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SERIES I: INTEGRATED SERVICES DIGITAL
NETWORK

Overall network aspects and functions – Protocol layer
requirements

B-ISDN ATM Adaptation Layer specification: Type 2 AAL

ITU-T Recommendation I.363.2

(Formerly CCITT Recommendation)

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B-ISDN ATM Adaptation Layer specification: Type 2 AAL

Summary

This Recommendation specifies the AAL type 2 that provides for the bandwidth-efficient transmission of low-rate, short, and variable length packets in delay sensitive applications. More than one AAL type 2 user information stream can be supported on a single ATM connection. This Recommendation covers the specification of the frame structure of the short and variable length packets, the packing of short length packets into one (or more) ATM cells, and the mechanisms to recover from transmission errors.

This Recommendation describes the interactions between AAL type 2 and the next higher layer, between AAL type 2 and the ATM layer, and between AAL type 2 and Layer Management, as well as AAL type 2 peer-to-peer operations.

Source

ITU-T Recommendation I.363.2 was revised by ITU-T Study Group 13 (2001-2004) and approved under the WTSA Resolution 1 procedure on 24 November 2000.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation I.363.2

B-ISDN ATM Adaptation Layer specification: Type 2 AAL

1 Scope

This Recommendation specifies the AAL type 2 that provides for the bandwidth-efficient transmission of low-rate, short, and variable length packets in delay sensitive applications. More than one AAL type 2 user information stream can be supported on a single ATM connection. This Recommendation covers the specification of the frame structure of the short and variable length packets, the packing of short length packets into one (or more) ATM cells, and the mechanisms to recover from transmission errors.

This Recommendation describes the interactions between AAL type 2 and the next higher layer, between AAL type 2 and the ATM layer, and between AAL type 2 and Layer Management, as well as AAL type 2 peer-to-peer operations.

2 Normative References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- [1] ITU-T I.361 (1999), *B-ISDN ATM layer specification*.
- [2] ITU-T X.200 (1994), *Information technology – Open Systems Interconnection – Basic Reference Model: The basic model*.
- [3] ITU-T X.210 (1993), *Information technology – Open Systems Interconnection – Basic Reference Model: Conventions for the definition of OSI services*.
- [4] ITU-T I.371 (2000), *Traffic control and congestion control in B-ISDN*.

3 Definitions

This Recommendation is based upon the concepts developed in ITU-T X.200 [2] and X.210 [3]. Details of the data unit naming convention used in this Recommendation can be found in Annex A.

4 Abbreviations

This Recommendation uses the following abbreviations.

AAL	ATM Adaptation Layer
AAL-CEP	AAL Connection End Point
AAL-SDU	AAL Service Data Unit
ANP	AAL type 2 Negotiation Procedures
ATC	ATM Transfer Capability
ATM	Asynchronous Transfer Mode

ATM-CEP	ATM Connection End Point
ATM-SDU	ATM Service Data Unit
AUU	ATM-User-to-ATM-User Indication
CEP	Connection End Point
CI	Congestion Indication
CID	Channel Identifier
CLP	Cell Loss Priority
CPS	Common Part Sublayer
CPS-INFO	CPS Interface Data
CPS-PDU	CPS Protocol Data Unit
CPS-PH	CPS Packet Header
CPS-PP	CPS Packet Payload
CPS-SDU	CPS Service Data Unit
CPS-UUI	CPS User-to-User Indication
HEC	Header Error Control
LI	Length Indication
LM	Layer Management
LSB	Least Significant Bit
MSB	Most Significant Bit
OAM	Operation and Maintenance
OSF	Offset Field
PAD	Padding
PCI	Protocol Control Information
PDU	Protocol Data Unit
QoS	Quality of Service
RLP	Received (Cell) Loss Priority
SAP	Service Access Point
SDL	Specification and Description Language
SDU	Service Data Unit
SLP	Submitted (Cell) Loss Priority
SN	Sequence Number
SSCS	Service Specific Convergence Sublayer
SSCS-PDU	SSCS Protocol Data Unit
STF	Start Field
UUI	User-to-User Indication
VCC	Virtual Channel Connection

5 Conventions

The AAL type 2 receives from the ATM layer the information in the form of a 48-octet ATM Service Data Unit (ATM-SDU). The AAL type 2 passes to the ATM layer information in the form of a 48-octet ATM-SDU.

