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SOURCE: ITU-T SG 9

TITLE: LIAISON STATEMENT TO ITU-T SG 13 (SWP 13/2/2, Question 6/13)

SUBJECT: About the ability of AAL type 1 for the transport of MPEG 2 signals

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A contribution about the ability of the AAL 1 to transport MPEG 2 CBR signals has been presented by France in the SG 9 meeting (Feb. 28th to March 4th, 1994). SG9 has expressed the opinion that the contribution is of high interest. No objection was raised as it appears that technical options of the contribution are in line with those of former TG CMTT/3. However, the paper has not been discussed in details, because it was the first meeting of SG 9 under its new status, and so no meeting of SWPs has been organized, particularly of SWP 1/9 to which Question 31/9 pertains. Besides, many technical experts were not participating to the meeting. On the other hand, SG 9 is aware that it is urgent to express an opinion about the transport of MPEG 2 signals in ATM due to the current activity on this topic in other standard bodies like the ATM Forum.

In conclusion, SG 9 is of the opinion that :

- the AAL 1 is adequate for the transport of MPEG 2 CBR signals
- further examination of the contribution in SWP 1/9 is urgently required to get a firm position about technical aspects given in the contribution. This will be done in a Rapporteur Group (Question 31/9) ~~in~~ within a short ~~delay~~ period of time. SG 9 will inform SG 13 about the result of its investigation.

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UIT - Secteur de la normalisation des télécommunications
ITU - Telecommunication Standardization Sector
UIT - Sector de Normalización de las Telecomunicaciones

Commission d'études / Study Group / Comisión de Estudio } 9

Contribution tardive / Delayed Contribution / Contribución tardía } **D.1 (SG 9)**

Geneva, 28 February- 4 March 1994

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Question: 31/9

SOURCE: FRANCE

TITLE: ABOUT THE ABILITY OF AAL 1 FOR THE TRANSPORT OF MPEG 2 SIGNALS

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1. Introduction

A growing interest is currently shown in the digital television community for the results from the ISO/ MPEG group. On the other hand, telecommunication operators have to provide means to transport digital television on emerging ATM-based B-ISDN.
As a result, it is deemed necessary to investigate the ability of existing AALs to transport MPEG 2 signals through ATM.
This contribution is also transmitted to ITU-T SG 13 where B-ISDN aspects are extensively examined.

2. MPEG 2 signals characteristics

It is assumed that MPEG 2 signals will have to be transported in B-ISDN under the form of MPEG transport stream (see Ref. 1). MPEG transport stream (TS) is organized in fixed-length packets sized to 188 octets. MPEG 2 standard is planned to be used by different types of services : interactive conversational applications (i.e. videoconference), retrieval applications involving audiovisual servers or distribution of television programmes to users. As a result, MPEG specifications are open to options so that they can apply to various services. Particularly, the output bit rate may be variable, i.e. the time interval between transport stream packets may be variable.
However, in the case of the distribution of television programmes, there could be no major advantage to transport variable bit rate (VBR) flows because the management of real-time VBR flows in ATM networks is not so straightforward.
Thus, at least in early ATM networks, the bit rate of MPEG-based distribution services may be constant, i.e. the time interval between packets may be constant.
This contribution focuses on the transport of MPEG transport stream with a constant bit rate in ATM networks.

3. Which AAL for MPEG 2 ?

For the transport of MPEG, several proposals have already been investigated. Most of them, if not all, are based either on the AAL 1 or on the AAL 5.
The AAL 1 has been defined for class A services, i.e. services with a constant bit rate and with real-time requirements. As MPEG 2 signals are assumed to be VBR signals in the general case, the AAL 1 has been seen as not very applicable to MPEG 2.
On the other hand, the scope of AAL 5 is high speed data transfer, therefore no real-time function is performed by this AAL.

As a result, depending whether stress is put on real-time aspects or on VBR aspects, the "best choice" would be the AAL 1 or the AAL 5 respectively. Nevertheless both AAL 1 and AAL 5 are scarcely applicable and only the definition of the AAL 2 (for services pertaining to class B) will solve the problem of real-time VBRs **at the AAL level.**

For the time being, ATM networks are close to installation and operators will take the opportunity to transport real-time broadband services including the distribution of television programmes. Urgent proposals are therefore needed to open these services. Because of the limited delay, they can only be based either on AAL 1 or on AAL 5.

