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Technical Specification

Broadband Radio Access Networks (BRAN);
HIPERACCESS;
Cell based Convergence Layer;
Part 1: Common Part

Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Broadband Radio Access Networks (BRAN).

The present document defines the functionality required for the support of cell based services (ATM) over HIgh PErformance Radio Local Area Network Type 2 (HIPERACCESS) [3]. Separate ETSI documents provide details on the system overview, physical layer, data link control layer, other convergence sublayers and conformance testing requirements for HIPERACCESS.

The Cell based Convergence Layer is split into several parts. Part 1, Common Part, describes the functionality for mapping ATM cells into data units used at the Data Link Control (DLC) layer [1]. Further parts, each defining a Service Specific Convergence Sublayer (SSCS), describe the control plane functionality required to support a specific signalling protocol, e.g. ATMFs M-UNI protocol (see annex E). It is envisioned that several, independent, service specific parts will be added as market requirements develop in the future.

The present document is part 1 of a multi-part deliverable covering the HIPERACCESS; Cell based Convergence Layer, as identified below:

Part 1: "Common part";

Part 2: "UNI Service Specific Convergence Sublayer (SSCS)".

Further parts may be added in the future.

1 Scope

The present document describes the basic transport of ATM cell streams via HIPERACCESS. The mapping between ATM cells and HIPERACCESS DLC PDUs is specified.

The present document does only address the functionality required to transfer ATM cells over the radio interface between a HIPERACCESS Access Point and Access Terminal. It does not address the requirements and technical characteristics for wired network interfaces at the Access Point and at the Access Terminal.

The Cell based Convergence Layer consists of a Common Part Convergence Sublayer, defined in the present document, and several Service Specific Convergence Sublayers (SSCS), which are defined in separate documents. The Service Specific Convergence Sublayers all use services provided by the Common Part Convergence Sublayer and the HIPERACCESS Data Link Control (DLC) layer [1].

The present document does not address the requirements and technical characteristics for conformance testing. These are covered by separate documents.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI TS 102 000: "Broadband Radio Access Networks (BRAN); HIPERACCESS; DLC protocol specification".

[2] ITU-T Recommendation I.361: "B-ISDN ATM layer specification".

[3] ETSI TR 101 378: "Broadband Radio Access Networks (BRAN); Common ETSI -ATM Forum reference model for Wireless ATM Access Systems (WACS)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Protocol Data Unit (PDU): data unit exchanged between entities at the same ISO layer

Service Data Unit (SDU): data unit exchanged between adjacent ISO layers

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AP	Access Point
AT	Access Terminal
ATM	Asynchronous Transfer Mode
CL	Convergence Layer
CLP	Cell Loss Priority

CPCS	Common Part Convergence Sublayer
DLC	Data Link Control
GFC	Generic Flow Control
HA	HiperAccess
HEC	Header Error Control
LAN	Local Area Network
LSB	Least Significant Bit
MSB	Most Significant Bit
NNI	Network Node Interface
OAM	Operation And Management
PDU	Protocol Data Unit
PTI	Payload Type Identifier
SDU	Service Data Unit
SSCS	Service Specific Convergence Sublayer
UNI	User Network Interface
M-UNI	User Network Interface + Mobility Extension
VC	Virtual Channel
VCI	Virtual Channel Identifier
VP	Virtual Path
VPI	Virtual Path Identifier

4 Convergence Layer architecture

The Convergence Layer (CL) resides on top of the Data Link Control (DLC) layer. The task of this Convergence Layer is to adapt the service requirements of ATM to the services offered by the HIPERACCESS DLC layer.

