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Technical Specification

**3rd Generation Partnership Project;
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Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

Contents

Foreword

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

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

Version x.y.z

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x the first digit:

1 presented to TSG for information;

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the standards for Signalling Transport to be used across Iu Interface. Iu Interface is a logical interface between the RNC and the UTRAN Core Network. The present document describes how the RANAP signalling messages are transported over Iu.

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. 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 Q.2100 (1994-07): "B-ISDN Signalling ATM Adaptation Layer (SAAL) - overview description".

[2] ITU-T Recommendation Q.2110 (1994-07): "B-ISDN ATM Adaptation Layer – Service Specific Connection Oriented Protocol (SSCOP)".

[3] ITU-T Recommendation Q.2140 (1995-02): "B-ISDN ATM adaptation layer – Service Specific Co-ordination Function for signalling at the Network Node Interface (SSCF AT NNI)".

[4] ITU-T Recommendation Q.2210 (1996-07): "Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140".

[5] ITU-T Recommendation I.361 (1995-11): "B-ISDN ATM layer specification".

[6] ITU-T Recommendation I.363.5 (1996-08): "B-ISDN ATM Adaptation Layer Type 5".

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

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

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

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

[11] ITU-T Recommendation Q.715 (1996-07): "Signalling connection control part user guide".

[12] ITU-T Recommendation Q.716 (1993-03): "Signalling Connection Control Part (SCCP) performance".

[13] IETF RFC 791 (1981-09): "Internet Protocol".

[14] IETF RFC 2684 (1999-09): "Multiprotocol Encapsulation over ATM Adaptation Layer 5".

[15] IETF RFC 2225 (1998-04): "Classical IP and ARP over ATM".

[16] IETF RFC 2960 (2000-10): "Stream Control Transmission Protocol".

[17] IETF RFC 3332(2002-09): "Signalling System 7 (SS7) Message Transfer Part 3 (MTP3) – User Adaptation Layer (M3UA)"

[18]   3GPP TS 25.410: "UTRAN Iu Interface: General Aspects and Principles".

[19]   IETF RFC 1661 (1994-07): "The Point-To-Point Protocol (PPP)".

[20]   IETF RFC 1662 (1994-07): "PPP in HDLC-like Framing".

[21]   IETF RFC 2507 (1999-02): "IP header compression".

[22]   IETF RFC 1990 (1996-08): "The PPP Multilink Protocol (MP)".

[23]   IETF RFC 2686 (1999-09): "The Multi-Class Extension to Multi-Link PPP".

[24]   IETF RFC 2509 (1999-02): "IP Header Compression over PPP".

[25]   IETF RFC 2460 (1996-12): "Internet Protocol, Version 6 (Ipv6) Specification".

[26]   IETF RFC 2474 (1998-12): "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".

[27]   Void.

[28]   IETF RFC 3031 (2001-01): "MPLS".

[29]   IETF RFC 3153 (2001-08): "PPP multiplexing".

[30]   IETF RFC 3309 (2002-09): "SCTP Checksum Change".

[31]   ANSI T1.111-2001: "Signalling System Number 7 (SS7) - Message Transfer Part (MTP)".

[32]   ANSI T1.112-2001: "Signalling System Number 7 (SS7) -- Signalling Connection Control Part (SCCP)".

[33]   ANSI T1.645-1995 (R2003), "B-ISDN Signaling ATM Adaptation Layer - Service Specific Coordination Function for Support of Signaling at the Network Node Interface (SSCF at the NNI)".

3   Abbreviations

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

AAL	ATM Adaptation Layer
AAL2	ATM Adaptation Layer 2
AAL5	ATM Adaptation Layer 5
ATM	Asynchronous Transfer Mode
CS	Circuit Switched
DiffServ	Differentiated Services
HDLC	High Level Data Link Control
IP	Internet Protocol
M3UA	SS7 MTP3 User Adaptation Layer
ML/MC-PPP	Muti-Link/Multi-Class PPP
MPLS	Multiprotocol Label Switching
MSC	Mobile services Switching Center
MTP3-B	Message Transfer Part
PPP	Point-to-Point protocol
PPPMux	PPP Multiplexing
PS	Packet Switched
RANAP	Radio Access Network Application Part
RNC	Radio Network Controller
SAAL-NNI	Signalling ATM Adaptation Layer – Network Node Interface
SCCP	Signalling Connection Control Part
SCTP	Stream Control Transmission Protocol
SGSN	Serving GPRS Support Node
SSCF	Service Specific Co-ordination Function

