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Fine Grained Scalability Video Multicast in Cognitive Radio Networks

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Abstract

We investigate the problem of scalable video multicast in emerging cognitive radio (CR) networks. Although considerable advances have been made in CR research, such important problems have not been the focus of mainstream CR research thus far. Naturally, "spectrum-hungry" multimedia applications would be excellent candidates for fully capitalizing the potential of CRs. We propose a cross-layer optimization approach to multicast video in CR networks. Specifically, we consider an infrastructure-based CR network collocated with N primary networks and model CR video multicast over the N channels as a mixed integer nonlinear programming (MINLP) problem. The objective is three-fold: (i) to optimize the overall received video quality, (ii) to achieve proportional fairness among multicast users, and (iii) to keep the interference to primary users below a prescribed threshold. We propose a sequential fixing algorithm and a greedy algorithm with low complexity and proven optimality gap to solve the MINLP. Our simulations with MPEG-4 fine grained scalability (FGS) video demonstrate not only the viability of video communications in CR networks, but also the efficacy and superior performance of the proposed algorithms as compared with an alternative equal allocation scheme.

Bio

Shiwen Mao received the Ph.D. degree in electrical and computer engineering from Polytechnic University, Brooklyn, NY, in 2004. Currently, he is an Assistant Professor in the Department of Electrical and Computer Engineering, Auburn University, Auburn, AL. His research interests include cognitive radio networks, cross-layer design and optimization of wireless networks, and multimedia communications. He is a coauthor of TCP/IP Essentials: A Lab-Based Approach (Cambridge, U.K.: Cambridge Univ. Press, 2004). Dr. Mao is on the Editorial Board of Advances in Multimedia, International Journal of Communication Systems, ICST Transactions on Mobile Communications and Applications, and Bentham Open Transportation Journal. He received the 2004 IEEE Communications Society Leonard G. Abraham Prize in the Field of Communications Systems and the Best Paper Runner-up Award from the Fifth International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness (QShine) 2008.

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