



Multimedia Systems Design

By Prabhat K. Andleigh, Kiran Thakrar

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Editorial Review

From the Inside Flap

This is a book about advanced multimedia systems, what constitutes a distributed multimedia system, current and emerging technologies that support advanced multimedia systems, and how to design and implement a multimedia system. The technologies at the core of the computing revolution have reached a point where one can envision a distributed computing system composed of a number of elements strung together by various communications methodologies, all striving to serve the user in a semi-intelligent manner. The system understands and knows how to interpret and combine data elements of various types and present them to the user in the desired mode set by the user. Multimedia systems, especially distributed multimedia systems, present extraordinary design challenges. This book discusses the characteristics of multimedia systems, identifies these design challenges, and presents design approaches to address them in an efficient manner.

Technologies discussed in this book include those required for distributed multimedia messaging. The way technical and business documents are compiled, written, distributed, and read has undergone a radical transformation to computer-based electronic hypermedia documents. Distributed computing networks link a variety of platforms with different operating systems and applications that must interact to allow storage and transmission of hypermedia documents. Hypermedia documents encapsulate storage, compression, and format conversion information to allow adapting documents for the specific user location and desktop environment. Desktop videoconferencing, video messaging, and hypermedia repositories require a combination of technologies including communications, decompression at high rates, high-resolution display systems, and storage and rapid dissemination of multidimensional objects consisting of text, image, voice, audio, and full-motion video components.

With transmission bandwidths at a premium, techniques for the compression and decompression of data take on a very important and visible role. Compression techniques have been standardized for digitized objects like binary images, gray-scale images, color images, video images, audio, and full-motion video data. These compressed objects need to be stored, retrieved, and transmitted over LANs and WANs, and decompressed before being displayed. Lossy compression is used for compressing objects for which absolute data accuracy is not required. For example, when a video image is decompressed on a frame-by-frame basis at 30 frames/sec, the loss of one frame will not be perceived by a user. For higher-quality rendering, DSP chips may be used for performing such tasks as compression and decompression, vector quantization, and data pacing to provide higher-quality video. This book is intended to help you design a real-world multimedia solution for an enterprise. Businesses have networked systems that span facilities, cities, and nations, and have integrated applications running on these networks. There is a growing need to manage widely distributed data in a timely and effective manner. The following describes three important design issues for a well-designed distributed multimedia system:

1. The underlying data management system and how well it handles diverse and complex data types, high data volumes, fast and controlled transfer rates, data integrity under access from distributed users, and updates from distributed sources of data.
2. Specialized hardware and software for managing creation, retrieval, recomposition, and display of hypermedia documents and multimedia database records, and supporting a variety of storage, compression, and decompression standards.
3. An advanced user interface provided by a graphics workstation or PC with the capability of integrating text, graphics, pictures, sound, and video.

These three components form an important group of topics for discussion in this book. As we said earlier,

this book is about what constitutes distributed multimedia systems, and how to design and implement an advanced distributed multimedia system. Readers are assumed to be students of computer programming or to have a professional interest in information systems and multimedia applications, especially in the design of advanced multimedia systems. We expect that the readers will have some understanding of the C and C++ languages (although that is not really necessary for understanding the examples) and MS Windows programming (again, not necessary but beneficial).

This book is divided into four major groupings of chapters that present relevant technologies—development methodologies, data modeling, and design—in a congruous manner. The progression in these chapter groups, especially Groups 1, 2, and 3, is important. These three groups are informative as well as tutorial in nature, especially when approached in sequence. At a more detailed level, the contents of the twelve chapters are as follows:

Group 1

Introduction to Multimedia Systems:

Group 1, comprising Chapter 1, concentrates on our definition of an advanced distributed multimedia system and an introduction of the prominent technologies and design features that contribute to a good multimedia system. Chapter 1 presents our basic definition of the various data elements and application sources associated with multimedia and the requirements of the universal multimedia application. We introduce the object types as well as specialized technologies used in multimedia systems. This chapter also introduces multimedia standards and compression and decompression technologies.