6 General framework of AAL type 2

6.1 Structure of AAL type 2

The AAL type 2 is subdivided into the Common Part Sublayer (CPS) and the Service Specific Convergence Sublayer (SSCS) as shown in Figure 1. For more detail, see Annex B.

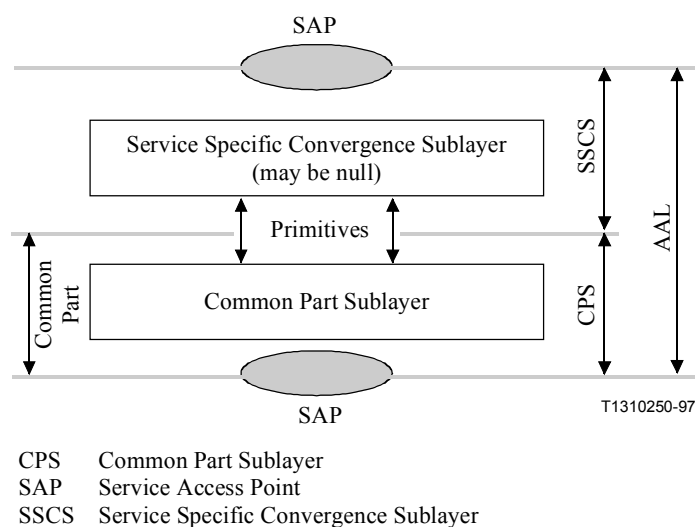


Figure 1/I.363.2 – Structure of the AAL type 2

Different SSCS protocols may be defined to support specific AAL type 2 user services, or groups of services. The SSCS may also be null, merely providing for the mapping of the equivalent AAL primitives to the AAL type 2 CPS primitives and vice versa. SSCS protocols are defined in separate Recommendations.

The AAL type 2 provides the capabilities to transfer AAL-SDUs from one AAL-SAP to one other AAL-SAP through the ATM network (see Figure 2 a)). The AAL type 2 in non-assured operation provides the capability to transfer the AAL-SDUs from one AAL-SAP to more than one AAL-SAP through the point-to-multipoint ATM layer capability (see Figure 2 b)).

