Preface

Multimedia Systems

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Multimedia has the potential of forming the basis of a new civilization. When we compare the current situation in Information Technology (IT) with that of only 10 years ago, we can see that revolutionary changes have occurred. For example, by using e-mail on the Internet we can communicate with people living all over the world both easily and at low cost. Also, through the Internet, we can access the large number of homepages that have been created.

The speed of research and development into multimedia systems and related areas is so fast that we will soon be able to use new tools, such as light-weight portable wireless multimedia information terminals, that can be connected to the broadband communication infrastructure.

Many major developments in civilization have been based on inventions directly related to a medium. For example, the great thinkers of the ancient age wrote on clay and on fabric made of papyrus. Another great step forward was made with the invention of paper and the printing machine. More recently, the invention of the telephone and telegraph in the previous century and the radio and television in this century have really changed the world.

The development of multimedia and the Internet is so fast that we can surely predict that these technologies will change the life-styles and cultures of many people. In fact, it will eventually form the basis of a new civilization.

Multimedia through the Internet will bring about the following major changes:
1) Freedom from the constraints imposed by physical distance
More electronics communication paths around the world and wider bandwidths will reduce the need to travel long distances to meet people

FUJITSU Sci. Tech. J.,33,2,pp.103-106(December 1997)

103

face to face, so people will have more free time.

2) Freedom from other constraints of the real world

In virtual reality, people can do things that are difficult or even impossible to do in the real world. For example, a virtual chemistry experiment involving dangerous or expensive materials can be conducted in a living room over and over again under any conditions the experimenter chooses without ever needing the real materials.

One observer, Jib Fowles, has made the following analogy between the fast-paced development of the Internet and the advent of radio technology [1] "It would appear that the Internet is about to undergo a transition as momentous as radio in the early 1920s. Just as radio, in the process of gaining large numbers of adherents, abruptly tipped from an informational system to an entertainment medium, so in a likelihood will the Internet." His forecast is that in the first stage, the Internet will be used as a tool for communicating information, and then eventually its major application will be in the field of entertainment. Doubtless it will be used for entertainment, but what we would like to emphasize here is that the Internet will influence each and every aspect of human life.

In the near future, the use of multimedia on the Internet will have a big impact in the following three areas:

1) Office work

Broadband multimedia communication will affect the structures of governments, private companies, and many other organizations. It will encourage people to establish home offices and satellite offices. People will have more free time because the Internet will enable many people to work from their homes.

2) Education

The Internet will provide educational materials that can be accessed at any time of the day from the home or office. This is discussed in the paper "Virtual University." [2]

3) Homes

People will be able to spend more time at home with their entertainments, hobbies, life-long education, etc. Also, they may spend some of their time in various virtual realities; for example, they may play an active role in a virtual community.

The following is a list of the important keywords associated with our research into multimedia systems:

- Light-wave communication networks
- High-bandwidth switching networks
- Real-time, on-demand multimedia data access
- Multimedia DB
- Network simulators

- Hyper-space applications
- Preparation of multimedia contents
- Mobile computing environments
- Human interface
- Seamless network
- Quality of service: QoS over networks
- Security
- Standardization

This special issue about Multimedia Systems covers the following six areas:

1) High-bandwidth switching networks

The various types of calls handled by an ATM network each have different requirements in terms of service priority, bandwidth, minimum error rate, and other service qualities. A method is required to control the connection and cell administration according to the required Quality of Service (QoS) for each connection. In "Quality Control Scheme for ATM Switching Network," we propose the Quality Control Path (QCP) concept to control the quality of established connections in an ATM switch.

2) Real-time, on-demand multimedia data access

Providing a multimedia-on-demand service quickly and efficiently requires a new service control architecture. In "Broadband Intelligent Network Architecture for Multimedia-on-Demand Service," we propose a phased network construction for multimedia on-demand services that is based on a broadband intelligent network architecture.

While the IP network uses best-effort delivery for conventional data communication and thus has no mechanism to ensure the quality of service, audio/video applications have more stringent requirements in terms of loss and delay of packets. In "Experiments of Real-Time MPEG Audio over the Internet," we discuss the development of an audio-on-demand system operating across the Internet.

3) Multimedia DB

Emerging multimedia applications such as digital libraries and document management require a new generation of databases to handle multimedia data. In "A Prototype Multimedia Database System," we describe an approach for extending an object-oriented database for multimedia. This paper describes a multimedia model and its efficient implementation.

An environment to support sharing, retrieving, and organizing of document information is needed to cope with the increasing amount of digital documents. In "Information Sharing using WWW in WHIST," we describe ways to organize Internet documents such as e-mail, news and Web pages and ways to share documents among the members of a work group.

FUJITSU Sci. Tech. J.,**33**,2,(December 1997)

105

4) Network simulator

When developing multimedia applications for the Internet, a simulation tool is essential for evaluating the effectiveness of various transmission schemes. In "Internet Simulator for Testing Networked Multimedia," we introduce a simulation tool we have built. The tool has several new features that traditional simulators do not have.

5) Hyper-media applications and preparation of multimedia contents

Three-dimensional computer graphics has an important role not only in stand-alone computers but also in a networked multimedia computer/terminal. In "3D-CG System for PCs with Video Texture," we look at 3D-CG technology and describe a high-performance rendering LSI.

Software for creating and simulating three-dimensional computer graphics requires many person-hours to develop. The development process can be speeded up by using the concept of reusable software components. In "High-Speed CG and Simulation Application Development Environment: Firstsight," we describe a computer graphics and simulation application development environment which allows application designers to reuse software components with high-speed processing and time control capabilities.

6) Mobile computing environments and the human interface

Systems based on the multi-agent framework feature autonomy, independency, flexibility, and extensibility. These attributes are ideally suited for mobile computing environments. In "A Multi-Agent Approach to a Distributed Schedule Management System," we describe a distributed schedule management system that is based on the multi-agent framework.

Mobile computing requires a light-weight and physically small text input device. In "Single-Hand Input Scheme for English and Japanese Text," we describe a new device which enables high-speed input of text using a single hand. The input scheme will be adapted in upcoming mobile multimedia terminals.

The papers in this issue cover only a small fraction of Fujitsu's R&D activities for multimedia systems. However, we hope that these papers will demonstrate our commitment to advancing multimedia systems in terms of manufacturing and basic research.

We will continue our R&D activities for the creation of the information infrastructure of the 21st century and beyond.

References:

1) Jib Fowles: The Future of the Internet: Forecasting by Analogy. *Future Research Quarterly*, **12**, 3, pp. 5 - 17 (Fall 1996).

2) Myron M. Miller and Samuel L. Dunn: From the Industrial to the Virtual University. *Future Research Quarterly*, **12**, 4, pp. 71 - 84 (Winter 1996).