Digital Multimedia on Demand

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Emerging multimedia systems are expected to support a wide range of applications and require integration of various data types such as textual and numerical, images, audio, video, graphics, speech, music, animation, and handwriting. In many multimedia applications—such as video on demand, digital libraries, and home-based shopping—a common feature is the requirement for storing, retrieving, and transporting these data types over a network upon user request.

In network multimedia applications, various entities cooperate, providing real-time guarantees that let data be presented to the user interface. Multimedia applications have several requirements with respect to the service offered to them by the communication system. These requirements depend on the type of application and on its usage scenarios. For instance, the retrieval of audio-visual or multimedia data has different needs depending on whether the application is a nonconversational or conversational application for live audio-visual communication (such as teleconferencing). The usage scenario influences the criticality of the demands.

Other important issues, such as protection of intellectual property, scalability of continuous media servers, storage capacity and bandwidth, different video delivery techniques for closed-loop video service (batching and patching), and computational complexity have become a necessity in the multimedia content market. Various methodologies have been proposed to deal with these issues, including biometrics schemes for protection against and detection of illegal users.

About this issue

This special issue deals with the directions and advances made in scientific and commercial fields for digital multimedia on demand—specifically those associated with the multimedia user's needs. This special issue received high-quality articles, reviewed by three referees per paper. We selected the top third for publication.

The articles in this issue don't cover all the important issues of the multimedia-on-demand field, but they do offer a starting point for studying them. The article by Diamand et al. deals with the development of a multilevel buffer architecture (MLBA) to address several video quality issues for the ever-burgeoning universe of heterogeneous client players. On video, the MPEG-4 access unit may cause some negative quality effects because of the large number of processor cycles for decoding. The presented MLBA architecture offers a reduction of such negative effects by caching several image frames prior to rendering.

Shu and Wu's article deals with issues related to video delivery techniques for closed-loop video service—such as batching and patching—and provides a capacity analysis. In particular, Shu and Wu look at the threshold of the arrival rate, because after reaching the threshold the system resource either doesn't increase or only slowly increases with the arrival rate. Several factors influence the threshold, including the number of videos, video length, batching time, and request distribution. Shu provides analysis for a new method—scheduled video delivery (SVD)—which improves the closed-loop video service. Content and service providers can use these analysis results to compute the system resource requirements, maximum number of videos, and the maximum number of clients that can be served, as well as making selection from various video delivery techniques.

The article by Fernandez and Soriano presents a traitor-tracing technique that takes advantage of soft-decision decoding and finds all possible identifiable traitors by extending the capabilities of previously known tracing algorithms. In particular, their technique deals with redistributing the multimedia sets without modification, and then it trivially identifies the guilty user or a

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group of users (traitors) aiming to distort their identities, combines their sets, and creates a new pirate set. In this case, the tracing process consists in identifying the users whose set agrees the most with the pirate. This approach also allows the search for parents (traitors) whose identification depends upon the previously found parents. Additionally, their traceability algorithm shows how outside information, like knowledge about the actual size of the coalition or how the coalition operates when generating descendants, can be introduced into the algorithm to trace in a more efficient manner.

The article by Zimmermann et al. deals with a remote media immersion (RMI) system for a digital media delivery platform. The goal is to provide an immersive user experience of the highest quality. RMI encompasses all end-to-end aspects—from media acquisition, storage, and transmission up to their final rendering. In particular, the Yima streaming media server delivers multiple high-bandwidth streams, transmission error- and flow-control protocols ensure data integrity, and high-definition video combined with immersive audio provide highest-quality rendering. The RMI system is operational and has been successfully demonstrated in small and large venues. Relying on the continued advances in electronics integration and residential broadband improvement, RMI demonstrates the future of on-demand home entertainment.

Wrapping up

Digital multimedia is an ever-evolving field that still has much to explore and perfect. The authors in this issue have made great strides, and we look forward to seeing further enhancements and developments.

We'd like to express our appreciation to the authors and reviewers for their valuable contributions to the quality of this issue. We'd also like to thank the *IEEE MultiMedia* staff for making this issue possible. **MM**

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