3—3 Interactive Multimedia Service Terminal for IMPRESS

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Abstract: This Paper describes the system configuration and implementation method of an IMPRESS (Interactive Multimedia exPRESS) terminal. The terminal is developed in the form of a PC add-on board that is called MINIBA (Media and Network Interface Board Assembly). IMPRESS is a communication service platform that supports various interactive multimedia services. The main objectives of developing IMPRESS are to implement DAVIC compliant service platform to verify DAVIC specification and to support testing environment. Currently IMPRESS terminal provides MPEG-2 quality movies on demand, switched video broadcasting, and home-shopping service to the service user, based on the ATM network.

1. Introduction

Recent multimedia and high speed network technologies integrate telecommunication, broadcasting, and information processing services as a new interactive multimedia service. In addition, users require more convenient and integrated services that support better quality. The international standardization organizations like DAVIC (Digital Audio-Visual Council) are making standardization of multimedia application services that can be commonly used in broadcasting, telecommunication, and computer. In this circumstance, many nations are trying to develop field trial services of various multimedia services [1].

DAVIC is a non-profit association. The purpose of DAVIC is to advance the success of emerging digital audio-visual applications and services by the timely availability of internationally agreed specifications of open interfaces and protocols [2]. The current DAVIC 1.0 specifications allows the deployment of systems that support initial applications such as TV distribution, near video on demand, video on demand and some basic forms of teleshopping. Each future version will extend on previous versions to provide more functionality while keeping, as far as possible, backwards compatibility with previous versions.

In Korea, Information superhighway is constructed step by step like other countries. Since the final infrastructure of Information superhighway will be a B-ISDN, the research on the B-ISDN has been carried out since last five years. ATM core switch, an ATM access network equipment, a transmission equipment and B-ISDN terminals were developed as results of the research. ATM technology provides high speed data transfer between user and service provider system, and allows a single network for all traffic types of media. ATM will enable the creation and expansion of new application services because of its high speed and the integration of various traffic types.

According to the background mentioned the above, we set a new plan to integrate network equipment developed and interactive multimedia services through IMPRESS. Research on the interactive multimedia systems, the creation of new services, and the verification of service specification will be included in this plan. IMPRESS terminal is developed in the form of a PC add-on board and provides MPEG-2 quality movies on demand, switched video broadcasting, and home-shopping service to the service user, based on the ATM network. In this paper, we will describe system design and implementation on IMPRESS terminal, and service protocol based on the DAVIC specification. At the end of this paper, the conclusion and our future directions are mentioned.

2. System Architecture of IMPRESS

The main objectives of IMPRESS are to implement DAVIC compliant service platform to verify DAVIC specification and to support new

service developing and testing environment.

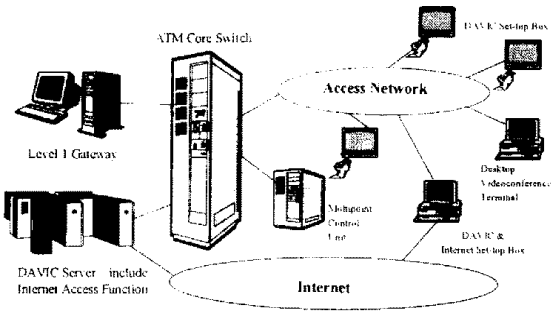

Fig. 1 Overall architecture of IMPRESS

Figure 1 shows an overall architecture of the IMPRESS. As the delivery system, ATM switch is used as a core network and CANS (Central Access Node System) and DANS (Distributed Access Node System) are used as access networks. CANS and DANS were developed as results of HAN(Highly Advanced Network)/B-ISDN project since last five years. PC based MPEG-2 set-top box and PC based videoconference terminals are being developed as the user access terminal. As the first implementing services in IMPRESS environment, movies on demand, multipoint videoconference service, and Internet service are selected.

