SOURCE : Japan
TITLE : Video clock justification
PURPOSE : Discussion

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1. Introduction

Video clock justification is not provided in H.261, because in H.261 video frames are sometimes dropped owing to bit rate restriction. However, we assume that the situation may not be the same in H.26X. In this document, the necessity of video clock justification and the method to transmit the clock are discussed.

2. The necessity of video clock transmission

The target quality of H.26X is much higher than H.261. It should be considered that user may not be satisfied with skipping/freezing video frames in some applications where all the frames are required. Two techniques to synchronize video frames are as follows ;
- Transmit the video clock
- Use the frame synchronizer

The latter is adopted in television source transmission. However, the frame synchronizer seems to be expensive. On the other hand, if the former can be achieved as an option by easy mechanism, it should be beneficial to the user.
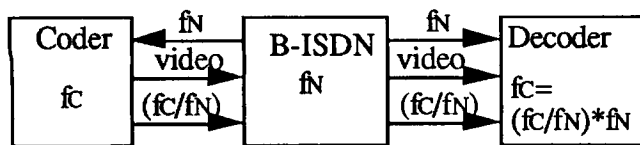
Note : It is for further study what kind of video clock is required ; video sampling frequency (13.5MHz) or video frame frequency (50/60Hz).
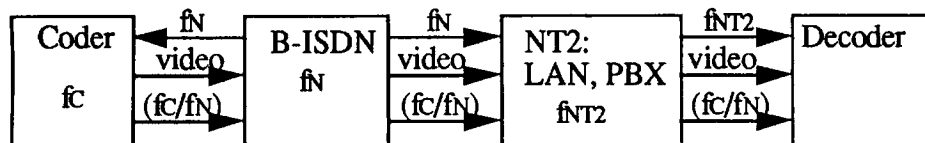
3. Video clock transmission methods

Tree types of video clock transmission can be considered.

(1) Use the network clock as a reference (Fig. 1)

If network clocks (f_N) for both sides are identical, f_N can be used as a reference clock. A coder counts the ratio of video clock (f_C) and f_N, and transmits the ratio (f_C/f_N) as a user information. A decoder can reproduce f_C from (f_C/f_N) and f_N. This method seems to be the simplest way to transmit the video clock. However, if NT2 (LAN or PBX etc.) is used and network clocks for both sides are different from each other, this method does not work.

1

```
┌────────┐  fN   ┌────────┐  fN   ┌──────────┐
│ Coder  │◄──────│ B-ISDN │──────►│ Decoder  │
│        │ video │        │ video │          │
│  fc    │──────►│  fN    │──────►│ fc=      │
│        │(fc/fN)│        │(fc/fN)│(fc/fN)*fN│
└────────┘       └────────┘       └──────────┘
```

(a) case 1: network clocks (fN) are equal

```
┌────────┐  fN   ┌────────┐  fN   ┌──────────┐ fNT2  ┌────────┐
│ Coder  │◄──────│ B-ISDN │──────►│ NT2:     │──────►│Decoder │
│        │ video │        │ video │ LAN, PBX │ video │        │
│  fc    │──────►│  fN    │──────►│          │──────►│        │
│        │(fc/fN)│        │(fc/fN)│  fNT2    │(fc/fN)│        │
└────────┘       └────────┘       └──────────┘       └────────┘
```
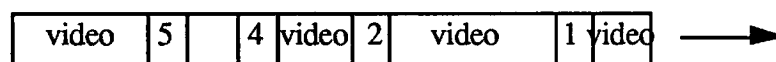
(b) case 2 : network clocks are different
(this method does not work)

Fig. 1 Use network clock as a reference clock

(2) Use the temporal reference (Fig. 2)

Temporal reference, which is used in H.261, send the video frame frequency (fc) itself. Therefore, a decoder can reproduce fc from temporal reference in theory. However, if number of bits per frame can be variable, the reproduction of video clock may be difficult because of the fluctuation of temporal reference arrival time.

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┌────────┐        ┌────────┐        ┌──────────┐
│ Coder  │ video  │ B-ISDN │ video  │ Decoder  │
│        │──────► │        │──────► │ fc :     │
│  fc    │with T.R│  fN    │with T.R│ from T.R.│
└────────┘        └────────┘        └──────────┘
```

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┌───────┬───┬─┬───┬─────┬─┬───────┬──┬────┐
│ video │ 5 │ │ 4 │video│ 2│ video │ 1│ideo│ ──────►
└───────┴───┴─┴───┴─────┴─┴───────┴──┴────┘
```
fluctuation of temporal reference

Fig. 2 Use the temporal reference

(3) Use the AAL function (Fig. 3)

For example, time stamp (see annex) can transmit the user clock. Though time stamp looks like temporal reference, the jitter is smaller than temporal reference. However, cell transmission rate is not so high, for example, 10Mbps CBR means 26.6kHz (=10M/(8bits*47Bytes)) cell rate. Furthermore it may have 1 cell jitter (1/26.6kHz). Therefore, the practical accuracy of reproduced clock by AAL function is for further study.
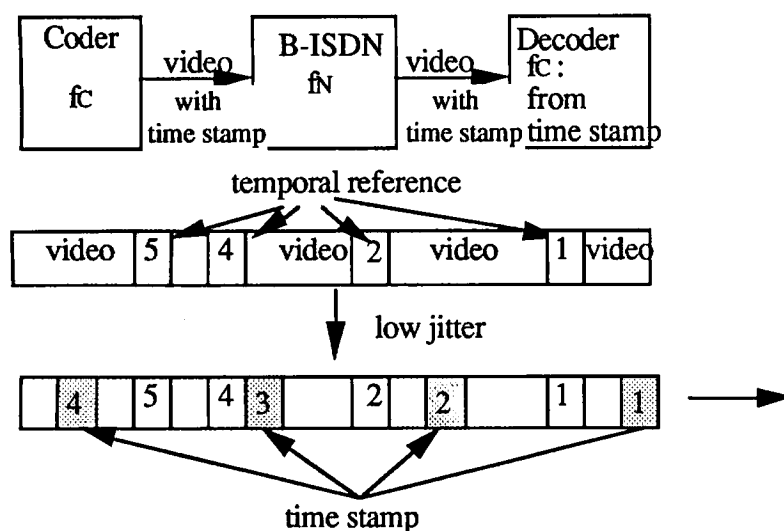
Fig. 3 Use the AAL function (ex. time stamp)

4. Conclusion

In some applications for H.26X, video clock justification may be required. The necessity of video clock transmission for video clock justification is discussed. Three methods to realize video clock transmissions are compared. We need further study about the method to realize video clock transmission.

It should be discussed and decided at early stage whether coder clock information be transmitted to the decoder, and whether this information be always utilized by the decoder.

Annex : SFET and time stamp

SFET and time stamp are now being studied in CCITT SGXVIII for the transmission of CBR user source rate. One bit for SN in AAL is used as a special bit.

(1) SFET

Special bit is set periodically. A receiver can recover clock by using easy mechanism, such as PLL (Phase Locked Loop). This method provides high transmission efficiency in CBR. However, if this method is applied to VBR, sometimes special empty cell is required to transmit the special bit periodically.

(2) Time stamp

When special bit is set, the following one (or two) byte is a time stamp, which is used to indicate some clock counter. The efficiency is lower than SFET because of time stamp, and the mechanism is more complicated than SFET. However, this method is also applicable to VBR without any change.