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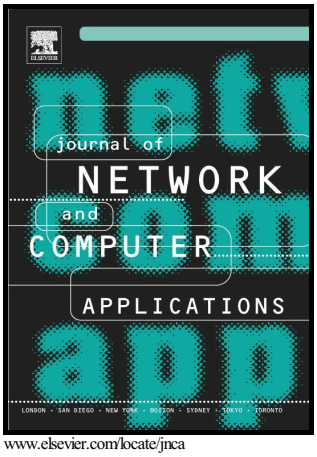

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An Integrated Prefetching/Caching Scheme in Multimedia Servers

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Abstract

Advances in storage and networking technologies have made on-demand multimedia services prevalent these days. To provide numerous concurrent users with such high-quality services, it is essential for storage systems to support sufficient I/O bandwidth for delivering multimedia data on time. Two data buffering techniques, *prefetching* and *interval caching*, have improved I/O performance by keeping data blocks in memory for future accesses when handling multimedia data with sequential access patterns. However, they have been addressed separately since it is challenging to determine whether it is better to prefetch or to cache each new stream depending on specific situations. Prefetching too many blocks or caching too long intervals may exhaust the cache space quickly. In this paper, we propose a scheme, called *Integrated Prefetching/Caching* (IPC), to simultaneously take benefit of both prefetching and interval caching using dynamic threshold values. The IPC schedules incoming streaming requests so that utilization of both cache space and disk bandwidth can be maximized. As a result, the IPC can continue to improve the performance without saturation as system resources are added. By simulation experiments, we show that IPC increases the number of concurrent streams significantly, compared to when either prefetching or caching is employed alone.

Keywords: Multimedia servers, buffer management, prefetching, interval caching.

1. Introduction

With advances in storage and networking technologies over the past decades, on-demand multimedia services such as VOD and IPTV have become prevalent for entertainment and education[1, 2, 3]. Such multimedia services enable users to access multimedia contents such as movies, video news clips, music videos, TV shows, and user generated videos. Video streaming services such as YouTube and Netflix are the most popular online services. Thus, it has been observed that video streaming has generated the most of traffic on the Internet and the video streaming traffic is expected to reach 69% of consumer traffic on the Internet by 2017 [4]. However, it is challenging to support a large number of users at the same time while satisfying real-time requirements for continuous playback of high playback rate videos. To provide such high-quality services, storage system design is particularly important since the storage systems should support sufficient I/O bandwidth for retrieving multimedia data and delivering to the network on time. To exploit the performance of the storage systems, many efficient techniques have been developed, including data placement [5, 6, 7], data replication [8, 9, 10, 11, 12, 13], batching [14, 15, 16, 17], piggybacking [18, 19], and data buffering [20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31].

The data buffering techniques have addressed the trend that, while memory price has been decreasing at a fast rate, it has been not easy to improve disk access time significantly due to the mechanical access

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