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Agenda Item:

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Title: Editor's Proposal for 25.410

Document for: Approval

This document is an editor's proposal for 25.410. Some of the changes were discussed in the editor's ad hoc during the last meeting. This document is based on v.1.0.0 (with the changes accepted).

TS 25.410 V1.0.~~0~~ x (1999-08)

Technical Specification

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

UTRAN I_u Interface: General Aspects and Principles

UMTS 25.410

3GPP

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Contents

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Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

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

Version m.t.e

where:

- m indicates [major version number]
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated into the specification.

1 Scope

The present document is an introduction to the UMTS 25.41x series of Technical Specifications that define the Iu interface for the interconnection of Radio Network Controller (RNC) component of the UMTS Terrestrial Radio Access Network (UTRAN) to the Core Network of the UMTS system.

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

[1] UMTS 25.401, UTRAN Overall Description
[2] UMTS 23.930, Iu Principles
[3] UMTS 23.110, UMTS Access Stratum; Services and Functions
[4] UMTS 25.411, UTRAN Iu Interface: Layer 1
[5] UMTS 25.412, UTRAN Iu Interface: Signalling Transport
[6] UMTS 25.413, UTRAN Iu Interface: RANAP Signalling
[7] UMTS 25.414, UTRAN Iu Interface: Data Transport & Transport Signalling
[8] UMTS 25.415, UTRAN Iu Interface: CN-RAN User Plane Protocols
[9] Q.711 (7/96), Functional description of the signalling connection control part
[10] Q.712 (7/96), Definition and function of signalling connection control part messages
[11] Q.713 (7/96), Signalling connection control part formats and codes
[12] Q.714 (7/96), Signalling connection control part procedures

3 Definitions~~, symbols~~ and abbreviations

3.1 Definitions

For the purposes of the present document, the ~~[following]~~ terms and definitions ~~[~~given in [1]~~... and the following]~~ 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
CC	Connection Confirm
CN	Core Network
CR	Connection Release
CREF	Connection Refusal
CS	Circuit Switched
GT	Global Title
NAS	Non Access Stratum
PS	Packet Switched
RANAP	Radio Access Network Application Part
RNC	Radio Network Controller

SAP	Service Access Point
SCCP	Signalling Connection Control Part
SPC	Signalling Point Code
SRNS	Serving Radio Network Subsystem
SSN	Sub-System Number
UE	User Equipment
UP	User Plane
UTRAN	UMTS Terrestrial Radio Access Network

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 section 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 XX 4.1 depicts the logical division of the I_u interface. From the Iu perspective, the Core Network access point is either an MSC or an SGSN and the UTRAN access point is an RNC.

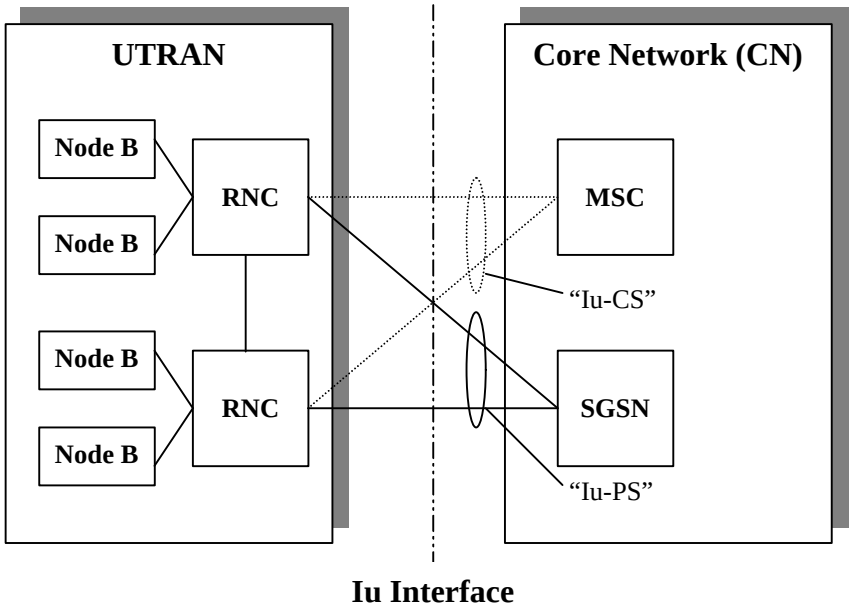

Figure 4.1: Iu Interface Architecture

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 this specification.

