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Introduction

The advances in computing and communication technologies and software have resulted in an explosive growth in computer-based systems and applications that impact all aspects of our life. However, as the scale and complexity of these systems and applications grows, their development, configuration and management challenges are beginning to break current paradigms, overwhelm the capabilities of existing tools and methodologies, and rapidly render the systems and applications brittle, unmanageable and insecure.

This has led researchers to consider an alternative approach based on strategies used by biological systems to successfully deal with similar challenges of complexity, dynamism, heterogeneity and uncertainty. *Autonomic computing* is emerging as a significant new strategic and holistic approach to the design of complex distributed computer systems. It is inspired by the functioning of the human nervous system and is aimed at designing and building systems that are self-managing. More specifically, an autonomic system is a self-reliable, autonomous and ubiquitous computing environment that completely hides its complexity, thus, providing the user with an interface that exactly meets her/his needs. The system will always decide on its own, what needs to be done to keep it stable. It will constantly check and optimize its status, and automatically adapt itself to changing conditions. Self-management is achieved through key aspects such as self-governing, self-adaptation, self-organization, self-management, self-optimization, self-configuration, self-diagnosis of faults, self-protection, self-healing, self-recovery, and autonomy. Achieving these goals comes down to bringing pre-emptive and proactive approaches to all areas of a computer-based system. Meeting these challenges of autonomic computing requires scientific and technological advances in a wide variety of fields, and new architectures that support effective integration of the constituent technologies. Engineering applications belong to the most demanding application areas and, thus, will profit substantially from this highly innovative and promising paradigm.

Invitations to submit substantially extended and updated manuscripts for possible publication in the special issue of this journal were sent to authors of the best papers of a number of conferences related to autonomic computing. The authors were instructed to extend their papers in a significant and substantive way in order to be considered for publication. The extended submissions were then rigorously reviewed by at least three reviewers and only those that met the high standards of this journal were accepted for inclusion in this issue. The papers published in this special issue represent important contributions to various elements within the field of autonomic computing in engineering. We would like to thank the authors for their high-quality submissions and the technical reviewers of the manuscripts submitted to this special issue for their excellent work.

Enjoy the reading!

Elizabeth Chang, Manish Parashar, Roy Sterritt,
Huaglory Tianfield, Rainer Unland
Guest Editors

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