

ETSI TS 138 425 V18.0.0 (2024-05)



**5G;
NG-RAN;
NR user plane protocol
(3GPP TS 38.425 version 18.0.0 Release 18)**



Reference

RTS/TSGR-0338425vi00

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

Important notice

The present document can be downloaded from:

<https://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our
Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.
All rights reserved.

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 <https://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	6
2 References	6
3 Definitions and abbreviations.....	6
3.1 Definitions	6
3.2 Abbreviations	7
4 General	7
4.1 General aspects.....	7
5 NR user plane protocol.....	7
5.1 General	7
5.2 NR user plane protocol layer services	7
5.3 Services expected from the Transport Network Layer	8
5.4 Elementary procedures	9
5.4.1 Transfer of Downlink User Data.....	9
5.4.1.1 Successful operation.....	9
5.4.1.2 Unsuccessful operation	10
5.4.2 Downlink Data Delivery Status	10
5.4.2.1 Successful operation.....	10
5.4.2.2 Unsuccessful operation	12
5.4.3 Transfer of Assistance Information	12
5.4.3.1 Successful operation.....	12
5.5 Elements for the NR user plane protocol.....	13
5.5.1 General.....	13
5.5.2 Frame format for the NR user plane protocol	14
5.5.2.1 DL USER DATA (PDU Type 0)	14
5.5.2.2 DL DATA DELIVERY STATUS (PDU Type 1).....	15
5.5.2.3 ASSISTANCE INFORMATION DATA (PDU Type 2).....	17
5.5.3 Coding of information elements in frames	18
5.5.3.1 PDU Type	18
5.5.3.2 Spare	18
5.5.3.3 Report polling	18
5.5.3.4 NR-U Sequence Number.....	18
5.5.3.5 Desired buffer size for the data radio bearer	18
5.5.3.6 Desired Data Rate	18
5.5.3.7 DL Flush	19
5.5.3.8 DL discard NR PDCP PDU SN	19
5.5.3.9 DL Discard Blocks.....	19
5.5.3.10 DL discard NR PDCP PDU SN start	19
5.5.3.11 DL discard Number of blocks	19
5.5.3.12 Discarded Block size.....	19
5.5.3.13 Lost Packet Report	19
5.5.3.14 Final Frame Indication	20
5.5.3.15 Number of lost NR-U Sequence Number ranges reported	20
5.5.3.16 Start of lost NR-U Sequence Number range	20
5.5.3.17 End of lost NR-U Sequence Number range	20
5.5.3.18 Highest Delivered NR PDCP SN Ind.....	20
5.5.3.19 Highest successfully delivered NR PDCP Sequence Number	20
5.5.3.20 Highest Transmitted NR PDCP SN Ind	20
5.5.3.21 Highest transmitted NR PDCP Sequence Number.....	21
5.5.3.22 Cause Report.....	21

5.5.3.23	Cause Value	21
5.5.3.24	Padding	21
5.5.3.28	Void.....	21
5.5.3.29	Retransmission flag.....	21
5.5.3.30	Delivered Retransmitted NR PDCP SN Ind.....	21
5.5.3.31	Retransmitted NR PDCP SN Ind	22
5.5.3.32	Successfully delivered retransmitted NR PDCP Sequence Number	22
5.5.3.33	Retransmitted NR PDCP Sequence Number.....	22
5.5.3.34	Data Rate Indication.....	22
5.5.3.35	PDCP Duplication Indication.....	22
5.5.3.36	PDCP Duplication Activation Suggestion	22
5.5.3.37	Number of Assistance Information Field	22
5.5.3.38	Assistance Information Type	23
5.5.3.39	Radio Quality Assistance Information	23
5.5.3.40	Assistance Information Report Polling Flag	23
5.5.3.41	Report Delivered.....	23
5.5.3.42	DL report NR PDCP PDU SN	23
5.5.3.43	User data existence flag	23
5.5.3.44	Number of octets for Radio Quality Assistance Information Field.....	24
5.5.3.45	Assistance Information Indication	24
5.5.3.46	UL Delay Indicator	24
5.5.3.47	DL Delay Indicator	24
5.5.3.48	UL Delay DU Result.....	24
5.5.3.49	DL Delay DU Result.....	24
5.5.3.50	Delivered NR PDCP SN Range Ind.....	25
5.5.3.51	Number of successfully delivered out of sequence PDCP Sequence Number range	25
5.5.3.52	Start of successfully delivered out of sequence PDCP Sequence Number range.....	25
5.5.3.53	End of successfully delivered out of sequence PDCP Sequence Number range.....	25
5.5.3.54	Request OutOfSeq Report.....	25
5.5.3.55	NR-U SN Ind.	25
5.5.3.56	Feedback Delay Ind.....	26
5.5.3.57	NR-U Sequence Number of Polling Frame.....	26
5.5.3.58	Feedback Delay Result.....	26
5.5.3.59	UL Congestion Information Indicator.....	26
5.5.3.60	DL Congestion Information Indicator.....	26
5.5.3.61	UL Congestion Information	26
5.5.3.62	DL Congestion Information	26
5.5.4	Timers	27
5.6	Handling of unknown, unforeseen and erroneous protocol data	27
Annex A (informative): Example of using future Extension		28
A.1	Example of using Future Extension field.....	28
A.1.1	New IE Flags.....	28
Annex B (informative): Change history		29
History		31

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 NR user plane protocol functions used within NG-RAN and, for EN-DC and LTE UP-CP split 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. User plane protocol functions support both E-UTRA PDCP and NR PDCP.

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] 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".
- [8] 3GPP TS 23.501: "System Architecture for the 5G System".
- [9] 3GPP TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture description".

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 PDCP for flow control. In an IAB network, this is the IAB-DU serving the UE for the corresponding data radio bearer.

eNB-CP: as defined in TS 36.401 [9].

eNB-UP: as defined in TS 36.401 [9].

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
IAB	Integrated Access and Backhaul
MBS	Multicast/Broadcast Service
MR-DC	Multi-RAT Dual Connectivity
MRB	MBS Radio Bearer
PTM	Point To Multipoint

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 or the W1 interface or the UP interface between eNB-CP and eNB-UP.

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 or at nodes hosting W1-U protocol terminations or at eNB-CP and eNB-UP. 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].

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 PDCP to the corresponding node.

