CCITT SGXV
Working Party XV/1
Specialists Group on Coding for Visual Telephony

Doc. # 495
March 7, 1989

SOURCE: AT&T, Bellcore, CLI, DIS, VTC, PictureTel

TITLE: Intercommunication among Audio/Visual terminals for flexible hardware trial

1. Introduction

The purpose of this document is to provide a detailed description of intercommunication procedure and the frame structure between audiovisual terminals capable of operating in a single or multiples of 64 Kbps channels. These specifications follow closely the existing CCITT Draft Rec. H.221 and Draft Rec. AV.242. They are, however, subject to further changes and modifications according to the progress made through study results in WP XV/1.

2. Framing Structure

The transmission format is arranged in 80-octet frames to Draft Rec. H.221. A multiframe refers to a group of sixteen frames, and each multiframe is divided into 8 two-frames submultiframes. The least significant bit of each octet conveys a service channel at 8 Kbps. The first eight bits of the service channel in each frame carry the frame alignment signal (FAS). The third bit of the FAS on odd frames, called the A-bit, is used to signal loss of frame or multiframe alignment. Further, the second eight bits of the service channel are reserved for bit allocation signal (BAS).

3. Transmission Modes and Terminal Types

All standardized audiovisual terminals using H.261 video coding, G.722 audio coding, and/or G.711 speech coding should be able to intercommunicate. This requires the establishment of a common mode of operation upon a call set-up; and, depending on the terminal type, the capability to switch mode during a call. For the purposes of the present discussion we have listed the following audio/video/data modes of operation and terminal types.

3.1 Transmission Modes

- Mode 0: 64 Kbps narrowband Audio to Rec G.711 (A or μ Law)
- Mode 1: 64 Kbps 7 KHz Audio to Rec. G.722
- Mode 2: 56 Kbps 7 KHz Audio to Rec. G.722 + up to 6.4 Kbps Data
- Mode 3: 48 Kbps 7 KHz Audio to Rec. G.722 + up to 14.4 Kbps Data
- Mode 4: 40 Kbps Audio + up to 22.4 Kbps Data
- Mode 5: 32 Kbps Audio + up to 30.4 Kbps Data
  - * The 32 Kbps Audio may either correspond to Rec. G.721, or, alternatively, to a downward extension of Rec. G.722 (i.e.; coding of the lowest band only).
- Mode 6: 24 Kbps Audio + up to 38.4 Kbps Data
- Mode 7: 16 Kbps Audio + up to 46.4 Kbps Data
- Mode 8: 8 Kbps Audio + up to 54.4 Kbps Data
- Mode 9: up to 62.4 Kbps Data
- Mode 10: up to 64 Kbps Data

To identify additional modes with video capability in one or more B/H0/H11/H12 channels, a naming convention according to the Draft Rec. AV.242 is used. That is, the audio mode is taken first, followed by symbol V, a digit m together with one of the symbols B, H0, H11, or H12 to indicate how many B/H0/H11/H12 channels are involved. Finally, an indication of the "actual" data channel bit rate is added to the end.

3.2 Terminal Types

Audio/Video (AV) terminals may be classified into the following "types" according to their capability to operate in various modes as identified above.

- Type 0: A digital telephone set working in Mode 0 only.
- Type 1: A 7 KHz terminal capable of working in Modes 1 or 0.
- Type 2: A member of 7 KHz audio/data terminals capable of working at least in Mode 0, 1, 2 and 3.
- Type 2V2B: A Type 2 terminal with video codec to Draft Rec. H.261 and 2B channel capability.
- Type 3: A member of a family of audio/data terminals capable of working at least in Modes 0, 1, 2, 3, 5, 7, 9, 10.
- Type 3V1B: A Type 3 terminal containing a video codec to Draft Rec. H.261, but no second B-channel capability.
- Type 3V2B: A Type 3 terminal containing a video codec to Draft Rec. H.261, capable of operating with one or two B-channels.
- Type 2V6B: A Type 2 terminal with 6B channel capability and video codec to Draft Rec. H.261.
- Type 2V1H0: A Type 2 terminal with 1H0 channel capability and video codec to Draft Rec. H.261.
- Type 3V1H11: A Type 3 terminal having capability for 1H11 channel with video codec to Draft Rec. H.261.
- Type 3V1H12: A Type 3 terminal having capability for 1H12 channel with video codec to Draft Rec. H.261.

