Preface

This book is addressed to a rather broad audience, encompassing anyone who is looking at cloud computing to use it, to learn more about it, or to apply it to her needs. Cloud computing is a buzzword in recent years, so diverse ranges of people need to understand it from different points of view.

This book aims to capture the interest of Information Technology practitioners, various engineers, managers, businesses, industries, and experimental scientific communities. More specifically, those who are in the grey area of usage, technical, and scientific profiles, and those practitioners (actual or potential end users) who need to attain the knowledge of novel and pervasive technologies. In addition, readers who want or need to learn essential but formal and rigorous technical materials of cloud computing may consider this book as a fruitful resource.

Very often it happens that as fast as IT-related technologies and their trends appear, they will disappear. In the computing landscape, “Application Service Provider,” “Service-Oriented Architecture,” “Services Architecture,” and “Grid Computing” are a few technologies that appeared and disappeared quickly because of reasons like the emergence of contemporary and complementary technologies. How about cloud computing? Will this be true for this emerging technology? This is a question we are going to investigate in this book.

In this book, we consider cloud computing as a core topic and various things emerging around it such as its services and delivery models, its economic aspects, applications, usages, challenges, and so on.

Many design and architectural patterns are emerging around cloud computing that make it difficult to fit everything into a perfect definition. For instance, from the marketing point of view, the term cloud computing is vague and somewhat meaningless because of its extensive overuse and misuse. In recent years, whatever an IT vendor sold, it somehow called cloud computing.

In chapter 1, we describe cloud computing from different angles. We clear up some misconceptions and ambiguities about it to reach a sound understanding of the topic. Then, we enumerate cloud attributes and its essential characteristics. This chapter aims at all categories of audiences. Chapter 2 is devoted to the introduction of emerging technologies centered around cloud computing. From the technological point of view, cloud computing was born as a result of the emergence and the convergence of contemporary technologies. This chapter regards tech-
nological aspects of cloud. In the software area, Virtualization Technology and Web Services; in the hardware area, shared compute components (i.e., multicore processors); in networking, Security, Virtual Private Network (VPN), and Network Overlay are the promising and motivating technologies for the future complex computing infrastructures. In this chapter, we review these technologies and describe how they contribute to the anatomy and the characteristics of cloud computing. It addresses those readers who need to know about the technologies behind cloud computing such as Information Technology practitioners and computer engineers.

The term cloud computing covers a range of delivery and service models. In chapter 3, cloud service delivery models (i.e., Software-as-a-Service, Platform-as-a-Service and Infrastructure-as-a-Service) and cloud deployment models (private cloud, community cloud, public cloud, and hybrid cloud) are described. With the aforementioned themes, this chapter is devoted to cloud users like IT engineers, industrial users, and experimental scientists.

Standardization is a key answer and solution to our main question in this book (i.e., whether cloud computing will survive and remain on IT trends track or not). Standardization will bring interoperability, integration, and portability to the cloud computing landscape. Cloud standardization needs to be addressed at various layers of a cloud infrastructure such as: Virtual Machine Format, Data, Interface, Context, and Identity Layers. Chapter 4 reviews the emerging standards from the side of various organizations and standard bodies. It targets IT practitioners, managers, and IT engineers.

The other big challenge for adoption and survival of cloud computing is security. Although cloud computing has been widely accepted in the enterprise and its usage is growing exponentially, a worry still exists about the security risks. How can a company be sure that is getting a secure cloud computing solution whose implementation is secure in every possible aspect? Chapter 5 discusses this important issue and enumerates some initiatives to address it. This chapter has a broad audience from cloud users to managers and IT engineers who need to know about security aspects of cloud computing.

The huge amount of data generated from various environments represents a significant source of information and knowledge, and therefore, it needs to be efficiently managed and processed. For this purpose, high performance and advanced computing and scalable storage facilities and tools become essential. In chapter 6, the management of big data is analyzed and described with reference to the clouds, introducing some significant issues like data security and data integrity. Some specific data mining techniques are detailed and some real life applications are described. Therefore, its audience mainly consists of IT engineers and practitioners.

Economic benefits of cloud adoption are the main drivers and motivations of making cloud as ubiquitous an IT paradigm as it is becoming. Public cloud computing can avoid capital expenditures because no hardware, software, or network devices need to be purchased. Cloud
usage is billed on actual use only and is therefore treated more as an expense. In turn, usage-based billing lowers the barrier to entry because the upfront costs are minimal. These economic aspects of cloud computing are discussed in chapter 7. We investigate whether cloud could be beneficial from economical points of view. Managers, economists, and IT decision makers are the main audience of this chapter.

Cloud computing is well-suited to support the multi-company business processes inherent in any supply chain of manufacturing, beginning with business applications as a service, followed by other cloud aspects such as development platforms. In chapter 8, the current usage of cloud in industry and manufacturing sectors are reviewed. This chapter gives useful information to business and industrial managers and practitioners.

Cloud computing is gaining consideration in the commercial world, with companies like Amazon, Google, and Yahoo! offering pay-to-play cycles to help organizations meet cyclical demands for extra computing power. Cloud computing technologies and service models are attractive to scientific computing users as well due to the ability to get on-demand access to resources, to replace or supplement existing systems, as well as the ability to control the software environment. Scientific computing researchers and resource providers servicing these users are considering the impact of these new models and technologies. Chapter 9 describes how cloud is helping researchers to accelerate scientific discovery by transforming manual and difficult tasks into the cloud. Thus, it particularly aims at experimental scientists.

Chapter 10 explores the connection between Operations Research and cloud computing. In particular, it demonstrates how the high intensive computational optimization tasks benefit from a cloud. For this purpose, some optimization problems that belong to linear programming, integer linear programming, stochastic programming, and logistics management are investigated. Then, it is shown how the optimization models and methods can support the process of designing and managing a cloud. For this purpose, the data center location problem, the workload distribution problem, the virtual machine allocation problem, and the partner provider selection problem are addressed. In addition, the relation between simulation-based optimization and cloud computing is highlighted.

Chapter 11 aims to discuss the intersection of cloud computing with healthcare. This is done by describing the advantages and benefits as well as the criticisms. The chapter also contains a useful and illustrative case study. In summary, the potential audience of this contribution mainly consists of medical experts, researchers, healthcare managers, and users.

Green computing is a research topic mostly developed in recent years to address climate and energy challenges of the world. Chapter 12 explores green computing. It envisions the duality of green computing with technological trends in other fields of computing such as High Performance Computing (HPC) and cloud computing on one hand and economy and business on
the other hand. For instance, in order to provide electricity for large-scale cloud infrastructures and to reach exascale computing, we need huge amounts of energy. Thus, green computing is a challenge for the future of cloud computing and HPC. Alternatively, clouds and HPC provide solutions for green computing and climate change. In this chapter, we discuss this proposition by looking at the technology in detail.

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