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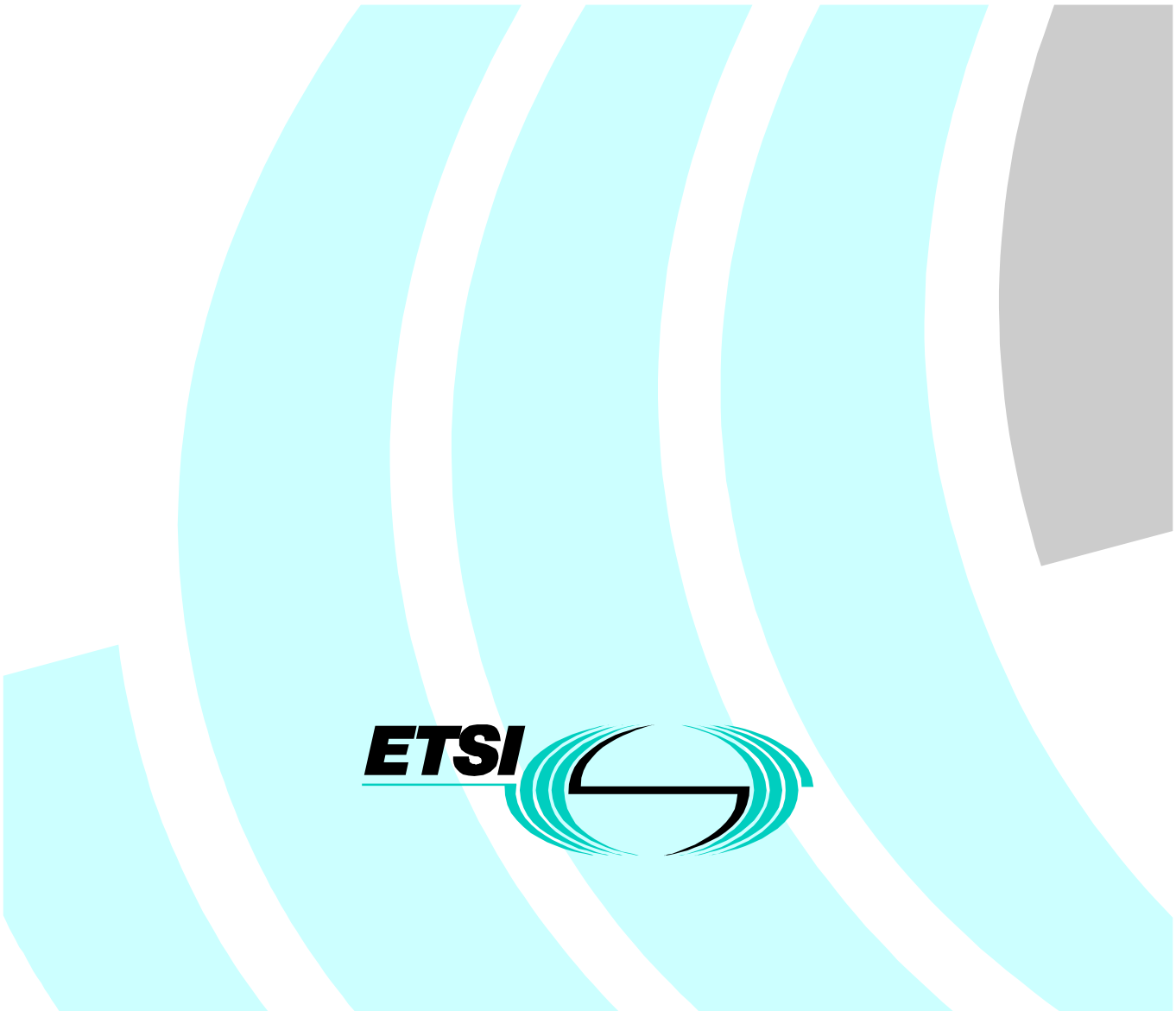
Technical Specification

Broadband Radio Access Networks (BRAN);
HIPERLAN Type 2;
Cell based Convergence Layer
Part 1: Common Part



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Contents

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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 (HIPERLAN/2) [4]. Separate ETSI documents provide details on the system overview, physical layer, data link control layer, other convergence sublayers and conformance testing requirements for HIPERLAN/2.

