

# Preface

The growth of the Internet over the past decade, together with the promise of lower costs to the customer, has led to the rapid emergence of Voice over Internet Protocol (VoIP). This growth has been further fueled by the rapid penetration of the broadband all over the world. As a real-time application served by the Internet, VoIP faces many challenges such as availability, voice quality, and network security. This book addresses three important issues in VoIP networks: quality of service, pricing and security.

In addressing Quality of Service (QoS), this book introduces the concept of delay not exceeding an upper limit, termed the bounded delay (rather than the average delay), to measure the QoS in VoIP networks. Queuing models are introduced to address performance in terms of bounded delays. Closed form solutions, relating the impact of bounding delays on throughput of VoIP traffic, are developed. Traffic that exceeds the delay threshold is treated as lost throughput. The results addressed can be used in scaling resources in a VoIP network for different thresholds of acceptable delays. Both single and multiple switching points are addressed. The same notion and analysis are also applied on jitter, another important indicator of the VoIP QoS.

This book also develops a pricing model based on the QoS provided in VoIP networks. It presents the impact of the quality of VoIP service demanded by the customer on the transmission resources required by the network using an analytical approach. The price to be paid by the customer, as developed in this book, is based on the throughput meeting the performance criterion and the network transmission resources required. In particular, the impact of the QoS, as developed in this book, can be used in the design of VoIP networks in a way that would provide fairness to the user in terms of quality and price while optimizing the resources of the network at the same time.

This book also extends and applies the bounded-delay throughput analysis developed for VoIP networks in assessing the impact of risks constituted by a number of transportation channels, where the risk associated with each channel can be quantified by a known distribution. This discussion presents another

application where the methodology developed in this book can be used successfully.

The overall economics of VoIP is addressed in [Chap. 9](#). While the earlier chapters in the book have focused on consumption of bandwidth, this chapter discusses several factors that ultimately determine price to the user.

Security is a matter of concern in VoIP. For VoIP security, this book mainly focuses on signaling authentication. It presents a networking solution that incorporates network-based authentication as an inherent feature. The authentication feature that we propose introduces a range of flexibilities not available in the legacy network commonly known as the Public Switched Telephone Network (PSTN). Since most calls will likely terminate on the network of another service provider, the book also presents a mechanism that networks can use to authenticate each other. This mechanism affords the possibility of authentication across networks. Finally, this book explores areas for future research that can be built on the foundation of the research presented.

The book incorporates research conducted by the authors over a four-year period through 2009. VoIP is a rapidly growing application driven not only by lower costs but also by the availability of innovative applications that can be rapidly designed. Mobility can be considered another feature that is inherent in VoIP. Industry, academic researchers and graduate students can use this book. It is the authors' hope that it will offer a framework within which the users' interest (as perceived through QoS and pricing) and the service provider's interest in satisfying the customers' needs can be balanced without sacrificing profitability commensurate with investment.



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