Πανεπιστήμιο Κύπρου
University of Cyprus

School of Engineering
Department of Electrical and Computer Engineering

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Department of Electrical and Computer Engineering

Title: "On Characterizing and modelling collective behavior in non-coordinated wireless networks"

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Wednesday, 04th October 2017, 17:00 – 18:00
Room XOD02 – 117, New Campus – University of Cyprus

Abstract:
During the last few years we have witnessed a rapid evolution of wireless technologies and a steep growth in the number of wireless networking devices. This proliferation of devices and networks is posing higher demands in terms of connectivity and capacity. Consequently, this necessitates a reduced reliance on infrastructure-based networks and support for network connectivity through non-coordinated networks. The attention of the research community has thus largely shifted from carefully planned, infrastructure-based wireless networks to non-coordinated, infrastructure-less wireless networks. The development of emerging non-coordinated wireless networks is, however, challenging. Significant efforts are still needed in both theoretical and practical domains for their analysis, modelling, and practical implementation. The objective and contribution of the presented work is the study of non-coordinated wireless networks using approaches that are novel to wireless networking research. The work is largely inspired by concepts and methods of statistical mechanics. In general, it is mainly motivated by the core idea behind statistical mechanics: the analysis of collective behaviour in systems comprising of many individual entities. In exploring this view, the talk will present the following topics: Application of one of the most widely used approximation methods of statistical mechanics – the mean field method – to provide a novel and flexible analysis of the throughput of a Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol with respect to offered traffic. Furthermore, the notion of phase transitions from statistical mechanics is exploited; we discuss a different approach on the stability of Nash Equilibria and question whether a Nash Equilibrium is always a desirable solution. In addition, motivated by the need for analytical work that goes beyond the assumption of Poisson distributed nodes, we study the percolation phase transition of clustered wireless topologies. Finally, on the practical implementation of self-organizing schemes, we show how Minority Games – a family of interaction models widely exploited in statistical mechanics – can be applied to provide self-organizing solutions for a wide range of resource allocation problems, with limited requirements for exchange of feedback information.

Biography:
Maria Michalopoulou holds a B.Sc. in Informatics and Telecommunications from the University of Athens, Greece, and an M.Sc. in Communications Engineering from the RWTH Aachen University, Germany. In 2015 she received her doctoral degree (Dr.-Ing.) on wireless networks from the Faculty of Electrical Engineering and Information Technology of the RWTH Aachen University, Germany.
Maria worked for six years as a full-time research and teaching assistant at the Institute for Networked Systems (iNETS) of the RWTH Aachen University. Since January 2016 she started collaborating with the department of Electrical and Computer Engineering at the University of Cyprus as a teaching associate and since September 2017 she joined the KIOS Research and Innovation Center of Excellence as a research scientist.
Her research interests are in the area of wireless networks and include, but are not limited to, non-coordinated and self-organized wireless networks, medium access control, non-homogeneous wireless node topologies, theoretical analysis of networks.