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Technical Specification

Broadband Radio Access Networks (BRAN);
HIPERACCESS;
Cell based Convergence Layer;
Part 2: UNI Service Specific
Convergence Sublayer (SSCS)

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Foreword

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

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 specification [3]. It is envisioned that several, independent, service specific parts will be added as market requirements develop in the future.

The present document is part 2 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)".

1 Scope

The present document describes the interworking between UNI signalling protocols and the HIPERACCESS control plane.

The present document is applicable to HIPERACCESS equipments that optionally support ATM UNI signalling according to one of the following UNI standard recommendations: ITU-T Recommendation Q.2931 [2], ATMF UNI 3.1 [3], ATMF UNI 4.0 [4] and M-UNI (see bibliography). The present document addresses only the functionality required to map ATM UNI signalling over the HIPERACCESS network, i.e. between an 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 [5] and several Service Specific Convergence Sublayers (SSCS), which are defined in separate documents. The task of the Common Part of the Cell based Convergence Layer is to map between the fixed data unit of an ATM cell and the fixed data unit size used in the HIPERACCESS DLC layer [1]. The Service Specific Convergence Sublayers all use services provided by the Common Part Convergence Sublayer [5] and the HIPERACCESS Data Link Control (DLC) layer [1].

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 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 Q.2931 (1995): "Digital Subscriber Signalling System No. 2 - User-Network Interface (UNI) layer 3 specification for basic call/connection control".

[3] ATM Forum (af-uni-0010.000): "ATM User-Network Interface Specification V2.0".

[4] ATM Forum (af-sig-0061.000): "UNI Signalling 4.0".

[5] ETSI TS 102 115-1: "Broadband Radio Access Networks (BRAN); HIPERACCESS; Cell based Convergence Layer; Part 1: Common Part".

[6] ATM Forum (af-lane-0084.000): "LANE v2.0 LUNI Interface".

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

[8] ATM Forum (af-mpoa-0114.000): "Multi-protocol Over ATM Specification, Version 1.1".

[9] IETF RFC 2364: "PPP over AAL5".

[10] IETF RFC 1755: "ATM Signalling Support for IP over ATM".

[11] ETSI TS 101 999: "Broadband Radio Access Networks (BRAN); HIPERACCESS; PHY protocol specification".

3 Definitions and abbreviations

3.1 Definitions

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

HIgh PErformance Radio ACCESS (HIPERACCESS): broadband fixed wireless access system above 11 GHz 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
AT	Access Terminal
ATM	Asynchronous Transfer Mode
BRAN	Broadband Radio Access Networks
CPCS	Common Part Convergence Sublayer
CPE	Customer Premises Equipment
DLC	Data Link Control
MPOA	Multi Protocol over ATM
PPP	Point-to-Point Protocol
RLC	Radio Link Control
SAP	Service Access Point
SSCS	Service Specific Convergence Sublayer
TE	Terminal Equipment
UNI	User Network Interface
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 HIPERACCESS DLC layer.

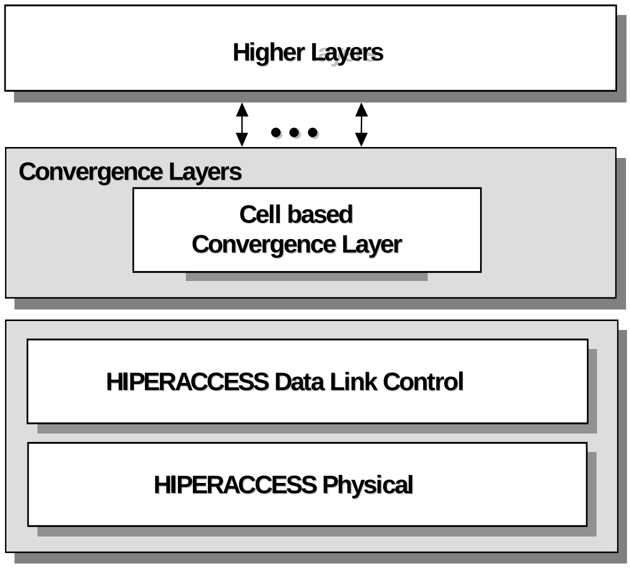

Figure 4.1: HIPERACCESS Convergence Layers

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) [5] 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 CPCS 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.

