

Preface

Autonomic computing and networking are emerging paradigms that allow for the creation of self-managing and self-controlling environments by employing distributed algorithms and context-awareness to dynamically control networking functions without human interventions. Autonomic networking is characterized by recovery from failures and malfunctions and agility to changing networking environments and self-optimization. The self-control and management features can help overcome the growing complexity and heterogeneity of existing communication networks and systems. The realization of fully autonomic heterogeneous networking requires fundamental research challenges in all aspects of computing, networking, communications, and other related fields.

This book, with chapters contributed by prominent researchers from academia and industry, will serve as a technical guide and reference material for engineers, scientists, practitioners, and researchers by providing them with state-of-the-art research findings and future opportunities and trends. These contributions include state-of-the-art architectures, protocols, technologies, and applications in pervasive computing and wireless networking. In particular, the book covers existing and emerging communications and computing models, design architectures, mobile and wireless applications, technologies, and research issues in autonomic computing systems and communications.

The book has 18 chapters organized into two sections: autonomic computing and autonomic networking. Each section contains nine chapters addressing existing and emerging architectures, protocols, and applications.

Part I Autonomic Computing

This section consists of Chapters 1–9 and covers various topics on autonomic computing systems and applications. Chapter 1 by Radu discusses a generic autonomic computing framework for the development of self-managing systems. A prototype implementation of the reconfigurable policy engine is used to develop autonomic solutions in case studies from several application domains.

Chapter 2 by Garlan et al. presents a system called Rainbow that uses software architecture models and styles to support self-adaptation. The framework provides

general and reusable infrastructures with well-defined customization points, allowing engineers to systematically customize Rainbow for particular systems. Chapter 3 by Mpitiopoulos et al. discusses mobile agent-based middleware solutions for autonomic data fusion tasks. Chapter 4 by Hagimont et al. presents a component-based autonomic management system for legacy software. It describes the design and implementation of such a system and evaluates different uses. Chapter 5 by Brock and Goscinski proposes a dynamic web services description language for supporting autonomic computing. The framework allows the attributes of web services to be visible, thus allowing the autonomic system to better cater to the installation and use of new components. Chapter 6 by Oliveri et al. discusses a bio-inspired cognitive radio for dynamic spectrum access. Autonomic bio-inspired approaches and spectral access are also discussed. Chapter 7 by Boucadair discusses the introduction of autonomous behaviors to IP multimedia subsystem (IMS)-based architectures. Solutions covered aim at enhancing the robustness and the availability of current IMS-based architectures owing to the activation of autonomic-like techniques. Chapter 8 by Bixio et al. discusses the cognition-based distributed spectrum sensing for autonomic wireless systems. Finally, in Chapter 9, Kwok presents an autonomic peer-to-peer systems with a focus on incentive and security issues.

Part II: Autonomic Networking

This section consists of Chapters 10–18 with a focus on autonomic networking and communications.

Chapter 10 by Boutaba et al. discusses autonomic networks with focus on knowledge management and self-stabilization. In-depth discussions of basic concepts, research challenges, and their importance for the success of autonomic networks are presented. Chapter 11 by Yu et al. discusses autonomic wireless sensor networks. The chapter has an in-depth discussion of existing research activities in this area. Chapter 12 by Wada et al. discusses a model-driven development environment for biologically inspired autonomic network applications. The chapter proposes and evaluates a new development environment, called iNetLab, which can improve the productivity of designing, maintaining, and tuning operational policies in autonomic network applications. Chapter 13 by Cascado et al. discusses network reconfiguration in high-performance interconnection networks. Chapter 14 by Zulkernine et al. discusses autonomic management of networked web service-based processes. The authors discuss web services management from service providers' and service consumers' perspectives.

Chapter 15 by Zseby et al. discusses self-protection in autonomic and related networks. Chapter 16 by Cong-Vinh discusses the formal aspects of self-* in autonomic networked computing systems. Chapter 17 by Alouf et al. discusses autonomic information diffusion in intermittently connected networks. The chapter proposes a framework for designing autonomic information diffusion mechanisms using techniques and tools drawn from evolutionary computing research. Finally, Chapter 18

by He et al. presents dynamic and fair spectrum access mechanism for autonomous communications.

This book has the following salient features:

- Provides a comprehensive reference on autonomic computing and networking.
- Presents state-of-the-art techniques in autonomic computing and networking.
- Contains illustrative figures enabling easy reading.
- Discusses emerging trends and open research problems in autonomic computing and networking.

We owe our deepest gratitude to all the authors for their valuable contribution to this book and their great efforts. All of them are extremely professional and cooperative. We wish to express our thanks to Springer especially Katelyn Stanne, Caitlin Womersley, and Jason Ward for their support and guidance during the preparation of this book. A special thank also goes to our families and friends for their constant encouragement, patience, and understanding throughout this project.

The book serves as a comprehensive and essential reference on autonomic computing and networking and is intended as a textbook for senior undergraduate and graduate-level courses. It can also be used as a supplementary textbook for undergraduate courses. The book is a useful resource for the students and researchers to learn autonomic computing and networking. In addition, it will be valuable to professionals from both the academia and industry and generally serves instant appeal to the people who would like to contribute to autonomic computing and networking technologies.

We welcome and appreciate your feedback and hope you enjoy reading the book.

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