Chapter XI
Adaptive Presentation and Scheduling of Media Streams on Parallel Storage Servers

Constantinos Mourlas
National & Kapodistrian University of Athens, Greece

ABSTRACT

One way to implement adaptive software is to allocate resources dynamically during run-time rather than statically at design time. Design of adaptive software and adaptive execution of processes are key factors that improve versatility of software and decrease maintenance costs. In this chapter we study the development of adaptive software focusing on a design strategy for the implementation of parallel media servers with an adaptable behaviour. This strategy makes the timing properties and the quality of presentation of a set of media streams predictable. The proposed adaptive scheduling approach exploits the performance of parallel environments and seems a promising method that brings the advantages of parallel computation in media servers. The proposed mechanism provides deterministic service for both Constant Bit Rate (CBR) and Variable Bit Rate (VBR) streams. We present an efficient placement strategy for data frames as well as an adaptability strategy that allows appropriate frames to be dropped without sacrificing the ability to present multimedia applications predictably in time.

INTRODUCTION

One property of most User Interfaces is the presentation of multiple streaming media (video and audio) that must be presented within a predefined range of acceptable levels of quality, i.e. satisfying a set of Quality of Service (QoS) constraints. The network servers which serve such interfaces differ enough from traditional storage servers since they store and manipulate continuous media data (video and audio) which consist of of media quanta (video frames and audio samples) that must be presented using the same timing sequence with which they were captured. For example, throughput must be

Copyright © 2009, IGI Global, distributing in print or electronic forms without written permission of IGI Global is prohibited.

maintained continuously for acceptable video playouts, and jitter must be kept within strict bounds of the order of 10ms for digital audio to be intelligible to humans.

Adaptive Systems Programming is a new direction for programming such complex systems which need to adapt their execution at run time according to new system requirements and requests that arrive from a dynamic and complex runtime environment where other processes coexist and share the same resources. Research results have been applied on system programming and implementations of advanced and evolving environments like multimedia servers, streaming media presentations, ubiquitous computing, soft real-time systems, agent computing and Grid computing applications. Adaptive Scheduling which is a special case of adaptive systems programming, and resource allocation strategies must be provided by the Continuous media (CM) server such that the required CM data will be available for the time they are needed. Hence, media servers need to ensure that the retrieval and storage of such CM streams proceed at their pre-specified real-time rates.

The proposed work is focused on the design and implementation of a predictable parallel media server with an adaptive behaviour. We focus mainly on resource management of the parallel server in order to provide on-demand support for a large number of concurrent continuous media objects in a predictable manner. With the ability to manage parallel data retrievals on media servers that satisfy the real-time requirements of each stream we could be able to concurrently support more predictable continuous media applications than on traditional single processing servers.

In a subsequent step, we extend our resource management strategy to provide *adaptability*. Instead of rejecting requests, adaptability allows more requests to be served by a suitable choice of frame dropping. The proposed adaptability management provides this feature without sacrificing the ability to present multimedia applications predictably in time. Our resource and adaptability management strategies have been especially designed for parallel media servers and support both CBR and VBR encoded media streams (video and audio) in a predictable manner.

THE ARCHITECTURE OF THE PARALLEL MEDIA SERVER

One common server architecture is the single processing model. However, this single processor server model has its limitations like performance, scalability, low transfer rate and low capacity. Recently, much research has been made on the topic of parallel systems in the community of parallel computing. In order to design a general purpose architecture which can be adapted to the current user requirements, a scalable parallel multimedia server shall be designed.

We will use the traditional model for a parallel media server previously described in (Wu & Shu, 1996; Jadav et al., 1997b). In that architecture there exist three kinds of nodes: storage nodes, delivery nodes and one control node (see Figure 1). The three kinds of nodes are explained in greater detail below:

Storage nodes are responsible for storing video and audio clips, retrieving requested data blocks and sending them to delivery nodes within a time limit. In addition, partitioned media blocks are wide striped among storage nodes in a round-robin fashion to balance the workload.

Delivery nodes are responsible for serving stream requests that have been previously accepted for service. Their main function is to request the striped data from the storage nodes through the internal interconnection network, re-sequence the packets received if necessary and then send the packets over the wide area network to the clients.

11 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/adaptive-presentation-scheduling-media-streams/24478

Related Content

Deconstructing Online Hospitality Review Systems: User Quality Experience Toward Design Features

Quan Xiao, Shun Li, Xing Zhang, Fuguo Zhang, Qi Yueand Shanshan Wan (2022). *Journal of Organizational and End User Computing (pp. 1-17).*

www.irma-international.org/article/deconstructing-online-hospitality-review-systems/292523

Optimization of Digital Information Management of Financial Services Based on Artificial Intelligence in the Digital Financial Environment

Xin Li, Jianxiang Zhang, Huizhen Long, Yangfen Chenand Anqi Zhang (2023). *Journal of Organizational and End User Computing (pp. 1-17).*

www.irma-international.org/article/optimization-of-digital-information-management-of-financial-services-based-on-artificial-intelligence-in-the-digital-financial-environment/318478

Legal and Ethical Implications of Employee Location Monitoring

Gundars Kaupinsand Robert Minch (2008). *End-User Computing: Concepts, Methodologies, Tools, and Applications (pp. 1968-1985).*

www.irma-international.org/chapter/legal-ethical-implications-employee-location/163872

The Changing Demographics: The Diminishing Role of Age and Gender in Computer Usage

Michael B. Knightand J. Michael Pearson (2007). *Contemporary Issues in End User Computing (pp. 197-215).*

www.irma-international.org/chapter/changing-demographics-diminishing-role-age/7037

Financial Cycle With Text Information Embedding Based on LDA Measurement and Nowcasting

Peijin Li, Xinyi Peng, Chonghui Zhangand Tomas Baležentis (2024). *Journal of Organizational and End User Computing (pp. 1-25).*

www.irma-international.org/article/financial-cycle-with-text-information-embedding-based-on-lda-measurement-and-nowcasting/335082