SSCOP   Service Specific Connection Oriented Protocol

4   Data Link Layer

4.1   ATM Transport Option

ATM shall be used in the radio network control plane according to (ITU-T Rec. I.361 [5]). 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 using IP transport option shall support the PPP protocol with HDLC framing (IETF RFC 1661 [19], IETF RFC 1662 [20]).

Note: This does not preclude the single implementation and use of any other data link layer protocol (e.g. PPPMux (IETF RFC 3153 [29])/AAL5/ATM, PPP/AAL2/ATM, Ethernet, MPLS (IETF RFC 3031 [28])/ATM, etc.) fulfilling the UTRAN requirements toward the upper Layers.

An RNC/CN using IP transport option having interfaces connected via low bandwidth PPP links like E1/T1/J1 shall also support IP Header Compression (IETF RFC 2507 [21]) and the PPP extensions ML/MC-PPP (IETF RFC 1990 [22], IETF RFC 2686 [23]). In this case, the negotiation of header compression (IETF RFC 2507 [21]) over PPP shall be performed via IETF RFC 2509 [24].

5   RANAP Signalling Bearer

5.1   Introduction

This subclause specifies the Signalling Bearer protocol stack that supports the RANAP signalling protocol.

The following requirements on the Signalling Bearer can be stated:

- provide reliable transfer of control plane signalling messages in both connectionless mode and connection-oriented mode;

- provide separate independent connections for distinguishing transactions with individual UE's;

- supervise the 'UE connections' and provide connection status information to the Upper Layers for individual UE's;

- provide networking and routing functions;

- provide redundancy in the signalling network;

- provide load sharing.

5.2   Signalling Bearer for Circuit Switched Domain

5.2.1   Protocol Stack for the CS Domain

The protocol stacks for the CS Domain are shown in figure 1. The standard allows operators to choose one out of two standardised protocol suites for transport of SCCP messages.

Figure 1 shows, for the Iu IP CS domain, the point at which the service primitives are invoked. A single SAP is defined independently of the signalling bearer. The SAP provides the SCCP primitives. The figure is not intended to constrain the architecture.

The following figure 1 also illustrates the protocol model having Broadband Signalling System No.7 as the signalling bearer for RANAP over the Iu interface that fulfils the requirements. Figure 1 shows, for the CS domain, the point at which the service primitives are invoked. The SAP provides the SCCP primitives.
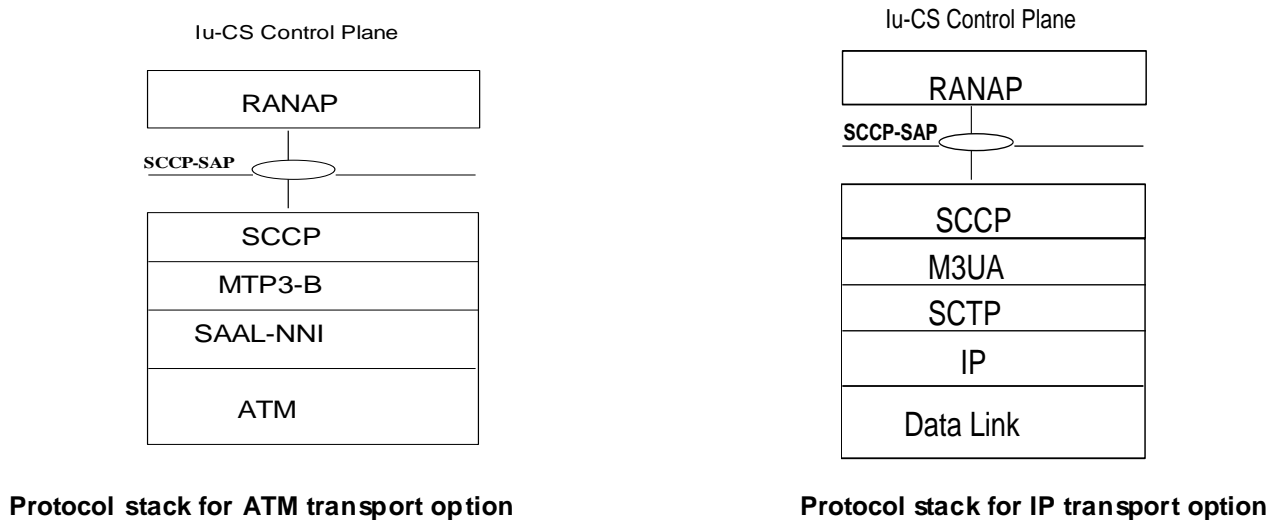
Iu-CS Control Plane

