CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

Document AVC-112
October 3, 1991

CCITT SGXVIII
Rapporteur's Meeting on AAL
Ottawa, 1-3 October 1991

SOURCE: Mr D. Dorman, Special Rapporteur SWPXVIII/8-5
Mr K. Yamazaki, Special Rapporteur SWPXVIII/8-3

TITLE: Report of Meeting

1. GENERAL

As agreed at the Study Group XVIII meeting in Geneva in June 1991, this Rapporteur's meeting was convened to draft new and/or revised text for 1992 versions of I.362 and I.363 as an input to the December 1991 SGXVIII meeting. Such drafting activity was based on the agreements on AAL achieved at the June 1991 meeting of SGXVIII. The scope of this drafting activity covered AAL Type 1 and the "common part" of AAL Types 3 & 4.

The group met from 1 to 3 October 1991 in Ottawa, Canada, at the kind invitation of Bell Northern Research. Discussion and drafting activity on AAL Type 1 was under the Chairmanship of Mr K.Yamazaki (KDD, Japan). Mr Dennis Dorman (Telecom Australia) chaired the discussions and drafting activities on AAL Types 3 and 4.

Thirty three delegates participated in the meeting, with approximately 60 contributions. The list of participants is contained in Annex 1.

2. LIAISON FROM CCITT SGXI

An advance copy of a liaison statement and meeting reports of SWP XI/4-3 and WP XI/2 relevant to AAL matters was made available to the meeting. A brief summary of the liaison and reports was provided for information by Mr T. Hin (Alcatel, France). The key issues identified in the draft documents from SGXI were:

- no staged approach to signalling AAL Recommendations;
- a work programme to achieve 1993 Recommendations has been developed;
- SGXI could not reach agreement to use the "common part" of AAL 3/4 for signalling;
- SGXI propose a joint WPXI/2 and SWPXVIII/8-5 experts meeting on AAL issues.

The input was noted but no specific action was taken on the draft liaison.

3. MEETING RESULTS

The prime objective of the meeting was to draft text for enhancement of Recommendations I.362 and I.363 based on the agreements of the June 1991 SGXVIII meeting.

The results of the drafting activity on AAL Type 1 are contained in the report of Mr Yamazaki in Annex 2 (Results of Discussions). Annex 3 provides a list of open issues relevant to AAL Type 1. Annex 4 contains the revised text of I.363 Section 2 as produced at the meeting.

The results of drafting activity for Recommendation text on AAL Types 3 and 4 are contained in Annex 3. It should be noted that the reservations on the three issues from the June 1991 meeting still stand. Where appropriate and available, alternative text has been included in Annexes 5 and 6 on these issues.

A key aspect of the drafting activity on AAL Types 3 and 4 was the agreement on the appropriate names of the sublayers and that there was no need seen to describe or define the term "common part".

Discussions on additional key issues relatating to AAL Types 3 and 4 that go beyond the June 1991 meeting agreements were convened under the Chairmanship of Mr P. Schicker (Switzerland). The results of this activity are contained in Annex 7.

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Rapporteur's meeting on AAL
Ottawa, 1 - 3 October 1991

Questions : 2, 13 / XVIII

SOURCE : Rapporteur SWP XVIII/8-3

TITLE : Report of the meeting on AAL type 1

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1. Key issues

Based on contributions submitted, the meeting discussed some key issues which require urgent study towards 1992 Recommendation of I.363 section 2 (AAL type 1). The summary of discussions is given below, and new text was produced according to the results of discussions for consideration at the December SG XVIII meeting.

1.1 SN and SNP operations
- TD.8[NTT], TD.9[NTT], TD.21[Portugal], TD.41[NTT]

TD.8 proposed to introduce the text on consequences of errors in SN/SNP. The proposal was agreed to. Furthermore, it was agreed to have the text on how to generate codeword of SNP field at the transmitting end. The text was drafted which paralleled the HEC descriptions in I.432. (See section 2.3.1.2.2 of I.363)

SN/SNP operations at the receiving end were presented by both TD.9 and TD.21, which contributions proposed specific algorithms. The meeting felt that it is premature to specify algorithms. However, the need for introducing general descriptions was recognized and the text based on contributions was drafted. (See section 2.3.2.2.1)

TD.41 proposed the text describing information to be passed from SAR to CS about SNP check status at the receiving end. A more generalized description was developed and incorporated in section 2.3.1.1 and 2.3.1.2.2.

