PREFACE

ABOUT THE BOOK

Companies today are undergoing digital transformation to build agile IT infrastructures that not only provide traditional IT support functions, but also enable innovation in business operations and planning. Rather than custom solutions that lock them into legacy systems, companies want flexible and cost-effective solutions that leverage the cloud's potential. Migrating to the cloud opens exciting new opportunities.

Microservices architecture offers a way to realize complex, cloud-native systems by decomposing functionality into numerous independent services that work together. This reduces overall complexity, allows quicker changes to meet shifting business needs, and enables efficient scaling for performance and reliability. Microservices are especially well-suited for cloud platforms and facilitate reorganization of development and operations (DevOps) methods to suit faster delivery schedules.

However, a gap exists between academic coverage of microservices patterns and actual deployment of microservices-based solutions on real cloud platforms. Many excellent resources focus on architectural principles but do not provide clear guidance on implementation. Conversely, books on specific cloud providers emphasize hands-on skills but fail to provide foundational knowledge to evaluate solutions properly or transfer learning across platforms.

This textbook bridges the gap by enabling readers to rapidly grasp microservices concepts and then deploy practical microservices applications on real cloud platforms. We provide the requisite technical grounding to assess and utilize various cloud services while explaining why particular implementation choices are made. With hundreds of figures and tested code samples, we offer a rigorous, hype-free guide to developing robust cloud-native apps.

The book meets the need for educational programs at colleges and universities to train the next generation of cloud solutions architects and DevOps engineers. It accompanies cloud computing curricula and certification programs where students seek valuable hands-on experience on commercial cloud platforms to complement conceptual knowledge.

The typical reader is a senior undergraduate or beginning graduate student in science, technology, engineering, or mathematics (STEM) fields who has completed introductory

programming courses. The book provides the necessary guidance and knowledge for readers to develop working code for cloud-based microservices applications. We believe augmenting traditional classroom learning with practical coding exercises significantly enhances the learning process. Additional student support resources are available on the book's companion website.

The textbook comprises twelve chapters delivering in-depth coverage of key concepts, technologies, and architectural patterns for cloud-based microservices. Our competency development approach aims to equip readers with practical skills rather than dwell on theory covered adequately elsewhere. While we refer frequently to commercial cloud providers' offerings, this textbook does not constitute an endorsement of any vendor, product, or service. All trademarks belong to their respective owners. The perspectives presented reflect the authors' opinions solely.

We offer a book that allows readers to quickly understand what microservices are and then deploy them on real cloud platforms, while providing the necessary technical background to guide them to improve their understanding and competency in evaluating and using cloud-based platforms. We have organized it so that it can be taught within a semester. We have provided running examples that explain the foundations of how and why the applications are implemented in a particular way, be they in a 'serverless manner' or a 'container-based approach'. Such a course can then be followed by a course that applies and extends these principles to establish a DevSecOps framework for efficient and powerful cloud application development and deployment.

Please also refer to our books "Cloud Computing: A Hands-On Approach", "Internet of Things: A Hands-On Approach", "Big Data Science & Analytics: A Hands-On Approach", "Blockchain Applications: A Hands-On Approach", and "Cloud Computing Solutions Architect: A Hands-On Approach" that provide additional and complementary information on these topics. We are grateful to the Association of Computing Surveys (ACM) for recognizing our book on cloud computing as a "Notable Book of 2014" as part of their annual literature survey. We are also grateful to the universities worldwide that have adopted these textbooks as part of their program offerings for providing us feedback that has helped us in improving our offerings

BOOK WEBSITE

For more information on the book, the copyrighted source code of all examples in the book, lab exercises, and instructor material visit the book website: www.hands-on-books-series.com

ACKNOWLEDGMENTS

From Arshdeep Bahga
I would like to thank my father, Sarbjit Bahga, for inspiring me to write books and sharing his valuable insights and experiences on authoring books. This book could not have been completed without the support of my mother Gurdeep Kaur, wife Navsangeet Kaur, sons Navroz and Nivaaz, who have always motivated me and encouraged me to explore my interests.

