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Universal Mobile Telecommunications System (UMTS); UTRAN Iu interface data transport and transport signalling (3GPP TS 25.414 version 5.0.0 Release 5)



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1 Scope

The present document specifies the standards for user data transport protocols and related signalling protocols to establish user plane transport bearers over the UTRAN Iu interface.

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.
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- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] ITU-T Recommendation I.361 (11/95): "B-ISDN ATM layer specification".
- [2] ITU-T Recommendation I.363.2 (11/00): "B-ISDN ATM Adaptation layer specification: Type 2 AAL".
- [3] ITU-T Recommendation I.363.5 (8/96): "B-ISDN ATM Adaptation layer specification: Type 5 AAL".
- [4] ITU-T Recommendation I.366.1 (6/98): "Segmentation and Reassembly Service Specific Convergence Sublayer for the AAL type 2".
- [5] ITU-T Recommendation E.164 (5/97): "The international public telecommunication numbering plan".
- [6] ITU-T Recommendation Q.2110 (7/94): "B-ISDN ATM adaptation layer - Service Specific Connection Oriented Protocol (SSCOP)".
- [7] ITU-T Recommendation Q.2140 (2/95): "B-ISDN ATM adaptation layer - Service Specific Coordination Function for Support of Signalling at the Network Node Interface (SSCF-NNI)".
- [8] ITU-T Recommendation Q.2150.1 (12/99): "AAL type 2 signalling transport converter on broadband MTP".
- [9] ITU-T Recommendation Q.2210 (7/96): "Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140".
- [10] ITU-T Recommendation Q.2630.1 (12/99): "AAL type 2 signalling protocol (Capability Set 1)".
- [11] ITU-T Recommendation X.213 (8/97): "Information technology - Open systems interconnection - Network Service Definitions".
- [12] IETF RFC 768 (August 1980): "User Datagram Protocol".
- [13] IETF RFC 791 (September 1981): "Internet Protocol".
- [14] IETF RFC 2684 (September 1999): "Multiprotocol Encapsulation over ATM Adaptation Layer 5".
- [15] IETF RFC 2225 (April 1998): "Classical IP and ARP over ATM".
- [16] IETF RFC 2460 (December 1998): "Internet Protocol, Version 6 (IPv6) Specification".
- [17] 3GPP TS 29.060: "General Packet Radio Service (GPRS) Service description; Stage 2".

- [18] IETF RFC 793 (September 1981): "Transmission Control Protocol".
- [19] IETF RFC 2474 (December 1998): "Definition of the Differentiated Services Field (DS Field) in the Ipv4 and Ipv6 Headers".
- [20] ITU-T Implementor's guide (12/99) for recommendation Q.2210 (07/96).
- [21] ITU-T Recommendation Q.2630.2 (12/00): "AAL type 2 signalling protocol (Capability Set 2)".
- [22] IETF RFC 1889 (January 1996): "RTP: A Transport Protocol for Real Time Applications".
- [23] IETF RFC 1890 (January 1996): "RTP Profile for Audio and Video Conferences with Minimal Control".
- [24] 3G TS 25.415: "UTRAN Iu Interface User Plane Protocols"
- [25] IETF RFC 1661 (July 1994): "The Point-to-Point Protocol (PPP)".
- [26] IETF RFC 1662 (July 1994): "PPP in HDLC-like Framing".
- [27] IETF RFC 2507 (February 1999): "IP header compression".
- [28] IETF RFC 1990 (August 1996): "The PPP Multilink Protocol (MP)".
- [29] IETF RFC 2686 (September 1996): "The Multi-Class Extension to Multi-Link PPP".
- [30] IETF RFC 2509 (February 1999): "IP Header Compression over PPP".
- [31] IETF RFC 2474 (December 1998): "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".
- [32] "IP-ALCAP" [ffs.]
- [33] IETF RFC 3153 (August 2001): "PPP Multiplexing".
- [34] IETF RFC 2364 (July 1998): "PPP over AAL5".
- [35] IETF RFC 3031 (January 2001): "Multiprotocol Label Switching Architecture".