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. 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 Bibliography). 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 TS covering the HIPERLAN Type 2; Cell based Convergence Layer, as identified below:

Part 1: "Common part";

Part 2: "ATM-UNI Service Specific Part".

Further parts will be added in the future.

1 Scope

The present document describes the basic transport of ATM cell streams via HIPERLAN/2. The mapping between ATM cells and HIPERLAN/2 DLC PDUs is specified.

The present document is applicable to HIPERLAN/2 equipment supporting ATM cell transport.

The present document does only address the functionality required to transfer ATM cells over the radio interface between a HIPERLAN/2 Access Point and Mobile Terminal. It does not address the requirements and technical characteristics for wired network interfaces at the Access Point and at the Mobile 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 HIPERLAN/2 Data Link Control (DLC) layer.

The present document does not address the requirements and technical characteristics for type approval and 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, 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETSI TS 101 761-1: "Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Data Link Control (DLC) Layer; Part 1: Basic Data Transport Functions".

[2] ETSI TS 101 761-2: "Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Data Link Control (DLC) Layer; Part 2: Radio Link Control Protocol Basic Functions".

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

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

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

[6] ATM Forum (af-lane-0084.000): "LAN Emulation over ATM Version 2 - LUNI Specification".

3 Definitions and abbreviations

3.1 Definitions

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

HIPERLAN/2: HIgh PErformance Radio Local Area Network Type 2, a short-range wireless LAN providing broadband local access. Standardized by ETSI Project BRAN

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
ATM	Asynchronous Transfer Mode
BRAN	Broadband Radio Access Networks (Project)
CL	Convergence Layer
CLP	Cell Loss Priority
CPCS	Common Part Convergence Sublayer
DLC	Data Link Control
DLCC	DLC Connection
DUC	DLC User Connection
GFC	Generic Flow Control
HEC	Header Error Control
LAN	Local Area Metwork
LANE	LAN emulation
LSB	Least Significant Bit
MIB	Management Information Base
MSB	Most significant Bit
MT	Mobile Terminal
OAM	Operation and Management
PDU	Protocol Data Unit
PT	Payload Type
PTI	Payload Type Identifier
SAP	Service Access Point
SDU	Service Data Unit
SSCS	Service Specific Convergence Sublayer
UNI	User Network Interface
M-UNI	User Network Interface + Mobility Extension
U-SAP	User Service Access Point
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 the Convergence Layer is to adapt the service requirements of different Higher Layers to the services offered by the HIPERLAN/2 DLC layer.

Two Convergence Layers can be distinguished in BRAN, a Cell based Convergence Layer and a Packet based Convergence Layer (see figure 4.1). Further Convergence Layers may be specified in the future. The Cell based Convergence Layer offers services to Higher Layers that use the fixed size ATM cell as the transfer unit. The Packet based Convergence Layer offers services to Higher Layers that use packets or frames of variable size or fixed size which exceed the ATM cell size. Typical examples of these are Ethernet and the Internet protocol suite.

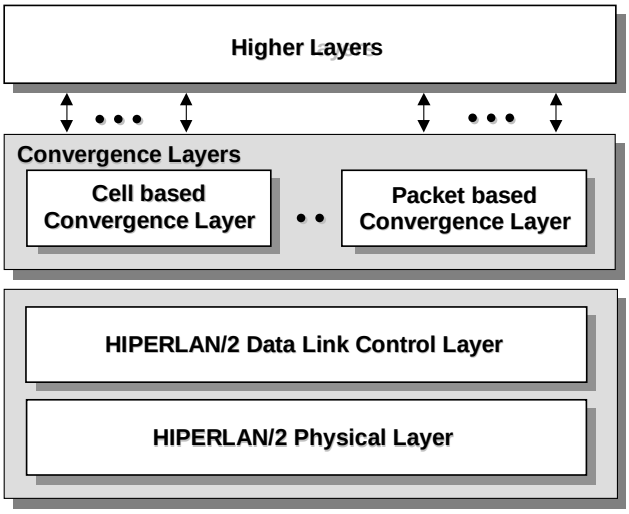


Figure 4.1: HIPERLAN/2 Convergence Layers

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 HIPERLAN/2 DLC transport unit (SDU) and vice versa. The Convergence Layer performs the adaptation between the User SDU and the DLC-SDU. User SDUs belonging to different ATM connections can be multiplexed on one DLC connection. Multiple DLC connections can be set up.

