

Preface

Overview

This book arose from a conversation at the Internet Network Management workshop (INM) in 2007. INM'07 was subtitled “The Five Nine’s Workshop” because it focused on raising the availability of Internet services to “Five Nine’s” or 99.999%, an availability metric traditionally associated with the telephone network. During our conversation, we talked about and vehemently agreed that there was a need for a comprehensive book on reliable Internet services and applications – a guide that would collect in one volume the accumulated wisdom of leading researchers and practitioners in the field.

Networks and networked application services using the Internet Protocol have become a critical part of society. Service disruptions can have significant impact on people’s lives and business. In fact, as the Internet has grown, application requirements have become more demanding. In the early days of the Internet, the typical applications were nonreal-time applications, where packet retransmission and application layer retry would hide underlying transient network disruptions. Today, applications such as online stock trading, online gaming, Voice over IP (VoIP), and video are much more sensitive to small perturbations in the network. For example, following one undersea cable failure in the Pacific, AT&T restored the service on an alternate route, which introduced 5 ms of additional packet delay. This seemingly small additional delay was sufficient to cause problems for an enterprise customer that operated an application between a call center in India and a data center in Canada. This problem led to subsequent re-engineering of the customer’s end-to-end connection.

In addition, networked application services have become an increasingly important part of people’s lives. The Internet and virtual private networks support many mission critical business services. Ten years ago, it would have been just an inconvenience if someone lost their IP service. Today, people and businesses depend on Internet applications. Online stock trading companies are not in business if people cannot implement their trades. The Department of Defense cannot operate their information-based programs if their information infrastructure is not operating. Call centers with VoIP services cannot serve their customers without their IP network.

Although we started work on this book with a focus on network reliability, it should be obvious from the preceding description that it is important to consider both reliability and performance, and to consider both networks and networked application services. Examples of networked applications include email, VoIP, search engines, ecommerce sites, news sites, or content delivery networks.

Features

This book has a number of features that make it a unique and valuable guide to reliable Internet services and applications.

Systematic, interdisciplinary approach: Building and operating reliable network services and applications requires a systematic approach. This book provides comprehensive, systematic, and interdisciplinary coverage of the important technical topics, including areas such as networking; performance, and reliability modeling; network measurement; configuration, fault, and security management; and software systems. The book provides an introduction to all of the topics, while at the same time, going into enough depth for interested readers that already understand the basics.

Specifically, the book is divided into seven parts. Part I provides an introduction to the challenges of building reliable networks and applications, and presents an overview of the structure of a large Internet Service Provider (ISP) network. Part II introduces reliability modeling and network capacity planning. Part III extends the discussion beyond a single network administrative domain, covering interdomain reliability and overlay networks. Part IV provides an introduction to an important aspect of reliability: configuration management. Part V introduces network measurements, which provide the underpinning of network management. Part VI covers network and security management, and disaster preparedness. Part VII describes techniques for building application services, and provides a comprehensive overview of capacity and performance engineering for these services. Taken in total, the book provides a comprehensive introduction to an important topic.

Coverage of pragmatic problems arising in real, operational deployments: Building and operating reliable networks and applications require an understanding of the pragmatic challenges that arise in an operational setting. This book is written by leading practitioners and researchers, and provides a unique perspective on the subject matter arising from their experience. Several chapters provide valuable “best practices” to help readers translate ideas into practice.

Content and structure allows reference reading: Although the book can be read from cover to cover, each chapter is designed to be largely self-contained, allowing readers to jump to specific topics that they may be interested in. The necessary overlap across a few of the chapters is minimal.

Audience

The goal of this book is to present a comprehensive guide to reliable Internet services and applications in a form that will be of broad interest to educators and researchers. The material is covered in a level of detail that would be suitable for an advanced undergraduate or graduate course in computer science. It can be used as the basis or supplemental material for a one-or-two semester course, providing a solid grounding in both theory and practice. The book will also be valuable to researchers seeking to understand the challenges faced by service providers and to identify areas that are ripe for research.

The book is also intended to be useful to practitioners who want to broaden their understanding of the field, and/or to deepen their knowledge of the fundamentals. By focusing our attention on a large ISP network and associated application services, we consider a problem that is large enough to expose the real challenges and yet broad enough to expose guidelines and best practices that will be applicable in other domains. For example, though the book does not discuss access or wireless networks, we believe that the principles and approaches to reliability that are presented in this book apply to them and are in fact, broadly applicable to any large network or networked application. We hope that you will find the book to be informative and useful.

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