

BCWS Seminar Series

Channel Assignment for Throughput Optimization in Multi-Radio and
Multi-Channel Wireless Mesh Networks Using Network Coding

by

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Time: Monday, January 10, 10:00 - 11:00 am

Place: Room ME 4356, Mackenzie Building, Carleton University

Abstract: Deploying multi-hop infrastructure wireless mesh networks (WMNs) increases reliability and coverage compared to single-hop networks such as WiFi. Rather than being point-to-point, links in the WMNs may originate from a single node and reach more than one other nodes which further may act as relays. With multiple radios, a node can improve its capacity by transmitting over multiple radios simultaneously using orthogonal channels. Capitalizing on these potential advantages requires effective routing and efficient channel assignment. While efficient channel assignment can greatly reduce interference from nearby transmitters; effective routing can potentially relieve congestion on network paths. Routing however requires that relay nodes know which packets to transmit to whom. Random network coding breaks this constraint by allowing nodes to randomly mix packets algebraically and broadcast them. A node thus only needs to know how much, and not what, it should send. We mathematically formulate the joint channel assignment and network coding problem, taking into account the interference constraints, the coding constraints, the number of orthogonal channels, the number of radios per node, and fairness among destinations. We then use this formulation to develop a suboptimal, auction-based solution for overall network throughput optimization. Our evaluation demonstrates that our algorithm can effectively exploit multiple radios and channels and provide better fairness, compared to the case with random channel assignment and traditional routing. Our experimental results further confirm this finding.

Biography: Ekram Hossain is currently a Professor in the Department of Electrical and Computer Engineering at University of Manitoba, Winnipeg, Canada. He received his Ph.D. in Electrical Engineering from University of Victoria, Canada, in 2001. He was a University of Victoria Fellow. Dr. Hossain's primary research interest lies in the area of radio resource management and multiple access in wireless/mobile communication networks and cognitive radio systems. The books "Dynamic Spectrum Access and Management in Cognitive Radio Networks" (Cambridge University Press, 2009) and "Cognitive Wireless Communication Networks" (Springer, 2007) are two of his important contributions in this area. Dr. Hossain currently serves as the Area Editor for the IEEE Transactions on Wireless Communications in the area of "Resource Management and Multiple Access", an Editor for the IEEE Transactions on Mobile Computing, the IEEE Communications Surveys and Tutorials, and IEEE Wireless Communications. He has been a Visiting Professor/Scientist/Fellow with Tohoku University, Japan, University of New South Wales, Australia, the University of Houston, USA, and Nanyang Technological University, Singapore. Dr. Hossain is a Senior Member of the IEEE and a registered Professional Engineer in the province of Manitoba, Canada.