1.2 Support of 8 KHz integrity
- TD.45[SG XV], TD.47[KDD]

TD.47 identified the need for 8 kHz integrity for supporting transport of 64 kbit/s based ISDN circuit. A typical example of 8 kHz integrity was given by TD.45 which requests 8 kHz integrity to support H.221 frame structure for px64 kbit/s video signals.

The meeting agreed on the support of structured data, e.g. 8 kHz structured data, in synchronous circuit transport and video signals transport of AAL type 1. One parameter which identifies the start of structured data was introduced in two primitives defined in section 2.1.2. Text was added for the descriptions of functions in section 2.3.2.1.2 and 2.3.2.1.4.

However, the meeting did not produce the descriptions on CS protocols for supporting structured data. This requires urgent study for 1992 Recommendation, and option 3 presented in TD.47 will give a basis for studies.

1.3 Delivery of local clock information
- TD.45[SG XV], TD.46[KDD]

Both SG XV and CMTT (ref. TD.8 of XVIII/8 at the last Geneva meeting) requested that local clock information derived from the ISDN user interface be available for use as reference clock by layers above AAL within terminals. The meeting understood the need for local clock availability, but did not reach an agreement on introducing explicit descriptions in AAL specifications. TD.46 presented some options to be considered. Since this local clock delivery has been realized in 64 kbit/s ISDN by implementations where applicable, it was felt that the same assumption will be possible in B-ISDN.

1.4 Support of A/u-law conversion and echo control
- TD.16[FRG]

Clarification on the support, within the AAL, of A/u-law conversion and echo control was identified at the last Geneva meeting. TD.16 proposed that AAL specification should not include any material about these functions. The meeting agreed that A/u-law conversion is provided outside the AAL. (See section 2.3.2.1.3).

1.5 Commonality between AAL type 1 and type 2
- TD.45[SG XV]

SG XV requested that commonality between type 1 and type 2 AAL should be considered in order to facilitate interworking between B-ISDN codecs and N-ISDN codecs (px64 kbit/s). SG XV also noted that the example of type 2 AAL in the current I.363 text may be restrictive for supporting a wide range of video services.

The meeting did not reach any conclusion at this stage, and recognized that the issue of commonalty between type 1 and type 2 AAL should be addressed to the next meeting.

1.6 Others
- TD.54[NTT], TD.7[NTT]

TD.54 presented a functional model of AAL type 1. The meeting decided the figure contained in TD.54 was useful, but that it should not be included in I.363 since it may cause some confusion between text and figure.

TD.7 proposed to include SDH signals transport as an example of synchronous circuit transport. Due to lack of time, TD.7 could not be discussed fully.

2. <u>Advancing the text of I.363</u>
   - TD.1[Rapporteur], TD.2[Bellcore], TD.19[France], TD.20[France], TD.45[SC XV]

Drafting work was based on agreements reached so far, and revised text of I.363 section 2 appears in ANNEX 4.

During the discussions, the following issues were raised which need further considerations towards 1992 Recommendations;

a) Support of high quality audio

Concerns were raised on the inclusion of high quality audio in CS text of I.363, since no explicit users and requirements have been identified. This concern relates to further development of AAL specifications within SG XVIII, particularly beyond 1992 Recommendations. The concern was not resolved, however text on high quality audio was revised according to results relevant to other AAL layer services. The issue of whether text on high quality audio should be provided in the 1992 Recommendation should be discussed at the next meeting.

b) Structure of text on CS functions

Alternative structure of text on CS functions (i.e section 2.3.2.1.1 to 2.3.2.1.5) was suggested as follows;

2.3.2.1.1 AAL type 1 layer services and classification
- identifies 5 layer services with possible examples.

2.3.2.1.2 Descriptions of functions
- Describes each function individually.

2.3.2.1.3 Matrix between functions and layer services
- e.g. the table below. (R:Required, O:Optional)

	Async.	Sync.	Voice	Video	H.Audio
Source clock freq. rec.	R			O	

The suggestion was based on the following considerations : 1) to avoid duplication of the same text, 2) to provide more complete descriptions on each function, 3) to give more expendability for future use of type 1 and possible emergence of other layer services.

