

Using and Administering Linux: Volume 3

Zero to SysAdmin:
Network Services

David Both

Apress®

Using and Administering Linux: Volume 3

David Both
Raleigh, NC, USA

ISBN-13 (pbk): 978-1-4842-5484-4
<https://doi.org/10.1007/978-1-4842-5485-1>

ISBN-13 (electronic): 978-1-4842-5485-1

Copyright © 2020 by David Both

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director, Apress LLC: Welmoed Spahr
Acquisitions Editor: Louise Corrigan
Development Editor: James Markham
Coordinating Editor: Nancy Chen

Cover designed by eStudioCalamar

Cover image designed by Freepik (www.freepik.com)

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail rights@apress.com, or visit <http://www.apress.com/rights-permissions>.

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at <http://www.apress.com/bulk-sales>.

Any source code or other supplementary material referenced by the author in this book is available to readers on GitHub via the book's product page, located at www.apress.com/9781484254844. For more detailed information, please visit <http://www.apress.com/source-code>.

Printed on acid-free paper

*This book – this course – is dedicated to all Linux and
open source course developers and trainers.*

:O{ :|:& }::

Table of Contents

About the Author	xvii
About the Technical Reviewer	xix
Acknowledgments	xxi
Introduction	xxiii
Chapter 1: Server Preparation	1
Objectives	1
Overview	1
Creating the VM.....	2
Installing Linux.....	3
Personalization	5
Chapter summary	5
Exercises.....	5
Chapter 2: Server Configuration	7
Objectives	7
Overview	7
Network configuration	7
Chapter summary	19
Exercises.....	19
Chapter 3: DHCP	21
Objectives	21
Overview of DHCP	21
Installing the DHCP server	22
Configuring the DHCP server	24

TABLE OF CONTENTS

- Configuring guest hosts 29
 - The dhcpd.conf file 31
- Chapter summary 32
- Exercises 32
- Chapter 4: Name Services 33**
 - Objectives 33
 - Introducing Domain Name Services 33
 - The /etc/hosts file 34
 - How a name search works 36
 - The DNS database 38
 - Common DNS record types 42
 - SOA 42
 - \$ORIGIN 43
 - NS 43
 - A 44
 - AAAA 44
 - CNAME 44
 - PTR 45
 - MX 45
 - Other records 46
 - Using BIND 46
 - Preparation 46
 - Setting up the caching name server 47
 - Configuring IPTables for DNS 50
 - Start the name service 53
 - Reconfiguring DHCP 55
 - Using the top-level DNS servers 56

Creating a primary name server	57
Creating the forward zone file	57
Adding the forward zone files to named.conf.....	58
Adding CNAME records.....	60
Creating the reverse zone file.....	62
Add the reverse zone to named.conf.....	63
Chapter summary	66
Exercises.....	66
Chapter 5: Remote Access with SSH	67
Objectives	67
Introduction.....	67
Starting the SSH server	68
How SSH works – briefly	70
Public/Private Key pairs	71
How PPKPs work	72
X-forwarding	78
The X Window System	80
Remote commands	81
Remote backups.....	83
Chapter summary	84
Exercises.....	85
Chapter 6: Routing and Firewalls	87
Objectives	87
Introduction.....	87
NIC configuration files.....	89
The ip command.....	90
Create an interface configuration File	90
The interface configuration file.....	93
Routing on a workstation	96

TABLE OF CONTENTS

- Network routing 97
- Creating a router 99
 - Preparation 100
 - Configure the new NIC..... 101
 - Reconfiguring DHCP 102
 - Reconfiguring DNS 106
- Setting up the router 110
 - Kernel configuration 110
 - Changing the firewall 112
- Complex routing..... 118
- Fail2Ban 119
- Chapter summary 123
- Exercises..... 123
- Chapter 7: Introducing Email 125**
 - Objectives 125
 - Introduction..... 125
 - Definitions 126
 - Email data flow 127
 - Structure of an email 129
 - Email headers..... 129
 - SendMail on the server 134
 - Sendmail installation..... 134
 - SendMail configuration 135
 - Firewall and DNS configuration..... 145
 - SendMail on the client 147
 - SMTP – The protocol 150
 - Email-only accounts 154
 - Who gets email for root?..... 155

