# TSG-RAN Meeting #15
# Cheju, Korea, 5 - 8 March 2002

*TSGRP#15(02) 0195*

**Title:** **Change Requests for WI "RAN work Intra Domain Connection of RAN Nodes to Multiple CN Nodes"**

**Source:** **TSG-RAN WG3**

| RP_Num | Tdoc_Num | Specification | CR_Num | Revision_Num | 3G_Release | CR_Subject | CR_Category | Cur_Ver_Num | Workitem |
|---|---|---|---|---|---|---|---|---|---|
| RP-020195 | R3-020628 | 25.401 | 045 | 1 | Rel-5 | NNSF Functional Description | B | 5.1.0 | IUFLEX |
| RP-020195 | R3-020629 | 25.410 | 036 | 1 | Rel-5 | NNSF Impacts upon the Iu Interface Connectivity | B | 4.3.0 | IUFLEX |
| RP-020195 | R3-020630 | 25.413 | 431 | 1 | Rel-5 | NNSF Functional Description | B | 4.3.0 | IUFLEX |

**3GPP TSG-RAN3 Meeting #27**
**Orlando, USA, February 18th-22nd, 2002**

***R3-020628***

*CR-Form-v4*

# CHANGE REQUEST

⌘ **25.401** **CR** **045** ⌘ rev **1** ⌘ Current version: **4.3.0** ⌘

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***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | NNSF Functional Description |
| ***Source:*** | ⌘ | R-WG3 |
| ***Work item code:*** | ⌘ | IUFLEX |
| ***Date:*** | ⌘ | 20/02/02 |
| ***Category:*** | ⌘ | **B** |
| ***Release:*** | ⌘ | REL-5 |

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***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

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*2 (GSM Phase 2)*
*R96 (Release 1996)*
*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*REL-4 (Release 4)*
*REL-5 (Release 5)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To describe the NAS Node Selection Functionality within the list of functions of the UTRAN. |
| ***Summary of change:*** | ⌘ | Inclusion of the textual description of the NAS Node Selection Function.<br><br>Impact Analysis:<br><br>Impact assessment towards the previous version of the specification (previous release):<br><br>This CR has no impact as the NNSF is optional functionality, which an existing implementation does not need to support. Furthermore nodes not implementing the function can interwork with nodes supporting NNSF.<br><br>NNSF is a new function to be optionally implemented in R5. |
| ***Consequences if not approved:*** | ⌘ | |

| | | | | |
|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 2, 3.2, 7.1, 7.2 | | |
| ***Other specs*** | ⌘ | **X** Other core specifications | ⌘ | CR36 25.410 V4.3.0<br>CR431 25.413 V4.3.0 |
| ***Affected:*** | | ☐ Test specifications<br>☐ O&M Specifications | | |
| ***Other comments:*** | ⌘ | | | |

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# 2 References

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

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[1] 3GPP TR 25.990: "Vocabulary for UTRAN".

[2] 3GPP TS 23.10: "UMTS Access Stratum Services and Functions".

[3] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".

[4] 3GPP TS 25.442: "Implementation Specific O&M Transport".

[5] 3GPP TS 25.402: "Synchronisation in UTRAN, Stage 2".

[6] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[7] 3GPP TS 25.331: "RRC Protocol Specification".

[8] 3GPP TS 23.101: "General UMTS Architecture".

[x1] 3GPP TS 23.236: " Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes ".

## 3.2 Abbreviations

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

| | |
|---|---|
| ALCAP | Access Link Control Application Part |
| BM-IWF | Broadcast Multicast Interworking Function |
| BMC | Broadcast/Multicast Control |
| BSS | Base Station Subsystem |
| CBC | Cell Broadcast Centre |
| CBS | Cell Broadcast Service |
| CN | Core Network |
| CPCH | Common Packet Channel |
| CRNC | Controlling Radio Network Controller |
| DCH | Dedicated Channel |
| DL | Downlink |
| DRNS | Drift RNS |
| FACH | Forward Access Channel |
| FFS | For Further Study |
| GTP | GPRS Tunnelling Protocol |
| MAC | Medium Access Control |
| NAS | Non Access Stratum |
| NBAP | Node B Application Part |
| NNSF | NAS Node Selection Function |
| PCH | Paging Channel |
| QoS | Quality of Service |
| RAB | Radio Access Bearer |
| RACH | Random Access Channel |
| RANAP | Radio Access Network Application Part |
| RNC | Radio Network Controller |
| RNS | Radio Network Subsystem |
| RNSAP | Radio Network Subsystem Application Part |
| RNTI | Radio Network Temporary Identity |
| SAB | Service Area Broadcast |
| SAS | Standalone A-GPS SMLC |
| SMLC | Serving Mobile Location Centre |
| SRNC | Serving Radio Network Controller |
| SRNS | Serving RNS |
| TEID | Tunnel Endpoint Identifier |
| TTI | Transmission Time Interval |
| UE | User Equipment |
| UL | Uplink |
| UMTS | Universal Mobile Telecommunication System |
| USIM | UMTS Subscriber Identity Module |
| UTRAN | Universal Terrestrial Radio Access Network |

# 7 UTRAN Functions description

## 7.1 List of functions

- Transfer of User Data
- Functions related to overall system access control
  - Admission Control
  - Congestion Control
  - System information broadcasting
- Radio channel ciphering and deciphering
- Integrity protection
- Functions related to mobility
  - Handover
  - SRNS Relocation
  - Paging support
  - Positioning
- Functions related to radio resource management and control
  - Radio resource configuration and operation
  - Radio environment survey
  - Combining/splitting control
  - Connection set-up and release
  - Allocation and deallocation of Radio Bearers
  - [TDD - Dynamic Channel Allocation (DCA)]
  - Radio protocols function
  - RF power control
  - [3.84Mcps TDD - Timing Advance]
  - [1.28Mcps TDD – Uplink Synchronisation]
  - Radio channel coding
  - Radio channel decoding
  - Channel coding control
  - Initial (random) access detection and handling
  - CN Distribution function for Non Access Stratum messages
- Synchronisation

- Functions related to broadcast and multicast services (see note) (broadcast/multicast interworking function BM-IWF)

NOTE: Only Broadcast is applicable for Release 99.