Protocol stack of IMPRESS is compliant to DAVIC 1.0 specification. Table 1 shows a protocol stack of IMPRESS. Each Information flow from a source object to a destination object may be content-information only, control-information only, or both. S1 Information flow is a content-information flow from a source object to a destination object, normally in the User Plane. S2 Information flow is a control-information flow from an application service layer source object to a peer destination object. S3 is control-information flow, normally in the control plane, from a session and transport service layer source object to a peer destination object. S4 is control-information flow, normally in the control plane, from a network service layer source object to a peer destination object.

Table 1. Protocol stack of IMPRESS

S1 Flow	S2 Flow	S3 Flow	S4 Flow
	DSM-CC U/U		
MPEG A/V ES	OMG CDR/UNO	DSM-CC U/N	Q.2931
MPEG PES	TCP	TCP/UDP	Q.2130
MPEG TS	IP	IP	Q.2110
AAL Type5			
ATM Layer			
Physical Layer			

3. Design and Implementation of IMPRESS Terminal

3.1 Design Consideration

In Korea, at the present stage, 6 million PCs have spread in office and home, and the demand of PC is increasing. In addition, PCs have merits in powerful user interface, graphical ability and various computer applications. PC-based communication system can support multiple multimedia telecommunication services. The PCI (Peripheral Component Interconnect) Local Bus is a high performance 32-bit or 64-bit bus with multiplexed address and data lines. It is intended for use as an interconnects mechanism between highly integrated peripheral controller components, peripheral add-on boards, and processor/memory systems. Therefore, we designed the IMPRESS terminal based on the PC platform and we chose a PCI Local Bus that provides 132 Mbytes of bandwidth. Figure 2 shows the functional block diagram of the system. The hardware of IMPRESS terminal is composed of network interface block, media processing block, and system control block. The software of IMPRESS terminal is composed of the connection control block and the application control block [3].

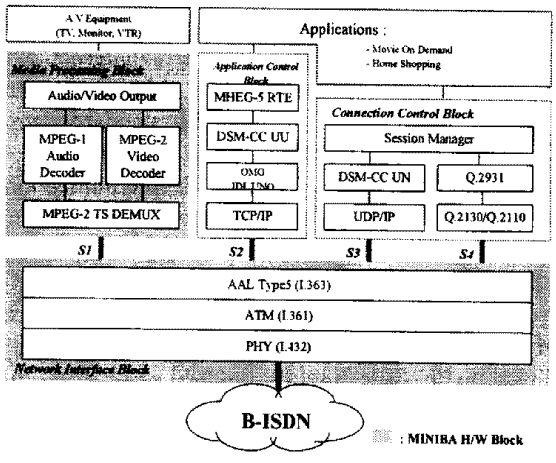

Fig. 2 Functional block diagram of IMPRESS terminal

3.2 Hardware Architecture

The hardware of IMPRESS terminal is developed in the form of an add-on board in PC system hardware that is called MINIBA (Media and Network Interface Board Assembly). Figure 3 shows the hardware architecture of the MINIBA.

Media Processing Block (MPB) is the main unit that is responsible for demultiplexing and decoding

multimedia information correctly to be displayed, as in the example, on the TV or computer screen. MPB is consists of MPEG-2 decoder, NTSC encoder and the digital to analog converter of audio. The MPEG-2 decoder demultiplexes the MPEG-2 transport stream and decodes audio and video separately, and sends them to corresponding block. The MPEG-2 decoder can deal with stream up to 15 Mbit/s. The NTSC encoders make the analog video signals that can be displayed to TV monitor from RGB or YCbCr digital video signal. It provides two kinds of output, composite video and separate video that provides more qualitative picture. The linear audio from MPEG-2 decoder is converted to analog audio, made to sound by speakers [4].

