TSG-RAN Meeting #14
Kyoto, Japan, 11 - 14 December 2001

RP-010762

Title: **Agreed CRs (Release '99 and Rel-4 category A) to TS 25.323**

Source: **TSG-RAN WG2**

Agenda item: **8.2.3**

Doc-1st-	Status-	Spec	CR	Rev	Phase	Subject	Cat	Version	Versio
R2-012658	agreed	25.323	037	1	R99	General PDCP corrections	F	3.6.0	3.7.0
R2-012659	agreed	25.323	038		Rel-4	General PDCP corrections	A	4.2.0	4.3.0

CR-Form-v4

CHANGE REQUEST

⌘   **25.323 CR 037**   ⌘ rev **r1** ⌘ Current version: **3.6.0** ⌘

For HELP on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.

Proposed change affects: ⌘   (U)SIM ☐   ME/UE **X**   Radio Access Network **X**   Core Network ☐

Title: ⌘	General PDCP corrections	
Source: ⌘	TSG-RAN WG2	
Work item code: ⌘	TEI	***Date:*** ⌘ 28 November 2001

Category: ⌘ **F**	***Release:*** ⌘ R99

Use <u>one</u> of the following categories:
   F *(correction)*
   A *(corresponds to a correction in an earlier release)*
   B *(addition of feature),*
   C *(functional modification of feature)*
   D *(editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP TR 21.900.

Use <u>one</u> of the following releases:
   2   *(GSM Phase 2)*
   R96 *(Release 1996)*
   R97 *(Release 1997)*
   R98 *(Release 1998)*
   R99 *(Release 1999)*
   REL-4 *(Release 4)*
   REL-5 *(Release 5)*

Reason for change: ⌘	1. The recent 23.060 says, "When the SRNS changes, the old RNS forwards all received and not yet transferred downlink GTP-PDUs to the target RNS. GTP-PDUs forwarded to the target RNS indicate a PDCP sequence number if the contained N-PDUs were sent to the MS as a PDCP-SDUs, but are not yet acknowledged by lossless PDCP." Therefore, during the SRNS relocation, the transmitted but not yet acknowledged PDCP SDUs should be forwarded together with their PDCP sequence numbers, while the not yet transmitted PDCP SDUs should be forwarded alone. In this way, the target PDCP can know whether a received PDCP SDU is an unconfirmed SDU or an unsent SDU. 2. From the same reason above, the target PDCP can determine the valid range of the DL_Receive PDCP sequence number which is received from UE. Since the validity check problem is solved, it is better to specify SN synchronization procedure for the UTRAN side. 3. Since header compression related control signalling is not related to the PDCP SDU, it does not have PDCP sequence number. Thus, header compression related control signalling should not be included in the PDCP SeqNum PDU.

Summary of change: ⌘	1. What shall be forwarded from source to target RNC is clarified.
	2. The validity check of the Receive PDCP sequence number is now applied both for the UE and UTRAN side.
	3. Header compression related control signalling is removed from the contents of the PDCP SeqNum PDU.
	4. Some editorial corrections are also made.
	
	Revision 1 (highlighted in yellow)
	
	  - For UTRAN side, "shall" is changed to "should" (5.4.1.1, 5.4.1.2, 5.4.1.3).
	
	  - The word "successfully" is removed in 5.4.1.

		Isolated Impact Analysis
		This CR only affects the lossless SRNS Relocation procedure; only the function to be corrected is affected. Thus this CR has an isolated impact. The change would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.
Consequences if not approved:	⌘	Incomplete lossless SRNS Relocaiton procedure. Misalignment between the spec.

Clauses affected:	⌘	5.4.1, 5.4.1.1, 5.4.1.2, 5.4.1.3, 6.1, 7.1, 8.2.1, 8.2.3

Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	25.323 v4.2.0, CR 038

Other comments:	⌘	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.4 SRNS Relocation

In case of SRNS Relocation upper layer indicates to PDCP to perform the re-initialisation of all compression entities of a RB. This entails the following:

- Configured compression parameters remain valid during re-initialisation.

