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Foreword

This Interim European Telecommunication Standard (I-ETS) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

NOTE: This I-ETS was submitted to the Public Enquiry phase of the ETSI standards approval procedure as a draft ETS. Following resolution of the comments received, the document was converted into an I-ETS. The annex containing Specification and Description Language (SDL) diagrams for the circuit transport with AAL type 1 has been removed, and may be re-inserted in a later version of this standard.

An ETSI standard may be given I-ETS status either because it is regarded as a provisional solution ahead of a more advanced standard, or because it is immature and requires a "trial period". The life of an I-ETS is limited to three years after which it can be converted into an ETS, have it's life extended for a further two years, be replaced by a new version, or be withdrawn.

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Introduction

The content of this I-ETS is derived from ITU-T Recommendation I.363 [10]. This I-ETS is one of a set of ETSs describing different Asynchronous Transfer Mode (ATM) Adaptation Layer (AAL) types.

The AAL uses the ATM layer service and offers its layer service to the higher layers. The connection-oriented transmission methods which provide timing relation between sending and receiving AAL service users, are described in ITU-T Recommendation I.363 [10], §2. These methods form the AAL type 1. They check the validity of the cell sequence count, transmit and utilize time stamp information for source clock recovery at the receiver as a user option, optionally correct data by using Forward Error Correction (FEC) and offer utilities to transfer structured data. Subtypes are defined for "circuit transport", "video signal transport" and "voice-band signal transport".

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1 Scope

As ITU-T Recommendation I.363 [10] contains options and describes methods which can be used in different combinations, this Interim European Telecommunication Standard (I-ETS) minimizes the options and methods and describes a subset of the Asynchronous Transfer Mode (ATM) Adaptation Layer (AAL) type 1 to be used in Europe.

In addition, a functional model for the circuit transport transfer of asynchronous data, i.e. Synchronous Residual Time Stamp (SRTS) method in combination with Structured Data Transfer (SDT), is given in annex B.

This I-ETS describes the interactions between the AAL and the next higher layer, and the AAL and the ATM layer, as well as AAL peer-to-peer operations. This I-ETS is based on the classification and the AAL functional organization described in ITU-T Recommendation I.362 [9].

2 Normative references

This I-ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this I-ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU-T Recommendation G.702: "Digital hierarchy bit rates".

[2] ITU-T Recommendation G.709: "Synchronous multiplexing structure".

[3] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[4] ITU-T Recommendation G.722: "7 kHz audio-coding within 64 kbit/s".

[5] ITU-T Recommendation G.823: "The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy".

[6] ITU-T Recommendation G.824: "The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy".

[7] ITU-T Recommendation I.231: "Circuit-transport-mode bearer service categories".

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

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

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

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this I-ETS, the following definitions apply:

ATM Adaptation Layer (AAL): The AAL uses the ATM layer service and includes multiple protocols to fit the need of the different AAL service users. In AAL type 1 source timing recovery is provided at the receiver.

Convergence Sublayer Indication (CSI): The CSI is a part of the Protocol Control Information (PCI) in the SAR sublayer; it indicates a special event in the sending Convergence Sublayer (CS) entity in combination with the Sequence Count (SC) and depending on the AAL subtype used: it supports source clock timing recovery using the SRTS method, data structure indication using the SDT method and bit error and cell loss recovery using Forward Error Correction (FEC).

Forward Error Correction (FEC): The FEC method is adapted to the error conditions at the ATM layer.

non-P format: Format of the SAR-PDU (Protocol Data Unit) payload, which does not carry a pointer of the SDT method.

P format: Format of the SAR-PDU payload which carries a pointer of the SDT method.

Residual Time Stamp (RTS): The SRTS method uses the RTS value to measure and convey information about the frequency differences between a common reference clock (derived from the network) and a service clock. The same derived network clock is assumed to be available at both the transmitter and the receiver.

Sequence Count (SC): This 3-bit field counts the SAR-PDUs from 0 to 7 (modulo 8).

Sequence Number (SN): The SN field consists of the 1-bit indication called CSI and a 3-bit SC in the SAR-PDUs.

Sequence Number Protection (SNP): The SNP protects the SN by Cyclic Redundancy Check (CRC) and parity check.

Structured Data Transfer (SDT): The SDT method supports the transmission of structured data (blocks of user data organized in octets) by using a pointer to the start of a block.

Synchronous Residual Time Stamp (method) (SRTS): This method uses the RTS values (transferred peer-to-peer) to recover the source service clock at the receiver side.

3.2 Abbreviations

For the purposes of this I-ETS, the following abbreviations apply:

AAL	ATM Adaptation Layer
ATM	Asynchronous Transfer Mode
CRC	Cyclic Redundancy Check
CS	Convergence Sublayer
CSI	Convergence Sublayer Indication
FEC	Forward Error Correction
PCI	Protocol Control Information
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
RPOA	Recognized Private Operating Agency
RTS	Residual Time Stamp
SAP	Service Access Point
SAR	Segmentation And Reassembly (sublayer)
SC	Sequence Count
SDH	Synchronous Digital Hierarchy
SDL	Specification and Description Language
SDT	Structured Data Transfer
SDU	Service Data Unit
SN	Sequence Number
SNP	Sequence Number Protection
SRTS	Synchronous Residual Time Stamp (method)
STM-1	Synchronous Transfer Mode - 1

4 AAL type 1

The AAL enhances the service provided by the ATM layer to support functions required by the next higher layer. The AAL performs functions required by the user, control and management planes and supports the mapping between the ATM layer and the next higher layer. The functions performed in the AAL depend upon the higher layer requirements.

The AAL supports multiple protocols to fit the needs of the different AAL service users. The service provided by the AAL type 1 protocol to the higher layer and the functions performed are specified in this I-ETS.

Details of the data unit naming convention used in this I-ETS can be found in annex A.

This I-ETS describes the interactions between the AAL and the next higher layer, and the AAL and the ATM layer, as well as AAL peer-to-peer operations. This I-ETS is based on the classification and the AAL functional organization described in ITU-T Recommendation I.362 [9].

Different combinations of SAR sublayers and CS provide different Service Access Points (SAPs) to the layer above the AAL. In some applications the SAR and/or CS may be empty.

The AAL receives from the ATM layer the information in the form of a 48 octet ATM Service Data Unit (ATM-SDU). The AAL passes to the ATM layer information in the form of a 48 octet ATM-SDU. See ITU-T Recommendation I.361 [8] for definition of ATM layer services and description of primitives provided by the ATM layer.

4.1 Service primitives provided by AAL type 1

The layer service capabilities provided by AAL type 1 to the AAL user are:

- transfer of service data units with a constant source bit rate and the delivery of them with the same bit rate;
- transfer of timing information between source and destination;
- transfer of structure information between source and destination;
- indication of lost or errored information which is not recovered by AAL type 1, if needed.

At the AAL-SAP, the following primitives are used between the AAL type 1 and the AAL user. They represent an abstract model of the interface and they are not intended to constrain implementations:

- from an AAL user to the AAL,
  AAL-UNITDATA-REQUEST;
- from the AAL to an AAL user,
  AAL-UNITDATA-INDICATION.

An AAL-UNITDATA-REQUEST primitive at the local AAL-SAP results in an AAL-UNITDATA-INDICATION primitive at its peer AAL-SAP.

4.1.1 AAL-UNITDATA-REQUEST

AAL-UNITDATA-REQUEST:

(DATA [mandatory],
STRUCTURE [optional]).

The AAL-UNITDATA-REQUEST primitive requests the transfer of the AAL-SDU, i.e. contents of the DATA parameter, from the local AAL entity to its peer entity. The length of the AAL-SDU is constant and the time interval between two consecutive primitives is constant. These two constants depend upon the specific AAL service provided to the AAL user.

4.1.2 AAL-UNITDATA-INDICATION

AAL-UNITDATA-INDICATION:

(DATA [mandatory],
STRUCTURE [optional],
STATUS [optional]).

An AAL user is notified by the AAL that the AAL-SDU from its peer is available (i.e. via the contents of the DATA parameter). The length of the AAL-SDU shall be constant and the time interval between two consecutive primitives shall be constant. These two constants depend upon the specific AAL service provided to the AAL user.

4.1.3 Definition of parameters

4.1.3.1 DATA parameter

(Mandatory).

The DATA parameter carries the AAL-SDU to be sent or delivered. Its size depends on the specific AAL service used.

4.1.3.2 STRUCTURE parameter

(Optional use).

The STRUCTURE parameter can be used when the user data stream to be transferred to the peer AAL entity is organized into groups of octets. The length of the structured block is fixed for each instance of the AAL service. The length is an integer multiple of one octet. An example of the use of this parameter is to support circuit mode bearer services of the 64 kbit/s based ISDN. If the optional parameter is present, the two values of the STRUCTURE parameter are:

START; and

CONTINUATION.

The value START is used when the DATA is the first part of a structured block which can be composed of consecutive DATA. In other cases, the STRUCTURE parameter is set to CONTINUATION. The use of the STRUCTURE parameter depends upon the specific AAL service provided. The use of this parameter is agreed prior to or at the connection establishment between the AAL user and the AAL.

4.1.3.3 STATUS parameter

(Local optional use).

The STATUS parameter identifies that the DATA is judged to be non-errored or errored. The STATUS parameter has two values:

VALID; and

INVALID.

The INVALID status can also indicate that the DATA is a dummy value. The use of the STATUS parameter and the choice of dummy value depend upon the specific AAL service provided. The use of this parameter is agreed prior to or at the connection establishment between the AAL user and the AAL.