Things to remember.....	157
It is not instant.....	157
There is no delivery guarantee.....	157
Chapter summary	158
Exercises.....	158
Chapter 8: Email Clients	159
Objectives	159
Introduction.....	159
More mailx	160
IMAP.....	163
Configuring IMAP on the server.....	163
Thunderbird.....	166
Adding authentication.....	170
Certificates	171
IMAP authentication	171
More about ports.....	175
Other considerations.....	185
Chapter summary	185
Exercises.....	186
Chapter 9: Combating Spam.....	187
Objectives	187
Introduction.....	187
The problem.....	188
But why?	189
My email server	189
Project requirements	190
Procmail.....	191
How it works.....	192
Preparation	193

TABLE OF CONTENTS

- Configuration..... 194
 - Configuring SendMail 194
 - Hacking mimedefang-filter..... 195
 - Setting up a mail folder 202
 - Configuring Procmail 203
 - Creating SpamAssassin rules..... 206
- Additional resources 212
- Chapter summary 212
- Exercises..... 213
- Chapter 10: Apache Web Server 215**
 - Objectives 215
 - Introduction..... 215
 - Installing Apache..... 216
 - Testing Apache..... 216
 - Creating a simple index file 219
 - Adding DNS..... 221
 - Using Telnet to test the web site..... 222
 - Good practice configuration..... 223
 - Virtual hosts 224
 - Configuring the primary virtual host..... 224
 - Configuring the second virtual host..... 226
 - Using CGI scripts..... 228
 - Using Perl 228
 - Using BASH..... 230
 - Redirecting the web page to CGI 231
 - Refreshing the page automatically..... 233
 - Chapter summary 233
 - Exercises..... 234

Chapter 11: WordPress	235
Objectives	235
Introduction.....	235
Install PHP and MariaDB	236
Install WordPress	237
HTTPD configuration	239
Creating the WordPress Database.....	240
Configuring WordPress.....	241
Administering WordPress.....	244
Updating WordPress.....	246
Exploring MariaDB	247
Chapter summary	249
Exercises.....	250
Chapter 12: Mailing Lists	251
Objectives	251
Introduction.....	251
Installing MailMan.....	252
Integrating MailMan with Apache	252
Site mailing list	253
Create a mailing list.....	256
Configuring the new list.....	257
Changing list defaults	259
The user interface.....	260
Rejections from large email services.....	262
Documentation.....	263
Chapter summary	264
Exercises.....	264

TABLE OF CONTENTS

- Chapter 13: File Sharing 265**
 - Objectives 265
 - Introduction..... 265
 - File sharing use cases 266
 - Preparation 268
 - FTP and FTPS 271
 - VSFTP 271
 - Installation and preparation of VSFTP 271
 - The FTP client..... 274
 - Firewall configuration for FTP 276
 - Anonymous FTP access..... 280
 - Securing VSFTP with encryption 282
 - NFS 284
 - NFS server 284
 - NFS client 291
 - Cleanup 292
 - SAMBA 293
 - Using the SAMBA client..... 299
 - Midnight Commander 302
 - Midnight Commander and SAMBA 306
 - Apache web server 306
 - Chapter summary 312
 - Exercises..... 313
- Chapter 14: Remote Desktop Access..... 315**
 - Objectives 315
 - Introduction..... 315
 - TigerVNC 316
 - Security..... 321

Problems	323
Blank TigerVNC view screen.....	323
Chapter summary	324
Exercises.....	324
Chapter 15: Network Time Protocol.....	327
Objectives	327
Linux and time	327
The NTP server hierarchy.....	328
NTP choices	329
Chrony structure	330
Client configuration.....	330
Configuring NTP with Chrony.....	334
Configuring the NTP server	334
Configuring the client and testing	336
chronyc as an interactive tool.....	338
Setting the hardware clock.....	339
About time zones	340
Chapter summary	343
Exercises.....	344
Chapter 16: Security.....	345
Objectives	345
Introduction.....	345
Advanced DNS security.....	346
About chroot.....	346
Enabling bind-chroot.....	346
Hardening the network	350
Advanced iptables.....	352

