

Preface to third edition

This text targets a broad audience, including the large number of individuals without a formal training in computer science, yet addicted to cloud computing, who want to optimize their applications and wish to better understand the inner workings of intricate systems such as computer clouds. The text could also be useful to software engineers tempted to exploit concurrency and take advantage of the computing power of multicore processors, graphics processing units, and tensor processing units. Graduate students who conduct research on different aspects of organization and management of computer clouds and complex systems could benefit from research sections marked (R) in several chapters.

Cloud computing has had a transformative impact not only on how we compute today but also on the algorithms we use and on computer systems' hardware and software. The text tracks the evolution of ideas in the field striving to maintain a delicate balance between what a gardener would call perennials, i.e., theoretical concepts mostly invariant in time and critical for understanding and exploiting concurrency, and annuals, i.e., practical recipes with a limited lifespan, helpful for using computer clouds now.

Any text dedicated to cloud computing must be periodically updated to keep up with the breathtaking evolution of cloud computing engines, the cloud software stack, cloud interconnection networks, and applications. The third edition of this book includes a reorganization of chapters, major revisions of most chapters, cloud computing applications to machine learning, Big Data, and other important areas, and a new chapter on emerging clouds.

Chapters 1 and 2 give an informal introduction to computer clouds and to the cloud ecosystem. Cloud computing is intimately tied to parallel and distributed processing, and Chapter 3 introduces important theoretical and practical concepts related to parallel and distributed computing. Chapters 4 and 5 discuss the cloud infrastructure and virtualization critical for facilitating access to cloud resources. Chapter 6 is dedicated to communication and cloud access and presents the cloud networking infrastructure, interconnection networks, and a scalable data-center communication architectures. Chapter 7 covers storage models, storage reliability at scale, and database services. Chapter 8 is dedicated to cloud security, and Chapter 9 covers resource management and scheduling.

The next three chapters are focused on the other important component of the cloud ecosystem, cloud applications. Chapter 10 covers subjects critical for understanding and using concurrency, including computational models, atomic actions, load balancing, and consensus protocols. Chapter 11 dissects the components of the cloud software stack and the frameworks supporting processing of large data sets. Chapter 12 analyzes challenges posed by Big Data, data streaming, mobile applications, and edge computing. Chapter 13 covers emerging clouds including cloud services supporting machine learning, quantum computing on clouds and vehicular clouds; the vehicular clouds section is written by one of the pioneers of this field, Prof. Stefan Olariu from the Old Dominion University.

Appendix A presents several cloud projects in large-scale simulations and cloud services, including applications when multiple design alternatives are evaluated concurrently, as well as Big Data applications in computational sciences and machine learning applications. Appendix B covers cloud application development. Some 540 references are cited in the text. A glossary and a list of abbreviations are also provided. The author is grateful for the advice and support of Stephen Merken and the Morgan Kaufmann team.

Teaching ancillaries for this book, including solutions manual, PowerPoint lecture slides, and image bank, are available online to qualified instructors. Visit <https://inspectioncopy.elsevier.com/book/details/9780323852777> for more information and to register for access.