- All compression state information is initialised, e.g. header compression contexts. Therefore, the first 'compressed' packet type after SRNS Relocation is a full header.

- The PDCP sequence numbers are not changed due to the PDCP header compression protocol re-initialisation.

5.4.1 Lossless SRNS Relocation

Lossless SRNS Relocation is only applicable when RLC is configured for in-sequence delivery and acknowledged mode. The support of lossless SRNS Relocation is configured by upper layer.

For the support of lossless SRNS Relocation PDCP maintains sequence numbers for PDCP SDUs, as described in subclause 5.4.1.1. These sequence numbers are synchronised between PDCP Sender and Receiver, as described in subclause 5.4.1.2. When a lossless SRNS Relocation is performed sequence numbers are exchanged between UE and UTRAN. They are used to confirm PDCP SDUs ~~successfully received be the Receiver~~ transmitted but not yet acknowledged by the Receiver~~to have been received by the lower layer~~, as described in subclause 5.4.1.3. After relocation the data transfer begins with the first unconfirmed PDCP SDU.

5.4.1.1 PDCP Sequence Numbering

PDCP sequence numbering shall be applied when lossless SRNS Relocation is ~~to be~~ supported. PDCP Sequence Numbers serve to acknowledge previously ~~sent~~transmitted PDCP SDUs prior to relocation. The value of the PDCP sequence number ranges from 0 to 65535. The PDCP SN window size indicates the maximum number of PDCP SDUS, not confirmed to have been successfully transmitted to the peer entity by lower layer, that can be numbered at any given time. The PDCP SN window size is configured by upper layers. PDCP sequence numbers are set to "0" when the PDCP entity is set-up for the first time.

In the following the "submission/reception of a PDCP SDU to/from lower layer" is used as a synonym for the submission/reception of a PDCP Data PDU or a PDCP SeqNum PDU to/from lower layer that carries in its Data field a compressed or uncompressed PDCP SDU. In case PDCP sequence numbers are applied, for each radio bearer:

- in the UE:

  - the UL_Send PDCP sequence number shall be set to "0" for the first PDCP SDU submitted to lower layer;

  - the UL_Send PDCP sequence number shall be incremented by "1" when a PDCP SDU is submitted to lower layer;

  - the DL_Receive PDCP sequence number ~~is~~shall be set to "0" for the first ~~received~~ PDCP SDU received from lower layer;

  - the DL_Receive PDCP sequence number ~~is~~shall be incremented by "1" when a PDCP ~~Data~~SDU is received from lower layer.

- in the UTRAN:

  - the DL_Send PDCP sequence number ~~shall~~should be set to "0" for the first PDCP SDU submitted to lower layer;

  - the DL_Send PDCP sequence number ~~shall~~should be incremented by "1" when a PDCP SDU is submitted to lower layer;

  - the UL_Receive PDCP sequence number ~~shall~~should be set to "0" for the first ~~received~~ PDCP SDU received from lower layer;

  - the UL_Receive PDCP sequence number ~~is~~should be incremented by "1" when a PDCP ~~Data~~SDU is received from lower layer.

PDCP sequence numbers shall not be decremented in a PDCP entity.

5.4.1.2   PDCP Sequence Number synchronization

For radio bearers that are configured to support lossless SRNS Relocation, the PDCP entity shall:

-    if upper layer indicates to a PDCP entity that it should synchronise the PDCP SN following a RLC reset or RB reconfiguration; ~~and~~or

-    if the UE/UTRAN PDCP entity receives an invalid "next expected UL/DL Receive PDCP ~~S~~sequence ~~N~~number" ~~for~~from upper layer after Relocation:

    -    trigger the PDCP SN ~~S~~synchronization procedure ~~of PDCP SN~~ by submitting one PDCP SeqNum PDU to lower layer;

    -    consider that the synchronisation procedure is complete on confirmation by lower layer of the successful transmission of the PDCP SeqNum PDU.