TABLE OF CONTENTS

- Advanced backups 355
 - rsync 356
 - Performing backups 360
 - Recovery testing 363
- Restrict SSH remote root login 363
- Malware 364
 - Root kits 364
 - Clam-AV 369
 - Tripwire 371
- SELinux 374
 - Additional SELinux considerations 380
- Social engineering 380
- Chapter summary 381
- Exercises 381
- Chapter 17: Advanced Package Management 383**
 - Objectives 383
 - Introduction 383
 - Preparation 384
 - Examining the spec file 388
 - Preamble 388
 - %description 390
 - %prep 390
 - %files 391
 - %pre 392
 - %post 392
 - %postun 392
 - %clean 393
 - %changelog 393
 - Building the RPM 394

Testing the RPM	396
Experimenting	397
Rebuilding a corrupted RPM database.....	398
Chapter summary	398
Exercises.....	399
Chapter 18: Where Do I Go from Here?	401
Introduction.....	401
Curiosity	401
Convert.....	402
Tools.....	403
Resources	404
Contribute	405
Skip this	405
Compiling the kernel	405
Chapter summary	406
Bibliography	409
Books	409
Web sites	410
Index.....	415

About the Author



David Both is an open source software and GNU/Linux advocate, trainer, writer, and speaker. He has been working with Linux and open source software for more than 20 years and has been working with computers for over 45 years. He is a strong proponent of and evangelist for the “Linux Philosophy for System Administrators.” David has been in the IT industry for over 40 years.

Mr. Both worked for IBM for 21 years and, while working as a Course Development Representative in Boca Raton, FL, in 1981, wrote the training course for the first IBM PC. He has taught RHCE classes for Red Hat and has worked at MCI WorldCom, Cisco, and the State of North Carolina. In most of the places he has worked since leaving IBM in 1995, he has taught classes on Linux ranging from Lunch’n’Learns to full 5-day courses. Helping others learn about Linux and open source software is one of his great pleasures.

David prefers to purchase the components and build his own computers from scratch to ensure that each new computer meets his exacting specifications. Building his own computers also means not having to pay the Microsoft tax. His latest build is an ASUS TUF X299 motherboard and an Intel i9 CPU with 16 cores (32 CPUs) and 64GB of RAM in a Thermaltake Core X9 case.

He has written articles for magazines including *Linux Magazine*, *Linux Journal*, and *OS/2* back when there was such a thing. His article “Complete Kickstart,” co-authored with a colleague at Cisco, was ranked 9th in the *Linux Magazine* Top Ten Best System Administration Articles list for 2008. He currently writes prolifically and is a volunteer community moderator for Opensource.com. He particularly enjoys learning new things while researching his articles.

David currently lives in Raleigh, NC, with his very supportive wife and a strange rescue dog that is mostly Jack Russell. David also likes reading, travel, the beach, old M*A*S*H reruns, and spending time with his two children, their spouses, and four grandchildren.

David can be reached at LinuxGeek46@both.org or on Twitter [@LinuxGeek46](https://twitter.com/LinuxGeek46).

About the Technical Reviewer

Klaatu Einzelganger is a UNIX geek, open source enthusiast, D&D nerd, and free-culture advocate. He has worked in the film and computing industry, often at the same time. He is one of the maintainers of the Slackware-based multimedia production project, <http://slackermedia.info>, and podcasts at gnuworldorder.info and hackerpublicradio.org.

Acknowledgments

Writing a book is not a solitary activity, and this massive three-volume Linux training course required a team effort so much more than most.

The most important person in this effort has been my awesome wife, Alice, who has been my head cheerleader and best friend throughout. I could not have done this without your support and love.

I am grateful for the support and guidance of Louise Corrigan, senior editor for open source at Apress, who believed in me and my vision for this book. This book would not have been possible without her.

To my coordinating editor, Nancy Chen, I owe many thanks for her hours of work, guidance, and being there to discuss many aspects of this book. As it grew and then continued to grow some more, our discussions were invaluable in helping to shape the final format of this work.

