

iSWORD: Instrumented Streaming Research and Testbed

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Overview

This project encompasses the design, implementation, and state-of-the-art instrumentation of new methods for scalable *wide-area on-demand reliable digital* (SWORD) streaming. The larger goal of the research is to enable new streaming media applications, such as immediate access to an arbitrary television show or other stored media content whenever a client anywhere would like to view it. The project will thus devise new cost-effective methods for reliable on-demand streaming of high quality popular media content over a variety of communication networks. The new methods will be implemented and evaluated using a novel distributed testbed architecture that operates seamlessly and *transparently* in a *live environment* with ordinary clients accessing *widely used media servers* for their own purposes over large-scale networks such as Internet2, the Internet MBONE, a proprietary enterprise network, or a satellite broadcast network. The testbed includes a network instrumentation substrate that enables adaptive streaming and detailed understanding of streaming performance. More specifically, this research involves the following:

1. The development of innovative practical new *reliable* multicast¹ techniques that *optimize* client stream sharing to conserve server and network bandwidth, improve bandwidth cost-sharing, and maximize system scalability.
2. The design of delivery techniques that work over the Internet or over satellite/cable networks, or any combination of these network technologies.
3. The development of new metrics and models to provision streaming media content delivery networks in order to *minimize delivery cost* for the data.
4. The development of a new network instrumentation facility for the streaming media delivery protocols that enables thorough understanding of the impact of network events and conditions on the performance of the protocols.
5. The use of the new on-line network instrumentation facilities to develop streaming methods that optimally adapt to current network conditions with (nearly) the minimum impact to the client.
6. The design and development of a distributed testbed with interfaces to the network instrumentation substrate that allows experimentation with alternative new scalable reliable streaming methods as well as alternative algorithms for provisioning and operating the content distribution network.

The design of new higher quality scalable streaming and caching methods will be guided by experimental performance comparisons among proposed methods, by high-fidelity analytic models that provide the optimal solutions against which practical algorithms can be compared, by analysis of client behavior captured in server logs for existing media servers, and by prototype implementation in the iSWORD testbed that will ensure that the new methods are feasible to implement and work well in practice.

¹ The term “multicast” is used to denote both multicast and true broadcast throughout this proposal.