When comparing pros and cons of AAL 1 vs. AAL 5, two major arguments must be taken into account :
1. The size of MPEG transport packets has been specified on the basis of a SAR-PDU payload of 47 octets corresponding to the AAL 1. A transport packet matches exactly four SAR-PDU payloads, and therefore it is easy to map MPEG transport packets in AAL 1 SAR-PDU payloads. Some attempts for the mapping of MPEG packets in the AAL 5 have been proposed, with major drawbacks (see Ref. 2).
2. Basically, the aim of the AAL is to enhance the quality of service provided by the ATM layer in order to fulfil service requirements, particularly real-time requirements. In the case of the distribution of television programmes, it is felt necessary to improve robustness to cell loss in the AAL. If not countered, cell loss events might lead to unacceptable artefacts for the users. Therefore the AAL for MPEG transport must provide cell loss correction capabilities. These are provided by the AAL 1 (in the CS for video transport). If using the AAL 5, a cell loss event would be detected only at the CS level, so the whole transport packet (i.e. 188 octets) would be damaged, which is not acceptable.

Moreover, in the case where MPEG transport stream is CBR, it is completely under the scope of the AAL 1 to carry it, and so the AAL 1 should be clearly proposed for this purpose.

4. Functions of the AAL 1 for MPEG 2 transport

As it is currently defined in the 1992 edition of Rec. I.363, the AAL 1 consists of four CS on top of one common SAR. Among these, one CS is dedicated to the transport of video signals. This CS should be used for the transport of MPEG 2 signals.

Functions of this CS are described in Rec. I.363 §. 2.5.1.2. For the transport of MPEG TS packets, some adaptations are suggested as follows :

- handling of AAL user information : the length of the AAL-SDU is proposed to be 188 octets in concordance to MPEG TS packet size.

- handling of cell delay variation (CDV) : it is essential to perform this function in order to get rid of CDV effects, thus avoiding updating of MPEG Program Clock Reference time-stamps.

- handling of lost and misinserted cells : detection of lost and misinserted cells events is performed by using a 3-bit SN enabling detection of up to 6 cell loss occurences and of 1 misinserted cell occurence. These detection capabilities are seen to be sufficient for MPEG transport.

- handling of timing relation : for end to end synchronization, two methods are proposed in the AAL 1 : the adaptive clock and the SRTS. The adaptive clock is a general end to end synchronization method in ATM, whereas the SRTS has been specified for the CS for circuit transport where stringent requirements of G.823 (concerning jitter and wander) have to be respected. In the CS for video, no method is recommended for the time being in Rec. I.363. However, it appears that it is not necessary in the case of the distribution of video programmes to respect wander specifications of G.823 in the receiving AAL, because clock requirements are less stringent. Additionally, the SRTS method relies on a common reference clock derived from the network clock, which increases the cost without any actual need in the case of video distribution. On the other hand, the adaptive clock method is seen to be sufficient in terms of performances. It is therefore proposed to use it in the case of the transport of MPEG signals.

- correction of bit errors and lost cells: in the CS for video transport, a method based on FEC is proposed optionally for unidirectional video transport. This method relies on a combination of RS codes and octet interleaving. Correction capabilities are up to 4 cell losses (consecutive or not) in a group of 128 cells, and up to 2 errored octets in a block of 128 octets. The counterpart is the processing delay (depending on the bit rate and corresponding to 248 cell durations) which reserves the usage of this method either to high bit rates or to unidirectional services where an additional delay has no effect. Such is the case of the transport of television programmes. One major feature of the method is that the beginning of the interleaving matrix corresponds to the beginning of a transport packet in any case (practically the interleaver contains exactly 31 transport packets). The method should therefore be used for the transport of MPEG 2 signals to upgrade the quality of service of the ATM layer.

5. Proposal

This contribution addresses the distribution of video programmes using MPEG 2 transport stream with a constant bit rate.
In order to transport this service in B-ISDNs the AAL 1 using the CS defined in Rec. I.363 (§. 2.5.1.2.) for the transport of video is suggested. Basically this CS includes functions to be performed, and some adaptations of these CS functions are proposed herein to fullfil the requirements of the transport of MPEG 2 TS packets.
In conclusion, it is suggested that ITU-T SG 9 examines CS functions for the transport of MPEG 2 TS, and informs ITU-T SG 13 of amendments to the CS description for the transport of video signals in Rec. I.363.

References :

1. ISO/IEC JTC1/SC 29 Coding of Audio, Picture, Multimedia and Hypermedia Information CD 13818.
2. Contribution to the ATM Forum Nr 94-0100, January 17-21, 1994 : "AAL, timing recovery and error detection/ correction for MPEG over ATM" by Sudhir S. Dixit from Nynex, USA.