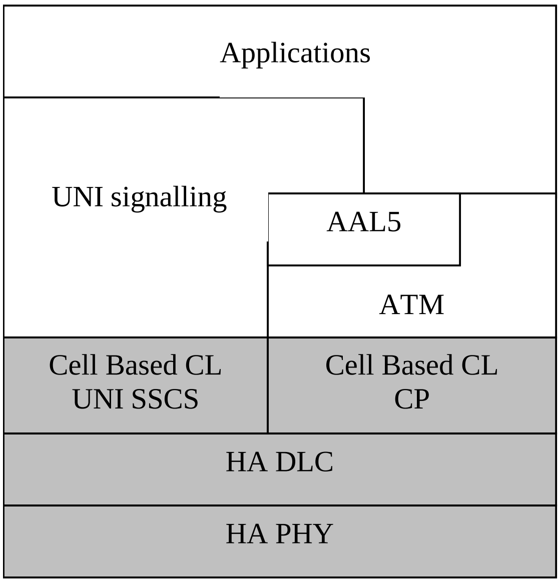

Figure 5.1: Protocol profile for Cell based Convergence Layer on ATM data transport (scope of HIPERACCESS specifications shaded in grey)

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 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 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.

The network model is shown in figure 5.2. HIPERACCESS Access Terminals (HA ATs) are attached to an ATM network via a HIPERACCESS Access Point (HA AP). The data transfer between ATs and the AP is cell based (ATM). Applications running at the AT or at the CPEs that are attached to the ATM-network communicate via ATM. Additional protocols like LANE [6], Classical IP [7] MPOA [8], or PPP [9] may be invoked by the communicating applications. These protocols use services provided by the ATM transport network and are negotiated during connection establishment phase.

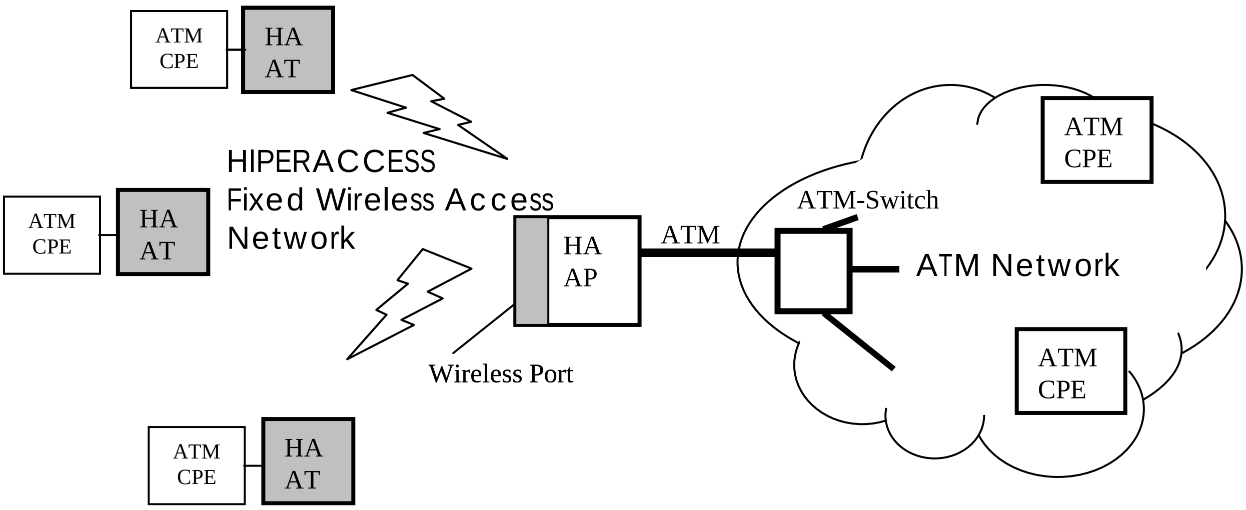

Figure 5.2: HIPERACCESS supporting ATM transport

5.2 ATM signalling interface

User-to-Network (UNI) signalling is used to dynamically establish, maintain, and terminate connections at the edge of the network between an ATM end station and a public/private network. Figure 5.3 shows the B-ISDN signalling interfaces between the private, public networks and the ATM TEs. Nevertheless, the present document concentrates on the principles of the private UNI interface between the ATM TE and the HA system - private network.

