

Krafft: The Debian System



Open Source Press (Sample)

Martin F. Krafft

The Debian System

Concepts and Techniques

Open Source Press (Sample)

While every precaution has been taken in the preparation of this book, the publisher and author assume no responsibility for errors or omissions. Neither is any liability assumed for damage resulting from the use of the information contained herein.

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and Open Source Press GmbH was aware of a trademark claim, the designations have been printed in caps or initial caps. Use of a designation in this book should not be regarded as affecting the validity of any trademark or service mark.

All rights reserved. No part of this book shall be reproduced, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, desktop publishing, recording, or otherwise, without permission from the publisher. No patent liability is assumed with respect to the use of the information contained herein.

Bibliographic Information of "Die Deutsche Bibliothek"

"Die Deutsche Bibliothek" registers this publication in the "Deutsche Nationalbibliografie"; detailed bibliographic data are available online at <http://dnb.ddb.de>.

© 2005 Open Source Press GmbH, Germany
Editor: Dr. Markus Wirtz
Cover Design: Fritz Design GmbH, Germany
Printed in Germany on acid-free paper.
ISBN 3-937514-07-4

<http://www.opensourcepress.de>

1

Chapter

Introduction

My first reaction to Linux? This defies all logic.
— Ian Murdock

The Debian GNU/Linux operating system is a fully-featured operating system for servers, workstations, and home desktop machines alike. It can serve up web pages, relay email, provide a database backend and file-sharing services, authenticate users, firewall and monitor networks, control appliances and power embedded devices. Debian can also act as a workstation or desktop machine, allowing users to browse the Internet, read and write emails, author documents, calculate spreadsheets, edit images, view multimedia content, play games, write software, or manage schedules, contacts and other personal information. When it comes to Debian (or GNU/Linux in general), the question is usually "how is it done?", rather than "can it be done?". Thus, the Debian system constitutes an excellent basis for most tasks.

The broad range of possible Debian GNU applications is an important part of Debian's undamped growth¹. Another, perhaps even more important reason for the success of the Debian system, is the stability of its software packages along with the robustness of its administrative tools, and invaluable overall reliability. Furthermore, Debian's support for eleven different processor architectures allows for unified administration across the various platforms that have become popular over the years.

The Debian system owes much of its power to numerous free software projects and movements, most notably GNU and Linux. Debian uses the Linux kernel, so anything that is possible with Linux itself is possible with Debian GNU as well. Over 15 000 Debian packages are available for straightforward installation, offering a great deal of functionality without the burden of manually satisfying dependencies, compiling source code, setting up initial configurations, and keeping programmes up to date. And then again, if you do have to compile a tool, library, or application manually, don't worry; Debian will give you all the tools, and then keep out of your way. This is perhaps one of the most important points about Debian: it is there to assist you, and it is quite successful in being quiet unless explicitly called for. In other words, you control the system, and not the other way around.

Debian package maintainers try to keep the packaged software as identical as possible to the original, upstream source. Instead of introducing major changes, they make sure their packaging work adheres to a strict set of rules designed to allow thousands of Debian packages to form a truly integrated system, rather than merely coexisting side by side, hoping they do not get in each other's way. Therefore, when you install official Debian packages, you install the original software that neatly slots into the system, rather than just working when used in a certain way or specific environment.

When modifications done by Debian are not Debian-specific (and this is often the case), they are usually merged with the original upstream code, improving the software and successfully keeping Debian-specific differences minimal. Even tools developed specifically for Debian are available for the public and often find their way into other distributions. The Debian project has a strong commitment to the free software community and makes all its work available for the benefit of others, just as it uses the produce of others for its own good.

The Debian community is a community of volunteers. Debian developers do not receive direct financial compensation from the project. Nevertheless, the philosophy and technical merits of Debian have always attracted professionals from all over the world who bring problem-solving proficiency to a variety of areas within the Debian project. Every Debian developer has to display a common conception of ethics and an acceptable level of Debian-specific skills before being officially accepted. As volunteers, these people are then free to approach any challenges of personal interest, while working on the same integrated system.

¹Netcraft determined Debian to be the fastest growing Linux distribution in 2003 and 2004: http://news.netcraft.com/archives/2004/01/28/debian_fastest_growing_linux_distribution.html

Computer users have needs *today* and Debian fulfills these needs successfully while encouraging their implementation in a formal and sustainable manner. Debian may not be universally applicable, but stability and maturity are its keywords. Assuming that these reflect a user's primary needs, the rest is negotiable.