In the UE/UTRAN, the "next expected UL/DL Receive ~~SN~~ PDCP sequence number" is considered invalid if its value is less than the Send PDCP SN of the first ~~sent~~transmitted but ~~un~~not yet acknowledged PDCP SDU or greater than that of the first unsent PDCP SDU.

On receiving a PDCP SeqNum PDU~~, the PDCP entity shall~~:

-    the UE PDCP entity shall set the value of the DL Receive PDCP sequence number ~~(i.e. UL Receive or DL Receive)~~ to the value indicated in the PDCP SeqNum PDU.

-    the UTRAN PDCP entity should set the value of the UL Receive PDCP sequence number to the value indicated in the PDCP SeqNum PDU.

5.4.1.3   Sequence Number and Data Forwarding

In case of a lossless SRNS Relocation procedure, as described in [1]:

-    the UTRAN should send to the UE the ~~next expected~~ UL Receive PDCP ~~S~~sequence ~~N~~number; and

-    the UE shall send to the UTRAN the ~~next expected~~ DL Receive PDCP ~~S~~sequence ~~N~~number.

This information exchange synchronises the Sequence Numbers at the UE and UTRAN PDCP entities.

When requested by the upper layer, for each radio bearer configured to support lossless SRNS Relocation, the PDCP sublayer in the source RNC should forward the following to the target RNC:

-    the Receive PDCP SN~~Sequence Number~~ of the next PDCP SDU expected to be received from the UE;

-    the Send PDCP SN~~sequence number~~ of the first transmitted but not yet acknowledged PDCP SDU ~~forwarded to the target SRNC~~;

-    the transmitted but not yet acknowledged PDCP SDUs together with their related Send PDCP SNs;~~not confirmed to have been received by the peer PDCP entity.~~

-    the not yet transmitted PDCP SDUs.

6   Services

6.1   Services provided to upper layers

The following services are provided by PDCP to upper layers:

-    transfer of user data;

-    maintenance of PDCP ~~P~~SDU sequence numbers.

6.2   Services expected from RLC layer

For a detailed description of the following functions see [5].

- transparent data transfer Service;

- unacknowledged data transfer Service;

- acknowledged data transfer Service.

7   Elements for layer-to-layer communication

The interaction between the PDCP layer and other layers are described in terms of primitives where the primitives represent the logical exchange of information and control between the PDCP layer and other layers. The primitives shall not specify or constrain implementations.

7.1   Primitives between PDCP and upper layers

The primitives between PDCP and upper layers are shown in Table 3.

Table 3: Primitives between PDCP and upper layers

Generic Name	Parameter			
	Req.	Ind.	Resp.	Conf.
PDCP-DATA	Data	Data	Not Defined	Not Defined
CPDCP-CONFIG	PDCP-Info, RLC-SAP SN_Sync, R/I	Not Defined	Not Defined	Not Defined
CPDCP-RELEASE	RLC-SAP	Not Defined	Not Defined	Not Defined
CPDCP-SN	PDCP SN	Not Defined	Not Defined	Not Defined
CPDCP-RELOC	Receive_SN	Not Defined	Not Defined	Receive_SN, Send_SN

Each Primitive is defined as follows:

a) PDCP-DATA-Req./Ind.

- PDCP-DATA-Req is used by upper user-plane protocol layers to request a transmission of upper layer PDU. PDCP-DATA-Ind is used to deliver PDCP SDU that has been received to upper user plane protocol layers.

b) CPDCP-CONFIG-Req.

- CPDCP-CONFIG Req is used to configure and – in case of already existing PDCP entity – to reconfigure a PDCP entity and to assign it to the radio bearer associated with that entity.

c) CPDCP-RELEASE-Req.

- CPDCP-RELEASE-Req is used by upper layers to release a PDCP entity.

d) CPDCP-SN-Req.

