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TITLE : COMMENTS ON THE SUB-RATE CODEC STUDY

Making a proposal on a single worldwide standard for the sub-rate codec, which is defined as the codec with a bit rate lower than the primary digital rate, is one of the most important tasks for the Ad Hoc Specialists Group on Coding. This contribution lists some items which should be considered in establishing the sub-rate codec study plan and describes preliminary observations.

1. Target of the study

In the sub-rate codec study, selection of bit rate is an essential subject. The bit rate should be selected considering the following conditions.

- Network availability
  ISDN user-network interface defines B channel (64 kbit/s), H0 channel (384 kbit/s) and H1 channel (1536 and 1920 kbit/s) in Recommendation I.412.

- Technical possibility
  How far will the low bit rate coding technology have matured by the end of the new study period? Acceptable decoded picture quality for video conferencing services should be obtained with reasonable hardware complexity.

- Proliferation of the existing equipment
  It is desirable that standardization activities be commenced before equipment is put into the market place. Some codecs for 500-800 kbit/s have already been introduced.

Possible sub-rates might be classified into the following two categories for each of which the codec performance objective should be described.

- Category A : 384 x n kbit/s, full motion video
- Category B : 64 x m kbit/s, lower grade motion video

Both categories need to be studied in the Specialist Group. As for the Category B codec, however, it is not clear whether the codec is applied to video conferencing service or video telephone service.

For the present, priority should be given to the Category A codecs to establish a recommendation during the 1985-1988 study period. This means that the Ad Hoc Specialists Group should make a proposal by 1987.

It is desirable that the study of the Category B codecs be started following the Category A codec study during the 1985-1988 study period after their application is more clearly defined.

2. Basic parameters

2.1 Bit rate

It is proposed that the basic bit rate for the Category A sub-rate codec should be n = 1, i.e. 384 kbit/s. The coding algorithm for the rate of n = 2 (768 kbit/s) should not be studied independently but be extended from that of n = 1.

2.2 Video interface

In addition to the analog video interface and color processing, the digital video interface (e.g. PCM-TDM format) should be defined for such possible cascade connections with higher bit rate codecs as suggested in the HRC (see H.110).

2.3 Pels to be coded

The number of pels to be coded and transmitted should be determined considering the performance objective. In order to absorb the difference in television standards between 525/60 and 625/50 regions, identical or easily convertible parameters should be employed.

2.4 Allocation of television standards conversion

In order that the same codec can be used for both national (intra-regional) and international (inter-regional) connections as in Fig. 1, a television standards conversion facility is necessary somewhere in the coders or decoders. The burden to include this facility should be equally shared between 525/60 and 625/50 regions.

One possibility will be to allocate it to the decoders on an optional basis. The simplest but most expensive way is to prepare two decoders as shown in Fig. 2(a). A more sophisticated way is to use some part of decoder in common as shown in Fig. 2(b).

3. Coding algorithm

The most efficient coding algorithm to give best picture quality should be determined based on the evaluation method described below. Discussion should be carried out on the following functional blocks.

- Pre-processing / post-processing
  Since subsampling and/or field repetition seem certain for 384 kbit/s coding, pre- and post-processing filters play an important role.

- Video source coding / decoding
  Video compression. Predictive coding, transform coding, a mixture of them or other techniques should be investigated.

- Entropy coding / decoding
  Data compression. Statistical properties of the video source coder output should be fully utilized.

- Transmission coding / decoding
  Necessary error correcting requirements should be examined for the 384 kbit/s rate referred to the network characteristics.

Comparison of coding algorithms need be carried out both objectively and subjectively. For this purpose, it is important to use the same set of original pictures. Analog and/or digital picture databases should be established and supplied on recorded tapes.

Objective performance can be measured in coding efficiency, e.g. in bits per pel and signal to noise ratio, while subjective performance evaluation, possibly in contest form, necessitates reproduced pictures. One or more of the following methods can be applied.

- Computer simulated scenes of 1 or 2 seconds
- Computer simulated scenes of 20 seconds or more
- Recorded output of codec hardware
- Real time output of codec hardware

4. Frame structure

According to the definition of the service, which will be given by the Working Party, the following channels should be allocated in the frame structure.

