ETSI TS 138 340 V17.3.0 (2023-01)

5G;
NR; Backhaul Adaptation Protocol (BAP) specification
(3GPP TS 38.340 version 17.3.0; Release 17)

Reference
RTS/TSGR-0238340vh30

Keywords
5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights 2
Legal Notice 2
Modal verbs terminology 2
Foreword 5
1 Scope 7
2 References 7
3 Definitions of terms, symbols and abbreviations 7
3.1 Terms 7
3.2 Abbreviations 8
4 General 8
4.1 Introduction 8
4.2 Architecture 8
4.2.1 BAP structure 8
4.2.2 BAP entities 8
4.3 Services 9
4.3.1 Services provided to upper layers 9
4.3.2 Services expected from lower layers 9
4.4 Functions 10
4.5 Configurations 10
5 Procedures 11
5.1 BAP entity handling 11
5.1.1 BAP entity establishment 11
5.1.2 BAP entity release 11
5.2 Data transfer 11
5.2.1 Transmitting operation 11
5.2.1.1 General 11
5.2.1.2 BAP routing ID selection 12
5.2.1.2.1 BAP routing ID selection at IAB-node 12
5.2.1.2.2 BAP routing ID selection at IAB-donor-DU 12
5.2.1.3 Routing 13
5.2.1.4 Mapping to BH RLC Channel 14
5.2.1.4.1 Mapping to BH RLC Channel for BAP Data Packets from collocated BAP entity at IAB-node 14
5.2.1.4.2 Mapping to BH RLC Channel for BAP SDUs from upper layers at IAB-node 15
5.2.1.4.3 Mapping to BH RLC Channel at IAB-donor-DU 16
5.2.2 Receiving operation 17
5.3 Flow control 18
5.3.1 Flow control feedback 18
5.3.1.1 Transmitting operation 18
5.3.1.2 Receiving operation 18
5.3.2 Flow control polling 18
5.4 BH RLF related indications 19
5.4.1 Transmitting operation 19
5.4.2 Receiving operation 19
5.5 Handling of unknown, unforeseen, and erroneous protocol data 19
6 Protocol data units, formats, and parameters 20
6.1 Protocol data units 20
6.1.1 Data PDU 20
6.1.2 Control PDU 20
6.2 Formats 20
6.2.1 General 20
6.2.2 Data PDU 20

6.2.3 Control PDU 20
6.2.3.1 Control PDU for flow control feedback 20
6.2.3.2 Control PDU for flow control polling 22
6.2.3.3 Control PDU for BH RLF indication 22
6.2.3.4 Control PDU for BH RLF detection indication 22
6.2.3.5 Control PDU for BH RLF recovery indication 22
6.3 Parameters 22
6.3.1 General 22
6.3.2 DESTINATION 22
6.3.3 PATH 23
6.3.4 Data 23
6.3.5 R 23
6.3.6 D/C 23
6.3.7 PDU type 23
6.3.8 BH RLC channel ID 23
6.3.9 BAP Routing ID 24
6.3.10 Available Buffer Size 24

Annex A (informative): Change history 25

History 26

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.

In the present document, certain modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

NOTE 1: The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

NOTE 2: The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

NOTE 3: The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

NOTE 4: The constructions "can" and "cannot" shall not to be used as substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

NOTE 5: The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document provides description of the Backhaul Adaptation Protocol (BAP).

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 38.300: "NG Radio Access Network; Overall description".

[3] 3GPP TS 38.331: "NR Radio Resource Control (RRC); Protocol Specification".

[4] 3GPP TS 38.322: "NR Radio Link Control (RLC) protocol specification".

[5] 3GPP TS 38.473: "NG-RAN F1 application protocol (F1AP) protocol specification".

[6] 3GPP TS 38.401: "NG-RAN; Architecture description".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms 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].

BH RLC channel: an RLC channel between two nodes, which is used to transport backhaul packets, as defined in TS 38.300 [2]**.**

Boundary IAB-node: an IAB-node with one RRC interface terminating at a different IAB-donor-CU than the F1 interface, as defined in TS 38.401 [6].

Egress BH RLC channel: a BH RLC channel on which a packet is transmitted by a node.

Egress link: a radio link on which a packet is transmitted by a node.

F1-terminating donor: refers to the IAB-donor that terminates F1 for the boundary IAB-node, as defined in TS 38.401 [6].

IAB-donor: as defined in TS 38.300 [2].

IAB-donor-DU: as defined in TS 38.401 [6].

IAB-node: as defined in TS 38.300 [2].

Ingress BH RLC channel: a BH RLC channel on which a packet is received by a node.