The SSCS defines the mapping of Control Plane procedures for connection and mobility management between HIPERLAN/2 and the ATM specific control plane.

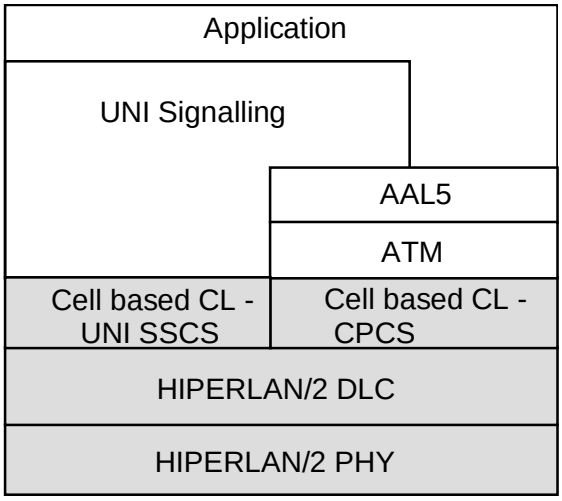


Figure 5.1: Protocol profile for Cell based Convergence Layer on Native ATM (scope of HIPERLAN/2 specifications shaded in grey)

Figure 5.1 shows a protocol profile for the Cell based Convergence Layer that uses Native ATM for basic data transport. The application interfaces with the ATM user plane comprising of AAL5 and ATM layer and the ATM control plane using the UNI signalling protocols. User plane and control plane data 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 H/2. The ATM control plane functionality, like connection control and mobility management, 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 H/2 control plane functions.

Other protocol profiles containing Classical IP over ATM [5] or LAN emulation (LANE) [6] enable to run the TCP/IP protocol suite over ATM. To provide interoperability, the protocol profile and the capabilities of the network are signalled between MT and AP upon association.

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.

5.2.2 Parameter definitions

Endpoint identifiers: some primitives contain an endpoint identifier. This identifier shall be used to distinguish primitives related to different protocol instances. As identifier the DLC User Connection ID (DUC_ID), which is the concatenation of a MAC_ID and DLCC_ID [1], shall be used. The coding of this identifier is a local matter and not defined in the present document. The identifier is defined as:

- DLC User Connection ID (DUC_ID)

Message unit: each piece of higher layer information that is included in the primitive is called a message unit. A series of one or more message units may be associated with each primitive where each separate unit is related to one information element in the corresponding DLC layer message. The list of message units is derived from the message definitions by reference to the information elements that may contain information from or to the CL.

5.3 Common Part Convergence Sublayer

5.3.1 Functional Model

The Higher Layer exchanges CL-SDUs (which correspond to an ATM cell) with the Cell based Convergence Layer. Upon transmission the Cell based Convergence Layer maps the ATM payload and header information into a DLC-SDU, which is subsequently passed to the HIPERLAN/2 DLC layer for transmission to the peer-entity. Upon reception a DLC-SDU is passed to the Cell based Convergence Layer where a CL-SDU is reconstructed and passed to the Higher Layer. The DLC User SAP forms the logical interface between those two layers. Figure 5.2 shows the primitives at CL-User SAP and the DLC User SAP that are used for further reference.