3 Definitions and abbreviations

3.1 Definitions

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

Access Link Control Application Part (ALCAP): generic name for the transport signalling protocols used to set-up and teardown transport bearers

3.2 Abbreviations

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

AAL	ATM Adaptation Layer
AESA	ATM End System Address
ALCAP	Access Link Control Application Part
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
CN	Core Network
GTP	GPRS Tunnelling Protocol
HDLC	High-level Data Link Control
IP	Internet Protocol
LC	Link Characteristics

LIS	Logical IP Subnet
MTP3b	Message Transfer Part level 3 for Q.2140
NSAP	Network Service Access Point
PDU	Protocol Data Unit
PPP	Point-to-Point Protocol
RFC	Request For Comment
RNC	Radio Network Controller
RTCP	Real-time Transport Control Protocol
RTP	Real-time Transport Protocol
SA	Service Area
SABP	Service Area Broadcast Protocol
SABS	Service Area Broadcast Service
SAR	Segmentation and Reassembly
SCSF-NNI	Service Specific Coordination Function-Network Node Interface
SSCOP	Service Specific Connection Oriented Protocol
SSCS	Service Specific Convergence Sublayer
SSRC	Synchronisation Source
TCP	Transmission Control Protocol
TEID	Tunnel Endpoint Identifier
UDP	User Datagram Protocol
VC	Virtual Circuit

4 Data Link Layer

4.1 ATM Transport Option

ATM shall be used in the transport network user plane and the transport network control plane according to ITU-T Recommendation I.361 [1]. The structure of the cell header used in the UTRAN Iu interface is the cell header format and encoding at NNI (see figure 3/I.361).

4.2 IP Transport Option

An RNC/CN-node supporting IP transport option on the Iu interface shall support PPP protocol with HDLC framing [25], [26].

NOTE: This does not preclude the single implementation and use of any other protocols (e.g. PPPMux/AAL5/ATM, PPP/AAL2/ATM, Ethernet, MPLS/ATM, etc.) fulfilling the UTRAN requirements toward the upper layers.

An RNC/CN-node supporting IP transport option on the Iu interface and having interfaces connected via slow bandwidth PPP links like E1/T1/J1 shall also support IP Header Compression [27] and the PPP extensions ML/MC-PPP [28], [29]. In this case the negotiation of header compression [27] over PPP shall be performed via [30].

5 Circuit switched domain

5.1 Transport network user plane

5.1.1 General

An RNC/CN-node supporting IP transport option on the Iu interface shall support PPP protocol with HDLC framing [25], [26].

NOTE: This does not preclude the single implementation and use of any other protocols (e.g. PPPMux/AAL5/ATM, PPP/AAL2/ATM, Ethernet, MPLS/ATM, etc.) fulfilling the UTRAN requirements toward the upper layers.

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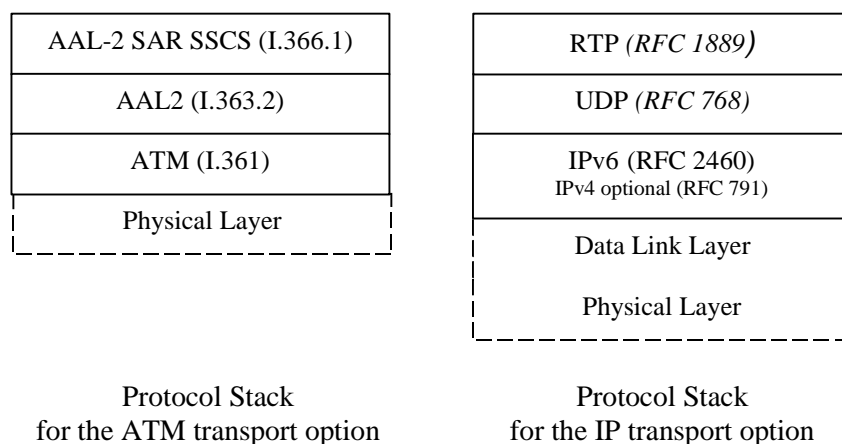


Figure 1. Transport network layer for data streams over Iu-CS.