- Broadcast/Multicast Information Distribution
- Broadcast/Multicast Flow Control
- CBS Status Reporting
- Tracing
- Volume reporting
- NAS Node Selection

# 7.2 Functions description

## 7.2.0 Transfer of user data

This function provides user data transfer capability across the UTRAN between the Iu and Uu reference points.

## 7.2.1 Functions related to overall system access control

System access is the means by which a UMTS user is connected to the UTRAN in order to use UMTS services and/or facilities. User system access may be initiated from either the mobile side, e.g. a mobile originated call, or the network side, e.g. a mobile terminated call.

### 7.2.1.1 Admission Control

The purpose of the admission control is to admit or deny new users, new radio access bearers or new radio links (for example due to handover). The admission control should try to avoid overload situations and base its decisions on interference and resource measurements. The admission control is employed at for example initial UE access, RAB assignment/reconfiguration and at handover. These cases may give different answers depending on priority and situation.

The Admission Control function based on UL interference and DL power is located in the Controlling RNC.

The Serving RNC is performing admission Control towards the Iu interface.

### 7.2.1.2 Congestion Control

The task of congestion control is to monitor, detect and handle situations when the system is reaching a near overload or an overload situation with the already connected users. This means that some part of the network has run out, or will soon run out of resources. The congestion control should then bring the system back to a stable state as seamless as possible.

NOTE: This admission Control function is related to Radio Resources.

Congestion control is performed within UTRAN.

### 7.2.1.3 System information broadcasting

This function provides the mobile station with the Access Stratum and Non Access Stratum information which are needed by the UE for its operation within the network.

The basic control and synchronisation of this function is located in UTRAN.

## 7.2.2 Radio channel ciphering and deciphering

This function is a pure computation function whereby the radio transmitted data can be protected against a non-authorised third-party. Ciphering and deciphering may be based on the usage of a session-dependent key, derived through signalling and/or session dependent information.

This function is located in the UE and in the UTRAN.

## 7.2.3 Functions related to Mobility

### 7.2.3.1 Handover

This function manages the mobility of the radio interface. It is based on radio measurements and it is used to maintains the Quality of Service requested by the Core Network.

Handover may be directed to/from another system (e.g. UMTS to GSM handover).

The handover function may be either controlled by the network, or independently by the UE. Therefore, this function may be located in the SRNC, the UE, or both.

### 7.2.3.2 SRNS Relocation

The SRNS Relocation function coordinates the activities when the SRNS role is to be taken over by another RNS. The SRNS relocation function manages the Iu interface connection mobility from an RNS to another.

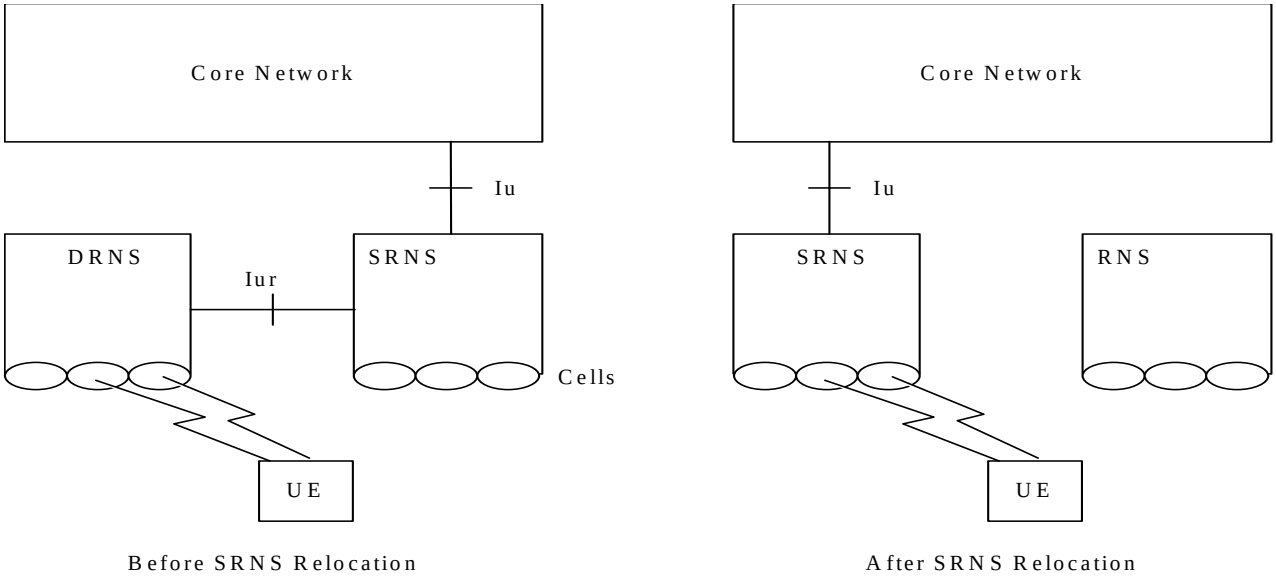


**Figure 7: Serving RNS Relocation**

The SRNS Relocation is initiated by the SRNC.

This function is located in the RNC and the CN.

### 7.2.3.3 Paging support

This function provides the capability to request a UE to contact the UTRAN when the UE is in Idle, CELL_PCH or URA PCH states [6]. This function also encompasses a coordination function between the different Core Network Domains onto a single RRC connection.

### 7.2.3.4 Positioning

This function provides the capability to determine the geographic position of a UE.

### 7.2.3.x NAS Node Selection Function

The optional NAS Node Selection Function (NNSF) enables the RNC to initially assign CN resources to serve a UE and subsequently setup a signalling connection to the assigned CN resource.

The NNSF is described in detail in [x1].