4.2 Interaction with the management and control planes

Currently no interactions are standardized.

4.2.1 Management plane

For example, the following indications may be passed from the user plane to the management plane:

- errors in the transmission of user information;
- lost and misinserted cells;
- cells with errored AAL-PCI;
- loss of timing and synchronization;
- buffer underflow and overflow.

4.2.2 Control plane

Currently no interactions are standardized.

4.3 Functions of AAL type 1

The following functions may be performed in the AAL type 1 in order to enhance the ATM layer service:

a) blocking and deblocking of user information;

b) handling of cell delay variation;

c) handling of cell payload assembly delay;

d) handling of lost and misinserted cells;

e) source clock frequency recovery at the receiver;

f) recovery of the source data structure at the receiver;

g) monitoring of AAL-PCI for bit errors;

h) handling of AAL-PCI bit errors;

i) monitoring of user information field for bit errors and possible corrective action.

4.4 SAR sublayer

4.4.1 Functions of the SAR sublayer

The SAR sublayer functions are performed on an ATM-SDU basis:

a) mapping between CS-PDU and SAR-PDU:

- the SAR sublayer at the transmitting end accepts a 47 octet block of data from the CS, and then prepends a one octet SAR-PDU header to each block to form the SAR-PDU;

- the SAR sublayer at the receiving end receives the 48 octet block of data from the ATM layer, and then separates the SAR-PDU header. The 47 octet block of SAR-PDU payload is passed to the CS;

b) indication of existence of CS function:

- the SAR sublayer has the capability to indicate the existence of a CS function. Associated with each 47 octet SAR-PDU payload, it receives this indication from the CS and conveys it to the peer CS entity. The use of this indication by the CS is optional;

c) sequence numbering:

- associated with each SAR-PDU payload, the SAR sublayer receives a SC value from the CS. At the receiving end, it passes the SC value to the CS. The CS may use these SC values to detect lost or misinserted SAR-PDU payloads (corresponding to lost or misinserted ATM cells);

d) error protection:

- the SAR sublayer protects the SC value and the CS indication against bit errors. It informs the receiving CS when the SC value and the CS indication are errored and can not be corrected.

4.4.2 SAR protocol

The SAR-PDU header together with the 47 octets of the SAR-PDU payload comprises the 48 octet ATM-SDU (cell information field). The size and positions of the fields in the SAR-PDU are given in figure 1.

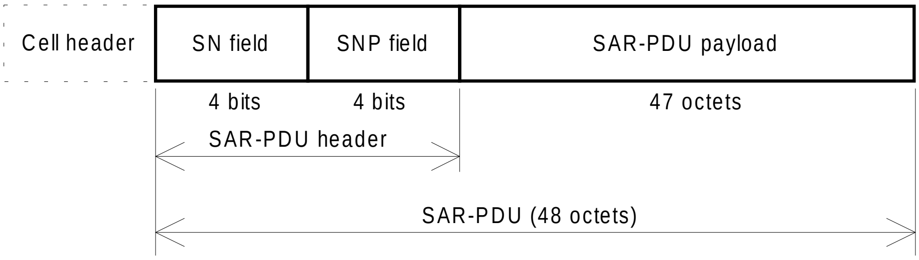

Figure 1: SAR-PDU format of AAL type 1

4.4.2.1 SN field

The SN field is divided into two subfields as shown in figure 2. The SC field carries the SC value provided by the CS. The CSI bit carries the CS indication provided by the CS. The default value of the CSI bit is "0".

The least significant bit of the SC value is right justified in the SC field.

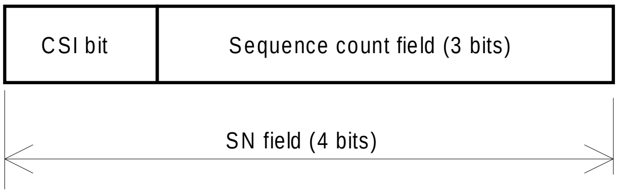

Figure 2: SN field format

4.4.2.2 SNP field

The SNP field provides error detection and correction capabilities over the SAR-PDU header. The format of this field is given in figure 3. A two step approach is used for the protection:

1) the SN field is protected by a 3 bit CRC code;

2) the resulting 7 bit code word is protected by an even parity check bit.

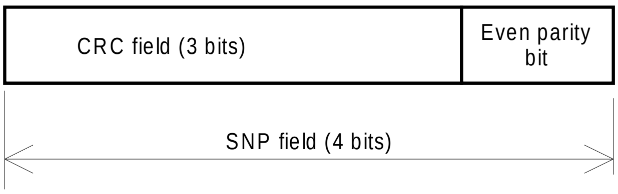

Figure 3: SNP field format

The receiver is capable of either single-bit error correction or multiple-bit error detection:

a) operations at transmitting end:

- the transmitter computes the CRC value across the first 4 bits of the SAR-PDU header and inserts the result in the CRC field;

- the notation used to describe the CRC is based on the property of cyclic codes. The elements of an n-element code word are thus the coefficients of a polynomial of order n-1. In this application, these coefficients can have the value 0 or 1 and the polynomial operations are performed using modulo 2 operations. For example a code vector such as 1011 can be represented by the polynomial $P(x)=x^3+x+1$. The polynomial representing the content of the SN field is generated using the left most bit of the SN field as the coefficient of the highest order term;

- the CRC field consists of three bits. It shall contain the remainder of the division (modulo 2) by the generator polynomial x^3+x+1 of the product x^3 multiplied by the content of the SN field. The coefficient of the x^2 term in the remainder polynomial is left justified in the CRC field;

- after completing the above operations, the transmitter inserts the even parity bit (i.e. the sum of the eight bits shall be even);

b) operations at receiving end:

- the receiver has two different modes of operation: correction mode and detection mode. These modes are related as shown in figure 4. The default mode is the correction mode, which provides for single-bit error correction. At initialization, the receiver is set up in this default mode;

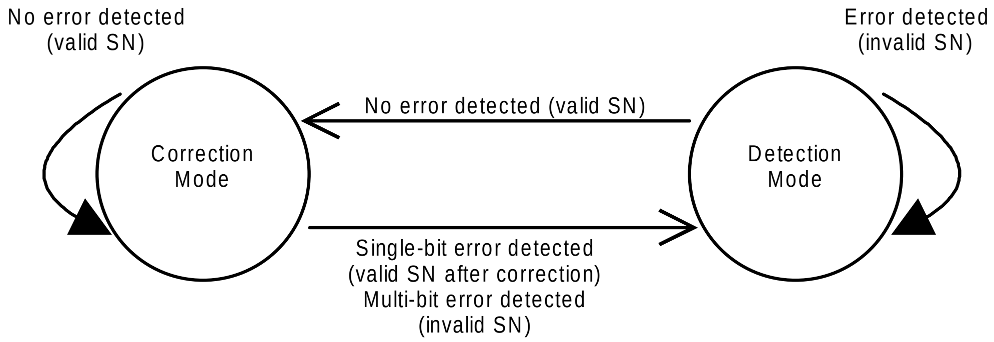

Figure 4: SNP - receiver modes of operation

- the receiver examines each SAR-PDU header by checking the CRC and the even parity. If a header error is detected, the action taken depends on the state of the receiver. In the "Correction Mode", only single-bit errors can be corrected and the receiver switches to "Detection Mode". In "Detection Mode", all SAR-PDU headers with detected errors are declared to have an invalid SN; however, when a SAR-PDU header is examined and found not to be in error, the receiver switches to "Correction Mode";

- tables 1 and 2 give the detailed mandatory operations of the receiver in the "Correction Mode" and "Detection Mode", respectively. The operation is based on the combined validity of the CRC and the parity bit;

- the receiver shall convey the sequence count and the CS indication to the CS together with SN check status (valid or invalid).

Table 1: Operations in Correction Mode

CRC syndrome	Parity	Action on current SN+SNP	Reaction for next SN+SNP
Zero	No violation	No corrective action. Declare SN valid.	Continue in Correction Mode
Non-zero	Violation	Single bit correction based on syndrome. Declare SN valid.	Switch to Detection Mode
Zero	Violation	Correct Parity bit. Declare SN valid.	Switch to Detection Mode
Non-zero	No violation	No corrective action: multi-bit errors are uncorrectable. Declare SN invalid.	Switch to Detection Mode

Table 2: Operations in Detection Mode

CRC syndrome	Parity	Action on current SN+SNP	Reaction for next SN+SNP
Zero	No violation	No corrective action. Declare SN valid.	Switch to Correction Mode
Non-zero	Violation	No corrective action. Declare SN invalid.	Continue in Detection Mode
Zero	Violation	No corrective action. Declare SN invalid.	Continue in Detection Mode
Non-zero	No violation	No corrective action. Declare SN invalid.	Continue in Detection Mode

4.5 CS

4.5.1 Functions of the CS

Depending on the specific AAL service provided, the CS may include the following functions. To perform some of these functions, the CS will need a clock. The CS can utilize the CS indication provided by the SAR sublayer to support CS functions for some AAL users:

a) handling of cell delay variation for delivery of AAL-SDUs to an AAL user at a constant bit rate;

b) processing of SC. The SC value and its error check status provided by the SAR sublayer can be used by the CS to detect cell loss and misinsertion. Further handling of lost and misinserted cells is also performed in this sublayer;

c) for AAL users requiring recovery of source clock frequency at the destination end, the AAL can provide a mechanism for a timing information transfer;

d) transfer of structure information between source and destination;

e) for video signal transport, FEC may be performed to protect against bit errors. This may be combined with interleaving of AAL user bits (e.g. octet interleaving) to give more secure protection against errors.