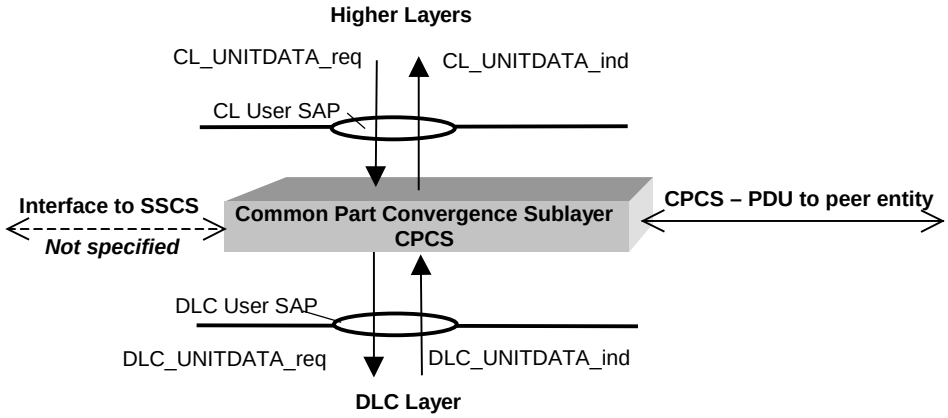


Figure 5.2: Cell based Convergence Layer User Plane model

5.3.2 Primitives at the CL-User SAP

The following primitives are used:

CL_UNITDATA {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 (PT)	A	A
Payload data	A	A
NOTE: A = Always present.		

Virtual Path Identifier (VPI): this parameter specifies an 8 bit Virtual Path Identifier.

Virtual Channel Identifier (VCI): this parameter specifies a 16 bit Virtual Channel Identifier.

Cell Loss Priority (CLP): this 1 bit parameter specifies the cell loss priority as it is defined in [3].

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

Payload data: the 48 octet user data.

The above mentioned parameters are defined for an ATM cell, see also annex B.

The primitives are passed through the CL User SAP to request the transmission of a CL-SDU (CL_UNITDATA request) or to indicate the reception of a CL-SDU to the Higher Layer (CL_UNITDATA indication).

5.3.3 Procedures

5.3.3.1 General

The procedures defined in the following subclauses are symmetric. The description is valid for both the MT and AP.

5.3.3.2 Procedures at the receiver

The receiver maintains the mapping between DLC connection identifier (DLCC_ID), CL_Tag and the ATM connection identifiers (VPI, VCI) for each active DLC connection. The SSCS shall configure the mapping for each ATM connection.

A CL_UNITDATA 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 DUC_ID (MAC_ID, DLCC_ID) and the CL_Tag shall be discarded.

The CL expects an in-sequence data transfer service from the DLC. The DLC User SAP is specified in the DLC Technical Specification [1]. 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 the combination of DLC connection identifier (DLCC_ID) and the CL_Tag for each active DUC. The SSCS shall configure the mapping for each ATM connection.

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

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

5.4 Interface to the DLC

The DLC User SAP is specified in the DLC Basic TS [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 comprise:

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) Multiple ATM connections referenced by the pair <VPI, VCI> can be multiplexed on one DLC user connection. Connections are bi-directional.

2) Each ATM connection that is multiplexed on one DLC –connection shall be assigned a unique CL_Tag. The CL_Tag is conveyed in the CPCS-PDU.

3) The mapping for the pair <VPI, VCI> and the combination of <DLCC_ID, CL_Tag> shall be configured upon connection set-up and shall not change during the lifetime of an ATM connection.

4) The mapping of the particular ATM connection identifier <VPI, VCI> into the combination of <DLCC_ID, CL_Tag> should be cleared once the connection is released. The freed combination of <DLCC_ID, CL_Tag> can be re-used for new connections.

5) Upon transmission the pair <VCI, VPI> that is conveyed in a CL_UNITDATA request primitive maps into a unique combination of DLCC_ID and CL_Tag for a given MAC_ID.

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

7) The GFC and HEC fields that are part of an ATM cell shall not be transmitted via HIPERLAN/2. It is assumed that the Higher Layer shall compute the HEC for the received SDU, if necessary. Any information that is conveyed in the HEC field is lost during the transmission via HIPERLAN/2.

8) The <VPI, VCI> pair at the receiver shall be the same as the <VPI, VCI> pair at the sender.

