Implementing Service Quality in IP Networks

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Preface

Development of packet-switched data communication networking technologies has been rapid in recent years, a phenomenon made possible by the open standardization process and the potential new territories for intellectual property creation. As a consequence, new ways of creating services have been devised, bringing more flexibility as compared to traditional telecommunications schemes. Such possibilities bring certain consequences with them – since services as such are no longer necessarily standardized and can be created rapidly, tailoring them to different access technologies is less feasible. New service creation models also allow for the existence of sole service providers making use of separate network transport operators' facilities. Interworking of different players of end-to-end service delivery requires advanced Service Level Agreement (SLA) handling capabilities between the parties involved.

This brings us to another major theme of this book, namely that of building a platform for converged service access. Internet Protocol (IP) has emerged as a tried-and-tested unifying end-to-end communication layer that can be run over multiple link layer technologies. Subsequently, using IP networks as a basis for providing end-to-end services makes perfect sense. The challenge to present-day IP networks comes from advanced real-time services such as streaming and voice/video conferencing, which are demanding applications from the viewpoint of network technology. This book addresses the service quality support technologies needed to deliver different types of content over IP network.

The economic environment of network operators has changed in the past years, becoming a very competitive business area. Price

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competition among players is at worst fierce, leading to the target of reduced operating costs for production networks. At the same time, the network operator must be able to provide service quality support to new services with as short time-to-market delays as possible. This situation calls for advanced management techniques and models for managing the resources of the multi-service network as effectively as possible.

A set of technologies and techniques known as traffic engineering addresses this need, providing for processes and frameworks to accommodate performance management of a network. The technologies belonging to this area, including measurements, multiprotocol label switching, and routing control in general, complement the capabilities of the IP protocol suite. The new, open Internet standardization process defines effective and scalable means of configuring the novel protocols complementing IP as the building blocks of multi-service networks. An example of such endeavours is the policy-based management work, bringing automated network configuration and management while at the same time raising the abstraction level of management.

In the chapters that follow, the steps needed to be taken to create and manage services in a multi-service IP network are presented. The vision of multi-service, multi-access networks with flexible service creation is presented first. A framework is developed for describing service quality, and the generic steps of service creation to service level specification are covered. The protocol tools available for managing service quality in IP environment are described within a service support framework. The managed technologies considered in this book include Internet Protocol versions 4 and 6 and Differentiated Services (DiffServ). The statistical service quality support model of DiffServ is compared with Integrated Services (IntServ) and Asynchronous Transfer Mode (ATM). Advanced IP service quality management techniques such as Multi-Protocol Label Switching (MPLS) and policy-based management are covered. Finally, the role of measurements and Service Level Agreements (SLAs) within the framework is described, and novel ideas such as the use of bandwidth broker and utility-based allocation of resources are discussed.

The approach of this book could perhaps be best described as a system level solution viewpoint, not going very deep into individual technologies while attempting to provide an overview of the relevant technologies.

This book represents the author's attempt to best capture the multi-faceted area of service quality in IP environment of today. Due to commercial factors and novel innovations, the reader is strongly encouraged to take heed of J.W. Goethe's advice:

> Gray, my friend, is all theory;
>
> Green only the tree of life.

ORGANIZATION OF MATERIAL IN THIS BOOK

Chapter 1 describes the technological and business scenario for multi-service networks. Chapter 2 describes the service quality requirements of IP service types in the network. Chapter 3 describes service quality support mechanisms that can be used in an IP-based access or transit network. Chapter 4 describes how traffic engineering processes can be used in optimizing the performance of a multi-service IP network domain, and technologies that can be used by policy management. Chapter 5 describes how services can be mapped to network resources in an IP domain as a part of an end-to-end service quality support chain. Chapter 6 describes technologies for service quality management and service level agreements (SLAs). Chapter 7 describes measurement technologies that can be used by service management and traffic engineering processes. Chapter 8 describes means of managing dynamic service quality within a DiffServ domain, and between Internet domains in general. Chapter 9 describes the implementation of service quality in IP RAN as a case study of the technologies discussed in the book. Chapter 10 summarizes the central themes of the book, and discusses potential emerging technologies relevant to the topic of the book.

Major interdependencies between chapters with respect to each other are illustrated by the matrix below.