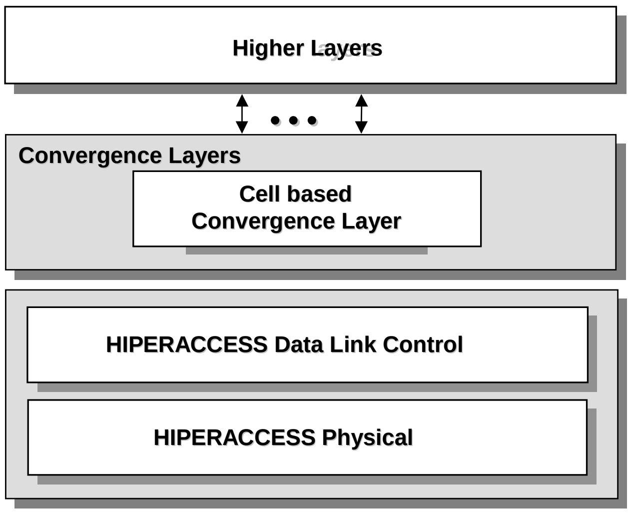


Figure 4.1: HIPERACCESS Convergence Layers

5 Cell based Convergence Layer

5.1 General

The Cell based Convergence Layer provides the capability to transfer User Service Data Units (User SDUs), that correspond to an ATM cell, transparently between users of the Convergence Layer. The Cell based CL itself consists of two parts, a Common Part Convergence Sublayer (CPCS) and a Service Specific Convergence Sublayer (SSCS). It is intended that several different Service Specific Convergence Sublayers will be specified within BRAN. An Access Point may support several SSCSs simultaneously. The CPCS describes the user plane functionality, i.e. how the information contained in an ATM cell is mapped into a HIPERACCESS DLC transport unit (SDU) and vice versa. The Convergence Layer performs the adaptation between the User SDU and the DLC-SDU.

The SSCS defines the mapping of Control Plane procedures for connection between HIPERACCESS and the ATM specific control plane.

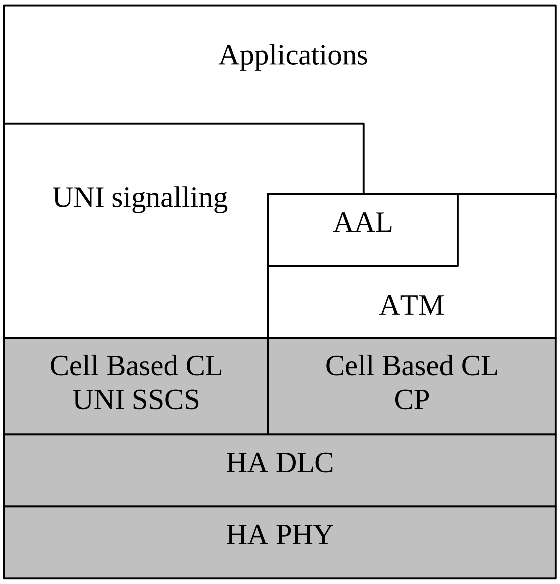


Figure 5.1: Protocol profile for Cell based Convergence Layer on ATM data transport (scope of HIPERACCESS specifications shaded in grey)

Figure 5.1 shows a protocol profile for the Cell based Convergence Layer that uses ATM for basic data transport. The application interfaces with the ATM user plane comprising of ATM AAL, ATM layer and the ATM control plane using the UNI signalling protocols. If needed, UNI signalling messages are encapsulated into AAL5 frames, which are segmented into ATM cells for further transport. The Common Part Convergence Sublayer of the Cell based CL adapts the ATM cell format to the DLC-SDU of HA. The ATM control plane functionality, like connection control, is handled by the UNI signalling protocols. The UNI Service Specific Part of the Cell based CL translates UNI control plane functions into the corresponding HA control plane functions.

5.2 Primitives (informative)

The Common Part Convergence Sublayer exchanges service primitives with the Higher Layer and the DLC.

NOTE: The primitives are defined only for the purpose of describing layer-to-layer and sublayer-to-sublayer interactions. These primitives are defined as an abstract list of parameters, and their concrete realization may vary between implementations. No formal testing of primitives is intended. The following primitive definitions have no normative significance.

5.2.1 Primitive types

Interface between layers

Four primitive types may be used between different layers:

- _req (request), for a higher layer to request service from a lower layer;
- _cnf (confirm), for the layer providing the service to confirm the activity has been completed;
- _ind (indication), for a layer providing service to notify the next higher layer of any specific service related activity;
- _rsp (response), for a layer to acknowledge receipt of an indication primitive from the next lower layer.

5.3 Common Part Convergence Sublayer

5.3.1 Functional Model

The Higher Layer exchanges CL-SDUs (which correspond to ATM cells) with the Cell based Convergence Layer. Upon transmission the Cell based Convergence Layer shall map the ATM payload and header information into a DLC-SDU, which shall be subsequently passed to the HIPERACCESS DLC layer for transmission to the peer-entity. Upon reception a DLC-SDU shall be passed to the Cell based Convergence Layer where a CL-SDU is reconstructed and passed to the Higher Layer. Figure 5.2 shows the primitives between CL and Higher Level and primitives between CL and DLC layer that are used for further reference.

