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Technical Specification

3rd Generation Partnership Project (3GPP);
Technical Specification Group (TSG) RAN
Iu Interface CN-UTRAN User Plane Protocols

UMTS ~~S3.15~~ 25.415

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Contents

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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project, Technical Specification Group RAN WG3.

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

Version m.t.e

where:

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

~~1~~Scope

This Technical Specification defines the protocols being used to transport and control over the Iu interface, the Iu User Data Streams.

~~2~~References

The following documents contain ~~provisions which~~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] UTRAN Architecture

[2] UMTS ~~S3.xx~~25.413 RANAP protocol

[3] UMTS ~~S3.14~~25.414, 3rd Generation Partnership Project (3GPP) Technical Specification Group (TSG) RAN; Iu Interface Data Transport and Transport Signalling

[4] UMTS 23.10, UMTS Access Stratum, services and functions

~~3~~Definitions, symbols and abbreviations

~~3.1~~Definitions

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

Note of the editor: The term Non Access Stratum Data Streams is used in place of a better term to identify the data streams coming from the Iu UP CS protocol upper layers. Contributions are invited to refine this terminology.

The following definition is an editor's proposal.

Non Access Stratum Data Streams:

Non Access Stratum Data Streams is a generic term to identify in the CN and the Terminal domains, these data streams exchanged at the Dedicated Service Access Points between the Non Access Stratum and the Access Stratum.

~~3.2~~Symbols

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

~~3.3~~Abbreviations

AS: Access Stratum
CN: Core Network
CS: Circuit Switched

GTP U: GPRS Tunnelling Protocol User part
NAS: Non Access Stratum
PDU: Protocol Data Unit
PS: Packet Switched
RAB: Radio Access Bearer
RANAP: Radio Access Network Application Part
UP: User Plane

~~3.4~~Concepts

Co-ordinated Radio Access Bearers:

Note of the editor: A proposal of a concept will be made by the editor and refined on the e-mail reflector.

~~3.5~~25.415 specification status

Section	Status	Comments
1	In progress	
2	In progress	
3	In progress	
4	In progress	
5	In progress	
6	In progress	
7	In progress	
8	In progress	To be moved to another specification.

~~4~~General

~~5~~PSTN/ISDN Domain

~~5.1~~General

~~5.1.1~~Protocol Architecture

From an architectural perspective, the Iu CS UP protocol layer is present in the Iu User plane towards the CS domain at the interface access points. The following figure illustrates the logical placement of the Iu CS UP protocol layer and the placement of the Data Streams sources outside of the Access Stratum.

The two strata communicate through a Service Access Point for Non Access Stratum (NAS) Data Streams. There can be one or several data streams towards one Iu CS UP protocol instance. These non-access stratum data streams need to be co-ordinated in the Non-Access Stratum.

Editor´s Proposal: *In order to keep independencies between the Radio Network and Transport Network layers specifcations, the following figure no longer details the Transport Network User plane protocols, specified in other documents and generically refer only to as User Plane Data Bearers protocols in the Transport Layer.*