There may be at most two distinct Iu interface for any RNC - one (Iu-CS) towards the CS domain and one (Iu-PS) towards the PS-domain.

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

In the combined architecture, there are separate connections in the user plane (in both transport and radio network layers). In the control plane, there are 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 Iu specifications (25.41x series – see section 7).

4.1.2 Iu 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
- Each UTRAN Access Point may be connected to no more than one CN Access Point per CN domain

4.2 I_u Interface General Principles

From a UTRAN perspective, maximising the commonality of the various protocols that flow on the Iu interface is desirable. This means at the minimum that :

- A common set of radio access bearer services will be offered by UTRAN to the Core Network nodes, regardless of their type (e.g. 3G-MSC or 3G-SGSN).

There will be a common functional split between UTRAN and the Core Network nodes, regardless of their type (e.g. 3G-MSC or 3G-SGSN).

Signalling in the radio network control plane shall not depend on the specific choice of transport layers.

4.3 I_u Interface Specification Objectives

The following objectives are partly derived from ~~See~~ [2]~~, chapter 4.1~~.

The Iu interface shall be specified such that it can support:

- the interconnection of RNCs with Core Network Access Points within a single PLMN
- the interconnection of RNCs with Core Network Access Points irrespective of the manufacturer of any of the elements.
- all UMTS services

The Iu interface shall facilitate the use of the same RNC, MSC or SGSN in all PLMNs.

Independence between the protocol layers and between control and user planes shall be maintained on the Iu interface.

The Iu interface shall allow independent evolution of technologies within the Core, Radio Access and Transport Networks.

Editor's Note (not for inclusion) – this objective comes from 23.930, but fits better in here than as a capability.

The Iu interface shall allow separate evolution of O&M facilities.

The Iu interface shall be standardised as an open and multi-vendor interface.

The Iu interface specifications shall facilitate the migration of some services from the CS-domain to the PS-domain. In particular, the RANAP protocol shall be common to both domains, and the Iu user plane protocol(s) shall be independent of the core network domain, except where a specific feature is only required for one domain.

4.4 I_u Interface Capabilities

~~*[Editor´s note: This chapter should shortly describe the I_u Interface Capabilities. In order to avoid inconsistency between documents, reference to [2], chapters 4 and 5, has been made]*~~

The following capabilites are derived from the requirements described in [2]. ~~See [2], chapter 4.2.~~

The Iu interface supports:

- procedures to establish, maintain and release Radio Access Bearers
- procedures to perform intra-system handover, inter-system handover and SRNS relocation
- a set of general procedures, not related to a specific UE
- the separation of each UE on the protocol level for user specific signalling management
- the transfer of NAS signalling messages between UE and CN
- location services by transferring requests from the CN to UTRAN, and location information from UTRAN to CN. The location information may comprise a geographical area identifier or global co-ordinates with uncertainty parameters.
- simultaneous access to multiple CN domains for a single UE.

Editors Note (not for inclusion) – there are two additional requirements that would map to capabilities:

a) interworking to A and Gb interfaces from GSM

b) mechanisms for resource reservation for packet data streams

Should these be included – i.e. do the Iu specifications meet these?

4.5 I_u Interface Characteristics

4.5.1 Use of SCCP

4.5.1.1 General

The SCCP is used to support signalling messages between the CNs and the RNC. One user function of the SCCP, called Radio Access Network Application Part (RANAP), is defined. The RANAP uses one signalling connection per active UE and CN for the transfer of layer 3 messages.

Both connectionless and connection-oriented procedures are used to support the RANAP. TS 25.413 explains whether connection oriented or connectionless services should be used for each layer 3 procedure.