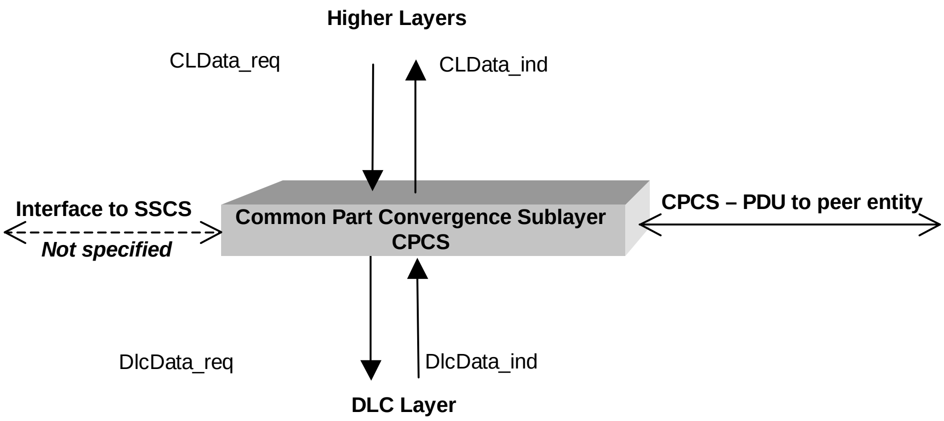


Figure 5.2: Cell based Convergence Layer User Plane model

5.3.2 Primitives

The following primitives are used:

CLData {req, ind}

PARAMETER	Req	Ind
Message units (possible elements)		
Virtual Path Identifier (VPI)	A	A
Virtual Channel Identifier (VCI)	A	A
Cell Loss Priority (CLP)	A	A
Payload Type Identifier (PTI)	A	A
Payload data	A	A
NOTE: A = Always present.		

Virtual Path Identifier (VPI): this parameter specifies an 8 bit Virtual Path Identifier in case of UNI or a 12 bit Virtual Path Identifier in case of NNI.

Virtual Channel Identifier (VCI): this parameter specifies a 16 bit Virtual Channel Identifier as it is defined in [2].

Cell Loss Priority (CLP): this 1 bit parameter specifies the cell loss priority as it is defined in [2].

Payload Type Identifier (PTI): this parameter specifies a 3-bit payload type as it is defined in [2].

Payload data: the 48 octet user data.

The above mentioned parameters are defined for an ATM cell, see also annex B. The ATM GFC field has only local meanings and it needs not to be transmitted over the air interface.

5.3.3 Procedures

5.3.3.1 General

The procedures defined in the following clauses are symmetric with respect to the direction. The description is valid for both the AT and the AP.

5.3.3.2 Procedures at the receiver

The receiver maintains the mapping between CID and the ATM connection identifiers (VPI, VCI) for each active DLC connection. The ATM VCI field is always transparently carried by CPCS-PDU. The SSCS shall configure the mapping for each ATM connection.

A CLData indication primitive shall be formed and passed to the Higher Layer once a CPCS-PDU is received from the peer-entity.

A received CPCS-PDU with a non-configured mapping for the CID and the VCI field of the CPCS-PDU shall be discarded.

The CL expects an in-sequence data transfer service from the DLC.

The format of the CPCS-PDU is shown in figure 5.3.

5.3.3.3 Procedures at the sender

The sender maintains the mapping between the ATM connection identifiers (VPI, VCI) and CID for each active CID. The ATM VCI field is always transparently carried by CPCS-PDU. The SSCS shall configure the mapping for each ATM connection.

The service user invokes the transmission service with a CLData request primitive. A CPCS-PDU is constructed as described in clause 5.5.3 and passed within a DlcData request primitive to the DLC layer.

A CPCS-PDU shall only be constructed and passed to the DLC layer as part of the CLData request primitive if the mapping for the VPI, VCI exists.

5.4 Interface to the DLC

The DLC primitives are specified in the DLC specification [1]. The CL expects an in-sequence delivery data transfer service from the DLC. The format of the CPCS-PDU (which is equivalent to the DLC-SDU) is shown in figure 5.3.