And to Jim Markham, my development editor, who quietly kept an eye and a guiding hand on the vast volume of material in these three volumes to ensure that the end result would meet the needs of you – my readers – and most importantly, you as the student.

Klaatu, my technical reviewer for this volume, has done a great job to ensure its technical accuracy. Due to the major changes made in some parts of the course as its final form materialized, he agreed to take on the task of technical reviewer for this volume late in the process. Nevertheless, he did an amazing job of keeping this highly technical volume on track.

Of course, any remaining errors and omissions are my responsibility alone.

Introduction

First, thank you for purchasing *Using and Administering Linux: Volume 3 – Zero to SysAdmin: Network Services*. The Linux training course upon which you have embarked is significantly different from other training that you could purchase to learn about Linux.

About this course

This Linux training course, *Using and Administering Linux – Zero to SysAdmin*, consists of three volumes. Each of these three volumes is closely connected and they build upon each other. For those new to Linux, it's best to start with Volume 1, where you'll be guided through the creation of a virtual laboratory – a virtual network and a virtual machine – that will be used and modified by many of the experiments in all three volumes. More experienced Linux users can begin with later volumes and download the script that will set up the VM for the start of Volumes 2 and 3. Instructions provided with the script will provide specifications for configuration of the virtual network and the virtual machine.

Refer to the following volume overviews to select the volume of this course most appropriate for your current skill level.

This Linux training course differs from others because it is a complete self-study course. Newcomers should start at the beginning of Volume 1 and read the text, perform all of the experiments, and complete all of the chapter exercises through to the end of Volume 3. If you do this, even if you are starting from zero knowledge about Linux, you can learn the tasks necessary to becoming a Linux system administrator, a SysAdmin.

Another difference this course has over others is that all of the experiments are performed on one or more virtual machines (VMs) in a virtual network. Using the free software VirtualBox, you will create this virtual environment on any reasonably sized host, whether Linux or Windows. In this virtual environment, you are free to experiment on your own, make mistakes that could damage the Linux installation of a hardware

INTRODUCTION

host, and still be able to recover completely by restoring the Linux VM host from any one of multiple snapshots. This flexibility to take risks and yet recover easily makes it possible to learn more than would otherwise be possible.

I have always found that I learn more from my mistakes than I ever have when things work as they are supposed to. For this reason, I suggest that rather than immediately reverting to an earlier snapshot when you run into trouble, you try to figure out how the problem was created and how best to recover from it. If, after a reasonable period of time, you have not resolved the problem, that would be the point at which reverting to a snapshot would make sense.

Inside, each chapter has specific learning objectives, interactive experiments, and review exercises that include both hands-on experiments and some review questions. I learned this format when I worked as a course developer for IBM from 1978 through 1981. It is a tried and true format that works well for self-study.

These course materials can also be used as reference materials. I have used my previous course materials for reference for many years and they have been very useful in that role. I have kept this as one of my goals in this set of materials.

Note Not all of the review exercises in this course can be answered by simply reviewing the chapter content. For some questions, you will need to design your own experiment in order to find a solution. In many cases there will very probably be multiple solutions, and all that produce the correct results will be the “correct” ones.

Process

The process that goes with this format is just as important as the format of the course – really even more so. The first thing that a course developer must do is generate a list of requirements that define both the structure and the content of the course. Only then can the process of writing the course proceed. In fact, many times I find it helpful to write the review questions and exercises before I create the rest of the content. In many chapters of this course I have worked in this manner.

These volumes present a complete, end-to-end Linux training course for students like you who know before you start that you want to learn to be a Linux system administrator – a SysAdmin. This Linux course will allow you to learn Linux right from the beginning with the objective of becoming a SysAdmin.

Many Linux training courses begin with the assumption that the first course a student should take is one designed to start them as users. Those courses may discuss the role of root in system administration but ignore topics that are important to future SysAdmins. Other courses ignore system administration altogether. A typical second course will introduce the student to system administration, while a third may tackle advanced administration topics.

