

IEEE New Zealand South Section

NZ North & South Communications Chapter Lecture

Title: COOPERATION AT THE NETWORK LEVEL

Speaker: Prof. Anthony Ephremides

Cynthia Kim Eminent Professor of Information Technology, Electrical and Computer Engineering Department, University of Maryland, USA

Date: Monday 21 December 2009

Time: Light refreshments served from 5:00 pm
Lecture begins at 5:30 pm

Venue: University of Canterbury
Dept of Electrical and Computer Engineering
Room A309 (Level 3 Lecture Theatre)

Abstract:

The concept of cooperative transmissions in a wireless network evolved from the notion of the relay channel and the MIMO technology. Most of the work to date has focused on physical layer techniques (such as decode-and-forward and the like) and aimed at characterizing the source-to-destination Information-theoretic Capacity. We take a different view and exploit the possibility of relaying in a cognitive fashion. That is, we sense unused resources (time-slots and/or frequency bands) and make opportunistic use of these resources for relaying.

We consider packets and slots rather than bits and seconds and thus our approach focuses on computing throughput, rather than capacity. In fact, we consider the realistic and practical case of finite delays, and, hence, bursty source traffic; thus we focus on the "stable throughput" region that can be achieved in a network with or without relaying. We find that significant improvements can be achieved if such cooperative/cognitive methods are used. And in fact we also consider superposing on these methods the more familiar physical layer schemes (such as combining, decode-and-forward, etc) and show that we can achieve, as expected, even further gains. We then look at cooperative routing in sensor networks (a totally different concept of cooperation, again at the network level) and identify some remarkable consequences in that case. These novel ideas and methods are the beginning of what we call "cooperation at the network level"; the potential exists that, through such cooperation, far-reaching implications may follow with regard to achievable transmission rates under bursty traffic conditions.

Biography:

Anthony Ephremides received his B.S. degree from the National Technical University of Athens (1967) and M.S. (1969) and Ph.D. (1971) degrees from Princeton University, all in Electrical Engineering. He has been at the University of Maryland since 1971 and currently holds a joint appointment as Professor in the Electrical Engineering Department and in the Institute of Systems Research (ISR) of which he is a founding member. He is co-founder of the NASA Center for Commercial Development of Space on Hybrid and Satellite Communications Networks established in 1991 at Maryland as an off-shoot of the ISR. He served as Co-Director of that Center from 1991 to 1994.

He was a Visiting Professor in 1978 at the National Technical University in Athens, Greece and in 1979 at the EECS Department of the University of California, Berkeley and at INRIA, France. During 1985-1986 he was on leave at MIT and ETH in Zurich, Switzerland. He was the General Chairman of the 1986 IEEE Conference on Decision and Control in Athens, Greece and the 1991 IEEE International Symposium on Information Theory in Budapest, Hungary. He also organized two workshops on Information theory in 1984 (Hot Springs, VA) and 1999 (Metsovo, Greece). He was the Technical Program Co-Chair of the IEEE INFOCOM in New York City in 1999 and the IEEE International Symposium on Information theory in Sorrento, Italy in 2000.

He has also been the Director of the Fairchild Scholars and Doctoral Fellows Program, an academic and research partnership program in Satellite Communications between Fairchild Industries and the University of Maryland. He won the IEEE Donald E. Fink Prize Paper Award (1992) and he was the first recipient of the Sigmobile Award of the ACM (Association of Computer Machinery) for contributions to wireless communications in 1997. He has been the President of the Information Theory Society of the IEEE (1987) and has served on its Board of Governors almost continuously from 1981 until the present. He was elected to the Board of Directors of the IEEE in 1989 and 1990.

Dr. Ephremides has authored or co-authored over 100 technical journal papers and 300 technical conference presentations. He has also contributed chapters to several books and edited numerous special issues of scientific journals. He has also won awards from the Maryland Office of Technology Liaison for the commercialization of products and ideas stemming from his research. He has served on the Editorial Boards of the IEEE Transactions on Automatic Control, IEEE Transactions on Information theory, the Journal of Wireless Networks, and the International Journal of Satellite Communications.

He has been the Dissertation Supervisor of over twenty Ph.D. students who now hold prominent positions in academia, industry, and research labs. He is the founder and President of Pontos, Inc., a Maryland company that provides technical consulting services since 1980.

Dr. Ephremides' interests are in the areas of communication theory, communication systems and networks, queueing systems, signal processing, and satellite communications. NSF, NASA, ONR, ARL, NRL, NSA, and Industry have continuously supported his research since 1971.