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1. Introduction

This report summarizes the activities of Experts Group for "Video Coding and Systems in ATM and Other Network Environments" which has been established in Working Party 1/15. It extracts the relevant parts of the fifth progress report presented at the September 1993 meeting of Study Group 15 and some results obtained at the October 1993 meeting of the group. Several items which need SG13's advice are also listed.

We are in charge of developing appropriate protocol stacks for the broadband audiovisual communication systems. Between the elementary audio, video, data and control bitstreams and the ATM layer specified by I.361, we need "network adaptation" consisting of multimedia multiplex and synchronization (H.22X) and AAL (I.363). Allocation of the functions between H.22X and AAL is one of the current study items. Our concern with AAL is as follows;

- Cell loss correction in AAL Type 1
- Video support AAL
- AAL for the delivery of MPEG-2 Transport Stream packets

2. Audiovisual communication system configuration

According to the practice of N-ISDN audiovisual standardization, ITU-T Recommendations as in Figure 1 are assumed. Dotted partitions between multimedia multiplex and AAL etc. are intended to represent the open nature of the current discussion.

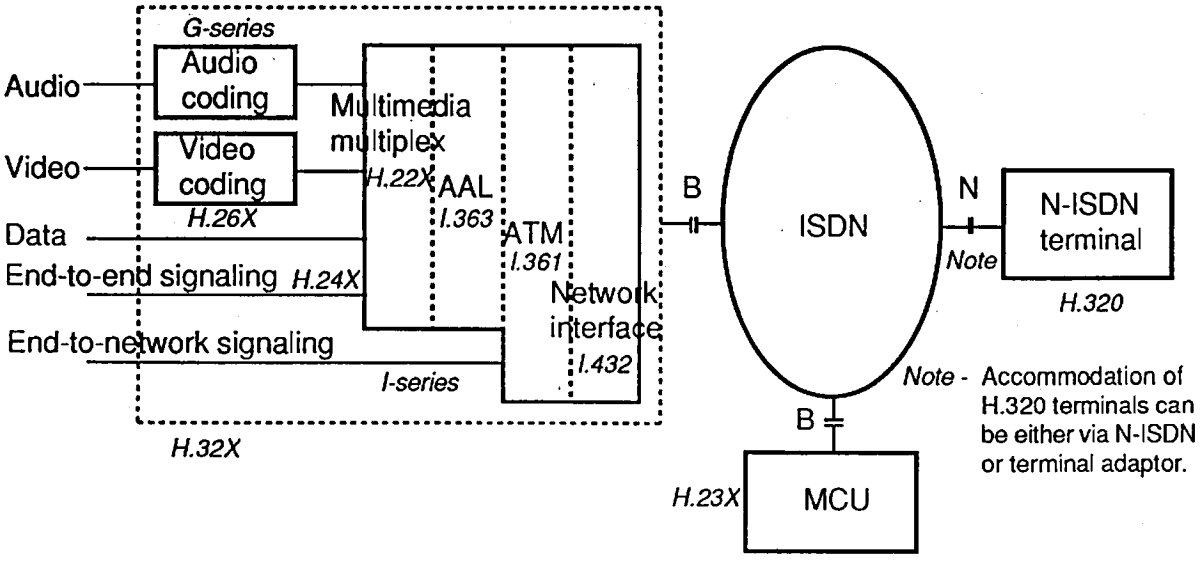


Figure 1 Audiovisual communication terminal and system configuration

The network adaptation consists of the "multimedia multiplex" and AAL as illustrated in Figure 2 (see AVC-606,619).

