THE CHINESE UNIVERSITY OF HONG KONG
Institute of Network Coding
and
Department of Information Engineering
Seminar

Performance Modeling and Algorithm Design for Sparsely-Connected Peer-to-Peer Video Streaming Systems with Distributed Control

by

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Date	:	17 October 2012 (Wednesday)
Time	:	11:00 am - 12:00 pm
Venue	:	Room 833 , Ho Sin Hang Engineering Building
		The Chinese University of Hong Kong

Abstract

The consumption of video content in the Internet is expected to grow dramatically in the near future. Peer-to-peer (P2P) technologies can take advantage of the upload capacity of clients, and hence can significantly lower the cost of large-scale video distribution. A number of commercial P2P video streaming systems have become very successful, especially in Asia. However, despite its practical success, the theoretical understanding of the performance of P2P video streaming appears to be lagging behind, which has impeded further improvement of P2P streaming towards a scalable video delivery platform with high and predictable quality-of-service. Hence, it is imperative to develop a theoretical foundation for performance modeling and algorithm design of large-scale P2P video streaming systems in order to fully realize their potential.

Specifically, in this talk we will focus on P2P live-streaming systems. A fundamental question for P2P live-streaming systems is their capacity, i.e., the maximum streaming rate that all users can sustain. Prior theoretical work often studied the optimal streaming rate by either assuming a complete graph and/or assuming centralized control, which are impractical in real systems. In this work, we study the achievable streaming rate when each peer can only connect to a small number of other peers (i.e., neighbors) chosen in a fully distributed fashion. Somewhat surprisingly, we show that even with a random peer-selection algorithm and uniform rate allocation, as long as each peer maintains $O(\log N)$ downstream neighbors, where N is the total number of peers, the system can asymptotically achieve a streaming rate that is close to the optimal streaming rate for a complete graph with centralized control. (This close-to-optimal streaming rate can be attained by performing random linear network coding at each peer.) Our result reveals important insights into the dynamics of the system, which can be used to guide the development of low-complexity and high-performance control algorithms. Specifically, based on these insights, we then design an improved algorithm that can further reduce the required number of neighbors significantly, while still achieving a comparable close-to-optimal streaming rate.

Biography

Xiaojun Lin received his B.S. from Zhongshan University, Guangzhou, China, in 1994, and his M.S. and Ph.D. degrees from Purdue University, West Lafayette, Indiana, in 2000 and 2005, respectively. He is currently an Associate Professor of Electrical and Computer Engineering at Purdue University.

Dr. Lin's research interests are in the analysis, control and optimization of large and complex wireless and wireline networks. He received the IEEE INFOCOM 2008 best paper award and 2005 best paper of the year award from Journal of Communications and Networks. His paper was also one of two runner-up papers for the best-paper award at IEEE INFOCOM 2005. He received the NSF CAREER award in 2007. He was the Workshop co-chair for IEEE GLOBECOM 2007, the Panel co-chair for WICON 2008, the TPC co-chair for ACM MobiHoc 2009, and Mini-conference co-chair for IEEE INFOCOM 2012. He is currently serving as an Area Editor for (Elsevier) Computer Networks journal, and has served as a Guest Editor for (Elsevier) Ad Hoc Networks journal.

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