1.1 About this book

Packages in the Debian archive contain a variety of free software, ranging from standard tools to amazing utilities. The Debian-specific tools, which will be our primary focus, form a major subset. This book uncovers those tools, explains the underlying concepts, and highlights potential pitfalls or shortcomings. It explains how the tools should be used, and how they interoperate to offer a robust and consistent means of administering and maintaining Debian installations. I will be focusing on the popular **x86** architecture. However, since the functionality and feel of the Debian system is mostly equivalent across all supported architectures (with the notable exception of installation and boot processes), the **x86**-specific parts of this book are minimal.

This book does not cover Linux in general, nor does it cover specific system administration aspects². It was written to be the source of knowledge about the Debian system and its specifics.

This book is intended to be objective. Debian may be the perfect operating system for some, but that does not make it ideal for everyone. Advocating the use of Debian is a good thing, and every additional user is a significant gain to the project. But nothing is gained if newcomers give up after painfully discovering that Debian does not meet their needs or expectations. Polemic praise of the "universal operating system" is not what prospective users need or want; information should be based on facts, not on advertisements.

The goal of this book is not to be a pamphlet about Debian. Instead, it presents the Debian approach to various system administration tasks and points out common myths and factoids. It highlights those points that make a Debian administrator's life easy and enjoyable, as well as those that cause headaches and the occasional fit of raving madness. All in all, however, the book primarily serves as a platform for the Debian system to speak for itself. It gives you the plain facts, allowing you to compare them with your expectations and either embrace Debian GNU, or move on. In appendix B, you will find a summary and more help in making this important decision with its many practical implications.

²If you are looking for references on these topics, I can recommend O'Reilly's *Running Linux*, 4th edition, written by Matt Welsh *et al.* Machtelt Garrels also provides a good online hands-on guide at <http://www.tldp.org/LDP/intro-linux/html>. Finally, the documentation compiled by *The Linux Documentation Project* (<http://www.tldp.org>) is a helpful and indispensable reference. Finally, Evi Nemeth *et al.* have written the excellent *Linux Administration Handbook* and the fantastic *Unix System Administration Handbook*, targeted specifically at system administrators providing services to users (<http://www.admin.com>).

Writing a book about Debian is not easy when you are involved with the project. Whenever I found a problem, I tended to fix (or at least report) it instead of documenting workarounds. Since the inception of this book, I have filed 354 bugs against Debian packages, fixed 68, exchanged about 5500 emails on topics related to the book and spent countless hours on IRC. Undoubtedly, the book would have been completed much faster if I had simply accepted the problems. As it stands, however, I feel that both the book and the project, have benefited from the procedure I followed, which can not be said for my peace of mind.

1.2 Target audience

This book is targeted at people familiar with Unix who are looking to understand what makes Debian different, and how to best put Debian's paradigms and tools to use. It is intended to be a reference for the Debian system, as well as a guide for those that want to go further with the system. Its target audience is broad and can be roughly classified into four groups, which are discussed in the following sections.

1.2.1 The Linux administrator

As the ideal reader of this book, you possess know-how in two main areas. First, you will have profound knowledge of the Linux kernel, the GNU userland utilities, and a general understanding of the Unix operating system as well as the Portable Operating System for Unix (POSIX) standards. Second, you will have practical experience of multiuser system administration. You will have developed an understanding of the scope of daily administration tasks and ideally written many scripts to facilitate the numerous aspects of your job. While it does not hurt to know the do's and don't's of system administration, the book concentrates more on the effective management of stable and secure production systems over long periods of time.

You will find in this book an enticing introduction to the Debian Way of system administration and management. It offers a comprehensive and objective overview of the strengths and weaknesses of Debian and serves as a basis for migrating from another Linux distribution to Debian GNU.

1.2.2 The Unix administrator

If you are an administrator of another Unix operating system, such as BSD or Solaris, you will want to read this book along with a GNU/Linux³ reference manual. The book is based on Debian using Linux as the kernel. Debian has been ported to

³See footnote on p. 19.

other kernels, but these ports are not yet as mature as the Linux-based distribution. Nevertheless, a great number of skilled and ambitious developers are working hard to bring these ports up to par, and every additional user ready to help out can speed up the process.

