

Network Coding

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Tutorial

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Abstract:

The tutorial provides an introduction to the rapidly growing research area of network coding. Network coding allows intermediate nodes in a network to manipulate data, for example by sending out packets that are combinations of previously received packets instead of simply forwarding them. The initial theoretical results on network coding were followed by a wealth of applications in a number of different areas that show that the theoretical insights can be translated into practical gains. The tutorial is divided into three parts. The first part provides the participants with the theoretical tools necessary to understand the field of network coding and focuses on the underlying algebraic principles. It will also introduce distributed randomized network codes and discuss their properties. We will not assume any prior knowledge of advanced algebra or optimization. The second part of the tutorial gives an overview of the different application areas and discusses, which types of networking problems are amenable to network coding (and which aren't). Finally, we will discuss implementation aspects in real-world systems. Such systems may range from core network routers all the way down to mobile phones and tiny sensor nodes.

Speaker Bios:

Frank H. P. Fitzek is a Professor in the department of Electronic Systems, University of Aalborg, Denmark heading the Mobile Device group. He received his diploma (Dipl.-Ing.) degree in electrical engineering from the University of Technology - Rheinisch-Westfälische Technische Hochschule (RWTH) - Aachen, Germany, in 1997 and his Ph.D. (Dr.-Ing.) in Electrical Engineering from the Technical University Berlin, Germany in 2002 and became Adjunct Professor at the University of Ferrara, Italy. He co-founded the start-up company acticom GmbH

in Berlin in 1999. He has visited various research institutes including Massachusetts Institute of Technology (MIT), VTT, and Arizona State University. In 2005 he won the YRP award for the work on MIMO MDC and received the Young Elite Researcher Award of Denmark. He was selected to receive the NOKIA Champion Award four times in a row in 2007 to 2010. In 2008 he was awarded the Nokia Achievement Award for his work on cooperative networks. His current research interests are in the areas of wireless and mobile communication networks, mobile phone programming, cross layer as well as energy efficient protocol design and cooperative networking.

Muriel Médard is a Professor in the Electrical Engineering and Computer Science at MIT. Professor Médard 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 serves as an associate editor for the IEEE/OSA Journal of Lightwave Technology and is a member of the Board of Governors of the IEEE Information Theory Society. Professor Médard's research interests are in the areas of network coding and reliable communications, particularly for optical and wireless networks. She was awarded the IEEE Leon K. Kirchmayer Prize Paper Award 2002 for her paper, "The Effect Upon Channel Capacity in Wireless Communications of Perfect and Imperfect Knowledge of the Channel. She was co- awarded the Best Paper Award for G. Weichenberg, V. Chan, M. Médard, "Reliable Architectures for Networks Under Stress". 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 Médard is a House Master at Next House and a Fellow of IEEE.

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