

### Tutorial Presentation

#### Executive Abstract

Malicious software (malware) has attracted significant attention, due to its impact on critical and/or widely employed infrastructures. The proposed tutorial (TMD-WCNet) will present theoretical background for modeling malware propagation in communication networks, especially wireless, with emphasis on the state-of-the-art approaches that have emerged in the last half-decade. The objective is to provide the audience a solid foundation on mathematical modeling techniques governing the spreading of malware through direct transmission links and also present several applications demonstrating these theoretical principles, which could be of potential interest in many different scientific fields as well. Starting from an elementary level and presenting approaches inspired from epidemiology, the tutorial will progress with more advanced mathematical tools, such as Queuing Theory, systems of Ordinary Differential Equations, Markov Random Fields and Game Theory, up to their application in malware propagation over communication networks and show how to utilize them for enhancing the infrastructures of the future. A solid and diverse basis on mathematical modeling of malware propagation will be built progressively. A clear picture of the objectives and competencies of each approach will be presented. The tutorial will also include extensions of the presented theory to more general spreading processes, e.g. Information Dissemination Dynamics. The overall theory of malware diffusion is promising and capable of providing significant insight for dealing with more diverse processes that resemble the malware diffusion behavior. As such, TMD-WCNet will provide a sufficient toolbox for scientists and professionals that wish to become involved in the field of spreading (diffusion) processes, or further extend the field of malware propagation modeling. To the best of our knowledge, TMD-WCNet is the first attempt to offer a tutorial focusing on the theory and applications of malware diffusion in wireless communications.

#### Keywords

Malware Diffusion – Security – Robustness – Complex Communications Networks – Mathematical Modeling

#### Date

To be announced

#### Duration

3.5 hours with break

#### Presenter

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#### Bio

Dr. Karyotis received the Diploma in ECE from the National Technical University of Athens (NTUA) in 2004, the M.Sc. in EE from the University of Pennsylvania in 2005 and the Ph.D. degree in ECE from NTUA in 2009. Since 2009, he is a research associate with the NETMODE Lab of NTUA. His research interests span the areas of modeling and performance evaluation of communication networks, stochastic analysis of malware propagation in wireless networks, topology control & resource allocation in decentralized networks, Network Science and Cognitive Radio ad hoc networks. Dr. Karyotis was awarded a fellowship from the Department of ESE of the University of Pennsylvania (2004-2005) and one of two departmental fellowships from the Department of ECE of NTUA (2007-2009). He is a member of the Technical Chamber of Greece since 2004 and a member of IEEE since 2003.

#### Intended audience

TMD-WCNet can be interesting and beneficiary for both researchers and engineering professionals. It is designed to provide a broad overview, as well as technical depth related to the theory of malware diffusion. The audience will have the chance to quickly obtain a breadth-oriented picture of malware propagation in complex communication networks. The detailed analytical part of the tutorial is oriented towards the more interested researcher or graduate student, by developing an in-depth technical overview of the mathematical models governing the malware propagation dynamics.

Due to the inherent mathematical diversity, the tutorial is intended towards researchers, graduate students and professionals from different scientific disciplines and the industry, e.g. electrical engineering, computer science, applied mathematics, physics, sociology, biology, finance, risk insurance, etc., interested in getting informed about the latest theoretical tools available for malware diffusion modeling and utilizing them in their own fields of applications or further extending the specific area. Stirring knowledge exchange among the audience will be the ultimate goal of TMD-WCNet, in addition to stimulating potential collaborations.