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New presentation - see History box

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Foreword

This ETSI Technical Report (ETR) has been prepared by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

This ETR provides additional information to the ETS 300 217 [2] for the provision of Connectionless Broadband Data Service (CBDS) via Asynchronous Transfer Mode (ATM) based networks. For the ease of reference a delta document to ITU-T Recommendation I.364 [1] has been provided. The ETSI deviations from the CCITT requirements and the selection of specific options are described in this ETR.

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1 Scope

This ETSI Technical Report (ETR) provides a delta document to ITU-T Recommendation I.364 [1]. The ETSI deviations from the CCITT requirements and the selection of specific options are described in this ETR.

As defined in ITU-T Recommendation I.364 [1], § 1, with the following changes.

This ETR describes the support of connectionless data service on B-ISDN in accordance with:

- ETS 300 217 [2], which details the stage 1 aspects for the Connectionless Broadband Data Service (CBDS);
- CCITT Recommendation I.113 [5], which defines "connectionless service" (vocabulary);
- CCITT Recommendation F.812 [4], which provides a service description of a "Broadband Connectionless Data Bearer Service". CCITT Recommendation F.812 [4] generally describes the service to include:
    - source address validation;
    - addresses based on CCITT Recommendation E.164 [3] numbering;
    - address screening;
    - point-to-point and multicast information transfer;
    - network capabilities for charging;
    - interworking with other connectionless and connection oriented data services;
    - Quality Of Service (QOS) parameters;
- ITU-T Recommendation I.211 [6], which describes connectionless data service aspects. ITU-T Recommendation I.211 [6] identifies two configurations, Type (i) and Type (ii) to support connectionless data service. In Type (i), a Connectionless Service Function (CLSF) is installed outside the B-ISDN. In Type (ii), a CLSF, which handles routeing of data to be transferred based on connectionless techniques, is installed within the B-ISDN;
- ITU-T Recommendation I.327 [8], which describes "high layer capabilities" for the support of services (e.g. connectionless service) and gives functional architectural models for the cases mentioned above;
- ITU-T Recommendation I.362 [10], which specifies the use of ATM Adaptation Layer (AAL) type 3/4 for connectionless data services (the use of other AAL types is for further study) and identifies that routeing and addressing are provided by the layer above AAL type 3/4;
- ITU-T Recommendation I.363 [11], which specifies AAL type 3/4.

This ETR relates to Type (ii) (direct) provision of connectionless service, using B-ISDN connectionless service. However, aspects of this ETR may be applied to some Type (i) provision of connectionless service. This ETR describes the framework for network support of connectionless data service and the protocols used to support connectionless service.

2 References

For the purposes of this ETR, the following references apply:

[1] ITU-T Recommendation I.364 (1993): "Support of Broadband Connectionless Data Service on B-ISDN".

[2] ETS 300 217 (1992): "Network Aspects; Connectionless Broadband Data Service".

[3] CCITT Recommendation E.164 (1991): "Numbering plan for the ISDN era".

[4] CCITT Recommendation F.812 (1992): "Broadband connectionless data bearer service".

[5] CCITT Recommendation I.113 (1988): "Vocabulary of terms for broadband aspects of ISDN".

[6] ITU-T Recommendation I.211 (1993): "B-ISDN service aspects".

[7] CCITT Recommendation I.324 (1988): "ISDN network architecture".

[8] ITU-T Recommendation I.327 (1993): "B-ISDN functional architecture".

[9] ITU-T Recommendation I.361 (1993): "B-ISDN ATM layer specification".

[10] ITU-T Recommendation I.362 (1993): "B-ISDN ATM adaptation layer (AAL) functional description".

[11] ITU-T Recommendation I.363 (1993): "B-ISDN ATM adaptation layer specification".

[12] ISO/IEC DIS 8802-6: "Processing systems- Local area networks- Part 6: Distributed Queue Dual Bus (DQDB) subnetwork of a Metropolitan Area Network (MAN)".

[13] Bellcore TR-TSV-000772: "Generic System Requirements in Support of Switched Multimegabit Data Services".

[14] Bellcore TR-TSV-001060: "Switched Multi-Megabit Data Services Generic Requirements for Exchange Access and Intercompany Serving Arrangements (SMDS)".

[15] ITU-T Recommendation I.371: "Traffic control and congestion control in B-ISDN".

[16] CCITT Recommendation I.340: "ISDN connection types".

[17] ISO/IEC TR 9577: "Information technology- Telecommunications and information exchange between systems- Protocol identification in the network layer".

3 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

AAL	ATM Adaptation Layer
AATF	ATM Access Termination Functions
AL	Alignment
ANTF	ATM Network Termination Functions
ATF	Access Termination Functions
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband Integrated Services Digital Network
BAsize	Buffer Allocation size
BCD	Binary Coded Decimal
BOM	Beginning Of Message
BTag	Beginning Tag
CBDS	Connectionless Broadband Data Service
CF	Connection Functions
CIB	CRC Indication Bit
CL	Connectionless
CLAI	Connectionless Access Interface
CLATF	Connectionless Access Termination Functions
CLCP	Connectionless Convergence Protocol
CLHF	Connectionless Handling Functions
CLMF	Connectionless Mapping Functions
CLNAP	Connectionless Network Access Protocol
CLNI	Connectionless Network Interface
CLNIP	Connectionless Network Interface Protocol
CLNTF	Connectionless Network Termination Functions
CLS	Connectionless Server
CLSF	Connectionless Service Function
COM	Continuation Of Message
CPCS	Common Part Convergence Sublayer
CPE	Customer Premises Equipment
CPI	Common Part Indicator
CRC	Cyclic Redundancy Check
CS	Convergence Sublayer
CTF	Control Functions
DA	Destination Address
DIS	Draft International Standard
DQDB	Distributed Queue Dual Bus
EOM	End Of Message
ETag	End Tag
GAHF	Group Address Handling Functions
HE	Header Extension
HEL	Header Extension Length
HLPI	Higher Layer Protocol Identifier
ICIP	Inter-Carrier Interface Protocol
IMPDU	Initial MAC Protocol Data Unit
ISDN	Integrated Services Digital Network
ISO	International Organisation for Standardization
MAC	Media Access Control
MAI	MSS ATM Interface
MAN	Metropolitan Area Network
ME	Mapping Entity
MID	Multiplexing Identification
MIR	Maximum Information Rate
MSS	MAN Switching System
NNI	Network Node Interface
NPC	Network Parameter Control
NTF	Network Termination Functions

OAM	Operation Administration and Maintenance
PCF	Protocol Conversion Functions
PDU	Protocol Data Unit
PI	Protocol Identifier
PPTU	PDU per Time Unit
QOS	Quality Of Service
SA	Source Address
SAP	Service Access Point
SAR	Segmentation And Reassembly
SDU	Service Data Unit
SIR	Sustained Information Rate
SMDS	Switched Multi-megabit Data Service
SSCS	Service Specific Convergence Sublayer
SSM	Single Segment Message
UMI	User MAN Interface
UNI	User Network Interface
UPC	Usage Parameter Control
VC	Virtual Channel
VCI	Virtual Channel Identifier
VP	Virtual Path
VPI	Virtual Path Identifier

4 Framework for the provision of connectionless data service on B-ISDN

As defined in ITU-T Recommendation I.364 [1], § 2.

4.1 Definition of a broadband connectionless data service on B-ISDN

As defined in ITU-T Recommendation I.364 [1], § 2.1.

4.2 Multicast transport for group addressing

This feature of the basic bearer service allows a subscriber to send a Connectionless Network Access Protocol - Protocol Data Unit (CLNAP-PDU) to the network which delivers the same CLNAP-PDU received from the subscriber to several intended recipients. The network will deliver one and only one copy of a group addressed CLNAP-PDU across each of the Connectionless Access Interfaces (CLAI) associated with the individual addresses represented by a group address (i.e. each CLAI associated with multiple destination addresses will receive a single copy from the network). The group addressed CLNAP-PDU should not be copied back to the originating CLAI.

The source address provided by the originating subscriber does not have to be one of the individual addresses of the set defined by the group address.

Any recipient of a group addressed CLNAP-PDU sent by a source may make use of the destination group address carried by that CLNAP-PDU to multicast to the recipients of the CLNAP-PDU including the source (but excluding himself).

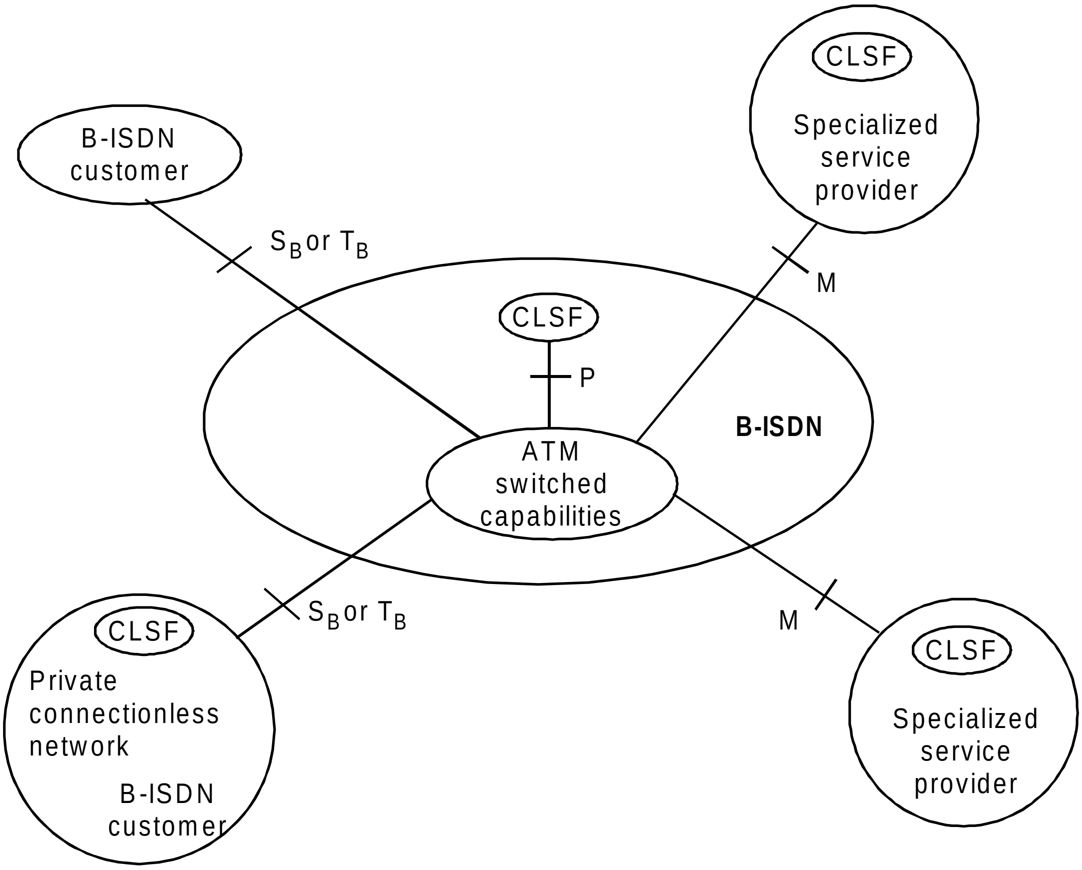
Supplementary services (e.g. address screening) may require that some of the copies of the group addressed CLNAP-PDU not be delivered, all other copies should be delivered according to the QOS parameters. The service provider is responsible for assigning group addresses and ensuring that each group address identifies uniquely only one set of individual addresses. Group addresses can be distinguished from individual addresses by the context of their use (via the address type).