Frankly, this baby step approach did not work well for many of us who are now Linux SysAdmins. We became SysAdmins, in part at least, due to our intense desire – our deep need – to learn as much as possible as quickly as possible. It is also, I think in large part, due to our highly inquisitive natures. We learn a basic command and then start asking questions, experimenting with it to see what its limits are, what breaks it, and what using it can break. We explore the man(ual) pages and other documentation to learn the extreme usages to which it might be put. If things don't break by themselves, we break them intentionally to see how they work and to learn how to fix them. We relish our own failures because we learn more from fixing them than we do when things always work as they are supposed to.

In this course, we will dive deep into Linux system administration almost from the very beginning. You will learn many of the Linux tools required to use and administer Linux workstations and servers – usually multiple tools that can be applied to each of these tasks. This course contains many experiments to provide you with the kind of hands-on experiences that SysAdmins appreciate. All of these experiments guide you one step at a time into the elegant and beautiful depths of the Linux experience. You will learn that Linux is simple and that simplicity is what makes it both elegant and knowable.

Based on my own years working with Unix and Linux, the course materials contained in these three volumes are designed to introduce you to the practical, daily tasks you will perform as a Linux user and, at the same time, as a Linux system administrator – SysAdmin. But I do not know everything – that is just not possible – no SysAdmin does. Further, no two SysAdmins know exactly the same things because that, too, is impossible. We have each started with different knowledge and skills; we have different goals; and we have different experiences because the systems on which we work have

INTRODUCTION

failed in different ways, had different hardware, were embedded in different networks, had different distributions installed, and many other differences. We use different tools and approaches to problem-solving because the many different mentors and teachers we had used different sets of tools from each other; we use different Linux distributions; we think differently; and we know different things about the hardware on which Linux runs. Our past is much of what makes us what we are and what defines us as SysAdmins.

So I will show you things in this course – things that I think are important for you to know – things that, in my opinion, will provide you with the skills to use your own curiosity and creativity to find solutions that I would never think of to problems I have never encountered.

What this course is not

This course is not a certification study guide. It is not designed to help you pass a certification test of any type. This course is intended purely to help you become a good or perhaps even great SysAdmin, not to pass a test.

There are a few good certification tests. Red Hat and Cisco certifications are among the best because they are based on the test-taker's ability to perform specific tasks. I am not familiar with any of the other certification tests because I have not taken them. But the courses you can take and books you can purchase to help you pass those tests are designed to help you pass the tests and not to administer a Linux host or network. That does not make them bad – just different from this course.

Content overview

Because there are three volumes to this course, and because I reference other chapters, some of which may be in other volumes, we need a method for specifying in which volume the referenced material exists. If the material is in another volume, I will always specify the volume number, that is, “Chapter 2 in Volume 3” or “Volume 2, Chapter 5.” If the material is in the same volume as the reference to it, I may simply specify the chapter number; however, I may also reference the current volume number for clarity.

This quick overview of the contents of each volume should serve as a quick orientation guide if you need to locate specific information. If you are trying to decide whether to purchase this book and its companion volumes, it will give you a good overview of the entire course.

Using and Administering Linux: Volume 1

Zero to SysAdmin: Getting Started

Volume 1 of this training course introduces operating systems in general and Linux in particular. It briefly explores *The Linux Philosophy for SysAdmins*¹ in preparation for the rest of the course.

Chapter 4 then guides you through the use of VirtualBox to create a virtual machine (VM) and a virtual network to use as a test laboratory for performing the many experiments that are used throughout the course. In Chapter 5, you will install the Xfce version of Fedora – a popular and powerful Linux distribution – on the VM. In Chapter 6, you will learn to use the Xfce desktop which will enable you to leverage your growing command line interface (CLI) expertise as you proceed through the course.

Chapters 7 and 8 will get you started using the Linux command line and introduce you to some of the basic Linux commands and their capabilities. In Chapter 9, you will learn about data streams and the Linux tools used to manipulate them. And in Chapter 10, you will learn a bit about several text editors which are indispensable to advanced Linux users and system administrators.

Chapters 11 through 13 start your work as a SysAdmin and take you through some specific tasks such as installing software updates and new software. Chapters 14 and 15 discuss more terminal emulators and some advanced shell skills. In Chapter 16, you will learn about the sequence of events that take place as the computer boots and Linux starts up. Chapter 17 shows you how to configure your shell to personalize it in ways that can seriously enhance your command line efficiency.