5.5.3 Coding of the CPCS-PDU

The CPCS-PDU has a length of 396 bits. It consists of a CL_Tag (8 bits), the CL-Flags (4 bits) 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.

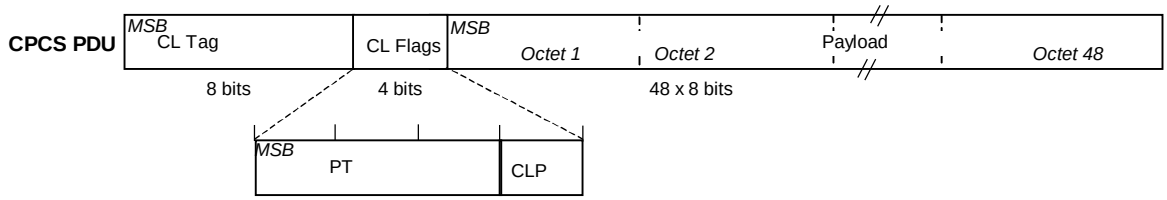


Figure 5.3: CPCS-PDU

Convergence Layer Tag: the 8-bit convergence layer tag contains additional connection multiplexing information.

Convergence Layer Flags: this 4-bit field contains the payload type (PT) and the cell loss priority bit (CLP) as it is defined in [3].

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

5.5.4 Mapping

The mapping between the <VPI, VCI> and the combination of <DUC_ID (DLCC_ID, MAC_ID), CL_Tag> is performed for each PDU. The mappings at the sender and the receiver are configured by the SSCS during the connection establishment phase and removed once the connection is released. Multiple mappings for multiple connections can be maintained simultaneously at the receiver and the transmitter. The number of supported connections and the supported identifier ranges are announced during association. Each Mobile Terminal and the Access Point shall be able to perform the mapping for the number and the Id-range of connections they announced during association. The mapping at the receiver and the transmitter shall be complementary, i.e. the <VPI, VCI> sent by the transmitter shall be restored at the receiver. An example for a mapping table that stores the mappings for multiple connections at the sender and the receiver is given in clause C.2.

Multiple ATM connections can be multiplexed on one DLC connection. The DLC connection is identified by its DLCC_ID. The CL_Tag that is part of the CPCS-PDU distinguishes between different connections. The policy for the multiplexing and the assignment of a new ATM connection to a particular DLC connection is implementation specific and out of the scope of the present document. Some values for DLCC_ID, MAC_ID are reserved and shall not be used for the conveyance of user data, see DLC Basic TS [1].

6 Convergence Layer Version

The Convergence Layer Version number is an 8-bit field used in the RLC [2]. This field is split into two 4-bit subfields. The four most significant bits (bits 5 to8) identify the version of the Common Part Convergence Sublayer and the four least significant bits (bits 1 to 4) identify the version of the SSCS. The Convergence Layer Version number shall be set according to the table below to signal the support of this edition (version 1) of the Common Part.

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 1 x x x x	Cell based CL, Common Part Convergence Sublayer version 1 supported

7 Common Part - MIB

The Management Information Base parameters for the Common Part of the Cell based Convergence Sublayer will be defined in the HIPERLAN/2 Network Management Technical Specification. These MIB parameters may be moved into this section in a future edition of the present document.

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.

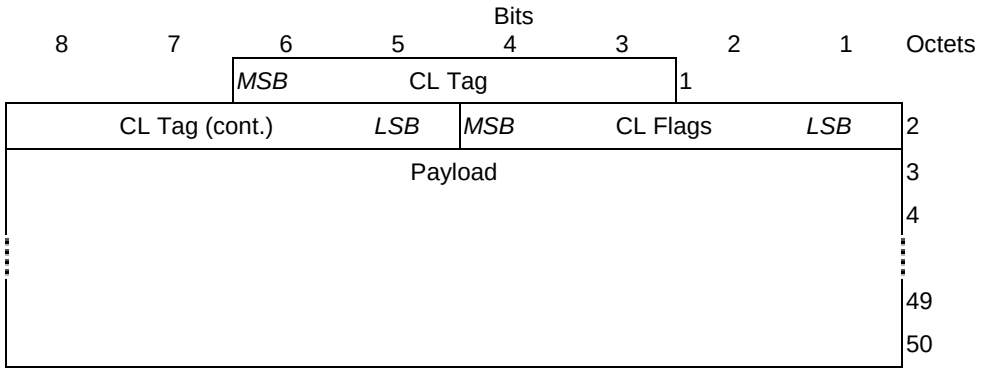


Figure A.1: CPCS PDU

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.