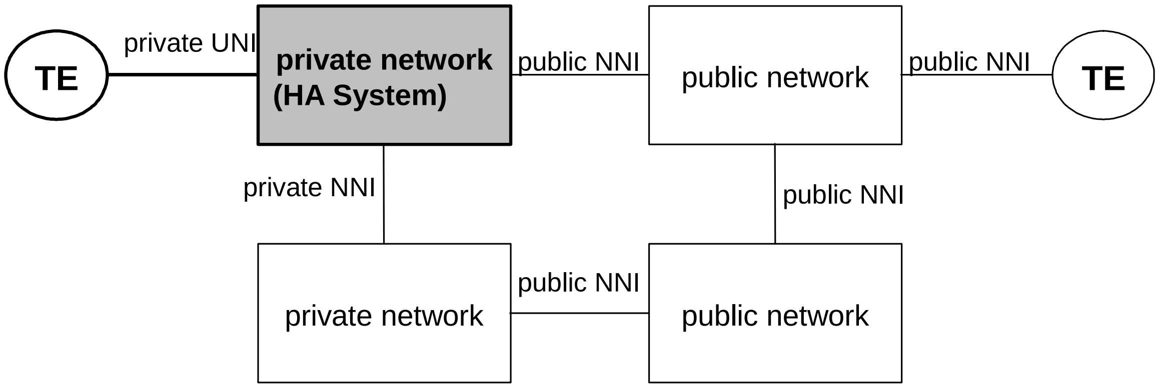

Figure 5.3: B-ISDN signalling interfaces

5.3 UNI Service Specific Part Convergence Sublayer

5.3.1 Functional model

The UNI Service Specific Convergence Sublayer is a part of the Cell based Convergence Layer. It provides the adaptation of the ATM User Network Interface (UNI) signalling to the Radio Link Control (RLC) functions of HIPERACCESS.

It is assumed that standard UNI signalling is used for ATM connection control management [3], [4]. The AT relays the signalling traffic transparently. The AP may act as signalling endpoint/instance for UNI signalling or may relay signalling traffic transparently to a signalling entity within the network, e.g. the ATM-switch the AP is attached to. The location of the SSCS in a specific entity, e.g. AP or ATM-switch, is implementation specific and therefore not specified within HA.

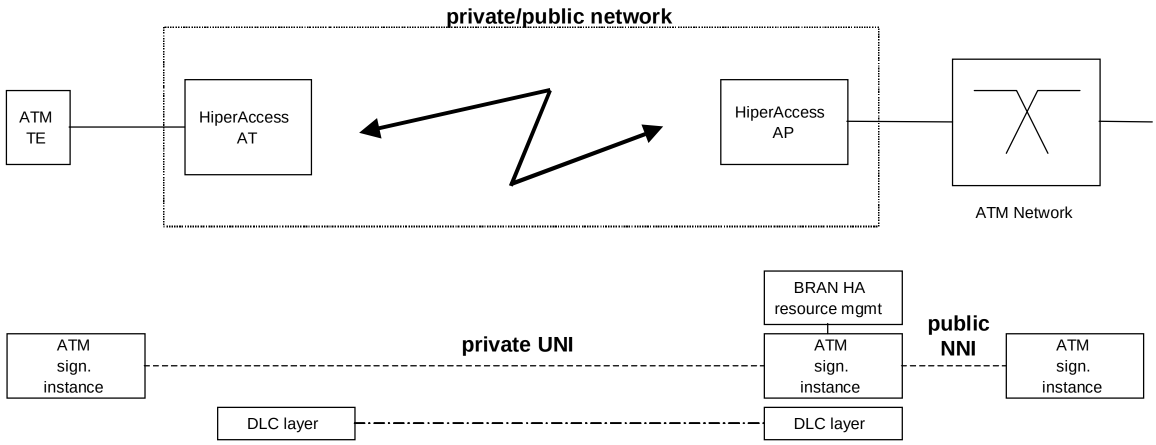

Figure 5.4: Interaction of ATM signalling and DLC layer

The AT is transparent for the ATM signalling messages (see figure 5.4). The AT provides only pre-established CIDs, one per independent ATM TE in case of multi-dwelling, to transport the signalling messages to the AP. From the ATM signalling perspective the private UNI interfaces of the ATM TE is directly connected to the AP signalling stack. The AP Hiperaccess resource management performs the traffic resource and QoS parameter decisions and translates these parameters into DLC corresponding parameters. The DLC layer is forced to setup these parameter values (CID etc.) in the AP and AT DLC layer. This approach requires also that the ATM/AAL layer parameters are transported via the DLC messages to the AT.

5.3.2 Cell based Convergence Layer planes

Figure 5.5 shows the protocol layers and the model of the planes for ATM-transport in HIPERACCESS. Three planes are distinguished:

- User Plane;
- ATM Control Plane;
- HIPERACCESS Control Plane.

