
Preface

The Internet is changing. This statement has been true since the first messages were sent between two nodes years ago. “The telephone wire, as we know it, has become too slow and too small to handle Internet traffic. It took 75 years for telephones to be used by 50 million customers, but it took only four years for the Internet to reach that many users.”—these words by Lori Valigra emphasize this rapid development of the Internet.

Several milestones have been observed over the past 20 years from the user’s point of view. These include the development of websites, which have certainly meant that the Internet has become popular worldwide. The rapid progress in optical networks has enabled faster transmission with higher quality. Peer-to-peer networks have opened the door to sharing resources between users. Finally, as we see currently, streaming transmissions have transformed computers into user-friendly multifunctional machines. Moreover, new devices such as smart-phones and tablets have made the Internet present everywhere and for everyone.

Streaming transmissions supporting web services now generate the majority of Internet traffic [1]. It is a challenge for network operators to ensure proper Quality of Service (QoS) for such traffic without degrading other transmissions in the network. In many cases, the transmission rate is not the key point for these applications. The most important factors are the acceptance delay of the connection, transmission delay, packet loss, and connection reliability. To be up to these requirements, network operators usually add extra bandwidth rather than implement complicated QoS architectures.

Since 1994, when the IETF’s IntServ appeared, many QoS architectures have emerged. In this book, we present one of the most promising, relatively new architecture for Future Internet—Flow-Aware Networking (FAN)—which may solve existing problems. It guarantees appropriate quality for transmitted traffic, it is easy to implement, and it is net neutral. FAN eliminates the need for signaling, which has proved unscalable in the past. Despite its simple approach to QoS assurance, service differentiation in FAN works sufficiently well. The architecture is not flawless; however, some disadvantages are mitigated by several additional traffic management mechanisms proposed within the course of FAN evolution. The most important and promising solutions, mainly proposed and developed by the authors of this guide, are presented and analyzed.

Chapter 1 contains a survey of flow-oriented approaches which introduces the reader to the world of flow-based networking. This chapter shows the most visible solutions which are based on the concept of flows.

Chapter 2 presents an extensive description of FAN. Approximate Flow-Aware-Networking (AFAN) is analyzed as the latest concept in FAN realization. Chapter 3 presents the scope and evolution of the debate on network neutrality. Moreover, it shows why Flow-Aware Networking conforms to current or future resolutions.

Mechanisms for improving transmission performance of streaming flows under congestion are presented and analyzed in Chap. 4. Seven proposals for congestion control mechanisms, with extensive simulation analysis, are presented. Moreover, we show how problems caused by congestion may be solved in a multi-layer environment. Next, we describe new proposals for enhancing transmission in wired-wireless FAN. At the end of this chapter, we propose a new routing concept to be used in flow-aware networks. This enables maximum utilization of the available resources, reducing the negative aspects of congestion.

In Chap. 5, the aspects of fair transmission in FAN are analyzed. A new method for estimating the values of congestion indication parameters, as well as a new per-user fairness concept, is proposed. Algorithms that improve transmission of streaming flows when a failure occurs are presented and analyzed in Chap. 6. The ideas presented here ensure continuous transmission of streaming flows even when a link in a network fails. Chapter 7 presents FAN's capabilities in relation to service differentiation. We show how much differentiation can be achieved in FAN and at what cost. Also, the problem of transmission waiting time is described. The chapter focuses on delivering a promised level of service in FAN. Unfortunately, the design of FAN's original admission control features some problems. This chapter presents and compares several approaches to solving them.

The implementation aspects of the cross-protect router are described in Chap. 9. We also present the implementation suite, i.e., the Click modular router and the first tests results of the developed prototype.

This book is addressed to network engineers, students, operators, and everyone interested in the development of the Internet. It can also be a source of valuable information for everyone who wants to better understand the basic principles underlying modern networking technology.

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Reference

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Domżał, J.; Wójcik, R.; Jajszczyk, A.

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