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| Technical Specification |
| 3rd Generation Partnership Project;Technical Specification Group Radio Access Network;NR;Sidelink Relay Adaptation Protocol (SRAP) Specification(Release 17) |
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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.

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

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

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

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

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

The constructions "can" and "cannot" are not 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

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document provides description of the Sidelink Relay Adaptation Protocol (SRAP).

# 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 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

**Egress RLC channel:** a RLC channel on which a packet is transmitted by a U2N Relay UE or a U2N Remote UE.

**Egress link**: a radio link on which a packet is transmitted by a U2N Relay UE or a U2N Remote UE.

**U2N Relay UE:** a UE that provides functionality to support connectivity to the network for U2N Remote UE(s).

**U2N Remote UE:** a UE, that communicates with the network via a U2N Relay UE.

## 3.2 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].

U2N UE-to-Network

# 4 General

## 4.1 Introduction

The objective is to describe the SRAP architecture and the SRAP entities from a functional point of view.

## 4.2 SRAP architecture

### 4.2.1 General

This clause describes a model of the SRAP, i.e., it does not specify or restrict implementations.

### 4.2.2 SRAP entities

Figure 4.2.2-1 represents one possible structure for the SRAP sublayer. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].



Figure 4.2.2-1: SRAP structure overview

On the U2N Relay UE, the SRAP sublayer contains one SRAP entity at Uu interface and a separate collocated SRAP entity at the PC5 interface. On the U2N Remote UE, the SRAP sublayer contains only one SRAP entity at the PC5 interface.

Each SRAP entity has a transmitting part and a receiving part. Across the PC5 interface, the transmitting part of the SRAP entity at the U2N Remote UE has a corresponding receiving part of an SRAP entity at the U2N Relay UE, and vice-versa. Across the Uu interface, the transmitting part of the SRAP entity at the U2N Relay UE has a corresponding receiving part of an SRAP entity at the gNB, and vice-versa.

Figure 4.2.2-2 represents the functional view of the SRAP entity for the SRAP sublayer.

Editor’s Note: A Figure 4.2.2-2 for the functional view is needed.

## 4.3 Services

### 4.3.1 Services provided to upper layers

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

- Data transfer.

### 4.3.2 Services expected from lower layers

An SRAP 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 SRAP sublayer supports the following functions:

- Data transfer;

- Determination of UE ID and BEARER ID for packets received from collocated SRAP entity;

- Determination of egress link and egress RLC channel;

Editor’s Note: Flow control function is FFS

## 4.5 Configurations

The configuration of the SRAP entity for U2N Remote UE includes:

- Mapping from BEARER ID to egress PC5 RLC channel via RRC.

Editor’s Note: FFS whether adaptation layer on PC5 hop include remote UE ID field or not.

The configuration of the SRAP entity for U2N Relay UE includes:

- The temporary/local identity for each U2N Remote UE via RRC.

- Mapping from BEARER ID to egress Uu RLC channel for each U2N Remote UE via RRC.

- Mapping from BEARER ID to egress PC5 RLC channel for each U2N Remote UE via RRC.

# 5 Procedures

## 5.1 SRAP entity handling

### 5.1.1 SRAP entity establishment

When upper layers request establishment of an SRAP entity, UE shall:

- establish an SRAP entity;

- follow the procedures in clause 5.

### 5.1.2 SRAP entity release

When upper layers request release of an SRAP entity, UE shall:

- release the SRAP entity and the related SRAP configurations.

## 5.2 DL Data transfer

### 5.2.1 Receiving operation of U2N Relay UE

Upon receiving an SRAP Data PDU from lower layer, the receiving part of the SRAP entity on the Uu interface of U2N Relay UE shall:

- deliver the SRAP Data Packet to the transmitting part of the collocated SRAP entity on the PC5 interface.

Editor’s Note: FFS whether adaptation layer on PC5 hop include remote UE ID field or not, which may lead to a change to the terminology of SRAP data packet.

### 5.2.2 Transmitting operation of U2N Relay UE

The transmitting part of the SRAP entity on the PC5 interface of U2N Relay UE can receive SRAP Data Packets from the receiving part of the SRAP entity on the Uu interface of the same U2N Relay UE[, and construct SRAP Data PDUs as needed (see clause 4.2.2)].

