Preface

During the last couple of decades, computing platforms have evolved into the wide-array deployment of distributed computing systems. The traditional client/server computing concepts have slowly matured into cloud computing systems. However, a cloud computing platform is a geographically distributed computing platform, fundamentally. On the other hand, cloud computing and design have added additional layers of transparency to the distributed computing platforms and improved commercial viability. Undoubtedly, cloud computing platforms will continue to see widespread application, globally improving quality of life in the era of Information Technology in the 21st century.

However, the cloud computing platforms face a set of technical challenges. The technical challenges stem from the scale of cloud computing infrastructure distributed geographically and the difficulties in resource monitoring as well as provisioning of computing resources to the end-users due to the geodistributed nature of cloud computing platforms. In the present form, the cloud computing platforms are designed as an extended platform of traditional distributed computing systems with additional layers of transparencies. Arguably, the truly large-scale cloud computing systems having continental-level distributions need fast as well as reliable networks, security, and optimal resource monitor enhancing utilizations of computing resources in the systems. These requirements bring in the issues related to large-scale distributed software engineering while designing and deploying the cloud computing software infrastructures. The heterogeneity of cloud computing platforms enhances the design and deployment challenges due to difficulties in achieving computational interoperability between heterogeneous nodes. On the contrary, it is evident that the computing systems in the future will increasingly tend to support cloud as well as distributed computing platforms by overcoming the challenges in order to avail the greater advantages of such platforms.

As a result, the area of cloud computing is brimming with innovative ideas, research issues, and applications at different dimensions to solve the existing technical challenges. This book is a timely effort to present and comprehend the technological concepts, current trends, and future directions in cloud (distributed) computing systems. The book is divided into six sections, namely “Introduction to Systems,” “Resource Management,” “Control and Monitoring,” “Concurrency and Models,” “Applications,” and “Security.”

The “Introduction” section of this book provides systems perspectives and design aspects of the heterogeneous cloud (distributed) systems. There is one chapter in this section dealing with the issues related to interoperability of computing nodes in the cloud computing systems. It describes the mechanisms to overcome the interoperability issues of heterogeneous cloud computing platforms.

Next, the issues of distributed resource management in the cloud computing environment are addressed in the “Resource Management” section of this book. This section contains three chapters. The first chapter of this section describes the design and deployment of network-aware Virtual Machines
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(VMs) in the cloud computing infrastructures, which is an essential element of a cloud platform deployment. The second chapter of this section explains how the cloudlet technology can be designed to implement resource monitoring as well as provisioning in cloud computing infrastructures. The third chapter addresses the issues related to energy consumption and QoS in big data centres, where such big data centres are realized utilizing the cloud computing platforms.

In the next section, the computational and resource control as well as monitoring methods are described. “Control and Monitoring” contains three chapters. The first chapter of this section describes mechanisms to implement service-level agreements as well as resource-utilization monitor in the cloud computing infrastructures. The second chapter of this section deals with the design and implementation challenges of a grid computing platform supporting virtual imaging computations. This chapter explains the issues and design solutions to implement grid computing executing virtual imaging applications. The third chapter of this section explains how the elasticity of cloud computing applications can be controlled, enhancing resource utilizations.

Next, the concurrency in parallel as well as virtual-parallel computations and communication are addressed in detail in the “Concurrency and Models” section of this book. This section contains one chapter on various aspects of parallel and distributed communication mechanisms. This chapter describes the synchrony issues in network communications and the designing of message-passing interfaces.

In the next section, a set of high-end cloud computing applications are presented. “Applications” contains two chapters. The first chapter of this section describes how the cloud computing platforms can be utilized to analyze structural bioinformatics applications. The second chapter of this section illustrates the design approach of healthcare applications by using cloud computing platforms. A set of technical challenges are identified.

Finally, “Security” deals with cloud computing security. This section contains two chapters. The first chapter of this section explains the mechanisms of implementing secured user-access control to cloud computing platforms. A set of security issues and their solutions are illustrated in the second chapter of this section. This chapter explains the cloud computing security issues having broad perspectives.

This book is a useful resource to the Computer Science/Information Technology students, computer scientists, as well as practicing engineers in the domains of cloud and distributed computing systems. The audiences of this book are comprised of advanced undergraduate students and graduate students in Computer Science or Information Technology. The computer scientists will find this book an attractive reference to consult with. This book is also an attractive choice for reading to practicing engineers and computer technologists in the domain of cloud and distributed computing systems.

This book presents introductions, key definitions, design methods, applications, and open research issues in cloud (distributed) computing systems in one place, making it a very complete book on the topics having wide technical coverage.

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