END OF CHANGES

**3GPP TSG-RAN3 Meeting #27** **R3-020629**
**Orlando, USA, February 18th-22nd 2002**

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# CHANGE REQUEST

⌘ **25.410** **CR** **036** ⌘ rev **1** ⌘ Current version: **4.3.0** ⌘

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***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

| | | |
|---|---|---|
| ***Title:*** | ⌘ | NNSF Impacts upon the Iu Interface Connectivity |
| ***Source:*** | ⌘ | R-WG3 |
| ***Work item code:*** | ⌘ | IUFLEX |
| ***Date:*** | ⌘ | 20/02/02 |
| ***Category:*** | ⌘ | **B** |
| ***Release:*** | ⌘ | REL-5 |

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*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*REL-4 (Release 4)*
*REL-5 (Release 5)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To describe the changes introduced to the Iu Connectivity to incorporate the NAS Node Selection Functionality. |
| ***Summary of change:*** | ⌘ | The Iu-CS and Iu-PS *may* be connected to more than one CS and PS node.<br><br>Impact Analysis:<br><br>Impact assessment towards the previous version of the specification (previous release):<br><br>This CR has no impact as the NNSF is optional functionality, which an existing implementation does not need to support. Furthermore nodes not implementing the function can interwork with nodes supporting NNSF.<br><br>NNSF is a new function to be optionally implemented in R5. |
| ***Consequences if not approved:*** | ⌘ | |

| | | | | |
|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 2, 3.2, 4.1, 5.1, 5.9 | | |
| ***Other specs affected:*** | ⌘ | **X** Other core specifications | ⌘ | 25.401 v4.3.0 CR45<br>25.413 v4.3.0 CR431 |
| | | ☐ Test specifications | | |
| | | ☐ O&M Specifications | | |
| ***Other comments:*** | ⌘ | | | |

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[1] 3GPP TS 25.401: "UTRAN Overall Description".

[2] 3GPP TR 23.930: "Iu Principles".

[3] 3GPP TS 23.110: "UMTS Access Stratum Services and Functions".

[4] 3GPP TS 25.411: "UTRAN Iu Interface Layer 1".

[5] 3GPP TS 25.412: "UTRAN Iu Interface Signalling Transport".

[6] 3GPP TS 25.413: "UTRAN Iu Interface RANAP Signalling".

[7] 3GPP TS 25.414: "UTRAN Iu Interface Data Transport and Transport Signalling"

[8] 3GPP TS 25.415: "UTRAN Iu Interface User Plane Protocols".

[9] ITU-T Recommendation Q.711 (07/1996): "Functional description of the signalling connection control part".

[10] ITU-T Recommendation Q.712 (07/1996): "Definition and function of signalling connection control part messages".

[11] ITU-T Recommendation Q.713 (07/1996): "Signalling connection control part formats and codes".

[12] ITU-T Recommendation Q.714 (07/1996): "Signalling connection control part procedures".

[13] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[14] 3GPP TS 25.419: "UTRAN Iu Interface: Service Area Broadcast Protocol SABP".

[15] 3GPP TS 23.153: "Out of Band Transcoder Control; Stage 2".

[16] ITU-T Recommendation Q.2630.1: "AAL type 2 signalling protocol - (Capability Set 1)".

[17] ITU-T Recommendation Q.2630.2: "AAL type 2 signalling protocol - Capability Set 2".

[x1] 3GPP TS 23.236 Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes

# 3 Definitions and abbreviations

## 3.1 Definitions

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

## 3.2 Abbreviations

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

| | |
|---|---|
| 3G-MSC | 3rd Generation Mobile Switching Centre |
| 3G-SGSN | 3rd Generation Serving GPRS Support Node |
| AAL | ATM Adaptation Layer |
| ATM | Asynchronous Transfer Mode |
| BC | Broadcast |
| BSSMAP | Base Station Subsystem Management Application Part |
| CBS | Cell Broadcast Service |
| CC | Connection Confirm |
| CN | Core Network |
| CR | Connection Release |
| CREF | Connection Refusal |
| CS | Circuit Switched |
| GT | Global Title |
| GTP-U | GPRS Tunnelling Protocol |
| IMSI | International Mobile Subscriber Identity |
| IP | Internet Protocol |
| ISDN | Integrated Services Digital Network |
| LA | Location Area |
| NAS | Non Access Stratum |
| NNSF | NAS Node Selection Function |
| O&M | Operation and Maintenance |
| PS | Packet Switched |
| PSTN | Public Switched Telephone Network |
| PVC | Permanent Virtual Circuit |
| QoS | Quality of Service |
| RA | Routing Area |
| RAB | Radio Access Bearer |
| RANAP | Radio Access Network Application Part |
| RLP | Radio Link Protocol |
| RNC | Radio Network Controller |
| RNL | Radio Network Layer |
| RRC | Radio Resource Control |
| SA | Service Area |
| SABP | Service Area Broadcast Protocol |
| SAP | Service Access Point |
| SCCP | Signalling Connection Control Part |
| SPC | Signalling Point Code |
| SRNS | Serving Radio Network Subsystem |
| SSN | Sub-System Number |
| SVC | Switched Virtual Circuit |
| TCP | Transmission Control Protocol |
| UE | User Equipment |
| UDP | User Datagram Protocol |
| UP | User Plane |
| URA | UTRAN Registration Area |

| | |
|---|---|
| UTRAN | UMTS Terrestrial Radio Access Network |
| VC | Virtual Circuit |

# 4 General Aspects

## 4.1 UTRAN Architecture

### 4.1.1 Iu Interface Architecture

The overall UMTS architecture and UTRAN architectures are described in [1]. This subclause specifies only the architecture of the Iu interface, and shall not constrain the network architecture of either Core or Radio Access Networks.

The $I_u$ interface is specified at the boundary between the Core Network and UTRAN. Figure 4.1 depicts the logical division of the $I_u$ interface. From the Iu perspective, the UTRAN access point is an RNC.