When the transmitting part of the SRAP entity on the PC5 interface has an SRAP Data PDU to transmit, the transmitting part of the SRAP entity on the PC5 interface shall:

- Determine the egress link in accordance with clause 5.2.2.1;

- Determine the egress RLC channel in accordance with clause 5.2.2.2;

- Submit this SRAP Data PDU to the selected egress RLC channel of the selected egress link.

Editor’s Note: FFS whether adaptation layer on PC5 hop include remote UE ID field or not, which may lead to a change to the terminology of SRAP data packet.

#### 5.2.2.1 Egress link determination

For a SRAP Data PDU to be transmitted, SRAP entity shall:

- if there is an entry in *sl-SRAP-Config-Relay*, whose *sl-LocalIdentity* matches the UE ID field in SRAP Data PDU:

- Determine the egress link on PC5 interface corresponding to *sl-L2Identity-Remote* configured for the concerned *sl-LocalIdentity* as specified in TS 38.331 [3];

#### 5.2.2.2 Egress RLC channel determination

For a SRAP Data PDU to be transmitted, the SRAP entity shall:

- if there is an entry in *sl-SRAP-Config-Relay*, whose *sl-LocalIdentity* matches the UE ID field in SRAP Data PDU, and whose *sl-RemoteUE-RB-Identity* matches the BEARER ID field in SRAP Data PDU,

- Determine the egress PC5 RLC channel in the determined egress link corresponding to *sl-Egress-RLC-Channel-PC5* configured for the concerned *sl-LocalIdentity* and concerned *sl-RemoteUE-RB-Identity* as specified in TS 38.331 [3];

### 5.2.3 Receiving operation of U2N Remote UE

Upon receiving an SRAP Data PDU from lower layer, the receiving part of the SRAP entity shall:

- remove the SRAP header of this SRAP Data PDU and deliver the SRAP SDU to upper layer, i.e., PDCP layer (TS 38.323 [5]), entity corresponding to the BEARER ID of this SRAP Data PDU;

## 5.3 UL Data transfer

### 5.3.1 Transmitting operation of U2N Remote UE

The transmitting part of the SRAP entity on the PC5 interface of U2N Remote UE can receive SRAP Data SDU from upper layer, and construct SRAP Data PDUs as needed (see clause 4.2.2).

Upon receiving a SRAP SDU from upper layer, the transmitting part of the SRAP entity on the PC5 interface shall:

- Determine the BEARER ID field in accordance with clause 5.3.1.1;

- Construct an SRAP Data PDU by adding an SRAP header to the SRAP SDU, where the [UE ID field and] BEARER ID field is set to the determined value, in accordance with clause 6.2.2;

- Determine the egress RLC channel in accordance with clause 5.3.1.2;

- Submit this SRAP Data PDU to the selected egress RLC channel.

Editor’s Note: FFS whether adaptation layer on PC5 hop include remote UE ID field or not.

#### 5.3.1.1 [UE ID and] BEARER ID field determination

For a SRAP SDU received from upper layer, the SRAP entity shall:

- Determine the BEARER ID corresponding to *srb-Identity* for SRB, or corresponding to *drb-Identity* minus 1 for DRB, from which the SRAP SDU is received, configured as specified in TS 38.331 [3];

[Editor’s Note: Pending 331 CR on how the UE ID configuration for remote UE is specified.]

#### 5.3.1.2 Egress RLC channel determination

For a SRAP Data PDU to be transmitted, the SRAP entity shall:

- if there is an entry in *sl-SRAP-Config-Remote*, whose *sl-RemoteUE-RB-Identity* matches the BEARER ID field in SRAP Data PDU,

- Determine the egress PC5 RLC channel corresponding to *sl-Egress-RLC-Channel-PC5* configured for the concerned *sl-RemoteUE-RB-Identity* as specified in TS 38.331 [3];

### 5.3.2 Receiving operation of U2N Relay UE

Upon receiving an SRAP Data PDU from lower layer, the receiving part of the SRAP entity on the PC5 interface shall:

- deliver the SRAP Data Packet to the transmitting part of the collocated SRAP entity.

Editor’s Note: FFS whether adaptation layer on PC5 hop include remote UE ID field or not.

### 5.3.3 Transmitting operation of U2N Relay UE

The transmitting part of the SRAP entity on the Uu interface of U2N Relay UE can receive SRAP Data Packets from the receiving part of the SRAP entity on the PC5 interface of the same U2N Relay UE[, and construct SRAP Data PDUs as needed (see clause 4.2.2)].