A possible use of the group address feature is by the address resolution protocol.

4.3 Functional architecture

As defined in ITU-T Recommendation I.364 [1], § 2.2, with the following changes.

The provision of the connectionless data service in B-ISDN is realized by means of Asynchronous Transfer Mode (ATM) switched capabilities and Connectionless Service Functions (CLSF). The ATM switched capabilities support the transport of connectionless data units in B-ISDN between specific functional groups CLSF able to handle the connectionless protocol and to realise the adaptation of the connectionless data units into ATM cells to be transferred in a connection-oriented environment. The CLSF functional groups may be located outside B-ISDN, in a private connectionless network or in a specialized service provider, or inside B-ISDN. The relevant reference configuration for the provision of the connectionless data service in B-ISDN is depicted in figure 1.



CLSF: Connectionless Service Functions P, M, S, T: Reference Point

Figure 1: Reference configuration for the provision of the connectionless (CL) data service in B-ISDN

The ATM switched capabilities are performed by the ATM nodes (ATM switch/cross-connect) which realise the ATM transport network. The CLSF functional group terminates the B-ISDN connectionless protocol stack. This includes the Connectionless Network Access Protocol/Connectionless Network Interface Protocol (CLNAP/CLNIP), AAL type 3/4, ATM and physical layers.

The Connectionless (CL) protocol includes functions such as routeing, addressing, QOS selection. In order to perform the routeing of CL data units, the CLSF has to interact with the control/management planes of the underlying ATM network. The interactions between the CLSF and control/management planes require further study.

The CLSF functional group can be considered implemented in the same equipment together with the ATM switched capabilities as depicted in figure 2 (option A). In this case there is no need to define the interface at the P reference point. CLSF functional group and ATM switched capabilities can be implemented also in separate equipment (figure 2, option B). In this case interfaces should be defined at the M or P reference points (refer to ITU-T Recommendation I.327 [8]/CCITT Recommendation I.324 [7]) depending on whether the CLSF is located outside or inside the B-ISDN.

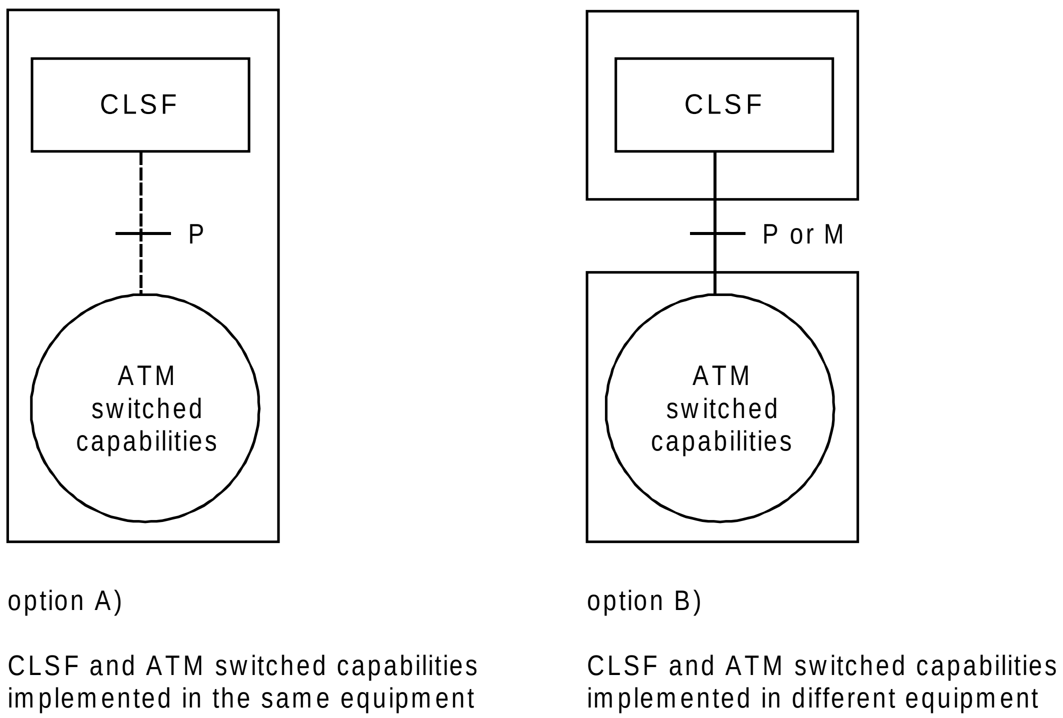


Figure 2: Implementation of CLSF and ATM switched capabilities

The general protocol structure for the provision of CL data service in B-ISDN is shown in figure 3.

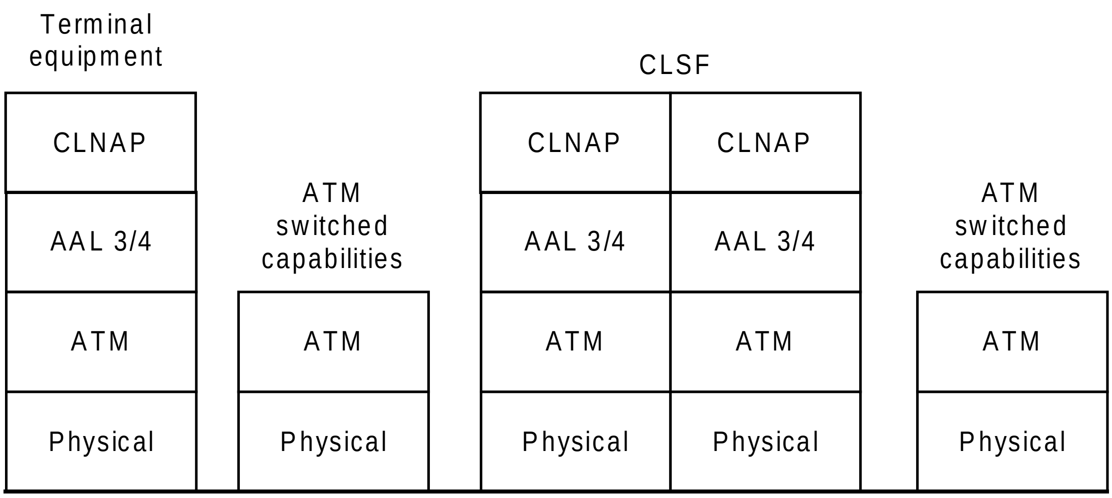


Figure 3: General protocol structure for provision of CL data service in B-ISDN

4.4 Connectionless server functional description

A Connectionless Server (CLS) is a network element which includes the CLSF group and interfaces the ATM node at the P/M reference points. The CLS may perform among others the following functions (see also figure 4):

- Connection Functions (CF), which include all port-related functionalities for the termination of ATM connections;

- Connectionless Handling Functions (CLHF), which include all the service-specific functions required for the support of connectionless service provision in B-ISDN. In general they are related to the network integrity issues (e.g. address validation/screening, access class enforcement) and to relaying issues (e.g. routeing, group address handling);

- Control Functions (CTF) are related to connection/resource handling and service processing; the information necessary to effect control over the communication resources in the server can be exchanged with other network elements through signalling or management protocols;

- Operation, Administration and Maintenance functions (OAM).

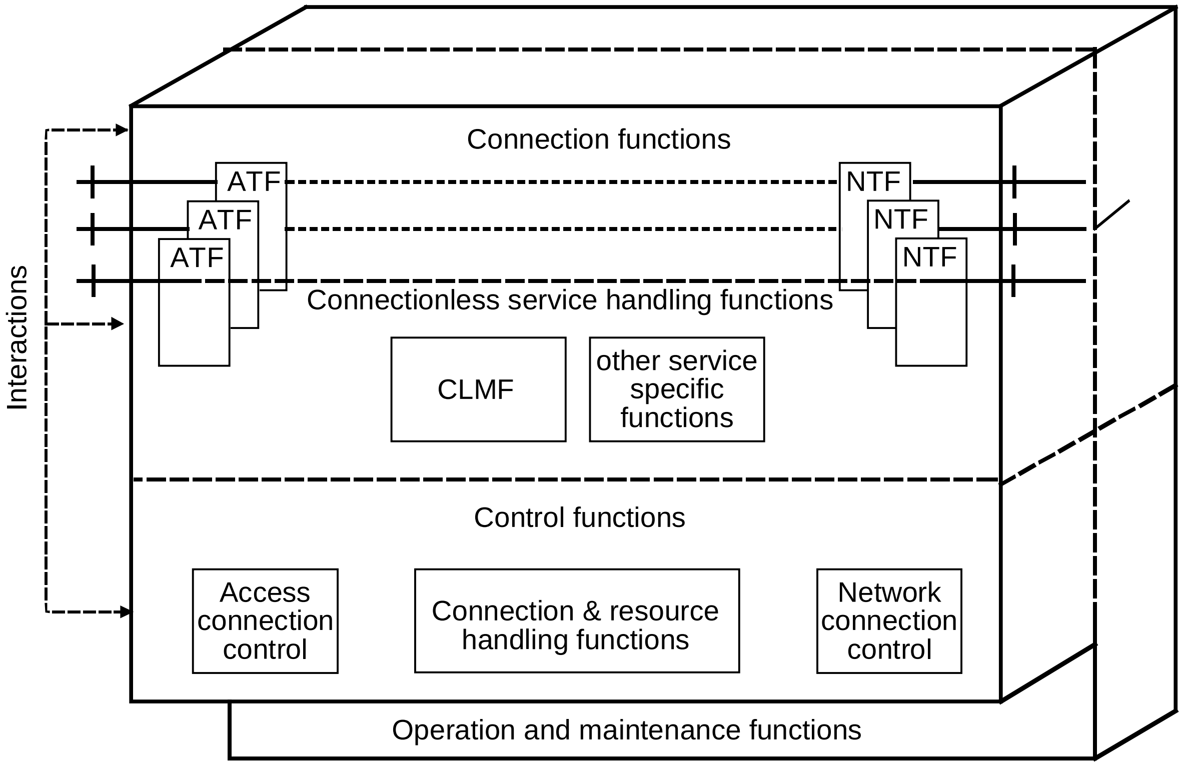


Figure 4: Connectionless Server Functional Model

The Access Termination Functions (ATF) blocks contain the functions required to receive/transmit information from/to a B-ISDN user possibly through an ATM node. The block performs protocol functionalities corresponding to physical, ATM, AAL type 3/4 and CLNAP layers.

The Network Termination Functions (NTF) blocks include the functions required to receive/transmit information from/to a CLS possibly through an ATM node. The block performs protocol functionalities corresponding to physical, ATM, AAL type 3/4 and CLNIP layers.

