A Parallel Continuous Media Server for Internet Environments*

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Abstract. The area of multimedia services in network environments is one of the most rapidly expanding fields in today's technological world. The demands on the actual multimedia servers and networks are reaching their limits. The objective of this study is to develop a high performance continuous media server, based on a distributed memory parallel computing system, that can deliver continuous media streams, e.g. video and audio information to a large number of clients in an Internet/Intranet environment.

1 Introduction

1.1 Motivation

The delivery of continuous media, i.e. video and audio data, from a central resource to a large number of clients is an increasingly important feature of various multimedia systems. Popular multimedia systems integrating continuous media types are teleteaching systems, information kiosks, and general purpose networked information services.

This paper presents a continuous media server as one of the building blocks of such a networked multimedia information system. The main characteristics of the presented media server system are:

- The server system allows the development of applications running on the client system that integrate continuous media and non-realtime media in a homogeneous way.

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- The server system is able to deliver a scalable amount of continuous media data to a scalable number of client systems.
- The server system supports the delivery of heterogeneous media streams, i.e. media streams with different bandwidth requirements ranging from MPEG-2 transport streams over MPEG-1 system streams to H.261 encoded video data.

The integration of continuous media and non-realtime media is achieved by using the "Real Time Streaming Protocol (RTSP)" to control the delivery of continuous media from the server to the clients and its associated data delivery protocol RTP (Realtime Transport Protocol) for the encapsulation of the media elements delivered by the server to the client.

The provision of a scalable amount of continuous media to a scalable amount of clients is a difficult problem because of the inherent realtime properties of continuous media streams. The scalability of the system presented in this paper is achieved by using a distributed memory parallel computer system that is scalable and therefore able to fulfil the requirement in terms of communication and computation capacity of the applications envisaged here.

The parallel computer system is built up by connecting a number of processors holding storage subsystems and/or external communication devices by a high speed internal communication network. It is then connected to the external communication network that can be built up using ATM, Fast Ethernet or other technologies. This network connects the parallel media server to the client systems that can be widely distributed (See Fig. 1).

1.2 Content & Results
Within this paper, we will present the architecture of the parallel computing system, the overall software structure of the parallel continuous media server as well as the architecture of a client system that was integrated and connected to the parallel server.

We will show that the use of the RTSP and RTP protocols for controlling the delivery as well as for encapsulating the media information allows the integration of a scalable media server system.

The overall architecture presented here is supported by experimental results that were gained by integrating a parallel computing system into an IP communication network and connecting it to a number of clients in this way.

In section 2 the hardware architecture of the parallel system is presented. Section 3 presents the overall server system software and its basic algorithms for data striping, scheduling and admission control in detail. After this, the structure of the client system is presented that is used for the experiments discussed in section 5. Some conclusions and the discussion of open issues finalize the paper.

2 Hardware architecture
The overall architecture of the parallel computing system hosting the media server determines the performance of the media delivery to a large extent. In