MPEG2 Realtime Multimedia Communication on Broadband Network

Yoshifumi Kawamura Takao Kasahara Shigeru Komatsu

Graphics Communication Laboratories
4-36-19,Yoyogi,Shibuya-ku, Tokyo,151,Japan

Abstract

We have developed an MPEG2 realtime codec system and ATM interface, and evaluated the performance and characteristics of the audio-visual communication in terms of Interoperability Specification of The ATM Forum, ITU-T H.310 draft recommendation [1] and the reference points of DAVIC specification through the experiments using the experimental public ATM network.

1. Introduction

We have developed an MPEG2 over ATM terminal.The purpose of this development is to study the technologies related to MPEG2/ATM, and also to contribute to the standardization of ITU-T H.310 audiovisual communication terminal for ATM and DAVIC specifications.

Although this terminal is featuring in realtime bi-directional communication use, there is very little difference between this terminal and DAVIC systems, as long as the content flow through the ATM interface is concerned.

This paper reports the implementation of our terminal, together with the results obtained by participating in the H.310 hardware interoperability trial, which was held last September and October in Yokosuka, Japan[2].Additionally, we've joined the OLU project which held field trails of the longdistance learning using ATM network last October and January.[3]

2. Implementation of GCL H.310 Terminal

Fig.1 shows the block diagram of our H.310 terminal for the trial. The flow at SMF (Single Mode Fiber) interface at the right hand side of Fig.1 is called S1 flow at A1/A9 in the DAVIC specifications.

Table 1 shows the specifications of GCL terminal. The underlined parameters are defaults of our terminal, which are mainly used in the H.310 Hardware Trial.

The features of this terminal are as follows:

1) Real-time encoding and decoding capability
2) Stand-alone system (not based on PC nor work station)
3) Flexible to preset various parameters via an external PC (bit rates, GOP structure, user frame size,test mode , etc.)
4) Real-time monitoring of AAL, ATM and physical layer (Type of errors, error counts, signal status, current parameters, etc.)

We have confirmed the basic function of our terminal with the loopback test using NTT nationwide 155Mbps experimental ATM network first. Then, we have examined the terminal by participating in the H.310 hardware interoperability trial explained below.

3. H.310 Hardware Trial

The outline of the H.310 Hardware Trial is as follows. (For more details, refer to the ITU-T document[2]).

(1) Periods: Performed in 3 periods between Sep. 11 to Oct. 24 , 1995
(2) Place: NTT Human Interface Labs., Yokosuka, Japan
(3) Participants: 7 organizations (Fujitsu, KDD, Mitsubishi, NEC, NTT, Sharp, GCL)
(4) Method: Interconnects every possible combination (as long as Profile and AAL type meet), directly and via NTT experimental ATM network with the line speed of 155 Mbps.

4. Field Trial of the Longdistance Learning on ATM Network

The outline of the Field Trial is as follows. (For more details, refer to the proceedings of The joint Symposium of JAIN Consortium- OLU Consortium in 1996 [3]).

(1) Periods: Performed in 2 periods between Oct. 27 1995 to Jan 23 1996.
(2) Place: Waseda Univ. and Osaka Univ., Kyoto Univ.and Nagoya Univ. Japan
(3) Method: Interconnects every possible combination (as long as Profile and AAL type meet), directly and via NTT experimental ATM network with the line speed of 155 Mbps.

5. Results

1) GCL terminal was able to be connected to 5 organization's terminals bi-directionally, and 6th terminal with uni-direction . (Decodable by our terminal but not in the opposite direction, due to the shaping problem mentioned below)
2) The major problems of the GCL terminal found in the initial trial, and their remedies are as follows:
   a) Our terminal produced a burst of 8 cells even in CBR mode, which was not accepted by some terminals. Implementing a shaper at the output port of our terminal showed improvement. But, the peak cell rate then was still about twice that of TS bitrate, which was not sufficient for the 6th terminal mentioned above.
   b) There were some restrictions or preassumptions in the system layer of our MPEG2 decoder. Also some irregular parameters existed in the TS stream, which were generated by our MPEG2 encoder .
   However, owing to the bit stream exchange and bitstream analysis, these problems were debugged.
   c) Our terminal could handle only SONET framing which was not accepted by some other SDH terminals and the ATM network .
   By using an ATM switch, we have succeeded in SONET / SDH transcoding.
   Related to an ATM switch, mixed use of SMF and MMF (Multi Mode Fiber) caused a mismatch of light level,which was solved by inserting an optical attenuator and a level amplifier.
3) We have confirmed the quality of the transmission, audio and video, and interoperability for the longdistance learning. We have got good results which show enough quality for the practical use.

6. Conclusion

1) Through the hardware trial of ITU-T H.310 terminal, interoperability of MPEG2/ATM stream was verified, which is quite similar to DAVIC S1 information at A1/A9 interface.
2) The results did not reveal any serious problem in the draft of ITU-T Draft Rec.H.310 and

DAVIC specifications so far.

However, further study may be necessary to improve interoperability in the specifications of ATM physical layer such as shaping, SONET/SDH, SMF/MMF.

3) Bit stream exchange prior to an actual interoperability test in the H.310 field trial was found to be extremely useful to

shoot the interoperability problems particularly in MPEG2 Systems layer. So it will be an important means to verify other standards compliant systems and contents.