5.1.2 ATM Transport Option

5.1.2.1 ATM Adaptation Layer 2

5.1.2.1.1 AAL2-Segmentation and Reassembly Service Specific Convergence Sublayer (I.366.1)

Service Specific Segmentation and Reassembly (SSSAR) sublayer of ITU-T Recommendation I.366.1 [4] is used for the segmentation and reassembly of AAL2 SDUs (i.e., only SSSAR is used from ITU-T Recommendation I.366.1).

5.1.2.1.2 AAL2-specification (I.363.2)

AAL2 shall be used according to ITU-T Recommendation I.363.2 [2].

5.1.3 IP Transport Option

5.1.3.1 General

In the IP transport option RTP over UDP over IP shall be supported as the transport for data streams on the Iu-CS interface. The data link layer is as specified in subclause 4.2.

The transport bearer is identified by the UDP port number and the IP address (source UDP port number, destination UDP port number, source IP address, destination IP address).

5.1.3.2 UDP/IP

The path protocol used shall be UDP [12].

An IP RNC/CN-node shall support IPv6. The support of IPv4 is optional.

NOTE: This does not preclude single implementation and use of IPv4.

IP dual stack support is recommended for the potential transition period from IPv4 to IPv6 in the transport network.

There may be one or several IP addresses in the RNC and in the CN. The packet processing function in the CN shall send downstream packets of a given RAB to the RNC IP address / UDP port (received in RANAP) associated to that

particular RAB. The packet processing function in the RNC shall send upstream packets of a given RAB to the CN IP address / UDP port (received in RANAP) associated to that particular RAB.

The RNC/CN-node shall use two consecutive port numbers for the RTP bearer and for the optional RTCP connection that transport a single Iu UP connection. Two such consecutive port numbers are termed "port number block" in what follows. The first port number shall be even and shall be assigned to the RTP protocol. The next port number shall be assigned to the RTCP protocol. This port shall be reserved even if the optional RTCP protocol is not used.

Each RNC/CN-node shall administer the port numbers it intends to use for RTP/RTCP port number blocks.

5.1.3.3 RTP

RTP [22] shall be applied.

5.1.3.3.1 RTP Header

The RTP Header Fields shall be used as described in the following subclauses:

5.1.3.3.1.1 Version

RTP Version 2 shall be used.

5.1.3.3.1.2 Padding

Padding shall not be used.

5.1.3.3.1.3 Extension

The RTP Header shall not have an extension.

5.1.3.3.1.4 Contributing Source (CSRC) count

There are zero CSRCs.

5.1.3.3.1.5 Marker Bit

The marker bit is ignored.

5.1.3.3.1.6 Payload Type

A dynamic Payload Type [23] shall be used. Values in the Range between 96 and 127 shall be used. The value shall be ignored in the receiving entity.

5.1.3.3.1.7 Sequence Number

The sequence number shall be supplied by the source of an RTP PDU. The sink of an RTP PDU may ignore the sequence number or it may use it to obtain statistics about the link quality and / or to correct out-of-sequence delivery, e.g. by dropping out-of-sequence packets.

5.1.3.3.1.8 Timestamp

The timestamp shall be supplied by the source of an RTP PDU. A clock frequency of 16000 Hz or multiples of this value shall be used. The sink of an RTP PDU may ignore the timestamp or it may use it to obtain statistics about the link quality and / or to correct jitter.

5.1.3.3.1.9 Synchronisation Source (SSRC)

The source of an RTP PDU shall supply a SSRC. The sink of an RTP PDU may ignore the SSRC if it does not use RTCP.

5.1.3.3.1.10 CSRC list

This list is empty.

5.1.3.3.2 RTP Payload

A single Iu UP PDU, as described in [x3], shall be transported as RTP payload.

5.1.3.4 RTCP

RTCP [22] may be applied. RTCP over UDP [12] over IPv6 [16] shall be used (IPv4 [13] may be used optionally). The use of the RTCP protocol is optional. The receiving entity may ignore incoming RTCP PDUs.

Figure 1a shows the protocol stack for the transport of RTCP. The above Sections about IP and UDP shall also apply for the transport of RTCP.

