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

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SOURCE : Japan
TITLE : Consideration on acceptable processing delay in the video codec
PURPOSE : Information

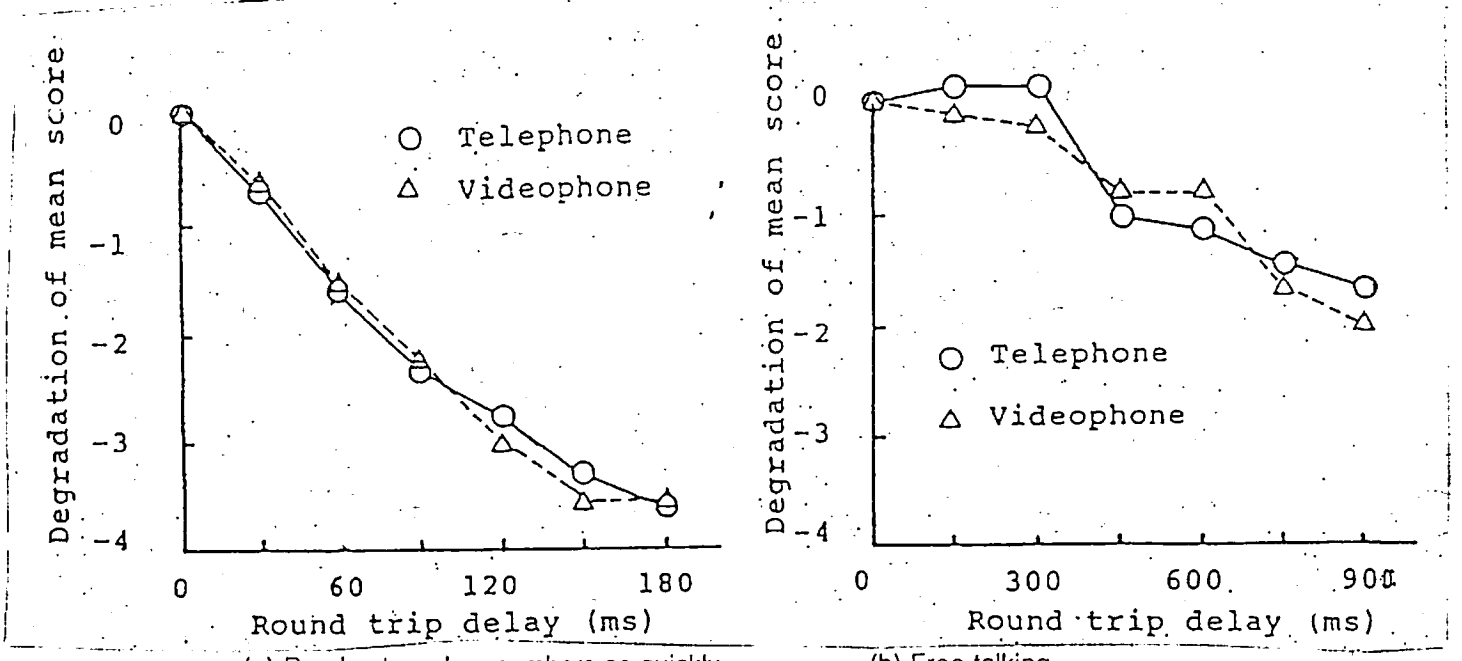
1. Introduction

We provisionally required that processing delay in H.26x should be smaller than about 150 msec[1]. However the reason for this requirement is not clear yet.

This contribution provides some information about what sources of delay should be taken into account in high quality audiovisual telecommunications and what range of value is really required for processing delay in the H.26x.

2. Acceptable one-way propagation time for videophone communication

The maximum value of acceptable one-way propagation time for audio is 400 msec[2]. On the other hand it is reported that the effect of delays on communication quality differs little between telephone (without video) and videophone (with video)[3][4] as shown in Fig.1. Therefore if we assume lip-sync., the maximum value of acceptable one-way propagation time for video is considered to be 400 msec.



(a) Read out random numbers as quickly as possible in turn

(b) Free talking

Fig.1 Effects of delay on communication quality for telephone and videophone (one way propagation time = round trip delay /2.0)

---------- Note ----------

CCITT Rec. G.114 : MEAN-ONE WAY PROPAGATION TIME

a) 0 to 150 ms, acceptable.

Note - Echo suppressors specified in Recommendation G. 161 of the Blue Book [11] may be used for delays not exceeding 50 msec (see Recommendation G. 131, § 2.2).

b) 150 to 400 ms, acceptable, provided that increasing care is exercised on connections when the mean one-way propagation time exceeds about 300 ms, and provided that echo control devices, such as echo suppressors and echo cancellers, designed for long-delay circuits are used;

3. Several sources of delay in audiovisual telecommunication

Fig. 2 shows several sources of delay in the ATM environment.