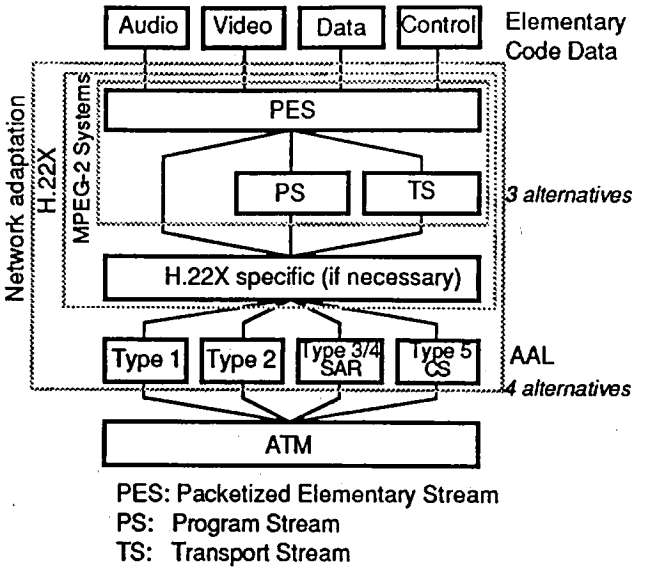


Figure 2 Protocol configuration in the audiovisual communication terminal

3. Cell loss correction in AAL Type 1

SG13's liaison response on support of H.320 terminals (which are cell loss critical) in B-ISDN indicated necessity of cell loss correction at bit rates not lower than 384 kbit/s and that requirements from CMTT (now ITU-T SG9) on high quality sound transmission indicate the same solution for cell loss. Another factor is that we may need some bit error correction mechanism as well in video signal transport through ATM networks.

An AAL Type 1 solution which uses Forward Error Correction and cell interleaving has been studied both in this group and SG13. Low delay characteristics have been sought for conversational applications. We agree to the SG13's cell loss correction method for delay sensitive signal transport in AAL Type 1; use of RS(94,88) with diagonal interleaving. We also agree on adoption of the polynomial $(x^8+x^7+x^2+x+1)$.

In addition to this open form of interleaving matrix, there has been provided a closed form solution of interleaving matrix. Its implication is that we can send user data in unit of 704 bytes which might be useful for VBR operation (see AVC-616).

4. Multimedia multiplex and video support AAL

In the system model of Figure 1, we are now going to have video coding standard H.262 while ATM layer specifications have already been fixed. To connect these two layers, we need network adaptation (multimedia multiplex and AAL) which should have the following functions;

- transfer of variable length data units. Interval between data units may be fixed or variable.
- multiplexing and synchronization of elementary streams
- capability to synchronize source and receiver clocks
- error detection and/or correction capability

In the H.32X terminal these functions are to be distributed between;

- H.22X - multimedia multiplexing and synchronization (possible common use of MPEG-2 Systems)
- I.363 - the ATM Adaptation Layer

taking into account the generic nature of AAL. As to the multimedia multiplex and synchronization, MPEG-2 "system coding" (projected International Standard ISO/IEC 13818-

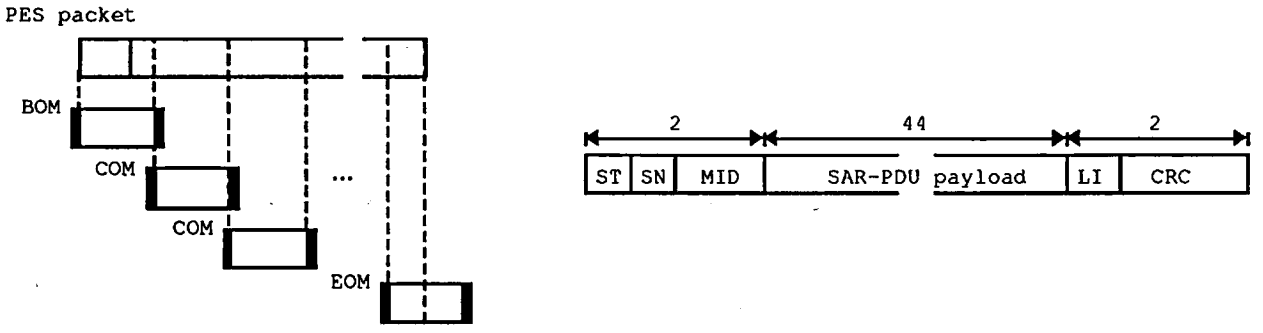
2) provides a packet and time-stamp based method. Each elementary bitstream is segmented into Packetized Elementary Stream (PES), and then respective packets are multiplexed. MPEG-2 Systems consist of the following syntax;

- "Program Stream" which is a multiplex of variable length PES packets and is similar to MPEG-1 Systems in functionality. This is designed for use in error free environments.
- "Transport Stream" which consists of 188 byte fixed length packets and has functionality of multiple program multiplexing (typically for broadcasting applications, each program having independent clock reference). This is designed for use in error prone environments.