Network Interface Block (NIB) is the network adaptation between an ATM access network and an IMPRESS terminal. NIB consists of three modules: Physical Layer Processing Module, ATM Layer Processing Module, and AAL Processing Module. Main functions of NIB are as follows;

- Termination of physical signal
- ATM processing function
- AAL type 5 processing function
- SAAL processing function
- Q.2931 UNI signaling
- PCI bus interface function between PC and MINIBA

System Control Block (SCB) plays the role of overall control of the board. It performs data transfer from PC host to the PCI controller and processes some related signals. It includes such processing that Direct Memory Access(DMA) handler, interrupt routine, the initialization routines of each block. The local processor in this block is RISC processor, can be easily programmed by user and provides more powerful computing ability.

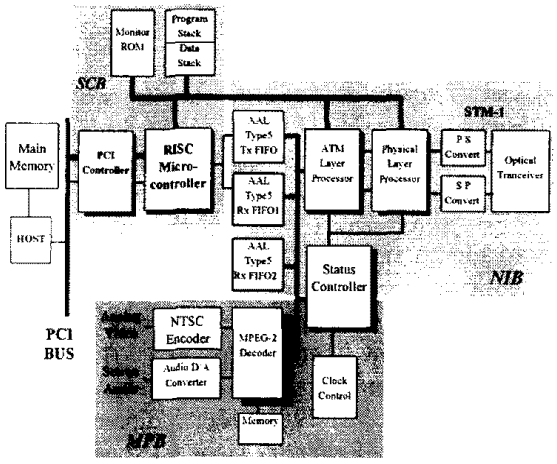

Fig. 3 Functional block diagram of MINIBA

3.3 Software Architecture

Software functions of IMPRESS terminal operate in the Windows NT environment. They are classed as the CCB (Connection Control Block) that control the low layer connection between IMPRESS terminal and server, SM (Session Manager) for session management, and ACB (Application Control Block). Figure 4 shows the software functional block of the IMPRESS terminal [5].

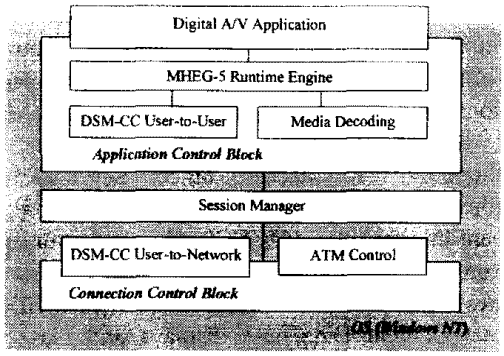

Fig. 4 Software functional block of IMPRESS terminal

CCB consists of ATM Control Module for B-ISDN call connection protocol and User-to-Network Communication Module defined in DSM-CC. Being installed on a PC, ATM Control Module is connected to the network-connecting hardware and API (Application Program Interface) that follows the native ATM service recommended by ATM Forum. ATM Control Module provides the functions of data transmission, establishment/release of SVC (Switched Virtual Channel) and PVC (Permanent Virtual Channel), traffic management, OAM protocol, and etc. DSM-CC U-N module performs the functions of user-network configuration, session control for session establishment/release, resource allocation/reallocation for the session, and status management. Session Manager establishes and manages sessions for service. It receives the request of session establishment/release from ACB, and asks CCB to serve the request. ACB consists of four modules: 1) DSM-CC U-U, 2) Media Decoding, 3) MHEG-5 RTE (Runtime Engine), and 4) Digital A/V Application module. DSM-CC U-U changes the request from MHEG-5 RTE into the DSM-CC U-U messages in order to get the running result from the server. Media Decoding Module decodes and processes all media received from the server such as MPEG, Bitmap, Text, and Audio. As an upper layer of above modules, Digital A/V Application supports the interaction between system and users. MHEG-5 RTE analyzes the MHEG-5 data to run application.

MHEG-5 RTE decodes MHEG-5 object files transmitted from the server in the form of coding stream for describing MHEG-5 information, then analyzes them according to the object [6]. It consists of a decoder, an entity processor, and an analyzer. Decoder decodes MHEG-5 objects coded as bit streams into internal data structure. Entity processor classifies the objects and inspects whether the objects are accessed properly. Analyzer is a link processing module to perform the cycle from preparation to destruction of an object.

