Fifth Edition

LPIC-1®

Linux Professional Institute Certification

STUDY GUIDE

EXAM 101-500 and EXAM 102-500

Includes interactive online learning environment and study tools:

2 custom practice exams

100 electronic flashcards

Searchable key term glossary

CHRISTINE BRESNAHAN
RICHARD BLUM

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LPIC-1®

Study Guide

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Christine Bresnahan

Richard Blum

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About the Authors

Christine Bresnahan, CompTIA Linux+, started working with computers more than 30 years ago in the IT industry as a systems administrator. Christine is an adjunct professor at Ivy Tech Community College where she teaches Linux certification and Python programming classes. She also writes books and produces instructional resources for the classroom.

Richard Blum, CompTIA Linux+ ce, CompTIA Security+ ce, has also worked in the IT industry for more than 30 years as both a system and network administrator, and he has published numerous Linux and open source books. Rich is an online instructor for Linux and web programming courses that are used by colleges and universities across the United States. When he is not being a computer nerd, Rich enjoys spending time with his wife Barbara and his two daughters, Katie and Jessica.

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Introduction

Linux has become one of the fastest-growing operating systems used in server environments. Most companies utilize some type of Linux system within their infrastructure, and Linux is one of the major players in the cloud computing world. The ability to build and manage Linux systems is a skill that many companies are now looking for. The more you know about Linux, the more marketable you'll become in today's computer industry.

The Linux Professional Institute (LPI) has developed a series of certifications to help guide you through a career in the Linux world. Its LPIC-1 certification is an introductory certification for people who want to enter careers involving Linux. The exam is meant to certify that you have the skills necessary to install, operate, and troubleshoot a Linux system and are familiar with Linux-specific concepts and basic hardware.

The purpose of this book is to help you pass the LPIC-1 exams (101 and 102), updated in 2019 to version 5 (commonly called 101-500 and 102-500). Because these exams cover basic Linux installation, configuration, maintenance, applications, networking, and security, those are the topics that are emphasized in this book. You'll learn enough to get a Linux system up and running and to configure it for many common tasks. Even after you've taken and passed the LPIC-1 exams, this book should remain a useful reference.

Why Become Linux Certified?

With the growing popularity of Linux (and the increase in Linux-related jobs) comes hype. With all the hype that surrounds Linux, it's become hard for employers to distinguish employees who are competent Linux administrators from those who just know the buzzwords. This is where the LPIC-1 certification comes in.

With an LPIC-1 certification, you will establish yourself as a Linux administrator who is familiar with the Linux platform and can install, maintain, and troubleshoot any type of Linux system. LPI has created the LPIC-1 exams as a way for employers to have confidence in knowing their employees who pass the exam will have the skills necessary to get the job done.

How to Become Certified

The certification is available to anyone who passes the two required exams: 101 and 102. The current versions of the exams are version 5 and are denoted as 101-500 and 102-500.

The exam is administered by Pearson VUE. The exam can be taken at any Pearson VUE testing center. If you pass, you will get a certificate in the mail saying that you have passed. Contact (877) 619-2096 for Pearson VUE contact information.

To register for the exam with Pearson VUE, call (877) 619-2096 or register online at www.vue.com. However you do it, you'll be asked for your name, mailing address, phone number, employer, when and where you want to take the test (i.e., which testing center), and your credit card number (arrangement for payment must be made at the time of registration).

Who Should Buy This Book

Anyone who wants to pass the LPIC-1 certification exams would benefit from this book, but that's not the only reason for purchasing the book. This book covers all of the material someone new to the Linux world would need to know to start out in Linux. After you've become familiar with the basics of Linux, the book will serve as an excellent reference book for quickly finding answers to your everyday Linux questions.

The book is written with the assumption that you have a familiarity with basic computer and networking principles. Although no experience with Linux is required in order to benefit from this book, it will help if you know your way around a computer in either the Windows or macOS world, such as how to use a keyboard, use optical disks, and work with USB thumb drives.

It will also help to have a Linux system available to follow along with. Each chapter contains a simple exercise that will walk you through the basic concepts presented in the chapter. This provides the crucial hands-on experience that you'll need, both to pass the exam and to do well in the Linux world.

While the LPI LPIC-1 exams are Linux distribution neutral, it's impossible to write exercises that work in all Linux distributions. That said, the exercises in this book assume you have either Ubuntu 18.04 LTS or CentOS 7 available. You can install either or both of these Linux distributions in a virtual environment using the Oracle VirtualBox software, available at https://virtualbox.org.

How This Book Is Organized

This book consists of 10 chapters plus supplementary information: an online glossary, this introduction, and the assessment test after the introduction. The chapters are organized as follows:

- Chapter 1, "Exploring Linux Command-Line Tools," covers the basic tools you need to interact with Linux. These include shells, redirection, pipes, text filters, and regular expressions.