RANAP may use SSN, SPC and/or GT and any combination of them as addressing schemes for the SCCP. Which of the available addressing scheme to use for the SCCP is an operator matter.

Which of the possible GT formats to be used is FFS. One option is to use the same format as for the MAP specification, i.e. GT format 4.

The following sections describe the use of SCCP connections for RANAP transactions. Section 4.5.1.2 describes the connection establishment procedures. Section 4.5.1.3 describes the connection release procedures. Section 4.5.1.4 describes abnormal conditions.

4.5.1.2 SCCP connection establishment

A new SCCP connection is established when information related to the communication between a UE and the network has to be exchanged between RNC and CN, and no SCCP connection exists between the CN and the RNC involved, for the concerned UE.

Various SCCP connection establishment cases have to be distinguished:

i) RNC Initiated SCCP Signalling Connection

ii) CN Initiated SCCP Signalling Connection

The above cases are the only cases currently identified for SCCP connection establishment. Others may emerge in the future.

4.5.1.2.1 Establishment procedure in case i

The SCCP signalling connection establishment is initiated, by the RNC, at the reception of the first layer 3 non access stratum message from the UE.

Initiation

The RNC sends SCCP connection request message to the Core Network. A RANAP message is included in the user data field of the SCCP connection request message.

Termination

- successful outcome

- The SCCP connection confirm message, which may optionally contain a connection oriented RANAP message in the user data field, is returned to the RNC.

- unsuccessful outcome

- If the SCCP signalling connection establishment fails, an SCCP connection refusal message will be sent back to the RNC. This message may contain a transparent message to be sent to the UE.

For more information on how the RANAP procedure Initial UE message is handled, please see the elementary procedure Initial UE message in TS 25.413.

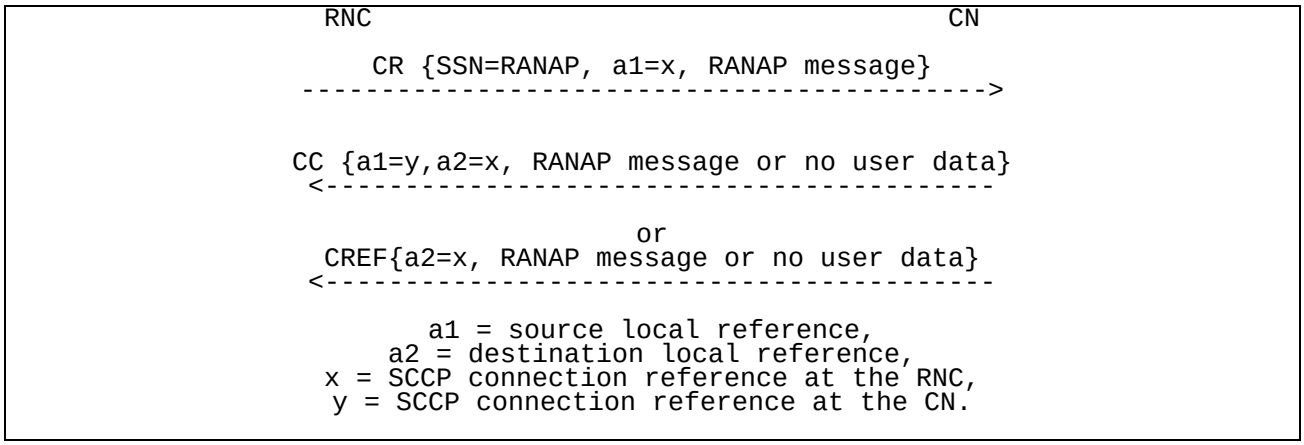

Figure ~~1~~4.2: Setting-up of RNC Initiated SCCP Signalling Connection

4.5.1.2.2 Establishment procedure in case ii

The SCCP signalling connection establishment is initiated, by the Core Network, in connection with performing a Relocation.

Initiation

The Core Network initiates the connection establishment by sending an SCCP connection request message to the RNC. Optionally, a RANAP message may be included in the user data field of the SCCP connection request message.