From Vijay Madisetti
I thank my family, especially Anitha and Jerry (Raj), and my parents (Prof. M. A. Ramlu and Mrs. Madhavi Saroja Ramlu) for their support.

From the Authors
We would like to acknowledge the instructors who have adopted our earlier books in the "A Hands-On Approach"™ series, for their constructive feedback.

ABOUT THE AUTHORS

ARSHDEEP BAHGA

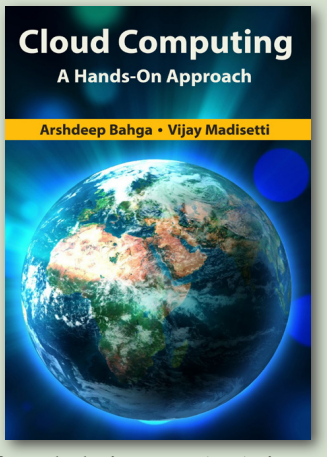
Arshdeep Bahga is a computer science researcher noted for his research work and textbooks in the areas of Blockchain, Internet of Things, Cloud Computing and Big Data. Arshdeep completed Masters degree in Electrical & Computer Engineering from Georgia Institute of Technology in 2010. He worked as Research Scientist with Georgia Tech from 2010-2016. Arshdeep has to his credit several scientific publications in peer-reviewed journals and technology patents. Arshdeep received the 2014 Roger P. Webb - Research Spotlight Award from the School of Electrical and Computer Engineering, Georgia Tech.

VIJAY MADISETTI

Vijay Madisetti is a Professor in the School of Cybersecurity and Privacy (SCP) in the College of Computing at Georgia Institute of Technology. Vijay is a Fellow of the IEEE, and received the 2006 Terman Medal from the American Society of Engineering Education and HP Corporation.

COMPANION BOOKS FROM THE AUTHORS

CLOUD COMPUTING: A HANDS-ON APPROACH

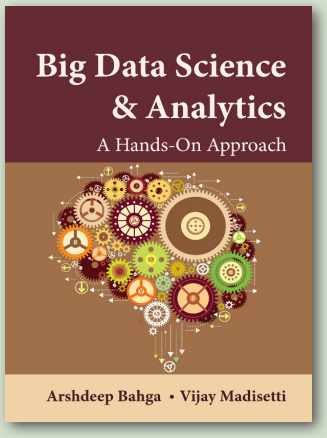


Recent industry surveys expect the cloud computing services market to be in excess of $20 billion and cloud computing jobs to be in excess of 10 million worldwide in 2014 alone. In addition, since a majority of existing information technology (IT) jobs are focused on maintaining legacy in-house systems, the demand for these kinds of jobs is likely to drop rapidly if cloud computing continues to take hold of the industry. However, there are very few educational options available in the area of cloud computing beyond vendor-specific training by cloud providers themselves. Cloud computing courses have not found their way (yet) into mainstream college curricula. This book is written as a textbook on cloud computing for educational programs at colleges. It can also be used by cloud service providers who may be interested in offering a broader perspective of cloud computing to accompany their customer and employee training programs.

INTERNET OF THINGS: A HANDS-ON APPROACH

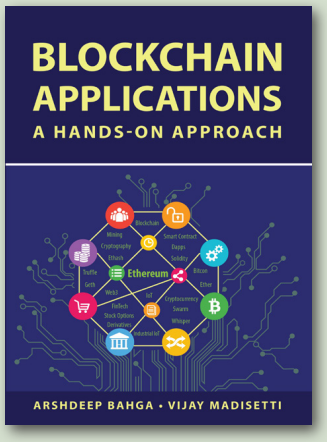
Internet of Things (IoT) refers to physical and virtual objects that have unique identities and are connected to the Internet to facilitate intelligent applications that make energy, logistics, industrial control, retail, agriculture, and many other domains "smarter". Internet of Things is a new revolution of the Internet that is rapidly gathering momentum driven by the advancements in sensor networks, mobile devices, wireless communications, networking, and cloud technologies. Experts forecast that by the year 2020 there will be a total of 50 billion devices/things connected to the Internet. This book is written as a textbook on the Internet of Things for educational programs at colleges and universities, and also for IoT vendors and service providers who may be interested in offering a broader perspective of Internet of Things to accompany their customer and developer training programs.

