

Paul S. Wang

Mastering Modern Linux



Preface

Linux, a great success story of open-source, community-developed software, is increasingly used in Web and application servers, software development platforms, personal workstations, and research machines. In the past few years, Linux has improved its user interface, added many useful and powerful apps, and greatly expanded its home and business user base.

In computer science and engineering departments, you'll find Linux systems in classrooms, programming labs, and computer centers—not just because Linux is free but also because it offers a rich computing environment for teaching and learning.

From its beginning in 1991, and with help from the GNU Project, Linux has evolved quickly and has brought new powers and conveniences to users. Competency on Linux will be important for any serious computer professional.

This book is a revised edition of *Mastering Linux* (late 2010), which was very well received and had the most wonderful review from *ACM Computing Reviews*:

“This authoritative and exceptionally well-constructed book has my highest recommendation. It will repay careful and recursive study.—Computing Reviews, August 2011”

The new edition has a new title, *Mastering Modern Linux*, yet retained much of the good materials while updating them, adding new topics and removing old ones.

This book provides a comprehensive and up-to-date guide to Linux concepts, usage, and programming. This text will help you master Linux with a well-selected set of topics. Hands-on practice is encouraged; it is the only way to gain familiarity with an operating system. A primer gets you started quickly. The chapters lead you from user interfaces, commands and filters, Shell scripting, the file system, networking, basic system administration, and Web hosting, to C-level programming and kernel system calls.

There are many examples and complete programs ready to download and run. A summary and exercises of varying degrees of difficulty can be found at the end of each chapter. A companion website provides appendices, information updates, an example code package, and other resources for instructors as well as students. See page 353 for details.

User Friendly and Comprehensive

There is both breadth and depth in this book's presentation. Chapter 1 contains a Linux primer to get the new user started as quickly as possible, without awkwardness or confusion. Being able to play and experiment with the system adds to the user's interest and motivation to learn more. Once introduced and comfortable, the user is guided through a well-selected set of topics covering the type of detailed material appropriate for a one-semester course at the advanced undergraduate or beginning graduate level.

The first part of the textbook covers interactive use of Linux via the *Graphical User Interface* (GUI) and the *Command-Line Interface* (CLI), including comprehensive treatment of the Gnome desktop and the Bash Shell. Using different apps, commands and filters, building pipelines, and matching patterns with regular expressions are major focuses.

Next come Bash scripting, file system structure, organization, and usage, which bring us to about the middle of the book.

The next chapters present networking, the Internet and the Web, data encryption, and basic system admin as well as Web hosting. The Linux Apache MySQL/MariaDB PHP (LAMP) Web hosting combination is presented in depth. Such practical knowledge can be valuable for many Linux programmers.

In Chapters 10–12, attention is then turned to C-level programming. Because the Linux kernel and most of its applications are implemented in C, it is considered the native language of Linux. In-depth knowledge of Linux requires understanding the *Standard C Libraries* and the *system calls* which form the interface to the Linux kernel. Topics covered include the C compiler, preprocessor, debugger, I/O, file manipulation, process control, inter-process communication, and networking. Many complete example programs, written in the standard ISO C99, are provided.

Appendices are kept on the book's website (mml.sofpower.com). They supply useful supplemental information for students, including text editing and how to set up Linux learning environments on their own Windows® or Mac® computers.

Flexible Usage

This book is for people who wish to learn Linux and to become good at using it and writing programs in it. The book does not assume prior knowledge of Linux or UNIX, but has the depth to satisfy even those with Linux experience.

Compared to other Linux books, this text is not a thick volume. However, it presents many topics comprehensively and in depth. Many examples are given to illustrate concepts and usage. It is well-suited for a one-semester course. An instructor can cover all the chapters in sequence or choose among them, depending on the class being taught.

For an *Introduction to Linux* course, the chapters on C-level programming and perhaps on Web hosting can be skipped.

For a system programming-oriented course, the Linux primer, interactive use of Bash, and the GNU desktop material can be omitted or assigned for reading at the beginning of the class. This will provide more time for the hardcore topics on programming.

For an *Introduction to Operating System Principles* course, this book is a good supplement. Discussion of Linux subjects—the Shell, file system structure, concurrent process management, I/O structure, signals/interrupts, and inter-process communication—provides concrete examples and adds to the students' understanding of the abstract operating system principles being studied.

For a server-side Web programming course, the coverage of Bash, file system, Internet and the Web, and Web hosting can make this book a great supplemental text.

For courses on network programming, graphics, C programming, distributed computing, etc., the book can be a valuable supplement as well.

For those who use Linux in school or at work, this book enables you to apply the system's capabilities more effectively, resulting in much increased productivity. Ready-to-use examples provide many immediate practical applications.

Going beyond, you can learn how to write programs at the Shell and the C levels. This ability enables you to build new capabilities and custom tools for applications or R&D.

Example Code Package

Throughout the book, concepts and usages are thoroughly explained with examples. Instead of using contrived examples, however, every effort has been made to give examples with

practical value and to present them as complete programs ready to run on your Linux system.

These programs are collected in an *example code package* ready to download from the companion website (mml.sofpower.com). See page 353 for instructions on downloading and unpacking the example code package. The description for each example program is cross-referenced to its file location with a notation such as (**Ex:** `ex05/argCheck.sh`).

Easy Reference

You'll find a smooth, readable style uncharacteristic of a book of this type. Nevertheless, it is understood that such books are used as much for reference as for concentrated study, especially once the reader gets going on the system. Therefore, information is organized and presented in a way that also facilitates quick and easy reference. There are ample resource listings and appendices (on the website) and a thorough and comprehensive index. The in-text examples are also cross-referenced with files in the example code package. This book will be a valuable aid for anyone who uses tools, accesses the Internet, or writes programs under Linux, even occasionally.

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Finally, I want to express my sincere gratitude to my wife, Jennifer, whose support and encouragement have been so important to me through the years.

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