Both ATF and NTF blocks include functions for terminating ATM connections and some decentralized CL services specific functions. The description of the functional architecture of the ATF and NTF blocks relevant to the specification of Connectionless Access Interface (CLAI) and Connectionless Network Interface (CLNI), respectively, is given in subclause 4.5.

The Connectionless Handling Functions (CLHF) are located partly in the ATF/NTF blocks and partly in the Connectionless Mapping Functions (CLMF).

The CLMF block performs routeing, protocol conversion between access and network terminations and group address handling functions. The CLMF block is composed of the following functional blocks: Group Address Handling Functions (GAHF), Protocol Conversion Functions (PCF) and routeing.

The GAHF block handles both group-addressed CLNAP-PDUs and group-addressed CLNIP-PDUs whose resolution is requested by this CLS. This functional block performs group-addressed data units handling, resolving the group address into its associated individual addresses. The resolved individual addresses may identify end-users served either by this CLS or by a remote CLS.

The PCF block performs protocol conversion between the Access Termination Functions (ATF) and the Network Termination Functions (NTF). In particular, it provides all the parameters necessary to properly create a CLNIP-PDU or to recover a CLNAP-PDU from the received CLNIP-PDU.

The PCF block, when processing CLNAP-PDUs coming from a local end-user, provides all the parameters so that encapsulation is properly performed when necessary. The PCF block, when processing CLNIP-PDUs coming from a Network Node Interface (NNI) interface, provides all the parameters so that de-capsulation is properly performed when necessary.

The block denoted as routeing, on the basis of the destination address of the data unit to be forwarded across a User Network Interface (UNI) or NNI interface, selects the proper outgoing physical link and Virtual Path Identifier/Virtual Channel Identifier (VPI/VCI) to reach that destination.

The Control Functions (CTF) include the following functional blocks: access connection control, network connection control, connection/resource handling functions. These blocks perform functions related to internal resource allocation (e.g. associated with CL message multiplexing, QOS preservation), connection establishment/release, etc. In particular, if the CL service is provided on the basis of switched ATM connections between the terminal equipment and the CLS or between CLSs, the access and network connection control functions provide the ability to support user access and network signalling systems, respectively. The access and network connection control functions are, instead, related to the management plane if the CL service is provided on the basis of semi-permanent ATM connections between the terminal equipment and the CLS or between CLSs.

The functions described above do not imply any particular implementation.

4.5 Interfaces

In the following subclauses, the access and network interfaces for the support of CBDS are described for the user plane. The description of the control and management planes for these interfaces is for further study.

4.5.1 Connectionless access interface

The Connectionless Access Interface (CLAI) supports user access to the CBDS, as defined in ETS 300 217 [2], on an ATM network.

User access to the ATM network is provided at the S_B/T_B reference points.

Direct CBDS provision is performed through the use of specialized network elements (CLSs), as described in subclause 4.4; user equipment may have direct access to the CLS at the S_B/T_B reference points. The protocol stack includes the UNI physical and ATM layers both in the user equipment on one side of the CLAI and in the CLS on the other side. Usage Parameter Control (UPC) functions, as foreseen for ATM user access, are performed on the server side of the CLAI. There is a one to one relationship between a CLAI and an ATM connection.

Indirect user access to the server through one or more ATM nodes is also possible. In this case the interface between the user equipment and the adjacent ATM node is defined at the S_B/T_B reference points, while that between the server and the adjacent ATM node(s) is defined at the P/M reference points.

At the S_B/T_B reference points, the physical and ATM layers of the CLAI stack are terminated in the user equipment and the ATM node(s). They are based on the ATM UNI. UPC functions as foreseen for ATM user access are performed by the ATM network elements at the network side of the UNI.

At the P reference point, the physical and ATM layers of the CLAI stack are terminated in the server and the ATM node(s) and are based on the ATM NNI. The physical and ATM layers at the M reference point are for further study.

The functions performed by the CL specific layers (AAL type 3/4 and CLNAP) are the same both in the direct and indirect access cases. The CLNAP protocol stack for the direct and indirect access is shown in figure 5. The CLNAP protocol functions and elements are defined in Clause 5.

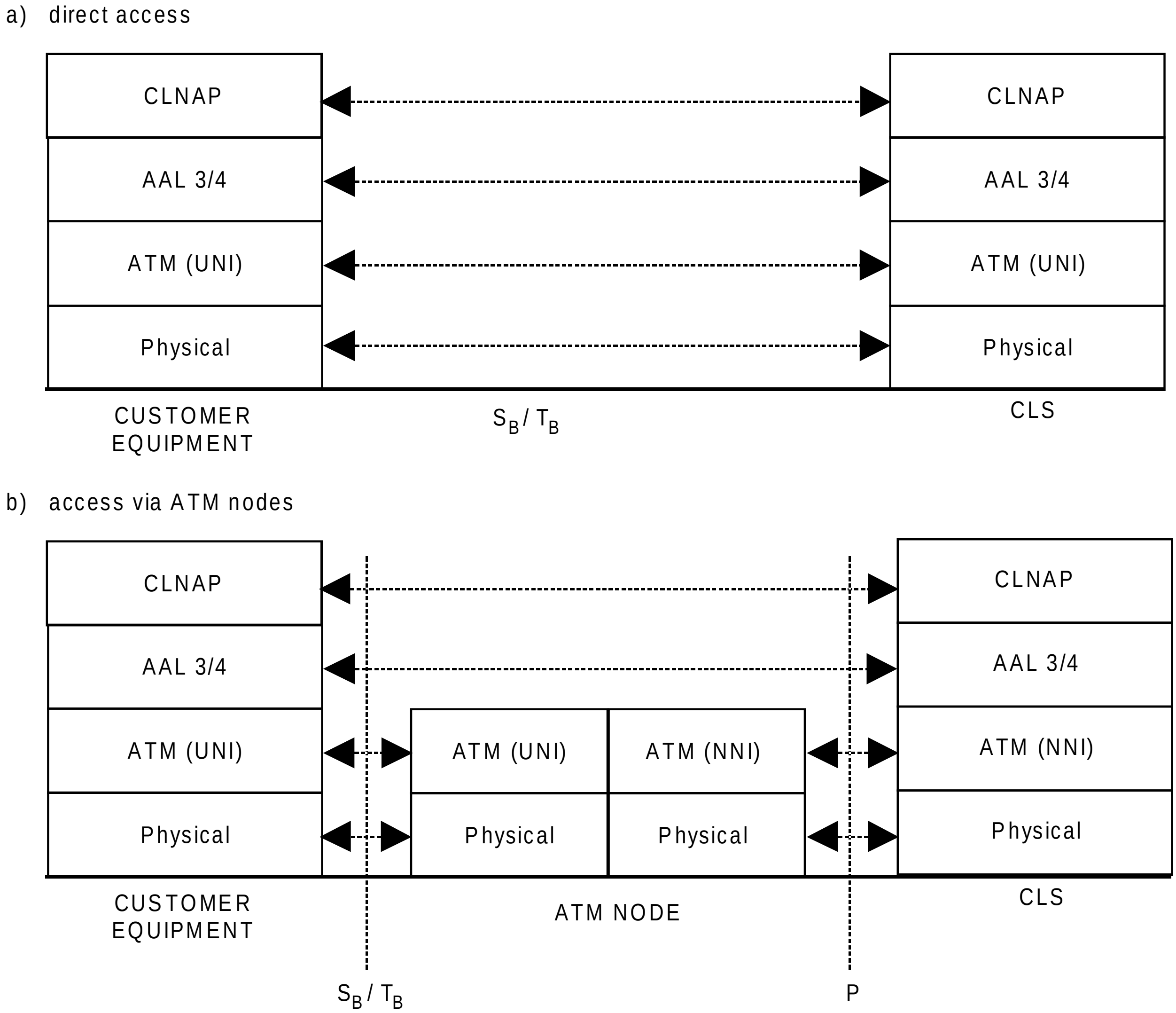


Figure 5: Protocol stack for CLAI

4.5.2 Access termination functions

The ATF block performs all termination functions associated with the CLAI protocol stack and some decentralized service support functions. Figure 6 gives a functional decomposition of the Access Termination Functions (ATF) block.

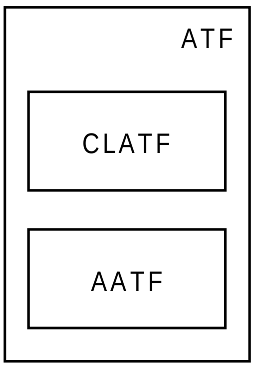


Figure 6: ATF Functional Decomposition

The positioning of the ATF block within the general CLS functional architecture is described in subclause 4.4.

The description given in the following does not imply any particular physical implementation.

4.5.2.1 ATM access termination functions

The ATM Access Termination Functions (AATF) perform the protocol functionalities of the physical and ATM layers of the B-ISDN protocol reference model.

Moreover the AATF perform the functions needed for the request of connection establishment and release to support communication between the server and the users served by it.

Traffic monitoring and control function based on UPC and/or Network Parameter Control (NPC) are also performed by the AATF, according to the specification of ITU-T Recommendation I.371 [15].

4.5.2.2 CL access termination functions

This subclause only describes the CL termination functions performed in the CLS. CL termination functions that are performed in the customer equipment are for further study.

The CL Access Termination Functions (CLATF) of the CLS perform the protocol functionalities of the AAL type 3/4 (Segmentation and Reassembly (SAR) sublayer and Common Part Convergence Sublayer (CPCS)) and CLNAP layers.

Other functions performed include:

- source address validation.

  The source address of each CLNAP-PDU is checked by the CLNAP layer on the server side of the CLAI to support the source address validation feature as specified in ETS 300 217 [2];

- local traffic screening.

  The destination address of each CLNAP-PDU is checked by the CLNAP layer on the server side of the CLAI to screen out communications internal to the Customer Premises Equipment (CPE);

- destination address screening.

  If the address screening supplementary service as defined in ETS 300 217 [2] is provided in addition to the basic CBDS bearer service, destination address screening is performed by the CLNAP layer on the server side of the CLAI on both individual and group addresses, in accordance with CBDS specifications;

- source address screening.

  If the address screening supplementary service is provided, source address screening is performed by the CLNAP layer of the server before delivering a CLNAP-PDU at the destination service access point;

- access class enforcement.

  If the network offers access class options, the CLNAP layer on the server side of the CLAI performs access class enforcement. The exact mechanism to support this service feature on an ATM network and the interactions with other protocol layers or functions for this purpose are for further study.

4.5.3 Connectionless network interface

The Connectionless Network Interface (CLNI) supports CBDS service provision, allowing transparent transfer of connectionless service data units within the ATM network.

The CLNI protocol stack is terminated in CLSs and is based on the ATM Network Node Interface (NNI).

Servers may be connected directly. Indirect linking through one or more ATM nodes is also possible. In both cases the AAL and CLNIP layers of the CLNI protocol stack are terminated in CLSs.

The physical and ATM layers are terminated in adjacent servers or between servers and adjacent ATM node(s). In both cases they are based on the ATM Network Node Interface (NNI) if servers are attached at the P reference point. At the M reference point the physical and the ATM layers are for further study.

