ITU-T Telecommunication Standardization Sector
Study Group 15
Experts Group for Video Coding and Systems
in ATM and Other Network Environments

Document AVC-770
May 15, 1995

Source : Japan
Title : Terminal specification for H.310 terminals
Purpose : Discussion

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1 Introduction

ITU-T SG 15 experts group is in the process of defining Recommendation H.310[1] which covers the technical requirements for the audiovisual communication systems and terminals in ATM environments. This recommendation is expected to provide users with a cost effective high quality audiovisual terminal in ATM environments. But the terminal specifications in the current draft recommendation is open to question about its cost effectiveness and complexity.

For example, in order to implement inter connectivity with a H.320 terminal, the H.310 terminal is required to be equipped with functions such as AAL1 for the I.580 interworking function, H.221[2] structured multiplexing and H.261 video encoding. Because of this, except for external I/O devices, the H.310 terminal is required to have almost double the functions for the similar protocol stack, which makes the terminal expensive and complex. Therefore, the current specifications in the draft H.310 may be a hurdle for popularizing the H.310 terminals.

In this contribution, first, the basic specifications of high quality audiovisual terminal in ATM environments are presented. Then, available technologies for inter connectivity with H.320 are introduced, and their features are compared.

2 Terminal specifications for H.310 terminals

2.1 Basic specifications for H.310 terminals

Figure 1 shows the protocol stack of a terminal conforming to the current draft Recommendation H.310. In this terminal the ATM adaptation layer has both AAL type 1 and AAL type 5, and the multimedia multiplex layer has both MPEG2 TS/PS and H.221, and then the video coding has H.262 and H.261 algorithms. Furthermore the end-to-end signaling has H.245 and H.242. So, except for external I/O devices like monitor TV, video camera etc., two sets of entire functions exist in parallel.

Now, Figure 2 shows an idea of simplified protocol stack focusing on high quality audiovisual services, for which the H.310 terminal is supposed to be used. In Figure 2, a duplicated function at each layer is removed. MPEG2 PS is removed from the basic specification, considering potential capability of TS for low delay and error resilience as well as its wider support by industries. AAL1 is eliminated because AAL5 is mandatory for the user-to-network signaling purpose, and it is also necessary for the VOD services.

2.2 The adaptation for H.320 over ATM networks

In this section, it is assumed that the basic specifications above are required, and inter connectivity with H.320 is optional. First, the relation between a high quality audiovisual terminal over ATM network and an H.320 terminal over N-ISDN is illustrated in Figure 3. Some implementation methods for the H.320 inter connectivity function are examined and explained below.

(1) Terminal type A

This terminal makes use of the I.580 interworking function in the network. As shown in Figure 4(a), functions of AAL1 and H.221 are necessary.

(2) Terminal type B

This terminal, shown in Figure 4(b), is the one reported in AVC-728[3] at the Kamifukuoka meeting. This type of terminal achieves all the AAL functions by single AAL type 5. A new gateway is provided to connect between a terminal accommodated in the ATM network and one in N-ISDN.

(3) Terminal type C

This terminal is a new one, proposed in this contribution. As illustrated in Figure 4(c), similar to the type B terminal, all the AAL functions are achieved by single AAL type 5. The multimedia multiplexing function is achieved only by using MPEG2 TS. Thus, only H.261 is additional to the basic specifications. Details of this terminal architecture is studied in the next chapter.

3 The adaptation of H.320 when applying MPEG2 TS and AAL5

3.1 Gateway architecture

A protocol stack of the gateway equipment for a type C terminal to communicate with an H.320 terminal is illustrated in Figure 5. The gateway equipment includes both H.221 Mux/DeMux and MPEG2 TS functions, and performs bi-directional conversion. So, this gateway equipment will become relatively complex. As for the AAL function, similar to the gateway equipment for type B terminals, AAL5 is adopted. Figure 6 illustrates an architecture of this gateway equipment. In order to communicate with a terminal over STM networks like N-ISDN, it is necessary to transmit exactly the same amount of data governed by H.320 to that terminal. In this gateway equipment, the MPEG2 DTS is generated from the H.221 submultiframe (SMF, 20 ms), and used as timing signal for packetization at the MPEG Mux block. This 20 ms timing is recovered in the terminal and used for synchronously transmitting multiplexed data In this way, the amount of data transmitted from MPEG2 system DeMux to H.221 Mux at the gateway will be exact, and no buffer overflow nor underflow will occur.