Relevant ANNEXES

ANNEX 3 : List of open items on AAL type 1

ANNEX 4 : Revised text of I.363 section 2

ANNEX 3

CCITT
Study Group XVIII

Rapporteur's meeting on AAL
Ottawa, 1 - 3 October 1991

Questions : 2, 13 / XVIII

SOURCE : Rapporteur SWP XVIII/8-3

TITLE : List of open items on AAL type 1

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1. SAR

H - Check mechanism for validity of SN (See section 2.3.1.2.2 b)

2. CS

H - Assessing source clock frequency method (TS and SFET)
  1) Maximum cell payload capacity ?
  2) Tolerance for bit errors, lost and misinserted cells ?
  3) Implementation complexity ?
  4) Suitability to applications other than G.703 signals ?

H - Relevant text for source clock frequency recovery (See section 2.3.2.2.3)

H - SN processing mechanism. To what extent should it be specified? (Is section 2.3.2.2.1 enough?)

H - Protocol description on support of structured data (See section 2.3.2.2.2)
- Other protocols to be specified (See section 2.3.2.2)

H - Structure of text on CS functions (Section 2.3.2.1.1 to 2.3.2.1.5)
- Need for text on high quality audio signals (Section 2.3.2.1.5)
- Need to include transport of SDH signals in CS for synchronous circuit transport?
- End-to-end QOS monitoring (In coordination with OAM aspects)

H : High priority items for 1992 Recommendations.

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Study Group XVIII

Rapporteur's meeting on AAL
Ottawa, 1 - 3 October 1991

Questions : 2, 13 / XVIII

SOURCE : Rapporteur SWP XVIII/8-3

TITLE : Draft text of I.363 section 2 (AAL type 1)

Rapporteur's Note :

This document presents draft text of I.363 section 2 (AAL type 1). The following notations are used in this document;

- Single vertical line : Changes from 1990 Rec. agreed up to the Geneva June 1991 meeting.
- Double vertical line : Changes from 1990 Rec. agreed at the Ottawa meeting.

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2. AAL type 1

2.1 Service provided by AAL type 1

2.1.1 Definitions

The layer services provided by AAL type 1 to the higher layer 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;
- indication of lost or errored information which is not recovered by AAL type 1, if needed.

2.1.2 Primitives

2.1.2.1 General

At the AAL-SAP, the following primitives will be provided by the AAL type 1 to the AAL user:

- From an AAL user to the AAL,
  AAL-DATA-REQUEST;

- From the AAL to an AAL user,
  AAL-DATA-INDICATION.

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

SAP.

2.1.2.2 AAL-DATA-REQUEST

AAL-DATA-REQUEST (data[mandatory],
structure[optional])

The AAL-DATA-REQUEST primitive requests the transfer of the AAL-SDU, i.e. contents of the data parameter associated with this primitive, from the local AAL entity to its peer entity. The length of the AAL-SDU should be constant and the time interval between two consecutive primitives should be constant. These two constants are a function of the AAL service provided to the AAL user.

The structure parameter can be used when the data to be transferred to the peer AAL-SAP is organized into groups of bits or octets. The two values of the structure parameter are;

START, and
CONTINUATION.

The value START means that the data is the first part of 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 on the type of AAL service provided (e.g. 8 kHz integrity).

2.1.2.3 AAL-DATA-INDICATION

AAL-DATA-INDICATION (data[mandatory],
structure[optional],
status[optional])

An AAL user is notified by the AAL that the AAL-SDU, i.e. contents of the data parameter, associated with this primitive coming from its peer, is available. The length of the AAL-SDU should be constant and the time interval between two consecutive primitives should be constant. These two constants are a function of the AAL service provided to the AAL user.