5.2 NR user plane protocol layer services

NOTE 1: In this section, NR user plane protocol layer services are also applicable to E-UTRA PDCP. With this understanding, each instance of NR PDCP can be replaced by E-UTRA PDCP.

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.
- Information for QoS monitoring 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.

5.4 Elementary procedures

NOTE 1: In this section, NR user plane elementary procedures are also applicable to E-UTRA PDCP unless specified otherwise. With this understanding, each instance of NR PDCP can be replaced by E-UTRA PDCP unless specified otherwise.

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 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.

If the Request OutOfSeq Report is set to 1, the corresponding node shall, if supported, include the NR PDCP PDU sequence number successfully delivered out of sequence in the DL DATA DELIVERY STATUS to the node hosting the NR PDCP entity.

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).

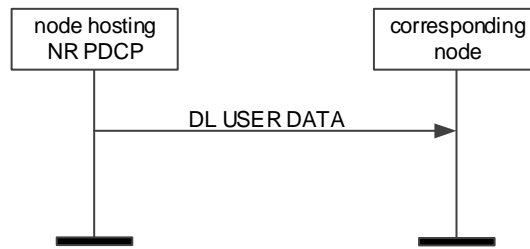


Figure 5.4.1.1-1: Successful Transfer of Downlink User Data

5.4.1.2 Unsuccessful operation

Void.

5.4.2 Downlink Data Delivery Status

5.4.2.1 Successful operation

The purpose of the Downlink Data Delivery Status procedure is to provide feedback from the corresponding node to the node hosting the NR PDCP entity to allow the node hosting the NR PDCP entity to control the downlink user data flow via the corresponding node for the respective data radio bearer. The corresponding node may also transfer uplink user data for the concerned data radio bearer to the node hosting the NR PDCP entity together with a DL DATA DELIVERY STATUS frame within the same GTP-U PDU.

The Downlink Data Delivery Status procedure is also used to provide feedback from the corresponding node to the node hosting the NR PDCP entity to allow the node hosting the NR PDCP entity to control the successful delivery of DL control data to the corresponding node.

When the corresponding node decides to trigger the feedback for Downlink Data Delivery procedure it shall report as specified in section 5.2:

- a) in case of RLC AM, the highest NR PDCP PDU sequence number successfully delivered in sequence to the UE among those NR PDCP PDUs received from the node hosting the NR PDCP entity i.e. excludes those retransmission NR PDCP PDUs;

NOTE 1: If the NR user plane protocol instance is associated a single RLC-AM entity for an MRB, specification text in bullet a) is applicable.

For all other cases, if the NR user plane protocol instance is associated with an MRB configured with at least one RLC AM entity and RLC-UM, the highest successfully delivered NR PDCP sequence number indicates the combined feedback of the highest NR PDCP sequence number successfully delivered in sequence to all the involved UEs for which the RLC AM entities have been configured, no retransmissions are performed, and the highest NR PDCP sequence number transmitted to the lower layers for PTM.

- b) the desired buffer size in bytes for the concerned data radio bearer or for the MRB;
- c) optionally, the desired data rate in bytes associated with a specific data radio bearer configured for the UE or for the MRB;
- d) the NR-U packets that were declared as being "lost" by the corresponding node and have not yet been reported to the node hosting the NR PDCP entity within the DL DATA DELIVERY STATUS frame;
- e) if retransmission NR PDCP PDUs have been delivered, the NR PDCP PDU sequence number associated with the highest NR-U sequence number among the retransmission NR PDCP PDUs successfully delivered to the UE in sequence of NR-U sequence number;
- f) if retransmission NR PDCP PDUs have been transmitted to the lower layers, the NR PDCP PDU sequence number associated with the highest NR-U sequence number among the retransmission NR PDCP PDUs transmitted to the lower layers in sequence of NR-U sequence number;
- g) the highest NR PDCP PDU sequence number transmitted to the lower layers among those NR PDCP PDUs received from the node hosting the NR PDCP entity i.e. excludes those retransmission NR PDCP PDUs;

NOTE 2: If the NR user plane protocol instance is associated with an MRB configured with RLC-UM entities only, the highest NR PDCP PDU sequence number transmitted successfully to all lower layer instances is reported.

NOTE 3: If a deployment has decided not to use the Transfer of Downlink User Data procedure, d), e) and f) above are not applicable.

h) in case of RLC AM, the NR PDCP PDU sequence number successfully delivered out of sequence to the UE among those NR PDCP PDUs received from the node hosting the NR PDCP entity i.e. excludes those retransmission NR PDCP PDUs.

As soon as the corresponding node detects the successful RACH access by the UE for the corresponding data radio bearer(s), the corresponding node shall send initial DL DATA DELIVERY STATUS frame to the node(s) hosting the NR PDCP entity(ies). The node hosting NR PDCP entity may start sending DL data before receiving the initial DL DATA DELIVERY STATUS frame. In case the DL DATA DELIVERY STATUS frame is sent before any NR PDCP PDU is transferred to lower layers, the information on the highest NR PDCP PDU sequence number successfully delivered in sequence to the UE and the highest NR PDCP PDU sequence number transmitted to the lower layers may not be provided.

The DL DATA DELIVERY STATUS frame shall also include a final frame indication when this frame is the last DL status report. When receiving such indication, the node hosting the NR PDCP entity considers that no more UL or DL data is expected to be transmitted between the corresponding node and the UE.

The DL DATA DELIVERY STATUS frame may also include an indication of detected radio link outage or radio link resume for the concerned data radio bearer. When receiving an indication of radio link outage detection, the node hosting the NR PDCP entity considers that traffic delivery over the data radio bearer configured for the UE is unavailable at the corresponding node both in UL and DL. When receiving an indication of radio link resume detection, the node hosting the NR PDCP entity considers that traffic delivery over the data radio bearer configured for the UE is available at the corresponding node both in UL and in DL. When receiving an indication of UL or DL radio link outage detection, the node hosting the NR PDCP entity considers that traffic delivery over the data radio bearer configured for the UE is unavailable at the corresponding node for UL or DL, depending on the indicated outage. When receiving an indication of UL or DL radio link resume detection, the node hosting the NR PDCP entity considers that traffic delivery over the data radio bearer configured for the UE is available at the corresponding node in UL or in DL, depending on the indicated resume. These indications are not applicable to E-UTRA PDCP.

