

Stochastic Methods for Dependability, Performability, and Security Evaluation

William H. Sanders

Coordinated Science Laboratory and
Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign
whs@uiuc.edu

Abstract. Stochastic methods are commonly used for dependability evaluation. In the mid 1970's, stochastic evaluation was proposed for combined performance/dependability evaluation, called performability evaluation. Extending reliability evaluation to include performance related behaviors presented new challenges, most notably due to the large difference in time scale of performance- and dependability-related events. Stochastic Petri nets, invented shortly thereafter, played an integral part in the development of performability evaluation methods. Most recently, stochastic evaluation has been proposed to quantify the security or survivability that a system provides, taking into account malicious attacks on the system. As with performability evaluation, attempts to stochastically evaluate system security and survivability met new challenges, and researchers have attempted to use stochastic net models to quantify the security and survivability a system will provide.

This invited presentation will survey the challenges, advances, and future research directions in the use of stochastic evaluation for dependability, performability, and security evaluation, paying particular attention to methods that make use of stochastic Petri nets and extensions. More specifically, I describe the challenges that were encountered as stochastic evaluation of successively more complex system properties was attempted, and show how net representations, together with new stochastic methods, enable their evaluation. In doing so, I show the relationship between methods for evaluating dependability, performability, and security, paying particular attention to issues that remain in creating a methodology for stochastically quantifying the security and survivability that a system provides to an end user.