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Telecommunication Standardization Sector
Study Group 15
Experts Group for ATM Video Coding
(Rapporteur's Group on Part of Q.2/15)

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SOURCE : Japan
TITLE : Bit error consideration on H.22X/AAL
PURPOSE : Discussion
Relevant sub-group: System

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1. Introduction

H.22X/AAL was discussed [1] [2] during Boston meeting to derive an appropriate AAL for audiovisual services (AAL type 2). Several H.22X/AAL alternatives were described in AVC-553R [3]. The discussion had been based on the assumption that bit error detection is necessary while correction is not necessary. QOS (bit error ratio and cell loss ratio) at ATM layer, however, is still ambiguous and may not be given at proper time. On the other hand, it was shown that bit error may cause unacceptable picture degradation in some cases [4].

In this document, we would like to discuss the necessity of detection/correction for bit error and cell loss.

2. Influence of bit error and cell loss on video bitstream

(1) Relation between bit error and cell loss

Bit errors in ATM header sometimes cause a cell loss. Its probability, however, is negligible as shown in Fig. 1 [5]. Since cell loss is mainly caused by buffer overflow in ATM switching node, it is controllable by the network provider. On the other hand, bit error ratio is hard to control.

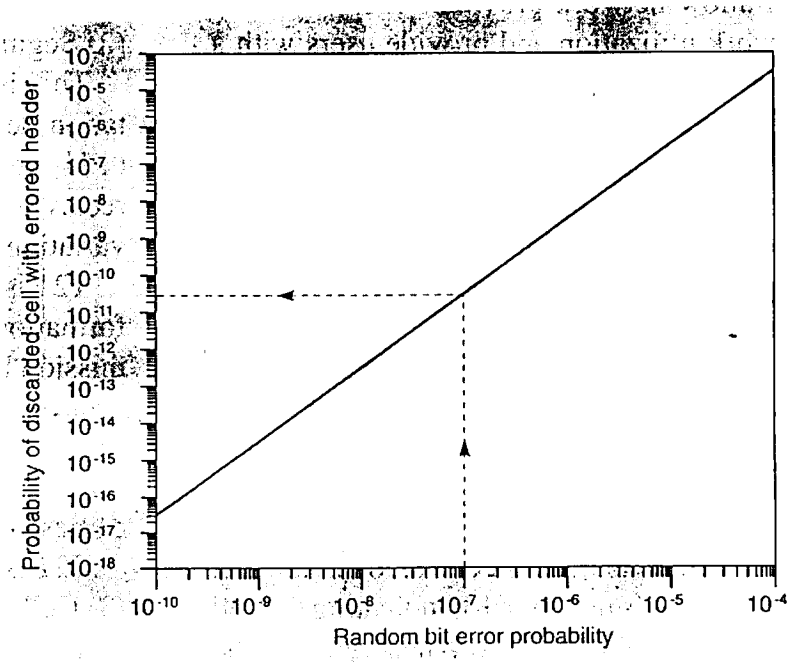


Fig. 1 Cell loss probability caused by random bit error

(2) Influence of bit error and cell loss on video

When a transmission error occurs and brings the coder into an abnormal state, video decoder usually stops decoding until next unique word (slice or picture start code). Therefore, bit error and cell loss have the same influence on video.

Sophisticated error resilience techniques in video can provide adequate (but not 'perfect') picture quality even if cell loss ratio is 10^{-3} [6]. On the other hand, it is indicated that bit error ratio 10^{-9} causes serious picture degradation 2~3 times per day without redundant data transmission [4].

The required QOS for H.22X/AAL layer depends on the required picture quality and error resilience in video.

