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Study Group 13

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Questions : 6/SG13

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TITLE: Status Report on AAL1&2 (AAL Types 1 and 2) for video signal transport

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1. Introduction

Studies have been carried out between SG13, SG15 ATM Video Coding Experts Group and SG9 (formerly CMTT) on AAL1&2 for video signal transport through Liaison documents and the IVS (Integrated Video Services) Baseline Document. This document is an updated version on the issues being discussed, and summarizes the status of study from network viewpoints.

2. AAL1

2.1 Error protection

In the March 1993 version of I.363, SG13 specifies the method of correcting lost cells and bit errors in a cell payload, namely the long interleaver method, for distributive services according to requirement by SG9. At its July 1993 meeting, SG13 also developed an error correction method for delay sensitive services, namely the short interleaver method, based on Liaison documents from SG15 and SG9. These two methods are summarized below:

(1) Long interleaver method

- 128-cell interleaving matrix with (128, 124) RS code, and vertical reading at the transmitter.
- Error correction: 4 cell loss within 128 cells, 2 cell loss and 1 errored octet in each row of 128 octets, 2 errored octets in each row if there is no cell loss.
- Delay including both ends at AAL1-SAP: 2x124 cells, i.e., 2.65 ms (34 Mbit/s) and 2.01 ms (45 Mbit/s).

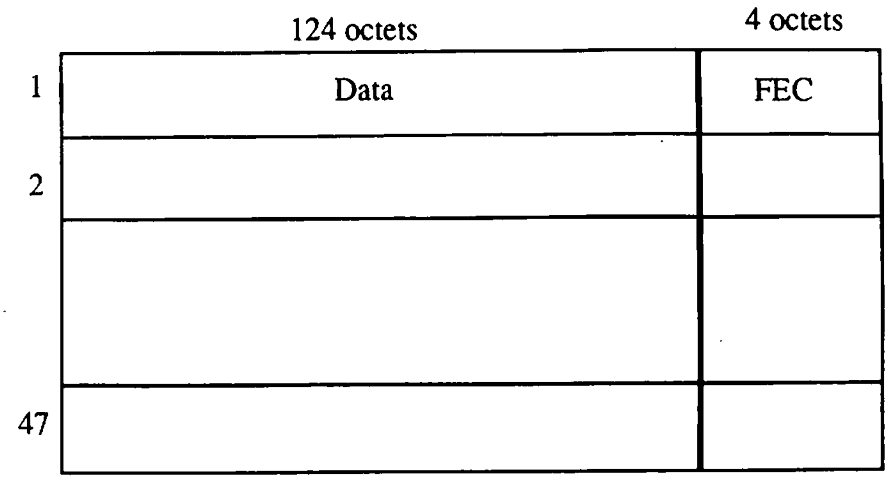


Fig. 1 Long interleaver method with vertical reading

(2) Short interleaver method

- 16-cell interleaving matrix with (94, 88) RS code, and diagonal reading at the transmitter.
- Error correction: 1 cell loss within 16 cells, or 3 errored octets in each row of 94 octets.
- Delay including both ends at AAL1-SAP: 14.7 ms (384 kbit/s), 3.67 ms (1536 kbit/s), 2.93 ms (1920 kbit/s).