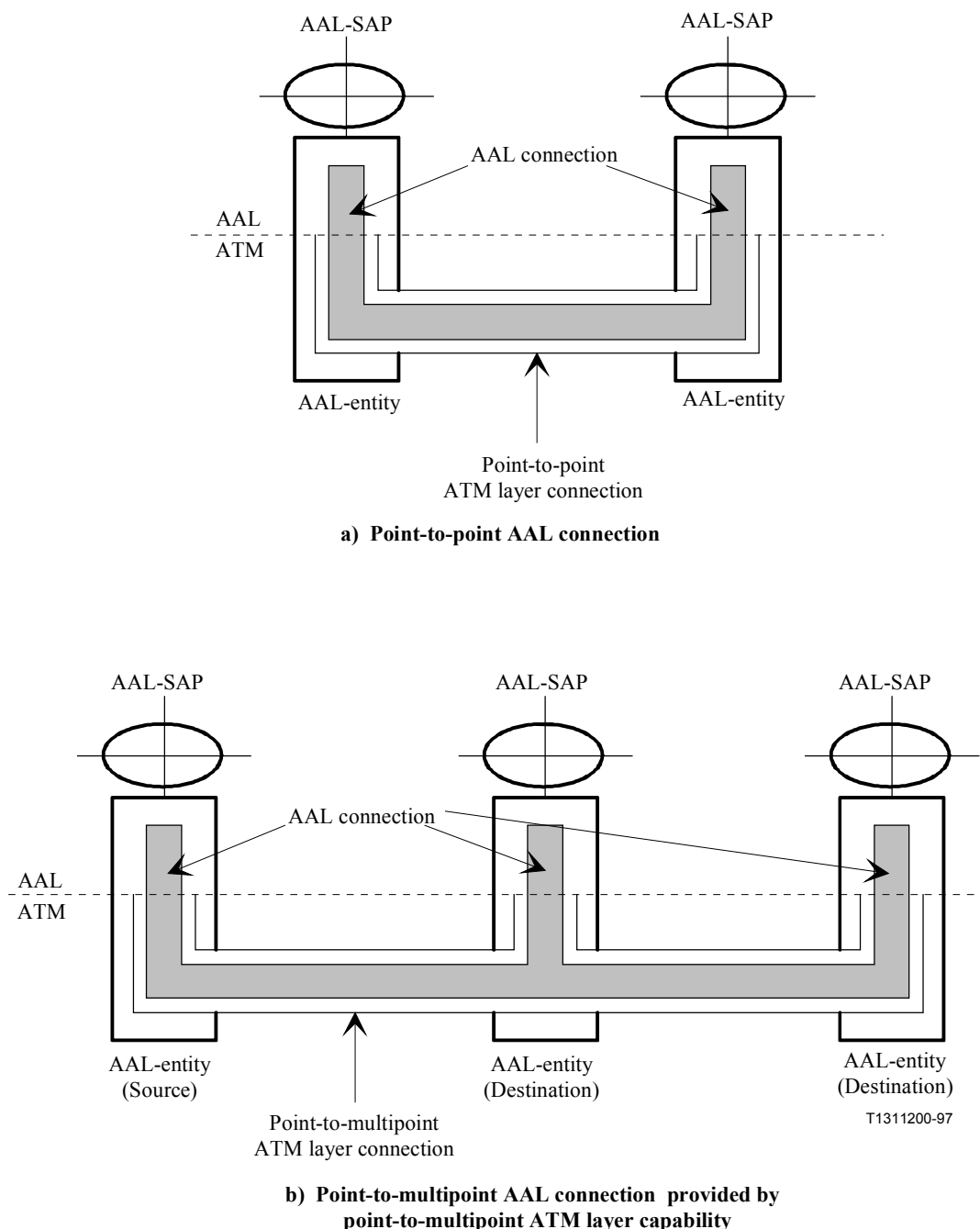
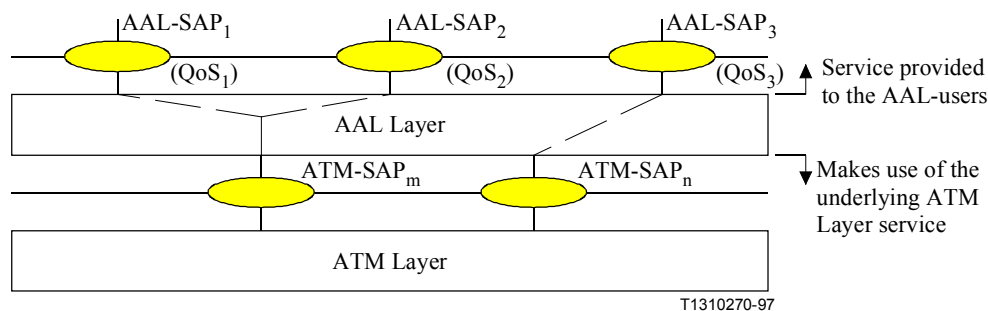


Figure 2/I.363.2

The AAL type 2 users have the capability to select a given AAL-SAP associated with the QoS (for example, delay and loss sensitivity) required to transport that AAL-SDU (see Figure 3). The AAL type 2 makes use of the service provided by the underlying ATM layer. Multiple AAL connections may be associated with a single ATM layer connection, allowing multiplexing at the AAL; multiplexing in the AAL type 2 occurs in the Common Part Sublayer (CPS). The AAL user selects the QoS provided by the AAL through the choice of the AAL-SAP used for data transfer. In this version of the Recommendation, Quality of Service (QoS_x in Figure 3) is provided by the ATM layer and there exists no standardized means to provide QoS at the AAL type 2 layer.