Termination

- successful outcome

- The SCCP connection confirm message, which may optionally contain a connection oriented RANAP message in the user data field, is returned to the Core Network.

- unsuccessful outcome

- If the SCCP signalling connection establishment fails, an SCCP connection refusal message will be sent back to the Core Network. This message may contain a RANAP message in the user data field.

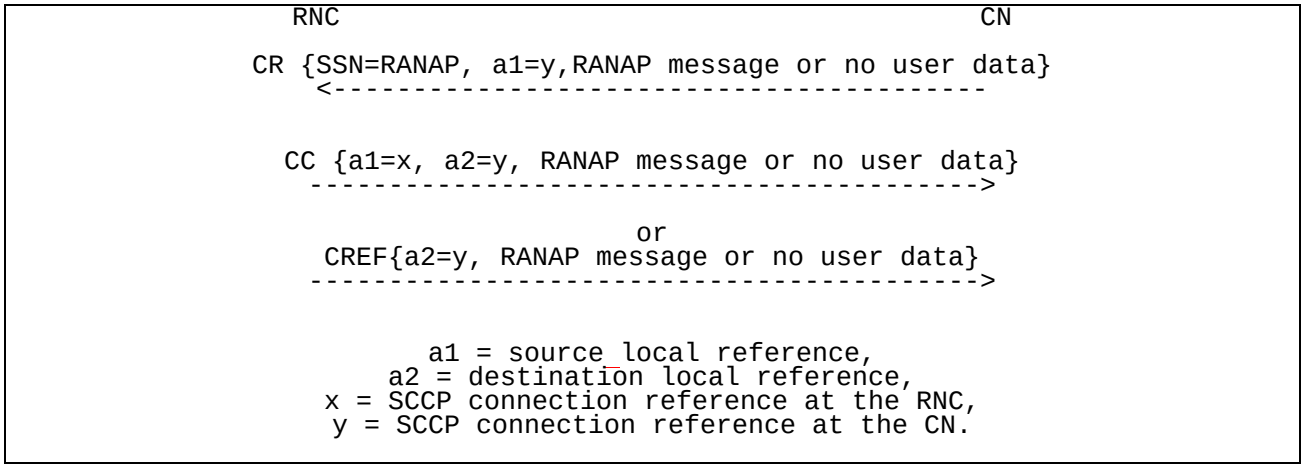

Figure ~~2~~4.3: Setting-up of CN Initiated SCCP Signalling Connection

4.5.1.3 SCCP connection release

This procedure is always initiated at the Core Network side.

An SCCP connection is released when the CN realises that a given signalling connection is no longer required.

The CN sends a SCCP Released message.

4.5.1.4 General SCCP Abnormal Conditions

If a user-out-of-service information or signalling-point-inaccessible information is received by the RANAP, no new attempt to establish SCCP connections towards the affected point code will be started until the corresponding user-in-service information or signalling-point-accessible information is received.

When a user-out-of-service information or signalling-point-inaccessible is received by the RNC, an optional timer may be started. When the timer expires, all the SCCP connections towards the affected point code will be released. When the user-in-service or signalling-point-accessible is received, the timer is stopped.

If for any reason an SCCP connection is released, the optional timer expires or a connection refusal is received while any of the RANAP procedures are being performed or while a dedicated resource is still allocated, the following actions are taken:

At RNC:

- Any RNC procedure relating to that connection is abandoned.
- The UTRAN resources allocated to the connection are released.

At Core Network:

- The resources associated with the SCCP connection are cleared as soon as possible.

5 Functions of the I_u Interface Protocols

~~*Editor's Note – this section will either contain a functional division across the interface, and/or a reference to the appropriate bit of the UTRAN Architecture Specification*~~

Congestion control shall be performed over the Iu user plane toward the ~~IP~~ PS domain using buffer management and no flow control.

6 I_u Interface Protocol Structure

6.1 General

The Radio Network signalling over Iu consists of the Radio Access Network Application Part (RANAP). The RANAP consists of mechanisms to handle all procedures between the CN and UTRAN. It is also capable of conveying messages transparently between the CN and the UE without interpretation or processing by the UTRAN.