3.2 Terminal architecture

As illustrated in Figure 4(c) the protocol stack of this terminal is very simple. The AAL consists of single AAL, and the multimedia Mux block consist of MPEG2 TS only. Figure 7 shows an architecture of this terminal. The DTS and packet data, which have been generated to each SMF in the gateway equipment, are demultiplexed in the MPEG Demux block. The STM network clock and audio clock are recovered from the DTS, which appears exactly once every 20 ms, by using a simple PLL. In the MPEG Mux block, by using the DTS timing from the MPEG DeMux block, data from the encoder is packetized. This block controls the total amount of data, taking into account FAS/BAS signals, every 20 ms cycle, so that it becomes equal to that of H.221 SMF.

4 Comparison among these terminals

(1) Terminal type A

This terminal will provide a user for high quality transmission services with cell loss robustness by using AAL1. An AAL5 chip is also necessary for the user-to-network signaling. Furthermore, in the 2*B communication an AAL1 chip is necessary for each VC in the current implementation. In a terminal over ATM networks the N-ISDN network clock is recovered by using adaptive clock method or SRTS method.

(2) Terminal type B

As the cell loss is considered negligible for CBR audiovisual services in ATM environments, the ATM adaptation layer uses AAL5. In the 2*B communication only an AAL5 chip is necessary for two VCs. In this terminal multimedia multiplexing function for the H.320 interworking is performed by using H.221.

(3) Terminal type C

In Figure 7 the network clock in N-ISDN is recovered from a time stamp in transport packet using PLL circuitry, hence audio sampling clock is also recovered from the time stamp. The function of multimedia multiplex and demultiplex is implemented by using MPEG2 transport system for both H.310 and H.320 communication modes. As each elementary stream data in an H.221 submultiframe period is packed in a PES packet, packing efficiency is not so good at low bit rates. Consequently this terminal is suitable in ATM LAN environments where communication cost is not so worried.

Comparison among these terminals is summarized in Table 1.

Table 1 Comparison among the three terminals with respect to H.320 interworking

	Type A	Type B	Type C
Packing efficiency	efficient at low bit rate	efficient at high bit rate (depends on PDU size)	low
Complexity	high	middle	low
Cell loss	detectable	undetectable	undetectable
Bit error correction	may be possible	may be possible	may be possible
Delay	low (less than 6 ms at 64 kbit/s)	relatively high (depends on PDU size) (about 10 ms)	high (20 ms)
Flexibility	little	large	large
N-ISDN clock recovery	Synchronous SRTS Adaptive clock	Adaptive clock	Time stamp
Complexity for gateway equipment	middle	low	high
Suitable environments	B-ISDN	B-ISDN / ATM-LAN	ATM-LAN

5 Conclusion

In this contribution basic specifications for high quality audiovisual terminals have been studied, then three different configurations for adaptation of the H.320 narrowband audiovisual terminal have been raised and compared in their characteristics. Furthermore a terminal architecture, together with corresponding gateway equipment, has been shown which uses AAL5 and MPEG2 TS Multimedia Mux / DeMux for adapting the narrowband audiovisual terminal.

It is foreseen that a seamless network is achieved with ATM and the ATM starts in LAN environments. In order to realize high quality audiovisual terminals with capability of adapting the narrowband audiovisual terminal in a cost effective manner, we hope this document will assist to make a proper framework of ITU-T Recommendations for different type of audiovisual terminals in ATM environments, taking into account not only B-ISDN but also ATM LANs.