The structure parameter can be used when the data to be transferred from the peer AAL-SAP is organized into groups of bits or octets. The two values of the structure parameter are;

START, and
CONTINUATION.

The value START means that the data is the first part of 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 on the type of AAL service provided (e.g. 8 kHz integrity).

The status parameter identifies that the data is judged to be non-errored or errored. That status parameter has two values;

VALID, and
INVALID.

The INVALID status could also imply that the data is a dummy value. The use of the status parameter and the choice of dummy value depend on the type of AAL service provided.

2.2 Interaction with the management and control planes

2.2.1 Management plane

The following indications may be passed from AAL type 1 in the user plane to the management plane:

- errors in the transmission of user information;
- lost or misinserted cells (further study is required on whether it is necessary to distinguish between lost and misinserted cells for management purpose);
- cells with errored AAL Protocol Control Information (AAL-PCI) (further study is required to determine if this indication is necessary for layer services supported by this AAL type);
- loss of timing and synchronization;
- buffer underflow and overflow.

2.2.2 Control Plane

For further study.

2.3 Functions in AAL type 1

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

a) segmentation and reassembly of user information;
b) handling of cell delay variation;
c) handling of lost and misinserted cells;
d) source clock frequency recovery at the receiver;
e) monitoring of AAL-PCI for bit errors;
f) handling of AAL-PCI for bit errors;
g) monitoring of user information field for bit errors and possible corrective action.

Other service specific functions are for further study.

Note - For some layer services, the end-to-end QOS may be monitored. This may be achieved by calculating a CRC for the CS-PDU payload, carried in one or more cells, and transmitting the CRC results in the CS-PDU. This could also be achieved by the use of OAM cells. Further study is required.

2.3.1 Segmentation and Reassembly sublayer

2.3.1.1 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 accepts a 47 octet block of data from the CS, and then prepends one octet SAR-PDU header to each block to form the SAR-PDU. The SAR sublayer 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) Existence of CS function
The SAR sublayer has the capability to indicate the existence of a CS function. It receives this indication from the CS and conveys it to the peer CS entity. The use of this indication is optional.

c) Sequence numbering
The SAR sublayer consecutively numbers each SDU that it passes to the ATM layer. At the receiving end, it passes the sequence number value to the CS. The CS may use these sequence number values to detect lost or misinserted SAR-PDUs (corresponding to lost or misinserted ATM cells).

d) Error protection
The SAR sublayer protects the sequence number value and the CS indication against bit errors. It informs the receiving CS when the sequence number value and the CS indication are errored.

Note – For certain applications such as speech, some SAR functions may not be needed. This item is for further study.

2.3.1.2 <u>SAR protocol</u>
The SAR-PDU header together with the 47 octets of 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/I.363.

```
+ - - - - - - -+--------------------------------------+
|Cell header |  SN    | SNP    | SAR-PDU payload       |
+ - - - - - - -+--------------------------------------+

             |SAR-PDU header |                         |
             |                                         |
             | - - - - - - - SAR-PDU - - - - - - - - - |

        SN  : Sequence Number               (4 bits)
        SNP : Sequence Number Protection    (4 bits)
```

FIGURE 1/I.363
<u>SAR-PDU format for AAL type 1</u>

2.3.1.2.1 <u>Sequence number field</u>
The SN field is divided into two subfields as shown in Figure 1-A/I.363. CS indication subfield is used to indicate the existence of CS functions. The subfield has the value 1 when a CS function exits. Otherwise the subfield has the value 0.

The sequence number count subfield is used for sequence number counting, allowing the stream of SAR-PDUs to be numbered modulo 8. Each SAR-PDU will have its sequence number count incremented by one relative to the previous sequence number count. The least significant bit of the sequence number count is right justified in the SN field.

```
|--------- SN field ---------|

+-----------------------------------------+
|         |         |         |            |
+-----------------------------------------+

|          |                              |
|CS        |  Sequence number count       |
|indication|                              |
```

Figure 1-A/I.363
<u>SN format of AAL type 1 SAR-PDU</u>

2.3.1.2.2 <u>Sequence number protection field</u>

The SNP field provides error detection and correction capabilities over the SN field. The format of this field is given in Figure 1-B/I.363. A two step approach is used for the protection of the SN field:

1) The SN field is protected by a CRC code x3+x+1;
2) The resulting 7 bit codeword is protected by an even parity check bit.