The following subclauses identify the functions of the CS for individual layer services of AAL type 1.

4.5.1.1 Functions of the CS for circuit transport

The following functions support both asynchronous and synchronous circuit transport.

Asynchronous circuit transport provides transport of signals from constant bit rate sources whose clocks are not frequency-locked to a network clock. Examples are ITU-T Recommendation G.702 [1] signals at 1,544 Mbit/s, 2,048 Mbit/s, 6,312 Mbit/s, 8,448 Mbit/s, 32,064 Mbit/s, 34,368 Mbit/s and 44,736 Mbit/s.

Synchronous circuit transport provides transport of signals from constant bit rate sources whose clocks are frequency-locked to a network clock. Examples are signals at 64 kbit/s, 384 kbit/s, 1 536 kbit/s and 1 920 kbit/s as described in ITU-T Recommendation I.231 [7] or conveyance of Synchronous Digital Hierarchy (SDH) signals described in ITU-T Recommendation G.709 [2].

a) handling of AAL user information:

   - the default value for the length of the AAL-SDU is one bit;

   - for those AAL users which require transfer of structured data, e.g. 8 kHz structured data for circuit mode bearer services of the 64 kbit/s based ISDN, the STRUCTURE parameter option of the primitives defined in subclause 4.1.1.3.2 and the SDT method described in subclause 4.5.2.3 shall be provided and used. When the STRUCTURE parameter option is used without the SRTS method the length of the AAL-SDU is one octet. The SRTS method is described in subclause 4.5.2.2.1;

b) handling of cell delay variation:

   - a buffer is used to support this function. The size of this buffer is dependent upon ATM performance specifications[1)]. In the event of buffer underflow, the CS maintains bit count integrity by inserting the appropriate number of dummy bits and dropping the corresponding number of bits which follow this insertion. The inserted dummy bits are all "1"s; In the event of buffer overflow, the CS drops the appropriate number of bits;

c) handling of lost and misinserted cells:

   - the SC values are further processed at this sublayer to detect lost and misinserted cells. The performance specifications for the processing of SC values are not yet defined. Detected misinserted cells are discarded. An informative example of processing is given in annex C;

   - in order to maintain the bit count integrity of the AAL user information, lost cells detected by buffer underflow and SC processing are compensated by inserting the appropriate number of dummy SAR-PDU payloads; the content of this dummy SAR-PDU payload is all "1"s;

d) handling of timing relation:

   - this function is required for delivery of AAL-SDUs to an AAL user at a constant bit rate;

   - the handling of timing relation for asynchronous circuit transport is referred to as source clock frequency recovery. Recovered source clock shall have satisfactory jitter performance. The jitter performance for ITU-T Recommendation G.702 [1] signals is specified in ITU-T Recommendations G.823 [5] and G.824 [6], for which the CS procedure to be used (the SRTS method) is described in subclause 4.5.2.2.1. For signals other than ITU-T Recommendation G.702 [1] signals possible timing recovery methods currently identified are: SRTS, adaptive clock method and a combination of SRTS and adaptive clock method.

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1) The ATM performance specifications are out of the scope of this I-ETS.

4.5.1.2 Functions of the CS for video signal transport

The following functions support transport of video signals for interactive and distributive services:

a) handling of AAL user information:

- the length of the AAL-SDU is one octet;

- for those AAL users which require transfer of structured data, the STRUCTURE parameter option of primitives defined in subclause 4.1.1.3.2 and the SDT method described in subclause 4.5.2.3 shall be provided and used. When the STRUCTURE parameter option is used without the SRTS method the length of the AAL-SDU is one octet;

- depending on the type of AAL service provided (i.e. the interface to the AAL user) the STATUS parameter defined in subclause 4.1.1.3.3 is passed to the AAL user to facilitate further picture processing, e.g. error concealment or not;

b) handling of cell delay variation:

- a buffer is used to support this function. The size of this buffer is dependent upon ATM performance specifications[2)]. In the event of buffer underflow, the CS maintains bit count integrity by inserting the appropriate number of dummy bits and dropping the corresponding number of bits which follow the insertion. The inserted dummy bits are all "1". In the event of buffer overflow, the CS drops the appropriate number of bits.

c) handling of lost and misinserted cells:

- the SC values are further processed at this sublayer to detect lost and misinserted cells. The performance specifications for the processing of SC values are not yet defined. Detected misinserted cells are discarded. An informative example of processing is given in annex C;

- information in lost cells may be recovered by the mechanism described in e);

- in order to maintain the bit count integrity of the AAL user information, lost cells detected by buffer underflow and SC processing are compensated by inserting the appropriate number of dummy SAR-PDU payloads. The content of this dummy SAR-PDU payload is all "1"s;

d) handling of timing relation:

- this function is required for delivery of AAL-SDUs to an AAL user at a constant bit rate;

- some AAL users may require source clock frequency recovery, e.g. recovery at the receiving end of camera clock frequency which is not locked to the network clock. Possible timing recovery methods currently identified are; SRTS, adaptive clock method;

e) correction of bit errors and lost cells:

- this is an optional function provided for those AAL users requiring bit error and cell loss performance better than that provided by the ATM layer. Examples are unidirectional video services for contribution and distribution. When this function is performed, the CS procedure described in subclause 4.5.2.4 shall be applied.

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2) The ATM performance specifications are out of the scope of this I-ETS.

4.5.1.3 Functions of the CS for voice-band signal transport

The following functions support transport of voice-band signals, e.g. 64 kbit/s A-law and µ-law coded ITU-T Recommendation G.711 [3] signals, and 64 kbit/s ITU-T Recommendation G.722 [4] signals:

NOTE: For transporting signals of speech and 3,1 kHz audio bearer services as specified in 64 kbit/s ISDN, the need for A-law to µ-law conversion is identified. This conversion function is outside the scope of this AAL.

a) handling of AAL user information:

- the length of the AAL-SDU is one octet;

b) handling of cell delay variation:

- a buffer is used to support this function. The size of this buffer is dependent upon ATM performance specifications[3)]. In the event of buffer underflow, the CS maintains bit count integrity by inserting the appropriate number of dummy bits and dropping the corresponding number of bits which follow this insertion. The inserted dummy bits are all "1". In the event of buffer overflow, the CS drops the appropriate number of bits;

c) handling of lost and misinserted cells:

- the detection of lost and misinserted cells, if needed, may be provided by processing the SC values. The monitoring of the buffer fill level can also provide an indication of lost and misinserted cells. The performance specifications for the processing of SC values are not yet defined. Detected misinserted cells are discarded. An informative example of processing is given in annex C.

d) handling of timing relation:

- some AAL users may require source clock frequency recovery. A possible method currently identified is the adaptive clock method.

4.5.2 CS protocol

The following subclauses describe CS procedures to be provided for implementing CS functions. The use of each procedure depends on the required CS functions and is given in subclauses 4.5.1.1 to 4.5.1.3.

4.5.2.1 SC operations

4.5.2.1.1 SC operations at the transmitting end

At the transmitting end, the CS shall provide the SAR with a SC value and a CS indication associated with each SAR-PDU payload. The count value shall start with 0, be incremented sequentially and be numbered modulo 8.

[3)] The ATM performance specifications are out of the scope of this I-ETS.

4.5.2.1.2 SC operations at the receiving end

At the receiving end, the CS receives from the SAR the following information associated with each SAR-PDU payload:

- SC;
- Convergence Sublayer Indication (CSI);
- check status of the SN.

The use of SC values and CS indications will be specified on a service specific basis. See subclause 4.4.2 for details about the calculation of the check status.

The CS processing at the receiving end shall identify lost and misinserted SAR-PDU payloads.

CS processing shall identify the following conditions:

- SAR-PDU payload sequence normal (i.e. in correct sequence);
- SAR-PDU payload loss;
- SAR-PDU payload misinsertion.

Processing of SC values may provide information to CS layer management entities, as required. Some examples are:

- location of lost SAR-PDU payload in the incoming SAR-PDU stream;
- number of consecutive SAR-PDU payloads lost;
- identification of misinserted SAR-PDU payloads.

NOTE: Processing of SC values may be subject to performance specifications. The performance specifications will be applied on an AAL service specific basis.

4.5.2.2 Source clock frequency recovery method

4.5.2.2.1 SRTS method

4.5.2.2.1.1 General

The SRTS method uses the RTS to measure and convey information about the frequency difference between a common reference clock derived from the network and a service clock. The same derived network clock is assumed to be available at both the transmitter and the receiver. If the common network reference clock is unavailable (e.g. when working between different networks which are not synchronized), then the asynchronous clock recovery method is in a mode of operation associated with "Plesiochronous network operation" which is described in subclause 4.5.2.2.1.5. The SRTS method is capable of meeting the jitter specifications of the 2,048 Mbit/s hierarchy in ITU-T Recommendation G.823 [5] and the 1,544 Mbit/s hierarchy in ITU-T Recommendation G.824 [6].

The following is a description of the SRTS method. The description uses the notation below:

fs	service clock frequency;

fn	network clock frequency, e.g. 155,52 MHz;

fnx	derived network clock frequency, fnx=fn/x, where x is an integer defined by an inequality (see formula {1});

N	period of RTS in cycles of the service clock of frequency fs;

T	period of the RTS in seconds;

M(Mnom, Mmax, Mmin) number of fnx cycles within a (nominal, maximum, minimum) RTS period;

Mq largest integer smaller than or equal to M.

