CCITT SG XV
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Title :

PROPOSAL FOR A FRAME STRUCTURE FOR TELECONFERENCING

1 - INTRODUCTION

A number of Study Groups from CCITT are trying to define a protocol for Teleconference. A lot of experience has been gained from the first generation of the Videoconference Service (Recommendation H 130). For a second generation, it is necessary to identify the requirements for a frame structure by analysing the different needs concerning channel retrieval, dynamic allocation, user-to-user signalling, etc...

2 - REQUIREMENTS

The 384 kbit/s channel, inserted or not in a PCM frame structure (like G 732 or G 733) is an entity of six time slots of 64 kbit/s each, ie 6 bytes are available at a frame rate of 8000 Hz. Those six time slots are used to carry :

- A permanent audio channel, for which it will be assumed that the used algorithm is being defined by SGXVIII's Rapporteur Group on Wideband Speech Coding. The characteristics of this algorithm are a wider bandwith than telephone and a variable bitrate (64, 56, 48 kbit/s) which may allow the dynamic insertion of a low bit rate data channel.

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- A permanent video channel, the used algorithm of which is being defined by SGXV's Specialist Group on Videoconference Coding. Here also, the bitrate is variable and allows the dynamic insertion of a data channel of 64 kbit/s or even more.

- One or several data channels allocated on request, only when needed.

The combination and the management of those different streams makes necessary the use of a frame structure to be superimposed to the 384 kbit/s channel. The main functions of this frame structure are described in the following.

2.1. Retrieval of the information flows

Whether the 384 kbit/s channel is within or not a primary rate channel, it will be available as an envelope of 6 Time Slots. It is probable that no indication will be given on the respective place of sound, video and data in the six time slots. The first function of the frame structure and of the frame alignment procedure would be able to number the time slots, 1-6 for example, so the different sub-channels can easily be demultiplexed. For that purpose, a Frame Alignment Signal (FAS) must be inserted, synchronously with the byte clock.

2.2. Dynamic allocation of data

For reasons of efficiency, chiefly at those low bitrates, it would be better that the bitrate devoted to data is returned to audio or video when not used. For that purpose, a dynamic allocation scheme is necessary. A Bitrate Allocation Signal (BAS) must be inserted synchronously with the byte clock. Two kinds of allocations should be necessary : one for 64 kbit/s or n x 64 kbit/s data channels to the expense of the video, one for 8 kbit/s or n x 8 kbit/s data channels to the expense of the audio.

2.3. Codec-to-codec signalling

Putting apart bitrate signalling, already considered above, it may be necessary to transmit side information, necessary for a proper and synchronous working of codecs. For the audio codec, from the draft recommendation G 72x on Wideband Speech Coding, it can be seen that no side information is necessary, outside the audio channel. For the video, some side information may be already identified and some is still to be studied. Anyway, most of this information may be transmitted in-band, synchronously with the video rate, at field rate, or block rate or line rate.

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2.4. User-to-user messages

For the management of the Videoconference service, for the management of a multipoint session, for the exchange of written messages, it is necessary to have a low-bit rate message channel (no more than 4 kbit/s), suited with an error recovery protocol. It is not necessary to have any kind of synchronism with the PCM frame structure nor with the video frame structure.

2.5. End-to-end Alarm and Control

For a better monitoring of the service, it may be necessary to signal degradations or breaks. This may be used for telesurveillance of terminals or to identify which part of the terminal has broken.

2.6. End-to-end binary information

It may be necessary to convey side information not relevant to the above paragraphs and to foresee some place for it.

3 - BASIC PRINCIPLES OF THE PROPOSAL

From the considerations above, some principles may be drawn up for the elaboration of a frame structure.

- The codec-to-codec signalling for respectively audio, video, data should be carried synchronously together with the information itself, ie respectively within the audio, video and data.

- Most of the items to be signalled need some kind of synchronism to the byte clock, ie to the PCM frame structure.

- As compatibility with audioconference is required, all the inband signalling common to audio- and video-conference must be in the audio time slot.

Proposal : **It is proposed to use 8 kbit/s out of the audio time slot to convey all the end-to-end information and signalling and to superimpose a frame structure to the 384 kbit/s signal.**

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This proposal has a number of advantages :

The reduction in audio quality is minimum. The compatibility with audioconference is maintained. It is no more necessary to cut off the video bitrate to carry any kind of signalling, synchronous with the PCM frame, which would take 32 or 64 kbit/s.

4 - DETAILS OF THE PROPOSAL

The 384 kbit/s channel is strutured in frames of 480 bytes at 100 Hz frame rate. Consequently, the audio time slot is strutured in frames of 80 bytes each. This number of 80 has been chosen to maintain compatibility with CCITT Recommendation I461-X30 "Support of X21 and X21 bis based DTEs by an ISDN" which specifies the insertion of low bitrate data channels in 8 kbit/s or n x 8 kbit/s slots of a 64 kbit/s channel.