The error protection function furnished by the SNP corrects single bit header errors and provides a low probability of delivery of errored SN values under bursty error conditions.

```
|--------- SNP field --------|

+-----------------------------------------+
|         |         |         |            |
+-----------------------------------------+

|                             |Even        |
|    Control bits             |parity      |
|                             |            |
```

Figure 1-B/I.363
<u>SNP format of AAL type 1 SAR-PDU</u>

The SNP covers the entire SAR-PDU header. 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 7 bits of the SAR-PDU header and inserts the result in the control bits subfield.

The notation used to describe the CRC is based on the property of cyclic codes. (For example a code vector such as 1011 can be represented by the polynomial P(x)=x3+x+1.) The elements of an n-element codeword 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. The polynomial representing the content of the SN field is generated using the first bit of the SN field as the coefficient of the highest order term.

The control bits subfield consists of three bits. It shall contain the remainder of the division (modulo 2) by the generator polynomial x3+x+1 of the product x3 multiplied by the content of the SN field.

At the transmitter, the initial content of the register of the device computing the remainder of the division is preset to all "0"s and is then modified by division of the SN field by the generator polynomial (as described above); the resulting remainder is transmitted as control bits.

After completing above operations, the transmitter inserts the even parity bit.

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 1-C/I.363. The default mode is the correction mode, which provides for single-bit error correction.

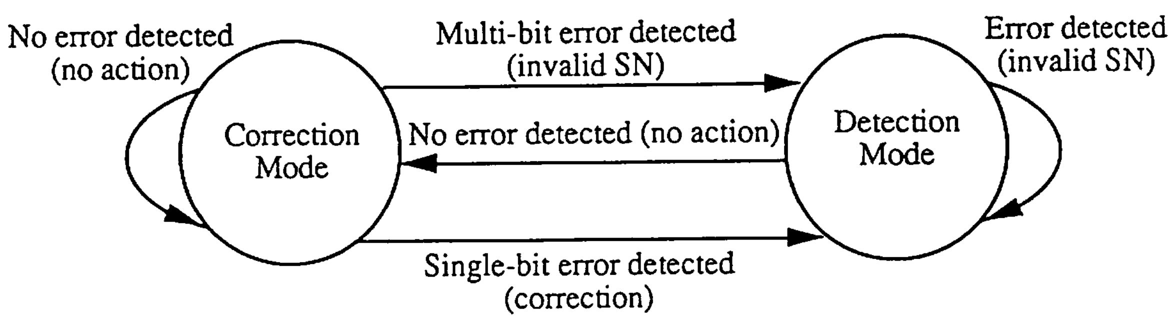

Figure 1-C/I.363
<u>SNP : receiver modes of operation</u>

The receiver examines an each SAR-PDU header. 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. When a SAR-PDU header is examined and found not to be in error, the receiver switches to "Correction Mode".

[Rapporteur's note : This text needs to be revised to take into account that the validity of SAR header can be checked by the control bits, by the parity bit, or jointly.]

The receiver conveys the sequence number count and the CS indication to the CS together with SNP check status (valid or invalid).

The Figure 1-D/I.363 shows the consequences of errors in the SAR-PDU header.