In the interest of service integration on B-ISDN, it is desirable that multimedia multiplexing is also common among various applications. WP1/15 already expressed this view at its meeting in November 1992 and MPEG welcomed this policy.

It should be noted, however, that the above mentioned Transport Stream has close relevance to AAL/ATM specifications in functionality. We are now finding an appropriate combination of part of MPEG-2 Systems, H.22X, and audiovisual support AAL (AAL Type 2 in particular). The following is considered as alternatives;

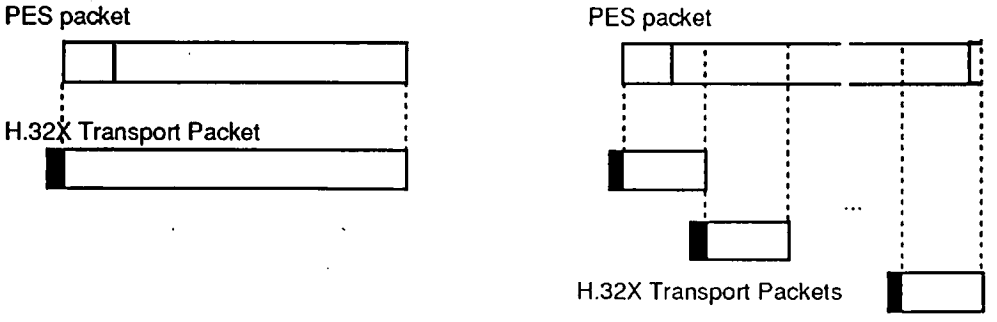
1) PES packet + modified AAL Type 3/4 SAR



a) PES and SAR relationship b) SAR-PDU structure

Figure 3 PES packet + modified AAL Type 3/4 SAR sublayer.

2) PES packet + modified Transport Stream packet (H.32X transport packet)+ AAL Type 5 CPCS/SAR



a) Error free b) Error prone

Figure 4 PES packet + modified Transport Stream packet + AAL type 5 CPCS/SAR

3) PES packet + AAL Type 5 CPCS/SAR

4) PES packet + AAL Type 1

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Evaluation of these and other solutions should be in terms of;

- delay,
- packing efficiency,
- error resilience,
- timing recovery,
- implementation, and
- functionalities (such as multimedia multiplexing, support of CBR/VBR, prioritization).

The choice of the method and parameter values largely depend on the network performance; bit error and cell loss characteristics, jitter performance (see AVC-609, 611, 613,619). One crucial question is whether correction of either bit error/cell loss is required. Another crucial question is to what extent the cell arrival delay varies.

This is the area where we can not make progress without advice of SG13.

5 Delivery of MPEG-2 Transport Stream packets

Given that it is required to deliver a Transport Stream across a number of systems, one part of which may be ATM/B-ISDN. An issue is what is the best way to adapt Transport Stream (TS) packets to the ATM/B-ISDN part of the link.

For the B-ISDN connection,

- some error detection/correction capability is required,
- it is believed that SAR/CS mechanisms common to other AALs should be used if possible.

Consideration is given to the use of AAL Type 1 and AAL new Type mechanisms (see AVC-617,618). The latter example is illustrated in Figure 5.