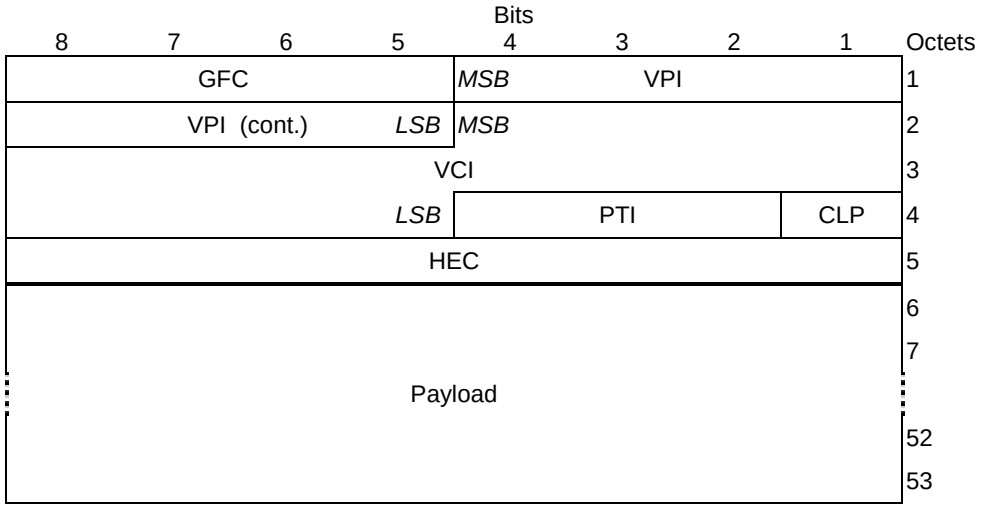


Figure B.1: ATM cell format

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

Annex C (informative): Mapping Table Example

Table C.1 illustrates an example for mapping between ATM connection identifiers (VPI, VCI) and H/2 identifiers (DLCC_ID, CL_Tag) for a given DUC. The mappings for multiple connections are stored in a mapping table that is configured by the SSCS during connection setup. Connections are bi-directional.

Upon transmission the VPI, VCI values that are passed in the CL_UNITDATA request primitive index the mapping table whenever a service primitive is invoked. The CL_Tag that is returned becomes part of the CPCS-PDU. The DLCC_ID identifies the DLC User connection the PDU should be sent on. As illustrated in the example (Table C.1), ATM connections with VPI/VCI = 0/2, VPI/VCI = 0/3, and VPI/VCI = 3/3 are multiplexed on the DLC connection identified with DLCC_ID = 2. The corresponding CL_Tags are 3, 4, and 12. Primitives with VPI = 2 use the DLC-connection with DLCC_ID = 3. The lower 8 bits of the VCI are directly exchanged with the CL_Tag, thus allowing the conveyance of VP-connections with limited VCI range over HIPERLAN/2. The ATM connections with VPI/VCI = 1/ 2 and 0/3001 are mapped onto the DLC-connection with DLCC_ID = 1 and the CL_Tags 0 and 255, respectively.

