Peer-to-peer systems for video delivery

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In the very recent years, peer-to-peer for streaming video applications has gained considerable attention: commercial systems have appeared, raising interest among a community of potential users that have quickly increased and reached an impressive size. The pioneering experience of the Coolstreaming prototype has been soon paired by popular systems such as PPlive, Sopcast and PPStream, platforms capable of attracting thousands of users to watch video programs over the Internet.

Among academia too, peer-to-peer streaming architectures have spurred curiosity: a significant body of papers has been produced, bringing forth studies on heterogeneous aspects related to these systems.

Nevertheless, much work remains to be done. The field of modeling is only partly explored; the understanding of the basilar laws that shape the behaviour of these systems is far from being satisfying; the mutual relation between system performance and the different algorithms that can be employed for scheduling and peer selection still awaits for a sound answer. How to provide differentiated service levels to different users is a further open question, and so appears the validation of peer-to-peer approaches for video applications with tight reliability constraints.

In this special issue we make an attempt to focus on a few specific issues of this realm: the contributions presented below shed some light on the examined problems, and let the reader appreciate the strength and novelty of their reach.

The work “iGridMedia: the system to provide low delay peer-to-peer live streaming service over the Internet”, by M. Zhang, L. Sun, S. Yang and Y. Fang, addresses the challenging issue of supporting interactive applications via a peer-to-peer streaming technology. An ad-hoc protocol, iGridMedia, is proposed and implemented, that satisfies delay and synchronization requirements more stringent than in current peer-to-peer solutions: its performance, in terms of consumed server bandwidth and required delay, is carefully investigated, outlining that even in the presence of peers with moderate upload capacity and peer churns the system behavior is excellent.

In “Adaptive Topology Formation for Peer-to-Peer Video Streaming”, H. Luan, K.-W. Kwong, X. Hei and D. H. K. Tsang propose an adaptive peer-to-peer framework consisting of two major components: source rate variation and most importantly, adaptive overlay topology formation. At source level, the video server dynamically adjusts its emitting rate on the basis of local measurements of the peers’ download rates. As regards topology, a link-level homogeneous overlay is built via a distributed algorithm, so that peers achieve an equal per-connection upload/download bandwidth and video flows experience no bottlenecks along the delivery path. Both analysis and simulations indicate that the proposed solution swiftly converges, maximizing the video playback quality.

The paper “Delay and playout probability trade-off in mesh-based peer-to-peer streaming with imperfect information”, by I. Chatzidrossos, G. Dan and V. Fodor, details an analytical framework to evaluate the performance that different scheduling algorithms achieve in a mesh-based peer-to-peer streaming system. This work examines alternative solutions, where scheduling is performed at the

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transmitting peers, and for each strategy it determines how the playout probability is affected by the number of neighbours, the playback delay and the update frequency of buffer maps. The scalability of the examined algorithms is also investigated, and the model is employed to determine the effects that peer churns have on system performance.

In “A Decentralized Service Composition approach for future peer-to-peer video delivery”, M. Kleis, B. Radier, S. Elmoumouhi, G. Carle and M. Salaun focus on QoS estimation techniques that decrease the time and measurement complexity of overlay-based service composition approaches. They put forth a distributed bandwidth estimation technique that combines landmark-based distance estimation and a projection technique; they further validate its accuracy via both theoretical analysis and simulation.

in “Analysis and Optimization of Peer-to-peer Streaming Efficiency Based on Buffer Model”, H. Liu and G. Riley study the chance that peers have no pieces interesting for their neighbours and derive an upper bound for system efficiency modeling the buffers and exploiting probability theory.

Finally, in “Measurement and Enhancement of BitTorrent-based Video File Swarming”, H. Wang, J. Liu and K. Xu examine BitTorrent via a large scale measurement campaign that concentrates on video file swarms. The authors highlight the challenges in providing streaming services in addition to the current download-and-play mode, and suggest the key to overcome such hurdles, lying in a suitable peer organization method.

As a concluding remark, I hope this special issue spurs the curiosity of the reader as it did with the reviewers of its submitted papers: its lively and interesting contributions are worth being studied and discussed.

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