4)

References

[1] DRAFT ITU-T Recommendation H.310 ,January 1996

[2] ITU-T SG15: 'REPORT OF THE H.310 HARDWARE TRIAL ', Temporary Document 36(1/15) (Nov.1995)

[3] The Proceedings of The joint Symposium of JAIN Consortium-OLU Consortium in 1996 (in Japanease)

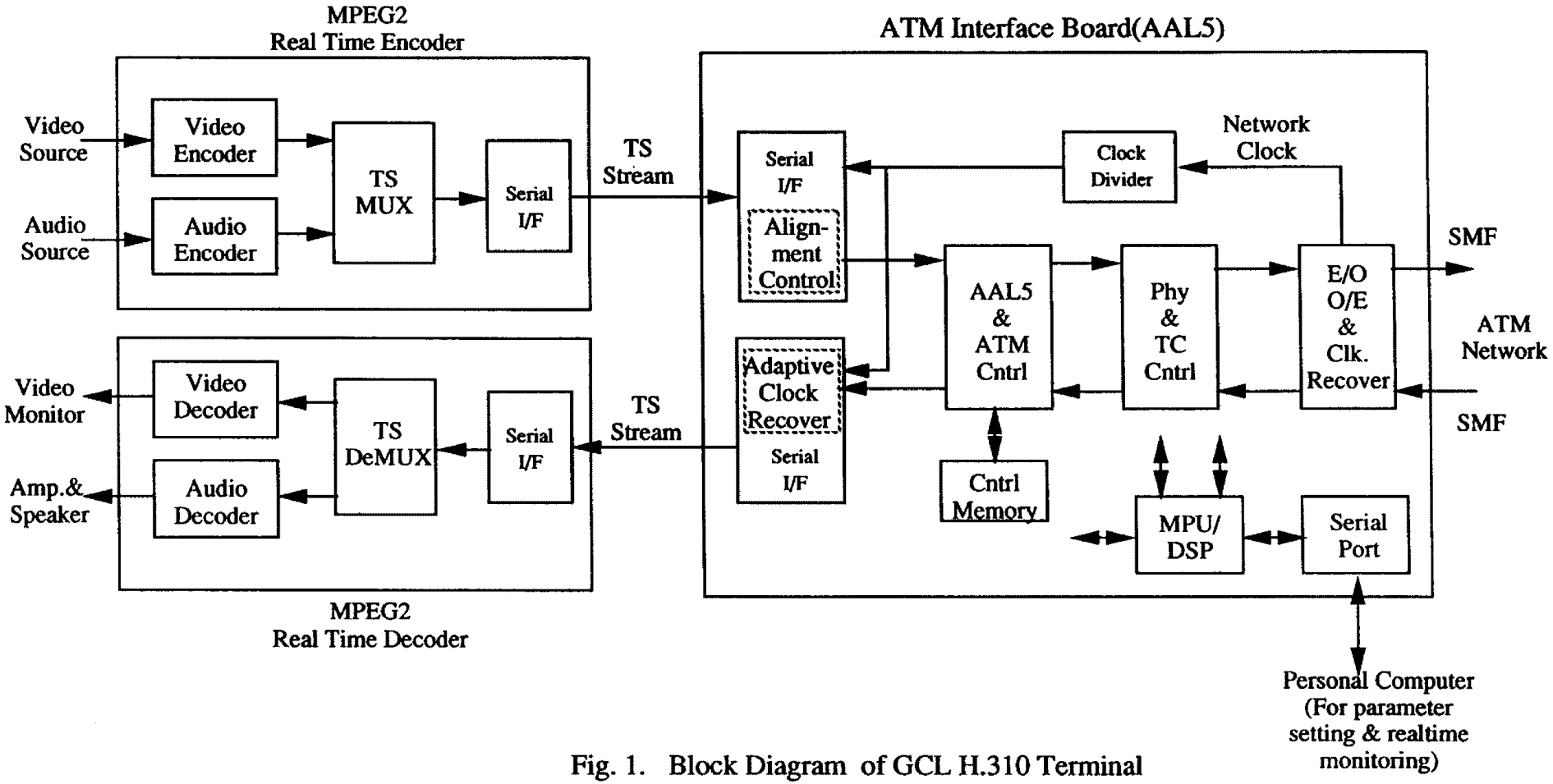

Fig. 1. Block Diagram of GCL H.310 Terminal

Table 1.Specifications of GCL H.310 Terminal

Block	Item	Specifications
Video Encoder	Coding scheme	H.262 / MPEG2 Video
	Picture sampling rate	13.5 MHz
	Picture format	704pel x 480line x 29.97Hz
	Picture structure	Frame structure
	Profile / Level	MP@ML(M=3), SP@ML
Video Decoder	Picture format	704pel x 480line x 29.97Hz 720pel x 480line x 29.97Hz
	Picture structure	Frame & Field structure
	Profile / Level	MP@ML , SP@ML
	Dual prime	yes
Audio Codec	Coding scheme	MPEG1 Layer-2
	The number of channel	2 channels (stereo)
	Sampling rate	48kHz
	Coding rate	192kbps x 2ch ,128kbps x 2ch,112kbps x 2ch
Systems (MUX/ DeMUX)	Input / output interface	RS422 serial
	MUX scheme	H.222.0 / MPEG2 Systems TS (Single program)
	Program Specific Information	Program Association Table Program Map Table
	PID value	Presettable via an external PC
	TS bitrate	6.016 / 9.024 / 3.008 / 6.144Mbps
	System clock recovery	By using PCR value and PLL
ATM Interface	AAL type	Type 5 , Type 1
	Cell mapping (AAL5)	8 cells / 2TS packet (fixed) , 5 cells / 1TS packet (fixed)
	Receive clock recovery	Network clock synchronization , Adaptive clock recovery
	User information bitrate	1.5 ~ 12Mbps (discrete)
	Shaping capability	yes
	Presettability of parameters	Possible via an external PC
	Real time status monitoring	Possible via an external PC