RANAP

SCCP-SAP

SCCP
MTP3-B
SAAL-NNI
ATM

Iu-CS Control Plane

RANAP

SCCP-SAP

SCCP
M3UA
SCTP
IP
Data Link

Protocol stack for ATM transport option　　　　**Protocol stack for IP transport option**

Figure 1: SAP between RANAP and its transport for Iu - CS Domain

5.2.2　ATM Transport Option

1. **SCCP** (ITU-T Rec. Q.711 [7] or ANSI T1.112-2001 [32]) provides connectionless service, class 0, connection oriented service, class 2, separation of the connections mobile by mobile basis on the connection oriented link and establishment of a connection oriented link mobile by mobile basis. SCCP shall be used as specified in TS 25.410 [18].

2. **MTP3-B** (ITU-T Rec. Q.2210 [4] or ANSI T1.111-2001 [31]) provides message routing, discrimination and distribution (for point-to-point link only), signalling link management load sharing and changeover/back between link within one link-set. The need for multiple link-sets is precluded. MTB3-B shall comply with ITU-T Rec. Q.2210 [4] or ANSI T1.111-2001 [31].

3. **SAAL-NNI** (ITU-T Rec. Q.2100 [1]) consists of the following sub-layers: - **SSCF** (ITU-T Rec. Q.2140 [3] or ANSI T1.645-1995 (R2003) [33]), - **SSCOP** (ITU-T Rec. Q.2110 [2]) and – **AAL5** (ITU-T Rec. I.363.5 [6]). The SSCF maps the requirements of the layer above to the requirements of SSCOP. Also SAAL connection management, link status and remote processor status mechanisms are provided. SSCOP provides mechanisms for the establishment and release of connections and the reliable exchange of signalling information between signalling entities. Adapts the upper layer protocol to the requirements of the Lower ATM cells. It shall be possible to use SAAL-NNI connections pre-configured as PVCs for signalling transport on the Iu-Interface.

4. **ATM** (ITU-T Rec. I.361 [5]).

5.2.3　IP Transport Option

1. **SCCP**, see subclause 5.2.2.

2. **M3UA** refers to the SCCP adaptation layer "SS7 MTP3 – User Adaptation Layer " (IETF RFC 3332 [17]) also developed by the Sigtran working group of the IETF. An RNC equipped with the M3UA stack option shall have client functionality. This enables the RNC to report to the MSC when it is a newly introduced entity in the network.

3. **SCTP** refers to the Stream Control Transmission Protocol (IETF RFC 2960 [16]) developed by the Sigtran working group of the IETF for the purpose of transporting various signalling protocols over IP networks. The checksum method specified in IETF RFC 3309 [30] shall be used instead of the method specified in IETF RFC 2960 [16]. Multi-homing is a way to achieve redundancy with SCTP between two endpoints, of which one or both is assigned with multiple IP addresses. SCTP endpoints shall support a multi-homed remote SCTP endpoint.

4. **IP**. IPv6 shall be supported according to IETF RFC 2460 [25]. IPv4 support (IETF RFC 791 [13]) is optional.

   Note: This does not preclude the single implementation and use of Ipv4.

   Due to the possible transition from IPv4 to IPv6 the IP dual stack support is recommended.

An RNC/CN using IP transport option shall support Diffserv code point marking IETF RFC 2474 [26]. The Diffserv code point may be determined from the application parameters.