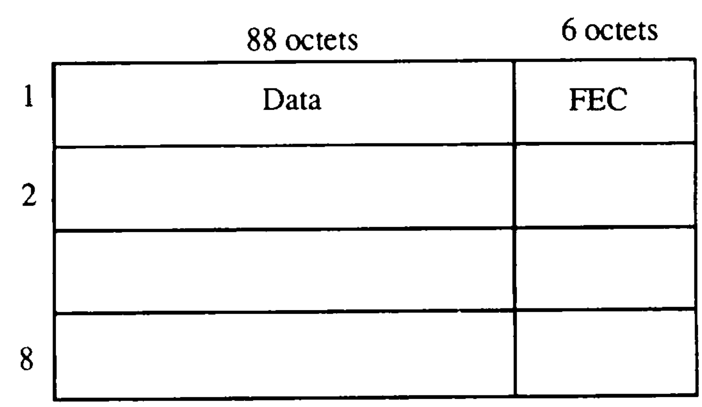


Fig. 2 Short interleaver method with diagonal reading

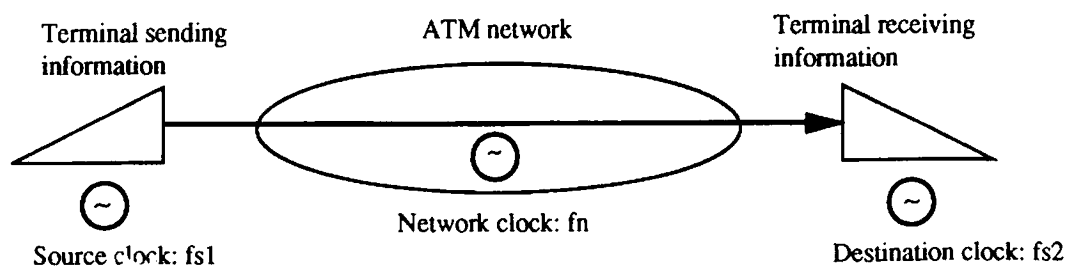
(3) Open issue

- Support of the Structured Transfer Method (SDT) method in the long and short interleaver methods (subject to SG13's study). SG 13 assumes that an H.320 includes H.221 that supports synchronization of bit streams, hence does not require the SDT method.

2.2 Source clock frequency recovery

Source clock frequency recovery is used for asynchronous transport, where clock frequency of a transmitter/receiver pair is not locked to the network, and is to be maintained between the transmitter and the receiver. I.363 specifies two methods of source clock frequency recovery, i.e., SRTS and adaptive clock. SG13 is still studying the issue, particularly for the case where no common reference clock is available at both ends, and where CPE does not know the exact clock situation between two ends. Such a case is typical in international networks and a network comprising public and private networks.

Use of source clock frequency recovery at AAL1 for CBR video signal transport needs to be addressed to both SG15 and SG9. After completion of SG13's work, SG15 and SG9 will be able to decide whether or not to use that function and which method is to be used. SG 13 assumes that an H.320 utilizes synchronous transport of AAL1, hence does not require source clock frequency recovery.



Note: Source clock frequency recovery makes fs2 equal to fs1, where fs1/fs2 is not frequency locked to fn.

Fig. 3 Source clock frequency recovery in ATM network

2. Support of MPEG-2 signal transport over ATM network

It was reported by SG9 at March 1994 meeting that SG9 has a plan to study transmission of MPEG-2 signals over an ATM network for digital video distribution services, according to requirements from ITU-R SG 10 and 11. The AAL1&2 group welcomed this information and concluded to have collaborative work with SG9 on this subject. The AAL1&2 group reached the following consensus:

- when MPEG-2 Transport Stream (TS) is supported in CBR services of an ATM network, it is adequate to use AAL1 with/without a long or short interleaver method depending on error protection and delay requirements. Use of source clock frequency recovery in AAL1 also needs to be assessed.
- when MPEG-2 is supported in VBR services, the group wishes to have as much communality between H.262 and MPEG-2 as possible. TS may not be appropriate due to its redundancy with ATM functionality. A collaborative study with SG9 and SG15 (ATM Video Group) will be taken in the scope of AAL2.

4. AAL2

4.1 Functions of H.22X

One purpose of the joint meeting is to decide the functions of AAL2 and H.22X respectively. It is assumed that H.22X will support the following functions:

- Audiovisual multiplexing, i.e., multiplexing video, voice and data in terms of H.32X system aspects.
- Synchronization between higher layers, e.g., between video and voice.