- This primitive is used at the UTRAN. CPDCP-SN-Req is used to transfer the PDCP SN to PDCP.

e) CPDCP-RELOC-Req/Conf.

- CPDCP-RELOC-Req initiates the SRNS Relocation procedure in PDCP for those radio bearers that are configured to support lossless SRNS Relocation. The Receive_SN is only included at the UE side.

- CPDCP-RELOC-Conf is used to transfer the Receive_SN and/or Send_SN to upper layers for lossless SRNS Relocation. The Send_SN is only included at the source RNC.

The following parameters are used in the primitives:

1) PDCP-Info:

   - Contains the parameters for each of the header compression protocols configured to be used by one PDCP entity.

2) RLC-SAP:

   - The RLC-SAP (TM/UM/AM) used by PDCP entity when communicating with RLC sublayer.

3) SN_Sync:

   - Indicates that PDCP should start PDCP SNsequence number synchronization procedure.

4) Send_SN:

   - The sSend PDCP SNsequence number of the next PDCP SDU to be sent. There is one in the uplink (UL_Send_SN) and one in the downlink (DL_Send_SN). Refer to subclause 5.4.1.

5) Receive_SN:

   - The rReceive PDCP SNsequence number of the next PDCP SDU expected to be received. There is one in the uplink (UL_Receive_SN) and one in the downlink (DL_Receive_SN). Refer to subclause 5.4.1.

6) PDCP SN:

   - This includes a PDCP sequence number.

7) R/I:

   - Indicates that PDCP should Re-initialise/Initialise the header compression protocols.

8 Elements for peer-to-peer communication

8.1 Protocol data units

Different PDU formats are defined for the PDCP protocol, one not introducing any overhead to the (compressed) PDCP SDU, others introducing such overhead.

8.2 Formats

A PDCP PDU shall be a multiple of 8 bits, if the RLC entity is configured for unacknowledged or acknowledged mode. Otherwise, if the RLC entity is configured for transparent mode, it is bit-aligned. In Tables 4, 5 and 6, bit strings are represented as follows: the first bit is the leftmost one on the first line of the table, the last bit is the rightmost on the last line of the table, and more generally the bit string is to be read from left to right and then in the reading order of the lines.

SDUs are bit strings, with any non-null length. If not compressed within PDCP an SDU is included from first bit onward.

8.2.1 PDCP-No-Header PDU

The PDCP-No-Header PDU does not introduce any overhead to the PDCP SDU. The use of the PDCP-No-hHeader PDU is configured by the upper layer.

The format of the PDCP-No-Header PDU is shown in Table 4.

Table 4: PDCP-No-Header PDU

Data

8.2.2 PDCP Data PDU

The PDCP Data PDU is used to convey:

- data containing an uncompressed PDCP SDU; or

- header compression related control signalling; or

- data that has been obtained from PDCP SDU after header compression.

The format of the PDCP Data PDU is shown in Table 5.

Table 5: PDCP Data PDU format

PDU type	PID
Data	

8.2.3 PDCP SeqNum PDU

The PDCP SeqNum PDU is used to convey a PDCP SDU sequence number and:

- data containing an uncompressed PDCP SDU; or

- ~~header compression related control signalling; or~~

- data that has been obtained from PDCP SDU after header compression.

The format of the PDCP SeqNum PDU is shown in Table 6.

Table 6: PDCP SeqNum PDU format

PDU type	PID
Sequence number	
Data	

CR-Form-v4

CHANGE REQUEST

| ⌘ | **25.323** CR **038** | ⌘ | rev | **-** | ⌘ | Current version: | **4.2.0** | ⌘ |

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Proposed change affects: ⌘   (U)SIM ☐   ME/UE **X**   Radio Access Network **X**   Core Network ☐

Title: ⌘	General PDCP corrections	
Source: ⌘	TSG-RAN WG2	
Work item code: ⌘	TEI	***Date:*** ⌘ 28 November 2001