For report polling triggered reporting, the DL DATA DELIVERY STATUS frame may include the feedback delay result and the NR-U sequence number of the frame where Report Polling Flag is included and that triggered the signalling of the DL DATA DELIVERY STATUS.

The node hosting the NR PDCP entity, when receiving the DL DATA DELIVERY STATUS frame:

- regards the desired buffer size under b) and the data rate under c) above as the amount of data to be sent from the hosting node:
 - If the value of the desired buffer size is 0, the hosting node shall stop sending any data per bearer.
 - If the value of the desired buffer size in b) above is greater than 0, the hosting node may send up to this amount of data per bearer:
 - first including the data to be retransmitted;
 - then the new data, starting from the last "Highest successfully delivered NR PDCP Sequence Number" for RLC AM if received, or starting from the last "Highest transmitted NR PDCP Sequence Number" for RLC UM if received.
 - The value of the desired data rate in c) above is the amount of data desired to be received in a specific amount of time. The amount of time is 1 sec.
 - The information of the buffer size in b) above and of the data rate in c) above is valid until the next DL DATA DELIVERY STATUS frame is received.
- is allowed to remove the buffered NR PDCP PDUs of a RLC AM bearer, according to the feedback of successfully delivered NR PDCP PDUs;

- decides upon the actions necessary to take for NR PDCP PDUs reported other than transmitted and/or successfully delivered.

In case of RLC AM, after the highest NR PDCP PDU sequence number successfully delivered in sequence is reported to the node hosting the NR PDCP entity, the corresponding node removes the respective NR PDCP PDUs. For RLC UM, the corresponding node may remove the respective NR PDCP PDUs after transmitting to lower layers.

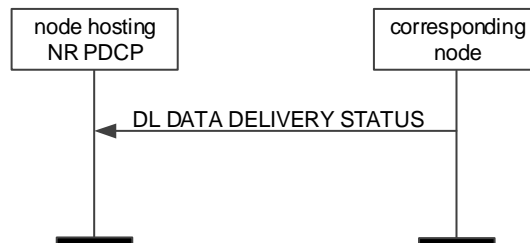


Figure 5.4.2.1-1: Successful Downlink Data Delivery Status

5.4.2.2 Unsuccessful operation

Void.

5.4.3 Transfer of Assistance Information

5.4.3.1 Successful operation

NOTE 1: In this section, PDCP duplication and delay measurement related information are not applicable to E-UTRA PDCP.

The purpose of the Transfer of Assistance Information procedure is to provide assistance information to the node hosting the NR PDCP entity. Such information may be taken into consideration by the node hosting the NR PDCP entity for UP management and optimisation procedures.

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

The Transfer of Assistance Information procedure may be invoked if

- the corresponding node decides to send the Radio Quality Assistance Information and/or the PDCP duplication activation suggestion to the node hosting the NR PDCP entity for the concerned data radio bearer or,
- the corresponding node decides to send the Radio Quality Assistance Information to the node hosting the NR PDCP entity for the concerned RLC entity.

The Transfer of Assistance Information procedure may be invoked if the corresponding node is configured to perform the QoS monitoring and to send the QoS monitoring results to the node hosting the NR PDCP entity for the concerned data radio bearer.

The ASSISTANCE INFORMATION DATA frame may include one or more Radio Quality Assistance Information. The information shall consist of the information indicated in the Assistance Information Type.

The ASSISTANCE INFORMATION DATA shall be sent, if supported, when the corresponding node receives a DL USER DATA PDU including the Assistance Information Report Polling Flag set to 1.

The ASSISTANCE INFORMATION DATA frame may include the PDCP Duplication Activation Suggestion, which informs the node hosting the NR PDCP entity of the suggestion from the corresponding node on whether to activate or not activate DL PDCP duplication. The node hosting the NR PDCP entity may take this information into account to take a decision on whether to activate or not activate PDCP duplication.

The ASSISTANCE INFORMATION DATA frame may include the UL Delay or/and DL Delay measured by the corresponding node. The node hosting the NR PDCP entity may take this information into account to calculate the whole UL or/and DL delay of RAN.

The ASSISTANCE INFORMATION DATA frame may include UL Congestion Information and/or DL Congestion information measured by the corresponding node. The node hosting the NR PDCP entity shall, if supported, take this information into account to perform ECN marking in the NG-RAN node, or to further send it to the UPF for ECN marking or information exposure as specified in TS 23.501 [8].

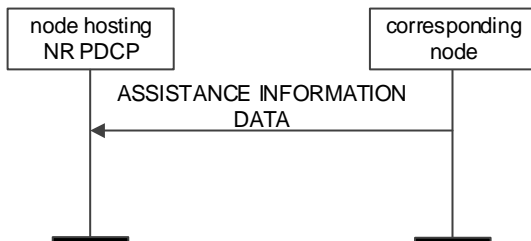


Figure 5.4.3.1-1: Successful Transfer of Assistance Information Data

5.5 Elements for the NR user plane protocol

5.5.1 General

In the present document the structure of frames is specified by using figures similar to figure 5.5.1-1.

Bits								Number of Octets	
7	6	5	4	3	2	1	0		
Field 1				Field 2				1	Octet 1
Field 3						Field 4		2	Octet 2
Field 4 continue				Spare					Octet 3
Spare				Field 5				1	Octet 4
Field 6								2	Octet 5
Field 6 continue				Padding Bits					Octet 6
Future Extension								0-m	
Padding								0-3	

Figure 5.5.1-1: Example frame format

Unless otherwise indicated, fields which consist of multiple bits within an octet have the most significant bit located at the highest bit position of the field (according to the bit numbers indicated above frame in figure 5.5.1-1). In addition, if a field spans several octets, most significant bits are located in lower numbered octets (right of frame in figure 5.5.1-1).

The frame is transmitted starting from the lowest numbered octet. Within each octet, the bits are sent according decreasing bit position (bit position 7 first).

Bits labelled "Spare" should be set to "0" by the sender and should not be checked by the receiver.

The header part of the frame is always an integer number of octets. The payload part is octet aligned (by adding 'Padding Bits' when needed). The total size of the frame shall not exceed 1018 octets (see TS 29.281 [2]).

The receiver should be able to remove an additional Future Extension field that may be present. See description of Future Extension field in A.1.

Padding octets may be added at the end of the frame, see Padding in 5.5.3.24

5.5.2 Frame format for the NR user plane protocol

5.5.2.1 DL USER DATA (PDU Type 0)

This frame format is defined e.g. to allow the corresponding node to detect lost NR-U packets and may be associated with the transfer of a Downlink PDCP PDU.