NOTE – How QoS at the AAL-SAP is mapped into the ATM-SAP QoS in the event of multiplexing in the AAL is for further study.

Figure 3/I.363-2 – Relation between AAL-SAP and ATM-SAP

The switching aspects of AAL type 2 connections are specified in Annex C.

6.2 Primitives provided by AAL type 2 for higher layer

The primitives that cross the AAL type 2 SAP are service-specific and contained in Recommendations that specify SSCS protocols.

The SSCS may be null, merely providing for the mapping of the equivalent AAL primitives to CPS and vice versa. In this case, the primitives for the AAL are equivalent to the AAL type 2 CPS primitives (see 7.2) but identified as AAL-UNITDATA.request and AAL-UNITDATA.indication consistent with the primitive naming convention at a SAP.

6.3 Information flow across the AAL-ATM boundary

The AAL type 2 makes use of the ATM layer services as defined in ITU-T I.361 [1]. The primitives that cross the ATM-SAP are defined in ITU-T I.361 [1]. They are summarized in Table 1. In the event of any difference between the following summary and the definitions in ITU-T I.361, the definitions in ITU-T I.361 take precedence.

Table 1/I.363.2 – Primitives and parameters of the ATM layer

Parameter	ATM-DATA request	ATM-DATA indication	Comments
ATM-SDU (INFO)	m	m	48 octets of ATM user data
ATM-User-to-ATM-User Indication (AUU) (Note)	m	m	1 bit of ATM user information
Submitted Loss Priority (SLP) (Note)	m	–	CLP = 1 increases the probability that the ATM network may discard the cell
Received Loss Priority (RLP)	–	m	The CLP may have been modified by ATM network from "0" to "1"
Congestion Indication (CI) (Note)	o	m	CI = "1" indicates that congestion has been encountered either before transmission or during transfer
m Parameter mandatory o Parameter optional – Parameter not present NOTE – AUU, SLP and CI of ATM-DATA.request are set to "0" (see clause 10).			

7 General framework of AAL type 2 Common Part Sublayer (CPS)

7.1 Service provided by AAL type 2 CPS

The AAL type 2 CPS provides the capabilities to transfer CPS-SDUs from one CPS user to one other CPS user through an ATM network. Two types of CPS users are supported:

- SSCS entities; and
- Layer Management.

The service offers peer-to-peer operation:

- data transfer of CPS-SDUs of up to 45 (default) or 64 octets [see 9.1 b)];
- multiplexing and demultiplexing of multiple AAL type 2 channels;
- CPS-SDU sequence integrity is maintained on each AAL type 2 channel.

The above service is non-assured, i.e.:

- integral CPS-SDU may be delivered or lost; and
- lost CPS-SDUs will not be corrected by retransmission.

The AAL type 2 CPS possesses the following characteristics:

- The AAL type 2 CPS connection is defined on an end-to-end basis as a concatenation of AAL type 2 channels.

NOTE – The concatenation of AAL type 2 channels requires a relay function within the Common Part Sublayer; details are for further study.

- The AAL type 2 channel is a bidirectional virtual channel. The same value of channel identifier value shall be used for both directions.
- The AAL type 2 channels are established over an ATM layer Permanent Virtual Circuit (PVC) or Switched Virtual Circuit (SVC).

7.2 Primitives between AAL type 2 CPS and SSCS entities

The primitives provided by the AAL type 2 CPS for communication with SSCS entities are CPS-UNITDATA.request and CPS-UNITDATA.indication. They are used for the data transfer.

The following parameters are defined.

CPS Interface Data (CPS-INFO)

This parameter specifies the interface data unit exchanged between the CPS and the SSCS entity. The interface data is an integral multiple of one octet. The CPS Interface Data represents a complete CPS-SDU.