- Chapter 2, "Managing Software and Processes," describes the programs you'll use to manage software. Much of this task is centered around the RPM and Debian package management systems. The chapter also covers handling shared libraries and managing processes (that is, running programs).
- Chapter 3, "Configuring Hardware," focuses on Linux's interactions with the hardware on which it runs. Specific hardware and procedures for using it include the BIOS, expansion cards, USB devices, hard disks, and partitions and filesystems used on hard disks.
- Chapter 4, "Managing Files," covers the tools used to manage files. This includes commands to manage files, ownership, and permissions, as well as Linux's standard directory tree and tools for archiving files.
- Chapter 5, "Booting, Initializing, and Virtualizing Linux," explains how Linux boots up and how you can edit files in Linux. Specific topics include the GRUB Legacy and GRUB 2 boot loaders, boot diagnostics, and runlevels. It also takes a look at how to run Linux in a virtual machine environment.
- Chapter 6, "Configuring the GUI, Localization, and Printing," describes the Linux GUI and printing subsystems. Topics include X configuration, managing GUI logins, configuring location-specific features, enabling accessibility features, and setting up Linux to use a printer.
- Chapter 7, "Administering the System," describes miscellaneous administrative tasks. These include user and group management, tuning user environments, managing log files, and setting the clock.
- Chapter 8, "Configuring Basic Networking," focuses on basic network configuration. Topics include TCP/IP basics, setting up Linux on a TCP/IP network, and network diagnostics.
- Chapter 9, "Writing Scripts," covers how to automate simple tasks in Linux. Scripts are small programs that administrators often use to help automate common tasks. Being able to build simple scripts and have them run automatically at specified times can greatly simplify your administrator job.
- Chapter 10, "Securing Your System," covers security. Specific subjects include network security, local security, and the use of encryption to improve security.

Chapters 1 through 5 cover the 101-500 exam, and Chapters 6 through 10 cover the 102-500 exam. These make up Part I and Part II of the book, respectively.

Each chapter begins with a list of the exam objectives that are covered in that chapter. The book doesn't cover the objectives in order. Thus, you shouldn't be alarmed at some of the odd ordering of the objectives within the book. At the end of each chapter, you'll find a couple of elements you can use to prepare for the exam:

Exam Essentials This section summarizes important information that was covered in the chapter. You should be able to perform each of the tasks or convey the information requested.

Review Questions Each chapter concludes with 20 review questions. You should answer these questions and check your answers against the ones provided after the questions. If you can't answer at least 80 percent of these questions correctly, go back and review the chapter or at least those sections that seem to be giving you difficulty.

The review questions, assessment test, and other testing elements included in this book are *not* derived from the actual exam questions, so don't memorize the answers to these questions and assume that doing so will enable you to pass the exam. You should learn the underlying topic, as described in the text of the book. This will let you answer the questions provided with this book *and* pass the exam. Learning the underlying topic is also the approach that will serve you best in the workplace—the ultimate goal of a certification.

To get the most out of this book, you should read each chapter from start to finish and then check your memory and understanding with the chapter-end elements. Even if you're already familiar with a topic, you should skim the chapter; Linux is complex enough that there are often multiple ways to accomplish a task, so you may learn something even if you're already competent in an area.

Additional Study Tools

Readers of this book can access a website that contains several additional study tools, including the following:

Readers can access these tools by visiting `www.sybex.com/go/lpic5e`.

Sample Tests All of the questions in this book will be included, along with the assessment test at the end of this introduction and the 200 questions from the review sections at the end of each chapter. In addition, there are two 50-question bonus exams. The test engine runs on Windows, Linux, and macOS.

Electronic Flashcards The additional study tools include 150 questions in flashcard format (a question followed by a single correct answer). You can use these to review your knowledge of the exam objectives. The flashcards run on both Windows and Linux.

Glossary of Terms as a PDF File In addition, there is a searchable glossary in PDF format, which can be read on all platforms that support PDF.

Conventions Used in This Book

This book uses certain typographic styles in order to help you quickly identify important information and to avoid confusion over the meaning of words such as on-screen prompts. In particular, look for the following styles:

- *Italicized text* indicates key terms that are described at length for the first time in a chapter. (Italics are also used for emphasis.)
- `A monospaced font` indicates the contents of configuration files, messages displayed at a text-mode Linux shell prompt, filenames, text-mode command names, and Internet URLs.
- *`Italicized monospaced text`* indicates a variable—information that differs from one system or command run to another, such as the name of a client computer or a process ID number.
- **`Bold monospaced text`** is information that you're to type into the computer, usually at a Linux shell prompt. This text can also be italicized to indicate that you should substitute an appropriate value for your system. (When isolated on their own lines, commands are preceded by non-bold monospaced `$` or `#` command prompts, denoting regular user or system administrator use, respectively.)

In addition to these text conventions, which can apply to individual words or entire paragraphs, a few conventions highlight segments of text:

A note indicates information that's useful or interesting but that's somewhat peripheral to the main text. A note might be relevant to a small number of networks, for instance, or it may refer to an outdated feature.

