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TECHNICAL SPECIFICATION

**5G;  
NG-RAN;  
NR user plane protocol  
(3GPP TS 38.425 version 15.7.0 Release 15)**

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# Foreword

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# 1 Scope

The present document specifies the NR user plane protocol functions used within NG-RAN and, for EN-DC, within E-UTRAN. NR user plane protocol functions may reside in nodes terminating either the X2-U (for EN-DC) or the Xn-U or the F1-U interface.

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## 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.
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- [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] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".
  - [4] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".
  - [5] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".
  - [6] 3GPP TS 36.322: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Link Control (RLC) protocol specification".
  - [7] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".
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## 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].

**Corresponding node:** a node interacting with a node hosting NR PDCP for flow control.

**Master node:** as defined in TS 37.340 [3].

**Secondary node:** as defined in TS 37.340 [3].

### 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].

EN-DC	E-UTRA-NR Dual Connectivity
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## 4 General

### 4.1 General aspects

The NR user plane protocol is located in the User Plane of the Radio Network layer over either the Xn or the X2 or the F1 interface.

The NR user plane protocol is used to convey control information related to the user data flow management of data radio bearers.

Each NR user plane protocol instance is associated to one data radio bearer only. There is one NR user plane instance per GTP tunnel. When a GTP tunnel is set up, a new NR user plane instance is set up.

If configured, NR user plane protocol instances exist at the Master node and the Secondary node in the context of DC or at nodes hosting F1-U protocol terminations. The NR user plane protocol supports direct communication between NR user plane protocol entities, regardless of whether they terminate the same or different user plane interfaces.

**NOTE:** User data radio bearers may be setup for data forwarding purposes during Xn HO or during DC related mobility without requiring the execution of any additional data radio bearer related user plane protocol functions related to an NR user plane protocol instance.

On each data radio bearer, the NR user plane protocol operates with RLC AM or RLC UM.

In this version of the present document, NR user plane protocol data is conveyed by GTP-U protocol means, more specifically, by means of the "NR RAN Container" GTP-U extension header as defined in TS 29.281 [2].

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## 5 NR user plane protocol

### 5.1 General

The NR user plane protocol layer is using services of the transport network layer in order to allow flow control of user data packets transferred from the node hosting NR PDCP to the corresponding node.

### 5.2 NR user plane protocol layer services

The following functions are provided by the NR user plane protocol:

- Provision of NR user plane specific sequence number information for user data transferred from the node hosting NR PDCP to the corresponding node for a specific data radio bearer.
- Information of successful in sequence delivery of NR PDCP PDUs to the UE from the corresponding node for user data associated with a specific data radio bearer.
- Information of NR PDCP PDUs that were not delivered to the UE or not transmitted to the lower layers.
- Information of NR PDCP PDUs transmitted to the lower layers for user data associated with a specific data radio bearer.
- Information of downlink NR PDCP PDUs to be discarded for user data associated with a specific data radio bearer;
- Information of the currently desired buffer size at the corresponding node for transmitting to the UE user data associated with a specific data radio bearer.

- Information of the currently desired data rate in bytes at the corresponding node for transmitting to the UE user data associated with a specific data radio bearer;
- Information of successful in sequence delivery of NR PDCP PDUs to the UE from the corresponding node for retransmission user data associate with a specific data radio bearer;
- Information of NR PDCP PDUs transmitted to the lower layers for retransmission user data associated with a specific data radio bearer.
- Information of the specific events at the corresponding node.
- Information on Radio Link Quality from the corresponding node for user data associated with a specific data radio bearer.

### 5.3 Services expected from the Transport Network Layer

The NR user plane protocol layer expects the following services from the Transport Network Layer:

- Transfer of user data.

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## 5.4 Elementary procedures

### 5.4.1 Transfer of Downlink User Data

#### 5.4.1.1 Successful operation

The purpose of the Transfer of Downlink User Data procedure is to provide NR-U specific sequence number information at the transfer of user data carrying a DL NR PDCP PDU from the node hosting the NR PDCP entity to the corresponding node.

An NR user plane protocol instance making use of the Transfer of Downlink User Data procedure is associated to a single data radio bearer only.

The node hosting the NR PDCP entity shall assign consecutive NR-U sequence numbers to each transferred NR-U packet. A retransmitted NR PDCP PDU shall be assigned a new NR-U sequence number.

The node hosting the NR PDCP entity indicates to the corresponding node whether this NR-U packet is a retransmission of NR PDCP PDU.

The node hosting the NR PDCP entity can indicate to the corresponding node to either discard all NR PDCP PDUs up to and including a defined DL discard NR PDCP PDU SN or discard one or a number of blocks of downlink NR PDCP PDUs.

If the Assistance Information Report Polling Flag is equal to 1, the corresponding node shall, if supported, send the ASSISTANCE INFORMATION DATA to the node hosting the NR PDCP entity.

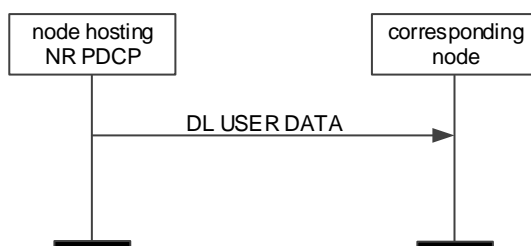
The corresponding node shall detect whether an NR-U packet was lost and memorise the respective sequence number after it has declared the respective NR-U packet as being "lost".

The corresponding node shall transfer the remaining NR PDCP PDUs towards the UE and memorise the highest NR PDCP PDU sequence number of the NR PDCP PDU that was successfully delivered (as defined in TS 36.322 [6] and TS 38.322 [7]) in sequence towards the UE (in case RLC AM is used) and the highest NR PDCP PDU sequence number of the NR PDCP PDU that was transmitted to the lower layers.

The corresponding node shall send the DL DATA DELIVERY STATUS if the Report Polling Flag is set to 1 or when the NR PDCP PDU with the indicated DL report NR PDCP PDU SN has been successfully delivered, unless a situation of overload at the corresponding node is encountered. The DL DATA DELIVERY STATUS sent as a response to a specific DL report NR PDCP PDU SN shall be sent only when all PDCP PDU SNs up to this DL report NR PDCP PDU have been successfully delivered in-sequence.

**NOTE:** The Transfer of Downlink User Data procedure and the associated feedback of lost NR-U packets assist the node hosting the NR PDCP entity in avoiding NR PDCP HFN de-synchronisation. If a deployment decides to not use the Transfer of Downlink User Data procedure, NR PDCP HFN synchronization should be ensured by other means.

If the User data existence flag is set to 1, the corresponding node assumes that the node hosting the NR PDCP entity has some user data for the concerned data radio bearer. The corresponding node decides whether and when to use DRX for the UE (i.e. the corresponding node may indicate the UE to use DRX even if the flag is set to 1 and the received DL USER DATA frame contains no user data).



**Figure 5.4.1.1-1: Successful Transfer of Downlink User Data**