CPS User-to-User Indication (CPS-UUI)

This parameter is transparently transported by the CPS between peer CPS users.

The usage of parameters is summarized in Table 2.

8 Interaction with Management and Control Plane

8.1 Management Plane

8.1.1 Management Plane interaction with AAL type 2 CPS User Plane

Layer Management provides the primitive MAAL-SEND.request to signal to the AAL type 2 CPS that the ATM Transfer Capability [4] (ATC) in force for the ATM connection allows the submission of a CPS-PDU for transmission; this primitive has no parameters. The AAL type 2 CPS also reports detected transmission errors to Layer Management by means of the MAAL-ERROR.indication primitive that has a single parameter indicating the error number (type of error, see Table 6).

To enable peer-to-peer AAL type 2 management communication via AAL type 2 channels, the primitive MAAL-UNITDATA.request is used to deliver data from the Management Plane to the CPS transmitter. The primitive MAAL-UNITDATA.indication is used to deliver data from the CPS receiver to the Management Plane. The following parameters are defined:

CPS Interface Data (CPS-INFO)

This parameter specifies the interface data unit exchanged between the CPS and Layer Management. The interface data is an integral multiple of one octet.

CPS User-to-User Indication (CPS-UUI)

This parameter is transparently transported by the CPS between peer Layer Management entities.

CPS Channel Identifier (CPS-CID)

This parameter contains a Channel Identifier (CID), it identifies the CPS connection for which this management information is exchanged.

The usage of parameters is summarized in Table 3.

Table 2/I.363.2 – Primitives and parameters between the CPS and the SSCS

Parameter	CPS-UNITDATA request	CPS-UNITDATA indication	Comments
CPS-Interface Data (CPS-INFO)	m	m	1..45 (default) or 1..64 octets of CPS user data (see 9.1 b))
CPS-User-to-User Indication (CPS-UUI)	m	m	5 bits of CPS user information (Note)
m Parameter mandatory NOTE – Only values "0" .. "27" are permitted.			

Table 3/I.363.2 – Primitives and parameters between the CPS and Layer Management

Parameter	MAAL-UNITDATA request	MAAL-UNITDATA indication	Comments
CPS- Interface Data (CPS-INFO)	m	m	1..45 (default) or 1..64 octets of Layer Management user data (see 9.1 b))
CPS- User-to-User Indication (CPS-UUI)	m	m	5 bits of Layer Management information (Note)
CPS-Channel Identifier (CPS-CID)	m	m	An 8 bit CPS Channel Identifier indicating the AAL type 2 channel on which the information will be or has been transmitted
m Parameter mandatory NOTE – Only values "30" .. "31" are permitted.			

Other interactions with the Management Plane are for further study.

8.2 Control Plane

Interaction between the AAL type 2 and the Control Plane (C-plane) is outside the scope of this Recommendation. If the AAL type 2 is used on a Switched Virtual Circuit (SVC) that has been established via Control Plane functions (signalling), the SVC is established at the AAL type 2 level and not at the individual channel level contained within the AAL type 2. Switching at the individual channel level within the AAL type 2 is for further study.

9 Format and coding of AAL type 2 Common Part Sublayer (CPS)

This clause specifies the format and coding of the CPS-Packet and the packing of CPS-Packets into AAL type 2 CPS PDUs.

The coding conforms to the coding conventions specified in 2.1/I.361 [1].

9.1 Format and coding of the CPS-Packet

A CPS-Packet consists of a 3-octet CPS-Packet Header (CPS-PH) followed by a CPS-Packet Payload (CPS-PP). The size and positions of the fields of the CPS-Packet are shown in Figure 4.