4. Communication Procedure

To establish intercommunication between various audiovisual terminals, it is necessary to carry out the following procedures.

A. Call set-up (Phase A): In this phase the transmission path between the terminals is set. Following the connection establishment, all the terminals will start to work in Mode 0 (i.e., Mode 0 forcing).

B. Initialization process (Phase B): This phase establishes a common mode of operation between the two terminals. It consists of three parts:

   1. exchange of information concerning capabilities of the respective terminals through terminal capability BAS commands (see Table 1). Here, the term "capability" refers to the receive side of the terminal, and it should signal the following:

      — Audio Capability

      — Video Capability

      — Transfer Rate Capability

      — Data Capability

   2. determination of an appropriate mode of operation, consistent with the known capabilities of both terminals. Table 2 shows an example in which a common mode of operation among various audiovisual terminals has been indicated.

3. switching to this mode through appropriate audio, video, transfer rate, data BAS commands (see Tables 3-4).

C. Information transfer phase (Phase C): This phase performs actual data transmission. It shall also include mode switching.

D. Mode Termination phase (Phase D): This is opposite to phase B, and it returns the terminal to mode 0.

E. Call Termination phase (Phase E): This phase disconnects the transmission path between the two terminals.

5. Operation Over Multiple B Channels

When two or more channels are involved, the far-end terminal, upon the receipt of terminal capability BAS code, establishes additional B channels as needed. Actual mode switching to occupy the new channels is initiated when and only when frame alignment and channel synchronization are achieved. Figures 1-2 show examples of 2B channel configurations when single or both channels are used to transmit video information. As depicted, the second B-channels carry only FAS for framing and differential channel delay compensation.

5.1 Unresolved Issues

A. Mode 0 forcing procedure.

B. Framing recovery and differential channel delay compensation procedure.

C. Interworking between H0 and 6B codecs.

D. Need to add new BAS capability and command codes to include still-frame picture codecs (e.g.; codecs based on ISO model).

E. A method to preserve channel sequence integrity.

The following BAS codes have been used in our present implementation. For Audio and Data BAS command codes refer to ANNEXES 1 and 5, of Draft Rec. H.221.

Table 1: Terminal Capability BAS Codes (Attribute Value 100/101)

Terminal Capability	BAS Code	Comments
Audio	10000000	Neutral
	10000001	Type 0 (A-Law)
	10000010	Type 0 (μ -Law)
	10000011	Type 1
	10000100	Type 2
	10000101	Type 3
Video	10001000	Standard video H.261, CIF
	10001001	Standard video H.261, 10 Frame/Sec
	10001010	Standard video H.261, 15 Frame/Sec
	10001011	Standard video H.261, 30 Frame/Sec
	10001100	Standard/non-Standard video (* extension)
	⟆	⟆
Transfer Rate	10100001	2B transfer rate capability (See Note 1)
	10100010	3B transfer rate capability
	10100011	4B transfer rate capability
	10100100	5B transfer rate capability
	10100101	6B transfer rate capability
	10100110	1H0 transfer rate capability
	10100111	2H0 transfer rate capability
	10101000	3H0 transfer rate capability
	10101001	4H0 transfer rate capability
	10101010	5H0 transfer rate capability
	10101011	1H11 transfer rate capability
	10101100	1H12 transfer rate capability
Data	10011000	300 bit/s data capability
	10011001	1200 bit/s data capability
	⟆	⟆
	10011111	14400 bit/s data capability

Note 1: A new attribute value "101" has been defined for Transfer Rate Capability.