Over the Iu interface the RANAP protocol is, e.g. used for:

- Facilitate a set of general UTRAN procedures from the Core Network such as paging -notification as defined by the notification SAP in [3].
- Separate each User Equipment (UE) on the protocol level for mobile specific signalling management as defined by the dedicated SAP in [3].
- Transfer of transparent non-access signalling as defined in the dedicated SAP in [3].
- Request of various types of UTRAN Radio Access Bearers through the dedicated SAP in [3].
- Perform the ~~streamlining~~ SRNS Relocation function.

The Radio Access Bearers are provided by the Access Stratum

6.2 Iu-CS

Figure 6.1 shows the protocol structure for Iu-CS, following the structure described in [1].

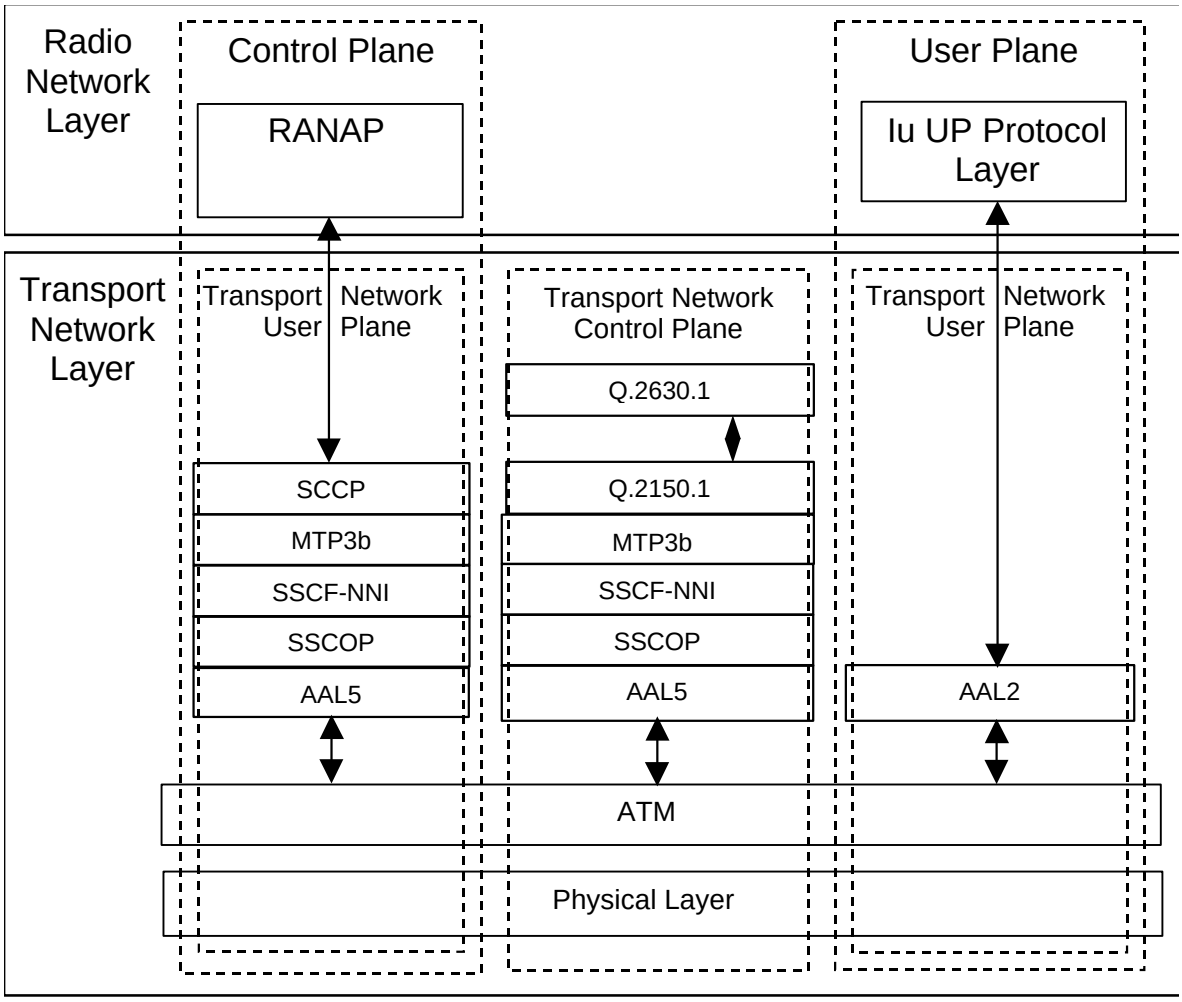

Figure ~~3~~6.1: I_u –Interface Protocol Structure towards CS Domain

~~***Editor's note: Should the next sentence be in here or in 25.414?***~~

Q.2630.1 is used as the ALCAP protocol for dynamically setup AAL-2 connections over Iu towards the ~~PSTN~~ CS ~~Domain~~domain.

6.3 Iu-PS

Figure 6.2 shows the protocol structure for Iu-PS, following the structure described in [1].