Editor’s Note: FFS whether adaptation layer on PC5 hop include remote UE ID field or not.

When the SRAP entity has an SRAP Data PDU to transmit, the transmitting part of the SRAP entity on the Uu interface shall:

- Determine the egress RLC channel in accordance with clause 5.3.3.1;

- Submit this SRAP Data PDU to the selected egress RLC channel.

#### 5.3.3.1 Egress RLC channel determination

For a SRAP Data PDU to be transmitted, the SRAP entity shall:

- if there is an entry in *sl-SRAP-Config-Relay*, whose *sl-LocalIdentity* matches the UE ID field in SRAP Data PDU, and whose *sl-RemoteUE-RB-Identity* matches the BEARER ID field in SRAP Data PDU,

- Determine the egress Uu RLC channel corresponding to *sl-Egress-RLC-Channel-Uu* configured for the concerned *sl-LocalIdentity* and concerned *sl-RemoteUE-RB-Identity* as specified in TS 38.331 [3];

## 5.4 Handling of unknown, unforeseen, and erroneous protocol data

Editor’s Note: how for SRAP entity at Uu interface on U2N Relay UE, SRAP entity at PC5 interface on U2N Relay UE, and SRAP entity at PC5 interface on U2N Remote UE to handle error data.

# 6 Protocol data units, formats, and parameters

## 6.1 Protocol data units

### 6.1.1 Data PDU

The SRAP Data PDU is used to convey one of the following in addition to the PDU header:

- upper layer data.

## 6.2 Formats

### 6.2.1 General

An SRAP PDU is a bit string that is byte aligned (i.e. multiple of 8 bits) in length. The formats of SRAP PDUs are described in clause 6.2.2 and their parameters are described in clause 6.3.

### 6.2.2 Data PDU

Figure 6.2.2-1 shows the format of the SRAP Data PDU. This format is applicable for SRBs and DRBs.

Editor’s Note: Pending CB decision on whether Figure 6.2.2-1 is applicable to PC5 interface as well.



Figure 6.2.2-1: SRAP Data PDU format

## 6.3 Parameters

### 6.3.1 General

If not otherwise mentioned in the definition of each field then the bits in the parameters shall be interpreted as follows: the left most bit string is the first and most significant and the right most bit is the last and least significant bit.

Unless otherwise mentioned, integers are encoded in standard binary encoding for unsigned integers. In all cases the bits appear ordered from MSB to LSB when read in the PDU.

### 6.3.2 UE ID

Length: 8 bits.

This field carries temporary/local identity of U2N Remote UE.

### 6.3.3 BEARER ID

Length: 5 bits.

This field carries Uu radio bearer identify for U2N Remote UE.

### 6.3.4 Data

Length: Variable

This field carries the SRAP SDU (i.e. PDCP PDU).

### 6.3.5 R

Length: 2 bits

Reserved. In this version of the specification reserved bits shall be set to 0. Reserved bits shall be ignored by the receiver.

Editor’s Note: The length of R-bit is to be decided.

### 6.3.6 D/C

Length: 1 bit

This field indicates whether the corresponding SRAP PDU is an SRAP Data PDU or an SRAP Control PDU.

Editor’s Note: FFS if we need a control PDU in this release..

Table 6.3.6-1: D/C field

|  |  |
| --- | --- |
| Bit | Description |
| 0 | SRAP Data PDU |
| 1 | SRAP Control PDU |

Annex <X> (informative):
Change history

|  |
| --- |
| **Change history** |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 11/2021 | RAN2#116 | R2-2109400 |  |  |  | Skeleton | 0.0.0 |
| 11/2021 | RAN2#116 | R2-2111485 |  |  |  | Skeleton update | 0.0.1 |
| 11/2021 | RAN2#116 | R2-2111489 |  |  |  | Capture the agreement till R2#116 | 0.1.0 |
| 01/2022 | RAN2#116bis | R2-2200364 |  |  |  | Capture the agreement till R2#116 that related to the 38.331 running CR | 0.2.0 |

**Agreement**

In RAN2#113bis

Proposal 3: For both DL and UL transmission of Uu radio bearers other than SRB0, identity information of a remote UE and its Uu radio bearer are included in the header of adaptation layer over Uu. FFS for SRB0. FFS if the presence of adaptation layer header can be configurable. (24/24)

Proposal 3a: The radio bearer ID in the adaptation layer header is the Uu radio bearer ID of the remote UE. (23/24)

Proposal 3b: The UE ID in the adaptation layer header is a local, temporary remote UE ID. FFS whether the local, temporary remote UE ID is assigned by the relay UE, or the serving gNB of the relay UE. (23/24)

Proposal 3c: Mapping is done at Relay UE between PC5 RLC bearer IDs, identity information of remote UE and Uu radio bearer, and Uu RLC bearer IDs.