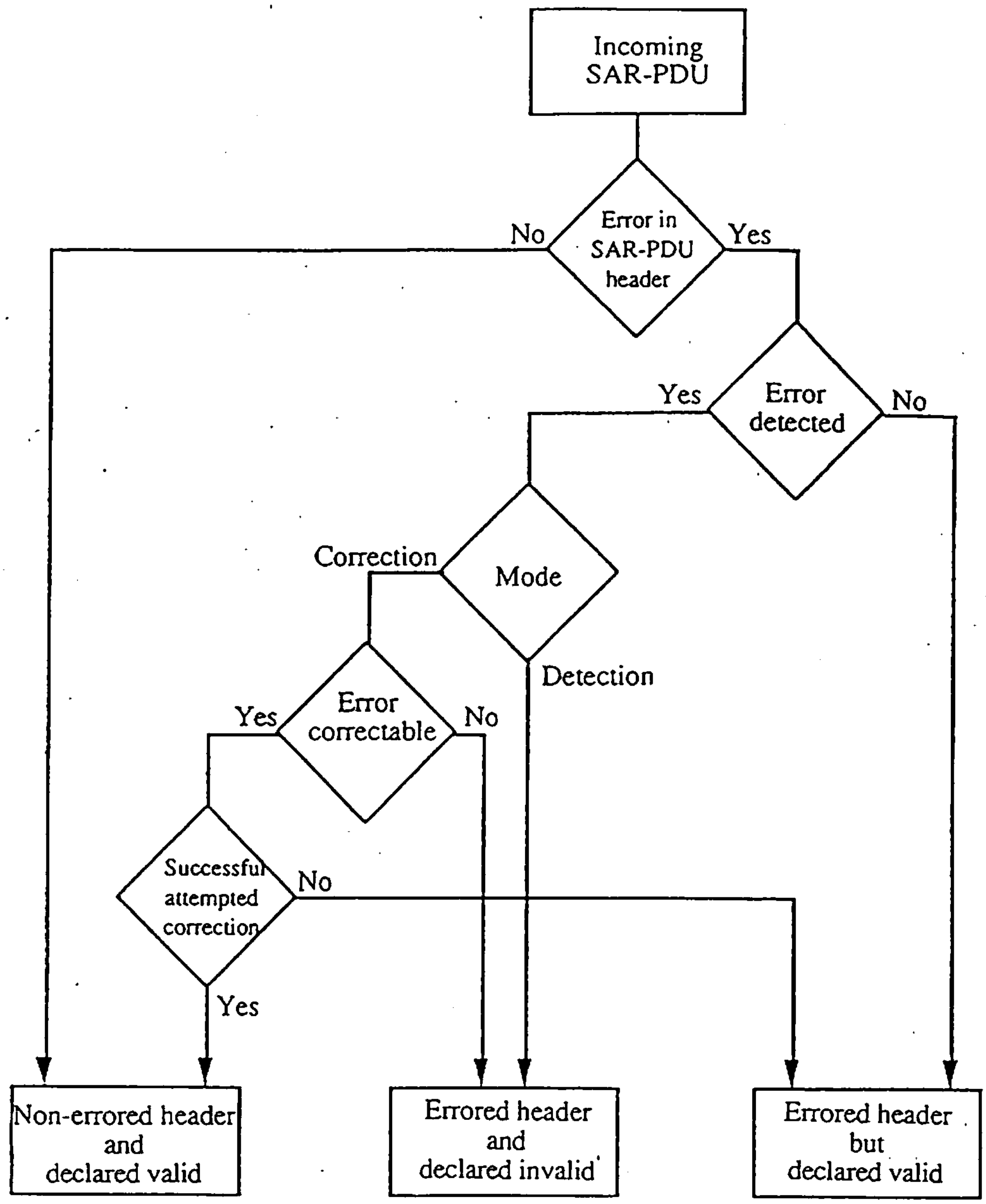

Figure 1-D/I.363
Consequences of errors in SAR-PDU header

2.3.2 Convergence Sublayer

2.3.2.1 Functions of the CS

The CS may include the following functions;

a) For high quality audio and video, forward error correction may be performed to protect against bit errors. This may be combined with bit interleaving to give more secure protection against errors.

b) For some layer services, this sublayer provides the clock recovery capability for the receiver, e.g., by monitoring the buffer fill. This requires no specific field in the CS-PDU.

c) For AAL services requiring explicit time indication between the source and destination clocks, the AAL can provide a mechanism for a timing information transfer. This transfer may be provided by means of a time stamp inserted in the CS-PDU or by some other mechanisms.

d) Further sequence number processing may be performed at this sublayer. The SN count 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.

e) The CS can utilize the CS indication provided by the SAR sublayer to support CS functions for some AAL services.

f) The CS may generate reports giving the status of end-to-end performance as deduced by the AAL. The performance measures in these reports could be based on;

- cell loss and misinserted events,
- buffer underflow and overflow,
- bit error events.

