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Contents

Foreword

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

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  - 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 user data transport protocols and related signalling protocols to establish user plane transport bearers over the X2 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.
- 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 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)".

[3] IETF RFC 768 (1980-08): "User Datagram Protocol".

[4] IETF RFC 2474 (1998-12): "Definition of the Differentiated Services Field (DS Field) in the Ipv4 and Ipv6 Headers".

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

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

[7] 3GPP TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture Description".

[8] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[9] 3GPP TS 36.425: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 interface user plane protocol".

[10] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".

[11] 3GPP TS 38.425; "NG-RAN; NR user plane protocol".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions below apply. Terms and definitions not defined below can be found in TR 21.905 [1].

Corresponding E-UTRAN node: Used in this specification according to the definition of the corresponding node in TS 38.425 [11].

Dual Connectivity: Defined in TS 36.300 [8].

EN-DC: Defined in TS 37.340 [10].

E-RAB: Defined in TS 36.401 [7].

X2: logical interface between two eNBs. Whilst logically representing a point to point link between eNBs, the physical realisation need not be a point to point link.

3.2 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].

DC	Dual Connectivity
eNB	E-UTRAN Node B
EN-DC	E-UTRA-NR Dual Connectivity
E-RAB	E-UTRAN Radio Access Bearer
E-UTRAN	Evolved UTRAN
GTP	GPRS Tunnelling Protocol
IP	Internet Protocol
MeNB	Master eNB
PDCP	Packet Data Convergence Protocol
PDU	Protocol Data Unit
SCG	Secondary Cell Group
SeNB	Secondary eNB
TEID	Tunnel Endpoint Identifier
UDP	User Datagram Protocol

4 Data link layer

Any data link protocol that fulfils the requirements toward the upper layer may be used.

5 X2 interface user plane protocol

5.1 General

The transport layer for data streams over X2 is an IP based Transport. The following figure shows the transport protocol stacks over X2.

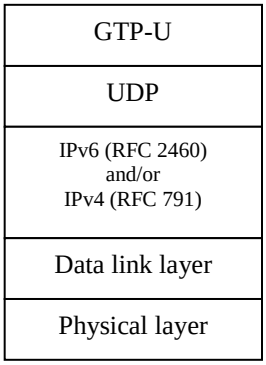

Figure 5.1: Transport network layer for data streams over X2

The GTP-U (TS 29.281 [2]) protocol over UDP over IP shall be supported as the transport for data streams on the X2 interface. The data link layer is as specified in clause 4.

There may be zero or one UL data stream and zero or one DL data stream per E-RAB at the X2 interface.

- The DL data stream is used for DL data forwarding from the source eNB to the target eNB.

- The UL data stream is used for UL data forwarding from the source eNB to the target eNB.

Each data stream is carried on a dedicated transport bearer.

The identity of a transport bearer signalled in the RNL control plane consists of the IP address and the TEID of the corresponding GTP tunnel, allocated by the target eNB (see TS 29.281 [2]).

5.2 GTP-U

The GTP-U (TS 29.281 [2]) protocol shall be used over the X2 interface between two eNBs.

5.3 UDP/IP

The path protocol used shall be UDP (IETF RFC 768 [3]).

The UDP port number for GTP-U shall be as defined in TS 29.281 [2].

The eNBs over the X2 interface shall support fragmentation and assembly of GTP packets at the IP layer.

The eNB shall support IPv6 (IETF RFC 2460 [5]) and/or IPv4 (IETF RFC 791 [6]).

There may be one or several IP addresses in the both eNBs. The packet processing function in the source eNB shall send downstream packets of a given E-RAB to the target eNB IP address (received in X2AP) associated to the DL transport bearer of that particular E-RAB. The packet processing function in the source eNB shall send upstream packets of a given E-RAB to the target eNB IP address (received in X2AP) associated to the UL transport bearer of that particular E-RAB.

The Transport Layer Address signalled in X2AP messages is a bit string of

a) 32 bits in case of IPv4 address according to IETF RFC 791 [6]; or

b) 128 bits in case of IPv6 address according to IETF RFC 2460 [5] ; or

c) 160 bits if both IPv4 and IPv6 addresses are signalled, in which case the IPv4 address is contained in the first 32 bits.

5.4 Diffserv code point marking

IP Differentiated Services code point marking (IETF RFC 2474 [4]) shall be supported. The mapping between traffic categories and Diffserv code points shall be configurable by O&M based on QoS Class Identifier (QCI)/ Label Characteristics and other E-UTRAN traffic parameters (e.g. ARP). Traffic categories are implementation-specific and may be determined from the application parameters.

