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Autonomic Computing

Principles, Design and Implementation

Springer

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ISSN 1863-7310
ISBN 978-1-4471-5006-0 ISBN 978-1-4471-5007-7 (eBook)
DOI 10.1007/978-1-4471-5007-7
Springer London Heidelberg New York Dordrecht

Library of Congress Control Number: 2013936543

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

The autonomic computing initiative—the creation of self-managing systems—was a call to arms from IBM (Paul Horn, 2001) to the industry and academic computing communities and signified the mainstream adoption of such research fields as intelligent fault management.

Although IBM set it in the context of coping with the ever-increasing 'systems of systems' complexity and dealing with the total cost of ownership (TCO), researchers expanded this to next generation of computing and communications, for instance, pervasive computing, ubiquitous computing, swarm-based computing, agent-based computing, smart grid, on-demand computing, next-generation Internet, adaptive communications and the latest trends, green and cloud computing. These streams of research have found focus through such research conferences as ICAC, EASe, SEAMS, MUCS and SASO (International Conference on Autonomic Computing, Engineering of Autonomic and Autonomous Systems, Software Engineering for Adaptive and Self-Managing Systems, Managing Ubiquitous Communication and Services and Self-Adaptive and Self-Organizing Systems, respectively). The decade of research also saw the creation of related initiatives such as Autonomic Communications and Organic Computing, as well as communities, such as the IEEE Technical Committee on Autonomous and Autonomic Systems (TCAAS) and the Autonomic Communications Forum (ACF).

Due to the complexity of the challenges that this subject brings to the fore, the Autonomic Computing has to rely on expertise from many fields—software engineering, systems engineering, control theory and AI (artificial intelligence), among others. As such it is hard to 'nail' down the field which is possibly the reason there hasn't emerged a good tutorial text—till now. As with many 'hot' research initiatives, the spotlight (and often the funding) moves on, yet the original long-term 2020–2030 needs have not. If anything, they have become more critical. The Software Crisis 2.0 (Fitzgerald 2012) highlighted more than ever the need to have our software self-managing, due to the demand for data from digital natives, coupled with the huge volume of data now generated through ubiquitous mobile devices, sensors and applications.

The success of the initiative has already been indicated by the notable move of 'autonomicity' from the previously mentioned conferences and communities to a standard topic in almost all computer- and communications-based conferences and communities. Ironically, the final success of the initiative may be marked as it no longer exists separately as a specialised field but as a standard, invisible and integrated part of our systems and software engineering.

For the autonomic systems research and development to make further leaps and bounds and move convincingly into the next decade to meet the Software Crisis 2.0 and its other longer term goals requires that it move beyond the research labs and PhD programmes to our graduate, undergraduate and CPPD (continuous professional and personal development) courses.

This book marks the enabler for that next stage.

University of Ulster, Northern Ireland Roy Sterritt
12 December 2012

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Preface

Autonomic computing seeks to render computing systems as self-managed. In other words, its objective is to enable computer systems to manage themselves so as to minimise the need for human input. Autonomic computing as an approach is guaranteed to change the way software systems are developed. Indeed, this new field is addressing some of the issues resulting from the ever-increasing complexity of software administration and the growing difficulty encountered by software administrators in performing their job effectively.

This book provides a practical perspective on autonomic computing. Implementing self-managed systems remains a true challenge today. Thus, beyond giving necessary explanations about the objectives and interests of autonomic computing, this book goes through the different software engineering techniques that are currently available for organising and developing self-managed software systems. In summary, this book uniquely:

- Provides a structured and comprehensive introduction to autonomic computing with a software engineering perspective, as far as we are aware this is the first book to do so
- Presents highly up-to-date information on techniques implementing self-monitoring, self-knowledge, decision-making and self-adaptation
- Provides a downloadable learning environment and source code that allows students to develop, execute and test autonomic applications at an associated website

Authors have created the aforementioned learning environment and placed it on a web page that will be regularly updated. The environment represents an autonomic pervasive computing application that simulates a *digital home*. A dedicated development environment has been designed around this; it allows the student to execute autonomic code in a runtime simulation that provides concrete, visual feedback of the behaviours illustrating what the student has programmed.

This book is aimed at students and practitioners working on software projects where system self-management would redress maintenance complexity and cost issues. Several aspects of this book have been tested in a classroom, which makes this book ideal for a 10-week lecture programme.

Content Level: master student/professional

Keywords: Autonomic computing, Software engineering, Software architectures, Software monitoring, Software adaptation, Knowledge and reasoning

Related Subjects: Software engineering

Authors: Authors are practitioners and recognised researchers in the field. They have published more than 200 publications in international conferences and journals.

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Acknowledgments

Many useful discussions with colleagues and students helped in the preparation of this book. The authors would like to thank the following people who, without reward, reviewed and critiqued the text; their comments and suggestions have been invaluable in ensuring the quality of this book:

Luciano Baresi, Charles Consel, Clément Escoffier, Catherine Hamon, Roman Kolcun, Pedro Martins, Iulian Neamtiu, Simon O'Keefe, Alessandra Russo, Poonam Yadav and Shusen Yang.

We are also grateful to Simon Rees of Springer who encouraged us to write the book and provided invaluable assistance in the production of the final copy.

We would also like to thank our colleagues, friends and family for their constant support, encouragement and patience. Ada thanks Mr. Smith for regularly changing the subject. Julie thanks husband Grant and son Carter—you can now use my laptop to watch 1950s cartoons. Philippe thanks his wife, now an expert in autonomic computing, and his two sons, Grégoire and Arthur—experts to come!

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