For performing some of these functions, the CS will need a clock. This clock may be derived from S or T interface.

2.3.2.1.1 <u>Functions of the CS for asynchronous circuit transport</u>

The following functions support asynchronous circuit transport, i.e., transport of signals from constant bit rate sources whose clocks are not frequency-locked to a network clock. Examples are G.703 signals at 1.544, 2.048, 6.312, 8.448, 32.064, 44.736 and 34.368 Mbit/s.

a) Handling of AAL user information

The length of AAL-SDU is one bit. The AAL does not provide structure information to the AAL user.

b) Handling of cell delay variation

A buffer is used to support this function. The size of this buffer is dependent upon specifications provided in Recommendation I.35B.

In the event of buffer underflow, it may be necessary for the CS to maintain bit count integrity by inserting the appropriate number of dummy SAR-PDU payloads.

c) Handling of lost and misinserted cells

The SN counter values are further processed at this sublayer to detect lost and misinserted cells. Misinserted cells are discarded.

In order to maintain the bit count integrity of the AAL user information, it is necessary to compensate for lost cells and for buffer underflow by inserting the appropriate number of dummy SAR-PDU payloads. The content of this dummy SAR-PDU payload depends on the AAL service being provided. For example, this dummy SAR-PDU payload is all "1"s for G.703 1.544 Mbit/s and 2.048 Mbit/s circuits.

d) Source clock frequency recovery

Recovered source clock should have satisfactory jitter performance. The jitter performance for G.703 signals is specified in Recommendations G.823 and G.824.

The CS at the source provides a mechanism for encoding timing information for transport to the receiver. The CS indication can be used to carry the timing information. The exact method is for further study.

[Rapporteur's note : Two techniques have been proposed to provide this function. They are Time Stamping (TS) and Synchronous Frequency Encoding Technique (SFET). Both methods rely on the provision of a common timing reference to provide the best performance.

In the case of the TS method, a time reference information is inserted in the CS-PDU header at the transmitting side. This information is used at the receiving end to achieve source clock frequency recovery and to cancel the jitter encountered through the ATM network.]

2.3.2.1.2 <u>Functions of the CS for synchronous circuit transport</u>

The following functions support synchronous circuit transport, i.e., transport of signals from constant bit rate sources whose clocks are frequency-locked to a network clock. Examples are signals at 64, 384, 1536 and 1920 kbit/s as described in Recommendation I.231;

a) Handling of AAL user information

The length of AAL-SDU is one octet.

For those layer services which require transport of structured data, e.g. 8 kHz structured data for nx64 kbit/s existing ISDN bearer services, the structure parameter of primitives defined in section 2.1.2 will be used.

b) Handling of cell delay variation

A buffer is used to support this function. The size of this buffer is dependent upon specifications provided in Recommendation I.35B.

c) Handling of lost and misinserted cells

The SN counter values are further processed at this sublayer to detect lost and misinserted cells. Misinserted cells are discarded.

Handling of lost cells and buffer underflow is for further study. Compensation for lost cells by dummy SAR-PDU payloads is a possible candidate.

2.3.2.1.3 <u>Functions of the CS for voice-band signals transport</u>

The following functions support transport of voice-band signals, e.g. 64 kbit/s A-law and u-law coded G.711 signals, and 64 kbit/s G.722 signals;

a) Handling of AAL user information
The length of 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 specifications provided in Recommendation I.35B.

c) Handling of lost and misinserted cells
The detection of lost and misinserted cells may be provided by processing the SN counter values. The monitoring of the buffer fill level can also provide an indication of lost and misinserted cells. Misinserted cells are discarded.

Handling of lost cells and buffer underflow is for further study.

Note - For transporting signals of speech and 3.1 kHz audio bearer services as specified in 64 kbit/s ISDN, the need for A/u-law conversion is identified. This conversion function is provided outside the AAL.