Category: ⌘ **A**	***Release:*** ⌘ REL-4

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Reason for change: ⌘	1. The recent 23.060 says, "When the SRNS changes, the old RNS forwards all received and not yet transferred downlink GTP-PDUs to the target RNS. GTP-PDUs forwarded to the target RNS indicate a PDCP sequence number if the contained N-PDUs were sent to the MS as a PDCP-SDUs, but are not yet acknowledged by lossless PDCP." Therefore, during the SRNS relocation, the transmitted but not yet acknowledged PDCP SDUs should be forwarded together with their PDCP sequence numbers, while the not yet transmitted PDCP SDUs should be forwarded alone. In this way, the target PDCP can know whether a received PDCP SDU is an unconfirmed SDU or an unsent SDU. 2. From the same reason above, the target PDCP can determine the valid range of the DL_Receive PDCP sequence number which is received from UE. Since the validity check problem is solved, it is better to specify SN synchronization procedure for the UTRAN side. 3. Since header compression related control signalling is not related to the PDCP SDU, it does not have PDCP sequence number. Thus, header compression related control signalling should not be included in the PDCP SeqNum PDU.

Summary of change: ⌘	1. What shall be forwarded from source to target RNC is clarified.
	2. The validity check of the Receive PDCP sequence number is now applied both for the UE and UTRAN side.
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	  - For UTRAN side, "shall" is changed to "should" (5.4.1.1, 5.4.1.2, 5.4.1.3).
	
	  - The word "successfully" is removed in 5.4.1.

		Isolated Impact Analysis This CR only affects the lossless SRNS Relocation procedure; only the function to be corrected is affected. Thus this CR has an isolated impact. The change would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.	
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Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	25.323 v3.6.0, CR 037r1
Other comments:	⌘			

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5.4   SRNS Relocation

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-    Configured compression parameters remain valid during re-initialisation.

-    All compression state information is initialised, e.g. header compression contexts. Therefore, the first 'compressed' packet type after SRNS Relocation is a full header.

-    The PDCP sequence numbers are not changed due to the PDCP header compression protocol re-initialisation.

5.4.1   Lossless SRNS Relocation

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5.4.1.1   PDCP Sequence Numbering

PDCP sequence numbering shall be applied when lossless SRNS Relocation is ~~to be~~ supported. PDCP Sequence Numbers serve to acknowledge previously ~~sent~~transmitted PDCP SDUs prior to relocation. The value of the PDCP sequence number ranges from 0 to 65535. The PDCP SN window size indicates the maximum number of PDCP SDUS, not confirmed to have been successfully transmitted to the peer entity by lower layer, that can be numbered at any given time. The PDCP SN window size is configured by upper layers. PDCP sequence numbers are set to "0" when the PDCP entity is set-up for the first time.

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-    in the UE:

  -    the UL_Send PDCP sequence number shall be set to "0" for the first PDCP SDU submitted to lower layer;

  -    the UL_Send PDCP sequence number shall be incremented by "1" when a PDCP SDU is submitted to lower layer;

  -    the DL_Receive PDCP sequence number ~~is~~shall be set to "0" for the first ~~received~~ PDCP SDU received from lower layer;

  -    the DL_Receive PDCP sequence number ~~is~~shall be incremented by "1" when a PDCP ~~Data~~ SDU is received from lower layer.

-    in the UTRAN:

  -    the DL_Send PDCP sequence number ~~shall~~should be set to "0" for the first PDCP SDU submitted to lower layer;

  -    the DL_Send PDCP sequence number ~~shall~~should be incremented by "1" when a PDCP SDU is submitted to lower layer;

  -    the UL_Receive PDCP sequence number ~~shall~~should be set to "0" for the first ~~received~~ PDCP SDU received from lower layer;

  -    the UL_Receive PDCP sequence number ~~is~~should be incremented by "1" when a PDCP ~~Data~~ SDU is received from lower layer.

PDCP sequence numbers shall not be decremented in a PDCP entity.