NOTE: If the CLNI is implemented in the same equipment as the ATM switched capabilities, there is no need to define an interface.

The protocol stack for CLNI is shown in figure 7.

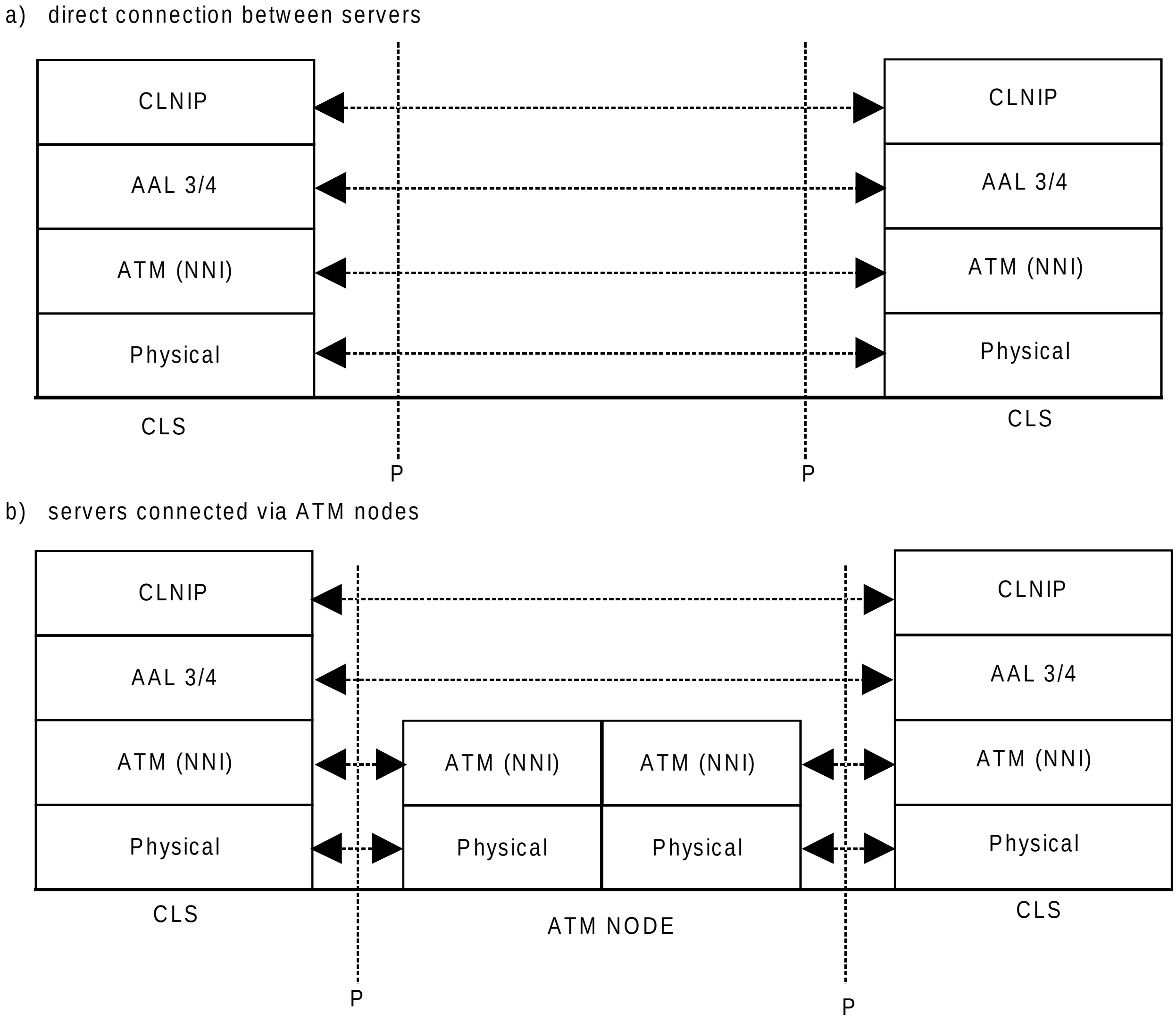


Figure 7: Protocol stack for CLNI

The protocol reference model for the CLNI includes, on the user plane, the physical, ATM, AAL type 3/4 and CLNIP.

This protocol reference model for the user plane applies both when the connected network elements belong to the same network operator/service provider and when the network elements belong to different operators/service providers.

The CLNIP protocol functions and elements are defined in Clause 6 of this ETR.

4.5.3.1 Network termination functions

The Network Termination Functions (NTF) block performs all termination functions associated with the CLNI protocol stack. Figure 8 gives a functional decomposition of the NTF block.

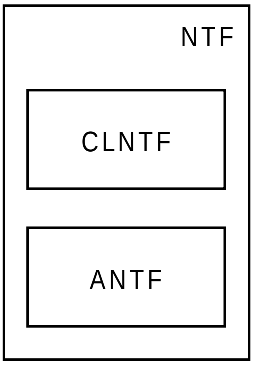


Figure 8: NTF functional decomposition

The positioning of the NTF block within the general CLS functional architecture is described in subclause 4.4.

The description given in the following does not imply any particular physical implementation.

4.5.3.2 ATM network termination functions

The ATM Network Termination Functions (ANTF) perform the protocol functionalities of the physical and ATM layers of the B-ISDN protocol reference model.

Moreover the ANTF perform the functions needed for the request of connection establishment and release to support communication between servers.

Traffic monitoring and control functions based on NPC are also performed by the ANTF, according to the specification of ITU-T Recommendation I.371 [15].

4.5.3.3 CL network termination functions

The CL Network Termination Functions (CLNTF) perform the protocol functionalities of the AAL type 3/4 (SAR and CPCS sublayer) and CLNIP layers.

4.6 Connections

CBDS (see ETS 300 217 [2]) should be supported in the B-ISDN via permanent, semi-permanent, and switched (see NOTE) point-to-point and multi-cast connections of the B-ISDN connection type "CL" (refer to CCITT Recommendation I.340 [16]). This CL connection type is an "AAL type connection". It includes the physical layer, the ATM layer and AAL type 3/4 functionalities (AAL type 3/4 connection).

NOTE: The control of switched connections by the CLS is for further study.

This connection type is used between the user and the CLS and between CLSs.

The AAL type 3/4 connection can use an ATM connection on a semi-permanent, permanent, or switched basis. Two options are envisaged for the assignment of the VCI/VPI values:

a) any values can be assigned. The assignment can be realized via network management in case of a semi-permanent connection. In case of a switched connection it can be realized during call set up.

   The indication of the assignment can be realized via OAM or signalling respectively;

b) a reserved / dedicated value or set of values can be assigned by prearrangement.

At the CLNAP/CLNIP layer connectionless communications take place. For simultaneous transmission of multiple CLNAP/CLNIP-PDUs each of them is associated with one AAL type 3/4 connection. Multiple AAL type 3/4 connections each associated with one Multiplexing Identification (MID) value can be mapped on a single ATM connection.

The maximum number of concurrent MID is allocated at subscription time. As a minimum, the allocation of the MID values at the subscription time should be supported and the dynamic allocations as defined in AAL type 3/4 definition may optionally be supported.

On a single AAL type 3/4 connection CLNAP/CLNIP-PDU sequence integrity is preserved.

4.7 Protocols

As defined in ITU-T Recommendation I.364 [1], § 2.5.

4.8 Numbering and addressing

The number structure of CCITT Recommendation E.164 [3] should be supported.

4.8.1 Addressing principles

The general addressing principles for the UNI interfaces are specified in ETS 300 217 [2] subclause 6.1.

4.8.2 Numbering within the U-plane

In the user plane only CCITT Recommendation E.164 [3] numbers are used to define:

a) source address, always of individual type;

b) destination address, of individual or group type.

4.8.3 Numbering within the C-plane

This subclause is for further study.

4.8.4 Relation between the address and network layers

This subclause is for further study.

4.9 Traffic aspects

4.9.1 Access class enforcement

The access class enforcement applies between the CPE and the connectionless server it is connected to in the direction from the user to the network. An access class is defined by three parameters.

MIR: Maximum Information Rate.

This parameter is defined in ETS 300 217 [2]. As the MIR is defined under the assumption of maximum length Service Data Unit (SDU) and maximum header extension in the PDU, it is possible to directly deduce the required bandwidth (peak cell rate) of the underlying ATM connection by the following formula.

ATM peak cell rate = MIR * (9188 + 44 + 8) / (9 188 * 44 * 8) given in cell/sec (see NOTE 1).

SIR: Sustained Information Rate.

This SIR is defined in ETS 300 217 [2].

PPTU: PDUs per time unit.

It is the long term average PDU rate for bursty traffic.

NOTE 1: This formula is applicable for payload length class 1. In case other payload length classes are used, the formula has to be changed accordingly.

The user should be able to utilize the SIR declared at subscription time as long as he sends messages that are equal to or longer than the length L defined by the formula L = SIR / (8 * PPTU).

For CBDS over ATM, AAL type 3/4 can operate in two different modes: message mode and streaming mode.

In the case of message mode operation, the Buffer Allocation Size (BAsize) field is equal to the length of the CPCS-PDU payload and the user credit should be correctly decremented for access class enforcement. In the case of streaming mode, the AAL type 3/4 specifies that the BAsize is equal to or greater than the CPCS-PDU length, which is derived from the maximum length indication given in the CPCS-UNITDATA-invoke primitive. The parameter in this primitive represents the maximum length of the CPCS-SDU, i.e. the CLNAP-PDU.

NOTE 2: If the access class enforcement is based on BASize value and if the maximum length is for example 9 188 octets, too much credit could be consumed with regard to the actual length of the CLNAP-SDU. This could lead to the network's discarding of user CPCS-PDUs which could have been accepted otherwise.

4.9.2 Access class mechanism for CLAI

In order to control the parameter related to an access class, the following algorithms are defined:

- **Maximum Information Rate (MIR).**

  Due to the direct relationships between the MIR and the ATM peak cell rate, it is sufficient to rely on the UPC at the ingress to the ATM network, to check this parameter.

  NOTE: It is important to note that the UPC checks the ATM peak cell rate regardless of the PDU structure and that, therefore, the impact of violation of the MIR may lead to a high degradation of the QOS.

- **Sustained Information Rate (SIR) and PDU per Time Unit (PPTU).**

  For each user the access class enforcement is to be applied to, the following set of variables will be maintained by the CBDS network:

  C: represents the current number of octets that is allowed to be accepted by the network;

  P: represents the current number of Beginning of Message (BOM) or Single Segment Message (SSM) SAR-PDUs that is allowed to be accepted by the network;

  Δt: represents the time period after which the C variable is incremented;

  $\delta\tau$: represents the time period after which the P variable is incremented;

  ΔC: represents the amount of octets by which C will be incremented every Δt period of time;

  ΔP: represents the amount of CLNAP-PDU by which P will be incremented every $\delta\tau$ period of time;

  CMAX: represents the maximum value that the variable C may reach;

  PMAX: represents the maximum value that the variable P may reach.