Table C.1: Mapping table at the sender

VPI VCI	0	1	2	3	…	255
0			DLCC_ID = 3 CL_Tag = 0			
1			DLCC_ID = 3 CL_Tag = 1			
2	DLCC_ID = 2 CL_Tag = 3	DLCC_ID = 1 CL_Tag = 0	DLCC_ID = 3 CL_Tag = 2			
3	DLCC_ID = 2 CL_Tag = 4		DLCC_ID = 3 CL_Tag = 3	DLCC_ID = 2 CL_Tag = 12		
:			DLCC_ID = 3 CL_Tag = bits 2^0 to 2^7 of VCI			
3001	DLCC_ID = 1 CL_Tag = 255					
:						
65535						

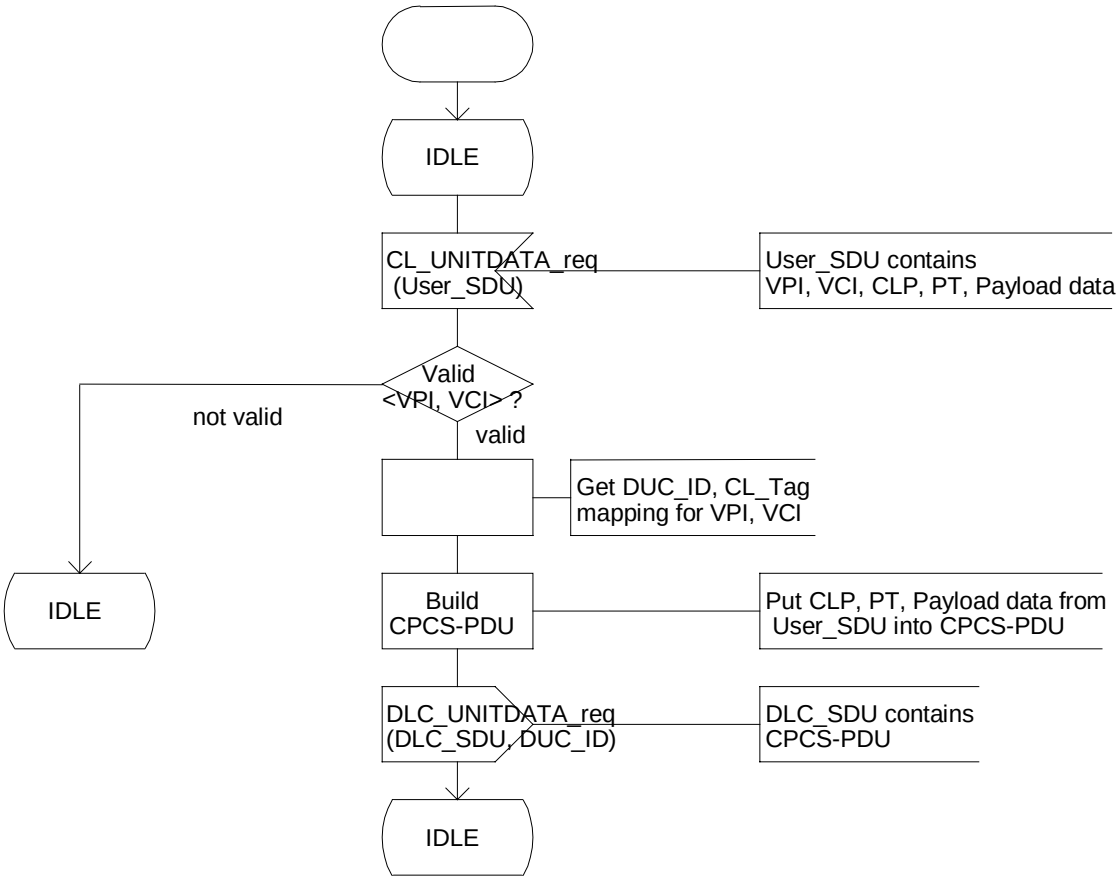
The configuration of the mapping table at the corresponding receiver is illustrated in table C.2. The DLCC_ID identifies the connection the PDU was received on and the CL_Tag that is part of the received CPCS-PDU. DLCC_ID and CL_Tag index the lookup table to obtain the corresponding values for VPI and VCI which are conveyed in the CL_UNITDATA indication primitive.

