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TECHNICAL SPECIFICATION

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Contents

Foreword

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Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

2   presented to TSG for approval;

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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 X2 interface. X2 interface is a logical interface between eNBs, or an eNB and an en-gNB. The present document describes how the X2-AP signalling messages are transported over X2.

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]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   IETF RFC 2460 (1998-12): "Internet Protocol, Version 6 (IPv6) Specification".

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

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

[5]   IETF RFC 4960 (2007-09): "Stream Control Transmission Protocol".

[6]   3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity; Stage 2".

[7]   IETF RFC 6335 (2011-08): " Internet Assigned Numbers Authority (IANA) Procedures for the Management of the Service Name and Transport Protocol Port Number Registry".

[8]   IANA: "Stream Control Transmission Protocol (SCTP) Parameters", [https://www.iana.org/assignments/sctp-parameters/sctp-parameters.xhtml#sctp-parameters-25].

[9]   IANA: "Service Name and Transport Protocol Port Number Registry", [https://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xhtml].

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

X2: logical interface between two eNBs or an eNB and an en-gNB.

3.3   Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

eNB   E-UTRAN Node B
en-gNB   as defined in TS 37.340 [6]
DiffServ   Differentiated Service
IANA   Internet Assigned Number Authority
IP   Internet Protocol
PPP   Point to Point Protocol
SCTP   Stream Control Transmission Protocol

4.   X2 signalling bearer

4.1   Function and protocol stack

X2 signalling bearer provides the following functions:

-      Provision of reliable transfer of X2-AP message over X2 interface.

-      Provision of networking and routeing function

-      Provision of redundancy in the signalling network

-      Support for flow control and congestion control

The protocol stack for X2 Signalling Bearer is shown in figure 4.1 and details on each protocol are described in the following sections.
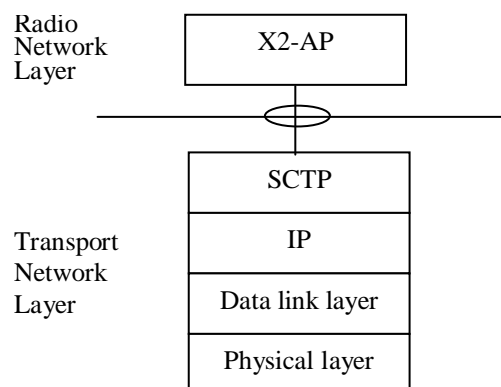

Figure 4.1: X2 signalling bearer protocol stack

The Transport Network Layer is based on IP transport, comprising SCTP on top of IP.

5   Data link layer

The support of any suitable Data Link Layer protocol, e.g. PPP, Ethernet, etc. , shall not be prevented.

6 IP layer

The eNB and the en-gNB shall support IPv6 (IETF RFC 2460 [2]) and/or IPv4 (IETF RFC 791 [3]).

The IP layer of X2 only supports point-to-point transmission for delivering X2-AP message.

The eNB and the en-gNB shall support the Diffserv Code Point marking as described in IETF RFC 2474 [4].

7 Transport layer

SCTP (IETF RFC 4960 [5]) shall be supported as the transport layer of X2 signalling bearer. The Payload Protocol Identifier (ppid) to be used by SCTP for the application layer protocol X2AP is assigned by IANA in [8]. The byte order of the ppid shall be big-endian.

SCTP refers to the Stream Control Transmission Protocol developed by the Sigtran working group of the IETF for the purpose of transporting various signalling protocols over IP network.

There shall be only one SCTP association established between one eNB pair. An eNB and an en-gNB shall support a configuration with a single SCTP association per one eNB and en-gNB pair. Configurations with multiple SCTP endpoints per one eNB and en-gNB pair should be supported. When configurations with multiple SCTP associations are supported, en-gNB may request to dynamically add/remove SCTP associations between one eNB and en-gNB pair. Within the set of SCTP associations established between one eNB and en-gNB pair, a single SCTP association shall be employed for X2AP elementary procedures that utilize non-UE-associated signalling with the possibility of fail-over to a new association to enable robustness. An eNB and an en-gNB shall use the Destination Port Number value assigned by IANA [9] to be used for X2AP and this value shall also be used in Source Port Number by all eNBs and en-gNBs within a network. When the en-gNB request to dynamically add additional SCTP association between one eNB and en-gNB pair, the SCTP Destination Port number value may be the one assigned by IANA in [9], or any dynamic port value (IETF RFC 6335 [7]).

> NOTE: A multi-homed eNB implementation should provide the correspondent eNB with the set of IP addresses supported during SCTP association establishment unless the correspondent eNB already has this information e.g. through IP address management.