If you are ready to move to the Linux kernel, or would like to continue profiting from your experience of the BSD kernels while entering the world of Debian, you may consider yourself an ideal reader. Debian acts and feels pretty much the same, no matter what the kernel or architecture may be (see chapter 4.5).

1.2.3 The Debian user

If you are already running Debian GNU/Linux, you can still profit from this book. The sophistication of the Debian system keeps a system running with minimal effort, and the maintenance of a single-user workstation does not require in-depth knowledge of the advanced concepts and intricacies of Debian GNU/Linux. Nevertheless, sooner or later new requirements are likely to surface, and this means the Debian user learning more about the system and enhancing it to handle new tasks, or improve the handling of old tasks. The need may arise to give out accounts to family and friends to let them experience the freedom of a Linux system. Or you may at one point consider turning your knowledge and enthusiasm for the system into money by entering the commercial world, assisted by the operating system. Lastly, you may discover that you simply like playing around with Debian and get a kick from its elegant methods, whether you need them or not⁴.

If this sounds like you, this book will mainly give you the motivations of the various Debian approaches, as well as showing you some utilities and paradigms that you may not yet have encountered. Unless you are confident of, or not fully dependent on, your production machine, I would recommend testing most of the stuff you read on the following pages on a fresh installation, or within a chroot install (see chapter 8.3.1). When you have understood and mastered each method, you can port it to your main system, if you so desire.

Shameless plug: while thinking about the target audience of this book, it occurred to me that I would *not* have bought it if I had seen it on the shelf. When I started writing, I considered myself an advanced Debian user and well-versed developer, who would not learn much from a printed Debian reference. I was wrong. As I put together the information that now fills these pages, I learnt about ideas and techniques that I had not previously not dreamt of; researching the depths of the Debian system opened up whole new perspectives to me, some of which have since revolutionised the way I work with the Debian system. If your involvement with Debian is anything more than chance, this book is for you.

⁴I have always been like that.

1.2.4 The Linux apprentice

This book assumes a good knowledge of the Linux operating system. Consequently, users new to Linux should probably look elsewhere for the basics. Nevertheless, along with a good introductory Linux reference², some enthusiasm, and quite a bit of free time, this book can facilitate a clean, bottom-up start into Linux system administration.

This said, Debian may not be the best choice for your first steps in the Linux world. If you are choosing Linux because you have had enough and want to author your documents, compose messages, and browse the Web on a stable, secure, and free operating system from now on, then you may want to consider one of the Debian derivatives (see appendix A.2) or a different distribution at first. These are frequently optimised for specific applications or target a specific user base, which makes them be simpler to learn. For instance, several Debian-based distributions provide simplified installers (or need not be installed at all), or provide a standard selection of common desktop programmes, allowing you to get to work immediately without having to find out how to get there first. These distributions do not need to handle the broad set of applications that Debian supports and can thus do with less flexibility (and complexity). Once you have learnt to walk with one of these, you can always come back to Debian for its maintainability (or any other reason).

If you really want to jump in at the deep end and hop right on the Debian bandwagon, then, by all means, go right ahead. You will find a welcoming community and a helpful crowd, but be aware that you will probably be in for a hard time at first. If the computer you plan to use for your learning experience also serves your productivity, make sure you know what you are doing. For your experiments, it might be wise to invest a small amount of money in another machine, networked to your main machine. Hardware is cheap, and your main computer will almost certainly be capable of sharing Internet access with the hosts on your local network. This allows you to restrict use of your production machine to important work. And should a problem on the Debian machine prevent network access, you can still use your main machine to seek help from the community.

1.3 How to use this book

The amount of information and knowledge you can extract from this book largely depends on how you use it. To harvest its full power, you will need access to a machine on which you can install Debian and ideally experiment to your heart's content without fearing the obliteration of your data or the loss of your computer system. Declining computer prices and Linux' minimal system requirements make this all the easier; you can install Debian on a Pentium II with 64 Mb RAM for this

purpose, or even a much less powerful machine. If this is not possible, then you can do with any Linux-based machine, but you need root access. You can use the installation walkthrough in chapter 8.3.1 to set up a working sandbox in which to experiment.