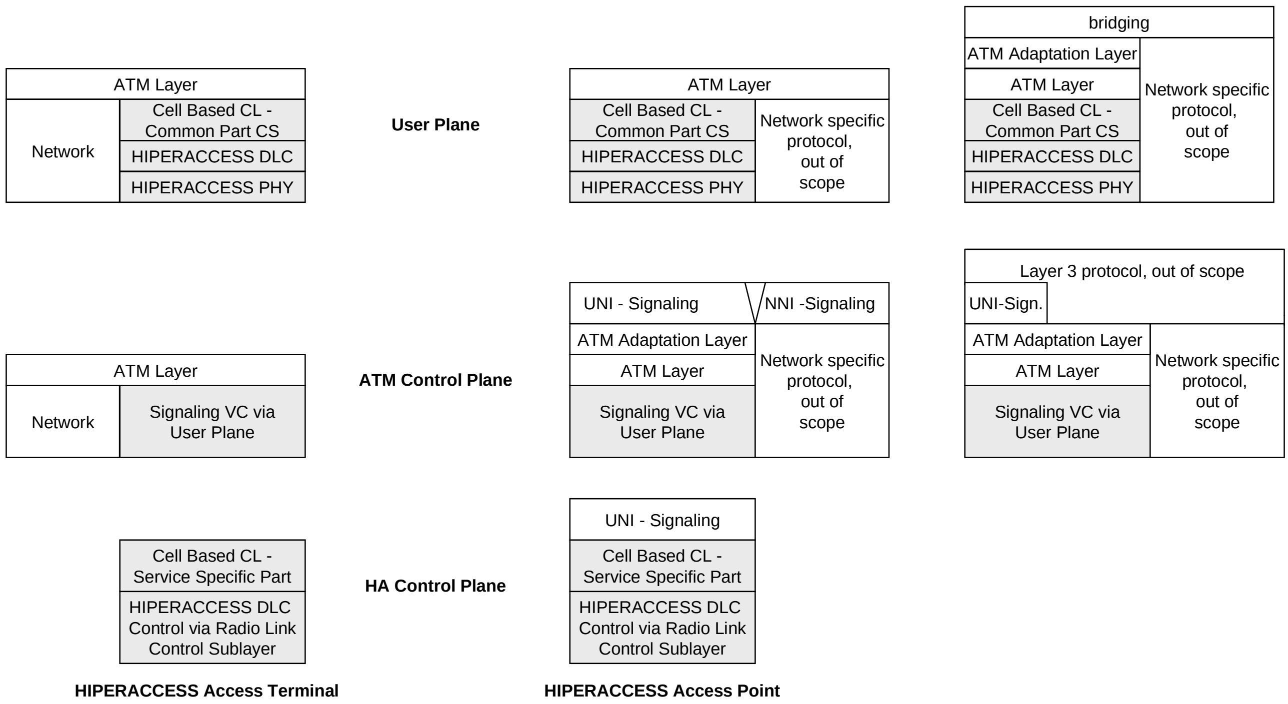

Figure 5.5: Protocol stacks in the AT and the AP

Table 5.1 lists the protocol layers as shown in figure 5.5 and their respective functions.

Table 5.1: Layer Description

Plane	Protocol Layer	Function
	ATM Adaptation Layer (AAL)	ATM Segmentation and Reassembly
	ATM	ATM cell transport
	Cell based - Common Part Convergence Sublayer	Adaptation between ATM-cell stream and HIPERACCESS DLC transport format
	HIPERACCESS DLC Layer	See [1]
	HIPERACCESS PHY Layer	See [11]
ATM Control Plane	Layer 3 protocol	Layer 3 protocols, like LAN emulation [6], Classical IP over ATM [10], Multiprotocol over ATM [8], and PPP over ATM [9]
	UNI signalling protocol	ATM UNI Signalling including SAAL functionality
	Signalling VC	ATM Transport via User Plane
HIPERACCESS Control Plane	Cell based UNI Service Specific Convergence Layer	Mapping of UNI signalling to DLC control functions; configuration of connection mapping between ATM connection identifier <VPI, VCI> and HA identifier <CID>
	HA DLC control via Radio Link Control Sublayer	Radio Resource Control and DLC Connection Control; HA specific control functions [1]

The bridging between wireless network and fixed network is out of the scope of BRAN.

5.3.3 ATM control plane

Figure 5.6 shows the stacks of the ATM control plane for the ATM TE, AT and AP. The ATM control plane stacks suppose that the AT is transparent for the ATM signalling messages. The only ATM layer function which the AT may have is the VPI translation if the connected ATM TE only accepts VPI=0 (in practise many ATM network interface cards - NIC - support only VPI = 0).