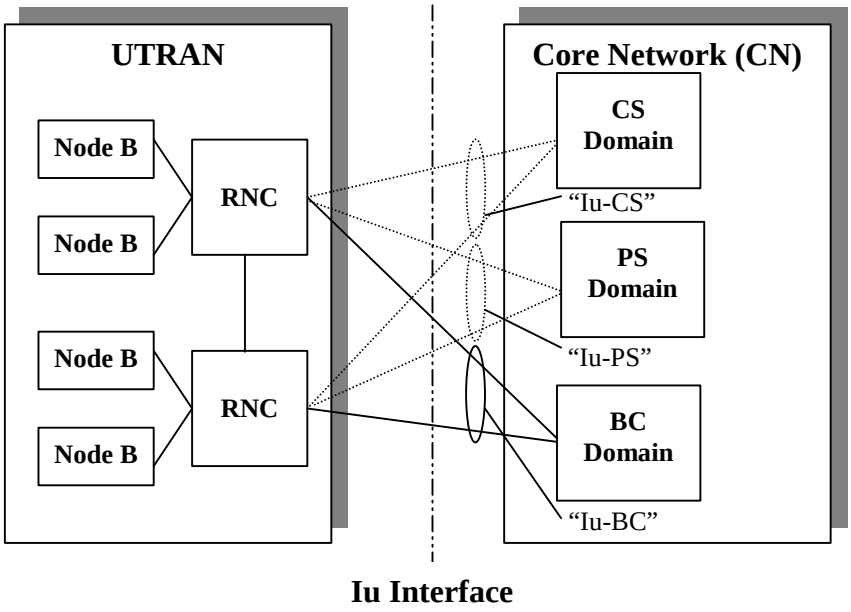


**Figure 4.1: $I_u$ Interface Architecture**

The Iu interface towards the PS-domain of the core network is called Iu-PS, and the Iu interface towards the CS-domain is called Iu-CS. The differences between Iu-CS and Iu-PS are treated elsewhere in the present document. The Iu interface to the Broadcast domain is called Iu-BC.

There shall not be more than one Iu interface (Iu-PS) towards the PS-domain from any one RNC– except where the NNSF is used, see subclause 4.1.x. Each RNC shall not have more than one Iu interface (Iu-CS) towards its default CN node within the CS domain, but may also have further Iu interfaces (Iu-CS) towards other CN nodes within the CS domain. (See [6] for definition of Default CN node.) These further Iu interfaces (Iu-CS) shall only be used as a result of intra-MSC inter-system handover or SRNS relocation, in the case the anchor CN node directly connects to the target RNC. There may also be more than one Iu interface towards the CS-Domain if the NNSF is used – see subclause 4.1.x. There shall not be more than one Iu interface (Iu-BC) from an RNC towards the Broadcast domain.

In the separated core network architecture, this means that there shall be separate signalling and user data connections towards the PS and CS domains – this applies in both transport and radio network layers.

In the combined architecture, there shall be separate connections in the user plane towards the PS and CS domains (in both transport and radio network layers). In the control plane, there shall be separate SCCP connections to the two logical domains.

In either architecture, there can be several RNCs within UTRAN and so UTRAN may have several $I_u$ access points towards the Core Network. As a minimum, each Iu access point (in UTRAN or CN) shall independently fulfil the requirements of the relevant Iu specifications (25.41x series – see clause 7).

### 4.1.2 $I_u$ connection principles

The Iu interface has a hierarchical architecture where one higher layer entity controls several lower layer entities. The hierarchy for the CN - UTRAN signalling connection end points is described below:

- Each CN Access Point may be connected to one or more UTRAN Access Points.
- For the PS domain, each UTRAN Access Point shall not be connected to more than one CN Access Point – except where the NNSF is used, see subclause 4.1.x.
- For the CS domain, each UTRAN Access Point may be connected to one or more CN Access Points.
- For the BC domain, each UTRAN Access Point may be connected to one CN Access Point only.

### 4.1.x Implementation of the NAS Node Selection Function

The optional NAS Node Selection Function (NNSF) is described in [x1].

If the NAS Node Selection Function is used by an RNC:

- There may be more than one Iu interface (Iu-CS) towards the CS domain and/or more than one Iu interface (Iu-PS) towards the PS-domain from this RNC.

# 5 Functions of the $I_u$ Interface Protocols & Functional Split

## 5.1 General

This subclause defines the functional split between the core network and the UMTS radio access network. In addition, the possible interaction between the functions is defined. The functional split is shown in table 5.1.

**Table 5.1: Iu interface functional split**

| Function | UTRAN | CN |
|---|---|---|
| **RAB management functions:** | | |
| RAB establishment, modification and release | X | X |
| RAB characteristics mapping $I_u$ transmission bearers | X | |
| RAB characteristics mapping Uu bearers | X | |
| RAB queuing, pre-emption and priority | X | X |
| | | |
| **Radio Resource Management functions:** | | |
| Radio Resource admission control | X | |
| Broadcast Information | X | X |
| | | |
| **$I_u$ link Management functions:** | | |
| $I_u$ signalling link management | X | X |
| ATM VC management | X | X |
| AAL2 establish and release | X | X |
| AAL5 management | X | X |
| GTP-U Tunnels management | X | X |
| TCP Management | X | X |
| Buffer Management | X | |
| | | |
| **$I_u$ U-plane (RNL) Management:** | | |
| $I_u$ U-plane frame protocol management | | X |
| $I_u$ U-plane frame protocol initialization | X | |
| | | |
| **Mobility management functions:** | | |
| Location information reporting | X | X |
| Handover and Relocation | | |
| Inter RNC hard HO, Iur not used or not available | X | X |
| Serving RNS Relocation (intra/inter MSC) | X | X |
| Inter system hard HO (UMTS-GSM) | X | X |
| Inter system Change (UMTS-GSM) | X | X |
| Paging Triggering | | X |
| | | |
| **Security Functions:** | | |
| Data confidentiality | | |
| Radio interface ciphering | X | |
| Ciphering key management | | X |
| User identity confidentiality | X | X |
| Data integrity | | |
| Integrity checking | X | |
| Integrity key management | | X |
| | | |
| **Service and Network Access functions:** | | |
| CN Signalling data | X | X |
| Data Volume Reporting | X | |
| UE Tracing | X | X |
| Location reporting | X | X |
| | | |
| **$I_u$ Co-ordination functions:** | | |
| Paging co-ordination | X | X |
| NAS Node Selection Function | X | |

NEXT CHANGE

# 5.9 Co-ordination Functions

## 5.9.1 Paging Co-ordination function

The two CN domain architecture implies need for a page co-ordination, i.e. handling of page triggered by one CN node when UE has a signalling connection to the other CN node. The paging co-ordination is performed by UTRAN and/or optionally by CN. The Common ID is used for UTRAN paging co-ordination. The CN provides the UTRAN with the Common ID.

The paging co-ordination is a UTRAN function. Optionally the paging co-ordination may be performed in the CN.

## 5.9.x NAS Node Selection Function

The optional NAS Node Selection Function enables the RNC to initially assign CN resources to serve a UE and subsequently setup a signalling connection to the assigned CN resource.

The method by which the RNC initially assigns CN resources is implementation dependent.

The NNSF is described in detail in [x1].