Finally, Chapters 18 and 19 dive into all things file and filesystems.

1. Introduction
2. Introduction to operating systems
3. The Linux Philosophy for SysAdmins
4. Preparation
5. Installing Linux
6. Using the Xfce desktop
7. The Linux command line

¹Both, David, *The Linux Philosophy for SysAdmins*, Apress, 2018

INTRODUCTION

8. Core utilities
9. Data streams
10. Text editors
11. Working as root
12. Installing updates and new software
13. Tools for problem-solving
14. Terminal emulator mania
15. Advanced shell topics
16. Linux boot and startup
17. Shell configuration
18. Files, directories, and links
19. Filesystems

Using and Administering Linux: Volume 2 Zero to SysAdmin: Advanced Topics

Volume 2 of *Using and Administering Linux* introduces you to some incredibly powerful and useful advanced topics that every SysAdmin must know.

In Chapters 1 and 2, you will experience an in-depth exploration of logical volume management – and what that even means – as well as the use of file managers to manipulate files and directories. Chapter 3 introduces the concept that, in Linux, everything is a file. You will also learn some fun and interesting uses of the fact that everything is a file.

In Chapter 4, you will learn to use several tools that enable the SysAdmin to manage and monitor running processes. Chapter 5 enables you to experience the power of the special filesystems, such as `/proc`, that enable us as SysAdmins to monitor and tune the kernel while it is running – without a reboot.

Chapter 6 will introduce you to regular expressions and the power that using them for pattern matching can bring to the command line, while Chapter 7 discusses managing printers and printing from the command line. In Chapter 8, you will use several tools to unlock the secrets of the hardware in which your Linux operating system is running.

Chapters 9 through 11 show you how to do some simple – and not so simple – command line programming and how to automate various administrative tasks.

You will begin to learn the details of networking in Chapter 12, and Chapters 13 through 15 show you how to manage the many services that are required in a Linux system. You will also explore the underlying software that manages the hardware and can detect when hardware devices such as USB thumb drives are installed and how the system reacts to that.

Chapter 16 shows you how to use the logs and journals to look for clues to problems and confirmation that things are working correctly.

Chapters 17 and 18 show you how to enhance the security of your Linux systems, including how to perform easy local and remote backups.

1. Logical volume management
2. File managers
3. Everything is a file
4. Managing processes
5. Special filesystems
6. Regular expressions
7. Printing
8. Hardware detection
9. Command line programming
10. Automation with BASH scripts
11. Time and Automation
12. Networking
13. systemd
14. dbus and udev
15. Using logs and journals
16. Managing users
17. Security
18. Backups

Using and Administering Linux: Volume 3 Zero to SysAdmin: Network Services

In Volume 3 of *Using and Administering Linux*, you will start by creating a new VM on the existing virtual network. This new VM will be used as a server for the rest of this course, and it will replace some of the functions performed by the virtual router that is part of our virtual network.

Chapter 2 begins this transformation from simple workstation to server by adding a new network interface card (NIC) to the VM so that it can act as a firewall and router, then changing its network configuration from DHCP to static. This includes configuring both NICs so that one is connected to the existing virtual router so as to allow connections to the outside world, and so that the other NIC connects to the new “inside” network that will contain the existing VM.

Chapters 3 and 4 guide you through setting up the necessary services, DHCP and DNS, that are required to support a managed, internal network, and Chapter 5 takes you through configuration of SSHD to provide secure remote access between Linux hosts. In Chapter 6, you will convert the new server into a router with a simple yet effective firewall.

You will learn to install and configure an enterprise class email server that can detect and block most spam and malware in Chapters 7 through 9. Chapter 10 takes you through setting up a web server, and in Chapter 11, you will set up WordPress, a flexible and powerful content management system.

In Chapter 12, you return to email by setting up a mailing list using Mailman. Then Chapter 13 guides you through sharing files to both Linux and Windows hosts. Sometimes accessing a desktop remotely is the only way to do some things, so in Chapter 14 you will do just that.