Within Hiperaccess network only the AP processes the ATM signalling messages which are transported via the user plane. The AP has to provide a private UNI towards the Hiperaccess network. This stack consists of the PHY, DLC and ATM layers, followed by the SAAL (Signalling AAL) layer composed of the SAR, CPCS and SSCOP sublayers. The Service Specific Coordination Function (SSCF) adapts the signalling protocol to the SSCOP protocol. The ATM signalling protocol may be based on ITU-T Recommendation Q.2931 [2] or ATM Forum UNI (3.0, 3.1 [3] or 4.0 [4]). The layer 3 protocol include LAN emulation (LANE), Classical IP over ATM (CLIP), Multiprotocol over AAL or PPP over ATM.

The setup, modify or release of SVCs on the HA changes the occupied resources on the DLC layer. This means that within the signalling message exchange protocol a DLC layer resource management has to be involved to evaluate whether in case of SVC setup or modify the QoS or traffic parameters can be provided. In case of SVC release the DLC layer resource management must be informed on the release DLC layer resources.

Towards the core network there are several possibilities that are out of scope for Hiperaccess Convergence Layer. In figure 5.6 a private NNI is shown as an example. Nevertheless it could also be any frame based interface.

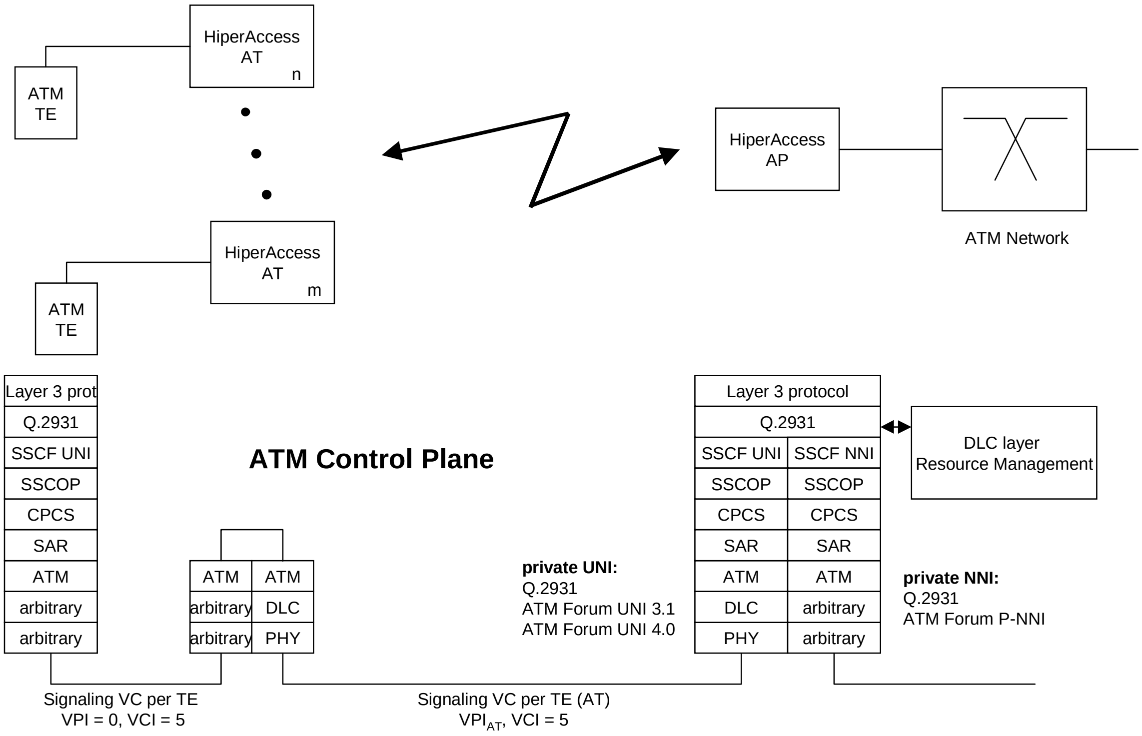

Figure 5.6: Protocol stacks for the ATM control plane

5.3.4 User Plane

If the AP interface towards the core network and the AT interface towards the user ATM TE are ATM based, then the user plane of the HA can transport any application data completely transparent as shown in figure 5.7.