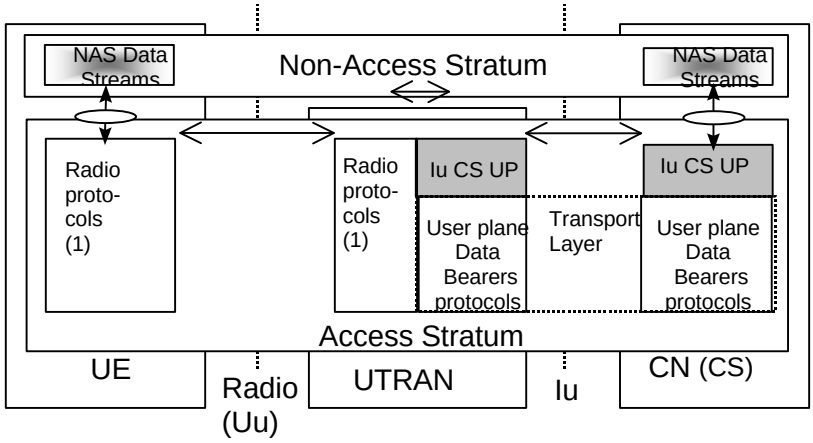

Figure 1: Iu CS UP protocol layer occurrence in UTRAN overall architecture

~~1.1.2~~Interfaces of the Iu CS UP protocol layer

As part of the Access Stratum responsibility, the Iu CS UP protocol layer provides the services and functions that are necessary to handle non access stratum data streams. The Iu CS UP protocol layer is providing these services to the UP upper layers in the CS CN domain through a Dedicated Service Access Point used for Information Transfer as specified in [4].

The Iu CS UP protocol layer is using services of the Transport layers in order to transfer the Iu UP PDUs over the Iu interface.

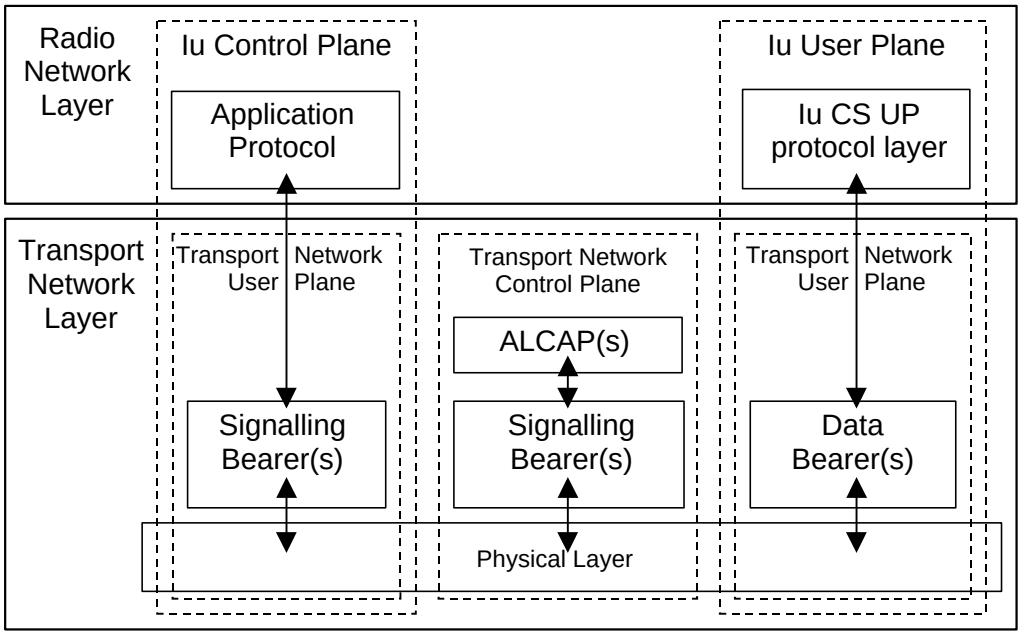

Figure 2: Iu CS UP protocol layer interfaces

~~1.2~~Iu CS UP Protocol layer Services

~~5.3~~Services Expected from the UP Data Transport layer

~~5.4~~Functions of the Iu CS UP Protocol Layer

The Iu CS UP CS protocol layer is made of a number of functions such as Procedure Control functions, Frame Handler function and Non Access Stratum specific functions.

Frame Handler function: This function is responsible for framing and de-framing the different parts of an Iu CS UP protocol frame. This function takes the different part of the Iu CS UP protocol frame and set the control part field to the correct values. It also ensures that the frame control part is semantically correct. This function is responsible for interacting with the Transport layers. This function is also responsible for the CRC check of the Iu CS UP frame header.

Procedure Control functions: This set of functions offers the control of a number of procedures handled at the Iu UP CS protocol level. These functions are responsible for the procedure control part of the Iu CS UP frames.

