
**BUFFERING TECHNIQUES
FOR DELIVERY OF
COMPRESSED VIDEO IN
VIDEO-ON-DEMAND SYSTEMS**

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by

Wu-chi Feng
The Ohio State University



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Printed on acid-free paper.

Printed in the United States of America

To my parents, Carol, and our newborn Ryan

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PREFACE

As the year 2000 approaches, we are witnessing an explosive growth in networked multimedia services that are available. The World-Wide-Web (WWW) is exponentially growing in size and will continue to do so in the years to come. In conjunction with web browsers, the WWW allows for the retrieval of multimedia information including sound, images, and video. In addition to the WWW, many new services are becoming available such as Digital Satellite System (DSS) or High-Definition Television (HDTV) broadcasts, which have been promised within the next 10 years. One important key will be the efficient handling of digital video within these contexts.

In this monograph, we examine how to efficiently deliver stored video streams across networks for applications such as video-on-demand and digital libraries. The goal of this book is to provide an in-depth examination of buffering techniques for the delivery of constant quality, variable-bit-rate, stored video. We will examine techniques for *smoothing* the bandwidth requirements in the delivery of stored video and examine extensions that are required in order to provide interactive services to users. To highlight the various techniques that are presented in this book, we have captured a large library of full-length movies and show how these techniques apply to videos that may actually be transmitted in a video-on-demand implementation.

The book is organized into five main sections: 1) *Preliminaries*, covering basic video compression algorithm such as MPEG and Motion-JPEG; 2) *Bandwidth Smoothing Algorithms*, which formulates the problem of delivering stored video across networks and how buffering techniques can be used to smooth the bandwidth requirement from the underlying network and server; 3) *A Bandwidth Smoothing Survey*, comparing and contrasting several bandwidth smoothing algorithms that have appeared in the literature; 4) *Interactivity in Bandwidth Smoothing Environments*, describing a basic infrastructure that may be used to provide interactive video-on-demand services to users; and 5) *Bandwidth Smoothing for Interactivity*, which describes a new class of bandwidth smoothing algorithms more sensitive to the needs of interactive video-on-demand services. A more detailed description of the individual parts of the book may be found in Section 1.3.