The SRTS concept is illustrated in figure 5. In a fixed duration T measured by N service clock cycles, the number of derived network clock cycles Mq is obtained at the transmitter. If Mq is transmitted to the receiver, the service clock of the source can be reconstructed by the receiver, since it has the necessary information: fnx, Mq and N. However, Mq is actually made up of a nominal part and a residual part. The nominal part Mnom corresponds to the nominal number of fnx cycles in T seconds and is fixed for the service. The residual part conveys the frequency difference information as well as the effect of the quantization and, therefore, can vary. Since the nominal part is a constant, it can be assumed that the nominal part of Mq is available at the receiver. Only the residual part of Mq is transmitted to the receiver.

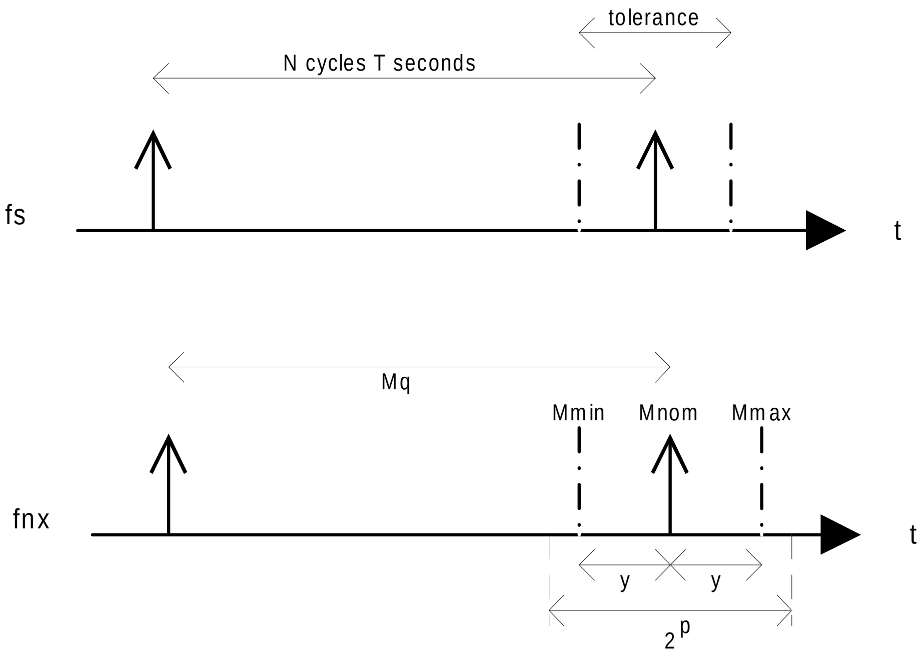


Figure 5: The concept of SRTS

A simple way of representing the residual part of Mq is by means of the RTS, whose generation is shown in figure 6. Counter Ct is a p-bit counter which is continuously clocked by the derived network clock. The output of counter Ct is sampled every N service clock cycles. This p-bit sample is the RTS.

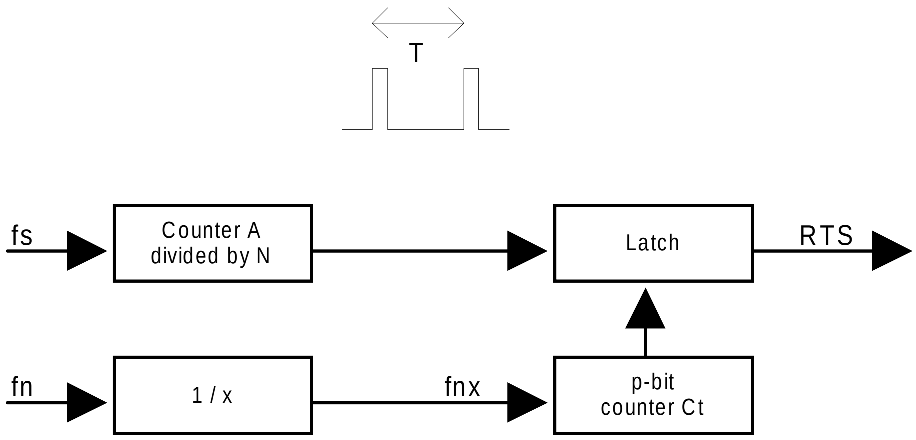


Figure 6: Generation of RTS

With a knowledge of the RTS and the nominal part of Mq at the receiver, Mq is completely specified. Mq is used to produce a reference timing signal for a Phase-Locked Loop to obtain the service clock.

At the sending side the p-bit counter Ct is set to zero when the first AAL-SDU is received via the primitive AAL-UNITDATA-REQUEST.

4.5.2.2.1.2 Choice of parameter

The minimum size of the RTS required to unambiguously represent the residual part of Mq is a function of N, the ratio fnx/fs, and the service clock tolerance, ± e. Let y be the difference between Mnom and the maximum or minimum value of M (denoted as Mmax, Mmin). The difference y is given by:

$$y = N * fnx / fs * e.$$

In order that Mq can be unambiguously identified, the following conditions shall be satisfied (see figure 5):

$$2^{(p-1)} > [y],$$

where [y] denotes the smallest integer larger than or equal to y.

The following parameter values are used for the asynchronous circuit transport of ITU-T Recommendation G.702 [1] signals:

N = 3008 (total number of bits in eight SAR-PDU payloads);
$1 \leq fnx/fs < 2$, {1}

Tolerance = $200 * 10^{-6}$
Size of RTS = 4 bits

The introduction of any AAL CS overhead into the SAR-PDU payload reduces the amount of payload available for the transport of AAL user data. This will reduce the number of service clock cycles over which the RTS period is specified, since the RTS period is defined over a fixed number of SAR-PDU payloads. The RTS period parameter, N, can be adjusted to accommodate such cases. For example, if four octets of CS overhead are required from every eight SAR-PDU payloads, then N would be reduced from 3 008 to 2 976. However, the CS overhead has to be allocated so that the RTS period always remains a constant number of service clock cycles. Therefore, the CS overhead will reduce the user data transport capacity by a constant amount over the fixed number of SAR-PDU payloads for which the RTS period is defined. See subclause 4.5.2.3.2 for an example.

4.5.2.2.1.3 Network clocks

For an SDH network, a 155,520 MHz network clock (fn) is available from which the following clocks can be derived:

$$155{,}520 \text{ MHz} * 2^{-k}, k=0,1, ..., 11.$$

As an example, to support service rates of 64 kbit/s the fnx will be 155,520 MHz * 2^{-11} (i.e. 75,9375 kHz).

This set of derived network clocks can accommodate all service rates ranging from 64 kbit/s up to the full capacity of the Synchronous Transfer Mode - 1 (STM-1) payload. The derived network clock to be used for a given service rate is uniquely specified, since the frequency ratio is constrained by formula {1}.

Administrations/Recognized Private Operating Agencies (RPOAs) may use existing network clocks to support national service in a non-SDH ATM network (e.g. 2,048 MHz).

4.5.2.2.1.4 Transport of the RTS

The 4-bit RTS is transmitted in the serial bit stream provided by the CSI bit in successive SAR-PDU headers. The modulo 8 SC provides a frame structure over 8 bits in this serial bit stream. Four bits of the framed 8 bits are allocated for the RTS and the remaining 4 bits are available for other uses. The SAR-PDU headers with the odd SC values of 1, 3, 5 and 7 are used for RTS transport. The MSB of the RTS is placed in the CSI bit of the SAR-PDU header with the SC of 1.

4.5.2.2.1.5 Plesiochronous network operation

The issue about the accommodation of plesiochronous operation (i.e. when a common reference clock is not available from the network) needs to be addressed. This scenario shall be accommodated in such a way that the recovered clock satisfies the jitter requirements specified in ITU-T Recommendations G.823 [5] and G.824 [6] for ITU-T Recommendation G.702 [1] signals. However, the detailed method of dealing with plesiochronous operation is not standardized.

4.5.2.2.2 Adaptive clock method

The following is a general description of the method. The receiver writes the received information into a buffer and then reads it with a local clock. The fill level of the buffer is used to control the frequency of the local clock. The control is performed by continuously measuring the fill level around its medium position, and by using this measure to drive the Phase-Locked Loop providing the local clock. The fill level of the buffer may be maintained between two limits in order to prevent buffer overflow and underflow.

4.5.2.2.3 Combination of SRTS and adaptive clock method

Optimum timing recovery can require an appropriate combination of the SRTS and the adaptive clock method.

4.5.2.3 SDT method

The CS procedure for SDT uses a pointer to delineate the structure boundaries. The procedure supports any fixed, octet-based structure. In particular, it supports 8 kHz based structures used in circuit mode services of ITU-T Recommendation I.231 [7].

The STRUCTURE parameter in the AAL-UNITDATA-REQUEST and AAL-UNITDATA-INDICATION primitives is used to convey structure information between the AAL and the AAL user. See subclause 4.1.1 for definition of primitives and parameters.

