Web Services Foundations

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Editors

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Foreword by Michael P. Papazoglou

Springer

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*To my parents, Horia and Mahmoud, and my wife Malika*

Athman Bouguettaya

*To my parents Shuilian and Jianwu, my brothers Guanzheng and Xinzheng, my wife Yaping and my daughters Fiona and Phoebe*

Quan Z. Sheng

*To Cinzia, my family, my friends*

Florian Daniel

# Foreword

Service-Oriented Computing (SOC) is the computing paradigm that utilizes software services as fundamental elements for developing and deploying distributed software applications. Services are self-describing, platform-agnostic computational elements that support rapid, low-cost composition of distributed applications. They perform functions, which can be anything from simple requests to complicated business processes. Services allow organizations to expose their core competencies programmatically via a self-describing interface based on open standards over the Internet (or intranet) using standard (XML-based) languages and protocols. Because services provide a uniform and ubiquitous information distributor for wide range of computing devices (such as handheld computers, PDAs, cellular telephones, or appliances) and software platforms (e.g., UNIX or Windows), they constitute a major transition in distributed computing.

A Web service is a specific kind of service that is identified by a URI that exposes its features programmatically over the Internet using standard Internet languages and protocols, and can be implemented via a self-describing interface based on open Internet standards (e.g., XML interfaces which are published in network-based repositories).

Understanding the conceptual underpinnings and mastering the technical intricacies of Web services is anything but trivial and is absolutely necessary to construct a well-functioning service-based system or application. Web service technology is undergoing continuous, rapid evolution, thanks to both standardization efforts pushed forward by industry and the research efforts of the scientific community.

Web services standards are still evolving. However, they seem to converge today on a handful of standards: the Simple Object Access Protocol (SOAP) for service communication, Web Services Description Language (WSDL) for service description, Universal Description, Discovery, and Integration Infrastructure (UDDI) for registering and discovering services, and the Business Process Execution Language (BPEL) for service composition. A plethora of WS-* specifications also exists to describe the full spectrum of activities related to Web services in topics such as reliable messaging, security, privacy, policies, event processing, and coordination, to name but a few.

Leading international conferences, such as the International Conference on Service-Oriented Computing (ICSOC), the International Conference on Web Services (ICWS), the International Conference on Service Computing (SCC), and others, have spearheaded groundbreaking research efforts. This has led to the emergence of novel topics such as semantic Web services, automated Web service composition, Web service recommendations, quality of service, trust, and a range of other interesting themes. Related conference series such as Web Engineering, Cloud Computing, Business Process Management, HCI, and Database related conferences, have all been strongly influenced by the emergence of Web services and consistently feature Web service related topics in their calls for papers. These conferences contribute to the wealth of knowledge that is growing exponentially around Web services.

The content of this book and that of its companion book *Advanced Web Services* (Springer, 2013) reflect such activities. It is a testimonial of the leading role of its editors and their highly influential work in the area of Web services. Together, both books cover an enormous wealth of important topics and technologies that mirror the evolution of Web services. They provide an exhaustive overview of the challenges and solutions of all major achievements pertaining to Web services. Each chapter is an authoritative piece of work that synthesizes all pertinent literature and highlights important accomplishments and advances in its subject matter.

To my knowledge, this is the first attempt of its kind, providing complete coverage of the key subjects in Web services. I am not aware of any other book that is as thorough, comprehensive and ambitious in explaining the current state of the art of scientific research and in synthesizing the perspectives and know-how of so many experts in the field. Both books are a must-read for everyone interested in the field. They cater for the needs of both novices to the field as well as seasoned researchers and practitioners. They are a major step in this field's maturation and will serve to unify, advance, and challenge the scientific community in many important ways.

It is a real pleasure to have been asked to provide the foreword for this book collection. I am happy to commend the editors and authors on their accomplishment, and to inform the readers that they are looking at a landmark in the development of the Web services field. Anybody serious about Web services ought to have handy a copy of *Web Services Foundations* and *Advanced Web Services* in their private library!

Tilburg, The Netherlands Michael P. Papazoglou
December 2012

# Preface

Web Service technology is undeniably the preferred delivery method for the Service-Oriented Computing (SOC) paradigm. It has evolved over the years to be a comprehensive, interdisciplinary approach to modern software development. Web services have gone beyond software componentization technology to embody and express the software manifestation of a general trend transforming our modern society from an industrial, production-centric economy into a digital, service-centric economy. Web services aim to provide the missing conceptual links that unify a variety of different disciplines, such as networking, distributed systems, cloud computing, autonomic computing, data and knowledge management, knowledge-based systems, and business process management. Web services are the technological proxies of services that power much of the developed and increasingly developing economies. In this respect, Web services play a central role in enabling and sustaining the growth of service-centric economies and help modernizing organizations, companies and institutions also from an IT perspective.

Over the last decade, Web services have become a thriving area of research and academic endeavors. Yet, despite a substantial body of research and scientific publications, the Web services community has been hitherto missing a one stop-shop that would provide a consolidated understanding of the scientific and technical progress of this important subject. This book (the second of a two-book collection) is a serious attempt to fill this gap and serve as a primary point of reference reflecting the pervasive nature of Web services.

This book is the first installment of a two-book collection (we discuss the advanced topics in the second book, *Advanced Web Services*, Springer, 2013). Together, they comprise approximately 1,400 pages covering state-of-the-art theoretical and practical aspects as well as experience using and deploying Web services. The collection offers a comprehensive overview of the scientific and technical progress in Web services technologies, design, architectures, applications, and performance. The first book of the collection consists of two major parts:

I Foundations of Web Services (12 chapters)—It explores the most representative theoretical and practical approaches to Web services, with a special focus on the general state-of-the-art approaches to Web service composition;
II Service Selection and Assisted Composition (16 chapters)—It focuses on other aspects of Web service composition problem, specifically takes a deep look at non-functional aspects (e.g., quality of service), Web service recommendations, and how Web service composition is made easy for less expert developers.

The second book (*Advanced Web Services*, Springer, 2013) consists of three major parts:

I Advanced Services Engineering and Management (11 chapters)—It explores advanced engineering problems, such as Web service transactions and recovery, security and identity management, trust and contracts, and Web service evolution and management;
II Web Service Applications and Case Studies (5 chapters)—It covers concrete scenarios of the use of Web service technology and reports on empirical studies of real-world Web service ecosystems;
III Novel Perspectives and Future Directions (10 chapters)—It surveys approaches of the applications on how the Web service paradigm can be applied to novel contexts, such as human-centric computing, human work and the Internet of Things, and discusses the value of Web services in the context of mobile and cloud computing.

The topics covered in the collection are reflective of their intent: they aim to become the primary source for all pertinent information regarding Web service technologies, research, deployment and future directions. The purpose of the two books is to serve as a trusted and valuable reference point to researchers and educators who are working in the area of Web services, to students who wish to learn about this important research and development area, and to practitioners who are using Web services and the service paradigm daily in their software development projects.

This collection is the result of an enormous community effort, and their production involved more than 100 authors, consisting of the worlds leading experts in this field. We would like to thank the authors for their high-quality contributions and the reviewers for their time and professional expertise. All contributions have undergone a rigorous review process, involving three independent experts in two rounds of review. We are also very grateful to Springer for their continuous help and assistance.

Melbourne, Australia, December 2012 — Athman Bouguettaya
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