UNIX Internetworking
Second Edition

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To my best friend and wife, Tina. To my heartbeats, Natasha and Nathan.

Preface to the First Edition

Just as TCP/IP is increasingly being accepted as the common thread to interconnect heterogeneous computer systems and X as the common denominator for graphical user interfaces, we find UNIX is slowly but surely asserting itself as the operating system for commercial organizations. This is despite the fact that the UNIX command interface is cryptic, and system configuration is no easy task.

The UNIX operating system of today supports features that are hard to find in any other operating system, past or present. For example, the flexibility the UNIX provides for client-server configuration of systems is unmatched. You can have UNIX nodes configured without any disk where the operating system is dynamically loaded from the network when the system starts up or you can have hundreds of processor loosely coupled together running UNIX and functioning as a CPU server for others. Most important, support for the TCP/IP protocols stack is built in to the UNIX kernel—it has been for a long time. UNIX. X and TCP/IP are the cornerstones of open system technology.

As we integrate UNIX systems in our environment, we need to understand how to configure a UNIX system on the network and how to configure an internetwork between UNIX and other technologies on the same network. The focus of this text is to take you through critical elements of the UNIX system and describe how they relate to the network, so that not only can we connect UNIX systems to the network, but also understand now to communicate between Novell, VAX/VMS, X, Macintosh, and DOS systems and UNIX host.

We begin by defining system and network protocol fundamentals. Next we examine the key elements of the UNIX system as they relate to networks: files, processes, and commands. Then we take a look at distributed computing technologies: NFS, NIS, and DNS. Chapter 4 turns to open, yet secure networks: there is a neeed to secure transactions on the network—this chapter emphasizes security—both for the operating system and the network. Chapter 5 details how to develop client-server applications—UNIX supports a rich set of interprocess and intersystem communication mechanisms, which this chapter describes. Finally, the last chapter focuses on internetworking: how to communicate between UNIX hosts and any other system in your environment, including Macintosh, DOS, X, and Novell systems.

Preface to the Second Edition

Both the UNIX industry and TCP/IP, the protocol stack that is the basis of the Internet, have grown incredibly in the last few years. When you seriously think about the basic building block for any computing environment, today, more than ever before, UNIX and TCP/IP are the natural choices. Anything else is expensive, proprietary, and not necessarily scaleable.

In a client/server computing environment, no operating system comes close to all of the advantages offered by UNIX. I think of price, performance, support for open industry standards, and most importantly, *flexibility* and *scaleability*. UNIX is it—be it database servers, compute servers, application servers, or communication servers. On the other side, from the smallest businesses to the largest global networks, the network protocol that is increasingly deployed is TCP/IP. TCP/IP is open, simple, and scaleable. Be it two PCs or the global Internet, TCP/IP is the global standard in designing networks.

My *motivation* in writing the second edition was to try and keep pace with the phenomenal changes in the UNIX and TCP/IP industry. My *approach* is to explain concepts and then describe step-by-step what it takes to configure and use specific protocols. The *style* is based on what I have learned from thousands of students nationwide—the style is practical and hands-on. Students who have attended my classes and you, the reader—your time is precious and your interest sincere. Hence, my objective is to be to the point and describe UNIX and network-related technologies in a clear, concise manner, so that you may apply the concepts to improve computing processes around you.

There are eight chapters in this book. Chapter 1 describes the fundamentals of UNIX especially as it relates to networks. Chapter 2 emphasizes network fundamentals with the focus on the TCP/IP protocol stack. Chapter 3 explains critical network related files, daemons (processes) and commands on UNIX systems. When you think of UNIX systems in a client/server computing environment, you think about NFS, NIS, NIS+ and DNS.

Distributed protocols, such as NFS, are emphasized in Chapter 4. Security concepts and terminology are described in Chapter 5, while Chapter 6 explains how to develop client/server applications. Chapter 7 details how to internetwork UNIX hosts with PC DOS, Windows, Novell NetWare, Apple

Macintosh, X Windows, and Windows NT systems. Chapter 8 describes how to effectively troubleshoot and manage UNIX and TCP/IP networks with technologies based on standards such as SNMP. The appendixes include some extremely useful references and UNIX and TCP/IP-related information including applications for Internet addresses and domain names.

All the examples specified in this text have been tested on Sun SPARCstation 2 systems running SunOS (BSD) 4.1.3 and Solaris (SVR4) 2.3.

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To my sister Jyoti—I wish you the best in academics and thanks for your encouragement and support—I am and will always be very proud of you. To my brother Mohnish, I wish you the very best in all your endeavors. To the best parents that anyone could have—I cannot indicate how thankful I am for the emphasis you placed on academics and learning, Papa and Mummy—thank you very, very much. Mother, Sri Aurobindo, and Ganesh—I am grateful for all your love and spiritual guidance.

To my children, Natasha and Nathan, you make a father proud. Tina, my best friend and companion for life, *this one is for you.* I love you with all my heart.

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