DSM-CC U-U module is defined in order to run multimedia applications in various network environments [7]. DSM-CC U-U let users access various objects in the server using Directory, File, and Stream Interface. Directory provides the methodology to access other Services and Applications. File makes users to access files, and Stream Interface provides VCR-like control function to control MPEG stream. Digital A/V Application relates input information from users with MHEG-5 Object Content Data, and displays and plays the presentable parts of an application. Figure 5 shows the main menu of IMPRESS.

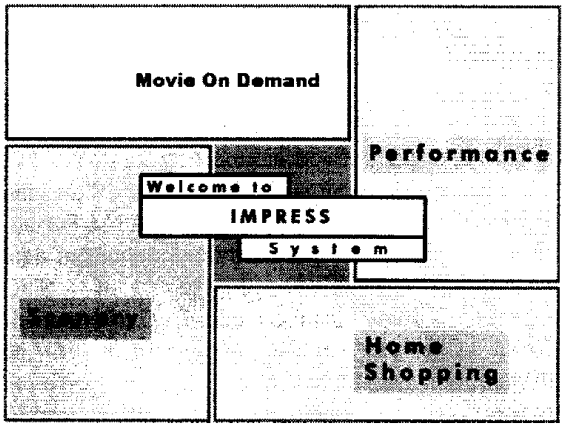

Fig. 5 Main Menu of IMPRESS

4. Conclusion and Future Directions

We have described the design and implementation of IMPRESS terminal that is developed in the form of a PC add-on board. IMPRESS terminal provides MPEG-2 quality movies on demand, switched video broadcasting, and home-shopping service to the service user, based on the ATM network. MINIBA is the main unit that is responsible for demultiplexing and decoding multimedia information and network interface between an ATM access network and an IMPRESS terminal. MINIBA is divided into three blocks: Network Interface, Media Processing and System Control block. We use the PCI bus for the interface between PC and MINIBA. Software functions of IMPRESS terminal operate in the Windows NT environment. They are classed as the Connection Control Block and Application Control Block. Until now, we finished the test of DAVIC's service protocols of the IMPRESS terminal. The major tested service protocols were DSM-CC, MHEG-5, ATM interface protocol, and MPEG-2 over ATM. Protocol for call control and multi-vendor interoperability test will be completed in this year.

At present, this terminal is used in the Set-top Box of IMPRESS platform, based on the ATM network. Research on the other interactive multimedia application service such as bi-directional communication service will be keeping going continuously.

5. Acknowledgment

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Reference

[1] Borko Furht, Deven Kalra, Frederick L. Kitson, Arturo A. Rodriguez, William E. Wall, "Design Issues for Interactive Television Systems", IEEE Computer, pp. 25 ~ 39, May, 1995.

[2] Digital Audiovisual Council, "DAVIC 1.0 Specifications", Berlin 11th Meeting, December, 1995.

[3] Park,J.H, Choi,J.S, Kim, S.J, Park, Y.D, "Multimedia Terminal in ATM Network", Korea Institute of Communication Science Proceeding Vol.14, No.2, pp. 1014 ~ 1018, 1995. (in Korean)

[4] Yu,K.Y, Park,J.H, Lee,J.H, " Implementation of Media Processing Part in ATM Multimedia Terminal", Korea Institute of Communication Science Proceeding Vol.14, No.2, pp. 239 ~ 242, 1995. (in Korean)

[5] S.J.Kim, Y.D.Park, "Design and implementation of the interface between MHEG-5 and DSM-CC in a service consumer system", Proceeding of the High-New Technology and Traditional Industry conferenc, pp. 845-850 ,1996.

[6] ISO/IEC JTC1/SC29/WG12, "Multimedia and Hypermedia information coding Export Group DIS 13522-5",1995.

[7] ISO/IEC JTC1/SC29/WG11, "Digital Storage Media Command & Control DIS 13818-6",1995.