An arbitrary eNB or en-gNB shall be able to initiate the INIT procedure towards another en-gNB or eNB for establishing the SCTP association.

Within the SCTP association established between one eNB pair;

- A single pair of stream identifiers shall be reserved for the sole use of X2AP elementary procedures that utilize non UE-associated signalling.

- At least one pair of stream identifiers shall be reserved for the sole use of X2AP elementary procedures that utilize UE-associated signalling. However a few pairs (i.e. more than one) should be reserved.

- A single UE-associated signalling shall use one SCTP stream and the stream should not be changed during the communication of the UE-associated signalling.

Between one eNB and en-gNB pair;

- A single pair of stream identifiers shall be reserved for the sole use of X2AP elementary procedures that utilize non UE-associated signalling.

- At least one pair of stream identifiers shall be reserved for the sole use of X2AP elementary procedures that utilize UE-associated signalling. However a few pairs (i.e. more than one) should be reserved.

- For a single UE-associated signalling, the eNB and the en-gNB shall use one SCTP association and one SCTP stream and the SCTP association/stream should not be changed during the communication of the UE-associated signalling until after current SCTP association is failed or removed, or TNL binding update is performed by the eNB or the en-gNB. The eNB (or en-gNB) can update the UE TNLA binding by sending the first available X2AP message for the UE to the peer en-gNB (or eNB) via a different TNLA, and the peer en-gNB (or eNB) shall update the X2AP UE TNLA binding with the new TNLA.

Transport network redundancy may be achieved by SCTP multi-homing between two end-points, of which one or both is assigned with multiple IP addresses. SCTP end-points shall support a multi-homed remote SCTP end-point. For SCTP endpoint redundancy an INIT may be sent from either of the eNBs or an en-gNB, at any time for an already established SCTP association, which shall be handled as defined in IETF RFC 4960 [5] in subclause 5.2.

The SCTP congestion control may, using an implementation specific mechanism, initiate higher layer protocols to reduce the signalling traffic at the source and prioritise certain messages.

Annex A (informative):
Change History

TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
38				Apecification approved at TSG-RAN and placed under change control	8.0.0
39	RP-080077	0001	-	Dedication of common streams over X2	8.1.0
40	RP-080301	0003	-	SCTP flow control and overload protection	8.2.0
41	RP-080583	0005	1	Correct the wording of common and dedicated procedures	8.3.0
41	RP-080583	0006	2	SCTP restart function for X2 interface	8.3.0
41	RP-080583	0007	-	Clarification of SCTP Congestion Indication over X2	8.3.0
42	RP-080855	0008	1	Further clarification of SCTP Association handling	8.4.0
42	RP-080855	0009		Removal of chapter 8	8.4.0
43	RP-090090	0010	1	The use of the number of stream ID for a UE-associated signalling	8.5.0
43	RP-090085	0011	1	Clarification of SCTP streams	8.5.0
43	RP-090085	0012	1	Clarification the overload protection function support in SCTP	8.5.0
46	RP-091183	0014	1	Specification of SCTP destination port number	8.6.0
-	-	-	-	Created Rel-9 version based on v8.6.0	9.0.0
47	RP-100213	0016		Specification of Payload Identifier	9.1.0
50				Created Rel-10 version based on v. 9.1.0	10.0.0
SP-49	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	10.0.1
52	RP-110685	0018		Correction to the References in 36.422	10.1.0
09/2012				Update to Rel-11 version (MCC)	11.0.0
09/2014				Update to Rel-12 version (MCC)	12.0.0
12/2015				Update to Rel-13 version (MCC)	13.0.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-03	SA#75					Promotion to Release 14 without technical change	14.0.0
2018-06	SA#80	-	-	-	-	Promotion to Release 15 without technical change	15.0.0
2018-12	RP-82	RP-182447	0025	2	F	Adding description of EN-DC	15.1.0
2020-03	RP-87-e	RP-200425	0035	2	B	CR to 36.422 for Supporting mutiple SCTP assoication in EN-DC	16.0.0
2020-03	RP-87-e	RP-200425	0036		F	Rapporteur's Update for 36.422	16.0.0
2020-09	RP-89-e	RP-201954	0037	3	F	SCTP association change when current SCTP association is failed (X2)	16.1.0
2022-03	SA#95-e					Promotion to Release 17 without technical change	17.0.0
2023-06	RAN#100	RP-231075	0039	3	A	Corrections on TNL association (X2)	17.1.0
2024-03	SA#103-	-	-	-	-	Update to Rel-18 version (MCC)	18.0.0
2024-06	RAN#104	RP-241113	0040	2	D	Correction on X2AP PPID and Destination Port Number over SCTP	18.1.0

History

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