Namely, these procedures are:

- **RAB Format selection (FFS)**: is the procedure which controls over Iu CS UP the maximum rate among the RAB Formats negotiated for the established RAB service. The function controlling this procedure interacts with functions outside of the Iu CS UP protocol layer.
- **Initialisation:** is the procedure which controls the exchange of initialisation information that may be required for certain RAB such as Speech. Such information can contain the RAB Format Set to be used until termination of the connection or until the next initialisation procedure.
- **Time Alignment (FFS)**: is the procedure that controls the information exchanged over the Iu related to the sending time of Iu CS UP frames. The function controlling this procedure interacts with functions outside of the Iu CS UP protocol layer.
- **Handling of Abnormal Event:** is the procedure that controls the information exchanged over the Iu related to detection of a fault situation. The function controlling this procedure interacts with functions outside of the Iu CS UP protocol layer.

Non Access Stratum Data Streams specific function(s): These functions are responsible for a “limited” manipulation” of the payload and the consistency check of the frame number. If a frame loss is detected due a gap in the sequence of the received frame numbers, this shall be reported to the procedure control function. These functions are responsible for the CRC check and calculation of the Iu UP frame payload part.

These functions interact with the upper layers through a SAP by exchanging Iu data stream blocks of Iu UP frame payload.

Note: The following paragraph is FFS

These functions interact with the procedure control function for handling the RAB format selection procedure data (RFN, Iu Data Stream Block size, etc.).

These functions may provide service access to the upper layers for the procedure control functions.