The 47 octet SAR-PDU payload used by the CS has two formats, called non-P and P format, as shown in figure 7:

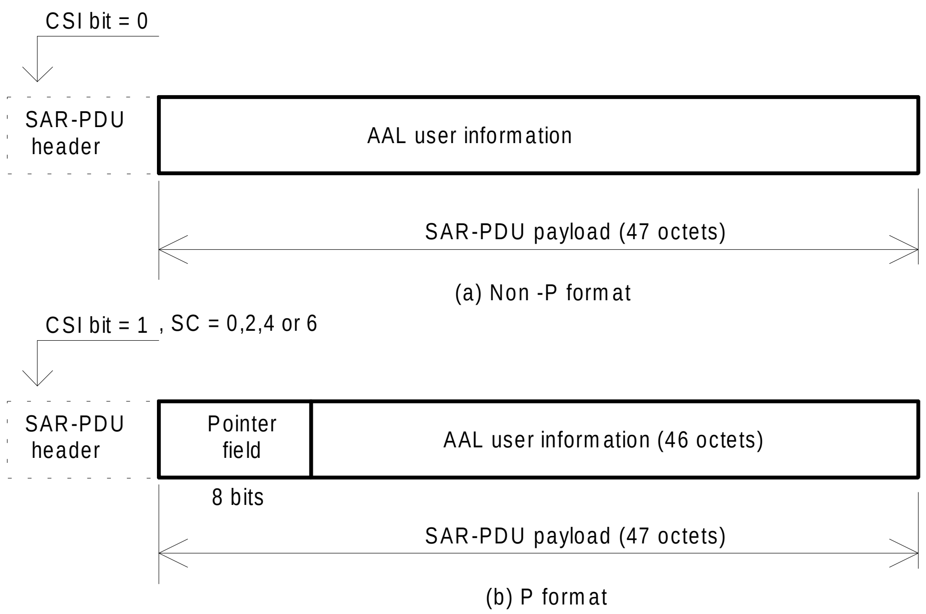


Figure 7: Format of SAR-PDU payload for SDT method

a) operations of the non-P format:

- in the non-P format, the entire CS-PDU is filled with user information. This format is always used if the sequence count value in the SAR-PDU header is 1,3,5, or 7.

b) operations of the P format:

- in the P format, the first octet of the SAR-PDU payload is the pointer field. The remainder is filled with AAL user information. This format may be used only if the SC value in the SAR-PDU header is 0, 2, 4 or 6.

The format of the pointer field is shown in figure 8. The actual format of a SAR-PDU is indicated by the combination of the CSI bit and the SC; the CSI value "1" in combination with an even SC indicates the P format, the CSI value "0" or an odd SC indicates the non-P format.

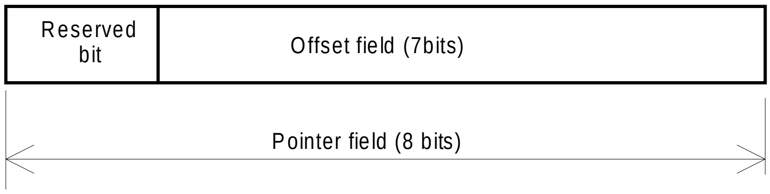


Figure 8: Pointer field format

The pointer field contains the binary value of the offset, measured in octets, between the end of the pointer field and the first start of the structured block in the 93 octet payload consisting of the remaining 46 octets of this SAR-PDU payload and the 47 octets of the next SAR-PDU payload. This offset ranges between 0 and 93 inclusive. The offset value 93 is used to indicate that the end of the 93 octet payload coincides with the end of a structured block whose start does not lie in the 93 octet payload. Moreover, the dummy offset value is used when no structure boundary is being indicated.

The binary value of the offset is inserted right justified in the offset field, i.e. the least significant bit of the offset is transmitted last. The first bit of the pointer field is used to provide an even parity check over the pointer field.

The P format is used exactly once in every cycle, where a cycle is the sequence of eight consecutive SAR- PDUs with sequence count values 0 through 7. The P format is used at the first available opportunity in a cycle to point to a start of a structure boundary. If a start of a structure boundary is not present in a cycle, then the P format with the dummy offset value in the pointer field is used at the last opportunity in the cycle, i.e. SAR-PDU with sequence count value 6.

In keeping with the above pointer rule, the first structured block to be transmitted after the AAL connection is established uses the P format with SC value in the SAR-PDU header equal to 0 and with the first octet of the structured data placed in the second octet of the SAR-PDU payload.

4.5.2.4 Correction method for bit errors and cell losses for unidirectional video services

This correction method combines FEC and octet interleaving, from which a CS-PDU structure is defined. FEC uses a Reed-Solomon (128,124) code which is able to correct up to 2 errored symbols (octets) or 4 erasures in the block of 128 octets. An erasure is an errored octet whose location in the block is known. The specific polynomial to be used for the Reed-Solomon code is:

$$G(x) = (x - \alpha^{120}) * (x - \alpha^{121}) * (x - \alpha^{122}) * (x - \alpha^{123})$$

where α is a root of the binary primitive polynomial $x^8 + x^7 + x^2 + x = 1$.

In the transmitting CS, the 4 octet Reed-Solomon code is appended to 124 octets of incoming data from the upper layer. The resulting 128 octet long blocks are then forwarded to the octet interleaver. See figure 9 for the format of the interleave matrix.

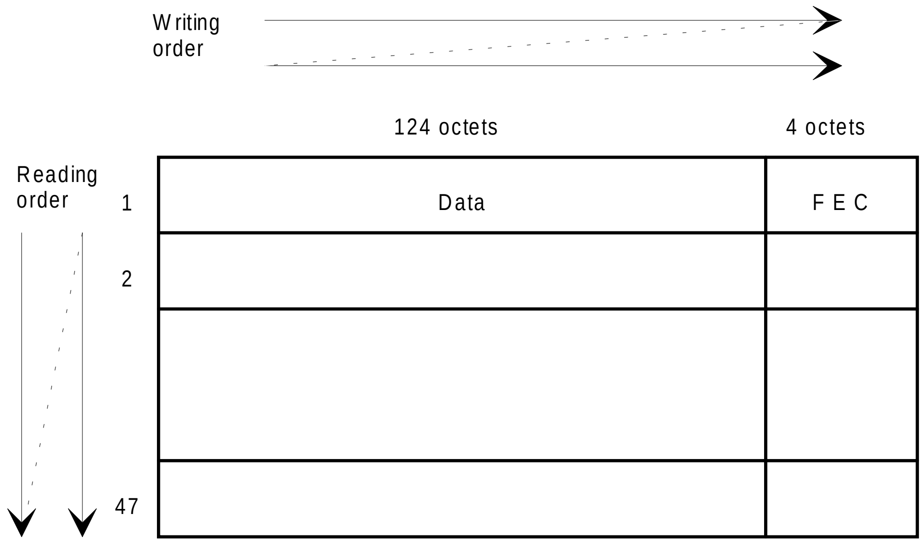


Figure 9: Format of the interleave matrix

The octet interleaver is organized as a matrix of 128 columns and 47 rows. In the transmitting CS entity, the interleaver is used as follows: at the input, incoming 128 octet long blocks are stored row by row (one block corresponding to one row); at the output, octets are read out column by column. The matrix has 128 x 47 = 6 016 octets, corresponding to 128 SAR-PDU payloads. These 128 SAR-PDU payloads constitute one CS-PDU.

In this process, the loss of one SAR-PDU payload in the matrix implies one erasure to correct in each row of the matrix. Erasures correspond to dummy cell payloads inserted in the cell flow when a cell loss has been detected. Misinserted cells which have been detected are merely discarded in the CS.

For the synchronization of the CS-PDU, the CSI bit of the SAR-PDU header is set to 1 for the first SAR-PDU payload of the CS-PDU. This use of the CSI bit precludes the use of the SDT method as specified in subclause 4.5.2.3.

Within any CS-PDU matrix, this method can perform the following corrections:

- 4 cell losses, at identified location; or

- 2 cell losses and 1 errored octet in each row; or

- 2 errored octets in each row if there is no cell loss.

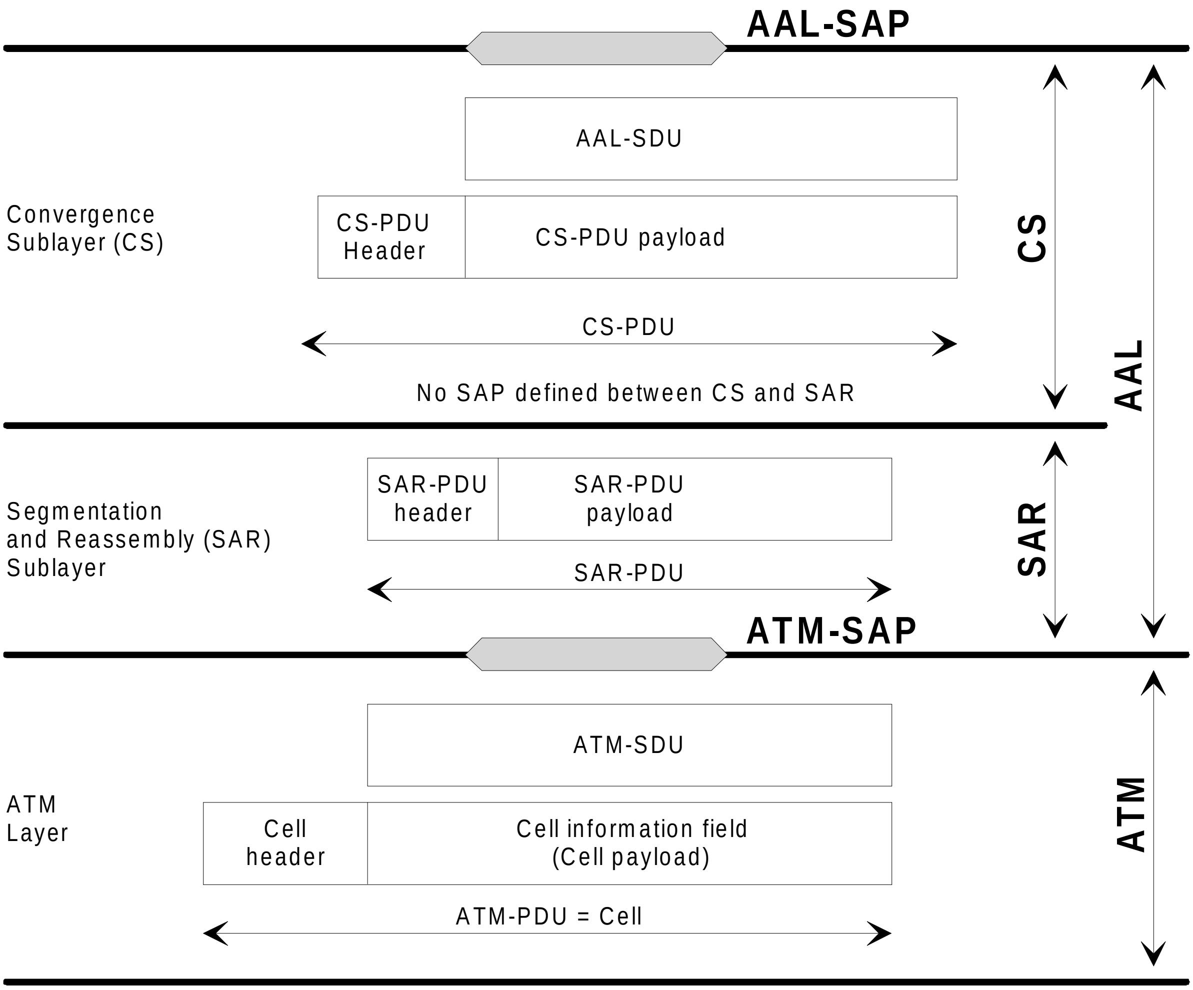
The overhead of this method is 3,1 %, and the delay is 128 cells both at the sending and at the receiving side.