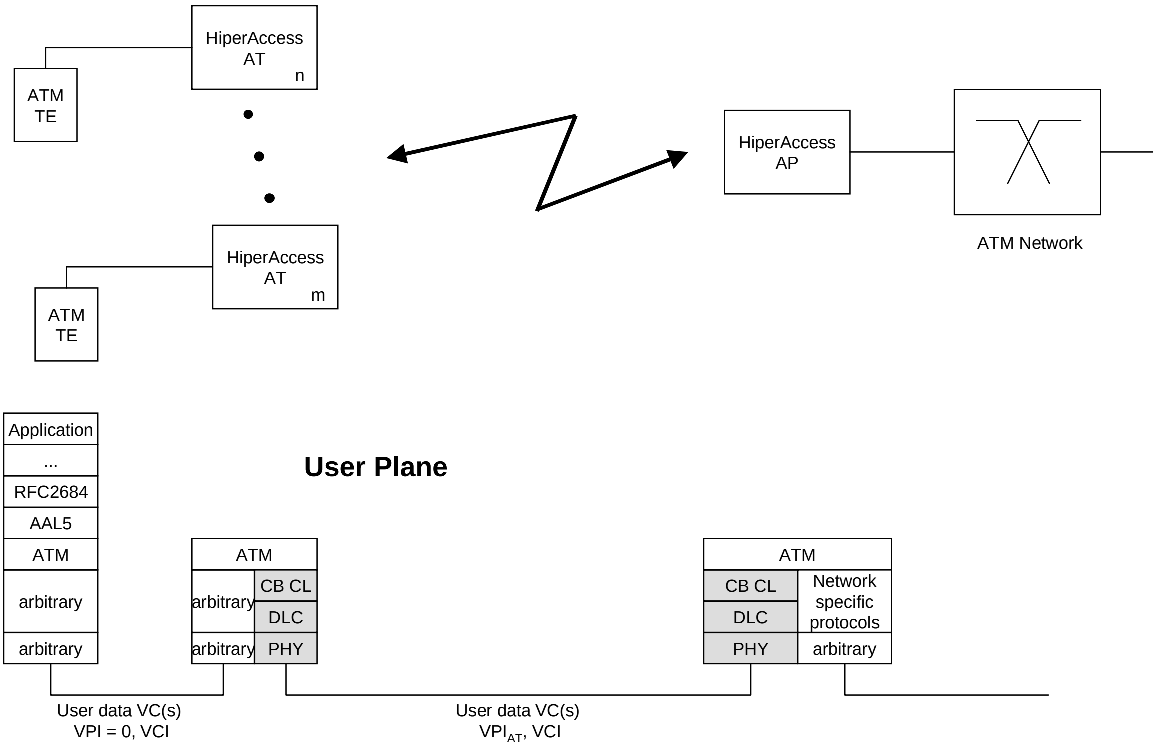

Figure 5.7: Protocol stacks for the user plane

5.4 Service Access Point

The higher layer exchanges control primitives with the Cell based Service Specific Convergence Layer via the CL-Control SAP. The SSCS interacts with the Radio Resource Control and DLC-Connection Control functions of the DLC-control plane, i.e. the Radio Link Control Sublayer (RLC) via the DLC-Control SAP. See figure 5.8. The interface to the Common Part Convergence Sublayer (CPCS) is not specified.

NOTE: The functionality of the Radio Resource Control and DLC-Connection Control (DCC) is not specified within BRAN.

Data that are exchanged with the peer SSCS are carried in RLC-messages in ClParameter field. The ASN.1 description of information elements is described in clause 7.3.2.

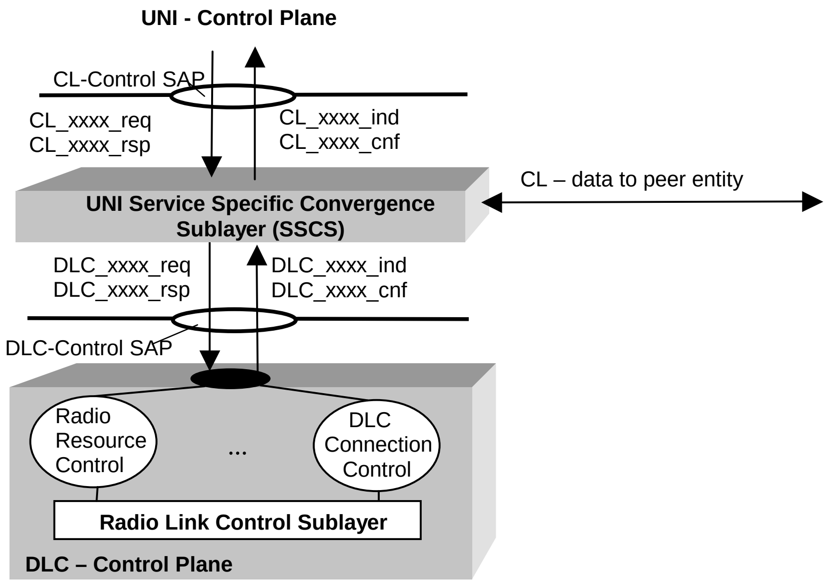

Figure 5.8: Control plane and Service Access Points

5.5 Primitives

The Service Specific 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.

