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Ahmed F. Sheikh

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CompTIA Linux+ Certification Companion

**Hands-on Preparation to Master
Linux Administration**

Ahmed F. Sheikh

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CompTIA Linux+ Certification Companion: Hands-on Preparation to Master Linux Administration

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Miami, FL, USA

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*This book is affectionately dedicated to all IT experts,
professionals, and students.*

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About the Author

Ahmed F. Sheikh is a Fulbright alumnus and has earned a master's degree in electrical engineering from Kansas State University, USA. He is a seasoned IT expert with a specialty in network security planning and skills in cloud computing. Currently, he is a Research Fellow at Energy Systems Research Laboratory.

As an experienced IT professional with a passion for Linux, Ahmed Sheikh has spent several years working in various roles, including system administration and network engineering. Throughout his career, he has witnessed the growing demand for Linux expertise and the need for comprehensive resources in the field. This has motivated him to share his knowledge and experience through writing this book.

Ahmed's goal is to provide readers with a practical and accessible guide that covers essential concepts, best practices, and real-world examples to help them succeed in their Linux journey. He is excited to contribute to the Linux community and empower individuals with the skills they need to excel in this ever-evolving field.

About the Technical Reviewer

Ayesha Nisar is a seasoned Linux expert with over five years of hands-on experience in Linux system administration. Her proficiency spans various distributions, including Ubuntu, CentOS, and Red Hat, where she has successfully designed, implemented, and maintained Linux-based infrastructures across diverse industries.

Holding certifications such as Linux+, RHCSA, RHCA, and RHCE, she prides herself on not only troubleshooting but strategically solving complex problems. Her skill set includes proficient shell scripting and automation, allowing her to streamline tasks and optimize system performance. She specializes in implementing robust security measures to safeguard against vulnerabilities.

Throughout her career, she has led successful migrations, implemented effective backup and recovery strategies, and provided expert guidance on Linux best practices. She is the go-to professional for ensuring the reliability and security of Linux environments.

Introduction

The *CompTIA Linux+ Certification Companion* is the ultimate guide to mastering Linux system administration in preparation for the **CompTIA Linux+ Certification**. Whether you're a beginner or an experienced professional, this comprehensive resource is designed to equip you with the knowledge and skills needed to excel in the world of Linux.

With its comprehensive coverage, this book delves into essential Linux concepts, commands, and techniques, providing you with a complete reference guide. You'll review how to customize and navigate the shell environment, write powerful scripts, configure user interfaces, perform administrative tasks, configure system services, establish network connections, and secure your system. No stone is left unturned in this in-depth exploration of Linux administration.

What sets this book apart is its practical approach. Real-world scenarios and practical applications take center stage, ensuring that you not only understand the theory but also know how to apply it effectively.

Troubleshooting common issues becomes second nature as you gain the skills to diagnose and resolve system problems with ease. You'll discover industry best practices and standards, enabling you to optimize systems, implement robust security measures, and adhere to compliance regulations.

CHAPTER 1

Introduction to Linux and Linux Certification

In this introductory chapter, you will learn about the history of Linux. You will gain an understanding of licensing, Linux distributions, reasons to use Linux, and exams related to Linux certification.

By the end of this chapter, you will be able to

1. Explain the history of Linux
2. Identify reasons why individuals and organizations use Linux
3. Discuss Linux certification requirements

What Is Linux?

To better understand the history of Linux, you will need to be able to identify what it actually is. You likely are familiar with Microsoft's operating systems, but there is another operating system that you should familiarize yourself with – it is called Linux. One way to understand it is to equate it to cars. A car is a car, but there are various brands of cars. There is the Mercedes, and then there is the Ford, and each one is purchased for a different reason. You have to look at what each operating system has to offer and pick the one that best suits your needs.

The Linux roots began in the 1960s with the Multiplexed Information and Computing Service (MULTICS) project created by the Massachusetts Institute of Technology (MIT), General Electric, and AT&T Bell Labs. Over the next 25 years, thanks to many dedicated programmers and engineers, the operating system created by that project evolved into the original version of Linux created by Linus Torvalds in 1991. Today, there are millions of Linux users worldwide, and this number continues to grow.