5.5 Functionality

5.5.1 General

The CPCS functions are performed per CPCS-PDU. The function implemented by the CPCS comprises the transfer of User-data.

This function is used for the conveyance of fixed length user data between users of the Convergence Layer.

5.5.2 Rules for connection mapping

The following rules apply:

1) VCI, PTI and CLP fields from a CLData request primitive shall be copied into the corresponding field of the DlcData primitive.

2) In case of VC switching, each ATM connection shall have assigned a unique CID. In case of VP switching all ATM connection with the same VPI will have assigned the same CID.

3) The mapping specified in the second bullet shall be configured upon connection set-up and shall not change during the lifetime of an ATM connection.

4) The mapping specified in the second bullet should be cleared once the connection is released. The freed combination of <CID, VCI field of CPSC-PDU> can be re-used for new ATM connections.

5) Upon transmission the pair <VPI, VCI> that is conveyed in a CLData request primitive maps into a unique combination of CID and VCI of the CPCS-PDU.

6) Upon reception of a CPCS-PDU the corresponding CID and the VCI that is part of the CPCS-PDU map into a unique pair of <VPI, VCI>. The <VPI, VCI> values are inserted in the CLData indication primitive that is sent to the Higher Layer. The CID references the DLC connection where the CPCS-PDU was received.

7) The HEC field that is part of an ATM cell shall not be transmitted via HIPERACCESS. The Convergence Layer shall compute the HEC for the received SDU.

8) The GFC field that is part of an ATM cell shall not be transmitted via HIPERACCESS. Any information that is conveyed in the GFC field is lost.

9) The <VPI, VCI> pair at the receiver shall be the same as the <VPI, VCI> pair at the sender. Any re-mapping is performed outside the Convergence Layer.

5.5.3 Coding of the CPCS-PDU

The CPCS-PDU has a length of 408 bits. It consists of 4 reserved bits (4 bits), a VCI (16 bits), a PTI (3 bits), a CLP (1 bit) and a payload field of 48 x 8 bits. The size and the position of the fields of the CPCS-PDU structure are given in figure 5.3. For coding conventions see also clause A.1.

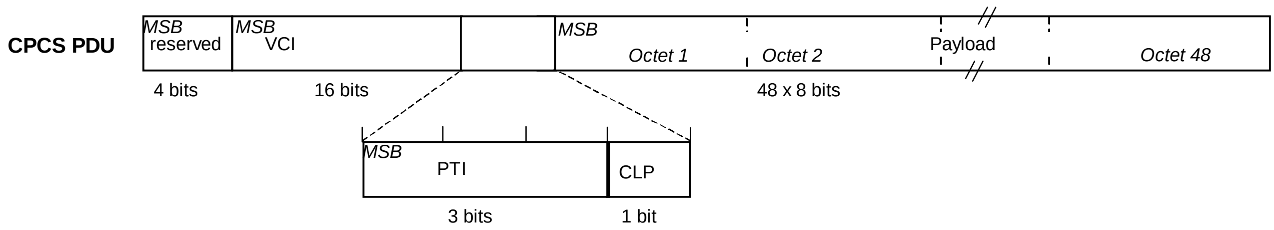


Figure 5.3: CPCS-PDU

reserved: the 4-bit are reserved. Shall be set equal to zero.

VCI: the 16-bit filed contains the ATM VCI as it is defined in [2].

PTI: the 3-bit filed contains the ATM PTI as it is defined in [2].

CLP: the 1-bit filed contains the ATM CLP as it is defined in [2].

Payload: the payload field contains the 48 x 8-bit payload.

Annex A (normative): Numbering and Coding Conventions

PDUs are transferred between the Cell based Convergence Sublayer and the underlying protocol layers in units of octets, in ascending numerical octet order (i.e. octet 1, 2, .., n-1, n), see figure A.1.

