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Guest editorial

The modeling and analysis of software performance is a discipline born many decades ago. Along the years, mathematical foundations have been consolidated to build and solve models able to capture the software behavior and its relationships with the underlying platform as well as the environment. A wide spectrum of tools have been implemented on the top of these theories to experiment approaches based on different notations (such as Queueing Networks, Petri Nets, Layered Queueing Models and Stochastic Process Algebras) and different solution techniques.

However, the performance modeling and analysis have always encountered, up to ten years ago, some reluctance from the software engineering domain to be embedded as a daily activity in the development practice, despite the performance problems that have been posed by the rapid wide-spreading of complex software/hardware systems in new application domains. The main reasons for this reluctance are: (i) the short time to market that does not allow to spend effort in extra-functional properties, and (ii) the lack of special skills in software companies to build mathematical models. In the last decade this discipline has started to experience a breakthrough due to the introduction of automation in the process of performance model creation. Automation can favor shortening the time for performance modeling and analysis, as well as making the whole process independent by the skills of specialists. In other words, performance models can be automatically created and solved, thus making transparent the mathematical aspects to software engineers that only have to consider the analysis results.

The theme of this special issue is "software performance". This issue aims at providing an up-to-date view on the field by covering several different aspects. The papers in this issue are extensions of the best selected papers presented at WOSP'07 (International Workshop on Software and Performance). WOSP is a forum for research in software performance engineering (SPE), which aims to build predictable performance into software products from the early development phases of a system throughout its entire life cycle. This workshop brings together software engineers, developers, performance analysts and modelers who address the challenges of increasing system complexity, rapidly evolving software technologies, short time to market, incomplete documentation, and less than adequate quantitative models and tools.

WOSP'07 took place in Buenos Aires (Argentina) from February 5 to 8, 2007. The previous WOSP events were held in Santa Fe, NM (1998), Ottawa, Canada (2000), Rome, Italy (2002), Redwood Shores, CA (2004) and Palma de Mallorca, Spain (2007). The WOSP'07 final technical program consisted of 13 full papers, 3 experience papers and 8 short papers selected from 39 submissions through a rigorous peer-review process. After the workshop, selected authors were invited to submit expanded versions of their contributions for this special issue of the Journal of Systems and Software. The selection was intended to address different problems that represent part of the main challenges of this domain, as shortly illustrated here below.

The paper by Becker et al. addresses the problem of representing performance parameters in component-based software systems, in order to extend the concept of composability to extra-functional properties. A new component model is introduced that allows to specify component-based software architectures in a parametric way. The performance analysis that can be carried out basing on this model is a support for architectural design decisions, such as component selection and deployment.

The paper by Farooq et al. faces the problem of guaranteeing quality of service (QoS) of applications running on Grid platforms. In fact, although the emerging Grid computing paradigm is scalable and flexible, achieving both efficiency and quality of service provisioning in Grids is a challenging task. A complete middleware framework for Grids is presented that achieves user satisfaction by providing QoS guarantees for Grid applications, cost effectiveness by efficiently utilizing resources and robustness by intelligently handling uncertain runtimes of applications.

The paper by Mathur et al. focuses instead on building appropriate, and easily solvable, models for Web Servers. The rationale of this work is that traditional performance models have failed to capture part of an overloaded Web Server behavior. In particular a phenomenon hard to model is a severe degradation of "goodput" initially (that is the useful work made by Web Servers for requests that have not timed out), with the eventual settling of "goodput" as load increases further. The new approach to the modeling is based on a two-stage layered queueing model of a web server that shows promising results when solved and compared to measurements.

The paper by Woodside et al. tackles another crucial problem, which is the joint modeling of different extra-functional attributes, in this case performance and security. The problem is to quantify the performance degradation introduced by security mechanisms such as the SSL protocol. The approach is based on aspect-oriented modeling (AOM) that allows software designers to describe features that address pervasive concerns separately as aspects, and to systematically incorporate the features into a UML design model using composition techniques. The composition of the aspects is performed at an intermediated level between UML and performance models.

The paper by Pustina et al. is an application of a performance engineering enhanced modeling methodology for designing appli-

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cations on embedded devices. The methodology uses UML to model the system, generates a multi-class queueing network for the analysis of the system performance and it is seamlessly integrated into a UML 2.0 CASE tool. This makes queueing theory accessible to system designers even if they are not familiar with the underlying mathematics, and the acceptance of developers to use performance engineering in their daily work is increased. Special attention has been put on an easy evaluation of design alternatives.

New exciting challenges are incoming from the field of software performance. For example, with the introduction of mobile devices with limited resources able to be interconnected through MANETs, performance issues will assume ever more a crucial role as first class entities to be addressed from the very beginning of the software development. Another type of challenges to be addressed is the actual integration of performance tools with development tools. The automation of the whole process, from a software model to a performance model and on the way back bringing feedback on the software model, would be a great contribution towards the adoption of the performance modeling and analysis in the software development process.

Finally, we offer our sincere thanks to those that helped to make this special issue possible, that are the JSS Editor in Chief, the WOSP steering committee, the WOSP'07 program committee, all the reviewers who worked in the paper revision process and all the authors, including those whose papers were not accepted.

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