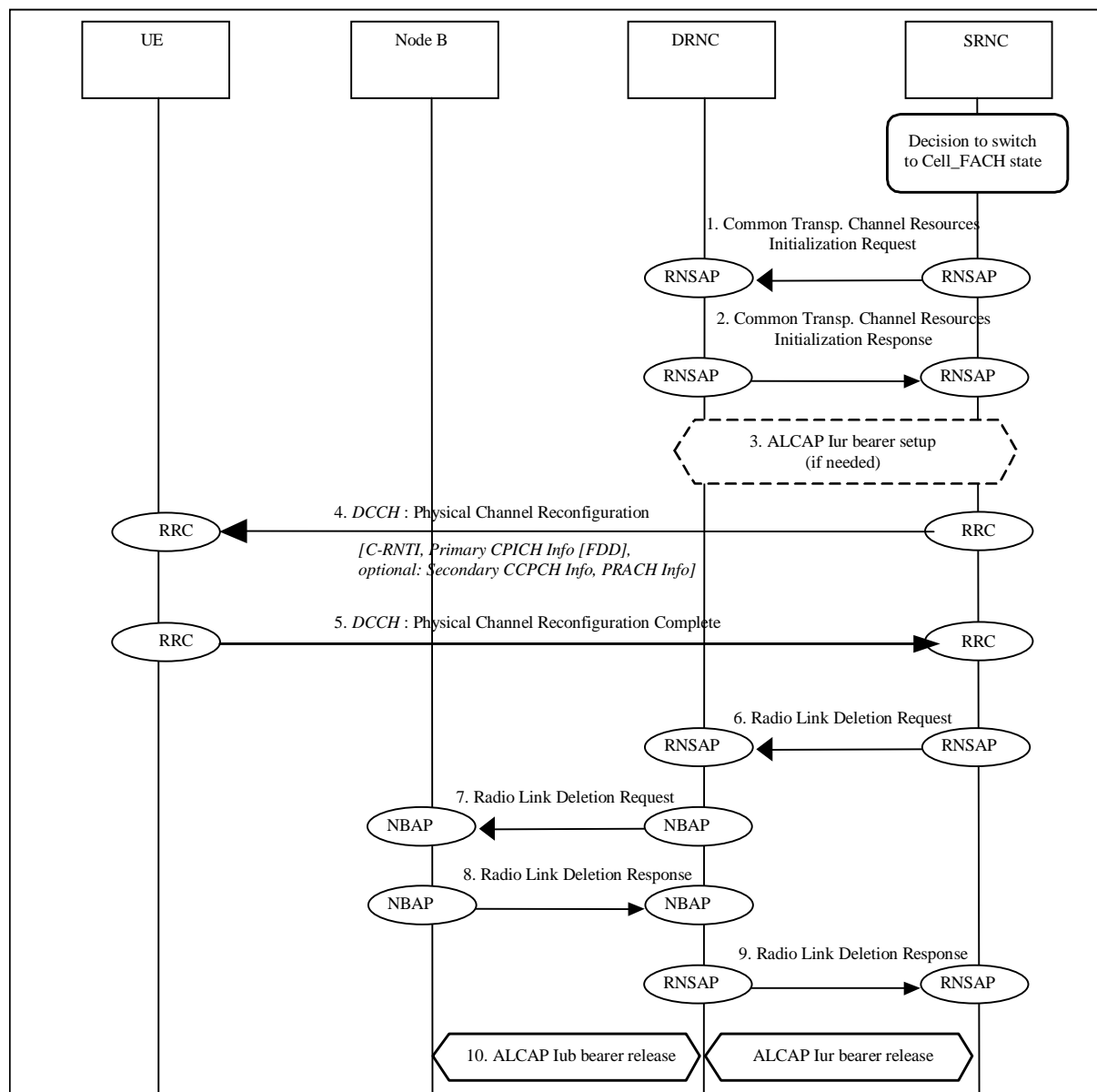
1. SRNC decides to switch to CELL_FACH state, releasing its present radio link via a the cell controlled by DRNC.

   The SRNC decides to setup a common channel for the UE via DRNC, informing DRNC with C-ID IE of the UE in order to obtain C-RNTI (allocated in the next step by DRNC) needed for RRC messages. This setup is done with the RNSAP **Common Transport Channel Resources Initialisation Request** message.
2. The target DRNC sends the transport layer address, binding identity and C-RNTI to the SRNC with the RNSAP **Common Transport Channel Resources Initialisation Response** message
3. SRNC initiates setup of Iur/Iub Data Transport Bearer (if needed) using ALCAP protocol. This request contains the AAL2 Binding Identity to bind the Iub Data Transport Bearer.
4. SRNC sends RRC message **Physical Channel Reconfiguration** to UE on DCCH, with new C-RNTI and identification of the cell where it is valid.
5. After the reconfiguration, the UE sends RRC message **Physical Channel Reconfiguration Complete** to SRNC.
   Parameters: Update type, Cell id, DL scrambling code, Power control information, Ncell information.
6. SRNC releases DRNC for radio resources allocated for DCH by sending RNSAP message **Radio Link Deletion Request**
   Parameters: Cell id, Transport Format Set per DCH, Transport Format Combination Set, frequency, UL scrambling code.
7. DRNC sends NBAP message **Radio Link Deletion Request** to Node B.
8. Successful outcome is reported in NBAP message **Radio Link Deletion Response**.
   DRNC sends RNSAP message **Radio Link Deletion Response** to SRNC.

9.   .Not used resources in-DRNC and Node B (Drift RNS) are released. DRNC initiates release of Iub and SRNC of Iur Data Transport bearer using ALCAP protocol.
     Note: there is not a time relation between set up of Iur and Iub. Both must be carried out before next step.

Annex A (informative): Change History

Change history					
TSG RAN#	Version	CR	Tdoc RAN	New Version	Subject/Comment
RAN_08	-	-	RP-000256	3.0.0	Approved at TSG RAN #8 and placed under Change Control
RAN_09	3.0.0	001 002 003		3.1.0	Approved at TSG RAN #9
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History

Document history		
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