The LSB of the audio time slot is proposed as an 8 kbit/s channel to convey the Service Channel. 80 bits are available for each frame, numbered 1-80. They are divided in four parts:

Part A carries the Frame Alignement Signal (FAS). An example of a good frame alignment procedure is the one used in CCITT Recommendation G704. "Functional Characteristics of interfaces associated with network nodes". The purpose is to use an efficient method and to take profit of the existence of dedicated integrated circuits.

Table 1 (similar to 1a/G704) gives to allocation of bits 1-8 of each frame.

This FAS structures the signal into even and odd frames.

A multiframe of 16 frames may be superimposed as described in Table 2 (similar to 1b/G704).

The alignment procedure, the loss criterion and the recovery criterion are to be defined.

Part B carries the Bitrate Allocation Signal (BAS) An example might be the provision of 8 bits on even frames and 8 bits on odd frames. This is used to signal configurations in the sharing of the available bitrate between audio and low bitrate data in the audio time slots, but also between video and 64 kbit/s data in the video time slots. Each change of configuration is validated every two frames : it is effective for the two frames following the two where it was signalled.
The exact meaning of BAS and its protection against transmission errors is to be defined.

Part C carries end-to-end non-message signalling (to be defined)

Part D carries end-to-end message signalling (for example 4 kbit/s compatible with H130) (to be defined).

The other bits of the audio time slot may be used dynamically to carry either sound (at 56, 48 and even maybe 40 or 32 kbit/s) or data at bitrates as defined in I461-X30. The configuration is described in real time by using the BAS.

The other time slots may be used dynamically to carry either video (at 256 or 320 kbit/s) or data at 64 kbit/s. Other configurations are possible (eg. no moving video and still pictures at 320 kbit/s). The configuration is described in real time by using the BAS.

5 - CONCLUSION

A basic frame structure for audioconference and second generation videoconference has been defined which makes the best use of the characteristics and properties of the compression algorithms for audio and video, the transmission frame structure and the existing CCITT recommendations. 8000 bit/s only are used to carry any side information necessary for a proper teleconference service. Dynamic allocation makes the best use of the available bitrate. Future is preserved by the flexibility of the proposal and the numerous free place still available.

TABLE 1a/G.704

Allocation of bits 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 3	S_n	S_n	S_n	S_n	S_n

Note 1 - S_i - Bits reserved for international use. One specific use is described in section 2.3.3. Other possible use may be defined at a later stage. If no use is realized, these bits should be fixed at 1 on digital paths crossing an international border. However, they may be used nationally if the digital path does not cross a border.

Note 2 - This bit is fixed at 1 to assist in avoiding simulations of the frame alignment signal.

Note 3 - A - Remote alarm indication. In undisturbed operation, 0; in an alarm condition, 1.

Note 4 - S_n - Spare bits reserved for national use. The bits allocated for national use may not be used internationally. On a digital path crossing an international border or when not being used, they should be fixed at 1.

TABLE 1b/G.704

CRC Multiframe structure

	Sub-multiframe (SMF)	Frame Number	Bits 1 to 8 of the frame							
			1	2	3	4	5	6	7	8
Multiframe	I	0	C_1	0	0	1	1	0	1	1
		1	0	1	A	S_n	S_n	S_n	S_n	S_n
		2	C_2	0	0	1	1	0	1	1
		3	0	1	A	S_n	S_n	S_n	S_n	S_n
		4	C_3	0	0	1	1	0	1	1
		5	1	1	A	S_n	S_n	S_n	S_n	S_n
		6	C_4	0	0	1	1	0	1	1
		7	0	1	A	S_n	S_n	S_n	S_n	S_n
	II	8	C_1	0	0	1	1	0	1	1
		9	1	1	A	S_n	S_n	S_n	S_n	S_n
		10	C_2	0	0	1	1	0	1	1
		11	1	1	A	S_n	S_n	S_n	S_n	S_n
		12	C_3	0	0	1	1	0	1	1
		13	S_i	1	A	S_n	S_n	S_n	S_n	S_n
		14	C_4	0	0	1	1	0	1	1
		15	S_i	1	A	S_n	S_n	S_n	S_n	S_n

Key :

S_i - Spare bits (see § 2.3.3d).

S_n - Spare bits reserved for national use (see § 2.3.4).

C_1 C_2 C_3 C_4 - Cyclic Redundancy Check (CRC) bits (see §§ 2.3.3d and 2.3.3e).

A - Remote alarm indication (see § 2.3.4).