MULTICS Project

The MULTICS (MULTiplexed Information and Computing Service) project was created in 1965 by a group of programmers and engineers from higher education and corporate settings. Their purpose was to create an operating system that could control the amount of time each process could use a mainframe's processor. Even though the project was abandoned a few years later, the operating system (OS) was used into the twentieth century and greatly influenced the future development of operating systems. It is a pioneering time-sharing operating system based on the idea of a single-level memory.

UNIX

One of the developers of the MULTICS system, Ken Thompson, made changes to the original operating system (OS) to create what we now know as UNIX. Unix is a modular operating system comprising essential elements, such as the kernel, shell, file system, and a fundamental set of utilities or programs. Unfortunately, it only ran on Digital Equipment Corporation's PDP-7 hardware. Not too long after Thompson's new OS was available in 1969, Dennis Ritchie developed a new programming language (called C) that allowed code to run on multiple hardware platforms. UNIX was then rewritten in that language.

Richie and Thompson were both working for AT&T Bell Labs when the new UNIX was created, and AT&T was legally restricted from selling this new OS. To best ensure the use of the new knowledge and technology, the source code was sold to several companies with the requirement that each would continue to maintain a specific standard set by AT&T. Afterward, even though the standard was usually maintained, each company added their own modifications thus creating different flavors of UNIX.

AT&T gave some universities copies of UNIX in an effort to promote the use of UNIX. Between 1977 and 1995, the University of California at Berkeley created its own version called BSD Unix – Berkeley Software Distribution, and it is still widely used today. Sun Microsystems, one of the companies that purchased the source code from AT&T, started selling its version of UNIX on relatively inexpensive hardware, which established it in many companies and universities. UNIX is rarely used as a home computer but is still widely used in business. Hewlett Packard's HP-UX and IBM's AIX are other versions of UNIX that are still very popular.

GNU Project

UNIX was not free to the public, which meant that all the techies that loved experimenting with an operating system and other software did not have a free platform they could use. In an effort to meet the needs of these techs, also known as hackers, Richard Stallman started the GNU project (“GNU’s not Unix!”). Through a collaborative effort, a new and free operating system was created.

Although the GNU OS did not gain much acceptance, it led to the new licensing format called GNU Public License (GPL). By licensing a new product, it would be legal to distribute it along with its source code. Any modifications to this free software would also have to be distributed for free.

Linux Created

Linus Torvalds took advantage of the GNU Public License (GPL) and created the operating system now known as Linux in 1991. There are lots of disagreements over whether it is pronounced “Linux” or “Lenux,” but most people refer to it as “Lenux.” Torvalds improved on what was known as MINUX, or the mini-UNIX OS, which was mainly developed for use with the Intel X86 platform. Linux is used in homes and businesses today.

Licensing

Linux is licensed as open-source software, which is code that is freely distributed to anyone that wants to use it or improve it. Thanks to the collaborative efforts of many Linux users, changes and improvements are constantly being made in the current versions of Linux as the need arises. One of the good things about open-source software is that errors are usually very quickly corrected. This software takes advantage of the GPL format, which means the source code is freely available, and any changes to this source code are also free.

Linux Distributions

To understand Linux distributions, you must first identify what a distribution is. A distribution, or distro, is a collection of Linux kernels, libraries, and additional software that has been added for a specific purpose.

The following list includes the most well-known distributions. If you look closely, you will find that many of them are versions of another distribution. For instance, Ubuntu is a derivative of Debian. Fedora is a derivative of Red Hat. This example demonstrates how one distribution can morph into another distribution and then morph again into yet another distribution.

Common Linux Distributions

Red Hat	SuSE
Fedora (Red Hat)	Debian
Slackware	Ubuntu (Debian)
Mint (Ubuntu & Debian)	CentOS (Red Hat)
Bodhi (Ubuntu)	Gentoo
OpenSuse (Slackware)	Mageia (Mandriva)
Manjaro	Elementary

Reasons to Use Linux

You may wonder why a business owner would want to use Linux when Windows is so popular with businesses today. The following information helps answer that question.

Reduces Total Cost

One of the main reasons to use Linux is that it reduces the total cost of ownership (TCO). Licensing is free, as are upgrades and fixes. Software that runs on the Linux platform is either very low in cost or free. Support for Linux can be quickly found on the Internet in how-to documents, FAQs, news groups, blogs, and Linux user groups (LUGs). One good practice to adopt when you do not know how to do something in Linux is to go straight to the Internet and search for information. You often will find the answer. Overall, the TCO is a lot less than when using another operating system.

