

# Preface

Cloud computing provides shared resources (e.g., infrastructure, platform, and software) as services. Service-oriented architecture (SOA) is the technical foundation of cloud computing, whereby services offered by different cloud providers are discovered and integrated over the Internet. Quality-of-Service (QoS) is widely employed to represent the non-functional performance of services and has been considered as the key factor to differentiate the qualities of service candidates. It becomes important to evaluate the QoS performance of services.

However, QoS evaluation is time- and resource-consuming. Conducting real-world evaluation is difficult in practice. Moreover, in some scenarios, QoS evaluation becomes impossible (e.g., the cloud provider may charge for service invocations, too many services to be evaluated). Therefore, it is crucial to study how to build effective and efficient approaches to predict the QoS performance of services.

In this book, we propose QoS prediction, a novel principle for enabling the QoS-aware approaches. We first formally identify the QoS prediction problem and propose three QoS prediction methods, which utilize the users' past usage experiences. The first prediction method employs the information of neighborhoods for making QoS value prediction and engages matrix factorization techniques to enhance the prediction accuracy. The second method provides time-aware personalized QoS value prediction service. The third method employs time information for efficient online performance prediction.

The predicted QoS values can be employed to a variety of applications in cloud and service computing. We demonstrate the benefits in two QoS-aware applications in this book. The first application employs QoS information to build a Web service search engine, which helps users discover appropriate Web services to fulfill both functional and non-functional requirements. The second application employs dynamic QoS information to build robust Byzantine fault-tolerant cloud systems.

This book is intended for professionals involved in cloud computing and graduate students working on the QoS-related problems. It is assumed that the reader has a basic knowledge of mathematics, as well as a certain background in cloud computing. The reader can get an overview of the QoS prediction research

area. We hope this monograph will be a useful reference for students, researchers, and professionals to understand three basic methodologies of QoS prediction. This book can be used as a starting point for QoS-related research topics. The readers can immediately conduct extensive researches and experiments on the real-world QoS datasets released in this book.

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