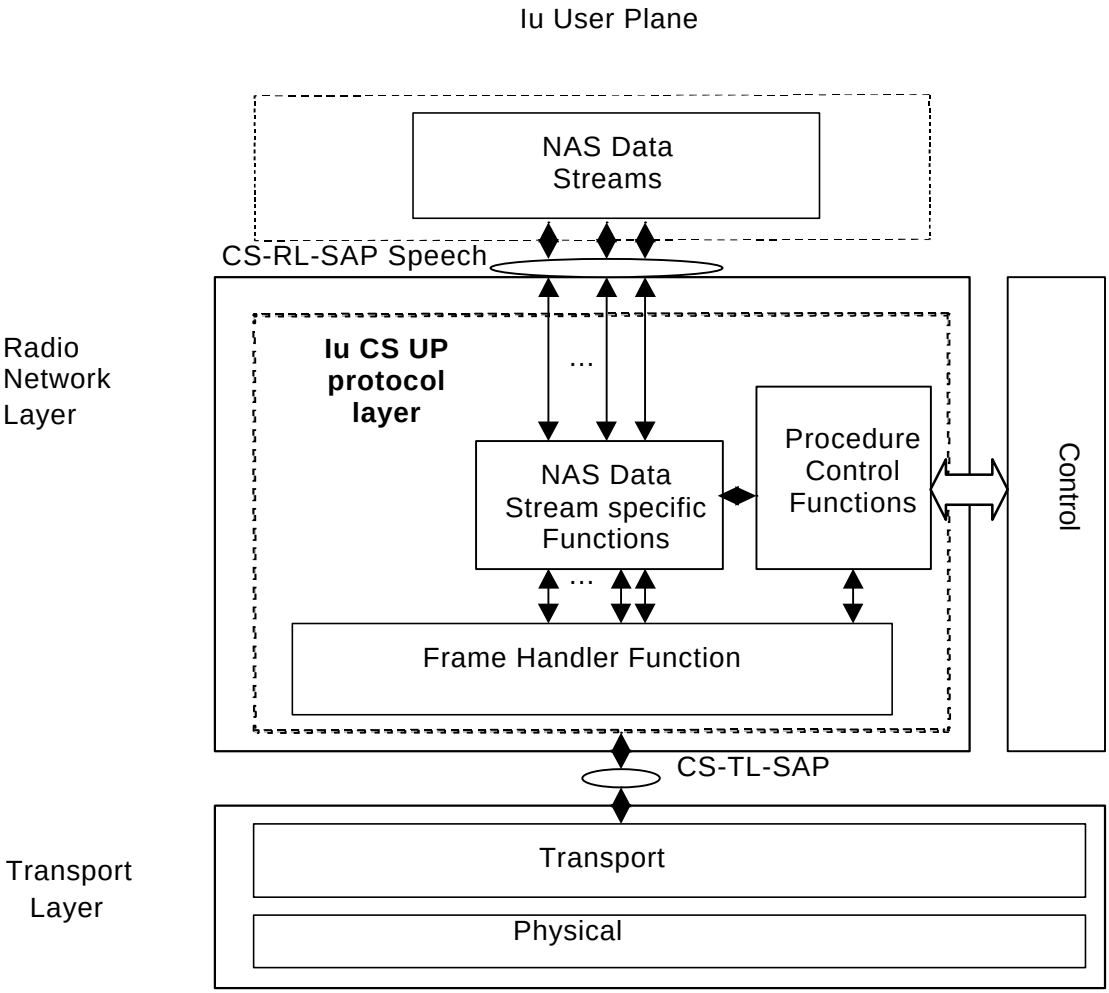

Figure 3: Functional model of the Iu CS UP protocol layer

~~5.5~~Elementary procedures

~~5.6~~Primitives used by the Iu CS UP Protocol Layer

~~5.6.1~~Primitives towards the upper layers

~~5.6.2~~Primitives towards the transport layers

~~5.7~~Elements for Iu CS UP communication

~~5.7.1~~Frame Format and content definition

The following shows the Iu frame structure of the Iu CS UP protocol at the SAP towards the transport layers (CS-TL-SAP):

Bits											
7	6	5	4	3	2	1	0				
This field is FFS Frame Type				Frame Number				M	1	Bytes	Frame Control Part
PME	Procedure Control Bitmap							M	2		Frame Procedure Control Part
PCE	**This field is FFS** RAB Format Selection Control Field							O	3		
PCE	**This field is FFS** Time Alignment Control Field							O	4		
PCE	Abnormal Event Control Field							O	5		
PCE	Initialization Control Field							O	6		
Frame Payload Check Sum							Frame Header Check Sum	M	7		Frame Check Sum Part
Payload Fields								C	8-n		Frame Payload part

Figure 4: Iu CS UP Frame Format

C: Conditional
M: Mandatory
O: Optional

The Iu UP protocol frames are made of four parts:

1) Iu UP Frame Control part

2) Iu UP Frame Procedure Control part

3) Iu UP Frame Check Sum

4) Iu UP Frame Payload part

The Iu UP Frame Control Part, the Iu UP Frame Procedure Control Part and the Iu UP Frame Check Sum constitute the Iu UP Frame Header.

~~5.7.2~~1.1.1 Frame coding

~~5.7.3~~1.1.2 Timers

~~5.8~~1.2 Handling of unknown, unforeseen and erroneous protocol data

~~6~~2 IP Domain

~~6.1~~2.1 General

Note of the editor: At the RAN WG3#3 meeting, it has been decided that the GTP U protocol belongs to the Transport Network Layer user plane. As a consequence, statements referring to the multiplexing layer on top of the common layer 2 resources and the section addressing the buffer management and no flow control have been moved to 25.414.

~~The standard shall support that the user data flows transported over the Iu reference point to/from the SGSN shall be multiplexed on top of common layer 2 resources.~~

~~6.1.1~~2.1.1 Protocol Architecture

Editor´s Proposal: *The content of this section is proposed by the editor to clarify the logical placement of the Iu PS UP layer in the overall UTRAN architecture.*

From an architectural perspective, the Iu PS UP layer is present in the Iu User plane towards the PS domain at the Iu interface access points.

The following figure illustrates the logical placement of the Iu PS UP protocol layer and the placement of the Data Streams sources outside of the Access Stratum.