Software Availability

Another important reason that businesses like to use Linux is that most of the software that is needed in their business is free and readily available for installation. Most installations are not for the desktop user but for a business server. Linux can be used as a desktop since it has a GUI and all of the normal office-type applications, such as text editors, presentation software, and spreadsheets. Linux software also offers audio and video editing software as well as various security options. One prominent reason that Linux is used is to provide web services.

Increases Security and Stability

Linux tends to be a very stable and secure operating system for a couple of reasons.

First, any vulnerability found is fixed very quickly. There are numerous people involved with maintaining the security of Linux. This is very different than the timeframe involved for an OS vendor to prepare and test fixes and then push them out to the public. Businesses like Linux because they want secure assets and information.

Another reason is there are not as many Linux systems in use as there are Windows. Hackers go after what can provide the biggest impact with the least effort. Until Linux becomes more widely used, it will not be as big a target as Windows.

Runs on Multiple Hardware Platforms

Almost every hardware platform can run Linux. In comparison, how many can you put Windows on? Intel and Itanium are present, but it cannot be installed on any of the other platforms. The specifications of the hardware are not nearly as stringent for Linux as are on other OSs. As a result, you can get by with less RAM and slower processors – even less hard drive space. Think about what that could do for businesses, as they usually have older hardware that cannot run another OS. They become too slow or do not have enough resources to satisfy the minimum requirements. These are still good machines on which to install Linux. Just imagine how much money that could save a business.

Some of the hardware platforms on which Linux can run are:

- Intel
- PowerPC
- SPARC

- Ultra-SPARC
- Itanium
- ARM
- MIPS
- Alpha
- ARC
- m68k

Some people have gone so far as to point out its benefit to the environment. Linux is not boxed and sold to users, as is most software. It is downloaded from the Internet. This keeps the boxes and packing materials from ending up in a landfill.

Linux Certification: Why Get Certified?

Earning certification shows prospective and current employers that you have the skills and knowledge needed to work with Linux. It also shows you want to continue learning so you can do better in your career. Linux certification is backed by a couple of well-known global Information Technology (IT) associations that have the respect of the industry. CompTIA's Linux+ is the most widely known Linux certification. The Linux Professional Institute (LPI) also has several Linux certifications.

CompTIA Linux+

The most widely known certification is CompTIA's Linux+, covering the following topics:

- System Management
- Security
- Scripting, Containers, and Automation
- Troubleshooting

For more details on this certification, visit www.comptia.org/certifications/linux.

Linux Professional Institute (LPI)

Another organization called the Linux Professional Institute, or LPI, produced four different certifications. The first certification is the Linux Essentials, which proves you understand the basics of Linux as a user. Next, Professional Certifications are available that cover a junior, advanced, and senior level of Linux. These certifications prove your ability to work with Linux at a specific level.

Introductory Certification

- Linux Essentials – Basics of Linux

Professional Certifications

- LPIC-1 – Junior Level Linux Certification
- LPIC-2 – Advanced Level Linux Certification
- LPIC-3 – Senior Level Linux Certification

For more information on these certifications, check out www.lpi.org/our-certifications/summary-of-lpi-certifications/.

Summary

In this chapter, you learned about the history and real-world applications of Linux, as well as certification requirements. Keep the following in mind:

- The MULTICS operating system was created in 1965 to allow multiple processes to time-share.
- UNIX was created in 1969 and could run on multiple hardware platforms.
- Linux was created from MINUX as a free, open-source operating system for home or business use.
- Linux continues to be modified and made available to the public, including the source code, due to GPL licensing.
- There are hundreds of flavors of Linux available today.

CHAPTER 2

Installing Linux

In this chapter, you will gain an understanding of the preparation needed and the methods used to install Linux.

By the end of this chapter, you will be able to:

1. Create a plan for installation
2. Identify methods of installation
3. Install Linux

Preparing for Installation

Before starting an installation of Linux, it is important that you begin with project management. You have to meet with numerous people and ask lots of questions. Here are some important questions that you should prepare to ask:

- What tasks will be performed on this host?
- What distribution of Linux do I need to install?
- Will the hardware I have now run the selected version?
- What type of hard drives am I going to use?
- How am I going to partition those hard drives?
- Which bootloader will be used to load the OS?
- What filesystem am I going to install?
- What information do I need to connect the host to a network?
- What method of installation will be used?