Group 2

Key Technologies for Multimedia Systems

Group 2, comprising Chapters 2, 3, 4, and 5, presents the key technologies consisting of input and output technologies, compression and decompression techniques, and storage technologies. In Chapter 2 we present a detailed discussion of compression and decompression techniques, including CCITT Group 3 and 4 as well as JPEG and MPEG (and quantization). A coded example shows how compression and decompression are performed. In Chapter 3 we present file and data formats such as the RTF, TIFF, RIFF, and AVI standards. Chapter 4 is a detailed discussion of techniques, standards, and key design issues for input and output technologies, including display systems, image scanners, digital voice and audio components, and full-motion video cameras. Chapter 5 provides a detailed analysis of the various storage technologies, including magnetic storage, RAID, CD-ROM, rewriteable optical media, and jukeboxes.

Group 3

Architectural and Multimedia Application Design Issues

Group 3, comprising Chapters 6, 7, 8, 9, and 10, presents a detailed discussion of the architectural and design issues that determine the functionality and the design strengths of a distributed multimedia system. Chapter 6 is dedicated to technologies and architectural issues comprising DSPs, processor and memory issues, connectivity via LAN and WAN (including ISDN), and overall architectural issues for multimedia systems. In Chapter 7 we discuss data flow control and other application design issues, including virtual reality for multimedia systems. Chapter 8 provides a discussion of authoring systems and user interface issues for multimedia systems. Chapter 9 presents an analysis of the design issues for multimedia messaging technologies including e-mail interface and addressing standards such as VIM, X.400, and X.500. In Chapter 10 we discuss the key design issues for distributed multimedia systems. The discussion includes design issues for multiserver networks, organizing a distributed multimedia database, managing objects in a distributed database, replication of objects, and storage optimization.

Group 4

Design Approaches to Advanced Multimedia Systems

Group 4, comprising Chapters 11 and 12 presents a design methodology to prepare readers of the book for adopting an advanced methodology for modeling the requirements and defining objects, and presents a step-by-step approach to multimedia systems design along with real coded examples. In Chapter 11 we present a

detailed design methodology for examining the requirements of the enterprise and the application, the current architecture and feasibility issues, and performance requirements. This chapter also presents a detailed system design methodology. In Chapter 12 we present design issues for a real-world example of a multimedia system application. This example will help the reader understand and put to immediate use the knowledge gained from this book.

In addition, a glossary of terms is provided for reference along with a complete detailed index. The exercises at the end of each chapter encourage readers to apply what they have learned through actual design and implementation. References, where applicable, are identified in footnotes.

A number of new concepts and methodologies are being presented in this book. The authors hope that the reader will enjoy exploring them and building upon them as much as the authors enjoyed developing them. We will find it especially rewarding if we have succeeded in promoting new ideas and avenues in the advancement of distributed multimedia applications technology.

Acknowledgments

Producing a book is a team effort. A number of people contributed their time and effort in reviewing the contents and bringing this book into production. We would like to thank everyone who contributed to this effort by sharing their time and taking interest in our work and encouraging us to continue.

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Prabhat K. Andleigh Kiran Thakrar

From the Back Cover

Informative as well as tutorial, this book explores the design of advanced multimedia systems in depth -- the characteristics of multimedia systems, the design challenges, the emerging technologies that support advanced multimedia systems, design methodologies, and implementation techniques for converting the design to produce efficient, flexible, and extensive applications. Using coded modules to illustrate design aspects, it covers the underlying data management system, specialized hardware and software, and an advanced user interface -- and presents a number of new concepts and methodologies. Defines an advanced distributed multimedia system and introduces the prominent technologies and design features that contribute to a good multimedia system. Presents the key technologies -- input and output technologies, compression and decompression techniques, and storage technologies. Includes a detailed discussion of the architectural and design issues that determine the functionality and design strengths of a distributed multimedia system.

Details an advanced design methodology for modeling the requirements and defining objects, and presents a step-by-step approach to multimedia systems design, along with real coded examples. For those involved in information systems and multimedia applications, especially in the design of advanced multimedia systems. Previously announced in the 9/94 PTR Catalog.

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