Chapter 15 shows you how to set up a time server on your network and how to determine its accuracy. Although we have incorporated security in all aspects of what has already been covered, Chapter 16 covers some additional security topics.

Chapter 17 discusses package management from the other direction by guiding you through the process of creating an RPM package for the distribution of your own scripts and configuration files.

Finally, Chapter 18 will get you started in the right direction because I know you are going to ask, “Where do I go from here?”

1. Server preparation
2. Server configuration

3. DHCP
4. Name services
5. Remote access with SSH
6. Routing and firewalls
7. Introducing email
8. Email clients
9. Combating spam
10. Apache web server
11. WordPress
12. Mailing lists
13. File sharing
14. Remote desktop access
15. Network time protocol
16. Security
17. Advanced package management
18. Where do I go from here?

Taking this course

Although designed primarily as a self-study guide, this course can be used effectively in a classroom environment. This course can also be used very effectively as a reference. Many of the original course materials I wrote for Linux training classes I used to teach as an independent trainer and consultant were valuable to me as references. The experiments became models for performing many tasks and later became the basis for automating many of those same tasks. I have used many of those original experiments in parts of this course, because they are still relevant and provide an excellent reference for many of the tasks I still need to do.

You will see as you proceed through the course that it uses many software programs considered to be older and perhaps obsolete like Sendmail, Procmail, BIND, the Apache

web server, and much more. Despite their age, or perhaps because of it, the software I have chosen to run my own systems and servers and to use in this course has been well-proven and is all still in widespread use. I believe that the software we will use in these experiments has properties that make it especially valuable in learning the in-depth details of how Linux and those services work. Once you have learned those details, moving to any other software that performs the same tasks will be relatively easy. In any event, none of that “older” software is anywhere near as difficult or obscure as some people seem to think that it is.

Who should take this course

If you want to learn to be an advanced Linux user and SysAdmin, this course is for you. Most SysAdmins have an extremely high level of curiosity and a deep-seated need to learn Linux System Administration. We like to take things apart and put them back together again to learn how they work. We enjoy fixing things and are not hesitant about diving in to fix the computer problems that our friends and co-workers bring us.

We want to know what happens when some part of computer hardware fails so we might save defective components such as motherboards, RAM memory, and hard drives. This gives us defective components with which we can run tests. As I write this, I have a known defective hard drive inserted in a hard drive docking station connected to my primary workstation and have been using it to test failure scenarios that will appear later in this course.

Most importantly, we do all of this for fun and would continue to do so even if we had no compelling vocational reason for doing so. Our intense curiosity about computer hardware and Linux leads us to collect computers and software like others collect stamps or antiques. Computers are our avocation – our hobby. Some people like boats, sports, travel, coins, stamps, trains, or any of thousands of other things, and they pursue them relentlessly as a hobby. For us – the true SysAdmins – that is what our computers are. That does not mean we are not well-rounded and do not do other things. I like to travel, read, go to museums and concerts, and ride historical trains, and my stamp collection is still there, waiting for me when I decide to take it up again.

In fact, the best SysAdmins, at least the ones I know, are all multifaceted. We are involved in many different things, and I think that is due to our inexhaustible curiosity about pretty much everything. So if you have an insatiable curiosity about Linux and

want to learn about it – regardless of your past experience or lack thereof – then this course is most definitely for you.

Who should not take this course

If you do not have a strong desire to learn about or to administer Linux systems, this course is not for you. If all you want – or need – to do is use a couple apps on a Linux computer that someone has put on your desk, this course is not for you. If you have no curiosity about what superpowers lie underneath the GUI desktop, this course is not for you.

Why this course

Someone asked me why I want to write this course. My answer is simple – I want to give back to the Linux community. I have had several amazing mentors over the span of my career and they taught me many things – things I find worth sharing with you along with much that I have learned for myself.

This course – all three volumes of it – started its existence as the slide presentations and lab projects for three Linux courses I created and taught. For a number of reasons, I do not teach those classes anymore. However, I would still like to pass on my knowledge and as many of the tips and tricks I have learned for the administration of Linux as possible. I hope that with this course I can pass on at least some of the guidance and mentoring that I was fortunate enough to have in my own career.