BIG DATA SCIENCE & ANALYTICS: A HANDS-ON APPROACH



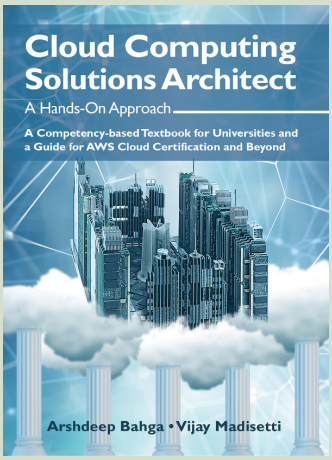
Big data is defined as collections of datasets whose volume, velocity, or variety is so large that it is difficult to store, manage, process, and analyze the data using traditional databases and data processing tools. Big data science and analytics deal with the collection, storage, processing, and analysis of massive-scale data. We have written this textbook for educational programs at colleges and universities, and also for big data service providers who may be interested in offering a broader perspective of this emerging field to accompany their customer and developer training programs. The book is organized into three main parts, comprising a total of twelve chapters. Part I provides an introduction to big data, applications of big data, and big data science and analytics patterns and architectures. Part II introduces the reader to various tools and frameworks for big data analytics, and the architectural and programming aspects of these frameworks, with examples in Python. Part III introduces the reader to various machine learning algorithms.

BLOCKCHAIN APPLICATIONS: A HANDS-ON APPROACH



Blockchain is a distributed and public ledger that maintains records of all the transactions on a blockchain network comprising suppliers of products and services and consumers. With the blockchain's ability to establish trust in a peer-to-peer network through a distributed consensus mechanism rather than relying on a powerful centralized authority, the technology is being seen by the industry experts as one of the greatest innovations since the invention of the Internet. The book is organized into three main parts, comprising a total of ten chapters. Part I provides an introduction to blockchain concepts, design patterns, and architectures for blockchain applications. A blockchain stack comprising a decentralized computation platform, a decentralized messaging platform, and a decentralized storage platform is described. Part II introduces the readers to tools and platforms for blockchain. Implementation examples of various smart contracts and decentralized applications (Dapps) are provided. The reader is introduced to the Whisper decentralized messaging platform and Swarm decentralized storage platform. Part III focuses on advanced topics such as the security and scalability related challenges for the blockchain platforms.

CLOUD COMPUTING SOLUTIONS ARCHITECT: A HANDS-ON APPROACH



Cloud computing is a transformative paradigm that enables scalable, convenient, on-demand access to a shared pool of configurable computing and networking resources, for efficiently delivering applications and services over the Internet. Amazon Web Services (AWS), a leading provider of cloud platforms and services, defines a cloud solutions architect as one who can provide solution plans for the best architectural practices for cloud applications, can design and deploy highly scalable and fault-tolerant services, can assist in lifting legacy applications and shifting them to the cloud, and can identify and plan for data entry and exit from the cloud platform, choose suitable cloud services based on data, compute, and security requirements. Further, the cloud solutions architect also ensures that enterprise offerings conform to sound principles, such as AWS Well-Architected Framework (WAF) for cloud applications and services. This book is written as a textbook for training the next generation of cloud solutions architects for educational programs at colleges and universities, and also accompanying cloud certification programs where students would be interested in obtaining valuable hands-on skills on actual cloud platforms to further develop their knowledge and competency base. The book is organized into twenty chapters that provide in-depth coverage of concepts, technologies, and architectures related to cloud computing environments and cloud applications. The reader is also introduced to specialized aspects of cloud computing, including serverless computing, cloud security, and big data analytics.