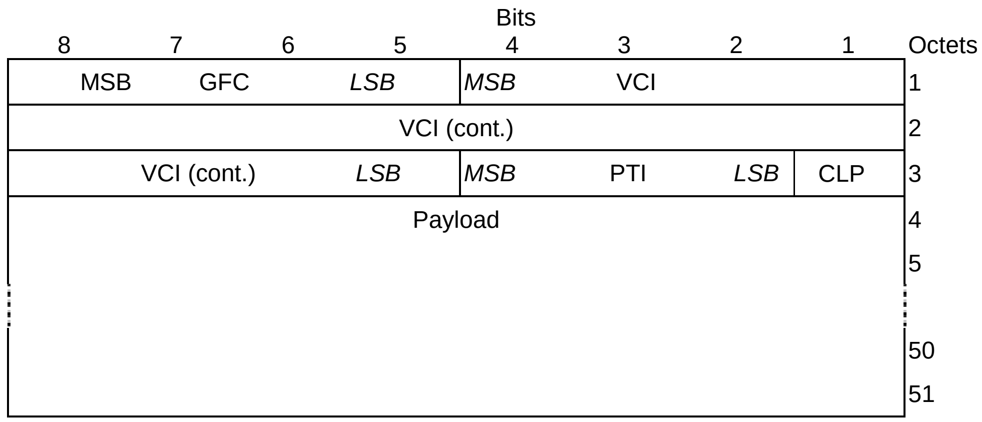
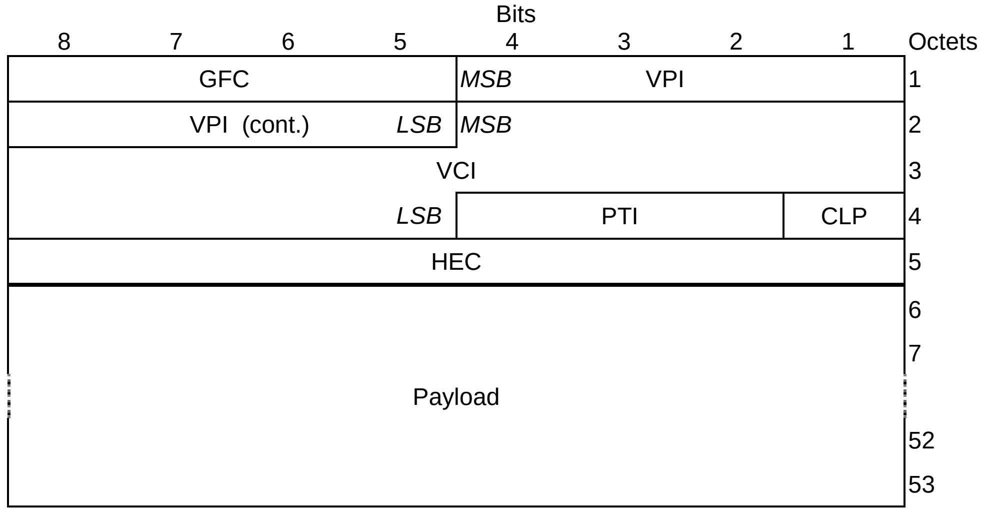


Figure A.1: CPCS PDU

When a field is contained within a single octet, the highest bit number (i.e. the bit labelled 8) represents the high order or Most Significant Bit (MSB).

Annex B (informative): ATM-cell format

The generic format of the ATM cell that is used for reference is depicted in figure A.1. The ATM cell header has 5 octets, which are used for Virtual Path Identifier (VPI), Virtual Channel Identifier (VCI), Payload Type Identifier (PTI), Cell Loss Priority (CLP), and Header Error Control (HEC). Figure B.1 shows the format of the ATM cell and its coding.



GFC = Generic Flow Control
VPI = Virtual Path Identifier
VCI = Virtual Channel Identifier
PTI = Payload Type Identifier

- 0xy
- x: Congestion Bit (1 if congested)
- y: User Signalling Bit (used for AAL5 SAR)
- 100 = OAM link associated cell
- 101 = OAM end-to-end associated cell
- 110 = Resource management cell
- 111 = Reserved for future use

CLP = Cell Loss Priority
HEC = Header Error Control

Figure B.1: ATM cell format

Annex C (informative): Mapping Table Example

Table C.1 illustrates an example for mapping between ATM connection identifiers (VPI, VCI) and HIPERACCESS identifiers (CID) for a given the DLC User connection. The mappings for multiple connections are stored in a mapping table that is configured by the SSCS during connection setup.