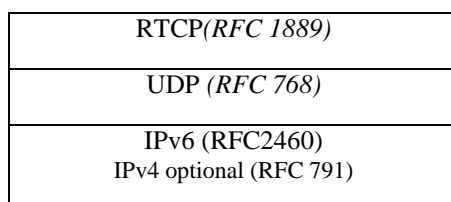


Figure 1a. RTCP Protocol stack for data stream transport on Iu-CS.

5.1.3.5 Diffserv code point marking

IP Differentiated Services code point marking [32] shall be supported. The Diffserv code point may be determined from the application parameters.

5.2 Transport network control plane

5.2.1 General

There are two options for the transport layer for transport signalling over Iu-CS:

- 1) ATM based Transport (ATM transport option)
- 2) IP based Transport (IP transport option)

The following figure shows the protocol stacks of the two options.

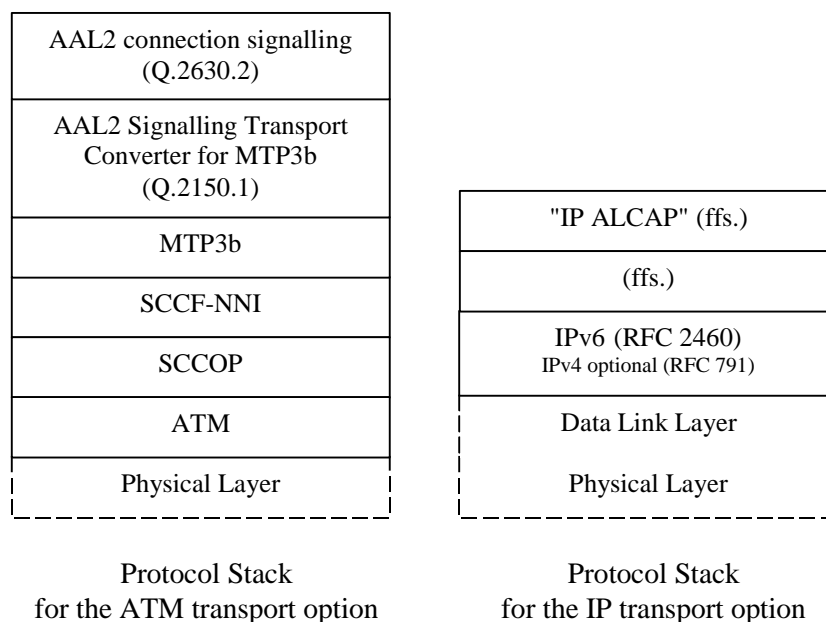


Figure 2. Signalling bearer for ALCAP on lu-CS interface.

5.2.2 Transport Signalling for the ATM Transport Option

5.2.2.1 Signalling protocol (ALCAP)

5.2.2.1.1 AAL2 Signalling Protocol (Q.2630.2)

In the ATM transport option ITU-T Recommendation Q.2630.2 [21] shall be used for establishing AAL2 connections towards the circuit switched domain. ITU-T Recommendation Q.2630.2 [21] adds new optional capabilities to ITU-T Recommendation Q.2630.1 [10].

The AAL2 transport layer uses the embedded E.164 [5] or AESA variants of the NSAP addressing formats [11]. Native E.164 addressing shall not be used.

Binding ID provided by the radio network layer shall be copied in SUGR parameter of ESTABLISH request primitive of ITU-T Recommendation Q.2630.2 [21].

If there is an AAL2 switching function in the transport network layer of the interface, the Link Characteristics parameter (LC) shall be included in the Establish Request message and in the Modification Request message of AAL2 signalling protocol.

5.2.2.2 Signalling transport converter

5.2.2.2.1 AAL2 MTP3B Signalling Transport Converter (Q.2150.1)

The AAL2 MTP3b Signalling Transport Converter shall be used according to ITU-T Recommendation Q.2150.1 [8].

5.2.2.3 MTP3b (Q.2210)

MTP3b shall be used according to ITU-T Recommendation Q.2210 [9 and 20].