5.5.1 Primitive types

Four primitive types may be used between Convergence Layer and higher (ATM) layer:

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

6 DLC connection establishment

The procedures are asymmetric and thus differ between Access Point and Access Terminal.

Since the AP is the only HA element to process ATM signalling, the setup procedure for dynamically established connections would be started in the AP.

The AP CL shall send a DlcConnectionAdditionReq primitive to the DLC layer to trigger the establishment of a new DLC connection providing the relevant information; the DLC shall use it to derive all the needed DLC parameters (e.g. the CID) and shall include them in the RlcConnectionAdditionSetup message to be sent to the destination AT. In this message a ClParameters field, that the DLC layer will carry transparently, is provided to give to the AT CL layer the information needed to handle the new connection.

The DLC layer has to convert the ATM QoS parameters contained in the DlcConnectionAdditionReq into the DLC specific parameters contained into the RlcConnectionAdditionSetup message. The mapping of these priority parameters is not defined within BRAN.

The AT will receive the RlcConnectionAdditionSetup message and issue a DlcConnectionAdditionInd primitive to the CL including all the relevant ATM parameters contained in the CLParameters field of the RlcConnectionAdditionSetup. At this point the DLC connection is uniquely identified in the AT. Upon reception of the DlcConnectionAdditionInd, a DlcConnectionAdditionRsp primitive shall be issued back to the DLC layer that shall send an RlcConnectionAdditionAck message carrying the CID back to the AP.

At the reception of the Ack, the AP DLC shall issue to the CL a DlcConnectionAdditionCnf still containing the CID. At this point the AP CL is also fully aware of the established DLC connection and its mapping with CLparameters.

7 Convergence Layer specific parameters

7.1 Information elements for Cell based SSCS

In order to transfer convergence layer specific information between AP and AT a number of CL information elements is defined. Some of these information elements are transferred transparently by the RlcConnectionAdditionInit and RlcConnectionAdditionSetup messages as specified in [1] using the ClParameter field. Some others are exchanged during the AT Initialization phase.

7.1.1 ATM VC Identifier range

The AtmVcIdentifierRange parameter is used to indicate the continuous range of supported VCIs.

If the AtmVcIdentifierRange parameter is not present, the AT and the AP shall support the following default values:

- VCI lower bound: 0.
- VCI upper bound: 255.

Since this parameter is a characteristic of the whole AT it shall be communicated to the AP during the AT initialization procedure.

```
AtmVcIdentifierRange ::= SEQUENCE {
upperBound              Bound,
lowerBound              Bound
}


Bound                  ::= INTEGER (0..65535)
```

7.1.2 Number of supported ATM connections

The different ATs might be able to handle a different number of ATM connections. Since the entity responsible of handling the ATM resources in the HA system is the AP only, it has to be aware of the distribution of available ATM connections in each AT in order to decide whether to accept a new request of ATM connection setup.

Since this parameter is a characteristic of the whole AT it shall be communicated to the AP during the AT initialization procedure.

```
SupportedAtmConnectionRange ::= INTEGER (0..65535)
```

7.1.3 ATM connection identifiers

The VPI/VCI pair identifies unambiguously an ATM connection. In HA the ATM VCI field is always transparently carried by CPCS-PDU so there is no need to include it in the ClParameters field.

The entity starting the DLC connection set up procedure shall communicate to the other side the VPI of the corresponding ATM connection. This value shall be carried by the DLC RlcConnectionAdditionsetup message within the ClParameters field.

```
Vpi ::= INTEGER (0..255)
```

7.1.4 ATM parameters

This field is filled by CL using relevant parameters received from ATM layer. CL transports transparently this field and passes it to the peer entity ATM layer.

```
AtmParameters        ::= OCTET STRING {SIZE(0..60)}
```

7.2 Interface to the DLC

The DLC Control-SAP is specified in the DLC Technical Specification [1].

Annex A (informative): ATM information elements

Follows the information elements described in [4].