  The following algorithm is applied:

  every Δt : $C = C + \Delta C$ up to CMAX

  every $\delta\tau$: $P = P + \Delta P$ up to PMAX

  Whenever a BOM or SSM SAR-PDU arrives in the CBDS network:

  if (($C \geq$ BAsize - 20 (see NOTE)) and ($P \geq 1$))

  then {PDU is transmitted

  and C = C - BAsize + 20

  and P = P - 1 }

  else {PDU is discarded}

  NOTE: It has been assumed that the header extension field length is zero since no standard use has been defined for the header extension field.

4.9.3 Congestion control and resource management

This subclause is for further study.

4.10 Operations and maintenance

This subclause is for further study.

4.11 Network charging capabilities

This subclause is for further study.

4.12 Interworking with non-B-ISDN connectionless data protocols

This subclause is for further study. (This is also defined as "for further study" in ITU-T Recommendation I.364 [1], § 2.10).

4.13 Interworking capabilities for users attached to the UNI communicating with a user attached to the UMI

This subclause is for further study.

4.14 Interworking conditions with switched multi-megabit data service

For interworking of the CBDS and Switched Multi-megabit Data Service (SMDS) services over ATM the following issues have to be considered.

NOTE: The terminology used in the case of SMDS can be found in Bellcore TR-TSV-000772 [13] and Bellcore TR-TSV-001060 [14].

4.14.1 Destination and source addresses

For version 1 of SMDS the 60-bit address subfield is restricted to 11 digits where the first digit is the country code of world zone 1. International addressing is not supported.

4.14.2 Header extension length

SMDS requires a fixed length of the header extension field of 12 octets. L3-PDUs with other Header Extension Length (HEL) values are to be discarded by the network.

CBDS, however, allows a variable HEL of 0 up to 20 octets and should forward a corresponding CLNAP-PDU to the end-user.

4.14.3 Header extension field

SMDS defines two elements to be carried in the Header Extension (HE) field. A version element, defining the SMDS version, is always required. If not present, the corresponding L3-PDU will be discarded by the network. A carrier selection element, defining the preferred carrier of the user on a per L3-PDU basis, may be present, but is not mandatory.

CBDS will validate and transfer the corresponding CLNAP-PDUs. However, the version and carrier selection features are not supported.

4.14.4 Non-encapsulated CLNIPs

It may be assumed that the encapsulation technique specified by SMDS for the DQDB-based Inter-Carrier Interface (ICI) will be defined for the ATM-based interface too.

NOTE: Therefore, an interworking unit will be required in the case non- encapsulated CLNIP-PDUs are transferred by the CBDS network. SMDS has defined different codes for the Protocol Identifier (PI) field in the Inter-Carrier Interface Protocol (ICIP)-PDU indicating different types of traffic, whereas for CBDS over ATM currently four codes have been reserved. Those codes specify that the encapsulation technique has been used. The two sets of codes are not compatible.

4.15 Interworking with connection oriented data services

For further study. (This is also defined as "for further study" in ITU-T Recommendation I.364 [1], § 2.11).

5 Protocol for the support of Connectionless Data Service on B-ISDN at the UNI

As defined in ITU-T Recommendation I.364 [1], § 3.

5.1 Protocol architecture

As defined in ITU-T Recommendation I.364 [1], § 3.1.

5.2 Service provided by the connectionless service layer

As defined in ITU-T Recommendation I.364 [1], § 3.2.

5.2.1 Description of primitives

As defined in ITU-T Recommendation I.364 [1], § 3.2.1.

5.2.1.1 CLNAP-UNITDATA.request

As defined in ITU-T Recommendation I.364 [1], § 3.2.1.1.

5.2.1.2 CLNAP-UNITDATA.indication

As defined in ITU-T Recommendation I.364 [1], § 3.2.1.2, with the following changes.

This primitive is issued to the CLNAP user entity to indicate the arrival of a CLNAP-SDU. In the absence of errors, the contents of the CLNAP-SDU are complete and unchanged, relative to the data parameter in the associated CLNAP-UNITDATA.request.

5.2.2 Definition of parameters

As defined in ITU-T Recommendation I.364 [1], § 3.2.2.

5.2.2.1 source_address

As defined in ITU-T Recommendation I.364 [1], § 3.2.2.1.

5.2.2.2 destination_address

As defined in ITU-T Recommendation I.364 [1], § 3.2.2.2.

5.2.2.3 QOS

As defined in ITU-T Recommendation I.364 [1], § 3.2.2.3.

5.2.2.4 Data

As defined in ITU-T Recommendation I.364 [1], § 3.2.2.4.

5.3 Service expected from the AAL

As defined in ITU-T Recommendation I.364 [1], § 3.3.

5.4 Connectionless service layer functions

As defined in ITU-T Recommendation I.364 [1], § 3.4.

5.4.1 Preservation of CLNAP-SDUs

As defined in ITU-T Recommendation I.364 [1], § 3.4.1.

5.4.2 Addressing

As defined in ITU-T Recommendation I.364 [1], § 3.4.2.

5.4.3 Carrier selection

The carrier selection, as described in ITU-T Recommendation I.364 [1], § 3.4.3 is deleted. However, a general mechanism for service provider and network operator selection in the European environment is currently under consideration.

5.4.4 QOS selection

As defined in ITU-T Recommendation I.364 [1], § 3.4.4.

5.5 CLNAP PDU structure and encoding

As defined in ITU-T Recommendation I.364 [1], § 3.5.

5.5.1 Destination address

As defined in ITU-T Recommendation I.364 [1], § 3.5.1, with the following changes.

This 8-octet field contains a 4 bit "address-type" subfield, followed by the 60-bit "address" subfield. The "address-type" subfield indicates whether the "address" subfield contains a publicly administered 60-bit individual address or a publicly administered 60-bit group address. The "address" subfield indicates to which CLNAP-entity(ies) the CLNAP-PDU is destined. The encoding of this "address-type" subfield is described in Annex A. This "address" subfield is structured according to CCITT Recommendation E.164 [3]. The encoding of the 60-bit address subfield is described in Annex A.

5.5.2 Source address

As defined in ITU-T Recommendation I.364 [1], § 3.5.2, with the following changes.

This 8-octet field contains a 4-bit "address-type" subfield, followed by the 60-bit "address" subfield. The "address-type" subfield always indicates that the "address" subfield contains a publicly administered 60-bit individual address. The "address" subfield indicates the CLNAP-entity that originated the CLNAP-PDU. The encoding of this "address-type" subfield is described in Annex A. This "address" subfield is structured according to CCITT Recommendation E.164 [3]. The encoding of the 60-bit address subfield is described in Annex A.

5.5.3 Higher Layer Protocol Identifier (HLPI)

As defined in ITU-T Recommendation I.364 [1], § 3.5.3, with the following changes.

This 6-bit field is used to identify the CLNAP User Layer entity which the CLNAP-SDU is to be passed to at the destination node. It is transparently carried end-to-end by the network.

Table 1: Coding of the Higher Layer Protocol Identifier (HLPI) field

HLPI Range	Protocol Entity
1	Reserved for Logical Link Control.
2	Reserved for MAN layer management (see NOTE 1).
3	Reserved for ISO TR 9577 [17].
44-47	Reserved for network usage (see NOTE 2).
48-63	Reserved for use by local administration (see NOTE 1).
Other values	Reserved for future standardization.

NOTE 1: No filtering is required by the network on the basis of these values.

NOTE 2: These values should never be set by an ATM CBDS user. Any CLNAP-PDU having the HLPI set to any of these values will be discarded by the network.

5.5.4 PAD length

As defined in ITU-T Recommendation I.364 [1], § 3.5.4.

5.5.5 QOS

As defined in ITU-T Recommendation I.364 [1], § 3.5.5.

5.5.6 CRC Indication Bit (CIB)

As defined in ITU-T Recommendation I.364 [1], § 3.5.6.

5.5.7 Header Extension Length (HEL)

As defined in ITU-T Recommendation I.364 [1], § 3.5.7.

5.5.8 Reserved

As defined in ITU-T Recommendation I.364 [1], § 3.5.8.

5.5.9 Header Extension

As defined in ITU-T Recommendation I.364 [1], § 3.5.9.

5.5.10 User information

As defined in ITU-T Recommendation I.364 [1], § 3.5.10, with the following change.

This field is of variable length up to 9 188 octets and is used to carry the CLNAP-SDU.

5.5.11 PAD

As defined in ITU-T Recommendation I.364 [1], § 3.5.11.

5.5.12 CRC

As defined in ITU-T Recommendation I.364 [1], § 3.5.12.

5.6 Procedures

For further study. (This is also defined as "for further study" in ITU-T Recommendation I.364 [1], § 3.6).

6 CLNIP

6.1 Overview

The CLNIP supports the CBDS as specified in ETS 300 217 [2] between MAN Switching Systems (MSSs) interconnected via an ATM network and between CLSs, inside a network operator domain and between two network operator domains.

NOTE: The applicability of the protocol inside a network operator domain needs to be checked. It is assumed in this ETR that the same protocol applies to all cases.

The CLNIP provides for the transport between network nodes of both encapsulated and non-encapsulated data units, originated from CBDS users. The protocol conversion between encapsulating and non encapsulating CLNIP requires further study. The CLNIP should be applied at the MSS ATM Interface/Connectionless Network Interface (MAI/CLNI), as shown in figure 9.

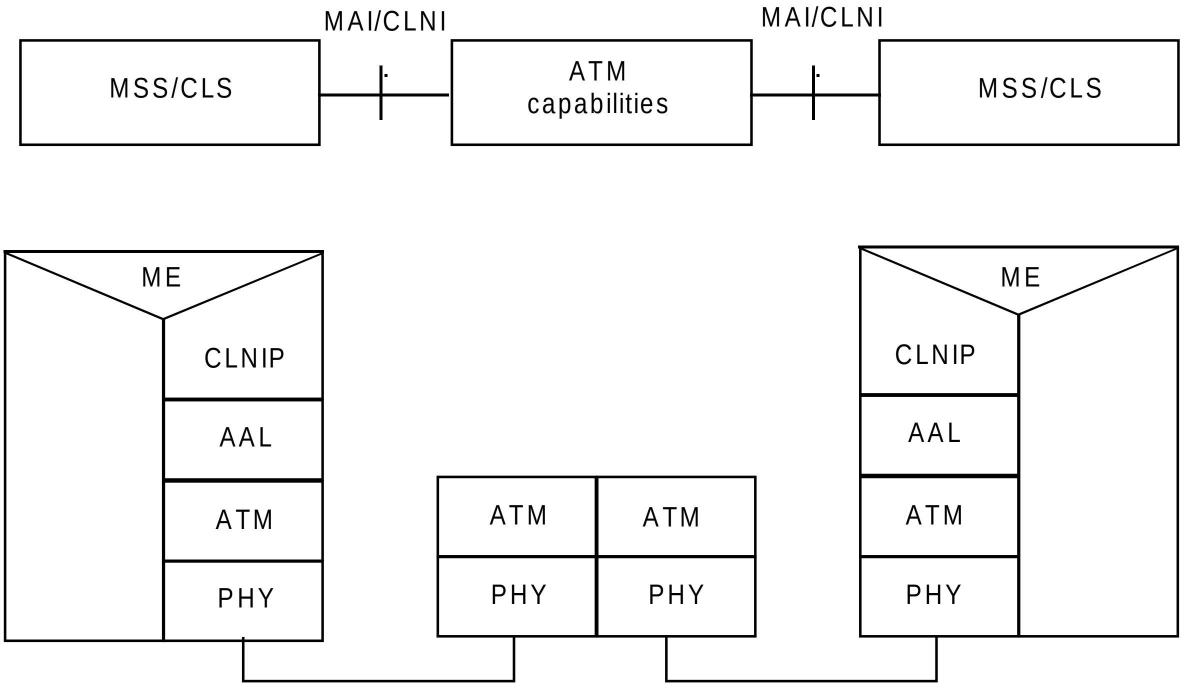


Figure 9: Network and protocol architecture

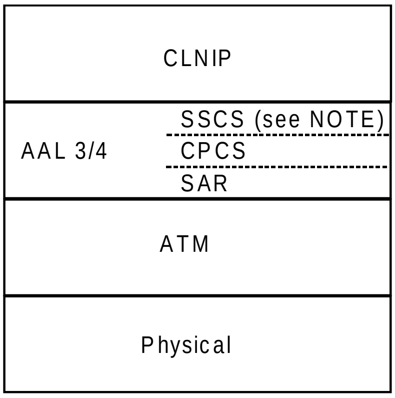
Application rules for the use of encapsulation:

- for NNI applications between network operators encapsulation is always used for both group and individually addressed PDUs;

- for NNI applications within a single operator's network, encapsulation and/or non-encapsulation may be used depending on the choice of the network operator.

6.2 Protocol architecture

The protocol stack for supporting the transfer of connectionless data between network nodes is depicted in figure 10. The CLNIP layer uses the AAL type 3/4 unassured service and includes the necessary functionality to provide the connectionless layer service. For structure and encoding of AAL type 3/4 (CPCS and SAR) see ITU-T Recommendation I.363 [11].



NOTE: For the connectionless service the Service Specific Convergence Sublayer (SSCS) is null in the sense that it provides only for primitives mapping (see ITU-T Recommendation I.363 [11] § 4.3.2.2).

Figure 10: Protocol stack for CLNIP

6.3 Service provided by the CLNIP layer

The CLNIP layer provides for the transparent transfer of the part of the CLNAP-PDUs/IMPDUs covered by the CRC32 between MAI/CLNI interfaces in such a manner that lost or corrupted data units are not retransmitted. The service primitives are defined in subclauses 6.6.2 and 6.7.3.

6.4 Service expected from the AAL

The B-ISDN CLNIP layer expects the AAL to provide for the transparent and sequential transfer of CLNIP-PDUs between two CLNIP layer entities if accessing a point-to-point bi-directional AAL connection, or two or more CLNIP layer entities if accessing a decentralized multipoint AAL connection. This transfer is operated in an unassured manner, i.e. lost or corrupted data units are not retransmitted (unassured operation). The information transfer between the CLNIP entity and the AAL entity can be performed in a message mode or streaming mode. The use of streaming mode service by CLNIP is for further study.

In general, the information exchanged between the AAL-entities and the CLNIP-entities across the AAL-Service Access Point (SAP) includes the following primitives:

1) AAL-UNITDATA-request (Interface Data, More, Maximum Length);

2) AAL-UNITDATA-indication (Interface Data, More, Maximum Length);

3) AAL-U-Abort-request (used only in streaming mode);

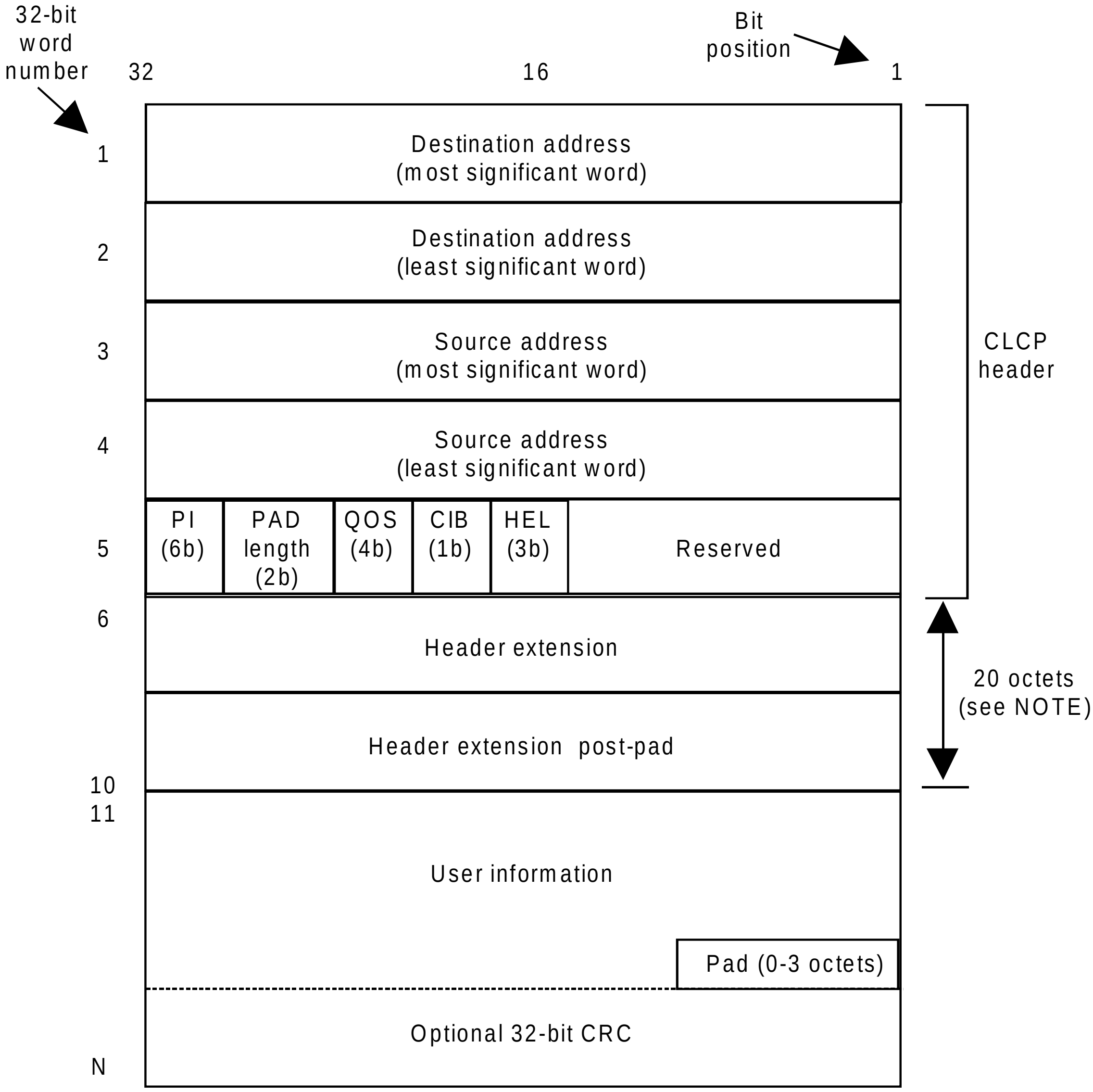
4) AAL-U-Abort-indication (used only in streaming mode);

5) AAL-P-Abort-indication (used only in streaming mode).

A detailed description of the primitives and parameters is provided in ITU-T Recommendation I.363 [11]. The CLNIP does not make use of the optional Reception Status parameter in the AAL-UNITDATA primitive and no corrupted data is delivered to the CLNIP layer.

6.5 CLNIP Protocol Data Unit (PDU) structure and encoding

The detailed structure of the CLNIP-PDU is illustrated in figure 11.



NOTE: The header extension Post-PAD is only present if encapsulation applies. In case of non-encapsulation the overall length is equal to the value of HEL.

Figure 11: Structure of the CLNIP-PDU

The CLNIP-PDU contains the fields given in subclauses 6.5.1 to 6.5.11.

6.5.1 Destination address

This 8-octet field contains a 4-bit "address-type" subfield, followed by the 60-bit "address" subfield. The "address-type" subfield indicates whether the "address" subfield contains a publicly administered 60-bit individual address or a publicly administered 60-bit group address. The privately administered 60-bit address is for further study. The encoding of the "address-type" subfield is described in Annex A.

The structure of the "address" subfield is modelled according to CCITT Recommendation E.164 [3]. The encoding of the "address" subfield is described in Annex A.

6.5.2 Source address

This 8-octet field contains a 4-bit "address-type" subfield, followed by the 60-bit "address" subfield. The "address-type" subfield always indicates that the "address" subfield contains a publicly administered 60-bit individual address. The privately administered 60-bit address is for further study. The encoding of the "address-type" subfield is described in Annex A.

The structure of the "address" subfield is modelled according to CCITT Recommendation E.164 [3]. The encoding of the "address" subfield is described in Annex A.

6.5.3 Protocol Identifier (PI)

If encapsulation is performed, this 6-bit field takes the value in range 44-47 and is used to indicate that the CLNIP-PDU is an encapsulating one.

If encapsulation is not performed, the field has the same coding and meaning as in the CLNAP-PDU or Initial MAC Protocol Data Unit (IMPDU) sent by the originating CBDS user.

6.5.4 PAD length

This 2-bit field indicates the length of the PAD field (0 - 3 octets). The number of PAD octets is such that the total length of the "user information" field and the PAD field together is an integral multiple of 4 octets. This field is always coded to 0 in case encapsulation is performed.

6.5.5 QOS

This 4-bit field is used to indicate the QOS requested for the CLNIP-PDU. In case of non-encapsulation this field has the same coding and meaning as in the CLNAP-PDU or IMPDU sent by the originating CBDS user.

In case of encapsulation the semantics of this field and its exact use in relationship with the network service support functions are for further study. Until such studies are completed, the field should be set to "0" at the sending side, at the receiving side, this field will be ignored.

6.5.6 CRC Indication Bit (CIB)

This 1-bit field indicates the presence (CIB=1) or absence (CIB=0) of a 32-bit CRC. In case encapsulation is performed, this field should be coded as "0".

NOTE: No CRC is used with encapsulated PDUs.

6.5.7 Header Extension Length (HEL)

This 3-bit field can take on any value from 0-5 and indicates the number of 32-bit words in the header extension field.

6.5.8 Reserved

This 16-bit field is reserved for future use. It should be coded as "0" by the sender, the receiver will ignore this field.

6.5.9 Header Extension

This variable-length field can range from 0 up to 20 octets, its length is indicated by the value of the header extension length field (see subclause 6.5.7). The structure, coding and semantics of this field and its use are for further study.

6.5.10 HE Post-PAD

In case encapsulation is performed, this field has a length in octets equal to 20 minus the length of the header extension field. It is inserted in the CLNIP-PDU in order to always bring the overall length of the CLNIP-PDU header of an encapsulating PDU (including Destination Address (DA), Source Address (SA), PI, PAD length, QOS, CIB, HEL, Reserved, HE and HE Post-PAD) to 40 octets.