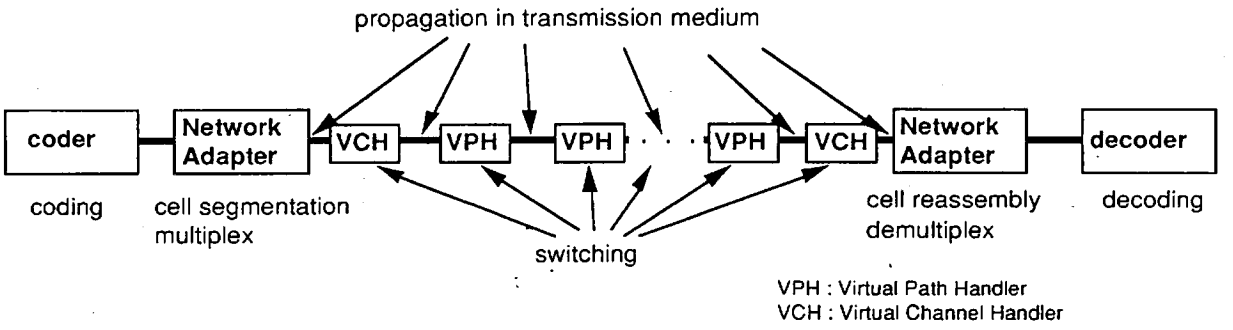


Fig.2 One-way propagation time in ATM environment

These delays can be classified into the following three parts;

a. Transmission delay unrelated to ATM : propagation time in transmission medium
b. Transmission delay related to ATM : cell segmentation/reassembly, multiplex/demultiplex, switching
c. Codec processing delay : coding/decoding

4. Acceptable processing delay in H.26x for several cases

From Section 2 and Section 3, the acceptable processing delay in H.26x ('c') is described as follows ;

$$'c' < 400-'a'-'b' \qquad (1)$$

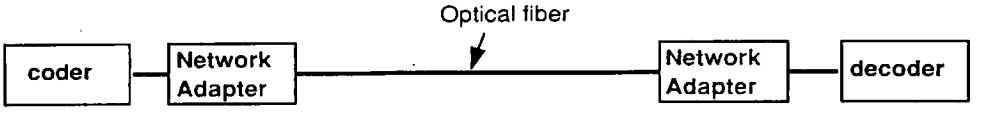
'a' varies according to the route of transmission channel but can be estimated as follows[2];

Table 1 Transmission medium and delay

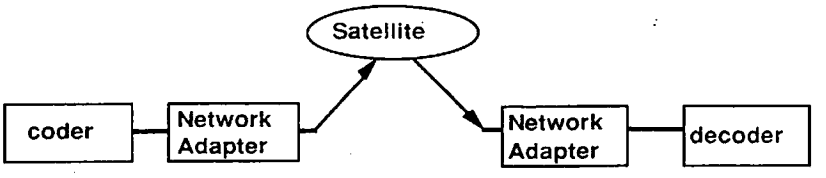
Transmission medium	Delay	Condition
Optical fiber system	15msec	3000km distance (5 μ sec/km)
Satellite system	260msec	36000km altitude

'b' is not clear now. It is assumed here that the maximum value of 'b' is 50 msec.

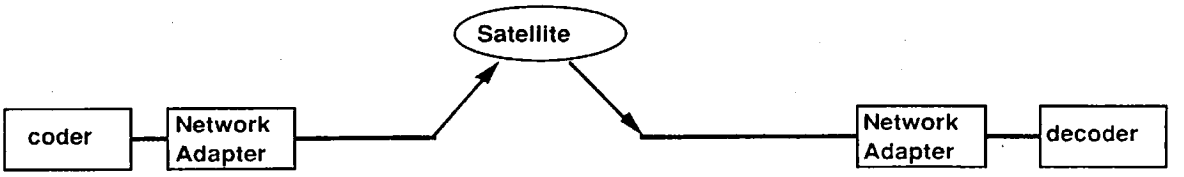
Table 2 shows acceptable processing delays for the following three cases (Fig.3);
case1 : optical fiber system transmission
case2 : satellite system transmission
case3 : satellite and optical fiber system transmission



Case 1 : optical fiber system transmission



Case 2 : satellite system transmission



Case 3 : satellite and optical fiber system transmission

Fig.3 Several cases for the transmission route

Table 2 Acceptable processing delay in H.26x

	case1 : optical fiber	case2 : satellite	case3 : satellite+optical fiber
a. Transmission delay unrelated to ATM	15	260	260+15
b. Transmission delay related to ATM	50	50	50
c. Acceptable codec processing delay	***335***	***90***	***75***

When a satellite system is used such as in case 2 or 3, the acceptable processing delay in H.26x is much smaller than 150msec.

5. Conclusion

The acceptable processing delay in H.26x, which is to be applied to high quality services, is discussed for several cases. When only optical fiber systems are used for transmission medium, the provisional value 150 msec is sufficient for conversational services. However, when the satellite system is used for transmission medium, a much smaller value is required.

Reference

(1) CCITT SG XV WP/1 experts group for ATM video coding ; "Report of the second meeting of the experts group for ATM video coding in Paris," AVC-65R § 5, May 1991
(2) CCITT Rec. G.114 : mean one-way propagation time
(3) CCITT SG XV COM XV-D.199, July 1990
(4)T. Kurita, S. Iai and N. Kitawaki ; " Effect on Different Delay Time Between Speech and Video Signal on Subjective Quality," Nat. Conv. IEICE (Autumn), B-535, 1990 (in Japanese).