Upon transmission the VPI, VCI values that are passed in the CLData request primitive index the mapping table whenever a service primitive is invoked. The CID identifies the DLC connection the PDU shall be sent on. As illustrated in the example (table C.1), ATM connections with VPI/VCI = 0/1, VPI/VCI = 0/2, VPI/VCI = 1/2, and VPI/VCI = 0/3001 are mapped on the DLC connections respectively identified with CID = 1, 2, 4 and 5. Primitives with VPI = 2 are multiplexed into DLC-connection with CID = 3 (VP switching). The VCI is directly exchanged with the VCI field in the DlcData primitive, thus allowing the conveyance of VP-connections with full VCI range over HIPERACCESS.

Table C.1: Mapping table at the sender

VPI/VCI	0	1	2	3	…	255
0			CID = 3			
1	CID = 1		CID = 3			
2	CID = 2	CID = 4	CID = 3			
3			CID = 3			
:						
3001	CID = 5					
:						
65535						

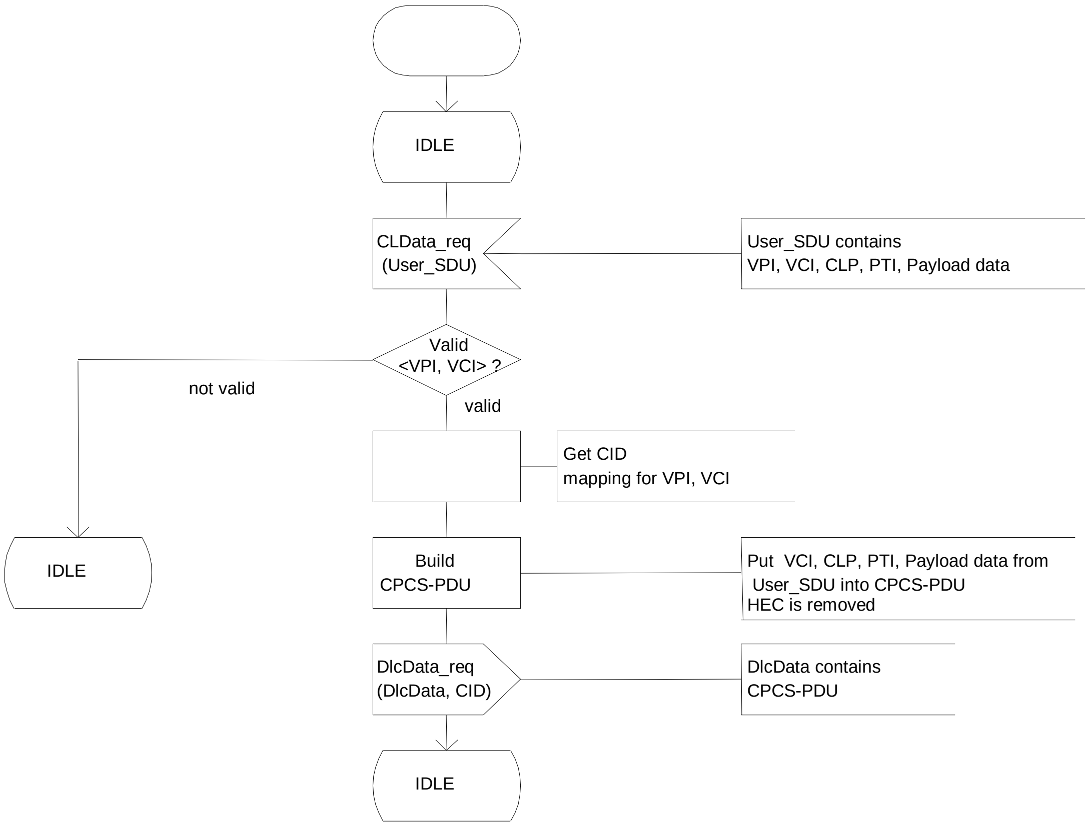
The configuration of the mapping table at the corresponding receiver is illustrated in table C.2. The CID identifies the connection the PDU was received on. CID indexes the lookup table to obtain the corresponding values for VPI which is conveyed in the CLData indication primitive.