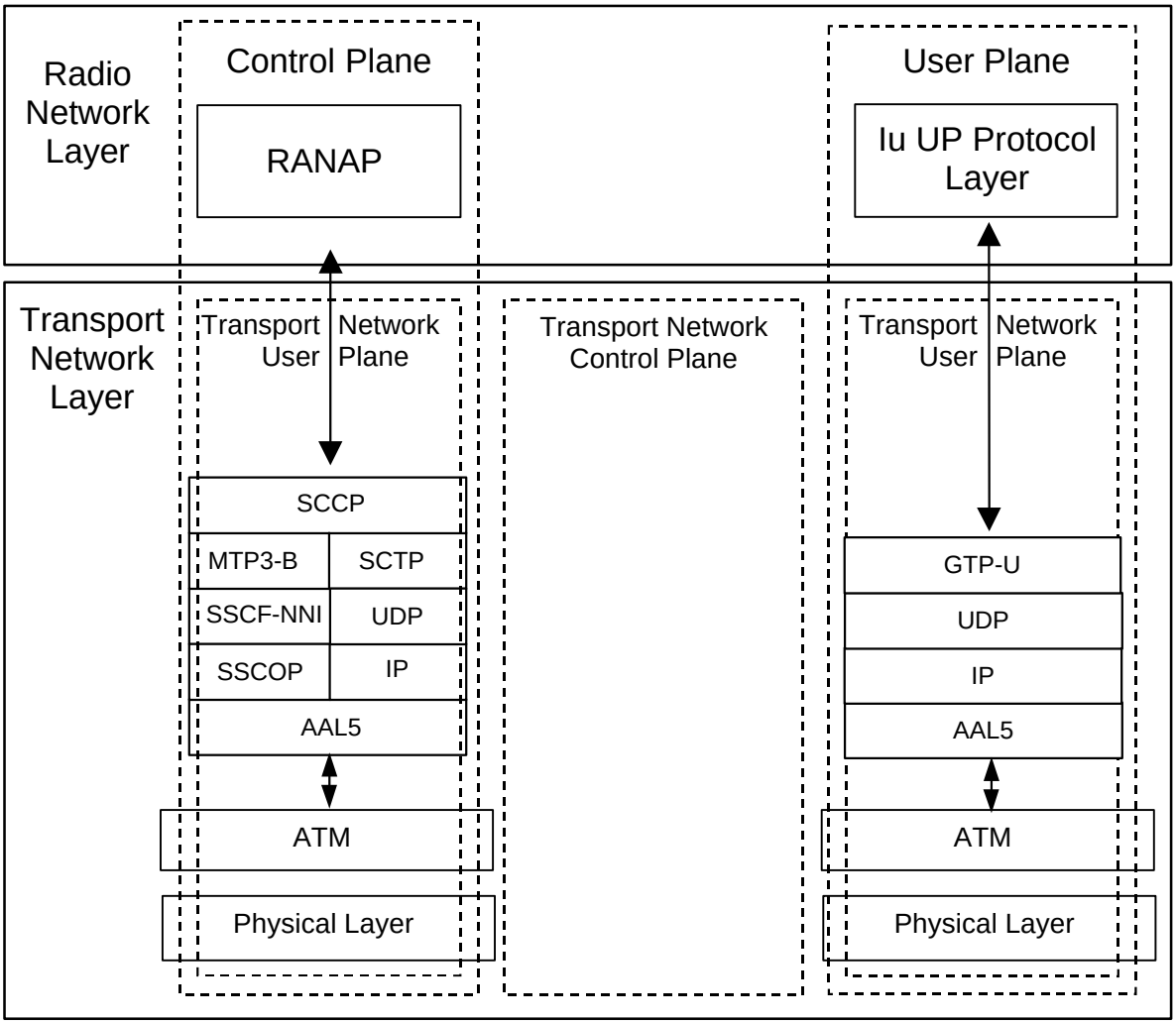

Figure 46.2: I_u Interface Protocol Structure towards PS Domain

Editor's Note (not for inclusion) – The figure has been modified to show CTP as SCTP, and to include the UDP layer according to the SCTP documentation. It should not be necessary to include a reference in this document, as the SCCP references are only present to clarify the SCCP text.

RANAP Signalling is used to establish, modify and release the GTP-U tunnels towards the PS domain.

7 Other I_u Interface Specifications

7.1 UTRAN Iu Interface: Layer 1 (UMTS 25.411)

UMTS 25.411 [4] specifies the range of physical layer technologies that may be used to support the Iu interface.

7.2 UTRAN Iu Interface: Signalling Transport (UMTS 25.412)

UMTS 25.412 [5] specifies the signalling bearers for the RANAP and ALCAP protocols for both Iu-PS and Iu-CS.

7.3 RANAP Specification (UMTS 25.413)

UMTS 25.413 [6] specifies the RANAP protocol for radio network control plane signalling over the Iu interface.

7.4 UTRAN Iu Interface: Data Transport and Transport Signalling (UMTS 25.414)

UMTS 25.414 [7] specifies the transport bearers for the user plane of the Iu interface. It also specifies the ALCAP protocol used to control these transport bearers.

7.5 UTRAN Iu Interface: CN-UTRAN User Plane Protocols (UMTS 25.415)

UMTS 25.415 [8] specifies the user plane frame handling protocol for the Iu interface.

7.8 Summary

The relationship between the technical specifications that define the UTRAN Iu interface is shown in figure 7.1.

