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Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
NG-RAN;
E1 signalling transport
(Release 16)**



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Foreword

This Technical Specification 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

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- 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 the E1 interface. The E1 interface provides means for the interconnection of gNB-CU-CP and gNB-CU-UP within the NG-RAN architecture (TS 38.401 [2]).

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] 3GPP TS 38.401: "NG-RAN; Architecture description".
- [3] IETF RFC 8200 (2017-07): "Internet Protocol, Version 6 (IPv6) Specification".
- [4] IETF RFC 791 (1981-09): "Internet Protocol".
- [5] IETF RFC 2474 (1998-12): "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".
- [6] IETF RFC 4960 (2007-09): "Stream Control Transmission Protocol".
- [7] 3GPP TS 38.460: "NG-RAN; E1 general aspects and principles".
- [8] 3GPP TS 38.461: "NG-RAN; E1 layer 1".
- [9] 3GPP TS 38.463: "NG-RAN; E1 Application Protocol (E1AP)".
- [10] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage-2".
- [11] IETF RFC 6083 (2011-01): "Datagram Transport Layer Security (DTLS) for Stream Control Transmission Protocol (SCTP)".
- [12] IETF RFC 6335 (2011-08): "Internet Assigned Numbers Authority (IANA) Procedures for the Management of the Service Name and Transport Protocol Port Number Registry".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

E1: interface between a gNB-CU-CP and a gNB-CU-UP, providing an interconnection point between the gNB-CU-CP and the gNB-CU-UP.

gNB: as defined in TS 38.300 [10].

gNB-CU: as defined in TS 38.401 [2].

gNB-CU-CP: as defined in TS 38.401 [2].

gNB-CU-UP: as defined in TS 38.401 [2].

SCTP endpoint: as defined in IETF RFC 4960 (2007-09) [6].

SCTP association: as defined in IETF RFC 4960 (2007-09) [6].

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

| | |
|----------|--------------------------------------|
| DiffServ | Differentiated Service |
| IANA | Internet Assigned Number Authority |
| IP | Internet Protocol |
| PPP | Point to Point Protocol |
| SCTP | Stream Control Transmission Protocol |

4 E1 signalling bearer

4.1 Function and protocol stack

E1 signalling bearer provides the following functions:

- Provision of reliable transfer of E1AP message over E1 interface.
- Provision of networking and routing function
- Provision of redundancy in the signalling network
- Support for flow control and congestion control

The protocol stack for E1 Signalling Bearer is shown in figure 4.1-1 and details on each protocol are described in the following sections.

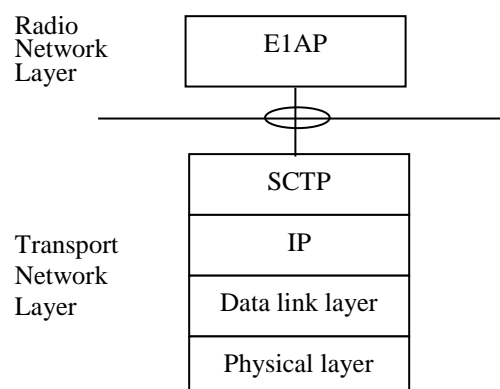


Figure 4.1-1: E1 signalling bearer protocol stack

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 gNB-CU-CP and gNB-CU-UP shall support IPv6 (IETF RFC 8200 [3]) and/or IPv4 (IETF RFC 791 [4]).

The IP layer of E1 only supports point-to-point transmission for delivering E1AP message.

The gNB-CU-CP and gNB-CU-UP shall support the Diffserv Code Point marking as described in IETF RFC 2474 [5].

7 Transport layer

SCTP (IETF RFC 4960 [6]) shall be supported as the transport layer of E1 signalling bearer. The Payload Protocol Identifier assigned by IANA to be used by SCTP for the application layer protocol E1AP is 64 and 67 for DTLS over SCTP (IETF RFC 6083 [11]). 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.