Ingress link: a radio link on which a packet is received by a node.

Non-F1-terminating donor: refers to the IAB-donor that has an RRC connection with the boundary node but does not terminate F1 with this boundary IAB-node, as defined in TS 38.401 [6].

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].

BH	Backhaul
DSCP	Differentiated Services Code Point
IAB	Integrated Access and Backhaul
MT	Mobile Termination
TEID	Tunnel Endpoint Identifier

4 General

4.1 Introduction

The present document describes the functionalities of BAP.

4.2 Architecture

4.2.1 BAP structure

Figure 4.2.1-1 represents one possible structure for the BAP sublayer; it should not restrict implementation. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].

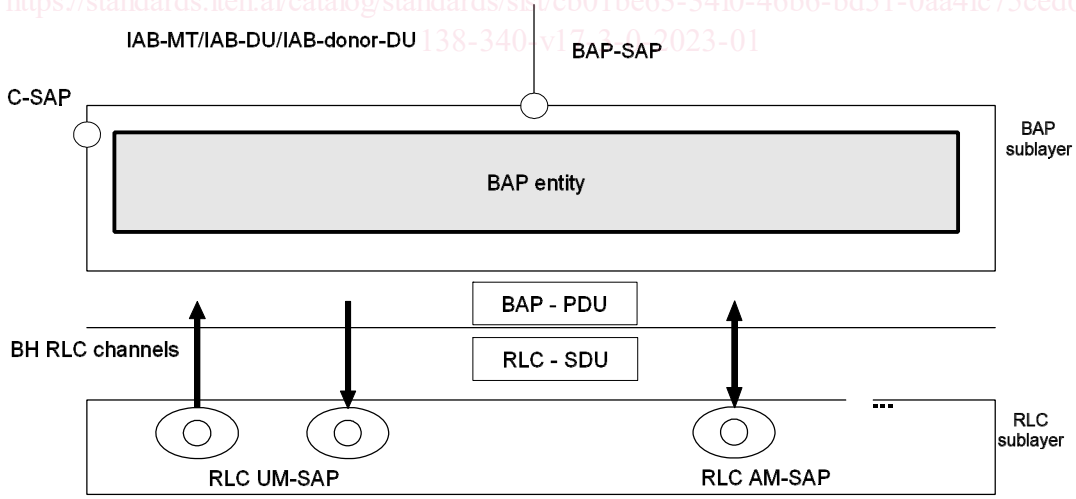

Figure 4.2.1-1: BAP layer, structure view

The BAP sublayer is configured by upper layers TS 38.331 [3] and TS 38.473 [5].

4.2.2 BAP entities

On the IAB-node, the BAP sublayer contains one BAP entity at the MT function and a separate collocated BAP entity at the DU function. On the IAB-donor-DU, the BAP sublayer contains only one BAP entity. Each BAP entity has a transmitting part and a receiving part.

NOTE: The modelling of BAP entities does not restrict internal implementation of IAB-nodes, i.e. the exact modelling of BAP sublayer may vary for different IAB-node implementations.

The transmitting part of the BAP entity has a corresponding receiving part of a BAP entity at the IAB-node or IAB-donor-DU across the BH link.

Figure 4.2.2-1 shows one example of the functional view of the BAP sublayer. This functional view should not restrict implementation. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].

In the example of Figure 4.2.2-1, the receiving part on the BAP entity delivers BAP PDUs to the transmitting part on the collocated BAP entity. Alternatively, the receiving part may deliver BAP SDUs to the collocated transmitting part. When passing BAP SDUs, the receiving part removes the BAP header and the transmitting part adds the BAP header with the same BAP header content as carried on the BAP PDU header prior to removal. Passing BAP SDUs in this manner is therefore functionally equivalent to passing BAP PDUs, in implementation. The following specification therefore refers to the passing of BAP Data Packets.

Besides, BAP entity generates, delivers/receives BAP Control PDU(s) as described in clause 6.1.2. BAP Control PDU can only be exchanged between peer BAP entities across the BH link.

In addition to the functions shown in Figure 4.2.2-1, for a boundary IAB-node, the transmitting part of the BAP entity may perform BAP header rewriting operation, in accordance with clause 5.2.1.