Table C.2: Mapping table at the receiver

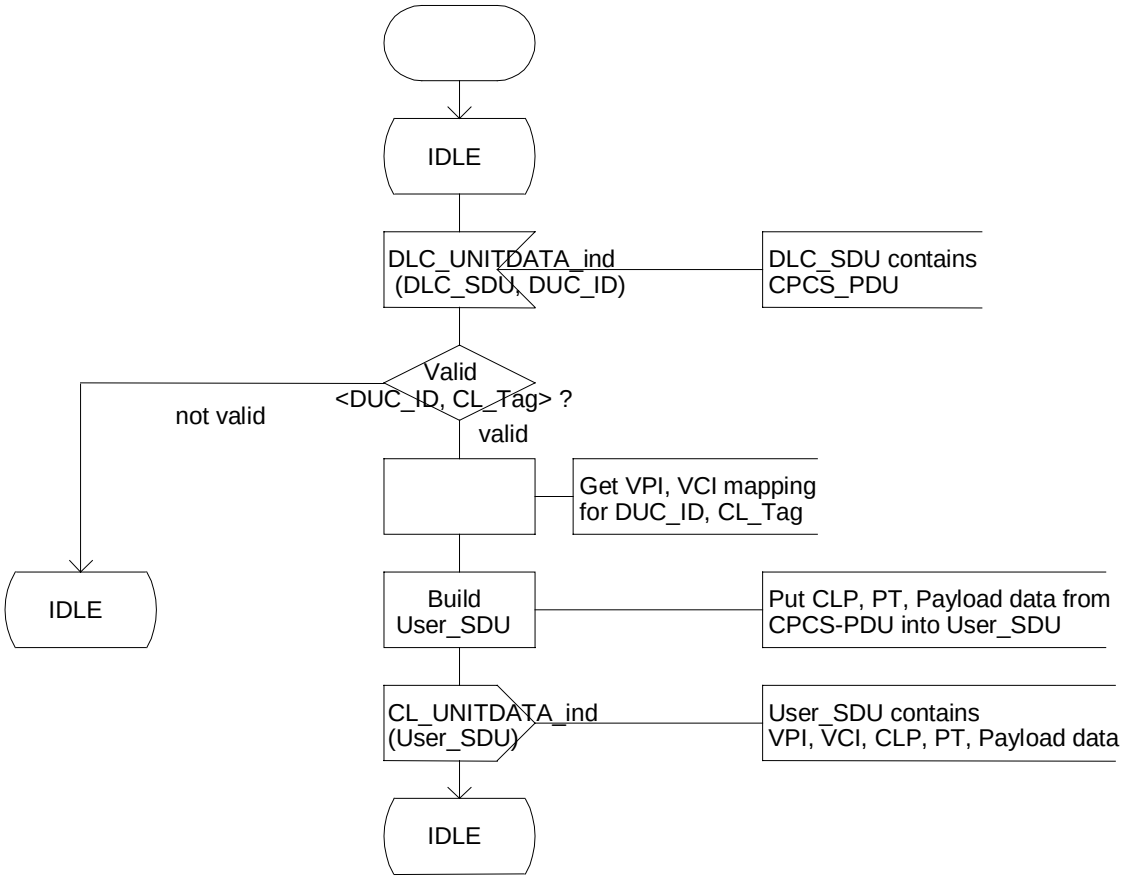
DLCC_ID CL_Tag	0	1	2	3	…	63
0		VPI = 1 VCI = 2		VPI = 2 VCI = 0		
1				VPI = 2 VCI = 1		
2				VPI = 2 VCI = 2		
3			VPI = 0 VCI = 2	VPI = 2 VCI = 3		
4			VPI = 0 VCI = 3	VPI = 2 VCI = 4		
:				VPI = 2 VCI = <CL_Tag>		
12			VPI = 3 VCI = 3	VPI = 2 VCI = 12		
:				VPI = 2 VCI = <CL_Tag>		
255		VPI = 0 VCI=3001		VPI = 2 VCI = 255		

Annex D (informative): SDL Diagrams

D.1 CPCS Sender



D.2 CPCS Receiver



Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ATM Forum (btd-watm-01.12): "Wireless ATM Capability Set 1 Specification - Draft".

History

Document history		
V1.1.1	April 2000	Publication