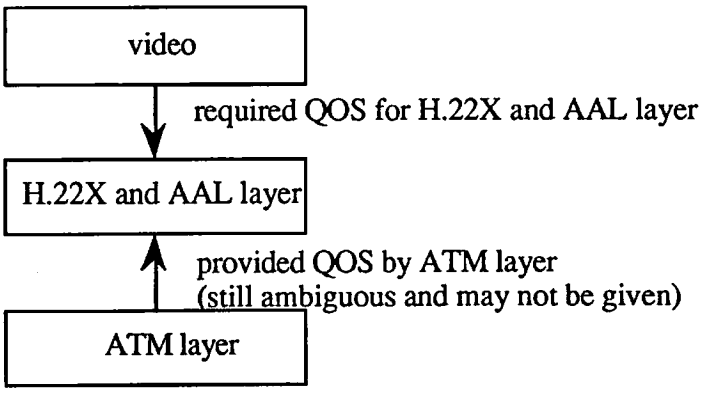
(3) Realistic bit error ratio and cell loss ratio in ATM layer

. One transmission error per one hour at 5Mbps corresponds to bit error ratio; 6×10^{-11} or cell loss ratio; 2×10^{-8}.

Bit error ratio and cell loss ratio are still ambiguous. General feeling is that cell loss ratio of 10^{-8} is realistic for high QOS. On the other hand, bit error ratio of 10^{-11} sometimes may not be realistic. Furthermore, bit error ratio is hard to control. It means that in some situations we should focus on bit error than cell loss.

3. Discussion points

H.22X/AAL should convert QOS provided by ATM layer to QOS required by video, audio and data.



Both required QOS for H.22X/AAL and provided QOS by ATM layer are ambiguous. The following three strategies can be considered for H.22X/AAL with respect to transmission error.

strategy 1; detect both bit error and cell loss

Already discussed [3].

strategy 2; correct bit error and detect cell loss

Not discussed yet.

strategy 3; correct both bit error and cell loss (FEC+cell interleaving)

Already discussed for constant bit rate (one option for AAL type 1)[7] and the restriction when applied to variable bitrate [8].

As mentioned in Section 2, strategy 2 is preferable to strategy 1 in some situations. It should be noted, however, that strategy 2 requires fixed length packet (or structure) such as MPEG2 Transport packet for convenience of FEC. The alternatives are as follows;

Several alternatives for standardization

H.22X/AAL	bit error	cell loss	case 1	case 2	case 3	case 4	case 5	case 6	case 7
Type 4 SAR or Type 5 [3]	detect	detect	○	○	○		○		
TS support AAL [9]	correct	detect	○	○		○		○	
Type 1 interleave [10]	correct	correct	○		○	○			○

○ defined by H.22X/AAL

Discussion point;
Should we define simple H.22X/AAL (Type 4 SAR or Type 5)? (case 1,2,3,5)
Should we define H.22X/AAL that has bit error correction functionality (TS support AAL)? (case 1,2,4,6)
Should we define powerful H.22X/AAL (Type 1 interleave)? (case 1,3,4,7)
Should we define one H.22X/AAL? (case 5,6,7)
Should we define several H.22X/AAL? (case 1,2,3,4)

4. Conclusion

H.22X/AAL was discussed during Boston meeting based on the assumption that bit error detection is necessary while correction is not necessary. In some cases, however, H.22X/AAL should have bit error correction function. We should consider again whether bit error correction and cell loss detection is necessary.

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[1] AVC-507 Aus. UVC H.32X terminal and MPEG-2 Systems
[2] AVC-524 Japan Relation between MPEG-2 transport mux and ATM/ALL and possible candidates for AAL
[3] AVC-553R Chairman REPORT OF THE TWELFTH MEETING IN BOSTON AND NEW YORK
[4] AVC-548 David Sarnoff Experiments on the effect of losses of picture-type or f-code in picture headers
[5] NTT Review, Vol.4, No.4 July 1992, pp.30-37
T. Yokoi et al. Performance Design Method for ATM Networks and Systems
[6] AVC-511 M. Biggar Report of Ad-hoc Group on ATM Cell Loss and Error Resilience
[7] AVC-557 SG13 LIAISON STATEMENTS TO SG15 EXPERTS GROUP FOR ATM VIDEO CODING
[8] AVC-522 Japan VBR coding and octet interleave
[9] AVC-568 Japan MPEG2 Transport packet transmission over ATM
[10] AVC-557 SG13 LIAISON STATEMENTS TO SG15 EXPERTS GROUP FOR ATM VIDEO CODING