In RAN2#115

Agreements:

Proposal 5 Adaptation layer is not present over PC5 hop for SRB0 [16/19].

Proposal 6 Adaptation layer is not present over PC5 hop for BCCH and PCCH [15/15].

Proposal 9 (modified) Send LS to SA3 to notify the RAN2 agreement on local/temporary remote UE ID field in adaptation layer [19/19].

Agreement:

Support the adaptation layer on PC5 for bearer mapping only.

Agreements:

Proposal 8 Serving gNB of relay UE assigns the local/temp remote UE ID.

Proposal 1 (revised) For SRB0, adaptation layer is present over Uu hop for UL.

Proposal 2 For SRB0, adaptation layer is present over Uu hop for DL.

Agreements:

Proposal 1: RAN2 postpones discussions on configurability of Uu adaptation layer header and revisits it if time allows.

Proposal 8: A single adaptation layer entity for the Uu adaptation layer is configured in the relay UE .

Agreement:

Uu RLF is not indicated in adaptation layer.

Agreement:

Uu adaptation layer and PC5 adaptation layer can be described as separate entities for specification purpose (we do not specify how they will be actually implemented).

In RAN2#116

Agreements:

Proposal 4: Relay UE has a single PC5 adaptation layer entity shared for multiple remote UEs.

Proposal 6: For Uu hop, rely on LCID to differentiate relay and non-relay traffic, i.e., no impact to adaptation layer design.

Proposal 7 (modified): For PC5 hop, rely on L2-ID to differentiate relay and non-relay traffic, i.e., no impact to adaptation layer design.

Proposal 9: header should be bytes alignments with additional R bits.

Agreements:

Proposal 15 (modified): Relay UE is configured by gNB with the local/temp remote UE ID to be used in adaptation layer by RRCReconfiguration message, after reporting the remote UE’s L2ID via SUI message to gNB and before forwarding the first SRB0 UL message of the remote UE. FFS if impact to the SUI contents is needed to enable this.

Proposal 16: It is left to gNB implementation to avoid collision on the usage of local/temp remote UE ID.

Agreements:

Proposal 17: gNB can update the local remote UE ID based on its implementation, and sends the updated ID via RRCReconfiguration message.

Proposal 18 (modified): Serving gNB can perform local remote UE ID update (based on its implementation) independent of the PC5 unicast link L2 ID update procedure. FFS if any spec impact.

Agreement:

As in Uu, a Uu DRB and a Uu SRB are mapped to different RLC channels (i.e., PC5 RLC channel and Uu RLC channel). FFS if there is any spec impact.

Agreement:

D/C bit is defined in the adaptation layer header at least for future compatibility. FFS if we need a control PDU in this release.

Agreements:

Proposal 1: For DL bearer mapping, relay UE is configured by gNB, for each remote UE, with a mapping from Uu E2E bearer ID in Uu adaptation layer header to egress PC5 RLC channel ID/LCID.

Proposal 2: For UL bearer mapping, relay UE is configured by gNB, for each remote UE, with a mapping from Uu E2E bearer ID used in PC5 adaptation layer header to egress Uu RLC channel ID/LCID.

Proposal 3: For UL bearer mapping, remote UE is configured by gNB with a mapping from Uu E2E bearer ID to egress PC5 RLC channel ID/LCID.

FFS detailed signalling design.

In RAN2#116bis

Agreement:

The size of remote UE Uu RB ID is of 5 bits in the adaptation layer header.

Working assumption:

Remote local UE ID is 8 bits.

Working assumption:

Remote UE ID is always present in PC5 adaptation layer header. RAN2 does not pursue procedural spec impact for handling it beyond P6 of R2-2200943. To be revisited this meeting in light of any conclusion on P6.