END OF CHANGES

**3GPP TSG-RAN3 Meeting #27**
**Orlando, USA, February 18th- 22nd 2002**

***R3-020630***

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# CHANGE REQUEST

⌘ **25.413** **CR** **431** ⌘ rev **1** ⌘ Current version: **4.3.0** ⌘

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***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

| | | |
|---|---|---|
| ***Title:*** | ⌘ | NNSF Functional Description |
| ***Source:*** | ⌘ | R-WG3 |
| ***Work item code:*** | ⌘ | IU FLEX |
| ***Date:*** | ⌘ | 22/02/02 |
| ***Category:*** | ⌘ | **B** |
| ***Release:*** | ⌘ | REL-5 |

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*REL-4 (Release 4)*
*REL-5 (Release 5)*

***Reason for change:*** ⌘ To add additional functional description to the Paging, Initial UE Message and Overload Procedures to enable the NAS Node Selection Function to be used. Proposed Changes to the References and Definitions are also included.

***Summary of change:*** ⌘ Inclusion of additional functional description to the Paging, Initial UE Message and Overload procedures in the situation to describe their usage when the NNSF is utilised.

Furthermore an additional IE (*Global CN-ID*) is proposed to be included (optionally) within the PAGING and Overload messages.

A timer ($T_{NNSF}$) is introduced – which is used by the RNC to store the IMSI and the relevant *CN Global-ID* in the short term after Paging.

Impact Analysis:

Impact assessment towards the previous version of the specification (previous release):

This CR has no impact as the NNSF is optional functionality, which an existing implementation does not need to support. Furthermore nodes not implementing the function can interwork with nodes supporting NNSF.

NNSF is a new function to be optionally implemented in R5.

***Consequences if not approved:*** ⌘

***Clauses affected:*** ⌘ 2, 3.1, 8.15, 8.22, 8.25, 9.1.23, 9.1.38, 9.3.2, 9.5

***Other specs*** ⌘ **X** Other core specifications ⌘ CR45 25.401 V4.3.0

| | | | |
|---|---|---|---|
| | | | CR36 25.410 V4.3.0 |
| ***affected:*** | | Test specifications<br>O&M Specifications | |
| ***Other comments:*** | ⌘ | | |

**How to create CRs using this form:**

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification

# 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] 3GPP TR 23.930: "3rd Generation Partnership Project (3GPP) Technical Specification Group Services and System Aspects; Iu Principles".

[2] 3GPP TS 25.410: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu Interface: General Aspects and Principles".

[3] 3GPP TS 25.401: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Overall Description".

[4] 3GPP TR 25.931: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Functions, Examples on Signalling Procedures".

[5] 3GPP TS 25.412: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu Interface Signalling Transport".

[6] 3GPP TS 25.415: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; UTRAN Iu Interface User Plane Protocols".

[7] 3GPP TS 23.107: "3rd Generation Partnership Project (3GPP) Technical Specification Group Services and System Aspects; QoS Concept and Architecture".

[8] 3GPP TS 24.008: "3rd Generation Partnership Project (3GPP); Mobile radio interface layer 3 specification, Core Network Protocols – Stage 3".

[9] 3GPP TS 25.414: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; Iu Interface Data Transport and Transport Signalling".

[10] 3GPP TS 25.331: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; RRC Protocol Specification".

[11] 3GPP TS 08.08: "Mobile services Switching Centre – Base Station System (MSC – BSS) interface".

[12] 3GPP TS 12.08: "Subscriber and equipment trace".

[13] X.691 (12/97): "Information Technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER)".

[14] X.680, (12/97): "Information Technology - Abstract Syntax Notation One (ASN.1):Specification of basic notation".

[15] X.681 (12/97): "Information Technology - Abstract Syntax Notation One (ASN.1): Information object specification".

[16] 3GPP TS 23.110: "3rd Generation Partnership Project (3GPP) Technical Specification Group Services and System Aspects, UMTS Access Stratum, Services and Functions".

[17] 3GPP TS 25.323: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; Packet Data Convergence Protocol (PDCP) Specification".

[18] 3GPP TS 25.921: "3rd Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network; Guidelines and principles for protocol description and error handling".

[19] 3GPP TS 23.003: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network; Numbering, addressing and identification".

[20] 3GPP TS 23.032: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network; Universal Geographical Area Description (GAD)".

[21] 3GPP TS 23.060: "3rd Generation Partnership Project (3GPP) Technical Specification Group Services and System Aspect; General Packet Radio Service (GPRS); Service description; Stage 2".

[22] 3GPP TS 24.080: "3rd Generation Partnership Project (3GPP) Technical Specification Group Core Network; Mobile radio interface layer 3 supplementary services specification; Formats and coding".

[x1] 3GPP TS 23.236: “Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes”.

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

**Default CN node**: An RNC with an inactive or not implemented NAS Node Selection Function [x1] has one single permanent default CN node per CN domain. It always initiates the Initial UE Message procedure towards its default CN node. If the NAS Node Selection Function is active, then no Default CN node exists.

**Relocation of SRNS:** relocation of SRNS is a UMTS functionality used to relocate the serving RNS role from one RNS to another RNS. This UMTS functionality is realised by several elementary procedures executed in several interfaces and by several protocols and it may involve a change in the radio resources used between UTRAN and UE

It is also possible to relocate the serving RNS role from:

- one RNS within UMTS to another relocation target external to UMTS;
- functionality equivalent to the serving RNS role from another relocation source external to UMTS to another RNS.

**Serving RNS (SRNS):** role an RNS can take with respect to a specific connection between an UE and UTRAN. There is one serving RNS for each UE that has a connection to UTRAN. The serving RNS is in charge of the radio connection between a UE and the UTRAN. The serving RNS terminates the Iu for this UE

**Serving RNC (SRNC):** SRNC is the RNC belonging to SRNS

**SRNC-ID:** see [3] for definition

**S-RNTI:** see [3] for definition

**Source RNS:** role, with respect to a specific connection between UTRAN and CN, that RNS takes when it decides to initiate a relocation of SRNS

**Source RNC:** source RNC is the RNC belonging to source RNS

**Target RNS:** role an RNS gets with respect to a specific connection between UTRAN and CN when it is being a subject of a relocation of SRNS which is being made towards that RNS

**Target RNC:** target RNC is the RNC belonging to target RNS

**Directed retry**: Directed retry is the process of assigning a User Equipment to a radio resource that does not belong to the serving RNC e.g. in situations of congestion. It is triggered by the RAB Assignment procedure and employs relocation procedures.