The following shows the respective DL USER DATA frame.

NOTE 1: All information elements defined in Figure 5.5.2.1-1 are also applicable to E-UTRA PDCP. With this understanding, each instance of NR PDCP can be replaced by E-UTRA PDCP.

Bits								Number of Octets
7	6	5	4	3	2	1	0	
PDU Type (=0)				Spare	DL Discard Blocks	DL Flush	Report polling	1
Spare			Request OutofSeq Report	Report Delivered	User data existence flag	Assistance Info. Report Polling Flag	Retransmission flag	1
NR-U Sequence Number								3
DL discard NR PDCP PDU SN								0 or 3
DL discard Number of blocks								0 or 1
DL discard NR PDCP PDU SN start (first block)								0 or 3
Discarded Block size (first block)								0 or 1
...								
DL discard NR PDCP PDU SN start (last block)								0 or 3
Discarded Block size (last block)								0 or 1
DL report NR PDCP PDU SN								0 or 3
Padding								0-3

Figure 5.5.2.1-1: DL USER DATA (PDU Type 0) Format

5.5.2.2 DL DATA DELIVERY STATUS (PDU Type 1)

This frame format is defined to transfer feedback to allow the receiving node (i.e. the node that hosts the PDCP entity) to control the downlink user data flow via the sending node (i.e. the corresponding node).

The following shows the respective DL DATA DELIVERY STATUS frame. The Figure shows an example of how a frame is structured when all optional IEs (i.e. those whose presence is indicated by an associated flag) are present.

Absence of such an IE changes the position of all subsequent IEs on octet level.

NOTE 1: All information elements defined in Figure 5.5.2.2-1 are also applicable to E-UTRA PDCP unless specified otherwise in section 5.5.3. With this understanding, each instance of NR PDCP can be replaced by E-UTRA PDCP.

Bits								Number of Octets
7	6	5	4	3	2	1	0	
PDU Type (=1)				Highest Transmitted NR PDCP SN Ind	Highest Delivered NR PDCP SN Ind	Final Frame Ind.	Lost Packet Report	1
Spare	Feedback Delay Ind.	NR-U SN Ind.	Delivered NR PDCP SN Range Ind	Data rate Ind.	Retransmitted NR PDCP SN Ind	Delivered Retransmitted NR PDCP SN Ind	Cause Report	1
Desired buffer size for the data radio bearer								4
Desired Data Rate								0 or 4
Number of lost NR-U Sequence Number ranges reported								0 or 1
Start of lost NR-U Sequence Number range								0 or (6* Number of reported lost NR-U SN ranges)
End of lost NR-U Sequence Number range								
Highest successfully delivered NR PDCP Sequence Number								0 or 3
Highest transmitted NR PDCP Sequence Number								0 or 3
Cause Value								0 or 1
Successfully delivered retransmitted NR PDCP Sequence Number								0 or 3
Retransmitted NR PDCP Sequence Number								0 or 3
Number of successfully delivered out of sequence PDCP Sequence Number range								0 or 1
Start of successfully delivered out of sequence PDCP Sequence Number range								0 or (6* Number of successfully delivered out of sequence PDCP Sequence Number range)
End of successfully delivered out of sequence PDCP Sequence Number range								
NR-U Sequence Number of Polling Frame								0 or 3
Feedback Delay Result								0 or 4

Padding	0-3
---------	-----

Figure 5.5.2.2-1: DL DATA DELIVERY STATUS (PDU Type 1) Format

5.5.2.3 ASSISTANCE INFORMATION DATA (PDU Type 2)

This frame format is defined to allow the node hosting the PDCP entity to receive assistance information.

The following shows the respective ASSISTANCE INFORMATION DATA frame.

NOTE 1: All information elements defined in Figure 5.5.2.3-1 are also applicable to E-UTRA PDCP unless specified otherwise in section 5.5.3.

Bits								Number of Octets
7	6	5	4	3	2	1	0	
PDU Type (=2)				PDCP Dupl. Ind.	Assistance Info. Ind.	UL Delay Ind.	DL Delay Ind.	1
Spare					UL Congestion Information Ind.	DL Congestion Information Ind.	PDCP Duplication Activation Suggestion	1
Number of Assistance Information Fields								0 or 1
Assistance Information Type								0 or (2*Number of Assistance Info Fields + sum of Number of octets for Radio Quality Assistance Information Fields)
Number of octets for Radio Quality Assistance Information Fields								
Radio Quality Assistance Information								
UL Delay DU Result								0 or 4
DL Delay DU Result								0 or 4
UL Congestion Information								0 or 2
DL Congestion Information								0 or 2

Figure 5.5.2.3-1: ASSISTANCE INFORMATION DATA (PDU Type 2) Format

5.5.3 Coding of information elements in frames

NOTE 1: In this section, information elements are also applicable to E-UTRA PDCP unless specified otherwise. With this understanding, each instance of NR PDCP can be replaced by E-UTRA PDCP unless specified otherwise.

5.5.3.1 PDU Type

Description: The PDU Type indicates the structure of the NR user plane frame. The field takes the value of the PDU Type it identifies; e.g. "0" for PDU Type 0. The PDU type is in bit 4 to bit 7 in the first octet of the frame.

Value range: {0=DL USER DATA, 1=DL DATA DELIVERY STATUS, 2= ASSISTANCE INFORMATION DATA, 3-15=reserved for future PDU type extensions}

Field length: 4 bits

5.5.3.2 Spare

Description: The spare field is set to "0" by the sender and should not be interpreted by the receiver. This field is reserved for later versions.

Value range: $(0-2^n-1)$.

Field Length: n bits.

5.5.3.3 Report polling

Description: This parameter indicates that the node hosting the NR PDCP entity requests providing the downlink delivery status report.

Value range: {0=Downlink Data Delivery Status report not requested, 1= Downlink Data Delivery Status report requested}.

Field length: 1 bit.

5.5.3.4 NR-U Sequence Number

Description: This parameter indicates the NR-U sequence number as assigned by the node hosting the NR PDCP entity.

Value range: $\{0..2^{24}-1\}$.

Field length: 3 octets.

5.5.3.5 Desired buffer size for the data radio bearer

Description: This parameter indicates the desired buffer size in bytes for the concerned data radio bearer as specified in clause 5.4.2.1.