The two strata communicate through a Service Access Point for Non Access Stratum (NAS) Data Streams transfer.

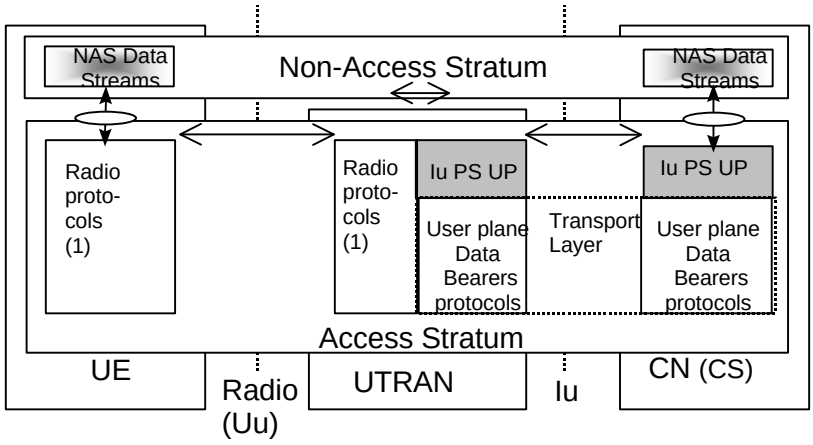

Figure 5: Iu PS UP protocol layer occurrence in UTRAN overall architecture

The Iu PS UP layer is a transparent layer. This layer does not offer any services than relaying PDUs.

~~6.1.2Interfaces of the Iu PS UP protocol layer~~

~~6.2Iu PS UP Protocol layer Services~~

~~6.3Services Expected from the UP Data Transport layer~~

~~6.4Functions of the Iu PS UP Protocol layer~~

~~1.1.1Congestion Control and Buffer management~~

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

~~6.5Elementary procedures~~

~~6.6Primitives used by the Iu PS UP Protocol layer~~

~~6.6.1Primitives towards the upper layers~~

~~6.6.2Primitives towards the transport layers~~

~~6.7Elements for Iu PS UP communication~~

~~6.8Handling of unknown, unforeseen and erroneous protocol data~~

~~7~~3 Annex A (Normative)

~~8~~4 Appendix A (Informative)

~~8.1~~Elements for Iu PS UP communication

~~8.1.1~~GTP-U Header format and content definition

Bits									
7	6	5	4	3	2	1	0		
Version			PT	Reserved				1	Bytes
Message Type								2	
Spare					Length			3	
Length								4	
Sequence Number								5	
Sequence Number								6	
Flow Label (1st Byte)								7	
Flow Label (2nd Byte)								8	
Flow Label (3rd Byte)								9	
Flow Label (4th Byte)								10	

Figure 8: Iu PS UP GTP-U protocol header

~~8.1.1.1~~Version

The Version field is used to separate different versions of the GTP protocol.

Note: It needs to be considered whether a new protocol discriminator is required and if not how version handling is performed.

~~8.1.1.2~~PT (Payload Type)

Bit 5 of the first octet is used as a protocol discriminator. It is used to separate the GTP-U protocol from a protocol that is used for charging purposes in the UMTS core network.

~~8.1.1.3~~Reserved

These bits are reserved for future use. Their use is FFS.

They shall be set to '1' by the sending side and shall not be evaluated by the receiving side.

This applies to bits 3-0 of octet 1.

Note: The usage of the reserved field in protocol messages needs to be clarified.

~~8.1.1.4~~Message Type

The Message Type field indicates the type of the GTP-U message.

This is needed to indicate whether the message consists of transparent user data (T-PDU) or path management messages.

Note: The usage of the reserved values in the message type needs to be clarified.

Message Type Value	Message
0	For future use. Shall not be sent. If received, shall be treated as an unknown message.
1	Echo Request
2	Echo Response
3	Version Not Supported
4 to 191	Reserved
192 to 254	For future use. Shall not be sent. If received, shall be treated as an unknown message.
255	T-PDU

~~8.1.1.5~~Length

The Length field indicates the length in octets of the GTP-U message excluding the GTP-U header. Bit 2 of octet 3 is the most significant bit and bit 0 of octet 4 is the least significant bit of the length field.