4.5.2.5 Partially filled cells

Future service specifications may require the SAR-PDU payloads to be partially filled with user data in order to reduce the cell payload assembly delay. In this implementation option, the number of leading octets utilized for user information (excluding pointer field) in each SAR-PDU payload is a constant which is determined by the allowable cell payload assembly delay. The remainder of the SAR-PDU payload consists of dummy octets. There is no need to define the value of these dummy octets.

The offset value in the pointer field includes all octets of the SAR-PDU payload regardless whether the octets are utilized for AAL user data or consist of dummy data.

Annex A (informative): Illustration of the data unit naming convention



NOTE: AAL type 1-PCI consists of the SAR-PDU header and the conditional CS-PDU header (pointer).

Figure A.1: Data unit naming conventions for the AAL type 1

Annex B (informative): Functional model for the circuit transport with AAL type 1

An example of a functional model for the AAL type 1 is shown in figures B.1 and B.2 for the transmitting and the receiving side respectively. These figures show a general functional SAR model which is valid for all subtypes combined with an example for the AAL type 1 subtype "circuit transport" with transport of structure information and timing recovery using SRTS.

B.1 Transmitter

The CS gets AAL-SDUs (here one bit each) by a primitive and stores them till the corresponding SAR-PDU payload is complete, i.e. 47 octets of AAL user data or 46 octets of AAL user data and an SDT pointer value are available. Each SAR-PDU payload is passed down together with the corresponding CSI bit and SC value to the SAR sublayer which adds the SAR-PCI and transmits the resulting SAR-PDU.

The timing information (RTS value) is read when the AAL-SDU which is the first bit in the SAR-PDU with SC equal to 0 is received.

B.2 Receiver

The SAR sublayer processes the SAR-PCI utilising the "Correction Mode" or the "Detection Mode". The CS processes the "Sequence Count" and offers the AAL-SDUs (here one bit each) to the AAL user in correct timing relationship to the transmitter.

The timing information is constructed from the cells with odd SCs (starting at SC equal to 1) and stored in the local service clock control at the delivery time of the AAL-SDU containing the first payload bit of the SAR-PDU with SC equal to 0.