5.5 Dual Connectivity

For the SCG bearer option, user data forwarding may be performed. The behaviour of the eNB from which user data is forwarded is the same as specified for the “source eNB”, the behaviour of the eNB to which user data is forwarded is the same as specified for the “target eNB”.

For the split bearer option:

- the GTP-U (TS 29.281 [2]) protocol over UDP over IP shall be supported as the transport for the data stream of PDCP PDUs on the X2 interface. The GTP-U PDU may include a RAN Container with flow control information as specified in TS 36.425 [9] which is carried in the GTP-U extension header. The transport bearer is identified by the GTP-U TEID (TS 29.281 [2]) and the IP address of the MeNB and SeNB respectively. There may be zero or one UL data stream and there is one DL data stream per E-RAB at the X2 interface;

    - The DL data stream is used for DL data transmission from the MeNB to the SeNB;

  - The UL data stream is used for UL data transmission from the SeNB to the MeNB;

- the packet processing function in the MeNB shall send downstream packets of a given E-RAB to the SeNB IP address (received in X2AP) associated to the DL transport bearer of that particular E-RAB. The packet processing function in the SeNB shall send upstream packets of a given E-RAB to the MeNB IP address (received in X2AP) associated to the UL transport bearer of that particular E-RAB;

- data forwarding may be performed by MeNB providing GTP-U TEID to receive the DL data forwarded by the SeNB.

5.6 E-UTRA-NR Dual Connectivity

User data forwarding may be performed for each E-RAB configured for EN-DC, towards or from the node hosting the PDCP entity. The behaviour of the E-UTRAN node from which user data is forwarded is the same as specified for the "source eNB", the behaviour of the E-UTRAN node to which user data is forwarded is the same as specified for the "target eNB".

If X2-U data bearer resources are allocated for EN-DC:

- the GTP-U (TS 29.281 [2]) protocol over UDP over IP shall be supported as the transport for the data stream of PDCP PDUs on the X2 interface. The GTP-U PDU may include an NR RAN Container with flow control information as specified in TS 38.425 [11] which is carried in the GTP-U extension header. The transport bearer is identified by the GTP-U TEID (TS 29.281 [2]) and the IP address of the E-UTRAN nodes involved in EN-DC;

- the packet processing function in the E-UTRAN node hosting the PDCP entity shall send downstream packets of a given E-RAB to the IP address indicated by the corresponding E-UTRAN node in X2AP associated to the DL transport bearer of that particular E-RAB. The packet processing function in the corresponding E-UTRAN node shall send upstream packets of a given E-RAB to the IP address indicated by the E-UTRAN node hosting the PDCP entity in X2AP associated to the UL transport bearer of that particular E-RAB;

Annex A (informative): Change history

TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
38				approved at TSG-RAN and placed under change control	8.0.0
39	RP-080078	0001	-	Editorial correction on 36.424	8.1.0
39	RP-080078	0002	-	Data link layer proposal	8.1.0
40	RP-080302	0003	1	eGTP draft reference for X2 Data Transport	8.2.0
40	RP-080302	0005	-	Define format for TLA signalled in X2AP messages	8.2.0
41	RP-080583	0006	1	X2 transport bearers	8.3.0
42	RP-080845	0007		Correction of SAE Bearer	8.4.0
43	RP-090083	0008		Correction on GTP-U version	8.5.0
09/2009	-	-	-	Creation of Rel-9 version based on v8.5.0	9.0.0
12/2010				Creation of Rel-10 version based on v. 9.0.0	10.0.0
SP-49	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	10.0.1
52	RP-110684	0009		Correction of references	10.1.0
09/2012				Update to Rel-11 version (MCC)	11.0.0
63	RP-140297	0011	1	The content of Transport Layer Address	12.0.0
66	RP-142089	0013	6	Data Forwarding and Data transmission	12.1.0
67	RP-150351	0021	1	Correction on Data Transmission over X2	12.2.0
12/2015				Update to Rel-13 version (MCC)	13.0.0
71	RP-160449	0022	1	Rapporteur editorial corrections	13.1.0

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
2017-06	RP#76	RP-171324	0024	2	F	Derivation of Diffserv code point marking includes ARP	14.1.0
2017-06	RP#76	RP-171324	0025		F	Clarification of the use of the RAN Container	14.1.0
2017-06	RP#76	RP-171324	0026		F	Rapporteur editorial review	14.1.0
2017-12	RP-78	RP-172672	0027	1	B	Introduction of EN-DC	15.0.0
2019-12	RP-86	RP-192915	0029	1	F	Independent migration to IPv6 on S1-U for en-gNB's	15.1.0
2020-07	SA#88-e	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0
2022-03	SA#95-e					Promotion to Release 17 without technical change	17.0.0

History

Document history		
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