This field should not be present if encapsulation is not performed.

6.5.11 User information

This field is of variable length, up to 9 236 octets. In case encapsulation is performed, this field carries the encapsulated CLNAP-PDU + alignment header (4 octets long) (see figure 13 and subclause 6.6.1.1 for definition of the content of the alignment header) or IMPDU without common PDU trailer. Otherwise, the field carries the source user data unit, the optional 32-bit CRC and the PAD field.

6.6 Encapsulation mechanism specification

This subclause specifies the encapsulation mechanism of ISO/IEC DIS 8802-6 [12] IMPDUs or CLNAP-PDUs within CLNIP-PDUs at the MAI/CLNI interface, as shown in figure 9. For reasons of simplicity this interface is called CLNI in the following.

This subclause describes the encapsulation/de-capsulation mechanism that is performed by MAN Switching System (MSS) or CLS to which the users are connected. The CLNIP as well as the encapsulation mechanism are defined in such a way that pipe-lining of SAR-PDUs is possible.

6.6.1 Mapping entity functionalities

The mapping entity, depicted in figure 9, is a logical collection of MSS/CLS functions that supplements the CLNIP layer functionalities in order to provide CBDS service over a multi-MSS/CLS network. The mapping entity is introduced to ensure proper encapsulation/de-capsulation of IMPDUs or CLNAP-PDUs into/from CLNIP-PDUs.

6.6.1.1 Transfer of PDUs from MSS or CLS towards CLNI

The mapping entity, within an MSS, strips off its common PDU trailer (Reserved, ETag, Length field) when receiving an IMPDU.

The IMPDU without the common PDU trailer will be encapsulated into a CLNIP-PDU. Figure 12 illustrates the encapsulation of the IMPDU using the information processed by the mapping entity.

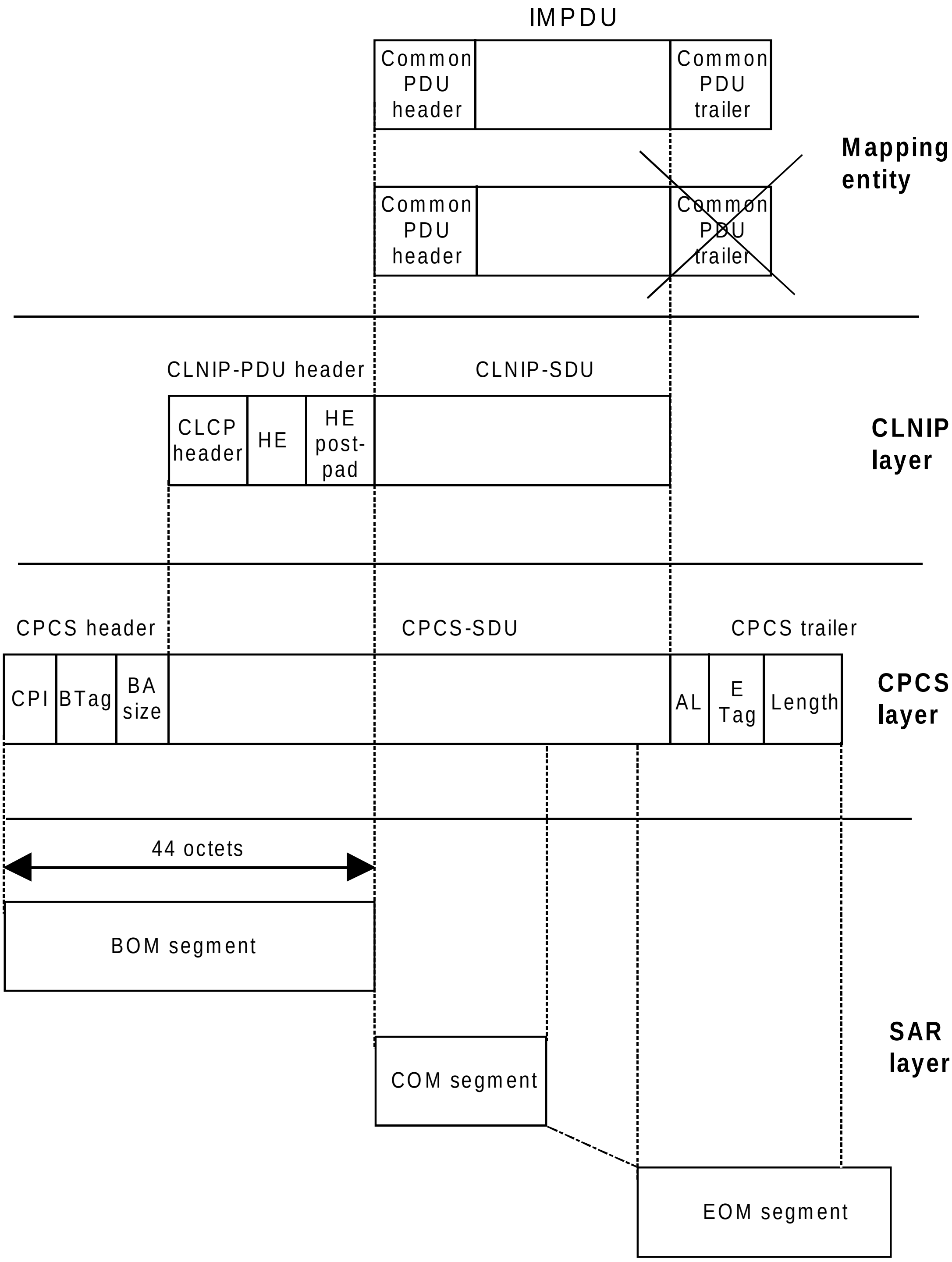


Figure 12: Encapsulation of an IMPDU within a CLNIP-PDU

The mapping entity, within a CLS, when receiving a CLNAP-PDU adds to it an alignment header (see NOTE) when receiving a CLNAP-PDU. The Alignment Header should either be populated with a Common PDU Header as specified for the IMPDU (see ETS 300 217 [2]) or with a default value which is defined as all 0s. No other content is allowed.

NOTE: Whether the indication of the presence of the alignment header is required is for further study.

The CLNAP-PDU plus the alignment header should be encapsulated within a CLNIP-PDU. Figure 13 illustrates the encapsulation of the CLNAP-PDU + alignment header using the information processed by the mapping entity.

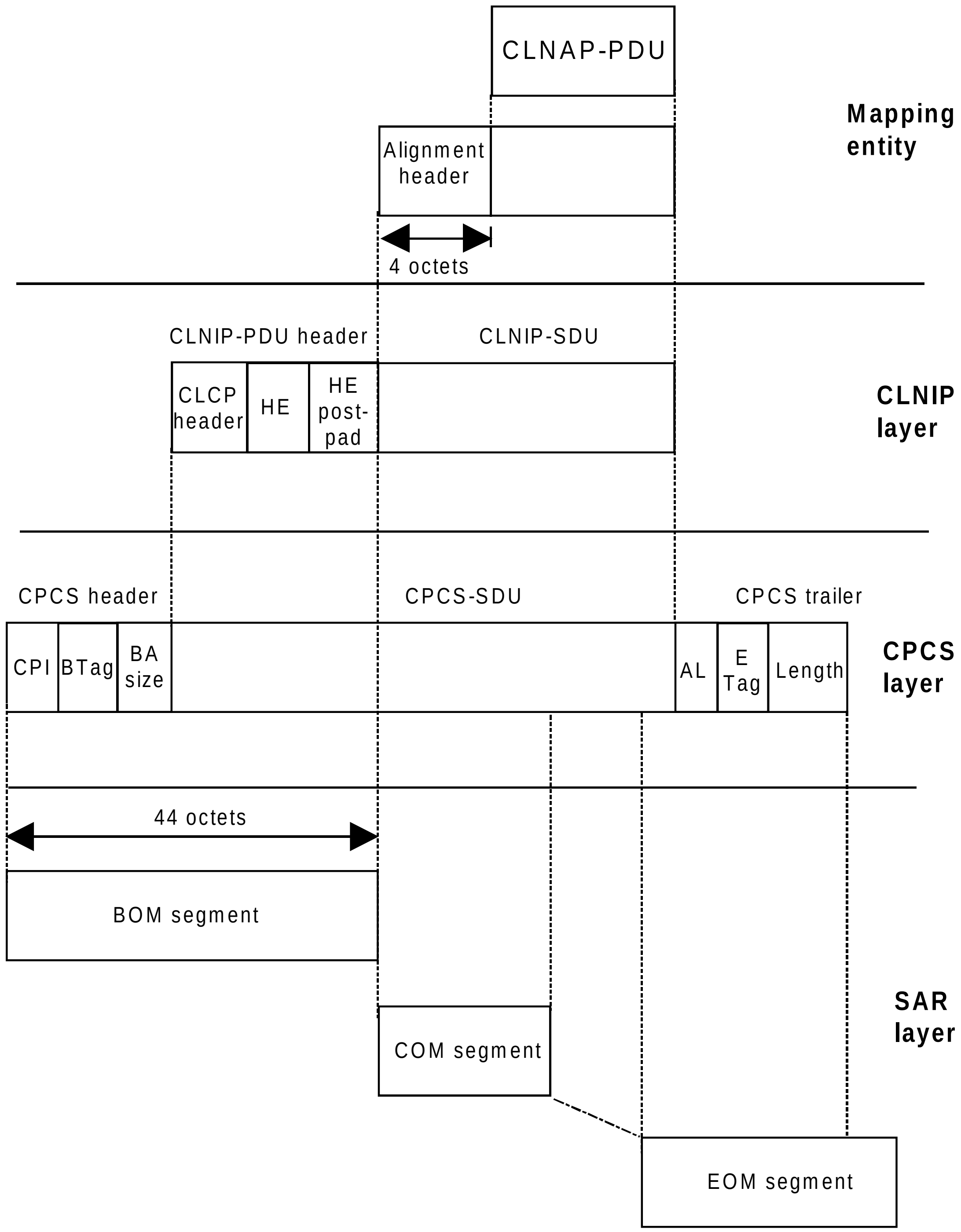


Figure 13: Encapsulation of a CLNAP-PDU within a CLNIP-PDU

6.6.1.2 Transfer of PDUs from CLNI towards MSS or CLS

The mapping entity, within a CLS, when receiving the payload of the CLNIP-PDU (which consists of the IMPDU without the common PDU trailer or the CLNAP-PDU plus the alignment header depending if the originating user is attached respectively to a MSS or to a CLS) strips off the first 4 octets (respectively common PDU header of the IMPDU or alignment header added to the CLNAP-PDU) and forwards the CLNAP-PDU.

The mapping entity, within a MSS, when receiving the payload of the CLNIP-PDU (which consists of the IMPDU without the common PDU trailer or the CLNAP-PDU plus the alignment header depending if the originating user is attached respectively to a MSS or to a CLS) checks if the first 4 octets contain the default value, i.e. all zeros of the Alignment Header. If yes, it strips off the first 4 octets and creates an IMPDU adding new common PDU header and trailer.