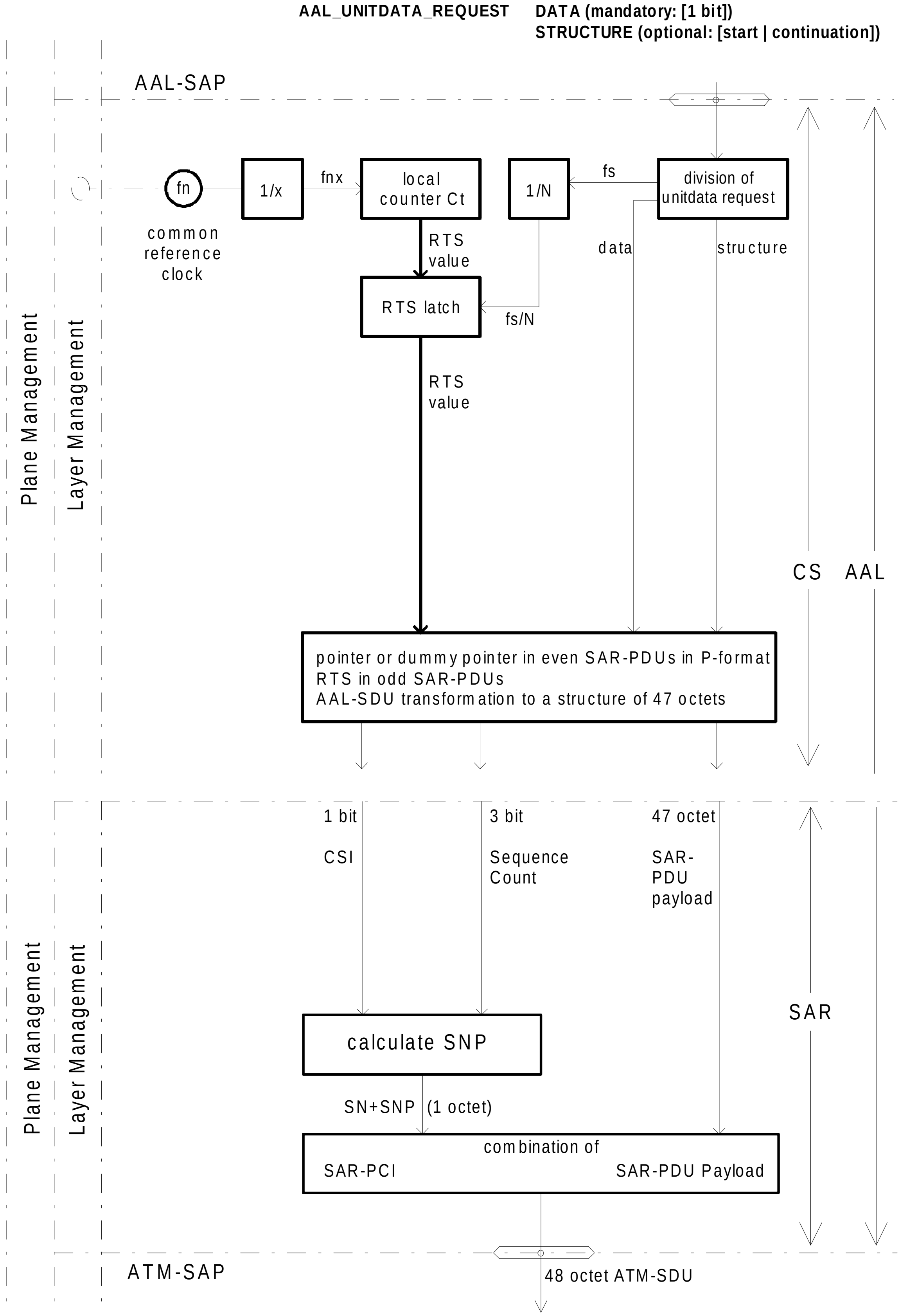


Figure B.1: Transmitter for circuit transport with SRTS and SDT

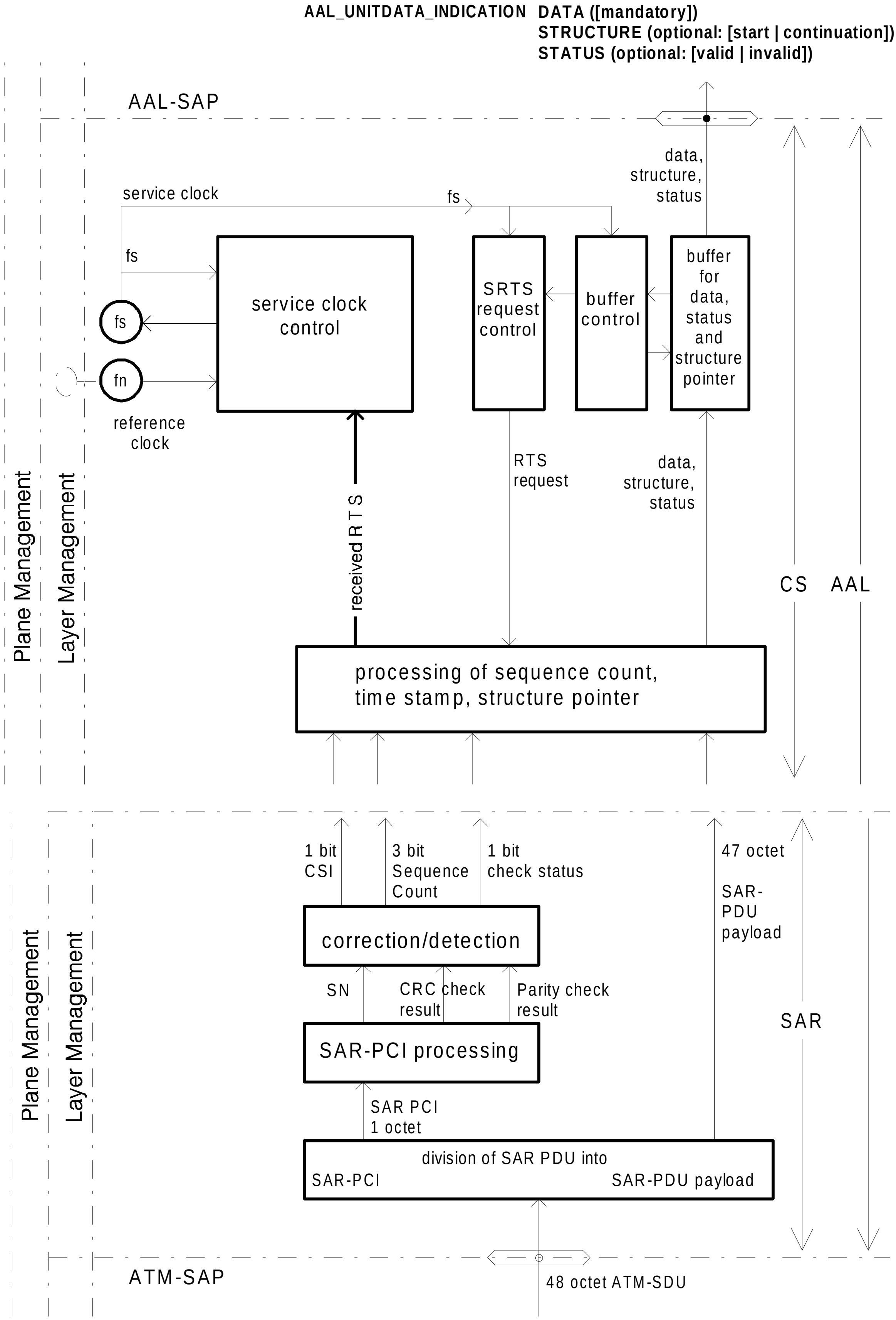


Figure B.2: Receiver for circuit transport with SRTS and SDT

Annex C (informative): Algorithm to detect lost and misinserted cells in AAL 1

This algorithm is an example on how it is possible to differentiate between the detection of lost and misinserted cells in AAL 1.

C.1 Side effects

The algorithm introduces a one cell delay before the delivery of received AAL user data because, in order to correctly evaluate the existence of lost or misinserted cells, it is necessary to wait for the next cell before taking a decision, as described in the algorithm. It is assumed that this delay causes no problems for high quality audio and video services. This results from the fact that typically at the receiving side, the buffer for the handling of cell delay variation contains on average a few cells.

C.2 Indications from the SAR sublayer

It is assumed that the SAR sublayer provides the following inputs to the algorithm, concerning the SN field:

a) the value of the SC (3 bits);

b) the value of the CS indication (CSI) in the SN field (1 bit);

c) the indication of the SN field validity (1 bit).

Only indications a) and c) are used by the algorithm to determine lost/misinserted cells.

C.3 Limits of the algorithm

The sequence counting of modulo 8 permits that the algorithm detects a maximum of 6 consecutive lost cells and 1 cell misinserted, assuming that misinsertion of one cell is at least as probable as the loss of 7 consecutive cells on a given ATM connection.

C.4 The algorithm

The algorithm is described by a state machine with five states, as shown in figure C.1. An evolution in the state machine is indicated by an arc, on which there are two distinct values represented. The first value refers to the event that originates the evolution in the state machine, and the second value refers to an action to be taken as a result of the event.

A decision in this algorithm is taken after the analysis of two consecutive SN. This means that when a cell is received it is stored, waiting for the next one before it is eventually passed to the final destination. In the state machine the action always refers to the stored cell.

A valid SN is defined as an SN which has no detected errors or it had an error that was corrected.

The different states of the algorithm are the following:

a) **START**

   It is the initial state. It remains in this state discarding the cells until there is a valid SN;

b) **OUT OF SYNC**

   In this state the sequence counting is not synchronized yet. It waits for an SC that is in sequence with the previous one. When it occurs, the stored cell is accepted by the system. If a cell with an invalid SN arrives the system returns to the START;

c) **SYNC**

In this state the sequence counting is considered to be synchronized:

- if the SC is in sequence with the previous one it remains in this state and the stored cell is accepted;
- if the SN is invalid, it goes to INVALID, but the stored cell is accepted;
- if the SC is not in sequence with the previous one, it goes to OUT OF SEQUENCE, accepting the stored cell;

d) **INVALID**

In this state the system shall take a decision on the stored cell with the invalid SN, when it receives the next cell:

- if the SN is again invalid, the system returns to START and the stored cell is discarded;
- if the SN is valid and the SC is in sequence with the last cell received with a valid SN the system returns to SYNC, but the stored cell is considered to be misinserted and it is discarded;
- if the SN is valid but the SC has a value exceeding by two the SC of the last cell received with a valid SN, it is assumed that although there was an invalid SN the stored cell is in sequence and therefore it is accepted. It returns to SYNC;
- if the SN is valid but is not in any of the previous situations, it discards the stored cell and goes to OUT OF SYNC;

e) **OUT OF SEQUENCE**

In this state the following actions are taken when a cell arrives:

- if the SN is invalid, it discards the stored cell and it goes to START;
- if the SN is valid and the SC is in sequence with the last cell received with a valid SN, the system returns to SYNC, but the stored cell is considered to be misinserted and is discarded;
- if the SN is valid and the SC is in sequence with the SC of the stored cell, the system assumes that cells were lost; it inserts a number of dummy cells identical to the number of lost cells, accepts the stored cell and returns to SYNC;
- if the SN is valid but is not in any of the two previous situations, it discards the stored cell and goes to OUT OF SYNC.

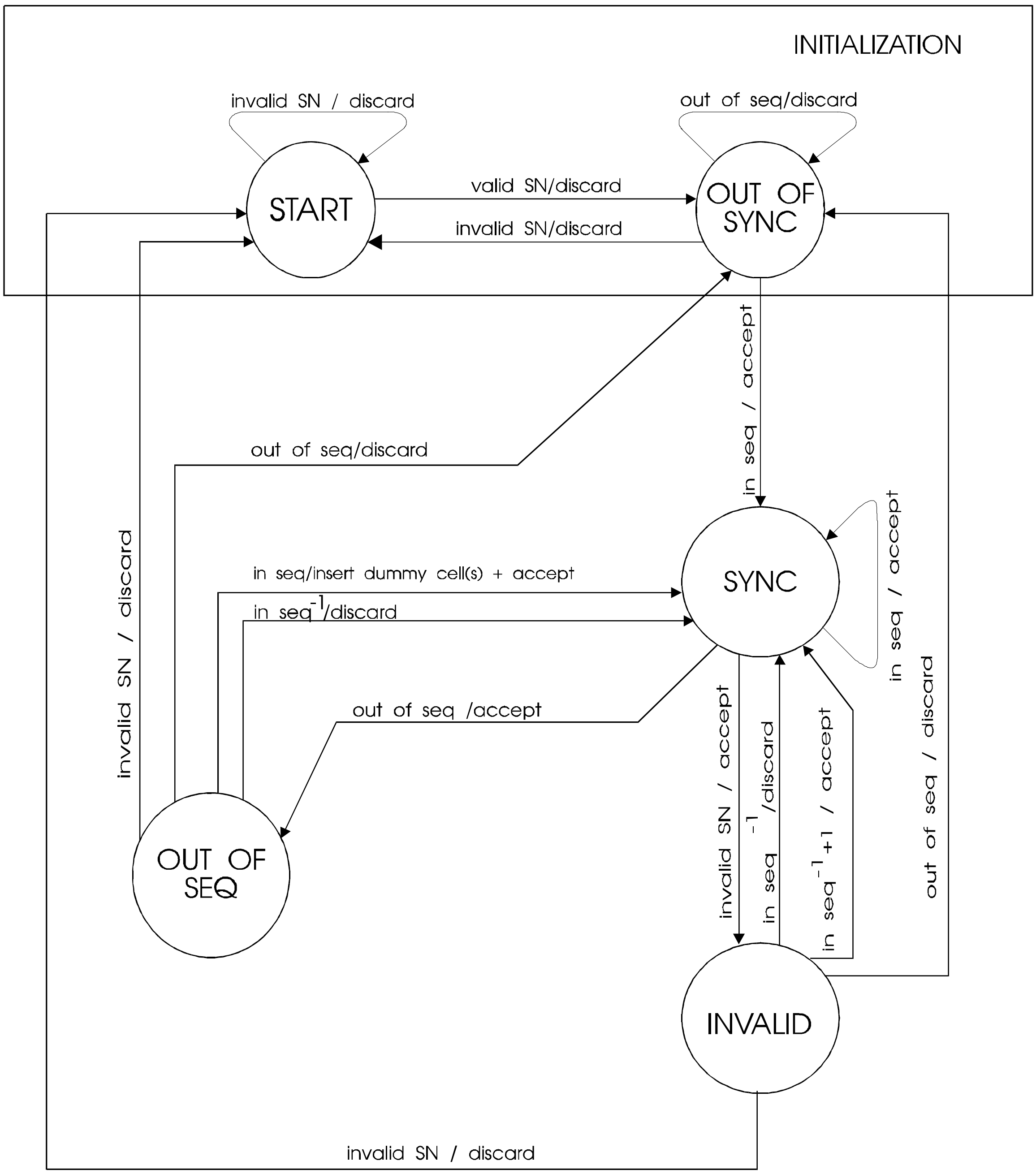


Figure C.1: Algorithm state machine

Annex D (normative): Protocol Implementation Conformance Statement (PICS) proforma for the AAL type 1

D.1 Introduction

In the following, the PICS proforma for the AAL type 1 protocol as specified in the main body of this I-ETS is defined.