**Elementary Procedure:** RANAP protocol consists of Elementary Procedures (EPs). An Elementary Procedure is a unit of interaction between the RNS and the CN. These Elementary Procedures are defined separately and are intended to be used to build up complete sequences in a flexible manner. If the independence between some EPs is restricted, it is described under the relevant EP description. Unless otherwise stated by the restrictions, the EPs may be invoked independently of each other as stand alone procedures, which can be active in parallel. Examples on using several RANAP EPs together with each other and EPs from other interfaces can be found in reference [4].

An EP consists of an initiating message and possibly a response message. Three kinds of EPs are used:

- **Class 1:** Elementary Procedures with response (success and/or failure).
- **Class 2:** Elementary Procedures without response.
- **Class 3:** Elementary Procedures with possibility of multiple responses.

For Class 1 EPs, the types of responses can be as follows:

Successful:

- A signalling message explicitly indicates that the elementary procedure successfully completed with the receipt of the response.

Unsuccessful:

- A signalling message explicitly indicates that the EP failed.
- On time supervision expiry (i.e. absence of expected response).

Successful and Unsuccessful:

- One signalling message reports both successful and unsuccessful outcome for the different included requests. The response message used is the one defined for successful outcome.

Class 2 EPs are considered always successful.

Class 3 EPs have one or several response messages reporting both successful, unsuccessful outcome of the requests and temporary status information about the requests. This type of EP only terminates through response(s) or EP timer expiry.

## 3.2 Symbols

Void.

## 3.3 Abbreviations

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

| | |
|---|---|
| AAL2 | ATM Adaptation Layer type 2 |
| AS | Access Stratum |
| ASN.1 | Abstract Syntax Notation One |
| ATM | Asynchronous Transfer Mode |
| CC | Call Control |
| CN | Core Network |
| CRNC | Controlling RNC |
| CS | Circuit Switched |
| DCH | Dedicated Channel |
| DL | Downlink |
| DRNC | Drift RNC |
| DRNS | Drift RNS |
| DSCH | Downlink Shared Channel |
| EP | Elementary Procedure |
| GPRS | General Packet Radio System |
| GTP | GPRS Tunnelling Protocol |
| IE | Information Element |
| IMEI | International Mobile Equipment Identity |
| IMSI | International Mobile Subscriber Identity |
| IPv4 | Internet Protocol (version 4) |
| IPv6 | Internet Protocol (version 6) |
| MM | Mobility Management |
| MSC | Mobile services Switching Center |
| NAS | Non Access Stratum |
| NNSF | NAS Node Selection Function |
| N-PDU | Network – Protocol Data Unit |
| OSP:IHOSS | Octet Stream Protocol: Internet-Hosted Octet Stream Service |
| P-TMSI | Packet TMSI |
| PDCP | Packet Data Convergence Protocol |
| PDP | Packet Data Protocol |
| PDU | Protocol Data Unit |
| PPP | Point-to-Point Protocol |
| PS | Packet Switched |

| | |
|---|---|
| QoS | Quality of Service |
| RAB | Radio Access Bearer |
| RANAP | Radio Access Network Application Part |
| RNC | Radio Network Controller |
| RNS | Radio Network Subsystem |
| RRC | Radio Resource Control |
| SAI | Service Area Identifier |
| SAP | Service Access Point |
| SCCP | Signalling Connection Control Part |
| SDU | Service Data Unit |
| SGSN | Serving GPRS Support Node |
| SRNC | Serving RNC |
| SRNS | Serving RNS |
| TEID | Tunnel Endpoint Identifier |
| TMSI | Temporary Mobile Subscriber Identity |
| UE | User Equipment |
| UEA | UMTS Encryption Algorithm |
| UIA | UMTS Integrity Algorithm |
| UL | Uplink |
| UMTS | Universal Mobile Telecommunications System |
| USCH | Uplink Shared Channel |
| UTRAN | UMTS Terrestrial Radio Access Network |

NEXT CHANGE

# 8.15 Paging

## 8.15.1 General

The purpose of the Paging procedure is to enable the CN to request the UTRAN to contact that UE. The procedure uses connectionless signalling.

## 8.15.2 Successful Operation

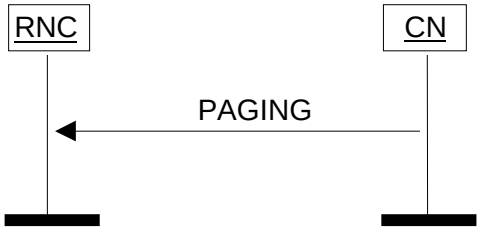


**Figure 1: Paging procedure. Successful operation.**

The CN shall initiate the procedure by sending a PAGING message. The PAGING message shall contain following IEs:

- *CN Domain Indicator*.
- *Permanent NAS UE Identity*.
- *DRX Cycle Length Coefficient* (if available).

The PAGING message may contain following IEs:

- *Temporary UE Identity.*
- *Paging Area.*
- *Paging Cause.*
- *Non Searching Indicator.*
- *Global CN-ID.*

The *CN Domain Indicator* IE shall be used by the RNC to identify from which CN domain the PAGING message originates.

The *Permanent NAS UE Identity* IE (i.e. IMSI) shall be used by the UTRAN paging co-ordination function to check if a signalling connection towards the other CN domain already exists for this UE. In that case, the radio interface paging message shall be sent via that connection instead of using the paging broadcast channel.

The *Temporary UE Identity* IE (e.g. TMSI) is the temporary identity of the user (allocated by that CN Domain) which can be used in a radio interface paging message. If the *Temporary UE Identity* IE is not included in the PAGING message, the RNC shall use the *Permanent NAS UE Identity* instead – if no signalling connection exists.

If NNSF is active, and the *Temporary UE Identity* IE is not included in the PAGING message, the PAGING message shall include the *Global CN-ID* IE and, the RNC may start the $T_{NNSF}$ timer and store the *Permanent NAS UE Identity* IE along with the related *Global CN-ID* IE until the $T_{NNSF}$ timer has expired.