References

[1]AVC-746 Draft Recommendation H.32X, Jan. 1995, Japan
[2]ITU-T Rec.H.221: Frame Structure for a 64 to 1920 kbit/s Channel in Audiovisual Teleservices
[3]AVC-728 Use of AAL5 for adapting narrowband audiovisual terminals to broadband ISDN environments, Jan. 1995, Japan

Annex

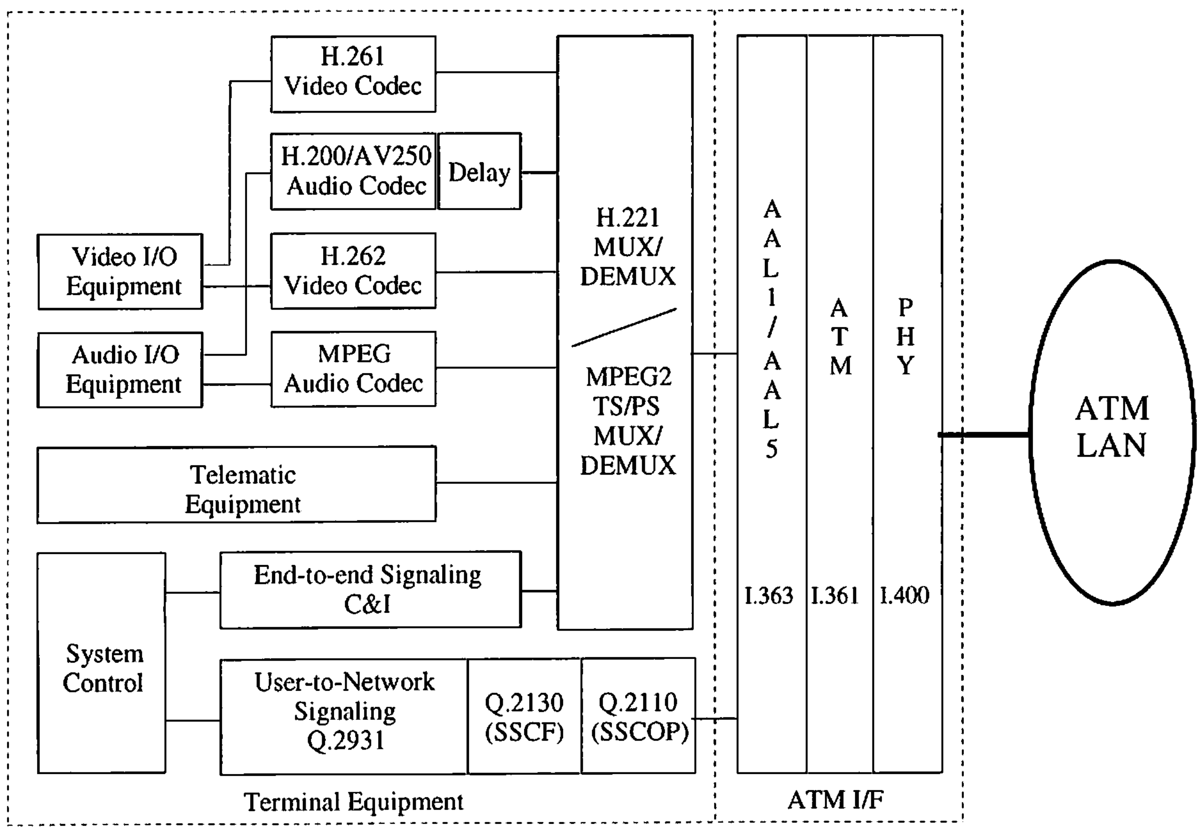