5.3 Signalling Bearer for Packet Switched Domain

5.3.1 Protocol Stack for the PS Domain

The protocol stacks for the PS Domain is shown in figure 2. The standard allows operators to choose one out of three standardised protocol suites for transport of SCCP messages.
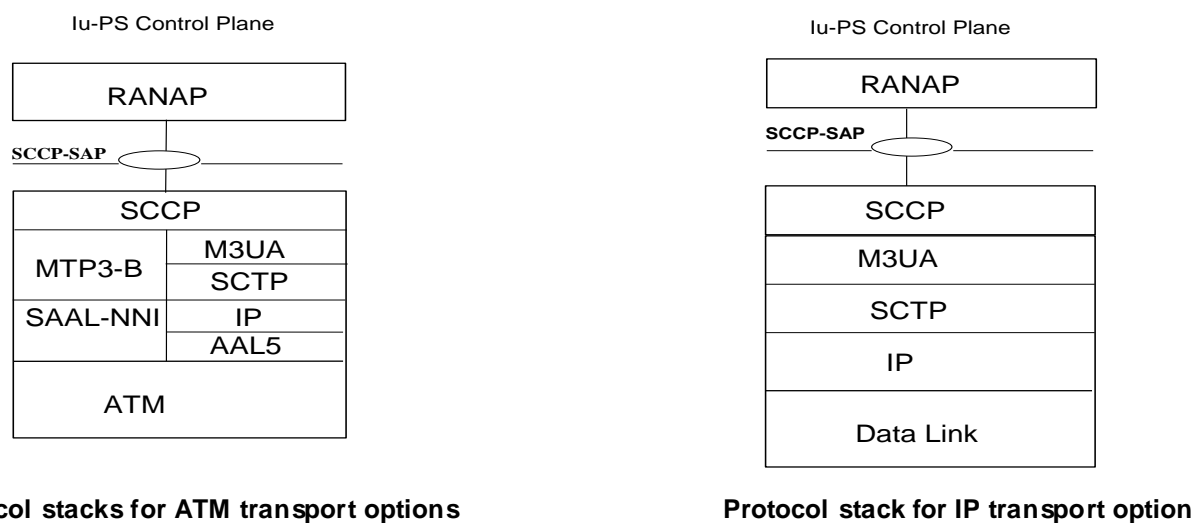

Protocol stacks for ATM transport options   **Protocol stack for IP transport option**

Figure 2: SAP between RANAP and its transport for the Iu –IP domain

Figure 2 shows, for the Iu IP domain, the point at which the service primitives are invoked. A single SAP is defined independently of the signalling bearer. The SAP provides the SCCP primitives. The figure is not intended to constrain the architecture.

5.3.2 ATM Transport Option 1

1. **SCCP** (ITU-T Rec. Q.711 [7] /ITU-T Rec. Q.712 [8] /ITU-T Rec. Q.713 [9] /ITU-T Rec. Q.714 [10] /ITU-T Rec. Q.715 [11] /ITU-T Rec. Q.716 [12] or ANSI T1.112-2001 [32]) provides connectionless service, class 0, connection oriented service, class 2, separation of the connections mobile by mobile basis on the connection oriented link and establishment of a connection oriented link mobile by mobile basis. The SCCP shall be used as specified in TS 25.410 [18].

2. **MTP3-B** (ITU-T Rec. Q.2210 [4] or ANSI T1.111-2001 [31]) provides message routing, discrimination and distribution (for point-to-point link only), signalling link management load sharing and changeover/back between link within one link-set. The need for multiple link-sets is precluded. MTB3-B shall comply with ITU-T Rec. Q.2210 [4] or ANSI T1.111-2001 [31].

3. **SAAL-NNI** (ITU-T Rec. Q.2100 [1]) consists of the following sub-layers: - **SSCF-NNI** (ITU-T Rec. Q.2140 [3] or ANSI T1.645-1995 (R2003) [33]), - **SSCOP** (ITU-T Rec. Q.2110 [2]) and – **AAL5** (ITU-T Rec. I.363.5 [6]). The SSCF maps the requirements of the layer above to the requirements of SSCOP. Also SAAL connection management, link status and remote processor status mechanisms are provided. SSCOP provides mechanisms for the establishment and release of connections and the reliable exchange of signalling information between signalling entities. Adapts the upper layer protocol to the requirements of the Lower ATM cells. It shall be possible to use SAAL-NNI connections pre-configured as PVCs for signalling transport on the Iu-interface.