Value range: $\{0..2^{32}-1\}$.

Field length: 4 octets.

5.5.3.6 Desired Data Rate

Description: This parameter indicates the amount of data desired to be received in bytes in a specific amount of time (1 s) for a specific data radio bearer established for the UE as specified in clause 5.4.2.1.

Value range: $\{0..2^{32}-1\}$.

Field length: 4 octets.

5.5.3.7 DL Flush

Description: This parameter indicates the presence of DL discard NR PDCP PDU SN.

Value range: {0= DL discard NR PDCP PDU SN not present, 1= DL discard NR PDCP PDU SN present}.

Field length: 1 bit.

5.5.3.8 DL discard NR PDCP PDU SN

Description: This parameter indicates the downlink NR discard PDCP PDU sequence number up to and including which all the NR PDCP PDUs should be discarded.

Value range: {0.. $2^{18}-1$ }.

Field length: 3 octets.

5.5.3.9 DL Discard Blocks

Description: This parameter indicates the presence of DL discard Number of blocks, DL discard NR PDCP PDU SN start and Discarded Block size.

Value range: {0= DL discard Number of blocks, DL discard NR PDCP PDU SN start and Discarded Block size not present, 1= DL discard Number of blocks, DL discard NR PDCP PDU SN start and Discarded Block size present}.

Field length: 1 bit.

5.5.3.10 DL discard NR PDCP PDU SN start

Description: This parameter indicates the starting SN of a downlink NR PDCP PDU block to be discarded.

Value range: {0.. $2^{18}-1$ }.

Field length: 3 octets.

5.5.3.11 DL discard Number of blocks

Description: This parameter indicates the number of NR PDCP PDU blocks to be discarded.

Value range: {1..244}.

Field length: 1 octet.

5.5.3.12 Discarded Block size

Description: This parameter indicates the number of NR PDCP PDUs counted from the starting SN to be discarded.

Value range: {1..255}.

Field length: 1 octet.

5.5.3.13 Lost Packet Report

Description: This parameter indicates the presence of Number of lost NR-U Sequence Number ranges reported, Start of lost NR-U Sequence Number range and End of lost NR-U Sequence Number range.

Value range: {0= Number of lost NR-U Sequence Number ranges reported, Start of lost NR-U Sequence Number range and End of lost NR-U Sequence Number range not present, 1= Number of lost NR-U Sequence Number ranges reported, Start of lost NR-U Sequence Number range and End of lost NR-U Sequence Number range present}.

Field length: 1 bit.

5.5.3.14 Final Frame Indication

Description: This parameter indicates whether the frame is the last DL status report as described in clause 5.4.2.1.

Value range: {0=Frame is not final, 1= Frame is final}.

Field length: 1 bit.

5.5.3.15 Number of lost NR-U Sequence Number ranges reported

Description: This parameter indicates the number of NR-U Sequence Number ranges reported to be lost.

Value range: {1..161}.

Field length: 1 octet.

5.5.3.16 Start of lost NR-U Sequence Number range

Description: This parameter indicates the start of an NR-U sequence number range reported to be lost.

Value range: {0.. $2^{24}-1$ }.

Field length: 3 octets.

5.5.3.17 End of lost NR-U Sequence Number range

Description: This parameter indicates the end of an NR-U sequence number range reported to be lost.

Value range: {0.. $2^{24}-1$ }.

Field length: 3 octets.

5.5.3.18 Highest Delivered NR PDCP SN Ind

Description: This parameter indicates the presence of Highest successfully delivered PDCP Sequence Number.

Value range: {0= Highest successfully delivered PDCP Sequence Number not present, 1= Highest successfully delivered PDCP Sequence Number present}.

Field length: 1 bit.

5.5.3.19 Highest successfully delivered NR PDCP Sequence Number

Description: This parameter indicates feedback about the in-sequence delivery status of NR PDCP PDUs at the corresponding node.

Value range: {0.. $2^{18}-1$ }.

Field length: 3 octets.

5.5.3.20 Highest Transmitted NR PDCP SN Ind

Description: This parameter indicates the presence of the Highest transmitted NR PDCP Sequence Number.

Value range: {0= Highest transmitted NR PDCP Sequence Number not present, 1= Highest transmitted NR PDCP Sequence Number present}.

Field length: 1 bit.

5.5.3.21 Highest transmitted NR PDCP Sequence Number

Description: This parameter indicates the feedback about the transmitted status of NR PDCP PDU sequence at the corresponding node to the lower layers.

Value range: $\{0..2^{18}-1\}$.

Field length: 3 octets.

5.5.3.22 Cause Report

Description: This parameter indicates the presence of Cause Value. This information element is not applicable to E-UTRA PDCP.

Value range: $\{0=\text{Cause Value not present}, 1=\text{Cause Value present}\}$.

Field length: 1 bit.

5.5.3.23 Cause Value

Description: This parameter indicates specific events reported by the corresponding node. This information element is not applicable to E-UTRA PDCP.

Value range: $\{0=\text{UNKNOWN}, 1=\text{RADIO LINK OUTAGE}, 2=\text{RADIO LINK RESUME}, 3=\text{UL RADIO LINK OUTAGE}, 4=\text{DL RADIO LINK OUTAGE}, 5=\text{UL RADIO LINK RESUME}, 6=\text{DL RADIO LINK RESUME}, 7-228=\text{reserved for future value extensions}, 229-255=\text{reserved for test purposes}\}$

Field length: 1 octet.

5.5.3.24 Padding

Description: The padding is included at the end of the frame to ensure that the NR user plane protocol PDU length (including padding and the Future Extension) is $(n*4-2)$ octets, where n is a positive integer. If there is any Future Extension, the padding should be added after the Future Extensions.

Field Length: 0–3 octets.

5.5.3.28 Void

Void.

5.5.3.29 Retransmission flag

Description: This parameter indicates whether the NR PDCP PDU is a retransmission NR-U packet sent by the node hosting the NR PDCP entity to the corresponding node.

Value range: $\{0=\text{Not a retransmission NR-U packet}, 1=\text{Retransmission NR-U packet}\}$.

Field length: 1 bit.

5.5.3.30 Delivered Retransmitted NR PDCP SN Ind

Description: This parameter indicates the presence of successfully delivered retransmitted PDCP Sequence Number.