The first column in each table identifies the item. The second column describes the capability or parameter to be tested. The third column contains the reference to the subclause of this I-ETS in which the capability or parameter is defined. The fourth column indicates the status of the feature:

m mandatory implementation;

o optional implementation;

c conditional;

n/a not applicable.

The complete notation for conditional features is:

c: <x>

to indicate that, under certain conditions, the status for the feature becomes <x>, where <x> belongs to {m, o, n/a}.

For conditional features, the fifth column states the condition under which the feature can become mandatory, optional or not applicable.

The sixth column contains the possible values for the feature:

xx .. yy indicates all the values from xx to yy;

xx/yy indicates either xx or yy.

The last column indicates whether the feature is supported or not in a specific implementation.

D.2 PICS

D.2.1 SAR sublayer

D.2.1.1 Capabilities

Item	Capability	Reference	Status		Pred.	Support
			Transmission	Reception		
SAR 1	Mapping between CS-PDU and SAR-PDU	4.4.1.a	m	m		
SAR 2	Existence of CS function	4.4.1.b	m	m		
SAR 3	Sequence numbering	4.4.1.c	m	m		
SAR 4	Error protection	4.4.1.d/ 4.4.2.2.a	m	n/a		
SAR 5	Error detection	4.4.1.d/ 4.4.2.2.b	n/a	m		
SAR 6	Error correction	4.4.1.d/ 4.4.2.2.b	n/a	m		
SAR 7	SN Check Status indication	4.4.1.d/ 4.4.2.2.b	n/a	m		

D.2.1.2 PDUs and PDU parameters

Item	Parameter	Reference	Status		Predicate	Value	Support
			Transmission	Reception			
SAR 8	SAR-PDU structure	4.4.2	m	m			
SAR 9	CSI bit	4.4.2.1	m	m		0/1	
SAR 10	Sequence count field	4.4.2.1	m	m		0..7	
SAR 11	SNP field	4.4.2.2	m	m			
SAR 12	SAR PDU payload content	4.4.2	m	m		any value	

D.2.2 CS major capabilities

Item	Major capability	Reference	Status	Support
CS 1	CS for circuit transport	4.5.1.1	o.1	
CS 2	CS for video signal transport	4.5.1.2	o.1	
CS 3	CS for voice band signal transport	4.5.1.3	o.1	
o.1	At least one of these capabilities shall be implemented.			

D.2.2.1 CS for circuit transport

D.2.2.1.1 Capabilities

Item	Capability	Reference	Status		Predicate	Support
			Transmission	Reception		
CS.CT.1	Structured data transfer	4.5.1.d	o	o		
CS.CT.2	SDT method	4.5.1.1.a/ 4.5.2.3	c: m c: n/a	c: m c: n/a	Structured data transfer else	
CS.CT.3	Maintain bit count integrity	4.5.1.1.b	n/a	m		
CS.CT.4	Detection of lost and misinserted cells	4.5.1.1.c	n/a	m		
CS.CT.5	Discard of detected misinserted cells	4.5.1.1.c	n/a	m		
CS.CT.6	Sequence count operations at transmission	4.5.2.1.1	m	n/a		
CS.CT.7	Sequence count operations at reception	4.5.2.1.2	n/a	m		
CS.CT.8 CS.CT.9	SRTS method Adaptive clock method	4.5.2.2.1 4.5.2.2.1 4.5.2.2.1 4.5.2.2.2	c: m c:o c: n/a c: n/a	c: m c:o c: n/a c: o	common clock and asynchronous ITU-T Recommendation G.702 [1] signals common clock and other signal types no common clock	
CS.CT.10	Combination of SRTS and Adaptive clock method	4.5.2.2.3	c: o	c: o		
CS.CT.11	Use of CSI bit	4.5.2.3.1 4.5.2.2.1.4	m m n/a	m m n/a	SDT method SRTS method else	

D.2.2.1.2 Protocol parameters

Item	Parameter	Reference	Status		Predicate	Value	Support
			Transmission	Reception			
CS.CT.12	Length of AAL-SDU	4.5.1.1.a/ 4.5.1.1.a/ 4.5.1.1.a/ 4.5.1.1.a	m m m m	m m m m	SRTS method SDT without SRTS SDT with SRTS else	1 bit 1 octet 1 bit 1 bit	
CS.CT.13	Value of inserted dummy bits	4.5.1.1.b	n/a	m		All 1's	
CS.CT.14	Service bit rate	4.5.1.1	o.3 o.3 o.3 o.3	o.3 o.3 o.3 o.3	CCITT Recommendation G.702 [1] asynchronous ITU-T Recommendation G.702 [1] asynchronous ITU-T Recommendation G.702 [1] asynchronous ITU-T Recommendation G.702 [1] synchronous other bit rates	2,048 Mbit/s 8,448 Mbit/s 34,368 Mbit/s other values n x 64 kbit/s (n ∈ [1..32]) 	
CS.CT.15	Network clock frequency (fn)	4.5.2.2.1.3/ 4.5.1.1 d)	c: m c: o n/a	c: m c: o n/a	SRTS method (SDH.SDH or PDH.SDH environment) SRTS method and PDH.PDH environment else	155,52 MHz existing network clock (e.g. 2,048 MHz) 	
CS.CT.16	Derived Network clock frequency (fnx)	4.5.2.2.1.3	c: o.2 c: o c: n/a	c: o.2 c: o c: n/a	SRTS method SRTS method and PDH.PDH environment else	$155,52 * 2^{-k}$ MHz $(1 \leq k \leq 11)$ 2,048 MHz 	

o.2 The SRTS method shall be implemented to work at least with one of these values for the parameter fnx.
o.3 Any non-empty subset of the values may be supported.

D.2.2.2 CS for video signal transport

D.2.2.2.1 Capabilities

Item	Capability	Reference	Status		Predicate	Support
			Transmission	Reception		
CS.VD.1	Structured data transfer	4.5.1.d	o	o		
CS.VD.2	SDT method	4.5.1.2.a/ 4.5.2.3	c: m c: n/a	c: m c: n/a	Structured data transfer else	
CS.VD.3	STATUS parameter indication	4.5.1.2.a	n/a	o		
CS.VD.4	Maintain bit count integrity	4.5.1.2.b	n/a	m		
CS.VD.5	Detection of lost and misinserted cells	4.5.1.2.c	n/a	m		
CS.VD.6	Discard of detected misinserted cells	4.5.1.2.c	n/a	m		
CS.VD.7	Sequence count operations at transmission	4.5.2.1.1	m	n/a		
CS.VD.8	Sequence count operations at reception	4.5.2.1.2	n/a	m		
CS.VD.9	FEC and octet interleaving	4.5.1.2.e/ 4.5.2.4.1	c: n/a c: m c: n/a	c: n/a c: am c:n/a	SDT method correction of bit errors and cell losses for unidirectional video else	
CS.VD.10	SRTS method	4.5.1.2.d	c: o c: n/a	c: o c: n/a	common clock no common clock	
CS.VD.11	Adaptive clock method	4.5.2.2.2	n/a	o		
CS.VD.12	Use of CSI bit	4.5.2.4 4.5.2.3 4.5.2.2.1	c: m c: m c: m c: n/a	c: m c: m c: m c: n/a	correction method SDT method SRTS method else	

D.2.2.2.2 Protocol parameters

Item	Parameter	Reference	Status		Predicate	Value	Support
			Transmission	Reception			
CS.VD.13	Length of AAL-SDU	4.5.1.2.a	m	m		1 octet	
CS.VD.14	Value of inserted dummy bits	4.5.1.2.c	n/a	m		All 1's	
CS.VD.15	Network clock frequency (fn)	4.5.2.2.1.3/ 4.5.1.1 d)	c: m c: o c: n/a	c: m c: o c: n/a	SRTS method (SDH.SDH or PDH.SDH environment) SRTS method and PDH.PDH environment else	155,52 MHz existing network clock (e.g. 2,048 MHz)	
CS.VD.16	Derived Network clock frequency (fnx)	4.5.2.2.1.3	c: o.2 c: o c: n/a	c: o.2 c: o c: n/a	SRTS method SRTS method and PDH.PDH environment else	$155,52*2^{-k}$ MHz $(1\leq k\leq 11)$ 2,048 MHz	
CS.VD.17	Service bit rate		o	o		any value	

D.2.2.3 CS for voice band signal transport

D.2.2.3.1 Capabilities

Item	Capability	Reference	Status		Predicate	Support
			Transmission	Reception		
CS.VO.1	Detection of lost and misinserted cells	4.5.1.3.c	n/a	o		
CS.VO.2	Discard of detected misinserted cells	4.5.1.3.c	n/a	m		
CS.VO.3	Maintain bit count integrity	4.5.1.1.b	n/a	m		
CS.VO.4	Adaptive clock method	4.5.1.2.d	n/a	o		
CS.VO.5	Sequence count operation at transmission	4.5.2.1.1	m	n/a		
CS.VO.6	Sequence count operation at reception	4.5.1.3 4.5.2.1.2	n/a	o		

D.2.2.3.2 Protocol parameters

Item	Parameter	Reference	Status		Predicate	Value	Support
			Transmission	Reception			
CS.VO.7	Length of AAL-SDU	4.5.1.3.a	m	m		1 octet	
CS.VO.8	Value of inserted dummy bits	4.5.1.3.c	n/a	m		All 1's	

History

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