In addition, support of CPE-to-CPE (in-channel) signalling (i.e., H.24X) may be provided by H.22X

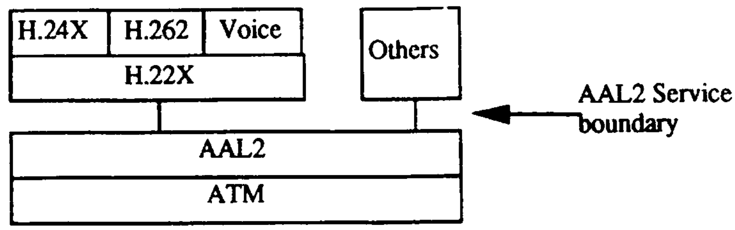


Fig. 4 Protocol stack of AAL2 and higher layers

4.2 Objectives of AAL2

The objectives of AAL2 are:

- to support interactive video applications, e.g., H.262, in VBR services,
- to support distributive video applications in VBR services,
- to support distributive services with real time constraint, e.g., VBR high quality audio, and
- to maintain future expandability to support other possible applications.

It is recognized that AAL1 is appropriate in CBR services, for supporting H.262 in CBR services as well, and AAL2 will be developed to be appropriate in VBR services.

4.3 Functions of AAL2

The following paragraph gives candidate functions and considerations regarding AAL2.

(1) Framing of H.22X data: cell-by-cell or packet with trailer

Since data exchanged between H.22X and AAL2 is variable length, AAL2 supports framing of such data. There are two alternatives for framing methods:

- cell-by-cell approach like AAL1, 3/4, and
- variable packet with trailer like AAL5.

When the packet method is adopted, protocol overhead will be reduced compared to the cell-by-cell method. It is anticipated, however, that in the packet method, a delay variation is introduced at the receiver due to variable waiting time, i.e., the receiver needs the whole packet for its trailer operation, and then passes the valid packet to H.22X. A typical value is 3 ms delay variation for 16k octets H.22X data over 45 Mbit/s.

In the following items (2) and (3), the two methods are further compared in terms of error protection functions and ATM user-to-user indication.

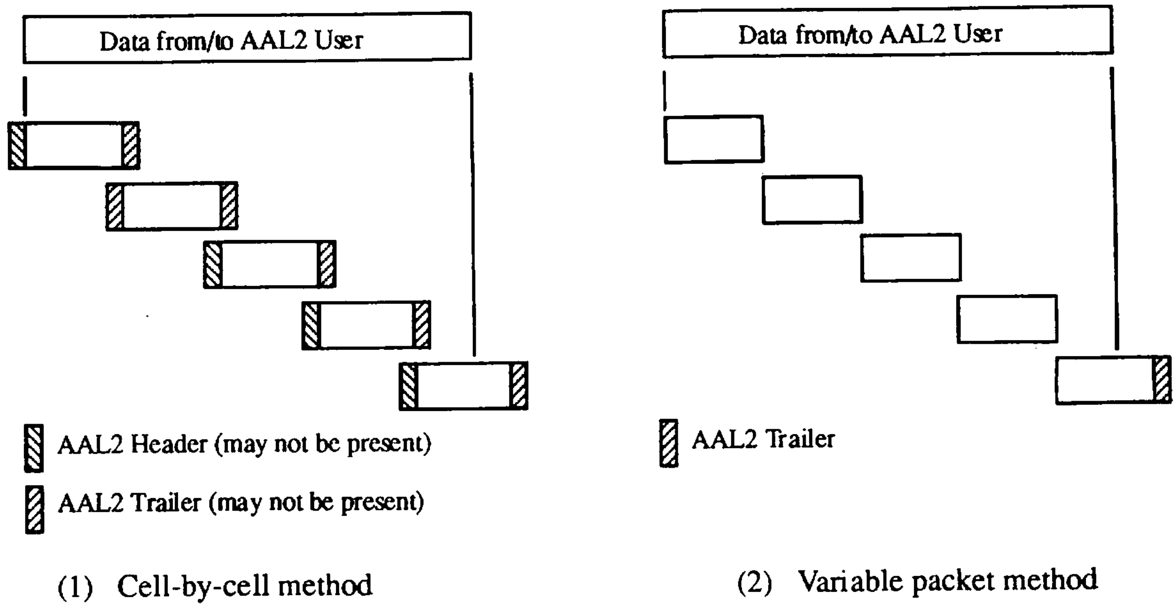


Fig. 5 Two methods of framing AAL2 user data

(2) Error protection: detection only or detection/correction

The need for an error protection function in AAL2 and the required performance should be addressed. The error protection capability of AAL1 can be used for assessing this issue in AAL2, which is described in section 2.1 of this document. Will AAL2 have to support:

- detection of cell losses?
- detection of bit errors of the cell payload?
- correction of cell losses?
- correction of bit errors of the cell payload?