Extended QoS Parameter Information Element

8	7	6	5	4	3	2	1	Octets
Extended QoS parameters Information element identifier								1
ext	Coding standard			Instruction-field				2
Length of Extended QoS parameters contents								3
Length of Extended QoS parameters contents (continued)								4
Origin								5
Acceptable Forward Peak-to-Peak Cell Delay Variation Identifier								6
Acceptable Forward Peak-to-Peak Cell Delay Variation [micro sec]								7
Acceptable Forward Peak-to-Peak Cell Delay Variation (continued)								8
Acceptable Forward Peak-to-Peak Cell Delay Variation (continued)								9
Acceptable Backward Peak-to-Peak Cell Delay Variation Identifier [micro sec]								10
Acceptable Backward Peak-to-Peak Cell Delay Variation								11
Acceptable Backward Peak-to-Peak Cell Delay Variation (continued)								12
Acceptable Backward Peak-to-Peak Cell Delay Variation (continued)								13
Cumulative Forward Peak-to-Peak Cell Delay Variation Identifier [micro sec]								(note 1) 14
Cumulative Forward Peak-to-Peak Cell Delay Variation								15
Cumulative Forward Peak-to-Peak Cell Delay Variation (continued)								16
Cumulative Forward Peak-to-Peak Cell Delay Variation (continued)								17
Cumulative Backward Peak-to-Peak Cell Delay Variation Identifier [micro sec]								(note 1) 18
Cumulative Backward Peak-to-Peak Cell Delay Variation								19
Cumulative Backward Peak-to-Peak Cell Delay Variation (continued)								20
Cumulative Backward Peak-to-Peak Cell Delay Variation (continued)								21
Acceptable Forward Cell Loss Ratio Identifier								(note 2) 22
Acceptable Forward Cell Loss Ratio								23
Acceptable Backward Cell Loss Ratio Identifier								(note 2) 24
Acceptable Backward Cell Loss Ratio								25

NOTE 1: If an acceptable forward and/or backward Peak-to-Peak CDV is included, then the corresponding cumulative forward and/or backward Peak-to-Peak CDV shall be included, respectively.

NOTE 2: The acceptable forward and/or backward cell loss ratio specified is either for the CLP=0 traffic stream or for the CLP=0+1 traffic stream, depending on the conformance definition.

End-to-End Transit Delay Information Element

8	7	6	5	4	3	2	1	Octets
End-to-End Transit Delay Information Element identifier								1
ext	Coding standard			Instruction-field				2
Length of End-to-End Transit Delay contents								3
Length of Extended QoS parameters contents (continued)								4
Cumulative End-to-End Transit Delay Identifier								5
Cumulative End-to-End Delay Value [milli sec]								6
Cumulative End-to-End Delay Value (continued)								7
Maximum End-to-End Transit Delay Identifier								8
Maximum End-to-End Delay Value [milli sec]								9
Maximum End-to-End Delay Value (continued)								10

Quality of Service Information Element

8	7	6	5	4	3	2	1	Octets
End-to-End Transit Delay Information Element identifier								1
ext	Coding standard			Instruction-field				2
Length of Extended QoS parameters contents								3
Length of Extended QoS parameters contents								4
QoS class forward								5
QoS class backward								6

ABR Setup Parameter Information Element

8	7	6	5	4	3	2	1	Octets
ABR setup parameters information element identifier								1
ext	Coding standard			Instruction-field				2
Length of ABR setup parameters information element contents								3
Length of ABR setup parameters information element contents (continued)								4
Forward ABR Initial Cell Rate Identifier (CLP = 0+1)								5
Forward ABR Initial Cell Rate								6
Forward ABR Initial Cell Rate (continued)								7
Forward ABR Initial Cell Rate (continued)								8
Backward ABR Initial Cell Rate Identifier (CLP = 0+1)								9
Backward ABR Initial Cell Rate								10
Backward ABR Initial Cell Rate (continued)								11
Backward ABR Initial Cell Rate (continued)								12
Forward ABR Transient Buffer Exposure Identifier								13
Forward ABR Transient Buffer Exposure								14
Forward ABR Transient Buffer Exposure (continued)								15
Forward ABR Transient Buffer Exposure (continued)								16
Backward ABR Transient Buffer Exposure Identifier								17
Backward ABR Transient Buffer Exposure								18
Backward ABR Transient Buffer Exposure (continued)								19

Annex B (informative): Bibliography

- ATM Forum (BTD-WATM-01.12): "Wireless ATM Capability Set 1 Specification - Draft".

History

Document history		
V1.1.1	October 2002	Publication