Table 2: Interworking Between Different Terminal Types

	0	1	2	3	2V2B	3V1B	3V2B	2V6B	2V1H11
0	0								
1	0	1							
2	0	1	2						
3	0	1	2	3					
2V2B	0	1	2	2	2V2B				
3V1B	0	1	2	3	2	3V1B			
3V2B	0	1	2	3	2V2B	3V1B	3V2B		
2V6B	0	1	2	2	2V2B	2	2	2V6B	
2V1H11	0	1	2	2	2	2	2	2	2V1H11

Table 3: Video Command BAS Codes

BAS Code	Video Command	Comments
01000000	Video "OFF"	
01000001	Standard Video H.261	
01000010	Non-Standard Video	
01010000	Freeze-Frame Request	
01010001	Fast-Update Request	
01011001	Standard video (H.261) with 800 b/s C&I	
01011010	Non-Std. video with 800 b/s C&I	

OK

Table 4: Transfer Rate Command BAS Codes

BAS Code	Transfer Rate Command	Comments
00100000	64 Kbps	
00100001	64 Kbps audio + 64 Kbps data	NO-TSSI
00100010	64 Kbps audio + 64 Kbps video	NO-TSSI
00100011	64 Kbps audio + 64 Kbps data + 64 Kbps video	NO-TSSI
00100100	64 Kbps audio + 128 Kbps video	NO-TSSI
00100101	64 Kbps audio + 64 Kbps data + 128 Kbps video	NO-TSSI
00100110	64 Kbps audio + 192 Kbps video	NO-TSSI
00100111	64 Kbps audio + 64 Kbps data + 192 Kbps video	NO-TSSI
00101000	64 Kbps audio + 256 Kbps video	NO-TSSI
00101001	64 Kbps audio + 64 Kbps data + 256 Kbps video	NO-TSSI
00101010	64 Kbps audio + 320 Kbps video	NO-TSSI
00101011	64 Kbps audio + 64 Kbps data + 256 Kbps video	TSSI within H0
00101100	64 Kbps audio + 320 Kbps video	TSSI within H0
00101101	64 Kbps audio + 64 Kbps data + 640 Kbps video	See Note 1
00101110	64 Kbps audio + 704 Kbps video	See Note 1
00101111	64 Kbps audio + 64 Kbps data + 1.024 Mbps video	See Note 1
00110000	64 Kbps audio + 1.088 Mbps video	See Note 1
00110001	64 Kbps audio + 64 Kbps data + 1.408 Mbps video	See Note 1
00110010	64 Kbps audio + 1.472 Mbps video	See Note 1
00110011	64 Kbps audio + 64 Kbps data + 1.792 Mbps video	See Note 1
00110100	64 Kbps audio + 1.856 Mbps video	See Note 1
00110110	64 Kbps audio + 64 Kbps data + 1.408 Mbps video	See Note 2
00110111	64 Kbps audio + 1.472 Mbps video	See Note 2
00111000	64 Kbps audio + 64 Kbps data + 1.792 Mbps video	See Note 3
00111001	64 Kbps audio + 1.856 Mbps video	See Note 3
⎛	⎛	⎛
00111111	NO FAS	See Note 4

Note 1: NO-TSSI between H0 channels is assumed.

Note 2: TSSI within H11 channel is assumed.

Note 3: TSSI within H12 channel is assumed.

Note 4: 64 Kbps rather than 63.2 Kbps B channels.

OCTECT	CHANNEL B1								OCTECT	CHANNEL B2							
	BIT 1	2	3	4	5	6	7	8		BIT 1	2	3	4	5	6	7	8
1									1								
2								FAS	2								FAS
3	AUDIO	AUDIO	AUDIO	AUDIO	AUDIO	AUDIO	AUDIO		3	VIDEO	VIDEO	VIDEO	VIDEO	VIDEO	VIDEO	VIDEO	
...									...								
8									8								
9								BAS	9								
...									...								
16									16								
17									17								
18									18								
...									...								VIDEO
24								?	24								
25									25								
...									...								
80									80								

Figure 1.

OCTECT	CHANNEL B1								OCTECT	CHANNEL B2							
	BIT 1	2	3	4	5	6	7	8		BIT 1	2	3	4	5	6	7	8
1			1	2	3	4	5		1	6	7	8	9	10	11	12	
2			13				17	FAS	2	18						24	FAS
3	AUDIO	AUDIO							3								
...									...								
8									8							96	
9			97					BAS	9							108	109
...									...								
16									16							199	200
17			201				205	206	17	207		209				213	214
18			215						18			223					228
...									...								
24									24								
25									25								
...									...								
80									80								

Figure 2.