2.3.2.1.4 Functions of the CS for video signals transport
The following functions support transport of video signals, e.g. px64 kbit/s video signals organized into H.221 frame;

[Rapporteur's note : Other examples for these functions are transport of video signals under study in CCITT SG XV and CMTT.]

a) Handling of AAL user information
The length of AAL-SDU is one octet.

For those layer services which require transport of structured data, e.g. H.221 structured frame for px64 kbit/s video signals, the structure parameter of primitives defined in section 2.1.2 will be used.

The status parameter will be passed to the AAL user to facilitate further picture processing, e.g. error concealment.

b) Handling of cell delay variation
A buffer is used to support this function. The size of this buffer is dependent upon specifications provided in Recommendation I.35B.

c) Handling of lost and misinserted cells
The SN counter values are further processed at this sublayer to detect lost and misinserted cells. Misinserted cells are discarded.

Information in lost cells may be recovered by the mechanism described in f). The exact functions for handling of lost cells and buffer underflow are for further study.

d) Source clock frequency recovery

This function is provided for those layer services which require source clock frequency recovery, e.g. recovery at the receiving end of camera clock frequency which is not locked to the network clock. The exact method is for further study.

e) Monitoring of user information field for bit errors and corrective actions

Forward error correction may be performed to protect against bit errors. The data interleaving mechanism (e.g. bit or octet interleaving) may also be performed on an optional basis. Furthermore, these two methods may be combined to give more secure protection against errors.

Note - Other functions, e.g. the need for CS-PCI and monitoring and handling of bit errors in CS-PCI, are for further study.

2.3.2.1.5 <u>Functions of the CS for high quality audio signals transport</u>

The following functions support transport of high quality audio signals;

a) Handling of AAL user information

The length of 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 specifications provided in Recommendation I.35B.

c) Handling of lost and misinserted cells

The SN counter values are further processed at this sublayer to detect lost and misinserted cells. Misinserted cells are discarded.

Information in lost cells may be recovered by the mechanism described in f). The exact functions for handling of lost cells and buffer underflow are for further study.

d) Source clock frequency recovery

This function is for further study.

e) Monitoring of user information field for bit errors and corrective actions

Forward error correction may be performed to protect against bit errors. The data interleaving mechanism (e.g. bit or octet interleaving) may also be performed on an optional basis. Furthermore, these two methods may be combined to give more secure protection against errors.

Note - Other functions, e.g. the need for CS-PCI and monitoring and handling of bit errors in CS-PCI, are for further study.

2.3.2.2 <u>CS protocols</u>

The following sections describe CS protocols to be provided for implementing CS functions. The use of each protocol depends on the required CS functions as given in section 2.3.2.1.

2.3.2.2.1 <u>SN operations at the receiving AAL entity</u>

The CS receives the following information from the SAR sublayer for each SAR-PDU received;

- SN field information,
- SNP check status (valid or invalid SN field information).

The CS can retrieve the CS indication and the SN counter value from SN field information.

The use of SN counter values and CS indications will be specified on a service specific basis. See section 2.3.1.2 for details about the SN field structure and coding, and the SNP check status processing.

2.3.2.2.1.1 <u>SN counter processing - cell loss/misinsertion</u>

A key feature provided by the CS processing at the receiving AAL entity is identification of the lost or misinserted SAR-PDUs. This feature will be useful for many CBR services.

The CS will have available as input the SN counter values and the SNP check status. CS processing may identify the following conditions;

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

The SN counter processing may provide additional information to related entities within the CS, as required. Some examples are;

- location of lost SAR-PDU in the incoming SAR-PDU stream,
- number of consecutive SAR-PDUs lost,
- identification of misinserted SAR-PDU.

Note - The SN counter processing may be subject to performance specifications. The performance specifications will be applied on a service specific basis.

2.3.2.2.2 <u>Transport of structured data</u>

(To be provided for 1992 Recommendation.)

2.3.2.2.3 <u>Source clock frequency recovery</u>

(To be provided for 1992 Recommendation.)