If not it creates the IMPDU adding a common PDU trailer in which the length field is set to the BAsize value recovered from the received common PDU header.

6.6.2 Interaction between mapping entity and CLNIP layer

This subclause describes the interaction between the mapping entity and the CLNIP layer.

The description of the interaction between mapping entity and the CLNIP layer is made in terms of primitives and parameters passing. The information exchanged between the CLNIP layer and the mapping entity includes the following primitives:

1) CLNIP_UNITDATA.request (source_address,
destination_address,
protocol_identifier,
header_extension,
data,
QOS (see subclause 6.5.5)).

This primitive is issued by the mapping entity to the CLNIP layer, requesting the transport of the IMPDU or the CLNAP-PDU through the ATM network.

Each CLNIP_UNITDATA.request primitive has six parameters:

- source_address: this parameter identifies the source interface that originated the data unit;

- destination_address: this parameter identifies the address of the intended recipient(s). This parameter may be different from the destination_address parameter received in the IMPDU/CLNAP-PDU (e.g. due to group address resolution);

- protocol_identifier: this parameter indicates that the encapsulation technique should be used in the construction of the CLNIP-PDU; it will contain any value in the range from 44 to 47 inclusive;

- header_extension: this parameter indicates the content of the header extension field of the resulting CLNIP-PDU;

- data: this parameter indicates the content of the CLNIP-SDU, i.e. an IMPDU without the common PDU trailer or a CLNAP-PDU with on alignment header;

- QOS: this parameter specifies the QOS desired for the resulting CLNIP-PDU (see subclause 6.5.5).

The CLNIP-PDU should be encoded as follows:

- the DA field should contain the value of the destination_address parameter of the primitive;
- the Source Address (SA) field should contain the value of the source_address parameter of the primitive;
- the Protocol Identifier (PI) field should contain the value of the protocol_identifier parameter of the primitive. This field takes any value in the range from 44 to 47 inclusive;
- the PAD length field should be coded to 0;

  NOTE: There is no need to pad the CLNIP-SDU which is already 32-bit aligned.

- the QOS field should contain the value of the QOS parameter of the primitive (see subclause 6.5.5). The default encoding of this field is 0;
- the CRC32 Indicator Bit (CIB) should be set to 0, indicating that the 32-bit CRC is not used;
- the Header Extension Length (HEL) field should contain the length of the header extension field;
- the reserved field should be encoded with 0;
- the Header Extension (HE) field should contain the value of the header_extension parameter of the primitive;
- the Header Extension post-PAD field should have a length in octets equal to 20 minus the length of the Header Extension (HE) field;
- the user information field should contain the value of the data parameter of the primitive. This field is variable length up to 9 236 octets.

2) CLNIP_UNITDATA.indication (source_address,
destination_address,
protocol_identifier,
header_extension,
data,
QOS (see subclause 6.5.5)).

This primitive is issued by the CLNIP layer to the mapping entity, terminating the transport of the PDU, encapsulated in a CLNIP-PDU through the ATM network.

Each CLNIP_UNITDATA.indication primitive has six parameters:

- source_address: this parameter should contain the value of the Source Address field of the received CLNIP-PDU;
- destination_address: this parameter should contain the value of the Destination Address field of the received CLNIP-PDU;
- protocol_identifier: this parameter indicates that the encapsulation technique has been used in the construction of the received CLNIP-PDU;
- header_extension: this parameter should contain the value of the Header Extension field of the received CLNIP-PDU;
- data: this parameter should contain the IMPDU without the common PDU trailer or the CLNAP-PDU plus the alignment header;
- QOS: this parameter contains the value of the QOS field of the received CLNIP-PDU (see subclause 6.5.5).

This interaction does not imply any particular implementation.

6.6.3 Error conditions

This subclause applies to CLNIP-PDUs which are identified as encapsulating by means of the PI field.

Various errors may occur in receiving CLNIP-PDUs. Whenever one of the following conditions is encountered at the receiver, the respective CLNIP-PDU will be discarded:

- invalid address format;
- CLNIP source address different to IMPDU/CLNAP-PDU source address;
- CLNIP destination address different to IMPDU/CLNAP-PDU destination address in the case that the latter is an individual address;
- PAD length not equal to 0;
- QOS field other than 0;
- CLNIP CRC Indicator Bit (CIB) equal to 1;
- reserved field other than 0.

6.7 Non encapsulation mechanism specification

6.7.1 Introduction

This subclause specifies the non-encapsulation mechanism of CLNAP-PDUs and IMPDUs at the CLNI/MAI interface as shown in figure 9. For reasons of simplicity these interfaces are referred to as CLNI in the following.

NOTE: The CLNIP is defined in such a way that pipe-lining of SAR-PDUs is possible.

6.7.2 Mapping entity functionalities

The mapping entity, depicted in figure 9, is a logical collection of CLS/MSS functions that supplements the CLNIP layer functionalities in order to provide CBDS service over a multi-CLS/multi-MSS network.

6.7.2.1 Transfer of PDUs from CLS or MSS towards CLNI

The mapping entity, when receiving a CLNAP-PDU/IMPDU from a CLS/MSS, extracts the payload of the PDU and forwards it together with the relevant parameters to the CLNIP layer.

NOTE: The use of the reserved field to implement a hop count to detect looping in the network is for further study.

6.7.2.2 Transfer of PDUs from CLNI towards CLS or MSS

The mapping entity, when receiving the payload of the CLNIP-PDU and the relevant parameter creates the CLNAP-PDU/IMPDU.

NOTE: The use of a hop count to detect looping in the network is for further study.

6.7.3 Interaction between the mapping entity and CLNIP layer

This subclause describes the interaction between the mapping entity and the CLNIP layer. The description of the interaction between the mapping entity and the CLNIP layer is made in terms of primitives and parameters passing. The information exchanged between the CLNIP layer and the mapping entity includes the following primitives:

1) CLNIP_UNITDATA.request (source address,
destination address,
protocol identifier,
QOS,
header extension,
reserved,
data,
CRC).

This primitive is issued by the mapping entity to the CLNIP layer, initiating the transport of the CLNAP-PDU/IMPDU through the ATM network.

Each CLNIP_UNITDATA.request primitive has 8 parameters:

- source-address: this parameter identifies the source interface that originated the data unit. This parameter has the same value as the value in the SA field in the received CLNAP-PDU/IMPDU;
- destination-address: this parameter identifies the address of the intended recipient(s). This parameter has the same value as the value in the DA field in the received CLNAP-PDU/IMPDU;
- protocol_identifier: this parameter is equal to the HLPI value of the CLNAP-PDU/IMPDU;
- QOS: this parameter specifies the QOS desired for the resulting CLNIP-PDU (see subclause 6.5.5);
- the reserved parameter definition is for further study;
- header extension: this parameter, if present, indicates the content of the header extension field of the CLNAP-PDU/IMPDU;
- data: this parameter indicates the content of the user information field of the CLNAP-PDU/IMPDU;
- CRC: this parameter, if present, indicates the content of the CRC field of the CLNAP-PDU/IMPDU.

The CLNIP-PDU should be encoded as follows:

- the DA field should contain the value of the destination_address parameter of the primitive;
- the SA field should contain the value of the source_address parameter of the primitive;
- the Protocol Identifier (PI) field should contain the value of the protocol_identifier parameter of the primitive;
- the PAD length field should be such that the length of the user-information + PAD is a multiple of 32 bits;
- the QOS field should contain the value of the QOS parameter of the primitive;
- the CIB bit should be set to 1 if the CRC is present otherwise to be set to 0;
- the Header Extension Length field should be set to the length of the header extension field expressed in 32 bits words;
- the Reserved field should be set to "0". Other values are for further study.

- the Header Extension field should contain the value of the header_extension parameter of the primitive;

- the User Information field should contain the value of the data parameter of the primitive. This field is of variable length up to 9 188 octets;

- a PAD field (0 - 3 octets) should be added to the PDU after the user information field for 4 octets alignment;

- the CRC field should contain the value of the CRC parameter if present.

2) CLNIP_UNITDATA.indication (source_address,
destination_address,
protocol_identifier,
QOS,
header_extension,
reserved,
data,
CRC).

Each CLNIP_UNITDATA.indication primitive has 8 parameters:

- source-address: this parameter should contain the value of the SA field of the received CLNIP-PDU;

- destination-address: this parameter should contain the value of the DA field of the received CLNIP-PDU;

- protocol_identifier: this parameter should contain the value of the protocol_identifier field of the received CLNIP-PDU;

- QOS: this parameter should contain the value of the QOS field of the received CLNIP-PDU (see subclause 6.5.5);

- the reserved parameter is ignored; its functionality (e.g. for a hop count) is for further study;

- header-extension: this parameter should contain the value of the Header Extension field of the received CLNIP-PDU;

- data: this parameter indicates the content of the user information field of the CLNIP-PDU;

- CRC: this parameter should contain the value of the CRC field of the CLNIP-PDU if present.

This interaction does not imply any particular implementation.

6.7.4 Error conditions

This subclause applies to CLNIP-PDUs which are identified as non-encapsulating by means of the PI field.

Various error conditions may occur in receiving CLNIP-PDUs. Whenever one of the following conditions is encountered at the receiver, the respective CLNIP-PDU will be discarded:

- invalid address format;
- PAD length such that the total length of user information and PAD fields is not a multiple of 4 octets;
- values of HEL different from ITU-T Recommendation I.364 [1], § 3.5.7.

Annex A: Encodings

As defined in ITU-T Recommendation I.364 [1], Annex A, with the following changes.

Table A.1: Destination address field

Address Type	Address Structure/Meaning
0100	Reserved (see NOTE).
1000	Reserved (see NOTE).
1100	CCITT Recommendation E.164 [3] publicly administered individual address.
1101	Reserved (see NOTE).
1110	CCITT Recommendation E.164 [3] publicly administered group address.
1111	Reserved (see NOTE).
All other codes	Reserved for future standardization.
NOTE: The usage of these values is defined for MAN applications - see ISO/IEC DIS 8802-6 [12].	

Table A.2: Source address field

Address Type	Address Structure/Meaning
0100	Reserved (see NOTE).
1000	Reserved (see NOTE).
1100	CCITT Recommendation E.164 [3] publicly administered individual address.
1101	Reserved (see NOTE).
All other codes	Reserved for future standardization.
NOTE: The usage of these values is defined for MAN applications - see ISO/IEC DIS 8802-6 [12].	

The CCITT Recommendation E.164 [3] number carried in the 60-bit address subfield is the international ISDN number. The international ISDN number can consist of up to 15 decimal digits. If numbers have fewer than 15 decimal digits, the number is placed in the most significant bits of the address subfield. The remaining part of the address subfield is coded to all 1s.

The CCITT Recommendation E.164 [3] numbers are coded using Binary Coded Decimal (BCD). The encoding of the encoded BCD digits into the address subfield follows the encoding principles described in ITU-T Recommendation I.361 [9].

Annex B: CRC32 generation and checking

CRC32 generation and checking is defined in ITU-T Recommendation I.364 [1], Appendix 1.

History

Document history	
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