The gNB-CU-CP and gNB-CU-UP shall support a configuration with a single SCTP association per gNB-CU-CP/gNB-CU-UP pair. Configurations with multiple SCTP endpoints per gNB-CU-CP/gNB-CU-UP pair should be supported. When configurations with multiple SCTP associations are supported, the gNB-CU-CP or the gNB-CU-UP may request to dynamically add/remove SCTP associations between the gNB-CU-CP/gNB-CU-UP pair. Within the set of SCTP associations established between one gNB-CU-CP and gNB-CU-UP pair, a single SCTP association shall be employed for E1AP elementary procedures that utilize non-UE-associated signalling with the possibility of fail-over to a new association to enable robustness.

When the configuration with multiple SCTP endpoints per gNB-CU-UP is supported and gNB-CU-UP wants to add additional SCTP endpoints, the gNB-CU-UP Configuration Update procedure shall be the first E1AP procedure triggered on an additional TNLA of an already setup E1 interface instance after the TNL association has become operational, and the gNB-CU-CP shall associate the TNLA to the E1 interface instance using the included gNB-CU-UP ID.

Either the gNB-CU-CP or gNB-CU-UP shall establish the first SCTP association. The additional SCTP associations are established by the gNB-CU-UP. The SCTP Destination Port number value to be used for E1AP is 38462 which is assigned by IANA. When the gNB-CU-CP requests to dynamically add additional SCTP associations between the gNB-CU-CP/gNB-CU-UP pair, the gNB-CU-CP port is selected and signalled by the gNB-CU-CP to the gNB-CU-UP, and it can be port number value 38462 or any dynamic port value as defined by IETF RFC 6335 [12].

Between one gNB-CU-CP and gNB-CU-UP pair:

- A single pair of stream identifiers shall be reserved over an SCTP association for the sole use of E1AP elementary procedures that utilize non UE-associated signalling.
- At least one pair of stream identifiers over one or several SCTP associations shall be reserved for the sole use of E1AP 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 gNB-CU-CP and the gNB-CU-UP 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 TNL binding update is performed.

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 a gNB-CU-CP or a gNB-CU-UP, at any time for an already established SCTP association, which shall be handled as defined in IETF RFC 4960 [6] in sub clause 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

| Change history | | | | | | | |
|----------------|----------|-----------|------|-----|-----|--|-------------|
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2018-02 | R3 #99 | R3-181421 | - | - | - | Endorsed skeleton | 0.0.0 |
| 2018-04 | R3 #99b | R3-182530 | - | - | - | New version including Rapporteur TP from RAN3#99b | 0.1.0 |
| | | | | | | - R3-182931: Multiple SCTP for E1 - R3-183273: rapporteur updates to 38.462 | 0.2.0 |
| 2018-06 | RAN#80 | RP-180768 | | | | Submitted to RAN for approval. | 1.0.0 |
| 2018-06 | RAN#80 | - | - | - | - | Specification approved at TSG-RAN and placed under change control | 15.0.0 |
| 2018-09 | RAN#81 | RP-181922 | 0002 | 2 | F | NR Corrections (38.462 Baseline CR covering RAN3-101 agreements) | 15.1.0 |
| 2018-12 | RAN#82 | RP-182448 | 0005 | 1 | F | Rapporteur's CR for TS 38.462 | 15.2.0 |
| 2019-03 | RAN#83 | RP-190560 | 0004 | 4 | F | CR Multiple TNLA over E1 transport | 15.3.0 |
| 2019-07 | RAN#84 | RP-191399 | 0007 | 1 | F | Multiple TNLA over E1 transport | 15.4.0 |
| 2019-09 | RAN#85 | RP-192167 | 0010 | 1 | F | Use of SCTP ports for multiple TNLA | 15.5.0 |
| 2019-09 | RAN#85 | RP-192167 | 0011 | 1 | F | CR to 38.462 on the introduction of PPID for DTLS over SCTP | 15.5.0 |
| 2020-03 | RAN#87-e | RP-200429 | 0012 | - | F | Rapporteur updates on editorial errors | 15.6.0 |
| 2020-04 | | | | | | Correction of the version number and date in the cover page | 15.6.1 |
| 2020-07 | SA#88-e | - | - | - | - | Update to Rel-16 version (MCC) | 16.0.0 |
| 2020-09 | RAN#89-e | RP-201955 | 0015 | | A | SCTP association change when current SCTP association is failed | 16.1.0 |