Length field is needed to enable volume based charging (in xGSN).

~~8.1.1.6~~Spare '1s'

These unused bits shall be set to '1' by the sending side and shall not be evaluated by the receiving side. This applies to bits 7-3 of octet 3.

~~8.1.1.7~~Sequence Number

The Sequence Number field is a transaction identity for signalling messages and an increasing sequence number for tunnelled T-PDUs.

For user data, based on the received and expected sequence number values, the receiving node may decide whether or not to discard the received PDUs. Alternatively, the receiving node shall reorder the incoming PDUs in sequence if the Reordering Information in the application part control plane indicates that Reordering is required.

Note: The aspects related to initialisation and synchronisation of the sequence number are FFS.

~~8.1.1.8~~Flow Label

The Flow Label field identifies unambiguously a GTP-U tunnel. The Flow Label is negotiated through RANAP dialogue during the setup phase of a GTP-U tunnel.

The SGSN assigns the Flow Label to be used for upstream traffic and the RNC assigns the Flow Label to be used for downstream traffic.

The following describes how the Flow Label is assigned:

In the control plane, the SGSN sends to the RNC a node IP address (Transport Layer address) and an upstream Flow Label to be used for the user plane data. The Flow Label corresponds to the Binding Identity and identifies a GTP-U tunnel.

The RNC responds in the control plane with an IP address (Transport Layer address) and a downstream Flow Label. The Flow Label corresponds to the Binding Identity in the RAB Assignment Complete message.

For signalling messages, the Flow Label is set to 0.

Similar procedures will be used for SRNS relocation and handover.

~~8.1.1.9~~Echo Request

This message is used for Path (UDP layer) management. It is used for one peer to verify that the corresponding peer is still operational. Echo Request messages may be sent for each path in use. The node shall be prepared to receive an Echo Request message at any time and reply with an Echo Response message. When and how often an Echo Request message may be sent is implementation specific but an Echo Request shall not be sent more often than every 60 seconds on each path.

The private extension is optional.

~~8.1.1.10~~Echo Response

This message is sent as a response to the Echo Request message. The private extension is optional. The Recovery field is required.

~~8.1.1.11~~Version not supported

This message contains only the GTP-U header and indicates the latest GTP version that the GTP-U entity on the identified UDP/IP address can support.

If a receiving node receives a GTP message of an unsupported version, that node shall return a Version not Supported message indicating in the Version field of the GTP-U header the latest GTP-U version that that node supports.

~~8~~5 History

Document history		
Edition x		Publication
0.0.1	Feb 1999	First draft
0.0.2	March 1999	Revised following RAN WG3#2 meeting: - TSG SA S2-99080: Iu UP instances - TSG RAN WG3#2 R3-99195
0.1.0	April 1999	Prepared for the RAN WG#3 meeting. - Document noted TSG SA S2-99080: Iu UP instances
0.1.1	May 1999	Revised following RAN WG3#3 meeting - Editorial additions: abbreviations, corrected references - TSG R3 (99) 281: incorporation of the proposals, inclusion of the frame format, RAB Format Selection and Time Alignment FFS - TSG R3 (99) 368: alignment of the 281 proposals with the co ordinated data streams concepts of 368. - Inclusion of detailed comments of the Iu SWG on TSG R3 (99) 281 - Note: - *TSG R3 (99) 257: provisions for load sharing on Iu between RNC and CN PS, moved to 25.414* - *TSG R3 (99) 276: incorporation of the two parts of proposal 1 (i.e. resulting in creation of appendix A): moved to 25.414*
0.1.2	May 1999	Revised by editor according to WG3#3 closing plenary meeting recommendations -Include Appendix A -Include Section 3.4.: Specification status

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