The *Paging Area* IE shall be used by the RNC to identify the area in which the radio interface paging message shall be broadcast in case no signalling connection, as described above, already exists for the UE. If the *Paging Area* IE is not

included in the PAGING message, the whole RNC area shall be used as Paging Area – if no signalling connection exists for that UE.

The *Paging Cause* IE shall indicate to the RNC the reason for sending the PAGING message. The paging cause is transferred transparently to the UE.

The *Non Searching Indication* IE shall, if present, be used by the RNC to decide whether the UTRAN paging co-ordination function needs to be activated or not. In the absence of this IE, UTRAN paging co-ordination shall be performed.

The *DRX Cycle Length Coefficient* IE may be included in the PAGING message, and if present, the UTRAN shall, when applicable, use it for calculating the paging occasions for the UE.

It should be noted that each PAGING message on the Iu interface relates to only one UE and therefore the RNC has to pack the pages into the relevant radio interface paging message.

The core network is responsible for the paging repetition over the Iu interface.

### 8.15.3 Abnormal Conditions

Not applicable.

NEXT CHANGE

# 8.22 Initial UE Message

## 8.22.1 General

The purpose of the Initial UE Message procedure is to establish an Iu signalling connection between a CN domain and the RNC and to transfer the initial NAS-PDU to the CN node as determined by the NAS Node Selection Function - if this function is active, or otherwise to the default CN node~~.~~. The procedure uses connection oriented signalling.

## 8.22.2 Successful Operation


**Figure 2: Initial UE Message procedure. Successful operation.**

When RNC has received from radio interface a NAS message (see ref. [8]) to be forwarded to CN domain to which the Iu signalling connection for the UE does not exist, RNC shall initiate the Initial UE Message procedure and send the INITIAL UE MESSAGE message to the CN. If NNSF is active, the selection of the CN node is made according to [x1].

In addition to the received NAS-PDU, RNC shall add following information to the INITIAL UE MESSAGE message:

- CN domain indicator, indicating the CN domain towards which this message is sent.
- For CS domain, the LAI which was the last LAI indicated to the UE by UTRAN via the current RRC connection, or if UTRAN had not yet indicated any LAI to the UE via the current RRC connection, then the LAI of the cell via which the current RRC connection was established.
- For PS domain, the LAI+RAC which were the last LAI+RAC indicated to the UE by UTRAN via the current RRC connection, or if UTRAN had not yet indicated any LAI+RAC to the UE via the current RRC connection, then the LAI+RAC of the cell via which the current RRC connection was established.
- Service Area corresponding to at least one of the cells from which the UE is consuming radio resources.
- Iu signalling connection identifier.
- Global RNC identifier.

The *Iu Signalling Connection Identifier* IE contains an Iu signalling connection identifier which is allocated by the RNC, and which the CN is required to store and remember for the duration of the Iu connection.

Whereas several processing entities within the CN (e.g. charging, interception, etc.) may make use of the location information given in the *SAI* IE and the *LAI* (and *RAC*) IE, the mobility management within the CN shall rely on the information given within the *LAI* IE (resp. *LAI* and *RAC* IEs) only.

NEXT CHANGE

# 8.25 Overload Control

## 8.25.1 General

This procedure is defined to give some degree of signalling flow control. At the UTRAN "Processor Overload" and "Overload in the Capability to Send Signalling Messages to the UE" are catered for, and at the CN "Processor Overload" is catered for. The procedure uses connectionless signalling.

The philosophy used is to stem the traffic at source with known effect on the service. The algorithm used is:

At the CN side:

- If $T_{igOC}$ is not running and an OVERLOAD message or "Signalling Point Congested" information is received, the traffic should be reduced by one step. It is also possible, optionally, to indicate the number of steps to reduce the traffic within the *Number of Steps* IE. At the same time, timers $T_{igOC}$ and $T_{inTC}$ should be started.

- During $T_{igOC}$ all received OVERLOAD messages or "Signalling Point Congested" information should be ignored.

- This step by step reduction of traffic should be continued until maximum reduction is obtained by arriving at the last step.

- If $T_{inTC}$ expires (i.e. no OVERLOAD message or "Signalling Point Congested" information is received during $T_{inTC}$) the traffic should be increased by one step and $T_{inTC}$ should be started unless normal load has been resumed.

At the UTRAN side:

- If $T_{igOR}$ is not running and an OVERLOAD message or "Signalling Point Congested" information is received, the traffic should be reduced by one step. It is also possible, optionally, to indicate the number of steps to reduce the traffic within the *Number of Steps* IE. At the same time, timers $T_{igOR}$ and $T_{inTR}$ should be started.

- During $T_{igOR}$ all received OVERLOAD messages or "Signalling Point Congested" information should be ignored.

- This step-by-step reduction of traffic should be continued until maximum reduction is obtained by arriving at the last step.

- If $T_{inTR}$ expires (i.e. no OVERLOAD message or "Signalling Point Congested" information is received during $T_{inTR}$) the traffic should be increased by one step and $T_{inTR}$ should be started unless normal load has been resumed.

The number of steps and the method of reducing the load are considered to be an implementation specific function.

There may be other traffic control mechanisms from O&M activities occurring simultaneously.

## 8.25.2 Philosophy

Void

## 8.25.3 Successful Operation

### 8.25.3.1 Overload at the CN


**Figure 3: Overload at the CN. Successful operation.**

The CN should indicate to the RNC that it is in a congested state by sending an OVERLOAD message . The *CN Domain Indicator* IE may be included, if the CN can determine the domain suffering the signalling traffic overload. A specific CN node shall send this message only towards those RNCs from which it can receive the INITIAL UE MESSAGE message ~~for which it is default CN node~~.

The UTRAN receipt of this message should cause the reduction of signalling traffic towards the CN. If *CN Domain Indicator* IE, but not the *Global CN-ID* IE, is indicated within the OVERLOAD message, the RNC should apply signalling traffic reduction mechanisms to the indicated domain.

If the NNSF is active, the CN shall include the *Global CN-ID* IE within the OVERLOAD message, and the RNC should apply signalling traffic reduction mechanisms to the indicated CN node only.

### 8.25.3.2 Overload at the UTRAN


**Figure 4: Overload at the UTRAN. Successful operation.**

If the UTRAN is not capable to send signalling messages to the UE due to overloaded resources then the UTRAN should send an OVERLOAD message to the CN. The RNC shall include the *Global RNC-ID* IE in this message. A specific RNC shall send this message only towards those CN nodes towards which it can send the INITIAL UE MESSAGE message~~its default CN node of the concerned domain(s)~~.