Value range: $\{0=\text{Successfully delivered retransmitted PDCP Sequence Number not present}, 1=\text{Successfully delivered retransmitted PDCP Sequence Number present}\}$.

Field length: 1 bit.

5.5.3.31 Retransmitted NR PDCP SN Ind

Description: This parameter indicates the presence of retransmitted NR PDCP Sequence Number.

Value range: {0= Retransmitted NR PDCP Sequence Number not present, 1= Retransmitted NR PDCP Sequence Number present}.

Field length: 1 bit.

5.5.3.32 Successfully delivered retransmitted NR PDCP Sequence Number

Description: This parameter indicates the NR PDCP PDU sequence number associated with the highest NR-U sequence number among the retransmission NR PDCP PDUs successfully delivered to the UE in sequence of NR-U sequence number.

Value range: $\{0..2^{18}-1\}$.

Field length: 3 octets.

5.5.3.33 Retransmitted NR PDCP Sequence Number

Description: This parameter indicates the NR PDCP PDU sequence number associated with the highest NR-U sequence number among the retransmission NR PDCP PDUs transmitted to the lower layers in sequence of NR-U sequence number.

Value range: $\{0..2^{18}-1\}$.

Field length: 3 octets.

5.5.3.34 Data Rate Indication

Description: This parameter indicates the presence of the Desired Data Rate.

Value range: {0= Desired Data Rate Information is not present, 1= Desired Data Rate Information is present}.

Field length: 1 bit.

5.5.3.35 PDCP Duplication Indication

Description: This field indicates the presence of the PDCP Duplication Activation Suggestion. This information element is not applicable to E-UTRA PDCP.

Value range: {0= PDCP Duplication Activation Suggestion not present, 1= PDCP Duplication Activation Suggestion present}.

Field length: 1 bit.

5.5.3.36 PDCP Duplication Activation Suggestion

Description: This parameter indicates the suggestion given by the corresponding node on whether PDCP duplication should be activated or not. This information element is not applicable to E-UTRA PDCP.

Value range: {0= Do not duplicate, 1= Duplicate}.

Field length: 1 bit.

5.5.3.37 Number of Assistance Information Field

Description: This field indicates the number of Assistance Information Type and Radio Quality Assistance Information pairs concatenated.

Value range: $\{1..2^8-1\}$.

Field length: 1 octet.

5.5.3.38 Assistance Information Type

Description: This field describes the type of radio quality assistance information provided, if supported, by the corresponding node to the node hosting the NR PDCP entity. The DL Radio Quality Index is a numerical index expressing the radio quality of the data radio bearer or the RLC entity in DL, where the value 0 represents the lowest quality. The UL Radio Quality Index is a numerical index expressing the radio quality of the data radio bearer or the RLC entity in UL, where the value 0 represents the lowest quality. The averaging window for the Average CQI, Average HARQ Failure, Average HARQ Retransmission, and Average Number of HARQ Transmissions is set by means of configuration. Power Headroom Report is PHR MAC control element reported by as defined in 3GPP TS 36.321[4] and 3GPP TS 38.321[5].

Value range: {0=UNKNOWN, 1=Average CQI, 2=Average HARQ Failure, 3=Average HARQ Retransmissions, 4=DL Radio Quality Index, 5= UL Radio Quality Index, 6= Power Headroom Report, 7= Average Number of HARQ Transmissions, 8-228=reserved for future value extensions, 229-255=reserved for test purposes}.

Field length: 1 octet.

5.5.3.39 Radio Quality Assistance Information

Description: This parameter indicates one of the assistance information indicated by the Assistance Information Type.

Value range: {0..2⁸-1}.

Field length: 1 octet.

5.5.3.40 Assistance Information Report Polling Flag

Description: This parameter indicates that the node hosting the NR PDCP entity requests the corresponding node to send an ASSISTANCE INFORMATION DATA PDU.

Value range: {0= Assistance Information Data not requested, 1= Assistance Information Data requested}.

Field length: 1 bit.

5.5.3.41 Report Delivered

Description: This parameter indicates the presence of DL report NR PDCP PDU SN.

Value range: {0= DL report NR PDCP PDU SN not present, 1= DL report NR PDCP PDU SN present}.

Field length: 1 bit.

5.5.3.42 DL report NR PDCP PDU SN

Description: This parameter indicates that the node hosting PDCP entity requests providing the down link delivery status report when the NR PDCP PDU with this sequence number has been successfully delivered.

Value range: {0..2²⁴-1}.

Field length: 3 octets.

5.5.3.43 User data existence flag

Description: This parameter indicates whether the node hosting the NR PDCP entity has some user data for the concerned data radio bearer.

Value range: {0= the node hosting the NR PDCP entity has no more user data for the concerned data radio bearer, 1= the node hosting the NR PDCP entity has some user data for the concerned data radio bearer}.

Field length: 1 bit.

5.5.3.44 Number of octets for Radio Quality Assistance Information Field

Description: This field indicates the number of octets for Radio Quality Assistance Information exists. For Average CQI, Average HARQ Failure, Average HARQ Retransmissions, DL Radio Quality Index, UL Radio Quality Index, this field shall indicate as “1.” For Average Number of HARQ Transmissions, this field shall indicate as “4”. For Power Headroom Report, this field shall indicate octet length of Power Headroom Report as defined in 3GPP TS 36.321[4] and 3GPP TS 38.321[5].

Value range: {0..2⁸-1}.

Field length: 1 octets.

5.5.3.45 Assistance Information Indication

Description: This field indicates the presence of the Number of Assistance Information Fields.

Value range: {0= Number of Assistance Information Fields not present, 1= Number of Assistance Information Fields present}.

5.5.3.46 UL Delay Indicator

Description: This parameter indicates the presence of the UL Delay DU Result. This information element is not applicable to E-UTRA PDCP.

Value range: {0= UL Delay DU Result not present, 1= UL Delay DU Result present}.

Field length: 1 bit.

5.5.3.47 DL Delay Indicator

Description: This parameter indicates the presence of the DL Delay DU Result. This information element is not applicable to E-UTRA PDCP.

Value range: {0= DL Delay DU Result not present, 1= DL Delay DU Result present}.

Field length: 1 bit.

5.5.3.48 UL Delay DU Result

Description: This field indicates UL delay measured at the corresponding node in milliseconds for the concerned DRB over Uu interface. It is encoded as an Unsigned32 binary integer value. The node hosting PDCP entity shall, if supported, use this information to calculate the total UL delay for the concerned DRB and report to the UPF for the purpose of QoS monitoring as specified in [8]. This information element is not applicable to E-UTRA PDCP.

