Introduction to Network Coding

Scheduled:
Monday 15 September 2008, morning

Presenter:
Muriel Medard, MIT, USA
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Abstract:

The course covers the principles of network coding from a theoretical perspective and from and application point of view, attempting to make clear connections between the two. Starting from algebraic foundations, it rapidly progresses to constructive issues such a distributed randomized network coding, optimization for network coding, ad-hoc approaches for non-multicast network coding and security issues in network coding. The course does not require a formal background in algebra, but supposes some general familiarity with the basic elements of networking and communications.

Outline:

The planned content is as follows:

1/ An introduction to network coding - algebraic aspects
2/ Randomized multicast network coding - theory and example applications, relation to distributed compression
3/ Optimization for multicast network coding - convex programs, distributed implementations for subgraph selection, simplified subgraph selection in wireless settings
4/ Non-multicast network coding: theoretical aspects, constructive algorithms and ad-hoc wireless approaches (XORs in the air)
5/ Security aspects of network coding: wiretap reliability and Byzantine reliability, with applications to malicious users in wireless settings.

Biographical Sketch:

Muriel Medard is a Professor in the Electrical Engineering and Computer Science at MIT. She was previously an Assistant Professor in the Electrical and Computer Engineering Department and a member of the Coordinated Science Laboratory at the University of Illinois Urbana-Champaign. From 1995 to 1998, she was a Staff Member at MIT Lincoln Laboratory in the Optical Communications and the Advanced Networking Groups. Professor Medard received B.S. degrees in EECS and in Mathematics in 1989, a B.S. degree in Humanities in 1990, a M.S. degree in EE 1991, and a Sc D. degree in EE in 1995, all from the Massachusetts Institute of Technology (MIT), Cambridge. She has served as an Associate Editor for the Optical Communications and Networking Series of the IEEE Journal on Selected Areas in Communications, as an Associate Editor in Communications for the IEEE Transactions on Information Theory, as a Guest Editor for the Joint special issue of the IEEE Transactions on Information Theory and the IEEE/ACM Transactions on Networking on Networking and Information Theorym as a Guest Editor for the IEEE Journal of Lightwave Technology and as an Associate Editor for the OSA Journal of Optical Networking. She serves as an associate editor for the IEEE Journal of Lightwave Technology. She was awarded the IEEE Leon K. Kirchmayer Prize Paper Award 2002 and the Best Paper Award at the Fourth International Workshop on the Design of Reliable Communication Networks (DRCN 2003). She received a NSF Career Award in 2001 and was co-winner 2004 Harold E. Edgerton Faculty Achievement Award, established in 1982 to honor junior faculty members "for distinction in research, teaching and service to the MIT community." She was named a 2007 Gilbreth Lecturer by the National Academy of Engineering. Professor Medard is a House Master at Next House, a Fellow of IEEE and a Member of the Board of Governors of the IEEE Information Theory Society.

Ralf Koetter is the Head of Institute of the Institute for Communications Engineering at the Technical University of Munich. He received a Diploma in electrical engineering from the Technical University Darmstadt, Germany, in 1990 and a Ph.D. degree from the Department of Electrical Engineering at Linkg University, Sweden. From 1996/1998, he was a Visiting Scientist at the IBM Almaden Research Lab., San Jose, California. He was a Visiting Assistant Professor at the University of Illinois at Urbana/Champaign and Visiting Scientist at CNRS in Sophia Antipolis, France. He joined the faculty of the University of Illinois at Urbana-Champaign in 1999 and was an Associate Professor at the Coordinated Science Laboratory at the University. His research interests include coding and information theories and their application to communication systems. In the years 19992001, he served as an Associate Editor for coding theory & techniques for the IEEE Transactions on Communications. In 2003, he concluded a term as an Associate Editor for coding theory of the IEEE Transactions on Information Theory. He received an IBM Invention Achievement Award in 1997, an NSF CAREER Award in 2000, and an IBM Partnership Award in 2001. He is the co-recipient of the 2004 Paper Award of the Information Theory Society. Since 2003, he has been a Member of the Board of Governors of the IEEE Information Theory Society.