5.2.2.4 SSCF-NNI (Q.2140)

SSCF-NNI shall be used according to ITU-T Recommendation Q.2140 [7].

5.2.2.5 SSCOP (Q.2110)

SSCOP shall be used according to ITU-T Recommendation Q.2110 [6].

5.2.2.6 ATM Adaptation Layer Type 5 (I.363.5)

AAL5 shall be used according to ITU-T Recommendation I.363.5 [3].

5.3 Interworking between ATM and IP Transport Options

5.3.1 Introduction

This clause specifies the interworking between IP and ATM transport options. An RNC/CN-node supporting IP transport option shall provide interworking to a CN-node/RNC supporting only ATM transport option.

5.3.2 Interworking Alternatives

For interworking with a CN-node/RNC supporting only ATM transport option, the RNC/CN-node supporting IP transport option shall additionally support at least one of the following interworking mechanisms:

- 1) ATM&IP dual stack. An IP-ALCAP protocol is not required in this interworking solution.
- 2) Interworking Function (IWF) as a logical part of the RNC/CN-node supporting IP transport option. An IP-ALCAP protocol is not required in this interworking solution.
- 3) Interworking Unit (IWU) as a logically separate unit. An IP-ALCAP protocol shall be used in the interface between the RNC/CN-node supporting IP transport option and the Interworking Unit.

5.3.3 IP-ALCAP for the Interworking

In the third interworking alternative as introduced in subclause 5.3.2, [32] is used as the IP-ALCAP protocol between the RNC/CN-node supporting IP transport option and the Transport Network Layer Interworking Unit.

6 Packet switched domain

6.1 Transport network user plane

6.1.1 General

There are two options for the transport layer for data streams over Iu-PS:

- 1) ATM based Transport (ATM transport option)
- 2) IP based Transport (IP transport option)

The following figure shows the protocol stacks of the two options.

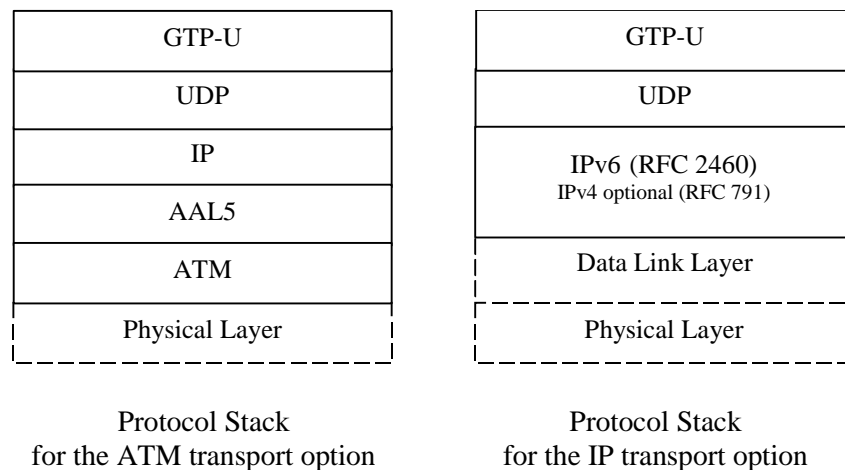


Figure 3. Transport network layer for data streams over Iu-PS.

6.1.2 ATM Transport Option

6.1.2.1 General

In the ATM transport option, the protocol architecture for the User Plane of the Iu interface towards the packet switched domain shall be GTP-U [17] over UDP over IP over AAL5 over ATM. One or several AAL5/ATM permanent VC's may be used as the common layer 2 resources between the UTRAN and the packet switched domain of the CN.

One switched VC may be used per user flow. The standardisation of the procedures and protocols for use of Switched VC is outside the scope of 3GPP.

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

6.1.2.2 GTP-U

The GTP-U [17] protocol shall be used over the Iu interface toward the packet switched domain.

6.1.2.3 UDP /IP

The path protocol used shall be UDP [12], which is specified in RFC 768.

The UDP port number for GTP-U shall be as defined in [17].

IPv4 [13] (RFC 791) shall be supported; IPv6 [16] (RFC 2460) support is optional.

