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Specialists Group on Coding for Visual Telephony

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Title: Frame Structure and User-to-Network Interface for m x 384 kbit/s-Videoconferencing Codecs, m = 1, 2, ..., 5.

Introduction

A proposal for a frame structure and a user-to-network interface for videoconferencing signals with m x 384 kbit/s is presented. We assume, that the signal for all m = 1, 2, ..., 5 is transmitted within a 2048 kbit/s-frame. The following requirements have to be met:

A) The multiplex structure should be suitable for use on

- digital links
- digital connections (synchronous operation with digital switches and/or multipoint conferencing units)

which interconnect codecs for videoconferencing or visual telephony on a permanent-, reserved- or demand service basis.

B) An indication bit for switching of the timing mode is required. The reason is as follows:
In the pre-ISDN phase, the codec will not always operate in a synchronous environment. E.g. if transmission via leased circuits is considered, the input and output line signal of the codec are not synchronized. On the other hand, in a multipoint connection or in a synchronous network, the transmitter clock has to be synchronous with the receiver clock at the same end. For automatic switching between these two timing modes, forced by the network or the MCU, an indication signal has to be defined.

Proposal

Videoconferencing and visual telephony are new services which require greater bit rates than telephony. In the studies within CCITT on the ISDN and on international interworking, Ho = 384 kbit/s is emerging as an important channel capacity for ISDN services.

This proposal covers frame structures for videoconferencing and visual telephony signals with m x Ho (m = 1, 2, ..., 5) at the primary rate user-network interface in close connection to CCITT-Rec. I.431, G.703, G.704, G.735 and G.737.

1 General Characteristic

The multiplex structure described in this proposal is suitable for use on digital links and connections which interconnect video codecs for videoconferencing or visual telephony at the primary rate user-network interface. The connection may either be at the ISDN reference points T or S or in the pre-ISDN phase direct or via higher-order digital multiplex equipment compatible with multiplex equipment defined in Recommendation G.735.

The main features of the multiplex structure are that it provides:

- one 64 kbit/s channel for frame alignment, CRC-check, alarm signals, maintenance information and other signals as required;
- the possiblity to indicate whether the frame is synchronized with the network timing or not;
- the possibility of subscriber-to-network signalling (D-channel with 64 kbit/s);
- one Ho-channel which is subdivided into one 64 kbit/s channel reserved for the transmission of the sound and a service channel(as defined in Doc. No. 58) and the remaining capacity (320 kbit/s) which is used for the encoded video signal and data;
- up to 4 additional Ho channels for other videoconferencing signals.

2. Interface at 2048 kbit/s

2.1 Electrical characteristics

This interface should conform to Recommendation G.703, which recommends the basic electrical characteristics.

2.2 Frame structure

2.2.1 Number of bits per time slot.

Eight, numbered from 1 to 8.

2.2.2 Number of time slots per frame

Thirty-two, numbered from 0 to 31. The number of bits per frame is 256, and the frame repetition rate is 8,000 frames/s.

2.2.3 Assignment of bits in time slot 0

Bit No. 1 is assigned to a CRC 4 procedure in accordance with Rec. G.704, section 2.3.3.
In every other frame, the frame alignment signal occupies bits 2 to 8 (see Table 1).

The frame alignment signal is: 0011011.

In order to avoid simulation of the frame alignment signal by bits 2 to 8 of channel time slot 0 in frames not containing the frame alignment signal, bit 2 in those channel time slots is fixed at 1.

Table 1

Allocation of bit numbers 1 to 8 of the frame

Alternate frames \ Bit Number	1	2	3	4	5	6	7	8
Frame containing the frame alignment signal	S_i (Note 1)	0	0	1	1	0	1	1
Frame not containing the frame alignment signal	S_i (Note 1)	1 (Note 2)	A (Note 4)	S_n	S_n	S_n	S_n	S_n (Note 3)

Note 1 - The S_i-bit is used for the CRC4 procedure described in §2.3.3 of Recommendation G.704. In addition to that the bits S_i* have to be set to binary zero if there is hierarchical timing at the network side. The bits S_i* in the transmitted frames must be set to binary one at the codec side if the timing signal is derived from an internal source.

Note 2 - This bit is fixed at 1 to assist in avoiding simulations of the frame alignment signal (see § 5.2.3 of Rec. G.704).

Note 3 - The use of these bits will be definded at a later stage.

Note 4 - The A-bit is used for maintenance purposes.