SG13 needs answers from SG15 on this issue. Performance requirements of error protection capabilities also need to be clarified. Such performance requirement may depend on a specific application with a specific bit-rate, as exampled below:

- 30 minutes error free for video conference with 1.5 - 10 Mbit/s.
- Two or three hours error free for video program transmission with 10 - 20 Mbit/s.
- Others?

One possible method for supporting correction of both cell losses and bit errors is the use of FEC and octet interleaving as specified in AAL1. Those methods may require a cell-by-cell AAL2 header such as sequence numbering, e.g., to detect positions of lost cells/octets in an interleaving matrix. It should be noted that correction of lost cells will be achieved more efficiently in AAL2 level, rather than in higher layer levels.

(3) Handling of ATM user-to-user indication

An AAL2 user is able to use two information streams on a cell basis by using an ATM user-to-user indication. Each information stream may be utilized with a cell-by-cell based cell loss priority, to enable two cell streams each having high or low priority. Use of an ATM user-to-user indication is not possible when an AAL5-like method is adopted.

(4) Handling of Cell Loss Priority

This function will allow an AAL2 user to use cell-by-cell based CLP. AAL2 supports mapping of this information between the AAL2 user and an ATM layer.

(5) Timing/synchronization issues

A study should be directed to clarify timing/synchronization issues in VBR services with real-time constraints. Issues to be addressed include: 1) what timing relationship be supported between a transmitter and receiver at AAL2-SAP?, and 2) should cell delay variation be removed at the receiver side of AAL2.?

A view is expressed such that when a bit-rate is going to high, e.g., 34 or 45 Mbit/s, generated traffic may tend to be close to CBR. It is, therefore, necessary to study applicable area or bit-rates of AAL2 support for VBR video services.

(6) Multiplexing of information

Although H.22X is supposed to provide for multimedia multiplexing of audio-visual services, support of multiplexing in AAL2 needs to be examined as possible advancement for future standardization. One possible use of AAL2 multiplexing is to support multipoint-to-multipoint connections as depicted below.

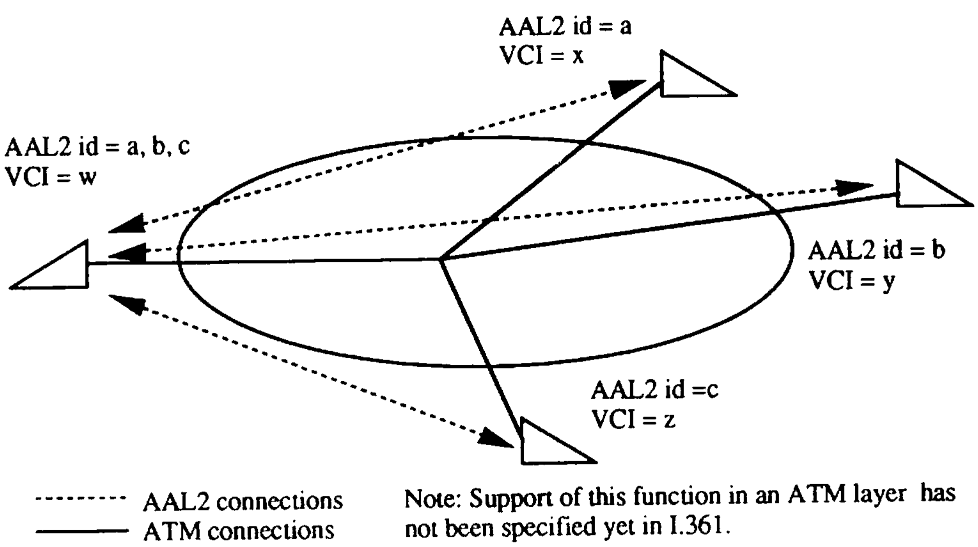


Fig. 6 A typical point-to-multipoint configuration over AAL2/ATM