- Codec-to codec information channel for frame alignment signal, control signal to distinguish between intra- and inter-regional connections and others

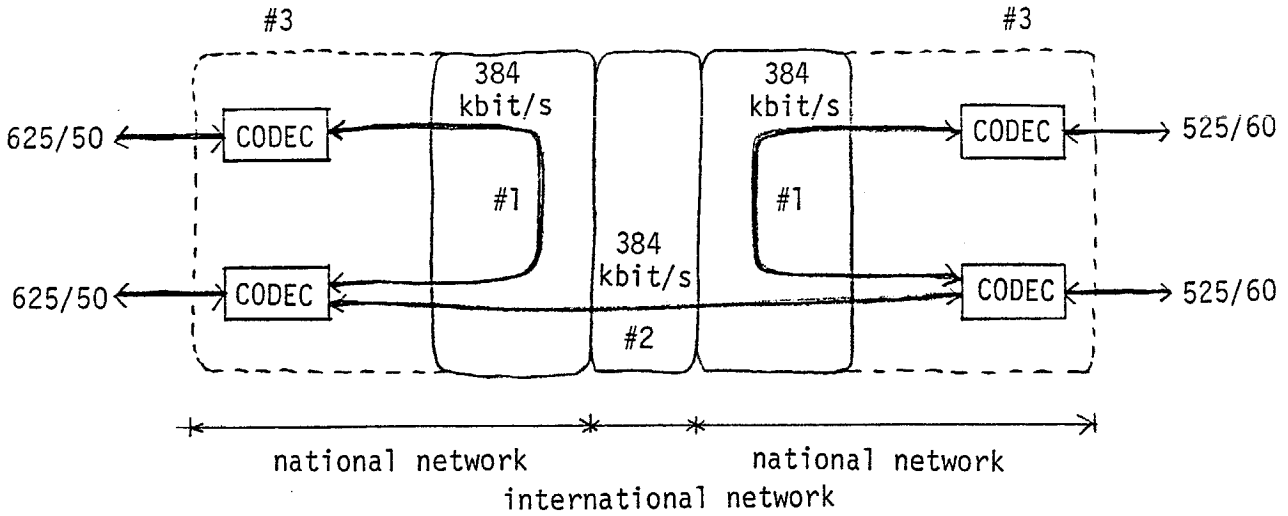
- Audio channel

- Optional auxiliary data channel

- Video channel

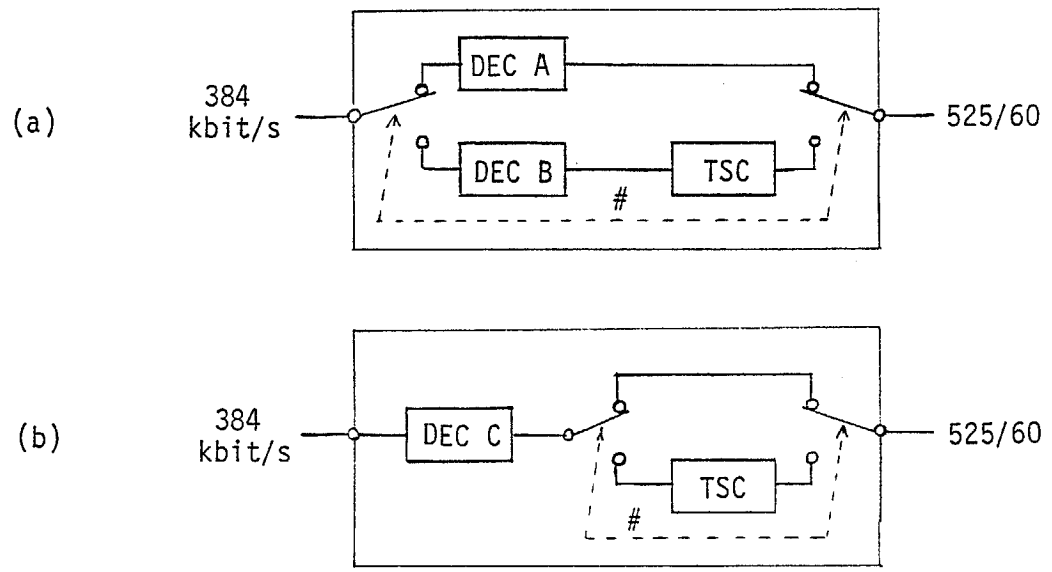
Since the bit rate for the video signal becomes almost 1/5 of 1536 kbit/s, bit rates for signals other than video should be kept as low as possible.

An examination should also be conducted into whether such format restrictions by some networks as are considered in the primary rate codecs are applied to the sub-rate codecs.



#1 : intra-regional connection #2 : inter-regional connection
#3 : Codecs are installed inside or outside the network.

Figure 1 Typical intra- and inter-regional connections



DEC A : Decoder for 525/60
DEC B : Decoder for 625/50
DEC C : Decoder commonly applied for 525/60 and 625/50
TSC : Television standard conversion

switched according to the codec-to-codec signal
up : intra-regional connection
down : inter-regional connection

Note : This example illustrates decoders in the 525/60 region.

Figure 2 Allocation of television standards conversion facility in decoders