5.4.1.2 PDCP Sequence Number synchronization

For radio bearers that are configured to support lossless SRNS Relocation, the PDCP entity shall:

- if upper layer indicates to a PDCP entity that it should synchronise the PDCP SN following a RLC reset or RB reconfiguration; ~~and~~or

- if the UE/UTRAN PDCP entity receives an invalid "next expected UL/DL Receive PDCP ~~S~~sequence ~~N~~number" ~~for~~from upper layer after Relocation:

    - trigger the PDCP SN ~~S~~synchronization procedure ~~of PDCP SN~~ by submitting one PDCP SeqNum PDU to lower layer;

    - consider that the synchronisation procedure is complete on confirmation by lower layer of the successful transmission of the PDCP SeqNum PDU.

In the UE/UTRAN, the "next expected UL/DL Receive ~~SN~~ PDCP sequence number" is considered invalid if its value is less than the Send PDCP SN of the first ~~sent~~transmitted but ~~un~~not yet acknowledged PDCP SDU or greater than that of the first unsent PDCP SDU.

On receiving a PDCP SeqNum PDU~~, the PDCP entity shall~~:

- the UE PDCP entity shall set the value of the DL Receive PDCP sequence number ~~(i.e. UL Receive or DL Receive)~~ to the value indicated in the PDCP SeqNum PDU.

- the UTRAN PDCP entity should set the value of the UL Receive PDCP sequence number to the value indicated in the PDCP SeqNum PDU.

5.4.1.3 Sequence Number and Data Forwarding

In case of a lossless SRNS Relocation procedure, as described in [1]:

- the UTRAN should send to the UE the ~~next expected~~ UL Receive PDCP ~~S~~sequence ~~N~~number; and

- the UE shall send to the UTRAN the ~~next expected~~ DL Receive PDCP ~~S~~sequence ~~N~~number.

This information exchange synchronises the Sequence Numbers at the UE and UTRAN PDCP entities.

When requested by the upper layer, for each radio bearer configured to support lossless SRNS Relocation, the PDCP sublayer in the source RNC should forward the following to the target RNC:

- the Receive PDCP SN~~Sequence Number~~ of the next PDCP SDU expected to be received from the UE;

- the Send PDCP SN~~sequence number~~ of the first transmitted but not yet acknowledged PDCP SDU ~~forwarded to the target SRNC~~;

- the transmitted but not yet acknowledged PDCP SDUs together with their related Send PDCP SNs;~~not confirmed to have been received by the peer PDCP entity.~~

- the not yet transmitted PDCP SDUs.

6 Services

6.1 Services provided to upper layers

The following services are provided by PDCP to upper layers:

- transfer of user data;

- maintenance of PDCP ~~P~~SDU sequence numbers.

6.2   Services expected from RLC layer

For a detailed description of the following functions see [5].

- transparent data transfer Service;

- unacknowledged data transfer Service;

- acknowledged data transfer Service.

7   Elements for layer-to-layer communication

The interaction between the PDCP layer and other layers are described in terms of primitives where the primitives represent the logical exchange of information and control between the PDCP layer and other layers. The primitives shall not specify or constrain implementations.

7.1   Primitives between PDCP and upper layers

The primitives between PDCP and upper layers are shown in Table 5.

Table 5: Primitives between PDCP and upper layers

Generic Name	Parameter			
	Req.	Ind.	Resp.	Conf.
PDCP-DATA	Data	Data	Not Defined	Not Defined
CPDCP-CONFIG	PDCP-Info, RLC-SAP SN_Sync, R/I	Not Defined	Not Defined	Not Defined
CPDCP-RELEASE	RLC-SAP	Not Defined	Not Defined	Not Defined
CPDCP-SN	PDCP SN	Not Defined	Not Defined	Not Defined
CPDCP-RELOC	Receive_SN	Not Defined	Not Defined	Receive_SN, Send_SN

Each Primitive is defined as follows:

a) PDCP-DATA-Req./Ind.