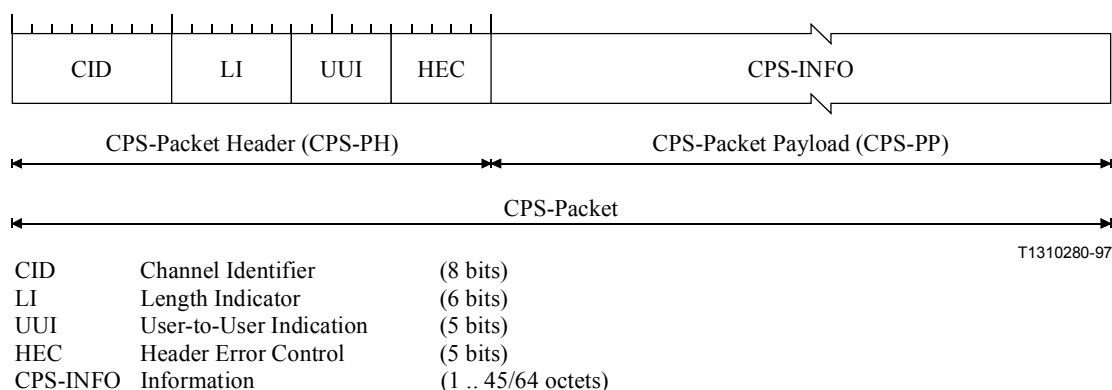


Figure 4/I.363.2 – Format of AAL type 2 CPS-Packet

The CPS-PH consists of four fields:

a) *Channel Identifier (CID)*

The CID value identifies the AAL type 2 CPS user of the channel. The AAL type 2 channel is a bidirectional channel. The same value of channel identification shall be used for both directions.

The value "0" is not used for channel identification because the all zero octet is used for the padding function (see 9.2.2). The values "1" .. "7" are reserved for use by the AAL type 2 and are specified in this Recommendation (see Table 4).

The values "8" .. "255" are used to identify the users of the AAL type 2 CPS; further discrimination between the two types of users, i.e. SSCS and Layer Management, is provided by the UUI field (see item c) below).

Table 4/I.363.2 – Coding of the CID Field

CID value	Use
0	Not used
1	Reserved for Layer Management peer-to-peer procedures
2	Reserved for Signalling
3 .. 7	Reserved
8 .. 255	Identification of AAL type 2 CPS user entity

b) *Length Indicator (LI)*

The LI field is binary encoded with a value that is one less than the number of octets in the CPS-Packet Payload. The default maximum length of the CPS-Packet Payload is 45 octets; otherwise, the maximum length can be set to 64 octets.

The maximum length is channel specific, i.e. its value need not be common to all AAL type 2 channels. However, for a given CID value, all CPS-Packet payloads must conform to a common maximum value. This maximum length is set by signalling or management procedures.

When the maximum length is 45 octets, LI values 45 ... 63 are not allowed.

c) *User-to-User Indication (UUI)*

The UUI field serves two purposes:

- to convey specific information transparently between the CPS users, i.e. between SSCS entities or between Layer Management; and
- to distinguish between the SSCS entities and Layer Management users of the CPS (see range of permissible values in Tables 2 and 3).

The 5-bit UUI field provides for 32 codepoints, "0" .. "31". Codepoints "0" .. "27" are available for SSCS entities, codepoints "30" .. "31" are available to Layer Management, and codepoints "28" .. "29" are reserved for future standardization.

The contents of the UUI field are used to transport the UUI parameters of the CPS-UNITDATA and MAAL-UNITDATA primitives.

d) *Header Error Control (HEC)*

The transmitter shall calculate the remainder of the division (modulo 2), by the generator polynomial $x^5 + x^2 + 1$, of the product of x^5 and the contents of the first 19 bits of the CPS-PH. The coefficients of the remainder polynomial shall be inserted in the HEC field with the coefficient of the x^4 term in the most significant bit of the HEC field.

The receiver uses the contents of the HEC field to detect errors in the CPS-PH.

9.2 Format and coding of the CPS-PDU

The CPS-PDU consists of a one octet start field and a 47-octet payload. The 48-octet CPS-PDU is the ATM-SDU. The size and positions of the fields of the CPS-PDU are shown in Figure 5.