Value range: {0..2³²-1}.

Field length: 4 octets.

5.5.3.49 DL Delay DU Result

Description: This field indicates DL delay measured at the corresponding node in milliseconds for the concerned DRB over Uu interface. It is encoded as an Unsigned32 binary integer value. The node hosting PDCP entity shall, if supported, use this information to calculate the total DL delay for the concerned DRB and report to the UPF for the purpose of QoS monitoring as specified in [8]. This information element is not applicable to E-UTRA PDCP.

Value range: {0..2³²-1}.

Field length: 4 octets.

5.5.3.50 Delivered NR PDCP SN Range Ind

Description: This field indicates the presence of the Number of successfully delivered out of sequence PDCP Sequence Number range, Start of successfully delivered out of sequence PDCP Sequence Number range and End of successfully delivered out of sequence PDCP Sequence Number range.

Value range: {0= Number of successfully delivered out of sequence PDCP Sequence Number range, Start of successfully delivered out of sequence PDCP Sequence Number range and End of successfully delivered out of sequence PDCP Sequence Number range not present, 1= Number of successfully delivered out of sequence PDCP Sequence Number range, Start of successfully delivered out of sequence PDCP Sequence Number range and End of successfully delivered out of sequence PDCP Sequence Number range present}.

5.5.3.51 Number of successfully delivered out of sequence PDCP Sequence Number range

Description: This parameter indicates the number of PDCP Sequence Number ranges reported to be successfully delivered out of sequence.

Value range: {1..255}.

Field length: 1 octet.

5.5.3.52 Start of successfully delivered out of sequence PDCP Sequence Number range

Description: This parameter indicates the start of a PDCN sequence number range reported to be successfully delivered out of sequence.

Value range: {0..2¹⁸-1}.

Field length: 3 octets.

5.5.3.53 End of successfully delivered out of sequence PDCP Sequence Number range

Description: This parameter indicates the end of a PDCN sequence number range reported to be successfully delivered out of sequence.

Value range: {0..2¹⁸-1}.

Field length: 3 octets.

5.5.3.54 Request OutOfSeq Report

Description: This parameter indicates that the node hosting the NR PDCP entity requests the corresponding node to report the NR PDCP PDU sequence number successfully delivered out of sequence in downlink delivery status report.

Value range: {0= NR PDCP PDU sequence number successfully delivered out of sequence reporting in downlink delivery status report not requested, 1= NR PDCP PDU sequence number successfully delivered out of sequence reporting in downlink delivery status report requested}.

Field length: 1 bit.

5.5.3.55 NR-U SN Ind.

Description: This parameter indicates the presence of NR-U Sequence Number of the Polling Frame that triggered transmission of the DL DATA DELIVERY STATUS.

Value range: {0= NR-U Sequence Number of Polling Frame not present, 1= NR-U Sequence Number of Polling Frame present}.

Field length: 1 bit.

5.5.3.56 Feedback Delay Ind.

Description: This parameter indicates the presence of Feedback Delay Result.

Value range: {0= Feedback Delay Result not present, 1= Feedback Delay Result present}.

Field length: 1 bit.

5.5.3.57 NR-U Sequence Number of Polling Frame

Description: This parameter indicates the NR-U sequence number of the Polling Frame that triggered transmission of the DL DATA DELIVERY STATUS.

Value range: {0.. $2^{24}-1$ }.

Field length: 3 octets.

5.5.3.58 Feedback Delay Result

Description: This parameter indicates the feedback delay time measured at the corresponding node in milliseconds from the time of reception of the Polling Frame that triggered transmission of the DL DATA DELIVERY STATUS to the time of transmission of the DL DATA DELIVERY STATUS. It is encoded as an Unsigned32 binary integer value.

Value range: {0.. $2^{32}-1$ }.

Field length: 4 octets.

5.5.3.59 UL Congestion Information Indicator

Description: This parameter indicates the presence of UL Congestion Information.

Value range: {0= UL Congestion Information not present, 1= UL Congestion Information present}.

Field length: 1 bit.

5.5.3.60 DL Congestion Information Indicator

Description: This parameter indicates the presence of DL Congestion Information.

Value range: {0= DL Congestion Information not present, 1= DL Congestion Information present}.

Field length: 1 bit.

5.5.3.61 UL Congestion Information

Description: For the cases of ECN marking Request, this field indicates the percentage of UL IP packets up to two decimal points that should be ECN marked for a DRB.

For the case of Congestion Information Request, this field should be interpreted as a percentage of congestion level in UL up to two decimal points for a DRB.

As an example, value 9574 corresponds to a percentage of 95.74%.

Value range: {0..10000}.

Field length: 2 octets.

5.5.3.62 DL Congestion Information

Description: For the cases of ECN marking Request, this field indicates the percentage of DL IP packets up to two decimal points that should be ECN marked for a DRB.

For the case of Congestion Information Request, this field should be interpreted as a percentage of congestion level in DL up to two decimal points for a DRB.

As an example, value 9574 corresponds to a percentage of 95.74%.

Value range: {0..10000}.

Field length: 2 octets.

5.5.4 Timers

Not applicable.

5.6 Handling of unknown, unforeseen and erroneous protocol data

Void.

Annex A (informative): Example of using future Extension

A.1 Example of using Future Extension field

New IE flag 7(E)	New IE flag 6	New IE flag 5	New IE flag 4	New IE flag 3	New IE flag 2	New IE flag 1	New IE flag 0	1 Octet New IE Flags
New IE 1								3 Octets
New IE 2								2 Octets

Figure X.Y: Example of Future Extension field

In the Example of the Future Extension field, New IE flag 0 indicates if the New IE 1 is present or not. New IE flag 1 indicates if the new IE 2 is present or not.

A.1.1 New IE Flags

Description: The *New IE Flags* IE is only present if at least one new IE is present. The *New IE Flags* IE contains flags indicating which new IEs that are present following the *New IE Flags* IE. The last bit position of the *New IE Flags* IE is used as the Extension Flag to allow the extension of the *New IE Flags* IE in the future. Extension octets of the *New IE Flags* IE shall follow directly after the first octet of the *New IE Flags* IE. When an extension octet of the *New IE Flags* IE is present, then all previous extension octets of the *New IE Flags* IE and the *New IE Flags* IE shall also be present, even if they have all their flag bits indicating no presence of their respective new IEs.