2.2.4 Time slot assignment

2.2.4.1 Frame alignment signal

Time slot 0 is assigned to frame alignment in accordance with § 2.2.3.

2.2.4.2 D-channel

Time slot 16 is assigned to the D-channel. The assignment of time slot 16 in the pre-ISDN phase to an user-to-user signalling is for further study.

2.2.4.3 Ho-channel

Time slots 1 to 15 and 17 to 31 are assigned to the Ho-channels as given in Table 2. This assignment is based on Annex A to Recommendation G.735 (synchronous insertion).

Table 2
Time slot assignment for Ho-channels

H0 channel	a	b	c	d	e
Time slots used	1-2-3 17-18-19	4-5-6 20-21-22	7-8-9 23-24-25	10-11-12 26-27-28	13-14-15 29-30-31

For each videoconferencing signal transmitted in an Ho channel of Tab. 2, the first time slot of the Ho channel is allocated to the audio/service channel and the fourth time slot may dynamically be allocated to a data channel. For videoconferencing signals occupying $m \geqslant 2$ Ho channels, a group of m adjacent Ho-channels in Tab. 2 is used. In this case only the leftmost channel of the group can carry an audio/service-signal and a data signal.

2.3 Timing considerations

The nominal bit rate is 2048 kbit/s. The tolerance on this rate is ± 50 parts per million (ppm).
It should be possible to derive the transmitting timing signal of a codec multiplex equipment from an internal source or from the incoming digital signal depending on the binary value of the incoming S_i* bit (see Table 1b/G.704) of the CRC multiframe.

2.3.1 Hierarchical timing

In the case the S_i*-bits in the received frame are set to binary zero the hierarchical synchronization method can be used. The codec derives its timing from the network clock and synchronizes its timing (bit, octet, framing) from the signal received from the network and synchronizes accordingly its transmitted signal.

2.3.2 Asynchronous timing

In the case the S_i*-bits in the received frame are set to binary one asynchronous timing should be used. This means that the received timing information must not be looped to the transmitting side. In this case the transmitting clock of 2048 kHz has to be derived from an independent source. The tolerance on this rate is ± 50 parts per million (ppm). The binary value of the S_i*-bits should be set to one in the transmitted frame.

2.4 Interface procedures

2.4.1 Codes for idle channels and idle slots
As defined in Rec. I.431.

2.4.2 Interframe (Layer 2, Timefill)

As defined in Rec. I.431.

2.4.3 Maintenance

For further study.

2.4.4 Frame alignment procedures

As defined in Rec. I.431.

2.4.5 CRC-frame synchronisation

As defined in CCITT Draft Rep. 18R9, Annex 3, Question 23/XVIII.

3. Codec to codec information

For further study.

4. Mechanical

4.1 Connector

For further study.

Discussion

A) Frame structure and interfaces

For multiplexing of Ho-channels within a primary rate multiplex, examples of time slot allocations are given in CCITT Rec. G.735, G.737 and I.431. The applicability of these recommendations to videoconferencing codecs was considered. The allocation scheme proposed is taken from Annex A to Rec. G.735, where synchronous insertion is applied.
For frame alignment the basic frame structure given in Rec. G.704 should be employed including the cyclic redundancy check procedure, for it is considered to transmit data signals in addition to encoded video signals. The electrical characteristics of the interface should comply with Rec. G.703.

B) Indication of timing mode

Bit 8 in time slot 0 of each other frame - as proposed in CCITT Rec. H.130 - should not be used for that purpose because this bit is for national use only. Bits 5 to 8 in odd frames are in discussion to be used for maintenance purposes in an ISDN.

It is therefore proposed to use bit 1 of time slot 0 (bit Si) or Si* in the case of CRC multiframe structure which is reserved for international use up to now. This bit should either be set to binary zero at a network node (or MCU) or be set to binary one, if a free running clock is applied in the codec.

However, a general specification is within the responsibility of CCITT SG XVIII and should be brought in attention to that group. This is an urgent matter.

Beyond the use for videoconferencing signals, the indication whether the timing of a 2048 kbit/s-frame is synchronized with the network clock or is independent of it, could be of general importance also for other applications in digital networks.

For videoconferencing, this indication bit could also be transmitted in the service channel defined in Doc. No. 58, if no agreement in CCITT SG XVIII can be reached. But preference is given to the proposal above.

A frame structure to be specified for 1544 kbit/s has to provide a transparent channel between 1544 kbit/s- and 2048 kbit/s-countries for transmission of this indication signal.