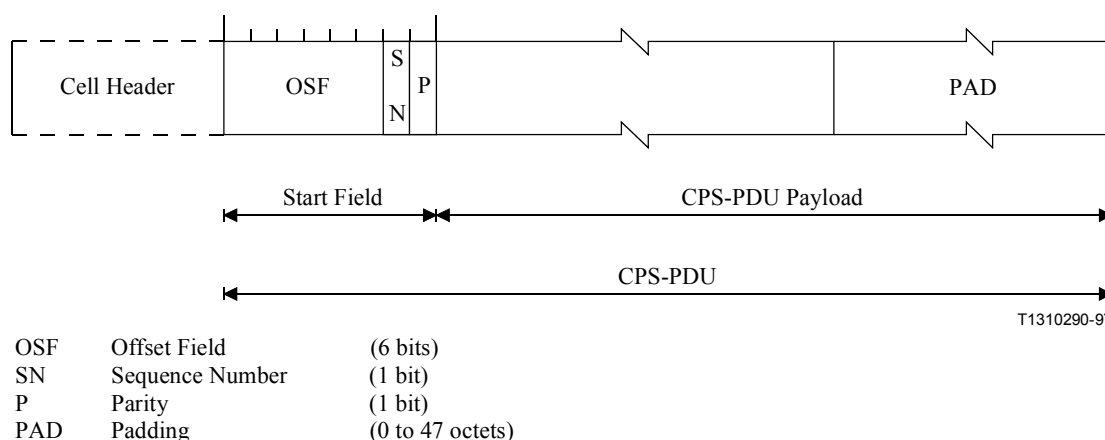


Figure 5/I.363.2 – Format of CPS-PDU

9.2.1 CPS-PDU start field (STF)

The CPS-PDU header also is referred to as the Start Field (STF). The STF consists of the following subfields:

a) *Offset Field (OSF)*

This field carries the binary value of the offset, measured in number of octets, between the end of the STF and the first start of a CPS-Packet or, in the absence of a first start, to the start of the PAD field. The value 47 indicates that there is no start boundary in the CPS-PDU payload. Values greater than 47 are not allowed.

b) *Sequence Number (SN)*

This bit is used to number (modulo 2) the stream of CPS-PDUs.

c) *Parity (P)*

This bit is used by the receiver to detect errors in the STF. The transmitter sets this bit value such that the parity over the 8-bit STF is odd.

9.2.2 CPS-PDU payload

The CPS-PDU payload may carry zero, one or more (complete or partial) CPS-Packets. Unused payload is filled with padding octets coded with the value zero. A CPS-Packet may overlap one or two ATM cell boundaries. The overlap point where the CPS-Packet becomes partitioned may occur anywhere in the CPS-Packet, including the CPS-Packet header.

NOTE – Example uses of the CPS-PDU payload are shown in Appendix I.