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-04	R3#95b	R3-171173	-	-	-	TS skeleton	0.0.0
2017-04	R3#95b	R3-171318	-	-	-	Merged TPs from R3#95b: R3-171346	0.0.0
2017-05	R3#96	R3-171743	-	-	-	Editorial changes	0.0.2
2017-06	R3#ad-hoc2		-	-	-	Submission	0.1.0
2017-10	R3#97bis	R3-173978 R3-174222	-	-	-	Incorporated agreed pCRs from R3#97bis	0.2.0
2017-11	R3#98	R3-174957 R3-174792 R3-175031 R3-174982	-	-	-	Incorporated agreed pCRs from R3#98	0.3.0
2017-12	RP-78					TS submitted to RAN plenary for Approval	1.0.0
2017-12	RP-78					TS approved by RAN plenary	15.0.0
2018-03	RP-79	RP-180468	0001	1	F	Rapporteur's update to TS38.425	15.1.0
2018-03	RP-79	RP-180468	0002	-	F	Corrections to NR UP protocol	15.1.0
2018-03	RP-79	RP-180468	0003	1	B	Data Retransmission Indication	15.1.0
2018-03	RP-79	RP-180468	0006	2	F	Avoiding exceeding the max size of the NR RAN Container	15.1.0
2018-03	RP-79	RP-180468	0010	2	F	Clarification and correction on U-plane for EN-DC	15.1.0
2018-03	RP-79	RP-180468	0014	1	F	Correction of frame structure and Spare extension	15.1.0
2018-03	RP-79	RP-180468	0015	1	F	Triggering of DDDS delivery	15.1.0
2018-03	RP-79	RP-180468	0016	-	F	Correction to DL Discard	15.1.0
2018-03	RP-79	RP-180468	0017	1	F	Clarifications on UP IE presence	15.1.0
2018-06	RP-80	RP-181238	0022	1	F	Correction on Initial DDDS triggering	15.2.0
2018-06	RP-80	RP-181238	0024	1	F	Clarification of the use of the desired buffer size	15.2.0
2018-06	RP-80	RP-181238	0028	1	F	Correction of Reporting PDCP SN	15.2.0
2018-06	RP-80	RP-181373	0029	-	F	Correction the max value of one octet	15.2.0
2018-06	RP-80	RP-181272	0032	3	F	Introduction of assistance information for DL PDCP duplication (38.425 Baseline CR covering RAN3 agreements)	15.2.0
2018-06	RP-80	RP-181239	0034	1	F	Final Frame Indication	15.2.0
2018-06	RP-80	RP-181238	0035	-	F	Correction on padding	15.2.0
2018-06	RP-80	RP-181238	0037	1	F	UL and DL outage	15.2.0
2018-06	RP-80	RP-181239	0039	1	F	Various corrections for the NR UP	15.2.0
2018-06	RP-80	RP-181239	0045	1	F	Rapporteur's update to TS38.425 v15.1.0	15.2.0
2018-06	RP-80	RP-181239	0047	-	F	Correction on length for retransmission	15.2.0
2018-09	RP-81	RP-181922	0049	4	F	NR Corrections (38.425 Baseline CR covering RAN3-101 agreements)	15.3.0
2018-09	RP-81	RP-181920	0050	2	F	CR on data existence indication for split bearer	15.3.0
2018-09	RP-81	RP-181920	0051	1	F	CR on Radio Quality Assistance Information for PHR	15.3.0
2018-09	RP-81	RP-181920	0054	-	F	Correct the range of the DL discard Number of blocks IE	15.3.0
2018-09	RP-81	RP-181921	0057	2	F	Correction on PDCP duplication indication	15.3.0
2018-12	RP-82	RP-182446	0061	1	F	Clarification of the NR UP initialisation	15.4.0
2018-12	RP-82	RP-182446	0066	-	F	Differentiate RLC AM and UM for user plane	15.4.0
2018-12	RP-82	RP-182446	0067	-	F	Corrections on DL USER DATA frame	15.4.0
2018-12	RP-82	RP-182446	0068	-	F	Miscellaneous corrections for User Plane	15.4.0
2018-12	RP-82	RP-182447	0070	-	F	DDDS polling clarification	15.4.0
2018-12	RP-82	RP-182447	0073	1	F	Retransmission Status in UP	15.4.0
2019-03	RP-83	RP-190555	0078	1	F	Final Frame Indication in NR-UP	15.5.0
2019-07	RP-84	RP-191394	0083	2	F	Clarification on desired buffer size	15.6.0
2020-03	RP-87-e	RP-200425	0105	2	B	E2E delay measurement for Qos monitoring for URLLC	16.0.0
2020-07	RP-88-e	RP-201079	0102	8	B	Resource efficient PDCP duplication: enhancement 3	16.1.0
2020-07	RP-88-e	RP-201077	0103	7	B	BL CR to 38.425: Support for IAB	16.1.0
2020-07	RP-88-e	RP-201085	0107	-	F	Rapporteur's correction for TS 38.425	16.1.0
2020-09	RP-89-e	RP-201955	0110	-	A	Correction of Downlink Data Delivery Status	16.2.0
2021-03	RP-91-e	RP-210239	0113	1	F	Discard NR PDCP PDUs without PDCP PDU transfer	16.3.0
2022-03	RP-95-e	RP-220217	0124	5	B	CR to 38.425: Baseline CR for introducing Rel-17 Enhanced eNB Architecture Evolution	17.0.0
2022-03	RP-95-e	RP-220224	0136	1	B	BLCR to TS 38.425: Introduction of MBS	17.0.0
2022-09	RP-97-e	RP-222201	0143	-	F	Correction of F1-U Delay Measurement for QoS Monitoring	17.1.0
2022-12	RP-98-e	RP-222892	0140	2	F	Clarification of the desired buffer size in case of retransmissions [DesBufRetrans]	17.2.0
2023-03	RAN#99	RP-230599	0145	-	F	Correction on W1 interface in TS38.425	17.3.0
2023-12	RAN#102	RP-233830	0148	5	B	Support for NR XR	18.0.0
2023-12	RAN#102	RP-233844	0149	2	F	Correction for HARQ Related Assistance Information in NR User Plane	18.0.0

History

Document history		
V18.0.0	May 2024	Publication