On the Connectivity and Capacity of Cooperative Wireless Networks

Wireless ad hoc networks have become a critical technology that enables nodes to communicate with each other in environments where there is no network infrastructure. Previous research and deployment of wireless ad hoc networks have focused almost entirely on non-cooperative schemes where each node transmits, relays, and receives packets on an individual basis. However, current technologies and network designs do not provide satisfactory performance in terms of throughput (or capacity), network connectivity, packet delay, etc. Recently, several cooperation schemes have been proposed to improve the performance of wireless networks. These include cooperative physical layer techniques (e.g. cooperative diversity) and network coding. In this talk we examine two promising technologies, (1) cooperative communications where multiple nodes intentionally transmit concurrently in the same channel at the physical layer, for example, distributed beam-forming, and (2) network coding where nodes combine data received from neighbors and then transmit these combinations to their neighbors to reduce the number of transmissions. For the first technology, cooperative communication, we establish the benefits to connectivity for the case of infinite one- and two-dimensional networks. For the second technology, network coding, we establish its benefits of on the capacity of infinite one- and two-dimensional networks.

This is joint work with D. Goeckel, B. Liu, J. Liu, L. Wang, C. Westphal.

Bio:

Don Towsley received a B.A. degree in physics and a Ph.D. degree in computer science, both from University of Texas at Austin. He is currently a Distinguished University Professor in the Department of Computer Science at the University of Massachusetts - Amherst, where he co-directs the Networking Research Laboratory. Dr. Towsley's research interests include network measurement, modeling, and analysis. He currently serves as Editor-in-Chief of the IEEE/ACM Transactions on Networking and on the editorial boards of Journal of the ACM and IEEE Journal of Selected Areas in Communications. He is also currently Chair of the IFIP Working Group 7.3 on computer performance measurement, modeling, and analysis. He has also served on numerous editorial boards including those of IEEE Transactions on Communications and Performance Evaluation.

Dr. Towsley has received the 2007 IEEE Koji Kobayashi Computer and Communications Award, the 2007 ACM SIGMETRICS Achievement Award, the 1999 IEEE Communications Society William Bennett Award, and several conference and workshop best paper awards. He is also the recipient of the University of Massachusetts Chancellor's Medal and the Outstanding Research Award from the College of Natural Science and Mathematics at the University of Massachusetts. He is one of the founders of the Computer Performance Foundation. He has twice received IBM Faculty Fellowship Awards, and is a Fellow of the IEEE and the ACM.