## 8.25.4 Abnormal Conditions

Not applicable.

NEXT CHANGE

## 9.1.23 PAGING

This message is sent by the CN to request UTRAN to page a specific UE.

Direction: CN → RNC.

Signalling bearer mode: Connectionless.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.1.1 | | YES | ignore |
| CN Domain Indicator | M | | 9.2.1.5 | | YES | ignore |
| Permanent NAS UE Identity | M | | 9.2.3.1 | | YES | ignore |
| Temporary UE Identity | O | | 9.2.3.2 | | YES | ignore |
| Paging Area ID | O | | 9.2.1.21 | | YES | ignore |
| Paging Cause | O | | 9.2.3.3 | | YES | ignore |
| Non Searching Indication | O | | 9.2.1.22 | | YES | ignore |
| DRX Cycle Length Coefficient | O | | 9.2.1.37 | | YES | ignore |
| Global CN-ID | O | | 9.2.1.46 | | YES | ignore |

| | |
|---|---|
| | |

NEXT CHANGE

## 9.1.38 OVERLOAD

This message is sent by both the CN and the RNC to indicate that the node is overloaded.

Direction: RNC → CN and CN → RNC.

Signalling bearer mode: Connectionless.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.1.1 | | YES | ignore |
| Number Of Steps | O | | 9.2.1.32 | | YES | ignore |
| Global RNC-ID | O | | 9.2.1.39 | | YES | ignore |
| CN Domain Indicator | O | | 9.2.1.5 | | YES | ignore |
| Global CN-ID | O | | 9.2.1.46 | | YES | ignore |

## 9.3.2 Elementary Procedure Definitions

(Unaffected ASN.1 code not shown here)

NEXT CHANGE

```
-- **************************************************************
--
-- Paging
--
-- **************************************************************

Paging ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {PagingIEs} },
    protocolExtensions      ProtocolExtensionContainer { {PagingExtensions} }                   OPTIONAL,
    ...
}

PagingIEs RANAP-PROTOCOL-IES ::= {
    { ID id-CN-DomainIndicator          CRITICALITY ignore  TYPE CN-DomainIndicator             PRESENCE mandatory  } |
    { ID id-PermanentNAS-UE-ID          CRITICALITY ignore  TYPE PermanentNAS-UE-ID             PRESENCE mandatory  } |
    { ID id-TemporaryUE-ID              CRITICALITY ignore  TYPE TemporaryUE-ID             PRESENCE optional } |
    { ID id-PagingAreaID                CRITICALITY ignore  TYPE PagingAreaID               PRESENCE optional } |
    { ID id-PagingCause             CRITICALITY ignore  TYPE PagingCause                PRESENCE optional  } |
    { ID id-NonSearchingIndication          CRITICALITY ignore  TYPE NonSearchingIndication       PRESENCE optional } |
    { ID id-DRX-CycleLengthCoefficient              CRITICALITY ignore  TYPE DRX-CycleLengthCoefficient          PRESENCE optional } ,
    ...
}

PagingExtensions RANAP-PROTOCOL-EXTENSION ::= {
    { ID id-GlobalCN-ID             CRITICALITY ignore  EXTENSION GlobalCN-ID                PRESENCE optional } ,

    ...
}
```

NEXT CHANGE

```
-- **************************************************************
--
-- OVERLOAD CONTROL ELEMENTARY PROCEDURE
--
-- **************************************************************

-- **************************************************************
--
-- Overload
--
-- **************************************************************

Overload ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {OverloadIEs} },
    protocolExtensions      ProtocolExtensionContainer { {OverloadExtensions} }                OPTIONAL,
    ...
}

OverloadIEs RANAP-PROTOCOL-IES ::= {
    { ID id-NumberOfSteps               CRITICALITY ignore  TYPE NumberOfSteps              PRESENCE optional } |
    { ID id-GlobalRNC-ID                CRITICALITY ignore  TYPE GlobalRNC-ID               PRESENCE optional },
    ...
}

OverloadExtensions RANAP-PROTOCOL-EXTENSION ::= {
    { ID id-CN-DomainIndicator          CRITICALITY ignore  EXTENSION CN-DomainIndicator    PRESENCE optional } |
    { ID id-GlobalCN-ID                 CRITICALITY ignore  EXTENSION GlobalCN-ID           PRESENCE optional } ,

    ...
}
```

NEXT CHANGE

## 9.5 Timers

$T_{RELOCprep}$

- Specifies the maximum time for Relocation Preparation procedure in the source RNC.

$T_{RELOCoverall}$

- Specifies the maximum time for the protection of overall Relocation procedure in the source RNC.

$T_{RELOCalloc}$

- Specifies the maximum time for Relocation Resource Allocation procedure in the CN.

$T_{RELOCcomplete}$

- Specifies the maximum time for waiting the relocation completion in the CN.

$T_{RABAssgt}$

- Specifies the maximum time in the CN for the whole RAB Assignment procedure.

$T_{QUEUING}$

- Specifies the maximum time in the RNC for queuing of the request of RAB establishment or modification.

$T_{DATAfwd}$

- Specifies the maximum time for GTP-PDU forwarding at the source RNC during relocation of SRNS.

$T_{igOC}$

- While this timer is running, all OVERLOAD messages or signalling point congested information received at the CN are ignored.

$T_{igOR}$

- While this timer is running, all OVERLOAD messages or signalling point congested information received at the RNC are ignored.

$T_{inTC}$

- While this timer is running, the CN is not allowed to increase traffic.

$T_{inTR}$

- While this timer is running, the RNC is not allowed to increase traffic.

$T_{RafC}$

- Specifies the maximum time for Reset procedure in the RNC.

$T_{RatC}$

- Specifies a guard period in the RNC before sending a RESET ACKNOWLEDGE message.

$T_{RafR}$

- Specifies the maximum time for Reset procedure in the CN.

$T_{RatR}$

- Specifies a guard period in the CN before sending a RESET ACKNOWLEDGE message.

$T_{NNSF}$

- Specifies the maximum time the RNC should store *Permanent NAS UE Identity* IE (and the related *Global CN-ID* IE) when NNSF is active.

END OF CHANGES