10 Procedure of AAL type 2 Common Part Sublayer (CPS)

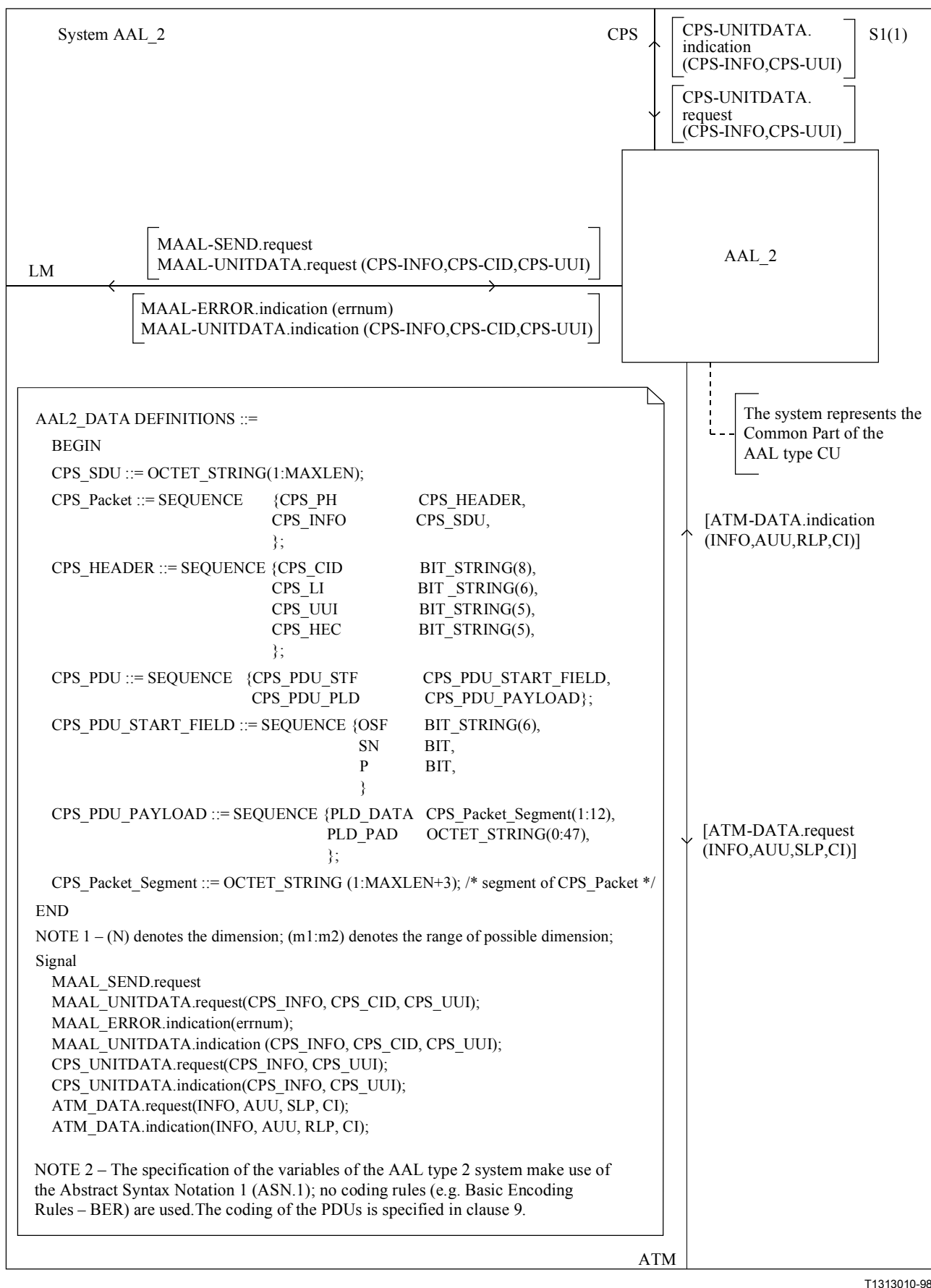
The multiplexing function in the Common Part Sublayer merges several streams of CPS-Packets onto a single ATM connection. The method of scheduling the different streams and the possible use of priorities is not specified in this Recommendation.

The SDL system diagram is shown in Figure 6 and the SDL block structure in Figure 7. SDL symbol repertoire is given in Figure 8.

The Common Part Sublayer receives CPS-SDUs from one or more SSCS transmitter processes. It multiplexes and packs CPS-Packets constructed from these into CPS-PDUs. At the CPS receiver, the CPS-Packets are unpacked and demultiplexed and passed to one of the SSCS receivers.

The SDL diagrams of the procedures of the Common Part Sublayer are given in this clause. If there exists any difference between the prose description also given in this clause and the SDL diagrams, the SDL diagrams take precedence.

NOTE – In the SDL diagrams of this clause, the octets in the CPS-PDU, i.e. the ATM cell payload, are numbered from "0" to "47".



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Figure 6/I.363.2 – SDL system of the AAL type 2