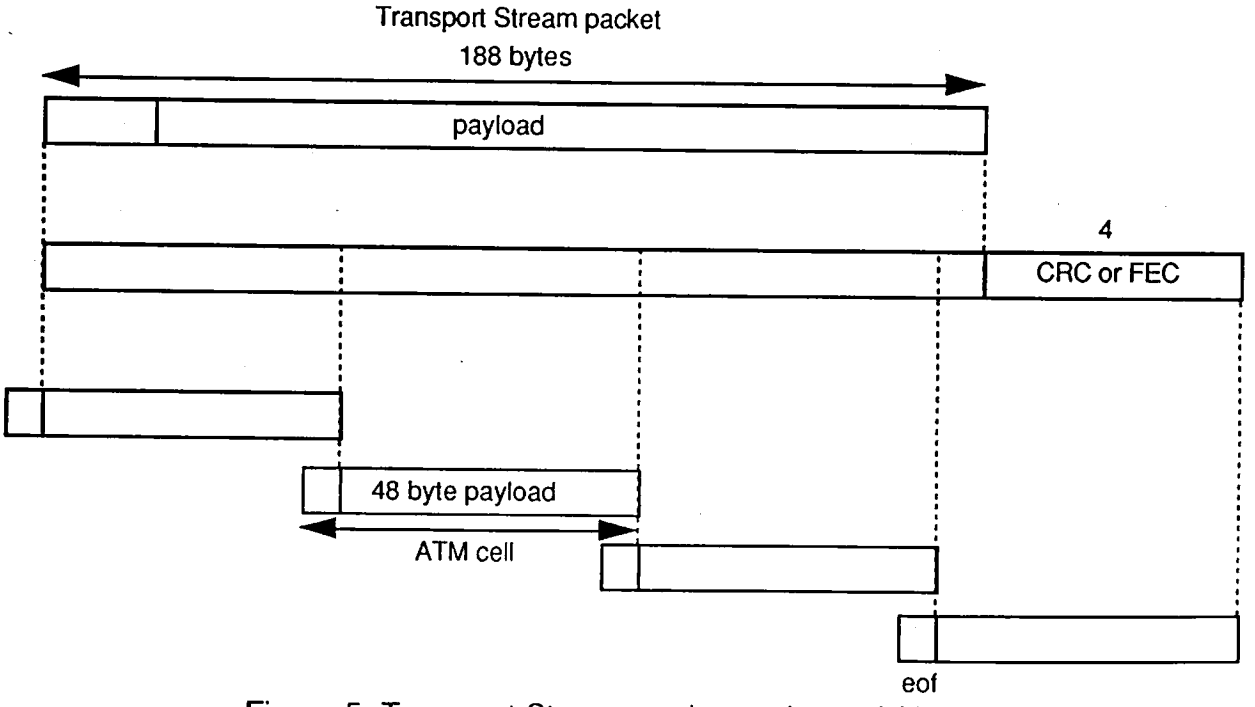

Figure 5 Transport Stream packet and new AAL.

One of the hot issues is whether the time stamp method of MPEG can cope with the ATM cell jitter.

It is suggested that jitter introduced to the Transport Stream by an ATM connection should be removed by an AAL on that connection. Figure 6 illustrates this. In Figure 6, on the ATM part of the connection it is proposed that the AAL remove ATM cell jitter, rather than allow the jitter to propagate to the MPEG receive terminal. This emphasizes the issue that an AAL for the transport packet should have methods to remove cell delay jitter.

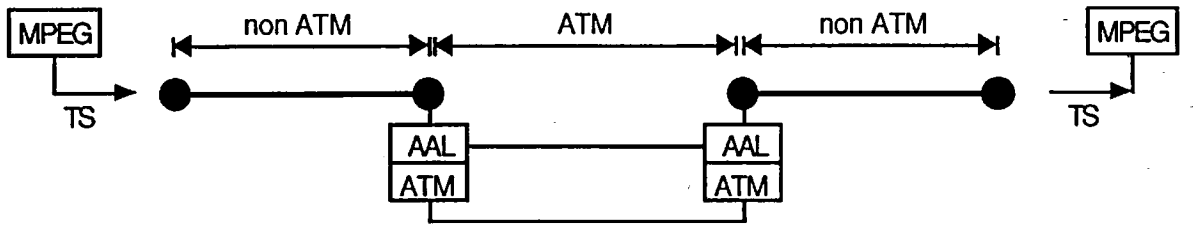

Figure 6 Example of Transport Stream on different networks.

6. Conclusion

The activities of the SG15 Experts Group for ATM Video coding have been reported with focus on the network adaptation which fills the gap between multimedia elementary streams and the ATM layer. The following is a list of items requiring SG13's advice for us to develop for audiovisual communication system standards ;

1) bit error characteristics
2) cell loss characteristics
3) cell delay jitter characteristics

In addition to those rather fundamental ones, we also need advice on the following items;

4) support of circuit emulation in the asynchronous network environments (we set the support of interworking with H.320 terminals are mandatory for H.32X terminals)
5) reaction to the closed form of interleaving matrix for cell loss correction
6) network restrictions on the VBR traffic

END