Besides reading this book, try out everything you see and read on your lab machine. Add your own experiments to the ones in this book. Try out everything that comes to your mind. If you hose the machine, just install it again, or set up an installation in a subdirectory of your local hard disk (**chroot**). If the worst comes to the worst, you can restore your lab machine by copying the untouched snapshot over the hosed version from the host system. I will explain how to do that in chapter 8.3.1. Also, there is **pbuilder** to automatically manage an environment in which you basically cannot break anything (see chapter 9.6).

In addition to playing around and experimenting away, you should try to read as much as you can about the concepts introduced. Every Debian system comes with a plethora of documentation and information about the available utilities (see chapter 10). In addition, the Internet is full of useful tidbits (chapter 10.2 lists some starting points), and one of Debian's core strengths is its mailing lists. It is highly advisable to join **debian-user** and to start reading random posts as well as posts of interest even before you get started with this book. The best advice is not to hesitate to write back to the list if you know (or think you know) the answer, or if you can offer valuable input. Chapter 10.4.1 will pick up this topic in greater detail.

If you use Debian partly for the fun (*i.e.* if you like playing around with your system rather than doing actual work⁵), then you may want to stop by the next flea-market or check your neighborhood for old machines and save them from hitting the junk yard. Sun Microsystem's slogan "the network is the computer" holds for Unix in general, and thus for Debian as well. You can have a lot of fun with a single machine; you can have exponentially more fun with a home network, and you do not need fancy equipment for that.

Finally, it is a good idea to take notes during your experimentation. First, it is a good practice to get into, as a meticulously kept log book can be the difference between data loss and data rescue. Second, it will be almost impossible to remember everything you learn during the first few months of your Debian experience. Instead of having to research the same topics time and time again, it is useful to be able to refer to your own notes. I found Wikis⁶ to be incredibly helpful for this sort of note taking.

⁵Those of you who believe in telekinesis, raise my hand!

⁶A Wiki is a collaborative web page that can be edited by everyone, even though access controls can be put in place to allow for closed-group use. Please refer to <http://en.wikipedia.org/wiki/Wiki> for more information.

1.4 Final notes

1.4.1 Conventions

Source code and shell interactions quoted in this book follow a standard convention and should be easy to understand. At times, screen output has been simplified for brevity and clarity, so please do not try to match it character by character.

Shell scripts use `/bin/bash` for interpretation, rather than `/bin/sh` (which is only used in a few simple cases). The main reasons for this choice are clarity and convenience, as `bash` supports some useful constructs that standard POSIX shells do not, and thus removes the need for complex workarounds. As `bash` is installed on every Debian system, it seems sensible to make use of it.

I assume a fresh directory for each example, which is denoted with the tilde (`~`). In between approaches and topics, I assume the directory to automatically⁷ empty itself.

File contents are usually shown as part of the corresponding `cat` or `grep` (or similar) invocation. This establishes the context and allows you to understand and use the examples without having to parse the text for the file data.

1.4.2 Keeping up to date

Debian's open development cycle puts the system into a state of continuous flux. While most tools covered in this book have been around for quite some while and are unlikely to change (with the exception of minor details), there is no guarantee. Software problems are reported and fixed every day, and while I have taken care to introduce the latest Debian developments, by the time this book is printed, some of the concepts may not be entirely state of the art. This said, the usage paradigms of almost all the tools mentioned in this book were established a while back and are unlikely to change. As Debian fixes bugs and adds new features, this book will continue to hold true.

In a fast-paced project such as Debian changes will happen, in fact they are a good thing, and of course I cannot predict the future. I will keep a list of changes at <http://debiansystem.info/> changes to complement the book and keep you up to pace with the Debian system. I also do not anticipate this book to be error-free. Whenever I find mistakes, I will publish them at <http://debiansystem.info/errata>. If you find an error or an unclarity, I would really appreciate your feedback via email to errata@debianbook.info.

⁷"Automatically, with a touch of magic"

1.4.3 An urgent plea for feedback

The book you are holding in your hands has completely occupied my life for almost a year. As a result, it is one of the most comprehensive references for the Debian system and the community surrounding it. It would not have been possible to put together all the facts, data, and tidbits you find here without the active help of many members of the community, answering my questions, providing valuable additional information, and letting me know about changes I had not immediately noticed.

It is my goal to keep this book as up to date as possible for future editions. I therefore rely on your help. In addition to spotting errors, I ask you to drop me a line whenever you note a development that you deem relevant to the contents of this book. I have reserved the `feedback@debianbook.info` address for this purpose. Thank you very much in advance!