Table C.2: Mapping table at the receiver

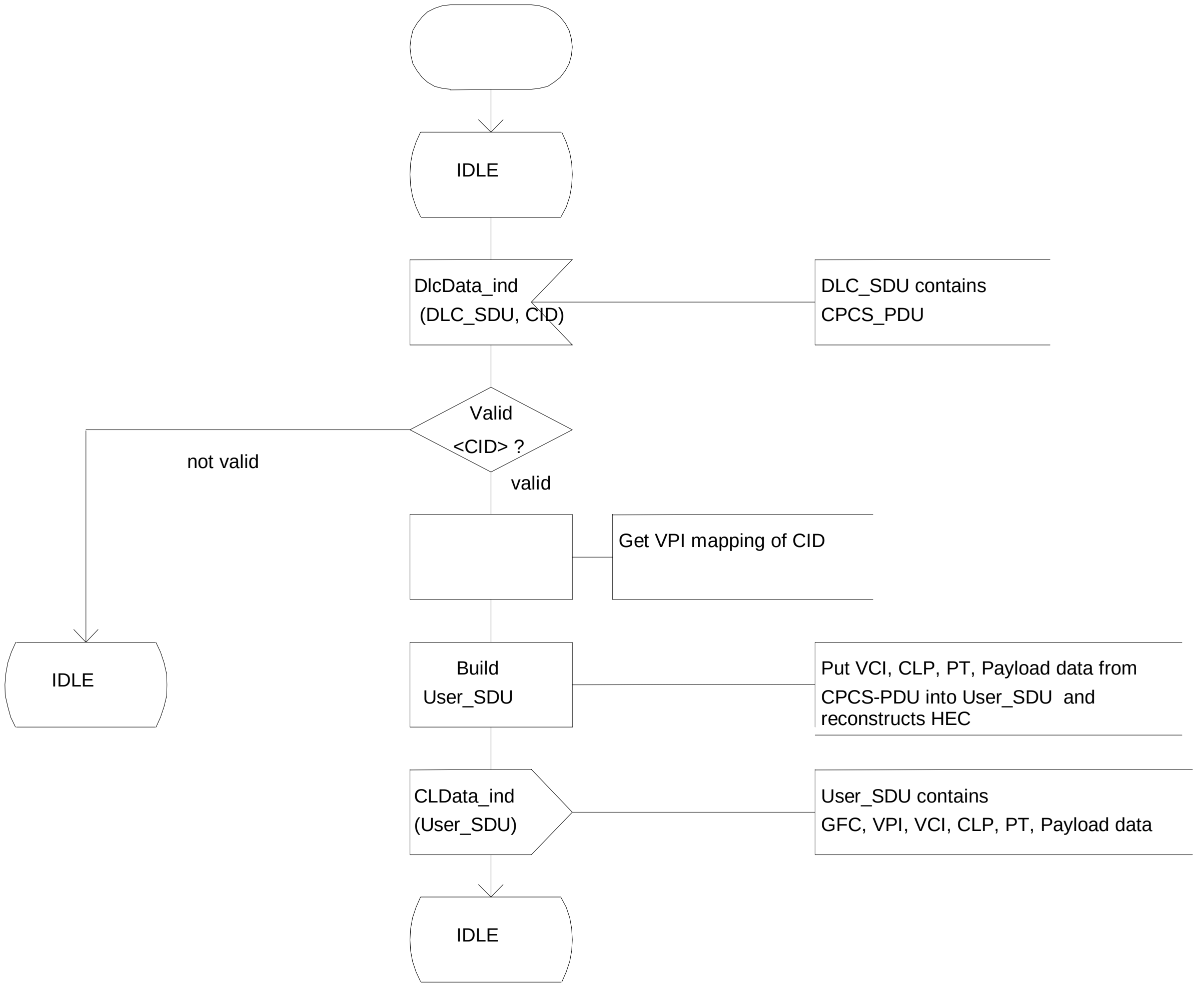
CID	VPI
0	
1	0
2	0
3	2
4	1
5	0
:	
12	
:	
65535	

Annex D (informative): SDL Diagrams

D.1 CPCS Sender



D.2 CPCS Receiver



Annex E (informative): Bibliography

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IETF RFC 1577: "Classical IP and ARP over ATM".

ATM Forum (af-lane-0084.000): "LAN Emulation over ATM Version 2 - LUNI Specification" (http://www.crihan.fr/PEPSY/1997/doc/atmf/af-lane-0084.000.pdf).

History

Document history		
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