Fig.1 Protocol stack of H.310 specific terminal

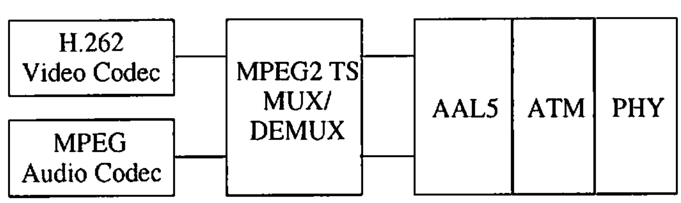


Fig.2 Protocol stack of H.310 Basic terminal

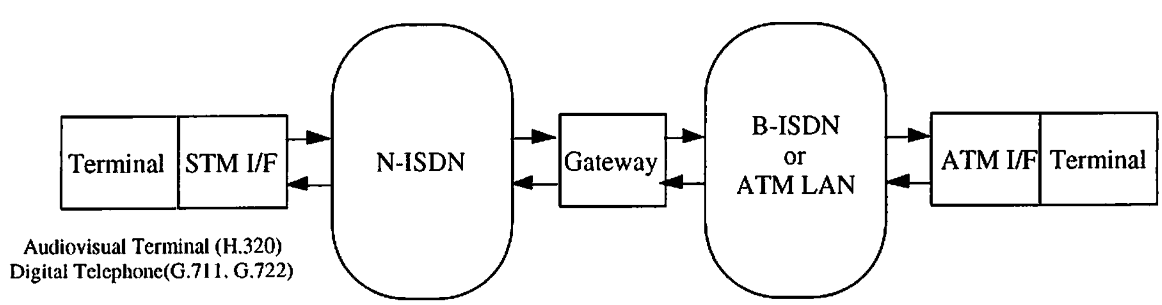
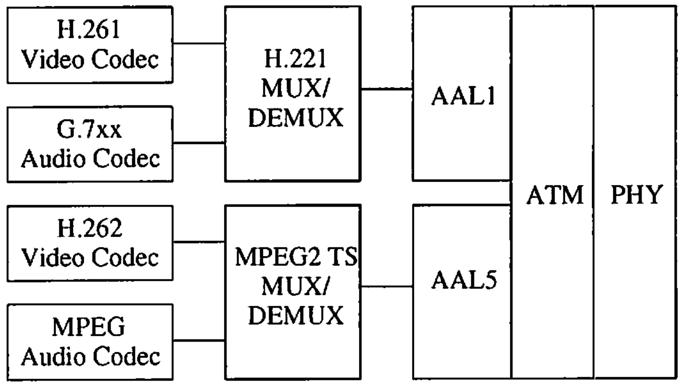
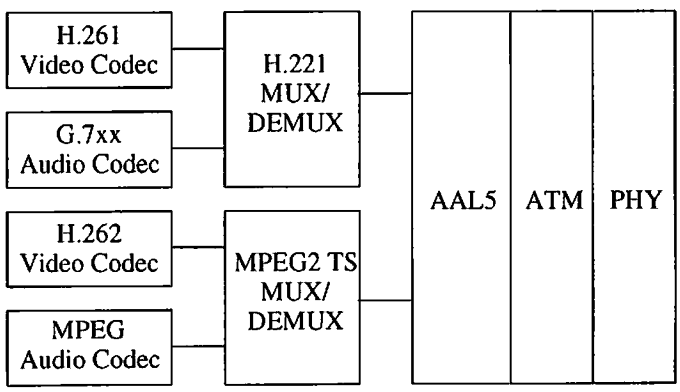


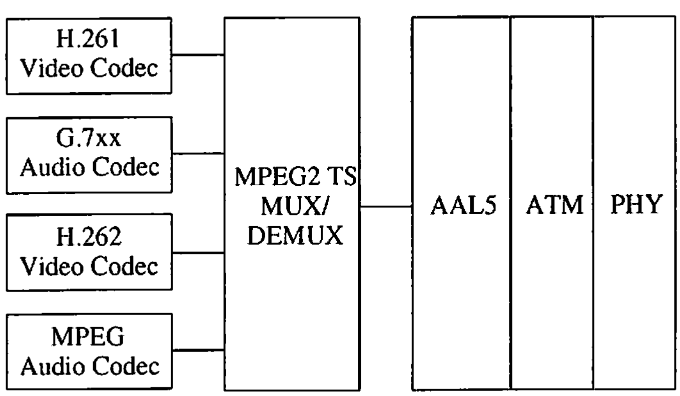
Fig.3 Network Configuration between STM and ATM