There may be one or several IP addresses in the RNC and in the CN. The packet processing function in the CN shall send downstream packets of a given RAB to the RNC IP address (received in RANAP) associated to that particular RAB. The packet processing function in the RNC shall send upstream packets of a given RAB to the CN IP address (received in RANAP) associated to that particular RAB.

6.1.2.4 ATM Adaptation Layer Type 5 (I.363.5)

AAL5 shall be used according to ITU-T Recommendation I.363.5 [3].

AAL5 virtual circuits shall be used to transport the IP packets across the Iu interface toward the packet switched domain. Multiple VCs may be used over the interface. An association shall be made between a VC and the IP addresses that are related to this VC in the peer node side. This association shall be made using O&M or using ATM Inverse ARP according to Classical IP over ATM when PVCs are used.

When PVCs are used, quality of service differentiation shall only be performed at the IP layer using differentiated services [19].

6.1.2.5 IP/ATM

Classical IP over ATM protocols and Multiprotocol Encapsulation over AAL5 shall be used to carry the IP packets over the ATM transport network when PVCs are used. Classical IP over ATM is specified in RFC 2225 [15]. Multiprotocol Encapsulation over AAL5 is specified in RFC 2684 [14].

Classical IP over ATM allows routers to be members of one or more LISs. The CN side of the Iu interface shall provide IP routing functionalities. The RNC side of the Iu interface may provide routing functionalities. If the RNC side of the Iu interface does not provide routing functionalities, the RNC routing tables shall include default route entries.

6.1.3 IP Transport Option

6.1.3.1 General

In the IP transport option GTP-U [17] over UDP over IP shall be supported as the transport for data streams on the Iu-PS interface. The data link layer is as specified in subclause 4.2.

The transport bearer is identified by the GTP-U TEID [17] and the IP address (source TEID, destination TEID, source IP address, destination IP address).

6.1.3.2 GTP-U

The GTP-U [17] protocol shall be used over the Iu interface toward the packet switched domain.

6.1.3.3 UDP /IP

The path protocol used shall be UDP [12].

The UDP port number for GTP-U shall be as defined in [17].

An IP RNC/CN-node shall support IPv6. The support of IPv4 is optional.

NOTE: This does not preclude single implementation and use of IPv4.

IP dual stack support is recommended for the potential transition period from IPv4 to IPv6 in the transport network.

There may be one or several IP addresses in the RNC and in the CN. The packet processing function in the CN shall send downstream packets of a given RAB to the RNC IP address (received in RANAP) associated to that particular RAB. The packet processing function in the RNC shall send upstream packets of a given RAB to the CN IP address (received in RANAP) associated to that particular RAB.

6.1.3.4 Diffserv code point marking

IP Differentiated Services code point marking [31] shall be supported. The Diffserv code point may be determined from the application parameters.

6.2 Transport network control plane

ALCAP is not required over the Iu interface towards the packet switched domain.

7 Broadcast Domain

7.1 Transport network user plane

7.1.1 General

There are two options for the transport layer for data streams over Iu-BC:

- 1) ATM based Transport (ATM transport option)
- 2) IP based Transport (IP transport option)

The following figure shows the protocol stacks of the two options.

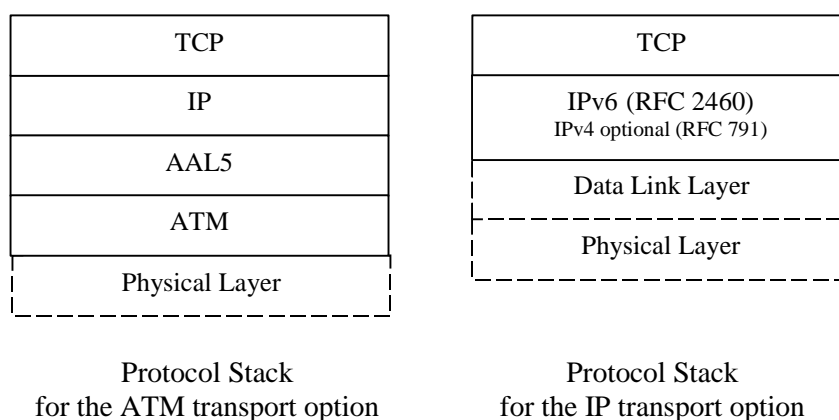


Figure 4. Transport network layer for data streams over Iu-BC.