A tip provides information that can save you time or frustration and that may not be entirely obvious. A tip might describe how to get around a limitation or how to use a feature to perform an unusual task.

Warnings describe potential pitfalls or dangers. If you fail to heed a warning, you may end up spending a lot of time recovering from a bug, or you may even end up restoring your entire system from scratch.

EXERCISE

Exercise

An exercise is a procedure you should try on your own computer to help you learn about the material in the chapter. Don't limit yourself to the procedures described in the exercises, though! Try other commands and procedures to really learn about Linux.

Real World Scenario

Real-World Scenario

A real-world scenario is a type of sidebar that describes a task or example that's particularly grounded in the real world. This may be a situation we or somebody we know has encountered, or it may be advice on how to work around problems that are common in real, working Linux environments.

The Exam Objectives

Behind every computer industry exam you can be sure to find exam objectives—the broad topics in which exam developers want to ensure your competency. The official exam objectives are listed here. (They're also printed at the start of the chapters in which they're covered.)

Exam objectives are subject to change at any time without prior notice and at LPI's sole discretion. Please visit LPI's website (`www.lpi.org`) for the most current listing of exam objectives.

Exam 101-500 Objectives

The following are the areas in which you must be proficient in order to pass the 101-500 exam. This exam is broken into four topics (101–104), each of which has three to eight objectives. Each objective has an associated weight, which reflects its importance to the exam as a whole. Refer to the LPI website to view the weights associated with each objective. The four main topics are:

Subject Area
101 System Architecture
102 Linux Installation and Package Management
103 GNU and Unix Commands
104 Devices, Linux Filesystems, Filesystem Hierarchy Standard

101 System Architecture

101.1 Determine and Configure hardware settings (Chapter 3)

- Enable and disable integrated peripherals.
- Differentiate between the various types of mass storage devices.
- Determine hardware resources for devices.
- Tools and utilities to list various hardware information (e.g., `lsusb`, `lspci`, etc.).
- Tools and utilities to manipulate USB devices.
- Conceptual understanding of `sysfs`, `udev`, `hald`, `dbus`.
- The following is a partial list of the used files, terms, and utilities: `/sys`, `/proc`, `/dev`, `modprobe`, `lsmod`, `lspci`, `lsusb`.

101.2 Boot the System (Chapter 5)

- Provide common commands to the boot loader and options to the kernel at boot time.
- Demonstrate knowledge of the boot sequence from BIOS/UEFI to boot completion.
- Understanding of SysVinit and system.
- Awareness of Upstart.
- Check boot events in the log file.
- The following is a partial list of the used files, terms and utilities: `dmesg`, `journalctl`, BIOS, UEFI, bootloader, kernel, `init`, `initramfs`, SysVinit, systemd.

101.3 Change runlevels/boot targets and shutdown or reboot system (Chapter 5)

- Set the default run level or boot target.
- Change between run levels/boot targets including single user mode.
- Shutdown and reboot from the command line.
- Alert users before switching run levels/boot targets or other major system events.
- Properly terminate processes.
- Awareness of `acpid`.
- The following is a partial list of the used files, terms and utilities: `/etc/inittab`, `shutdown`, `init`, `/etc/init.d`, `telinit`, `systemd`, `systemctl`, `/etc/systemd/`, `/usr/lib/system/`, `wall`.

102 Linux Installation and Package Management

102.1 Design hard disk layout (Chapter 3)

- Allocate filesystems and swap space to separate partitions or disks.
- Tailor the design to the intended use of the system.
- Ensure the `/boot` partition conforms to the hardware architecture requirements for booting.
- Knowledge of basic features of LVM.
- The following is a partial list of the used files, terms and utilities: / (root) filesystem, `/var` filesystem, `/home` filesystem, `/boot` filesystem, swap space, mount points, partitions, EFI System Partition (ESP).

102.2 Install a boot manager (Chapter 5)

- Providing alternative boot locations and backup boot options.
- Install and configure a boot loader such as GRUB Legacy.
- Perform basic configuration changes for GRUB 2.
- Interact with the boot loader.
- The following is a partial list of the used files, terms, and utilities: `/boot/grub/menu.lst`, `grub.cfg` and `grub.conf`, `grub-install`, `grub-mkconfig`, MBR.

102.3 Manage shared libraries (Chapter 2)

- Identify shared libraries.
- Identify the typical locations of system libraries.
- Load shared libraries.
- The following is a partial list of the used files, terms, and utilities: `ldd`, `ldconfig`, `/etc/ld.so.conf`, `LD_LIBRARY_PATH`.

102.4 Use Debian package management (Chapter 2)

- Install, upgrade and uninstall Debian binary packages.
- Find packages containing specific files or libraries which may or may not be installed.
- Obtain package information like version, content, dependencies, package integrity and installation status (whether or not the package is installed).
- Awareness of apt.
- The following is a partial list of the used files, terms, and utilities: `/etc/apt/sources.list`, `dpkg`, `dpkg-reconfigure`, `apt-get`, `apt-cache`.