(a) Terminal Type A



(b)Terminal Type B



(c)Terminal Type C

Fig.4 Protocol stack of these Terminals

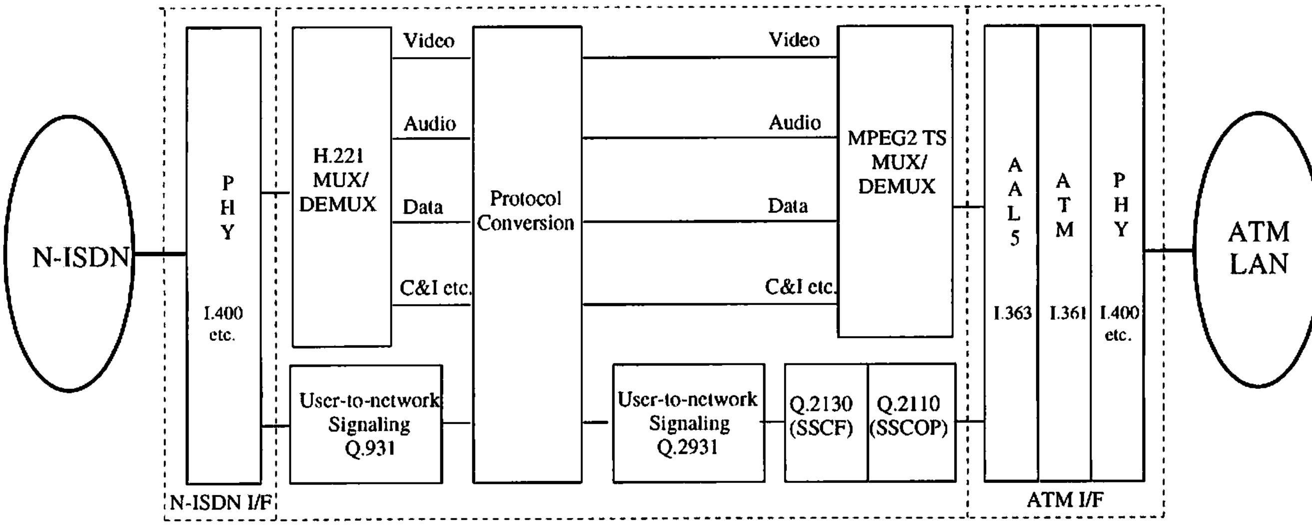


Fig.5 Protocol stack of the gateway for Terminal type C