7.1.2 ATM Transport Option

7.1.2.1 General

In the ATM transport option, the protocol architecture for the Service Area Broadcast Plane of the Iu interface shall be TCP over IP over AAL5 over ATM.

7.1.2.2 TCP/IP

The path protocol used shall be TCP, which is specified in RFC793 [18]. IPv4 [13] (RFC 791) shall be supported, IPv6 [16] (RFC 2460) support is optional.

7.1.2.3 ATM Adaptation Layer Type 5 (I.363.5)

AAL5 shall be used according to ITU-T Recommendation I.363.5.

AAL5 virtual circuits shall be used to transport the IP packets across the Iu interface toward the broadcast domain. Multiple VCs may be used over the interface. An association shall be made between a VC and the IP addresses that are related to this VC in the peer node side. This association shall be made using O&M or using ATM Inverse ARP according to Classical IP over ATM when PVCs are used.

7.1.2.4 IP/ATM

Classical IP over ATM protocols and Multiprotocol Encapsulation over AAL5 shall be used to carry the IP packets over the ATM transport network when PVCs are used. Classical IP over ATM is specified in RFC 2225 [15]. Multiprotocol Encapsulation over AAL5 is specified in RFC 2684 [14].

7.1.3 IP Transport Option

7.1.3.1 General

In the IP transport option TCP over IP shall be supported as the transport for data streams on the Iu-BC interface. The data link layer is as specified in subclause 4.2.

The transport bearer is identified by the TCP port number and the IP address (source TCP port number, destination TCP port number, source IP address, destination IP address).

7.1.3.3 TCP /IP

The path protocol used shall be TCP, which is specified in RFC 793 [18].

An IP RNC/CN-node shall support IPv6. The support of IPv4 is optional.

NOTE: This does not preclude single implementation and use of IPv4.

IP dual stack support is recommended for the potential transition period from IPv4 to IPv6 in the transport network.

7.1.3.4 Diffserv code point marking

IP Differentiated Services code point marking [x11] shall be supported. The Diffserv code point may be determined from the application parameters.

7.2 Transport network control plane

ALCAP is not required over the Iu interface towards the broadcast domain.

Annex A (informative): Change history

Change history					
TSG RAN#	Version	CR	Tdoc RAN	New Version	Subject/Comment
RAN_04	-	-	-	3.0.0	Approved at TSG RAN #4 by correspondence and placed under Change Control
RAN_05	3.0.0	-	-	3.1.0	Approved at TSG RAN #5
RAN_06	3.1.0	001	RP-99747	3.2.0	Approved at TSG RAN #6
RAN_07	3.2.0	-	-	3.3.0	Approved at TSG RAN #7
RAN_08	3.3.0	-	RP-000237	3.4.0	Approved at TSG RAN #8
RAN_09	3.4.0	018 020	RP-000375	3.5.0	Approved at TSG RAN #9
RAN_10	3.5.0	022	RP-000614	3.6.0	Approved at TSG RAN #10
RAN_11	3.6.0	023 024	RP-010112	3.7.0	Approved at TSG RAN #11

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
March 01	11	RP-010162	26		Approved at TSG RAN #11 and placed under Change Control	-	4.0.0
March 01	11	RP-010163	25		Approved at TSG RAN #11 and placed under Change Control	-	4.0.0
09/2001	13	RP-010580	022		Reference correction to Q.2630.1	4.0.0	4.1.0
12/2001	14	RP-010850	029		Reference corrections	4.1.0	4.2.0
03/2002	15	RP-020165	032		AAL5 used to transport IP packet for Broadcast Domain	4.2.0	4.3.0
03/2002	15	RP-020189	030	3	Introduction of IP transport option in UTRAN	4.3.0	5.0.0

History

Document history		
V5.0.0	March 2002	Publication