4. **ATM** (ITU-T Rec. I.361 [5]).

5.3.3   ATM Transport Option 2

1. **SCCP**, see subclause 5.3.2.

2. **M3UA** refers to the SCCP adaptation layer "SS7 MTP3 – User Adaptation Layer " (IETF RFC 3332 [17]) also developed by the Sigtran working group of the IETF. An RNC equipped with the M3UA stack option shall have client functionality. This enables the RNC to report to the SGSN when it is a newly introduced entity in the network.

3. **SCTP** refers to the Stream Control Transmission Protocol (IETF RFC 2960 [16]) developed by the Sigtran working group of the IETF for the purpose of transporting various signalling protocols over IP networks. The multi-homing services of SCTP shall be required at both ends of an SCTP-association to enable transport redundancy and reliability. **M3UA**. An implementation of SCTP to this document shall utilise the new checksum method specified in IETF RFC 3309 [30] instead of the method specified in IETF RFC 2960 [16].

4. **IP** (IETF RFC 791 [13]) over ATM is defined in IETF RFC 2684 [14] and IETF RFC 2225 [15].

5. **AAL5** refers to ITU-T Rec. I.363.5 [6]. It shall be possible to use AAL5 connections pre-configured as PVCs for signalling transport on the Iu-interface.

5.3.4   IP Transport Option

1. **SCCP** , see subclause 5.3.2.

2. **M3UA**, refers to the SCCP adaptation layer "SS7 MTP3 – User Adaptation Layer " (IETF RFC 3332 [17]) also developed by the Sigtran working group of the IETF. An RNC equipped with the M3UA stack option shall have client functionality. This enables the RNC to report to the SGSN when it is a newly introduced entity in the network.

3. **SCTP**, refers to the Stream Control Transmission Protocol (IETF RFC 2960 [16]) developed by the Sigtran working group of the IETF for the purpose of transporting various signalling protocols over IP networks. An implementation of SCTP to this document shall utilise the new checksum method specified in IETF RFC 3309 [30] instead of the method specified in IETF RFC 2960 [16]. Multi-homing is a way to achieve redundancy with SCTP between two endpoints, of which one or both is assigned with multiple IP addresses. SCTP endpoints shall support a multi-homed remote SCTP endpoint.

4. **IP**. IPv6 shall be supported according to IETF RFC 2460 [25]. IPv4 support (IETF RFC 791 [13]) is optional.

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

    Due to the possible transition from IPv4 to IPv6, the IP dual stack support is recommended.

An RNC/CN using IP transport option shall support Diffserv code point marking (IETF RFC 2474 [26]). The Diffserv code point may be determined from the application parameters.

5.4   Services Provided by the Signalling Bearer

When considering the requirements that the upper layers, i.e. RANAP, have on the Signalling Bearer, there are a number of services it has to provide and a number of functions to perform. These numbers of services that the signalling bearer shall provide, to the upper layers, are stated in references ITU-T Rec. Q.711 [7] /ITU-T Rec. Q.712 [8] /ITU-T Rec. Q.713 [9] /ITU-T Rec. Q.714 [10] /ITU-T Rec. Q.715 [11] / ITU-T Rec. Q.716 [12] or ANSI T1.112-2001 [32].

Annex A (informative):
Change History

Date / TSG	TSG Doc.	CR	Rev	Subject/Comment	New
12/2008	-	-	-	Creation of Rel-8 version based on v7.1.0	8.0.0
12/2009	-	-	-	Creation of Rel-9 version based on v8.0.0	9.0.0
03/2011	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	9.0.1
03/2011				Creation of Rel-10 version based on v9.0.1	10.0.0
06/2011	RP-110685	0026		Correction to the References in 25.412	10.1.0
09/2012				Update to Rel-11 version (MCC)	11.0.0