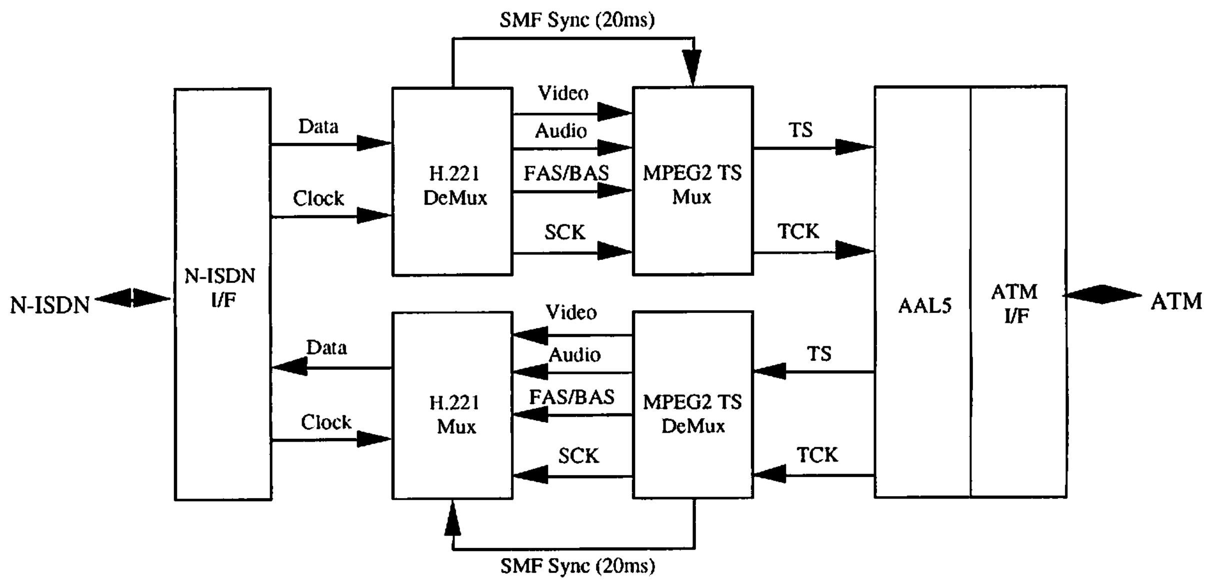


Fig.6 Gateway architecture of Type C

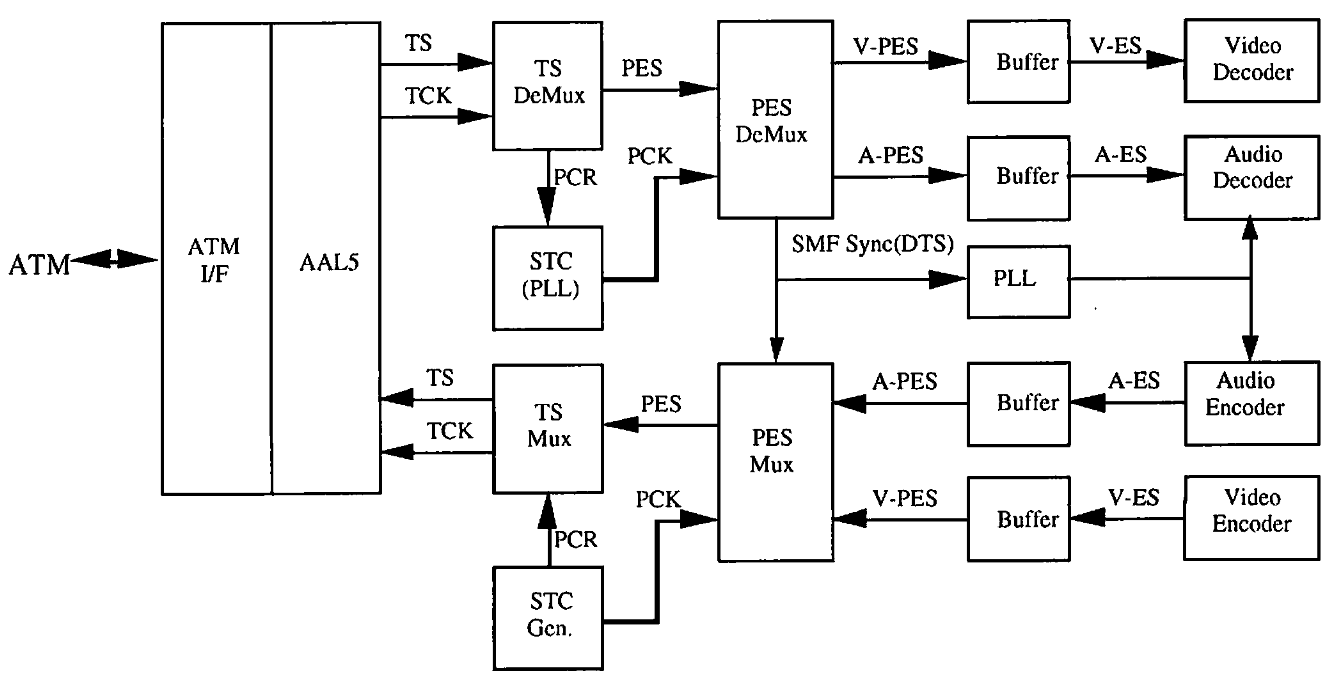


Fig.7 Terminal architechture of Type C