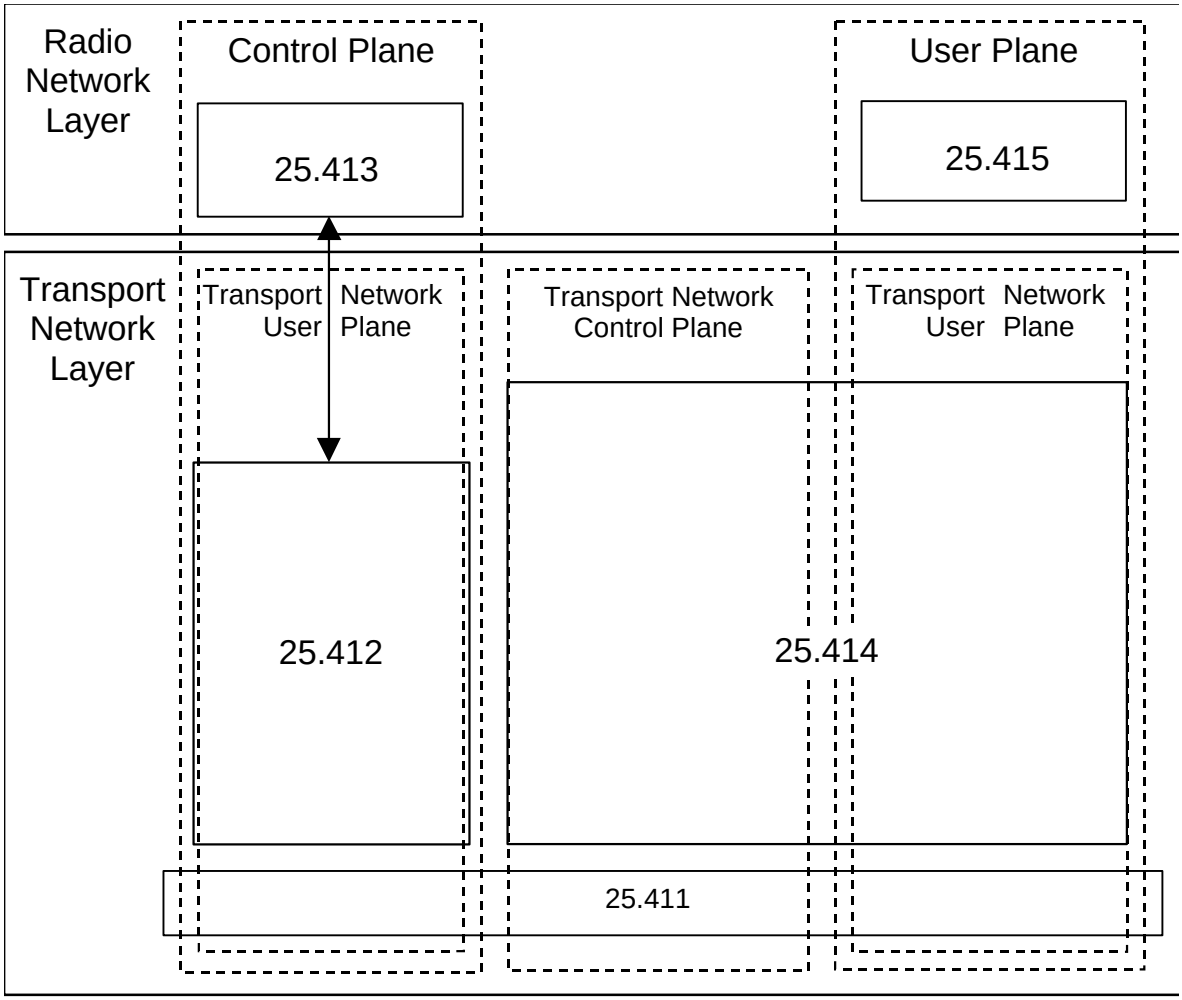

Figure 7.1: Summary of Iu Interface Specification Structure

~~9 Bibliography~~

~~The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.~~

Annex A (Informative) – Stability Information

This annex details the stability of each section of the document, and notes areas where further text is required.

Section	Content missing	Incomplete	Restructuring needed	Checking needed	Editorial work required	Finalisation needed	Almost stable	Stable
1,2						✓		
3	✓							
4.1							✓	
4.2							✓	
4.3							✓	
4.4		✓						
4.5								✓
5		✓						
6								✓
7							✓	

In general, a thorough editorial review will be required to ensure internal consistency.

810 History

Document history		
v 0.0.1	1999-02	Initial Specification Structure
V0.0.2	1999-02	Text from merged document included.
V0.0.3	1999-03	Updated with decision from WG3 #2 (inclusion of IP domain congestion control)
V0.1.0	1999-04	Approved by WG3
v.0.1.1	1999-05	Updated with decisions from WG3 #3 – mostly from Tdoc 344. References and Ch7 updated according to document renumbering.
v.0.1.2	1999-06	Further changes after SWG review, and text from Iu SWG @ WG3#4 added. – This version was never treated in a WG3 meeting.
v.0.2.1	1999-06	Approved at WG3#4, and showing changes agreed at that meeting – sentence on establishment of GTP-U tunnels, and commonality of U-plane protocols.
v.0.3.1	1999-08	Approved at WG3#5, and showing changes agreed at that meeting – figures updated to show single UP protocol, and with SCCP usage text (modified from tdoc 725)
v.1.0.0	1999-08	Approved at WG3#6, and showing changes agreed at that meeting. Including corrections/clarifications to SCCP section, new text for architecture, objectives and characteristics sections.
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