- PDCP-DATA-Req is used by upper user-plane protocol layers to request a transmission of upper layer PDU. PDCP-DATA-Ind is used to deliver PDCP SDU that has been received to upper user plane protocol layers.

b) CPDCP-CONFIG-Req.

- CPDCP-CONFIG Req is used to configure and – in case of already existing PDCP entity – to reconfigure a PDCP entity and to assign it to the radio bearer associated with that entity.

c) CPDCP-RELEASE-Req.

- CPDCP-RELEASE-Req is used by upper layers to release a PDCP entity.

d) CPDCP-SN-Req.

- This primitive is used at the UTRAN. CPDCP-SN-Req is used to transfer the PDCP SN to PDCP.

e) CPDCP-RELOC-Req/Conf.

- CPDCP-RELOC-Req initiates the SRNS Relocation procedure in PDCP for those radio bearers that are configured to support lossless SRNS Relocation. The Receive_SN is only included at the UE side.

- CPDCP-RELOC-Conf is used to transfer the Receive_SN and/or Send_SN to upper layers for lossless SRNS Relocation. The Send_SN is only included at the source RNC.

The following parameters are used in the primitives:

1) PDCP-Info:

    - Contains the parameters for each of the header compression protocols configured to be used by one PDCP entity.

2) RLC-SAP:

    - The RLC-SAP (TM/UM/AM) used by PDCP entity when communicating with RLC sublayer.

3) SN_Sync:

    - Indicates that PDCP should start PDCP SNsequence number synchronization procedure.

4) Send_SN:

    - The sSend PDCP SNsequence number of the next PDCP SDU to be sent. There is one in the uplink (UL_Send_SN) and one in the downlink (DL_Send_SN). Refer to subclause 5.4.1.

5) Receive_SN:

    - The rReceive PDCP SNsequence number of the next PDCP SDU expected to be received. There is one in the uplink (UL_Receive_SN) and one in the downlink (DL_Receive_SN). Refer to subclause 5.4.1.

6) PDCP SN:

    - This includes a PDCP sequence number.

7) R/I:

    - Indicates that PDCP should Re-initialise/Initialise the header compression protocols.

8 Elements for peer-to-peer communication

8.1 Protocol data units

Different PDU formats are defined for the PDCP protocol, one not introducing any overhead to the (compressed) PDCP SDU, others introducing such overhead.

8.2 Formats

A PDCP PDU shall be a multiple of 8 bits, if the RLC entity is configured for unacknowledged or acknowledged mode. Otherwise, if the RLC entity is configured for transparent mode, it is bit-aligned. In Tables 6, 7 and 8, bit strings are represented as follows: the first bit is the leftmost one on the first line of the table, the last bit is the rightmost on the last line of the table, and more generally the bit string is to be read from left to right and then in the reading order of the lines.

SDUs are bit strings, with any non-null length. If not compressed within PDCP an SDU is included from first bit onward.

8.2.1 PDCP-No-Header PDU

The PDCP-No-Header PDU does not introduce any overhead to the PDCP SDU. The use of the PDCP-No-hHeader PDU is configured by the upper layer.

The format of the PDCP-No-Header PDU is shown in Table 6.

Table 6: PDCP-No-Header PDU

Data

8.2.2 PDCP Data PDU

The PDCP Data PDU is used to convey:

- data containing an uncompressed PDCP SDU; or

- header compression related control signalling; or

- data that has been obtained from PDCP SDU after header compression.

The format of the PDCP Data PDU is shown in Table 7.

Table 7: PDCP Data PDU format

PDU type	PID
Data	

8.2.3 PDCP SeqNum PDU

The PDCP SeqNum PDU is used to convey a PDCP SDU sequence number and:

- data containing an uncompressed PDCP SDU; or

- ~~header compression related control signalling; or~~

- data that has been obtained from PDCP SDU after header compression.

The format of the PDCP SeqNum PDU is shown in Table 8.

Table 8: PDCP SeqNum PDU format

PDU type	PID
Sequence number	
Data	