1.5 About the author

I promise to keep this short, but let me introduce myself. I am a PhD student at the Artificial Intelligence Laboratory of the University of Zurich, Switzerland, researching neurobiologically inspired models of learning in robots. I am also actively involved with RobotCub⁸, an international endeavour to develop an open source robotics research platform. To earn my living, I work for the Munich-based AERASec GmbH⁹, teaching network security and privacy protection to professional system administrators.

Linux has been an integral part of my life ever since 1995, and I had my first encounter with Debian in 1997, albeit rather passively. Ever since then, my interest in the project and its operating system has grown exponentially. I became a developer in 2002, after spending at least three years fielding support questions on the `debian-user` mailing list, representing Debian at fairs, and fixing bugs.

My role within Debian is that of a simple developer with special interest in security, support, quality assurance, and public representation of Debian. I have tried hard to concentrate on my real life and reduce the time I spend on Debian, but have always found something to do for the project to keep me from working on my thesis. This book is perfect proof of my lack of discipline. I hope you will enjoy it.

I offer professional consultancy services for Debian and open source deployment with a strong focus on security and integration. I am based in Zurich, Switzerland but would travel within Europe and Asia. My rates depend on the project and its duration. I will donate up to a fifth of all profits to the Debian project and

⁸<http://www.robotcub.org>

⁹<http://www.aerasec.de>

other related open source projects. If you are interested, please write to me at madduck@debian.org.

1.6 Acknowledgements

First and foremost, I would like to thank all supporters of the Debian project. The beauty of the operating system as well as the spirit of the community made writing this book a marvelous experience! I am proud to be a member of the Debian team and wish all the members of the projects all the best for the future. Hopefully this book will help to improve Debian and its acceptance even further.

The book in your hands is the work of many people. I would not have been able to write it without the regulars of the `#debian-devel` IRC channels, who have put up with my daily presence for months and tried to be helpful all along. In particular, I would like to thank Goswin von Brederlow, Jeroen van Wolffelaar, Thomas Hood, Marco d'Itri, Joey Hess, Roland Mas, Frans Pop, Christian Perrier, Andres Salomon, Martin Michlmayr, Joshua M. Kwan, Colin Watson, Adeodato Simó, Manoj Srivastava, Branden Robinson, Steve Langasek, Andreas Barth, Peter Palfrader, Jaldhar Harshad Vyas, Wouter Verhelst, Thiemo Seufert, Matt Taggart, Junichi Uekawa, Thomas Lange, Peter Grandi, Matthias Klose, Norbert Tretkowski, Piotr Roszatycki, Gerfried Fuchs, Karsten M. Self, Lars Wirzenius, Helen Faulkner, Benjamin Mako Hill, Klaus Knopper, Pierre Morel, Warren Woodford, David Kammerer, Dirk Eddelbuettel, and many others for their cooperation and their help in making sure that I correctly documented their respective domains.

Most of my gratitude goes to the two people who spent countless hours with the manuscript, poked holes at it, and provided me with invaluable feedback: Hanspeter Kunz and Davor Ocelić. In addition, Don Armstrong, Lorrin Nelson, Martin Michlmayr, Sean Finney, and Stephan Beal inspected individual sections and made helpful suggestions; thank you too!

I want to thank the NetBSD team for their operating system, and the various discussions I witnessed on the `#netbsd/freenode.org` IRC channel. The Wikipedia encyclopedia has been most helpful (despite its restrictive licence); thanks to all those people who make it possible.

Outside of the free software community, many people have been instrumental in making this book happen. First of all, I want to thank my girlfriend Aline for her patience and loving support. I am greatly indebted to my parents, and my family and friends for putting up with my endless retreats to the computer screen. The same applies to Professor Rolf Pfeifer and the members of his Artificial Intelligence Laboratory at the University of Zurich: thanks for your understanding! Last but not least, I want to express my gratitude towards my publisher, Markus Wirtz for giving

me the opportunity to write this book, and for his patience and advice¹⁰, and Ian Travis for carefully reading over the final version and working with me through errors in my spelling and grammar.

¹⁰Talking to other authors, I seem to have been given a chance to work with one of the best publishers of the field... thanks for spoiling me on my first book, Markus.