Proceedings of the 2012 Winter Simulation Conference
C. Laroque, J. Himmelspach, R. Pasupathy, O. Rose, and A.M. Uhrmacher, eds

TITANS TALK ON "MODELING AND SIMULATION OF COMPLEX SYSTEMS: ARE PETRI NETS USEFUL?"

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ABSTRACT

Modeling and analysis of complex systems is becoming increasingly popular due to the availability of powerful processors and the possibility of distributing the analysis over a large set of cooperating computers. Within this context, simulation is often the method of choice for studying the validity of a model and for deriving reliable indications on the efficiency and the effectiveness of the system under study. Despite the power of the machines used for these analyses, the complexity of the models often exceeds the capabilities of direct simulation methods and techniques must be developed to exploit the structure of the model to derive faster simulation algorithms and to obtain reliable performance indications. Petri nets (PNS) are a formalism which allows a precise representation of the intricacy of modern systems and thus of the interactions among different system components characterized by internal complex functionalities with a very well defined semantics. In this paper we will discuss the properties of PNs that are useful for a preliminary qualitative validation of the model and we will show how the PN representation can be easily exploited to gain a reasonable confidence about the correctness of the model. Moreover, we will discuss the possibility of using the structure of the PN model to perform multi-scale analysis of systems with many components characterized by large speed differences. Examples from Systems Biology and from immunology will be used to support the arguments discussed in the paper.

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Gianfranco Balbo is Professor of Computer Science at the University of Torino, Italy. He received a MS and Ph.D. in Computer Science from Purdue University (USA), with a specialization in operating systems and evaluation methods for the study of their performances. His research interests are in the area of performance evaluation of computer systems, queueing network models, stochastic Petri nets, and queueing theory. After working on the computational algorithms for the solution of product form queueing networks, he started to use Stochastic Petri Nets for the analysis of the performance of parallel computers. In 1984, together with M. Ajmone-Marsan and G. Conte, he proposed the Generalized Stochastic Petri Net (GSPN) formalism which, supported by the GreatSPN software package, quickly became one of the most popular modelling languages for the specification and analysis of performance and reliability models of computer and communication systems. He has published over 70 scientific papers and co-authored three books. He is an ISI highly cited researcher, a member of the Academy of Sciences of Torino, and a member of the ACM.

978-1-4673-4781-5/12/$31.00 ©2012 IEEE