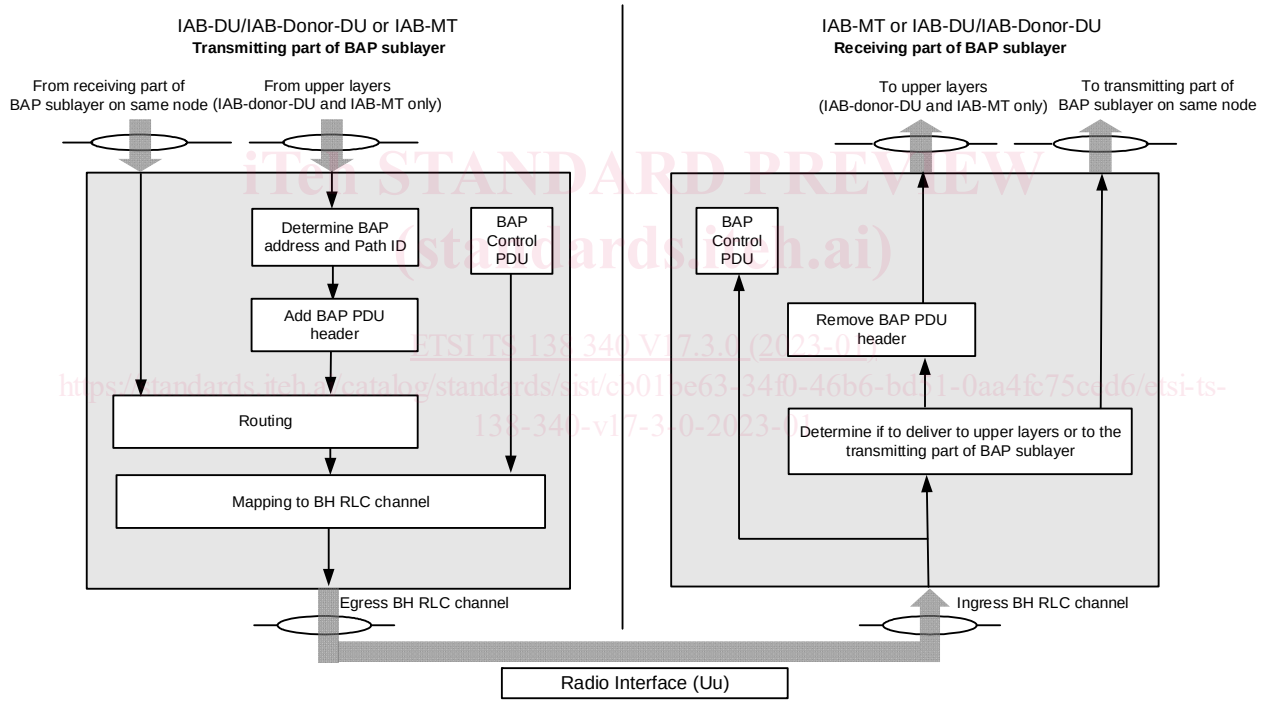

Figure 4.2.2-1. Example of functional view of BAP sublayer

4.3 Services

4.3.1 Services provided to upper layers

The following services are provided by the BAP sublayer to upper layers:

- data transfer.

4.3.2 Services expected from lower layers

A BAP sublayer expects the following services from lower layers per RLC entity (for a detailed description see TS 38.322 [4]):

- acknowledged data transfer service;
- unacknowledged data transfer service.

4.4 Functions

The BAP sublayer supports the following functions:

- Data transfer;
- Determination of BAP destination and path for packets from upper layers;
- Determination of egress BH RLC channels for packets routed to next hop;
- Routing of packets to next hop;
- BAP header rewriting;
- Differentiating traffic to be delivered to upper layers from traffic to be delivered to egress link;
- Flow control feedback and polling signalling;
- Handling of BH RLF related indications;

4.5 Configurations

The configuration of the BAP entity includes:

- The IAB-node's BAP address via RRC.
- The IAB-donor-DU's BAP address via F1AP.
- Mapping from next hop BAP address to downstream egress link via F1AP.
- Mapping from next hop BAP address to upstream egress link via RRC.
- Mapping from upper layer traffic to BAP routing ID in BAP header via F1AP and RRC.
- The BAP routing entries via F1AP.
- Mapping to egress BH RLC channels via F1AP and RRC.
- Flow control feedback type(s) to be provided, if any, via RRC.
- Inter-donor-DU re-routing enabling/disabling via F1AP.

BH RLC channels are configured via RRC on the IAB-MT, and via F1AP on the IAB-DU/IAB-donor-DU.

For F1AP configurations, the following mapping, which are derived from the original F1AP signaling, are used in procedure:

- Uplink Traffic to Routing ID Mapping Configuration.
- Downlink Traffic to Routing ID Mapping Configuration.
- BH Routing Configuration.
- BH RLC Channel Mapping Configuration.
- Uplink Traffic to BH RLC Channel Mapping Configuration.
- Downlink Traffic to BH RLC Channel Mapping Configuration.
- Header Rewriting Configuration.